

FORCES IN THE INITIATION AND IMPLEMENTATION OF THE
RURAL GROUNDWATER PROTECTION PROCESS

by

Rodney A. Bankson

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APPROVED:

James F. Wolf, Chairman

John W. Dickey

William E. Cox

Philip L. Martin

B. Douglas Skelley

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ABSTRACT

Groundwater contamination is a growing problem that is receiving increasing attention on the national scene. There is recognition that federal, state, and local, programs for the protection of the nation's groundwater lack coordinated, integrated policy. Consequently, much of the responsibility for groundwater protection in rural areas falls upon local elected officials and public administrators who may be ill-equipped to deal with technically complex issues that are becoming increasingly germane and costly for many communities.

This dissertation examines a rural county in Virginia (Clarke County) noted for its progressive groundwater protection policies, with the intent of the examination to improve the knowledge base of the dynamics of the groundwater protection process in rural areas. Case study methodology, implementation theory, and ethnographic techniques are used to determine what factors and forces play the greatest role in initiating and influencing groundwater protection outcomes in a rural setting. Answers are suggested for questions such as: (1) why does Clarke County display a different attitude towards groundwater protection than many of its neighbors in the Shenandoah Valley of Virginia; (2) how was Clarke County able to initiate and institute groundwater protection plans; and (3) is there a special role for the public administrator in the rural groundwater protection policy process?

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CHAPTER ONE

INTRODUCTION

"The decisions of local government have the greatest potential impact on groundwater yet localities have, to date, been the level of government least involved in groundwater protection." (A Groundwater Protection Strategy for Virginia 1987)

This chapter focuses on the central theme of this dissertation: the initiation and implementation of groundwater protection policies in rural areas. It also provides an overview of Clarke County, Virginia, which serves as a case study. Various issues are examined, such as the importance of groundwater, groundwater as a policy issue, and the issue of why rural public administrators need to be more concerned about the quantity and quality of groundwater in their areas. These issues serve as a basis to the argument that rural groundwater protection is a public policy area of increasing concern needing greater attention.

FOCUS OF EMPIRICAL INQUIRY

There are several reasons why Clarke County, in the Shenandoah Valley of Virginia, has been recognized as a vanguard of county groundwater protection among

a number of other rural Valley of Virginia counties (Hirschman and Roth 1991).

Clarke County has a Ground Water Protection Plan, a Water Resources Plan, comprehensive land use policies, and sophisticated GIS groundwater-related computer hardware and software while most other counties in the Valley do not¹.

Why is Clarke County different from other rural counties in the Valley of Virginia in its commitment to the protection of groundwater resources? What are the driving factors and forces that have allowed the county to develop a protective framework for its water resources? Does the experience of Clarke County contain lessons of interest to other public administrators concerned with the protection of groundwater or other national resources?

An empirical inquiry using single case study methodology (Yin 1984) was conducted in order to suggest various answers relating to successful policy implementation in Clarke County. Paul Sabatier and Daniel Mazmanian's (1980) and Helen Ingram's (1990) conceptual implementation frameworks were used as research tools during the examination of various aspects of groundwater protection efforts in Clarke County. The conceptual implementation frameworks were chosen to give focus and coherence to a series of events in a policy subsystem that would perhaps be

¹ See Appendix E for a comparison of Clarke County's groundwater protection efforts to those of other counties in the Lord Fairfax Planning District.

interesting as a case study, but would not necessarily be relevant in a broader view of the rural groundwater protection process. Ethnographic techniques and a computer software program by the name of The Ethnograph (Seidel et al. 1988) were used to collect, code, and sort data, and develop various themes. The research was helpful in capturing the dynamics of a particular process: that which drives Clarke County's groundwater policies. The research was selectively conducted throughout a system that can be viewed as Clarke County's groundwater policy subsystem (Wamsley 1985, 15-18).

THE IMPORTANCE OF GROUNDWATER

Although water is seen as mankind's most precious resource, its true importance has yet to be grasped by much of the general public and most public officials. Groundwater constitutes the major source of drinking water for most of the world and about one-half of the United State's population, as well as representing 96 percent of our nation's total fresh water resources (Boyd et al. 1984). Leading environmental organizations recognize the worldwide pollution of groundwater as one of the top ten most serious global environmental problems, and they stress this fact to the public through various means such as the Environmental Defense Fund's "Nine for the Nineties" (1989) poster. In many inhabited regions of the United States, groundwater is used for industrial and agricultural purposes, and is the only

dependable source of drinking water. Scientists and technical experts now believe groundwater pollution problems and associated concerns may reach crisis proportions by the turn of the decade (Canter 1987).

While the importance of water resources would seem obvious to even the most causal observer, most Americans take water for granted until they themselves have a problem with either the quality or quantity of a water supply. In an article for The Journal of Pesticide Reform, Velma Smith, Director of Groundwater Protection at the Environmental Policy Institute, notes that the loss of a rural family's water supply can be more than a mere inconvenience: "When a family's water supply is damaged and the closest alternative water line is beyond reasonable reach, that family may have to choose between a long-term threat and complete loss of home and property." (Smith 1987)

Suitable and adequate sources of water for drinking and the growing of food have always been and will remain the most basic prerequisite for any type of long-term human settlement. A certain amount of water is required for human consumption and needs, and it is somewhat staggering to grasp the large amounts of water required for even the most common of food items. A scientist at Michigan State University has calculated the production of a single hen egg requires about 120

gallons of water, a loaf of bread requires 300 gallons, and a pound of beef 3,500 gallons (Asimov's Book of Facts 1979, 131).

As this research focuses on public policy issues surrounding the protection of groundwater, a usable definition of groundwater is required. A simple definition of groundwater would refer to water within the earth that supplies wells and springs.

Another way to define groundwater is to describe what it is not. Groundwater is not:

...an underground lake or river of water. Only in certain limestone and dolomite formations in which caves are formed does groundwater flow in solution channels. Ground-water occurs in sand and gravel strata in the spaces between the particles, or in rock formations that have faults, fractures, or joints through which water can pass. Water bearing formations are called aquifers.

...a rapidly moving body of water. In fact, except in areas where caves or solution openings are formed, groundwater generally moves very slowly in the earth from a few feet per day to a few feet per year.

...mysterious and occult. Principles of hydrogeology are well known and allow scientists and engineers to predict ground-water quantity and quality. Groundwater is a part of the natural hydrologic cycle of water through the environment.

...cleansed of all contaminants as it moves through the soil. Though soil has the capacity to filter and absorb some wastes, many contaminants are unaffected by the soil layer and reach the saturated zones. There they may contaminate the aquifer, often making it unusable as a drinking water source. (Groundwater Protection Strategy for Virginia 1987)

There is a finite amount of water on the earth, particularly groundwater. The water used for baths during the eras of the Greek and Roman civilizations is being

used now for many other purposes. If protected, water is a truly recyclable resource and the hydrological cycle that produces fresh water brings life to the earth. Only four percent of the hydrological cycle, which consists of the movement of water between oceans and other bodies of water, the atmosphere, and the land, is comprised of groundwater (Pye et al. 1983). Surface water and groundwater are viewed as interconnected in most areas of the United States, especially in karst areas like the Shenandoah Valley, where rainfall recharges groundwater resources contained in unconfined aquifers. Groundwater discharges to springs and streams provide a large percentage of the water necessary to maintain stream flows and established ecosystems, as well as providing recreational areas on lakes and rivers.

THREATS TO GROUNDWATER

Because of the vastness of its supply, groundwater is often regarded as a limitless resource. Groundwater is vulnerable to a wide range of contaminants, everything from human and animal waste to synthetic chemicals, with virtually every activity of society having the potential to affect groundwater quality. In ancient times, waterborne bacteria from human and animal waste were the most dangerous sources of pollutants. While waterborne bacteria continued to pose a serious threat, the nature of pollutants flowing into water began to change in the nineteenth century as America moved into the industrial age. Besides the microbiological contaminants,

trace minerals, and organic compounds supplied by nature, it is now common to find in water carcinogenic, synthetic organic compounds created by modern science. Residents near the infamous Love Canal near Niagara Falls had eighty-two chemical compounds in their drinking water, with eleven of the compounds known or suspected carcinogens (Keough 1980).

Groundwater pollution can be categorized as "point source" and "nonpoint source" pollution. Point source pollution is easier to identify and is more susceptible to regulation than nonpoint source pollution. Point source pollution refers to a specific, readily identifiable pollution source, such as a pipe from an industry or a private home discharging contaminants that will eventually reach the groundwater. Nonpoint source pollution is caused by a contaminant that is diffused by rainfall over a wide geographic area. It may be the product of various activities in several different geographical locations, such as pesticide spraying, yard fertilization in urban areas, or a large number of grazing animals in a rural area (EPA 1987).

Landfills, septic systems, hazardous wastes, old wells, buried gasoline and oil tanks, agricultural practices, construction, oil drilling and coal mining operations are but a few of the contaminant sources and practices that can have a major detrimental impact upon the quantity and quality of a community's groundwater. Once contaminated, the possibility of cleaning up an aquifer is tied to the amount and type

of contaminants involved as well as the hydrogeological characteristics of the area. Certainly, it is not an easy task. The cleaning up of groundwater is extremely costly, difficult, and sometimes impossible. (Fultz 1991)

GROUNDWATER PROTECTION

Water use, and water protection, are two of the most crucial and potentially volatile issues that can be addressed by elected officials and public administrators. This has been true in the past, it is true in the present, and will continue to be true in the future. Groundwater protection was one of the very first issues addressed by settlers to the New World, as evidenced by a 1610 law designed to protect the health of settlers at Jamestown (See Chapter 4, p. 69). The policy issues surrounding groundwater use and protection will elevate to a greater significance and volatility as population growth creates an increasing demand for water resources, and as the anthropogenic factors of growing populations adversely affect the quality of the resource.

Groundwater protection as a prominent public policy issue has increased dramatically since the mid 1970s (Pye, Patrick and Quarles 1983). Little, if any, public consciousness toward groundwater issues could be determined 25 years ago. Increasing quantity and quality issues have moved groundwater to the forefront of the

issues considered by public officials and legislators (Executive Office of the President, Environmental Quality Report 1989). Groundwater is also a preferred source of water for many industrial uses because its purity is higher than surface water, and in certain arid and semi-arid areas of the United States it is the only source available for agricultural uses. As the population of the United States continues to grow, unpolluted groundwater resources are needed to satisfy the increasing demands become all the more precious. Despite the Reagan Administration's efforts in the 1980s to reverse the environmental policies of the previous decade (Vig and Kraft 1990), many factors and forces are now combining to build a convincing argument that advocates greater attention to groundwater at all levels of government. The development and implementation of groundwater protection policies and programs are vital if America's groundwater resources are to be protected for future generations.

Although a number of different approaches for the prevention of groundwater contamination had been developed by both the federal government and various states, comprehensive attempts to preserve and protect this precious resource at state and local levels have been, with the exception of a few progressive states, sporadic (Henderson et al. 1984; Page 1987). Environmental issues do not easily translate into policy. Lester and Bowman (1989) contend that in order for states to move forward in environmental policy areas, they need a sense of strong citizen commitment toward environmental protection issues as well as strong institutional capabilities. Current

attempts to protect groundwater resources stem from two actions: either serious prodding from the federal level, such as federal requirements that the states develop programs to prevent contaminants from entering public water supplies; or the triggering effect of droughts and massive pollution catastrophes that galvanize states and localities into action. Wasteful water practices, including those known to pose serious threats to the quality of water resources, are still common throughout most states and localities. Meanwhile, on the positive side of the issue, a national consensus acknowledging the serious threats to the quantity and quality of groundwater continues to build (Speidel et al. 1988; Jorgensen 1989).²

Federal Level

Since 1970, federal and state legislators generally agree that measures must be taken to protect water the country uses for drinking and other purposes. Beginning in the early 1970s significant federal and state legislation was passed as a means to protect groundwater resources. Major federal legislation, such as the Federal Water Pollution Control Act of 1972 (Clean Water Act), the Safe Drinking Water Act of 1974 (SWDA), the Resource Conservation and Recovery Act of 1976 (RCRA), the

² In a 1989 study, 2,172 key policy leaders when asked to identify the 10 highest priority environmental issues at the state and local level for the 1990s ranked protecting ground water first. (The American Ground Water Trust (newsletter) 1, no.1, 1990).

Toxic Substances Control Act of 1976 (TSCA), and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA or Superfund), with their later amendments, all contribute to the protection of groundwater. The Directory of Groundwater Programs compiled by the Department of The Interior, lists over 40 programs involved in the conservation, protection, and monitoring of groundwater. The Environmental Protection Agency's (EPA) 1984 draft of a groundwater protection strategy for the nation recognized the need for a partnership among local, state, and federal agencies to protect public health and critical environmental systems. Yet, there remains a reluctance or inability by the federal government to require that the states vigorously enforce many of the federal statutes designed to increase the level of groundwater resource protection. The federal government is reluctant to dictate to each state what must be done to protect its groundwater as each state's situation is unique. And, the federal government does not have the manpower or the money to ensure groundwater resources are being protected in each state. Available data suggests that little progress has been made in halting groundwater contamination, despite the significant federal legislation and amendments passed during the decades of the 1970s and 1980s (Vig & Kraft 1990, 22).

State Level

Federal and state statutory authority directed at the protection of water resources continues to evolve. Federal and state legislators continue to craft new laws and regulatory programs that will work in a more coordinated fashion to protect groundwater from contaminants (Henderson et al. 1984; Walker and Bridgeman 1985; Page 1987). The EPA can offer assistance to the states, but such factors as the unique nature of the groundwater resource, the diverse range of dangers that threaten it, and the lack of any overall federal-level umbrella of protection will continue to shift the burden of direct responsibility to states and localities. The Environmental Protection Agency (EPA) makes it clear where the responsibility lies: "EPA believes that the most effective and broadly acceptable way to increase national institutional capability to protect ground water is to strengthen State programs" (U.S. Environmental Protection Agency, 1984). In terms of the responsibilities of local government, an EPA wellhead protection document states, "Although the responsibilities of local government depend on the specific requirements of their state programs, these governments are often in the best position, and have the greatest incentive, to ensure proper protection of wellhead areas. They have the most to lose if their groundwater becomes contaminated" (EPA Citizen's Guide to Groundwater Protection 1990, 10).

Beyond the new and revised philosophy of federalism advocated by the Nixon, Reagan, and Bush administrations that seeks to return power to states and localities, four major factors support the likelihood that states and not the federal government will expand and retain the responsibility for protecting groundwater quality: (1) each state has a system of statutory and common law that can be used to protect groundwater and the health of its citizens; (2) the variety of hydrogeological forms and types of contamination make a uniform federal law impractical; (3) land use controls are necessary for groundwater protection solutions; and (4) states are increasing their administrative authority to respond to national pollution laws that affect groundwater (Henderson, Trauberman and Gallagher 1984, 23).

Water has little regard for state and local boundaries, and groundwater can be polluted via a diversity of pollution sources and contaminant pathways. Almost any form of human activity, land use or waste disposal can threaten groundwater quality. Therefore, when a state or a locality acts to protect its groundwater, the action may impinge upon the rights of neighboring jurisdictions or may seek to curtail established practices among local individuals or institutions. Prevailing attitudes toward the local role vary greatly from state to state. Some states express a reluctance to dictate groundwater protection policies to local communities, while other states adopt an even greater influence over local development decisions in order to mitigate potential environmental problems (Jorgensen 1989). There also have been attempts by states in

recent years to strengthen their institutional capacity to deal with complex policy issues such as groundwater protection (Bowman 1990). Unfortunately, considering the current realities of most state finances, it is only logical to assume that much of the final responsibility for the actual development and implementation of policies and programs to protect groundwater resources will by necessity fall upon the shoulders of local government.

Local Level (Rural County Governments)

Counties have a responsibility to protect the health, safety and welfare of their citizens, and groundwater protection as a policy issue needs to be recognized as especially crucial for rural governments. About 40 percent of the United States' population -- and about 90 percent of the population in rural areas depend on groundwater for drinking water (GAO 1991). While every citizen may bear a sense of personal responsibility for the protection of groundwater, it is necessary that county and local officials provide the guidance and leadership that enables citizens to protect their groundwater resources (Hrezo and Nickinson 1986). Many industrial, agricultural, and commercial activities that pose serious threats to groundwater occur in rural areas with little or no regulation. The use of pesticides and fertilizers, underground storage tanks, manure spreading, septic systems, unregulated landfills, feedlots, road-salting, and the improper disposal of household hazardous waste are all

typical rural events that may lead to groundwater pollution. While local officials may be called upon to ensure such diverse events are properly controlled and regulated, some scholars contend such officials often are ill-equipped to bear an increasing burden of complex and technical environmental responsibilities (Tripp and Jaffe 1979). Many local programs are developed with an awareness that state and federal assistance will be required in order for them to be implemented, but the primary responsibility for developing such programs currently remains at the local level (Rail, 1989).

In the past there has been a tendency to view small local governments in America as the very "embodiment of democracy" (Local Government, 1955), and as "interaction among neighbors for the common good" (Banovetz 1990). New England town meetings still seem to fall into that category (Elder 1992). But some writers have questioned such a viewpoint of local government by suggesting that "the government closest to the people is not necessarily the best government: it may be the most biased, inefficient, and corrupt government" (Buell & Brigman 1968). Legislative interference in purely local concerns is a recognized evil and a contentious subject, especially for Virginia. Yet tiny, rural local governing bodies have displayed characteristics that often reflect a stereotypical part-time, low expertise, good-old-boy, amateurish, anachronistic, decision making nature. Such bodies make choices not so much made on the merits of the issues, but on the basis of personal loyalties among

the actors (Martin 1957). Other scholars suggest the subject of local government at the county level is an area that needs scholarly research, to ascertain the current ability of county governments to respond to ever increasing functional duties and responsibilities (Marando and Reeves 1991; Menzel et al. 1992).

REVIEW OF CHAPTERS

Chapter 2 examines literature existing in the field of groundwater protection and discusses evidence of recent trends that affects groundwater protection efforts at the local level. Before the environmental movement of the 1970s and 1980s, for example, most of the literature concerning groundwater consisted of scientific journals as well as studies oriented toward the practicing engineer regarding the use of groundwater resources. During the decade of the 1970s, the literature increasingly documented groundwater pollution problems, along with proposed technical solutions for cleaning up contaminated groundwater. By the early 1980s, the literature began to reflect an awareness of the extent of the problem among the general public and the scientific community, and questioned the ability of localities, the states, and the federal government to deal with it.

Chapter 3 describes the research strategy and the methodology used to examine the policy subsystem of Clarke County, Virginia to see how the county approached its

groundwater protection issues. It explains the structure of the case study, data collection methods used, and data analysis. Chapter 4 is a history of groundwater protection in Virginia designed to give the reader an appreciation of the multitude of federal and state laws that address some aspect of protecting groundwater resources, as well as problems associated with protection of the resource at the local level. Chapter 4 also addresses questions specifically directed to Virginians such as: the legal definition of groundwater; whether or not the legal focus should be on use or on protection of the resource; who has the right to use the resource; and how groundwater contamination cases are treated in the courts.

Chapter 5 is an in-depth look at Clarke County and its groundwater protection policy subsystem when events are focused through the use of a conceptual implementation framework. The process is similar to the different focusing devices used when Gareth Morgan (1986) attempted to analyze complex organizations. While the use of the implementation frameworks can be viewed as an analytical endeavor, it provides a structured means to view the events in Clarke County. Professor Morgan would describe it as a method to explore "a way of thinking" about the events that transpired in Clarke County. In Chapter 6, themes that have emerged as a result of the coding and analysis of the data from Clarke County are offered as explanations of the county's demonstrated ability to move forward in groundwater protection. The emergent themes from Clarke County, when compared to other themes emerging from

recent public administration literature, suggest there may be new ways to view and approach groundwater protection in rural areas.

CHAPTER TWO

LITERATURE

This chapter examines literature existing in the field of groundwater protection and identifies changing trends in the field. Groundwater protection literature focusing on the actions of local government in rural areas is emphasized. Numerous articles and publications addressing various aspects of groundwater protection from a variety of federal, state, and local agencies involved in groundwater protection issues, while perhaps not seen as a true literature base, are also presented to the reader.

GROUNDWATER PROTECTION LITERATURE

The literature of groundwater protection falls into three broad categories:

- (1) scientific and technical journals, papers, and textbooks that discuss the various properties of groundwater and its behavior in various hydrogeological settings;
- (2) publications addressed to the average citizen that list threats to drinking water/groundwater and the precautions a citizen may take to protect themselves or their family; and
- (3) groundwater studies of a regional/local nature that include state and local groundwater protection guides.

Change In The Literature

It is difficult to try to determine exactly when a literature addressing a particular area of concern may begin to change, but a clear transitional period regarding the content and focus of the literature relating to groundwater occurred during the decades of the 1970s and 1980s.

Pre-Environmental Movement

Before 1970, the literature on groundwater is characterized primarily by its technical and scientific content, the way it intertwines with geologic and hydrologic literature, and its focus on the use of the resource. Textbooks on the related subjects of geochemistry and hydrology (Wisler and Brater 1959), professional journals such as; Water Well Journal, Ground Water, Journal of Geophysical Research and the international Journal of Hydrology, all addressed various aspects of the use and protection of groundwater with an orientation toward the practicing professional engineer and hydrologist. The potential for groundwater contamination was well recognized by the scientific community, and decontamination of groundwater seen as technically possible.

The National Water Summaries produced by United States Geological Survey (USGS) with its section on groundwater quality, and the U.S. Department of the Interior's pamphlet A Primer on Ground Water (Baldwin and McGuiness 1963) typify the groundwater information available to the general public. No extensive body of literature in the pre-1970 period addressed groundwater protection from a policy or program standpoint, nor were the role of the citizen or working professional in the implementation of such policies and programs extensively discussed. The bulk of the literature on groundwater consisted of scholarly and technical approaches directed primarily toward the student or working professional. The predominant message was that groundwater was abundant and relatively pure and that, if it happened to become contaminated, modern technology could most likely be used to clean it up.

Post Environmental Movement

Articles, professional papers and institutional documents relating to groundwater pollution and proposed clean-up methods increased dramatically during the decade of the 1970s. "Relation of Agriculture to Groundwater Pollution: A Review" (Robbins and Kriz 1969), "Gasoline Pollution of a Ground Water Reservoir - A Case History" (Williams 1971), "The Use, Abuse and Recovery of a Glacial Aquifer" (Burt 1972), "Survey of Ground Water Protection Methods of Illinois Landfills" (Clark 1975), and The American Petroleum Institute's "Underground Spill

Cleanup Manual" (1980) exemplify an increasing awareness of the problems associated with groundwater pollution. Evidence of groundwater contamination occurring on a wide front across the nation was increasing, but the literature contained minimal questioning about the ability of technology to deal with the problems presented.

As reports of national and worldwide evidence of contaminated groundwater increased, "Ground-Water Pollution -- An Imminent Disaster" (Pettyjohn 1979), the scientific community shifted its focus more toward the protection of the resource. Textbooks such as Fried's Groundwater Pollution: Theory, Methodolgy, Modeling, and Practical Rules (1975), and Dunne and Leopold's Water in Environmental Planning (1978) covered a wide range of topics from snow hydrology to water supply and emphasized how land use fits into the total water protection picture. R. Allen Freeze and John A. Cherry's Groundwater (1979), Bowen's Ground Water (1980), and David Keith Todd's Groundwater Hydrology (1980), detail the various chemical and physical properties of groundwater and address methods for the protection and management of the resource.

Literature focusing on protection of water resources and addressing groundwater problems continued to grow during the decade of the 1980s with much of the information presented to the public (Conservation Foundation 1976; Canby

1980). National and international symposiums and conferences, including the National Conferences on Management of Uncontrolled Hazardous Waste Sites and National Symposiums on Aquifer Restoration and Ground Water Monitoring by the National Water Well Association, addressed various aspects of the issue. Along with scientific articles and papers addressing protection and clean-up methods, "Remedial Activities at Florida's Uncontrolled Hazardous Waste Sites" (Myers, Domenico, Hartsfield 1982), new discussions emerged on containment of polluted waters capable of reaching groundwater, as well as the subsequent containment of any groundwater that had happened to become polluted "Ground Water -- A National Issue (Ward et al. 1984). New literature defined the planning necessary to prevent contamination at the outset, rather than contain it or clean it up after a pollution incident.

Interest in matters such as pollution containment and the planning necessary for pollution prevention continued to grow as members of government and the scientific community questioned the economic and technical feasibility of a total clean-up of polluted aquifers. Representative of increased institutional and scientific acknowledgement of the complexity and extent of groundwater pollution in the nation are articles such as; "Ground-Water Contamination -- No "Quick Fix" in Sight" (U.S. Geological Survey Yearbook 1980), "Questions about Quality are Hard to Answer" (Shafroth 1983), "Limitations in Implementing Aquifer Reclamation Schemes" (Schmidt 1983), "Groundwater Contamination: Local Problems Become

National Issue" (Tanglely 1984), and "Protecting the Nation's Groundwater from Contamination: Office of Technology Assessment" (Leveen 1985). The limited number of economic and physical resources available to clean up substantial amounts of contaminated groundwater was becoming apparent.

Along with an increase in scientific data documenting increasing pollution of the nation's groundwater resources, increased interest focused on statutes, legal frameworks to protect groundwater, and questions of liability Groundwater Pollution: Environmental and Legal Problems (Travis and Etnier 1984). Attempts to apply common law riparian doctrine to the protection of subsurface water where the physical boundaries of the resource and any damage to the resource were difficult to assess, were seen as unsatisfactory. A manual developed by J. Lerh for the Environmental Protection Agency (EPA), (A Manual of Laws, Regulations and Institutions For the Control of Groundwater Pollution (1976) provided a scheme of statutory and regulatory provisions that states could use to control practices affecting the quantity or quality of its groundwater resources. In "The Muddy Waters of Liability for Cities," Frank Shafroth (1983) discusses cases involving liability for environmental damages, as well as the interpretation and construction of the Safe Water Drinking Act of 1974, the Resource and Recovery Act of 1976, and the Comprehensive Response, Compensation, and Liability Act of 1980.

Wickersham's "A Preliminary Survey of State Ground Water Laws," (1981), described both the methodology and the permit process used by several states to ensure that well-drillers and others who worked with the resource were properly licensed and maintained high-quality operational standards. "Trends In U.S. Groundwater Law, Policy, and Administration" by Erhardt et al. (1984) documented an increasing national trend toward the use of aquifer classification systems, including an EPA system of classification that allows states to apply appropriate levels of protection. While some suggested the use of zoning and other authorized powers of local governments to control land use and threats to groundwater, others began to question the abilities of existing federal and state legislation and governmental institutions to deal with an array of increasingly complex, technical, and political water issues (Speidel, Ruedisili, and Agnew 1988; Fredrick and Gibbons 1986; Lennet 1992).

The literature also raised serious questions about the effects of groundwater contamination upon the health of the citizenry. Water Fit to Drink (Keough 1980), Rice's Impact of Chemicals on a Limited Resource (1985) and the Sierra Club's Poisoned Well (Jorgensen 1989) tried to alert the average citizen to potential dangers in their drinking water. Journal articles targeted at working professionals addressed specific areas of concern, including "Pollution of Groundwater" by Ralph C. Heath, (1983) and "Pesticides and Groundwater: A Health Concern in the Midwest" (Gust et

al. 1986). New emphasis was also being placed on protecting groundwater from many traditional activities. Actions related to the Comprehensive Environmental Response Compensation and Liability Act of 1980, also known as CERCLA or "SuperFund," as well as subsequent investigations of uncontrolled hazardous waste sites, furnished new information concerning the extent of damage to the nation's groundwater. Birth defects, sterility, cancer, kidney and liver damage, methemoglobinemia and other known health hazards were linked to the proliferation of pollutants and contaminants appearing in the nation's groundwater. The contaminants included nitrates and pesticides; heavy metals such as mercury, lead, chromium, copper and zinc; and new synthetic compounds less susceptible to degradation. Unseen, horrible health risks appeared likely just by taking a drink of tap water, and it was deemed important for the citizen to learn to protect themselves.³

One interesting type of groundwater literature that developed during the 1970s and 1980s were the publications that disseminated groundwater information to citizen groups and local officials. Three obvious reasons for this new literature centered

³ (Jorgensen, 1989) articulates the post environmental era message that the best way for citizens to protect their health is to go out and wage their own fight against groundwater contamination. In addition to providing a wealth of information for citizen action, Figure 8-1, p. 103, outlines citizen suit provisions under various federal statutes protecting groundwater and shows the citizen who they may sue.

around the increasing trend of national awareness: (1) people began to recognize a growing groundwater contamination problem; (2) the scientific community projected a limited ability to solve complex local groundwater contamination problems; and (3) federal and state governments were unresponsive toward what local citizens saw as serious groundwater contamination problems.

Groundwater Contamination in the United States by Veronica I. Pye, Ruth Patrick, and John Quarles (1983) is an excellent example of the new trend in the literature. The 315 page book combines scientific groundwater facts and data and defines the extent of groundwater contamination within the United States. It also contains explanations and critiques of various proposed protection strategies, emphasizing the roles played by federal, state, and local governments in the protection of groundwater. A section on proposed statutory and regulatory provisions cautions, "Implicit in any kind of legislation is a concept of the type of society the community, state, or country wishes to have and the methods that can be used to achieve it" (Pye, Patrick and Quarles 1983, 283).

Literature directed to groundwater protection at the local or state level was typically critical of the commitment of the federal government (Tripp & Jaffe 1979; Pye, Patrick and Quarles 1983; Cox and Patrizi 1984; Henderson, Trauberman and Gallagher, 1985). Because the threats to groundwater consist of a multi-media

interrelationship among land, water, and air resources, one locality's groundwater contamination may well be a by-product of an established program in another locality, or state, particularly that of one's neighbors (National Research Council 1986; Cox and Herson 1987; Koppel 1987). Consequently, the capability of any locality or state to independently develop an effective, institutional means of protecting against groundwater contamination was questioned (Kerns 1977; Horn 1982; Batie and Diebel 1990).

In the early 1970s, Susan Boyd of Concern, Inc. noted an increasing number of queries from concerned citizens who did not know where to begin in their effort to take action regarding apparent environmental problems (interview file: site 2, int.# 24, 11-27). Earth Day, 1970 is viewed by some as the beginning of a new environmental consciousness and may have contributed to this new awareness on the part of the citizen (Odell 1980).⁴ The 1970s also marked the beginning of a new Congressional and national political awareness and action in water protection and other environmental issues.⁵

⁴ Others credit the recent rise of our nation's environmental consciousness to Rachel Carson's Silent Spring (1962).

⁵ Walter A. Rosenbaum in The Politics of Environmental Concern contends the confrontation between the steel industry and the Environmental Protection Agency about severe air pollution in Birmingham, Alabama, on November 1970 marked the advent of the Environmental Era in American Politics.

While the scientific and institutional literature continued to sharpen the focus on groundwater pollution problems (Lehr 1981; Craun 1981; President's Council on Environmental Quality 1981; National Science Foundation 1983; Neilsen and Lee 1987), this new branch of groundwater protection literature began to evolve into an appropriate source of information for layman citizens and local officials (National Research Council 1986; Waller 1989). Practical groundwater protection guides were developed that emphasized the importance of the role played by local citizens and officials in the implementation of groundwater protection policies and the tools they could use (Potter 1984). The guides contained specific methodology and descriptions of various developmental tools that would assist local planners, administrators, and citizens as they endeavored to protect the resource.

Local Action Guides

New Hampshire, which established a Water Resource Research Center in 1964, is representative of states that provided working publications (Groundwater Protection Manual: A Guide for Local Action) designed to help town resource planners and managers identify and protect groundwater resources in their areas. Danna B. Truslow's publication Preparing for Groundwater Protection and Planning (1982) is a manual that provides the background, understanding, and tools necessary for a rural resource planner interested in groundwater protection. The manual

contains an overview of the groundwater principles and properties, discusses the specific geological characteristics of New Hampshire and areas that need to be targeted for groundwater protection, shows a step by step groundwater assessment process, and also provides a case study of a groundwater assessment project. The manual is useful to small rural communities when they begin the initial critical step of defining their inventory of groundwater resources and the potential threats such resources may encounter.

A more ambitious approach to the problem was undertaken by The Association of Central Oklahoma Governments with the development of a "Protocol for Establishment of a Ground Water Management and Protection Plan" (1983). This approach was designed to help manage the quality of central Oklahoma's major groundwater source, the huge Garber-Wellington Aquifer. The "protocol" identified key actors in the process, the importance of the regulation of land use, and emphasized the role of the public and local governments in groundwater protection. A similar approach was taken by the state of Minnesota with The Handbook For Comprehensive Local Water Planning (1987) that contained a step by step process to guide local officials and their staffs through applicable statutes.

A plethora of guides for local action with less technical language began to appear during the late 1980s. They outlined tools for use by key players in the

implementation of groundwater policies and programs. The Northeast Michigan's Council of Governments' Local Strategies of Groundwater Management (1987) and Jaffe and DiNovo's Local Groundwater Protection (1987), sponsored by the American Planning Association, are examples of the comprehensive guides available for planning local groundwater protection procedures.

As a rule, action guides have addressed the groundwater protection issue from a regional or state perspective with an overall goal of providing information about groundwater to individuals or groups interested in the protection of the resource. Typical examples of publications that fall into this category are: Jan Gallagher's Citizen's Guide to Ground-Water Protection (1990) from EPA with general information about groundwater and the roles citizens and communities can play in protecting groundwater; Maureen Mecozzi's Groundwater: Protecting Wisconsin's Buried Treasure (1989), a pamphlet from the Wisconsin Department of Natural Resources that contains a concise explanation of groundwater and the options that may be taken in Wisconsin to enhance groundwater protection; Alexandra D. Dawson's Local Authority for Groundwater Protection, Groundwater Information Flyer #4 (1984), a short eighteen page flyer focused on the powers of local governments in Massachusetts that may be used for groundwater protection; and Margaret Hrezo and Pat Nickinson's manual, Protecting Virginia's Groundwater: A Handbook for Local Government Officials (1986), that provides information about groundwater from a

Virginia perspective, highlighting community actions that may be taken to protect the resource against the threat of pollution.

Two action guides aimed at the local level will be discussed in further detail because of their national use. One is a booklet published by Concern, Inc.; the other consists of a thirty-two page guide published by the Minnesota Project, a nonprofit organization that focuses on rural community issues in Minnesota. Concern, Inc., a non-profit organization founded in 1970 that encourages community action on environmental issues, published Groundwater: A Community Action Guide in June, 1984. The editors were Susan Boyd, Lynn Fuller, and Reed Wulsin. Its primary goal was to de-mystify the subject of groundwater for the benefit of the average citizen (interview file: site 2, int.# 24, 11-27). It is now in its fourth printing.

Concern, Inc. developed the guide after its research on groundwater protection identified a need for local action. They also uncovered a lack of collective groundwater information that could be presented in a usable form for individuals or groups who might be interested in developing their own local plan of action. The result was a short, fourteen page booklet that effectively exposed the reader to a variety of groundwater information and issues. Topics addressed include: "What is Groundwater?," "Availability and Depletion," "Quality and Contamination," "Public

Health Considerations," "Detection and Monitoring," "Federal Role," "State and Local Roles," and "Citizen Action."

The small action guide also includes three case studies that serve as examples for communities interested in addressing groundwater issues, eight pages of appendices that summarize applicable federal and state legislation, a comparison of state groundwater quality legislation, information on interstate and regional commissions, and helpful data about citizen organizations and state groundwater contacts. The booklet is a good initial source for individuals or environmental organizations interested in groundwater protection. A wide range of subjects are covered, from water testing procedures to a large list of specific actions for citizens who, in cooperation with state and local governments, endeavor to protect their groundwater. Rather than direct its message toward a narrow group of officials involved in groundwater protection, this publication contributes significantly toward a heightened awareness about groundwater issues among a more diverse group of average citizens and local officials.

The Minnesota Project's Citizen's Guide to Local Water Planning was developed by a staff that had been involved in groundwater activities for over ten years. The major objectives of the staff include citizen education, model groundwater protection ordinances, and groundwater-related program and policy research. The

Minnesota Project's 1988 booklet, by Janice Thompson under a Ford Foundation grant, is a short thirty-two page document that provides individuals and groups with the information necessary to protect their groundwater. It is a well-organized and practical booklet and serves as an example for other states and communities interested in building a higher level of citizen involvement.

The local action guide, as developed by The Minnesota Project, has two major sections. The first section discusses key policy issues concerning groundwater protection. The second section presents different local and state programs and emphasizes policy action options available to individuals and groups. The action guide is useful for determining statutory authority in Minnesota for various groundwater protection actions. Various points of contact for federal, state (Minnesota), and local (Minnesota) groundwater issues are identified throughout the document, as well as a toll-free telephone number for non-residents of the state who wish to communicate with Minnesota state agencies.

Most important, The Minnesota Project's local action guide helped identify the roles of government and citizens in groundwater protection. There is recognition that all levels of governmental and private entities must cooperate if groundwater is to be protected. The document displays a sensitivity toward local and regional differences and acknowledges that much of the burden for groundwater protection must be borne

by local governments. Private industry and the government cannot be relied upon to do everything necessary to prevent pollution and protect groundwater resources. Citizens are cautioned that they cannot sit and wait for government programs to provide a solution all the problems; such solutions will not occur automatically. The local action guide articulates a clear message to those who share concerns about groundwater protection. Groundwater protection programs will never be implemented to their full potential unless individuals and groups decide on necessary actions and, without waiting for intergovernmental initiation, move forward on their own.⁶

The Concern, Inc., and Minnesota Project publications provide examples of the strong protectionist message that is now prevalent in the activist literature, including the most recent federal and state publications. Potential social and economic consequences dictate that a community cannot afford to wait until its groundwater is contaminated before it makes an effort to protect the resource. The 1986 National Groundwater Policy Forum summarized the national case for groundwater protection with a plea for comprehensive management:

We urge every state that has not already done so to enact legislation to affirm the public interest in groundwater protection and adopt the comprehensive programs necessary to manage groundwater effectively. It is essential that groundwater be afforded the strong protection that has been afforded to other natural resources. Moreover, we believe that the focus on

⁶ The Minnesota Project continues to expand its efforts in combating groundwater pollution with Protecting Groundwater Through Sustainable Agriculture (Kemp and Erickson 1989), a publication aimed directly at the farmer.

source controls and cleanup that characterizes many of the existing environmental laws will not suffice to provide the protection this valuable resource requires (Conservation Foundation 1987, 6-7).

The trend in Virginia groundwater literature is similar to the emphasis on protection (Sponenberg and Kahn 1984; Slifer and Erchul 1989), and the responsibilities of state and local governments now seen in the national literature (Dean 1988). Issues of particular concern to groundwater protection such as the lack of state initiative, institutional frameworks, statutory law, and land use controls are addressed (Miri 1971; Clara Cox 1981; Cox, W.E. and Shabman 1984; Walker and Bridgeman 1985; Jones and Holmes 1985; Kerns 1990). The Virginia Groundwater Protection Steering Committee's A Groundwater Protection Strategy for Virginia (1987) stresses the need for an information network sharing ideas about the implementation of groundwater programs by local governments, particularly within Virginia.⁷ Lee and Christoffel's (1989) "Clarke County's Groundwater Protection Plan: An Innovative Response to an Emerging Issue," and the Virginia Council on the Environment's (1991) "Environmental Management in Montgomery's Karst Terrain" are examples of recent articles and reports that detail the concerns and actions of local

⁷ The Committee developed a handbook for agency officials and the public, Virginia Groundwater Management Handbook: State Agency Programs for Groundwater Protection (1988). The focus of the handbook was not solely on protection of the resource, but on assisting those involved in the permitting process and use of the resource.

governments that are trying to protect groundwater in especially sensitive geological regions.

The most ambitious Virginia project to date is a compendium of guidance materials for local and regional governments developed by a team from the College of Architecture and Urban Studies at Virginia Polytechnic Institute and State University, funded by a grant (December 1989) from the Virginia Environmental Endowment (VEE). Managing Water Resources by Virginia Localities (Hirschman and Roth, 1991), provides information to localities that would help them respond to water-related problems. It also incorporates water resources information into land use and comprehensive planning . Six documents were produced by the team in the first year of the grant:

- (1) John Randolph's Water Resources Management in Virginia,
- (2) David Hirschman and Richard Roth's Case Studies of Local Water Resources Management in Virginia,
- (3) William Owens and David Hirschman's Managing Water Resources at the Local Level: Regulatory and Nonregulatory Programs,
- (4) William Shepard's Analytical Methods for Local Water Resources Management,
- (5) William Owens' Multijurisdictional Approaches to Managing Water Resources: Options for Virginia Localities,
- (6) William Shepard's and Valerie Birch's Data Resources for Local Water Resources Management.

The six documents are evidence of increasing recognition in Virginia of the critical role local communities play in the protection of groundwater resources, and the need to provide information directly to the local level to assist in the fulfillment of that role.

SUMMARY

Within the last ten years, groundwater protection literature has reflected an increasing awareness of the necessity for a more comprehensive approach to the problem (Pye and Kelly 1988). Emphasis has been placed on the need for appropriate, as well as practical, local strategies and approaches to the problem (O'Donnell 1982; Potter 1984; National Research Council 1986; Libby 1990). The development of model groundwater protection ordinances with wide national application have provided local governments with some of the "cut-and-paste" tools they need to quickly solve some specific groundwater related problems (Minnesota Project, 1984 and 1990). Journal articles such as Meij, McGary and Abdalla's (1990) "A Comprehensive Approach to Groundwater Management for Rural Governments" and Yanggen and Born's (1990) "Protecting Groundwater Quality by Managing Local Land Use" continue to indicate the current emphasis on action by local government.

A legacy of the transitional period of the 1970s and 1980s is that various professionals concerned with water pollution began to acknowledge and debate the pros and cons of local citizen involvement in the decision-making process of groundwater protection (Canter 1977; Mc Allister 1980; Helling et al. 1982; Canter and Knox 1985). Public participation was generally seen in a positive light. A variety of practical suggestions were made to encourage public participation, such as how to develop public participation programs (Delli Priscoli 1981) and particular methods that could serve to expedite conflict resolution (Garden 1984; Gilpin 1989).

Groundwater protection became recognized as a multi-disciplinary problem that required involvement from many entities and disciplines (Frederick and Gibbions 1986; Garden 1988; Guerrero 1991; Hembra 1991). The "Final Conclusions and Recommendations" of the National Groundwater Policy Forum in 1986 (Conservation Foundation 1987, 8) reemphasized "that the public, private industry, and local, state, and federal governments must all join together and be actively involved in the management and protection of the nation's groundwater resources." The literature of groundwater protection has expanded beyond the sole boundaries of interest to engineering and groundwater professionals, to encompass all those interested in protecting what some view as the most valuable of the world's resources.

CHAPTER THREE

METHODOLOGY

Chapter three discusses three elements of the methodology used for this research: the case study methodology that structures the research, the policy implementation frameworks that focus and filter the data collected, and the ethnographic techniques that code, sort and catalog the data.

CASE STUDY METHODOLOGY

Case study methodology was employed to explore the groundwater protection activities in Clarke County. The basic theory of the case study method is that empirical research advances only when accompanied by logical thinking, and not when it is treated as a mechanistic endeavor (Yin 1984). The case study contributes uniquely to our knowledge of individual, organizational, social, and political phenomena. The methodology is a common research strategy in psychology, sociology, political science, economics and public policy. The purpose of the research is to explain why one rural county in Virginia has apparently made significant strides toward accomplishing a task that many Virginia rural counties find

almost unapproachable. Case study methodology exposes the researcher directly to many of the phenomena that played a role in shaping groundwater protection policies in Clarke County.

Case study methodology allows an investigator to retain the holistic and meaningful characteristics of real-life events, such as individual life cycles, organizational and managerial processes, social-economic change, and inter-governmental relations. The need for a case study arises out of the desire to understand complex social and political phenomena in all of these situations, and to understand the bond between theory and practice (Waldo 1955). Excellent examples of the usefulness of single case study methodology are seen in classic case studies that include Philip Selznick's (1949) sociological analysis of the Tennessee Valley Authority, Herbert Kaufman's (1960) look at the behavior of forest rangers, and Graham Allison's (1971) competing explanations regarding events surrounding the Cuban Missile crisis. These cases contribute a richness to the field of public administration, assist in theory development, and continue to be used to explain contemporary events. For example, Allison's competing organizational models are still used to offer explanations about America's involvement in other wars, the possibilities of nuclear confrontation, and the conditions that may induce a nation to terminate a war.

RESEARCH STRATEGY

The "how" and "why" questions of a case study are explanatory and deal with operational links that need to be traced over a period of time, rather than merely reporting the frequency of an incident. It takes more than a survey or the retrieval of archived records to determine "why" Clarke County has been successful in an area where many others have failed. The case study methodology is appropriate for Clarke County because data is derived from the analysis of contemporary events, not from the "dead" past. While a case study may use documents and cultural and physical artifacts as sources of evidence, it relies upon direct observation and systematic interviewing of living people who are available to report on what occurred, but whose behaviors are not manipulated by the researcher. The unique strength of the case study is its ability to deal with a variety of evidence: documents, archived information, direct interviews, participant observations, and physical artifacts (Yin 1984). According to Yin, a case study as a research strategy has a distinct advantage when a how or why question is asked about a contemporary set of events, over which the investigator has little or no control.

CASE STUDY DESIGN

How and why questions were asked throughout a system that can be viewed as Clarke County's groundwater policy subsystem, a system of multifarious actors as defined by Gary Wamsley (1985) (see Appendix D). The idea of a groundwater policy subsystem was used to guide the analysis, as there is a danger of seriously misjudging the dynamics of the process if one is not alert to circumstances and other actors throughout the policy network that may have driven Clarke County's groundwater policies. In a general sense, the groundwater protection policy subsystem for Clarke County was seen as stretching from the county, through the Loud Fairfax Planning District, through concerned state agencies and the Virginia General Assembly, to the Environmental Protection Agency and other federal institutions concerned with groundwater protection issues.

This case study of Clarke County is a single-case study with a holistic design. The unit of analysis was its overall rural groundwater protection policy subsystem. This differs from an imbedded single-case study where the implementation of groundwater protection policy in each town or municipality within a single rural county could function as the subject of a case study. For ease of identification, the rural groundwater protection policy subsystem of Clarke County was defined primarily in terms of its main actors. In other words, the main actors are those

members who have contributed in some manner to the functional area of groundwater protection.

The policy network for Clarke County was viewed as a policy subsystem of a larger political system using Easton's classic definition of a system as "variables interrelated so that a change in one results in a change in others" (Easton 1965). Major actors in a policy subsystem may include bureaucratic agencies in all levels of government, as well as interest groups, legislative committees and subcommittees, professional associations, powerful individuals, intellectuals with ideas in good currency, or relevant others (Wamsley 1985).

Yin identified five important components when conducting a case study: (1) a study's questions; (2) its propositions, if any; (3) its unit or units of analysis; (4) the logic that links the data to the propositions; and (5) the criteria for interpreting the findings.

1. The case study's questions:

Why was Clarke County able to move toward a greater groundwater protection policy stance than many other rural counties in the Valley?

What are the critical factors or forces that policy formulators and key actors need to be aware of when designing and implementing rural groundwater protection programs and policies in Virginia?

2. The propositions for the case study:

Rural groundwater protection policies falter and/or fail in Virginia because key actors do not properly focus on critical factors or forces that are related to the implementation process.

Certain statutory and non-statutory implementation variables play a critical role in the initiation and implementation of rural groundwater protection policy.

3. The unit of analysis:

The groundwater protection policy subsystem of Clarke County, Virginia.

4. The logic linking the data to the propositions:

The study is an explanatory-type case, and emerging themes should be found in Clarke County that relate to critical forces and factors of the groundwater protection process.

5. The criteria for interpreting the findings:

Determination of precise criteria is difficult for case studies as each case study presents a unique set of circumstances. In this case study, comparisons will be made between the groundwater protection actions of Clarke County and other counties in the Lord Fairfax Planning District.

The Policy Implementation Frameworks

Implementation models are used by implementation scholars to view and order issues surrounding policy implementation, and a variety of analytical frameworks exist (Van Meter and Van Horn 1975; Mazmanian and Sabatier 1981; Elmore 1982; and

Ingram 1990). While the methodology and criteria for evaluating implementation success may differ among the frameworks, the basic objective remains the same -- to identify the critical variables affecting the implementation of a particular public policy.

The implementation concepts developed by Sabatier and Mazmanian (1981), and Ingram (1990), were used to focus data collected during this case study, and the use of the frameworks will be discussed in detail. The conceptual frameworks were employed as research tools to help examine actors and events surrounding the initiation and implementation of groundwater policies in Clarke County, Virginia. The frameworks give focus and coherence to events in a policy subsystem that, while otherwise interesting as a case study, may not be seen as related and contributing to the total rural groundwater protection process.

Paul Sabatier and Daniel Mazmanian's framework (Exhibit 3-1) for the analysis of the implementation process of public policy and Helen Ingram's Flexible Framework for Implementation Studies (Appendix F), were chosen as lenses to focus upon the policy subsystem involved in the implementation of groundwater protection policies in Clarke County because each contributed an important dimension. The Sabatier and Mazmanian framework allows one to consider a virtual plethora of variables that may affect the implementation process. The Ingram framework allows

one to focus primarily on how the nature of decision costs and the structure of the statute create different patterns that affect implementation.

Sabatier and Mazmanian Framework

The Sabatier and Mazmanian framework identifies a number of stages usually involved in the analysis of the implementation of public programs: the policy outputs, or decisions, of the implementing agencies; compliance with agency decisions by target groups (i.e., the private or public actors whose behavior must ultimately be changed if program objectives are to be realized); and the program's actual impacts on the problem or problems that are addressed, as well as any unintended impacts. While formal evaluations of public programs have normally dealt only with these three stages, Sabatier and Mazmanian contend that an understanding of the evolution of such programs also involves the perceived impacts of the programs and major revisions (or attempted revisions) in the initial statute or other authoritative decision. These stages, as well as the evolutionary nature of public policy, were considered during the research. But research focus was directed toward the identification of particular independent variables that affected the formulation of groundwater protection policies in Clarke County, rather than the determination and evaluation of a specific stage in the implementation process.

The Sabatier and Mazmanian framework examines the effects of three sets of independent variables on (1) the tractability of the problem being addressed, e.g., the availability of a valid causal theory and the extent of change required in target group behavior; (2) a variety of ways in which a statute or other policy directive can structure (or constrain) the implementation process through the clarity of its directives and the assignment of rights and responsibilities to various actors; and (3) the non-statutory variables affecting policy implementation, e.g., the attitudes and resources of various sovereigns and constituency groups. In contrast to the predominantly behavioral orientation of much of the policy research, this framework seeks to remind scholars and practitioners of the manner in which legal directives can significantly constrain the behavior of implementing officials and other actors (Sabatier and Mazmanian 1980)

One reason the Sabatier and Mazmanian framework was chosen for the research was because of its stress on the ability of a statute to "structure" the implementation process (Sabatier and Mazmanian 1980, 544). The researcher assumed that the construction of federal and state statutes may have assisted the implementation of groundwater protection policies in Clarke County. The framework's seventeen independent variables and five stages of dependent variables also give a very broad perspective for identifying those factors having the greatest affect upon the achievement of objectives throughout the entire implementation

process. The independent variables affecting implementation and the dependent variables in the implementation process as defined by Sabatier and Mazmanian are shown in Figure 3-1.

INDEPENDENT VARIABLES (THREE STAGES)

Tractability of the Problem:

- (1) Availability of valid technical theory and technology;
- (2) Diversity of target group behavior;
- (3) Target group as a percentage of the population;
- (4) Extent of behavioral change required.

Ability of Statute to Structure Implementation:

- (1) Clear and consistent objectives;
- (2) Incorporation of adequate causal theory;
- (3) Financial resources;
- (4) Hierarchical integration within and among implementing institutions;
- (5) Decision-rules of implementing agencies;
- (6) Recruitment of implementing official;
- (7) Formal access by outsiders.

Non-statutory Variables Affecting Implementation:

- (1) Socio-economic conditions and technology;
- (2) Media attention to the problem;
- (3) Public support;
- (4) Attitudes and resources of constituency groups;
- (5) Support from Sovereigns;
- (6) Commitment and leadership skill of implementing officials.

DEPENDENT VARIABLES

Stages (Dependent Variables) of the Implementation process:

- (1) Policy outputs of implementing agencies;
- (2) Compliance with policy outputs by target groups;
- (3) Actual impacts of policy outputs;
- (4) Perceived impacts of policy outputs;
- (5) Major revision in statute.

The independent variables used to filter and focus the data from the research are explained in further detail in Chapter Five, "The View Through The Framework."

Figure 3-1. SABATIER AND MAZMANIAN ANALYTICAL FRAMEWORK
(1980)

Sabatier and Mazmanian summarize the necessary conditions for successful implementation in terms of a list of six crucial conditions:

1. The enabling legislation or other directive mandates policy objectives that are clear and consistent (or at least provides substantive criteria for resolving goal conflicts).
2. The enabling legislation incorporates a sound theory identifying the principal factors and causal linkages affecting policy objectives, and gives implementation officials sufficient jurisdiction over target groups and other points of leverage to attain, at least potentially, the desired goals.
3. The enabling legislation structures the implementation process to maximize the probability that implementing officials and target groups will perform as desired.
4. The leaders of the implementing agency possess substantial managerial and political skills and are committed to statutory goals.
5. The program is actively supported by organized constituency groups and by a few key legislators (or a chief executive) through the implementation process, with the courts being neutral or supportive.
6. The relative priority of statutory objectives is not undermined over time by the emergence of conflicting public policies or by changes in relevant socioeconomic conditions that undermine the statute's causal theory or political support. (Sabatier and Mazmanian 1980, 554)

Although these six crucial conditions reflect a federal agency perspective, they were utilized during the analysis portion of the research to help identify emerging themes.

Prior to the beginning of the case study, the researcher questioned whether the Sabatier and Mazmanian framework would be suitable as the total focusing device for

the study. Their framework had been used by scholars to identify factors that inhibit policy implementation (Lester and Bowman 1989), yet it has also been criticized by scholars as lacking parsimony and being too cumbersome (Ingram 1990). There is also the argument that one should be aware of and take into consideration past explanations for implementation success and failure, and the true complexity of the policy environment. For example, others stress the overall complexity of the policy environment and the multiplicity of decision points (Pressman and Wildavsky 1973).

Ingram's Framework

Ingram's (1990) "Flexible Framework for Implementation Studies" appears to add to the Sabatier and Mazmanian framework by revealing critical factors in the "big picture" of implementation. Ingram's framework incorporates both policy formulation and policy results. Her framework is also responsive to the kind of statute and the nature of the policy implemented. In trying to explain why Clarke County has moved toward a groundwater protection stance, the researcher wanted to move away from focusing solely on what was the standard criteria of most implementation studies, ie. whether statutory goals are met. It was seen as equally important to reflect upon whether the groundwater protection policy process that had taken place in Clarke County had in fact resulted in increased protection of the county's groundwater.

Ingram agrees with Wildavsky and others that policy problems are seldom solved, because each new policy creates a new situation. Good implementation is said to occur when the implementation process introduces improvement. Ingram also contends that the appropriate criterion for evaluating performance is policy evolution and improvement (Ibid., 470). Therefore, the test of implementation success may not necessarily be based on specific problem-related objectives that are achieved, but on whether any resulting problems are preferable to the initial problems (Ibid., 473).

The flexible framework presented by Ingram is a broad framework comprehending the nature of the decision costs faced by policy formulators and the consequent policy challenges presented to implementors by the structure of the statute. Her framework contains the major classifications of: 1) nature of decision costs; 2) structure of statute; 3) appropriate approach; 4) criteria for evaluation; and 5) critical variables affecting implementation (Appendix F). Ingram contends that patterns of implementation will vary with the implementation challenge presented by the statutory structure. The implementation phase should contribute toward policy improvement or evolution toward more tractable problems for which there are more doable and agreeable responses (Ibid., 476). Her ideas parallel Wildavsky's belief that the basic reason programs survive is that they adapt themselves to their environment over a long period of time. Ingram's framework suggests that different determinants, or clusters of variables associated with administrative competence or responsiveness to

clientele, will take on critical status depending on the nature of the challenge presented to implementors. Her framework is a dynamic one that sees implementation evolving over time as decision costs and other implementation factors change.

It was expected that the Sabatier and Mazmanian framework would prove useful for initial focusing on relevant events and individuals in the Clarke County groundwater policy network. The Ingram framework was expected to provide the additional clarity of implementation by policy type, and the broad perspective necessary to suggest and identify the factors and forces throughout the groundwater policy network that have unfolded over time to make Clarke County special. As Bolman and (1987) used the concept of "frames" in trying to order the world filtering some things while allowing others to pass through easily, the policy implementation frameworks were used to filter those determinants thought to be important to the implementation process.

Open ended questions were asked during the interview stage of the research to insure that data gathering was not restricted by the conceptual lenses selected. While the Sabatier and Mazmanian, and Ingram, frameworks were used during the research to guide critical thinking and gain a more comprehensive view of the groundwater program and policy subsystem, the researcher was not totally bound by these

conceptual frameworks during the case study. As the dynamics of the case evolved other explanations emerged, outside of the implementation frameworks, that were helpful in understanding the groundwater policy successes in Clarke County.

Helen Ingram's "flexible framework" was not found to be as useful as anticipated for this particular study. Application problems with Ingram's framework at the local level developed because the themes that emerged from the research were difficult to place in her framework. Many of the themes that emerged related to an actor or the county's overall attitude toward groundwater protection, and were not centered around specific critical variables relating to the nature of decision costs of a particular federal or state statute. A very strong belief prevailing at the local level in Clarke County was that groundwater protection policies and local statutes should reflect local concerns, not the concerns of the state or federal government. This independent attitude was consistently apparent among many different people, regardless of their particular attitude toward the implementation of strong statutory measures to protect groundwater. In retrospect, Ingram's framework may not be especially useful for explanations at the local level as it was built upon research primarily directed at federal policies (Ingram 1990).

Data Collection

Yin's case study rules functioned as general guidelines for the collection of data. Document and archival research was conducted, and Clarke County groundwater protection policy subsystem actors were interviewed. Interview questions were open-ended questions (see Appendix C) that corresponded to a guiding framework of specific topics. This particular technique allowed the interviews to focus on the policy area of groundwater protection in Clarke County, yet allowed emergent responses from the interviewees. In practice it was found that, after a brief introduction about the subject of research, interviewees (who were in general very knowledgeable about groundwater protection) covered the desired area with very little guidance. The open-ended questions were primarily employed to bring the interviewee back to the subject when it became apparent that the interview had strayed too far along a particular tangent. While there are limitations with open-ended questions as they only evoke what people wish to bring up, the open-ended questions served as a double-check by the interviewer to insure the coverage of relevant areas.

Most of the individuals interviewed in the study were professionals who had experience in different aspects of groundwater protection, as well as elected local officials and citizens who participated in some manner to further the goals of groundwater protection in their area. Open-ended questions structured around the case study protocol provided lead-in to commentary about groundwater protection while avoiding lengthy excursions into non-relevant areas. The open-ended questions

were pre-tested on public officials of Rockingham County, which is located in the Shenandoah Valley of Virginia. Interviewees were tape recorded, after being asked if they would be comfortable with the procedure, and notes taken with a summary sheet of data compiled the same day as the interview.

The interviewees appeared to be very comfortable with a taped interview, and seemed to become more enthusiastic as the interviews progressed. In fact, they appeared a bit more verbose than they perhaps might have been had the interview been recorded on written notes. Only one interviewee declined the use of a tape recorder. He had held an elected office and wished to provide off-the-record background information that he believed was important to the study, yet he did not wish to be directly quoted.

Most of the interviews lasted more than one hour, with interviews scheduled for forty-five minutes, plus or minus thirty minutes. The termination of the interview primarily dependent upon the information flow from the interviewee, and the interviewer was reluctant to terminate the interview arbitrarily, especially while the interviewee made what he or she considered to be important points. Many interviews proceeded on an informal basis, for one or two hours, after the interview had formally ended and the recorder was shut off. Important points that arose during these informal sessions were documented in a notebook for inclusion in the transcript,

and in a few cases the recorder was turned back on to allow an important subject to be embellished in the interviewees' own words. While most interviews were conducted in Clarke County, data collection did follow the groundwater policy subsystem for Clarke County with interviews conducted in the Lord Fairfax Planning District, neighboring counties, Richmond (the state capital), the Virginia Water Resources Research Center in Blacksburg, VA, the Virginia Water Project office in Roanoke, VA, and in Washington, D C.

Formal data collection techniques were utilized in the five specific areas of: documentation, archived records, interviews, direct observations, and physical artifacts.

Documentation - Included formal studies concerning groundwater protection, administrative documents, media articles, and communiques between actors in the policy network.

Archived records - Included organizational records, maps and charts, and survey data of Clarke County.

Interviews - Twenty-four focused interviews were conducted using open-ended questions and active listening techniques, plus four individuals who responded to specific follow-up questions.

Direct observation - Includes the observation of actions relevant to groundwater protection taking place in Clarke County, and the character of Clarke County itself.

Physical artifacts - Includes information about technological groundwater protection tools or devices used by Clarke County and others for groundwater protection, as well as other physical evidence such as products, or computer printouts.

The strategy of collecting data from multiple sources is seen as one of the major strengths of case studies. Data collected were cataloged and placed into a primary or secondary file, depending on the importance of the information to the data base, or how data related to the original research questions. The data from the interviews were transcribed into WordPerfect, normally the day following the interview, converted to ASCII and transferred to The Ethnograph software. Through the use of The Ethnograph software, coding of data took place with the data still fresh, which allowed emergent patterns or themes to be more readily recognized when data was manipulated later. Yin (1984) and Miles and Huberman (1984) all stress the requirement for an ongoing effort in regard to data collection if the researcher is to accomplish a high quality case study and recognize patterns that may emerge from the data.

Ethnograph Methodology

As mentioned previously, the conceptual framework of Paul A. Sabatier and Daniel Mazmanian is criticized in the implementation literature as lacking parsimony and being too cumbersome to use as a framework for analysis. The argument set forth is that in trying to include all the possible variables (they selected a total of seventeen) that impact on the implementation process, one loses the ability to predict which variables are most important to the process. The challenge, as seen by this

researcher, was to construct a process where the variables of the Sabatier and Mazmanian model could easily be identified in the emerging data, and a methodology developed that would allow the data to be manipulated in such a manner that major themes would emerge from the total data collection. The researcher discovered that such a process could be constructed around the methodology found in a software package entitled The Ethnograph.

The Ethnograph is a software program developed by John Seidel, Rolf Kjoseth, and Elaine Seymour (1988) for social scientists who wanted to move away from the cut-and-paste routines of traditional ethnographic studies. The program gives a user the ability to assign identifying codewords to various segments of analytically relevant text. The computer can then be used to assist in qualitative data analysis. In other words, The Ethnograph consists of a set of interactive, menu-driven computer programs designed to assist the ethnographic-qualitative researcher in various mechanical aspects of data analysis. The program provides an efficient alternative to the normally cumbersome task of managing field notes, transcripts, documents and other types of data collected in qualitative research. Since the computer does some of the mechanical aspects of the work, the researcher becomes free to devote more time and attention to the critical interpretive aspects of qualitative data analysis (Seidel et al. 1988).

The researcher transcribed data collected from a taped interview into a particular WordPerfect format that allowed it to become compatible with The Ethnograph data structures. A Word Perfect data file was created and later converted into ASCII text, which enabled the data to be imported into The Ethnograph program. Once it had been imported into the program, the data could be coded, recoded, and sorted by data files into different analytic categories (see Appendix A for codes used). This process allows the researcher to review text in whatever form necessary. The program could also display, sort, compare, modify codes, or print data segments in any particular order or sequence.

After data importation into The Ethnograph program, the next step in the data processing procedure was data printout in a format that facilitated the use of key words to develop a rough code-map of the text. The printout was then studied carefully. In this particular case, the data was viewed in the context of its appearance under a particular conceptual implementation "lens," and its interesting features identified and assigned key words (codes) from the implementation lens. The mapped codes were then entered into the computer. This process provided a means of identifying certain features and patterns in the data that related to groundwater protection and implementation, and also gave the user the ability to index such data for later retrieval and more careful analysis. Further data analysis established relationships that appeared under the focus of the conceptual implementation lenses,

and it became easier to understand and interpret themes that emerged. As ethnographic coding is an interpretive, evolutionary process, no additional coders or cross-coding techniques were used. The assignment of a specific code to a given segment of data was a determination made solely by the researcher.

The Search application is the heart of The Ethnograph and provides a means to move defined segments of text from their original context into a new context of similar segments. As relational segments are compared and contrasted, new patterns begin to emerge, particularly those that fit into the overall larger phenomenon of groundwater protection in Clarke County. The Ethnograph software was an appropriate tool for a computer-assisted synthesis of the conceptual frameworks of Sabatier and Mazmanian and, to some extent, Ingram. It provided the user a relatively easy means to mentally, and later physically, organize data into categorical and conceptual collections; allowing one to move forward to practical or theoretical explanations for the groundwater protection events that had occurred.

Two main search options available in the software allow users to pull out associated segments: single (criteria for locating a segment is a single code word), or multiple (criteria for locating a segment is a combination of code words). If a multiple code search is used, up to five code words linked by "and" or "not" may be used to define a segment. For example, one could accomplish a quasi-Boolean search

for all segments defined by (1) CODE1 and CODE2, (2) CODE1 but not CODE2, (3) CODE1 and CODE2 but not CODE3 (Seidel 1988, 9-10). When a multiple search is conducted, The Ethnograph software allows selected segments to be nested and/or overlapped. Themes were normally developed by using single code word searches, but at times the researcher employed multiple searches to examine the high incidence of code word occurrences related to one of the major categories in the Sabatier and Mazmanian or Ingram frameworks. A volume of ethnographic coded interviews (approximately 200 pages) and two volumes of ethnographic data sorted by codes (approximately 125 pages each) are available through Virginia Tech's Center for Public Administration and Policy, (703) 231-5133 for anyone desiring the information. These volumes of raw data were not included in the final dissertation because of their bulk and as the data is summarized in Chapter 5 and Appendix B.

Analysis of Data

The collection and analysis of the data were guided by the propositions that shaped the case study: (1) certain statutory and non-statutory implementation variables play a critical role in the initiation and implementation of rural groundwater protection policy, and, (2) that the conceptual implementation frameworks of Ingram, and Sabatier and Mazmanian, should prove useful in explaining successes and failures in rural groundwater protection policy by identifying the key forces or factors

involved. The data from the research does appear logically linked to the research propositions and, as discussed in chapters five and six, emerging themes from the data collected appear to offer explanations about Clarke County's success in groundwater protection.

Clarke County's groundwater protection policies and the groundwater protection policies of other counties in the Lord Fairfax Planning District were compared by using data gathered by Lord Fairfax Planning District personnel. Data relating to guidelines in The Groundwater Protection Strategy for Virginia were identified as elements suitable for a rural groundwater protection program. A matrix of categories (Miles & Huberman, 1984) was developed to provide a means to weigh the elements of a county program, thereby developing a method of rough quantification that could be used to provide a quick indicator of the quality of a county's groundwater protection program (see Appendix E). Because of the complexity of the case methodology and the time required for a comprehensive study of each case, the case study selection was limited to one case. Nevertheless, data from surrounding counties was used to assist in drawing inferences concerning the causal relations among the forces and factors under investigation.

Criteria For Validity

A selection of sufficient operational measures is necessary to insure construct validity for a case study. As the primary type of changes to be studied in this case related to the protection of groundwater, actions relating to ordinances, zoning, and land use practices were selected. Insuring that any selected measures of change actually reflect and relate to an increased groundwater protection stance is always difficult, especially when groundwater protection may, or may not, have been the primary motivating factor behind any change that actually occurred.

The selection of measures for this research took into consideration the evolutionary nature of the policy process and the acceptance of Ingram's and Wildavsky's ideas of policy evolution toward more tractable problems. The overall measure of success used in the study was whether the action that had occurred made the issue of groundwater protection more manageable for the county. As stated by Martin Jaffe (1987):

The long-term success of establishing a local groundwater protection program can best be evaluated by the lack of pollution threats to public and private water supplies; in a preventive program, the absence of problems is, in some ways, a more accurate measure of success than merely identifying pollution through groundwater monitoring and responding to it by stringent regulatory measures.*

* Martin Jaffe in "Requirements for Local Planning," (Planning for Groundwater Protection, Page G.W. 1987, 155), presents an approach to groundwater protection for local planners and officials that proposes initially focusing on only a few high-priority threats in a few high-priority locations.

The issue of internal validity (did X in fact lead to Y, or did Z cause Y?) was more difficult to address because of the inter-relationship between land use and groundwater protection policies. At times there is a "chicken-or-egg" scenario between growth management and groundwater protection, and perhaps it is not important to try and decide which came first as long as the result is better groundwater protection. Restrictive land use policies in Clarke County have led to better groundwater protection, and it is also true that the passage of groundwater protection ordinances have restricted the use of land. There is not a lack of opposition in Virginia to methods like those employed by Clarke County to protect its natural resources. Development interests, lately led by northern Virginia developer John T. (Til) Hazel, continue to use the Virginia General Assembly as a means to attack and blunt environmental and preservation legislation that limits land use.⁹ As it was the researcher's intent to be sensitive to what had actually happened in Clarke County, opposition to policies restricting land use was considered a given and research emphasis placed on the determination of what factors helped to move protectionist type policies forward. Interviewee comments relating to opposition to environmental and protectionist policies were noted and are presented under the applicable variable in the Chapter Five findings. The goal of this research was to

⁹The 1992 session of the Virginia General Assembly saw a massive assault by developers to abolish Virginia's Department of Historic Resources, and allow landowners to solely determine whether their properties have any historical significance (GRASSROOTS, Spring 1992, Berryville, VA.)

focus on what are seen as positive events from a groundwater protection perspective. It is possible that other researchers may wish to focus on what some see as the negative aspects of groundwater protection efforts, mainly more restrictive land use policies.

The external validity of the case should be good as specific actions taken by Clarke County to protect its groundwater can be generalized beyond the immediate case. The reliability of the study was enhanced by the careful documentation of interviews and procedures, and portions of the findings should apply to other rural counties in Virginia, as well as to the United States and other rural areas of the world.

Criteria Of Credibility

Because of the potential for researcher bias and the inherent subjectivity of a case study, Lincoln and Guba's (1985) idea of trustworthiness was the main guiding criteria for the research. The criteria of credibility was used as the overriding test. The research must be conducted in a truthful manner so that it presents an accurate representation of a perceived reality, and any evidence must address the original research questions. One also needs to be constantly aware of his or her personal biases, especially during interviewing and the generalization phase (O'Sullivan and

Rassel 1989). The multiple data sources from different geographical locations add to the credibility of the research. Moreover, the interviewees were given an opportunity to react to the data collected, and some were also given an opportunity to review draft copies of the study.

An important feature of a single case study is that statistical generalizations, such as those that are generally associated with survey research, are not made. Rather, there is a reliance upon analytical generalization (Yin 1984, 39). The results of the Clarke County groundwater protection policy subsystem research were generalized in order to articulate broader theories that emerged from the data. Broader theoretical issues, such as the roles of the County Administrator, the Board of Supervisors, supporting agencies, and the citizens; as well as the need to publicly acknowledge the interaction between land use and groundwater protection, did indeed emerge. They form the basis for a theory of why and how groundwater protection policies were established in one county in the Shenandoah Valley region of Virginia. While such a theory may be considered controversial, it should serve as a useful addition to the groundwater protection literature and may prove to be a satisfactory framework for examining or initiating groundwater protection actions in other counties.

CHAPTER FOUR

HISTORY OF GROUNDWATER PROTECTION IN VIRGINIA

INTRODUCTION

This chapter begins with a discussion of the importance of protecting groundwater that was evident both among Virginia's earliest settlers and ancient civilizations. It will also show how the emphasis toward the resource changed from protection to use as our country grew, and how federal and state water laws accordingly developed. Within the last 20 years, the emphasis has begun to shift back toward protection of the resource with a proliferation of federal environmental protection laws; along with a flurry of activity directed toward water resource protection at both the federal and state level. Despite growing evidence that the protection of groundwater should be rising to the top of local agendas, groundwater protection in most Virginia localities remains a secondary consideration to that of economic and social development.

Virginia's Problem

Virginians have always been blessed with an abundance of groundwater water. Forty-one percent of Virginia's 5.3 million residents depend on groundwater throughout the year as a water source. Public water systems rely on groundwater in 64 out of 95 counties in Virginia to provide 50 percent or more of drinking water, and residents of 37 counties and five of the state's independent cities rely wholly on groundwater (Weigmann & Kroehler 1988). In recent years the quality of private well water in many rural areas, in aquifers that range from the Chesapeake Bay to the Blue Ridge mountains of Virginia, is beginning to be questioned as a suitable source of drinking water (Ross et al. 1991; J. Leo Bourassa 1991). The evidence of increasing coliform levels and other pollutants in aquifers raises additional questions about the ability of current federal, state, and local statutes to protect the quality and quantity of Virginia's groundwater.

SECTION ONE - EVOLUTION OF GROUNDWATER PROTECTION IN VIRGINIA

EARLY SETTLERS

In April of 1607 when ships carrying Englishmen sailed up the James River, a foremost thought in their minds was the finding of "sweet water" in a location suitable for a settlement. While springs and streams could be used in good weather and non-threatening environments, a protected well located inside a palisade was deemed necessary in order to insure the protection and survival of the community during the winter months or in the event of Indian hostilities. American modern-day conveniences tend to lull water users into forgetting how important water is to a family and a community. It is easy to overlook how time consuming and labor intensive it is for primitive societies to provide water for drinking, cooking, and cleaning. A dug well eased such chores and left time for other endeavors, and the location of community wells eventually developed into a gathering place for social interaction (Tolman 1937).

Since earliest recorded times, the ability to reach groundwater defined the very beginnings of cities and cultures. Elaborate, hand-dug, interconnecting systems of tunnels that tapped groundwater were known to exist in Ancient Persia and Egypt as early as 3000 years ago. The birth of some cities began with the digging of a well. The Old Testament describes one city's beginnings, " And it came to pass that same day, that Issac's servants came, and told him concerning the well they had digged, and they said unto him, We have found water. And he called it Shebah: therefore the name of the city is Beersheba unto this day" (Genesis 26: 32-33).

Once dug, a well was one of a community's most precious possessions. The very existence of the community dependent on a good flow of water and the protection of the water from any contamination that might lead to the outbreak of communicable diseases. Protection of the "sweet water" found by America's first settlers had the highest of priorities as evidenced by the first known sanitation law in Virginia:

No man, woman, launderer, or laundresse dare to wash any unclean linen, drive bucks, or throw out the water or suds of fowle clothes in open streets, within the Palizadoes, or within forty foot of the same, nor rench, and make clean any kettle, pot or pan, or such like vessel within twenty foot of the old well, or new pumps, nor shall anyone aforesaid within less than a quarter of one mile from the Palizadoes, dare to doe the necessities of nature, since by these unmanly, slothful, and loathsome immodesties, the whole fort may be choaked and poisoned. (Virginia, 1610)

The above 1610 law was a reaction to severe sickness that had occurred within the fort and reflects an understanding of several common sources of waterborne contaminants that pose a threat to human health. The washing of unclean linens, foul clothes, and dirty pots and pans were clearly seen as events that could contaminate the well water. There is a clear understanding of the dangerous threat an old well poses to the quality of the groundwater in the new well, a lesson that still needs to be emphasized in Virginia. Perhaps most astonishing in the 1610 law is the requirement that all persons proceed a quarter of a mile from the palisades before performing the daily acts of nature. Only those who have had the opportunity to participate in winter

tent camping, can truly understand what a herculean effort this law required of inhabitants during the winter months.

While the 1610 sanitation law is evidence that the first settlers of "Old Virginia" had a good working knowledge of pollution dangers to groundwater, this same level of awareness apparently was not maintained as settlers expanded west into areas with abundant water resources. They encountered an abundance of rivers, streams, and spring water flowing from the ground and well water that looked, smelled, and tasted good was seen (and is still seen) as "pure" by those in rural areas. For example, though early settlers realized that underground streams were a common source of water, rural landowners did not take extraordinary measures to protect water sources in the karst area of the Valley of Virginia (interview file: site 2, int.# 5, 259-292). It was a common practice to graze livestock alongside springs, and sinkholes were handy receptacles for household and farm trash.

The lack of protective action by rural landowners may have been due to the initial population sparsity in the rural settlements, as well as the belief that the contamination of water in one family's area would not necessarily lead to water contamination over a wide area. Moreover, little comprehension of the interrelatedness between surface water and groundwater existed. The sights of dairy cows being fed along streams and cattle in streams are still common ones in rural

Virginia, and it is not impossible to find an outhouse hanging over a stream. The somewhat lackadaisical rural perspective on water protection can be contrasted to the earlier perspective of a community who lived within a palisade and were dependent upon the groundwater from a well. There, the inappropriate actions of one individual were viewed as having the potential to choke and poison the entire community.

One historical note may perhaps be important for Tidewater Virginia.

Evidence suggests that other societies have taken extraordinary measures to provide high-quality drinking water for their citizens. Circa 300 B.C., evidence suggests the Romans did not wish to get their drinking water from groundwater in certain coastal areas. Instead, they relied upon an extensive aqueduct system that they built and continued to expand as their empire grew (Tolman 1937). A reason behind the action is that the Romans realized their groundwater had become a source of sickness. This historical lesson may contain some important lessons for future Virginians as new surveys of Virginia wells continue to show high levels of coliform contamination. (Ross et al. 1991)

EARLY VIRGINIA WATER LAW

Early laws relating to water and groundwater resources in Virginia and the United States primarily addressed the use, rather than the protection of the resource.

In order to grasp the historical view toward groundwater in Virginia, four rules frequently used within the United States for governing allocations of groundwater will be examined. Four distinct groundwater allocation doctrines developed in the United States: 1) the "English Rule" of absolute ownership that gives a landowner complete freedom to use as much groundwater as he wishes; 2) the "American Rule" of reasonable use that establishes a doctrine of reasonable use on withdrawals and helps to protect the water resources of others; 3) the correlative rights rule developed in California to apportion groundwater dependent on the amount of land owned over an aquifer; and 4) the prior appropriation common law and statutory mechanisms of western states that seek to give priority for groundwater use to those who first applied for withdrawals, as well as attempt to allocate groundwater according to defined beneficial uses (Henderson et al. 1985). The doctrines that evolved on a national level offered little in the way of protecting the quality of the resource. Accordingly, the court cases of the past were concerned about access to and use of the resource.

Walker and Cox (1968) note that Virginia water law has its origins in the colonial and state land grants to individuals, the state Constitution, the decisions of the courts of the State, and in various statutory enactments. Any mention of use or protection of water resources in the original Constitution of Virginia is limited to a brief comment about the navigability of rivers (Section 63) and other comments that reserve natural oyster beds, rocks, and shoals in the waters of the State for the people

(Section 175). The common law doctrine concerning water rights that evolved in Virginia came from English law and focused on use of the resource. This law traditionally has been divided into separate doctrines of groundwater and surface water law. Early Virginia laws that dealt with water issues revolved mainly around questions concerning navigation on streams and the rights of riparian owners (Embrey 1931).¹⁰

Preparation of a new Constitution of Virginia in 1969 and 1970 resulted in a strong State declaration to protect water resources in the Commonwealth:

To the end that the people have clean air, pure water, and the use and enjoyment for recreation of adequate resources, it shall be the policy of the Commonwealth to conserve, develop, and utilize its natural resources, its public lands, and its historical sites and buildings. Further, it shall be the Commonwealth's policy to protect its atmosphere, lands, and waters from pollution, impairment, or destruction, for the benefit, enjoyment, and general welfare of the people of the Commonwealth. (Virginia Constitution, Art. XI, 1)

EVOLUTION OF GROUNDWATER DOCTRINES

In Virginia law two main doctrines concerning groundwater developed. If groundwater flowed in well-defined channels or streams beneath the ground and the

¹⁰ See Judge Alvin T. Embrey's "Waters of the State," or Property in Virginia, in the BANKS, SHORES AND BEDS of the BAY OF CHESAPEAKE, THE SEA, THE RIVERS AND CREEKS OF THE STATE and CONTROL OF THE WATERS THEREOF (1931), for a fascinating study of the evolution of early Virginia water law.

existence of the stream could be factually determined, then the same rules applied as if the stream were on the surface. If there was no proof of an underground stream or watercourse, the groundwater was assumed to be percolating ground water. Depending on the particular situation, flows from springs could be addressed by either doctrine. Well-defined channeled flows from springs were treated as streams, but flows that did not take on the characteristics of an underground watercourse were treated in the courts according to the percolating ground water doctrine (Walker and Cox 1968).

Early twentieth century Virginia cases concerning the use of groundwater such as Miller v. Black Rock Springs Improvement Co., (99 Va. 747, 40 S.E. 27 (1901)) and Heninger v. McGinnis (131 Va. 70, 108 S.E. 671 (1921)) applied the English doctrine of absolute ownership as a general legal principle, affirming that the owner of the surface of a tract of land had absolute ownership of underlying percolating waters. Clinchfield Coal Corporation v. Compton (148 Va. 437, 139 S.E. 308 (1927)) recognized the differences between the English doctrine of absolute ownership and the new American doctrine associated with "reasonable use" that would ". . . forbid maliciously cutting it off, its unnecessary waste, or withdrawal for sale or distribution for uses not connected with the beneficial enjoyment or ownership of the land from which it is taken . . ." Percolating waters were further defined in the Clinchfield case as: ". . . those which ooze, seep or filter through the soil beneath the

surface, without a defined channel, or in a course that is unknown and not discoverable from surface indications without excavation for that purpose" The court in Clinchfield also provided additional criteria for determining the existence of an underground stream: all underground water not meeting the "flowing underground stream" or "well-defined channel" criteria is assumed to be percolating waters.

Groundwater Rights Doctrine of Reasonable Use

The issue of absolute ownership as opposed to the reasonable use doctrine for percolating waters has yet to be decided in Virginia Courts. C & W Coal Corp. v. Salver (200 Va. 18, 104 S.E. 2d 50 (1958), a case that involved a landowner's spring drying up because of mining operations, is used as an example of the courts' tendency to move toward a doctrine of reasonable use. In this case, the waters of the landowner were held to be percolating, but no liability in the absence of negligence was attached to the corporation (Walker and Cox 1968, 101). Three areas continue to be unclear in Virginia groundwater law. Whether an owner of a property may (1) withdraw as much water as he wants from his land, (2) for any use he may choose, and (3) even if it exhausts the source. These unanswered questions are seen as the most serious defects in Virginia's attempts to protect groundwater resources.¹¹

¹¹ Joseph A. Miri, Some Problems Of Water Resources Management In Virginia: A Preliminary Examination, The College of William and Mary (1971), examined the suitability of common law and current statutory law to protect water resources in the

Walker and Cox (1968) contended that Virginia laws focused on preventing the wasting of water (Va. Code Ann. section 62.1-11, 1968), and to prevent the waste of groundwater from artisan wells (VA. Code Ann., section 10-117.1 (1964)), are consistent with the assertion that the courts are moving toward a reasonable use doctrine. The 1987 Groundwater Protection Strategy for Virginia also contends that the courts are moving toward a reasonable use doctrine for groundwater allocations (the water must be used on the land where it is withdrawn, versus an absolute ownership theory that would allow the landowner to export water to other locations), although the courts had yet to consider the issue directly.

The term "reasonable use," when applied to groundwater, may indeed not be "reasonable use" at all as defined in other water doctrines. Cox and Shabman (1984) point out clear distinctions between reasonable use as seen by the courts under the riparian doctrine, and reasonable use under a groundwater rights doctrine. When the riparian doctrine is applied, water withdrawal (reasonable use) is determined with the rights of others taken into consideration. When the groundwater rights doctrine is used, water withdrawal (reasonable use) can be determined without considering the rights of other users. The application of the latter doctrine means that almost any traditional use of groundwater on one's own land may be seen as reasonable by the

Commonwealth, and found the statutes examined directed more toward maximum development and use of the resource than protection.

courts -- even if such use eventually destroys the groundwater of neighbors (Cox and Shabman 1984, 190-191).¹²

Virginia has yet to emphasize in its statutes the interrelationships between surface water and groundwater, and water quantity and water quality. The state has thus far been unable to tie concepts of water quality and water quantity together whenever the subject of interest is groundwater. The "marriage" of water quality and water quantity is currently manifest in the water laws of western states, where any separation between water quality and water quantity is seen as artificial and as obstructing the ability to reach solutions (Squier 1991). LaJuana Wilcher, Assistant Administrator for Water at the U.S. Environmental Agency, speaking at a water quality conference held at Northwestern School of Law of Lewis and Clark College (Feb. 22, 23, 1991), reiterated two major themes emerging from the states: (1) water quality and water quantity are not separate elements today; and (2) in carrying out its charge under the Clean Water Act (CWA), the Environmental Protection Agency

¹² Cox and Shabman's 1984 article on Virginia Water Law focused on the interjurisdictional transfer issue but also highlighted the reoccurring theme of weak institutional mechanisms to resolve current and future water supply conflicts in the Commonwealth.

(EPA) regulates not just water quality but water quantity as well (Squier 1991, 1082).¹³

Development of Water/Groundwater Pollution Law

In terms of surface water pollution, the actions of Virginia courts at the turn of the century could be fairly characterized as concurring with the then-prevalent belief that a certain amount of pollution was the acceptable cost of progress and that no one had an absolute right to "pure" water. In 1900, the court in Trevett v. Prison Association of Virginia (98 Va. 332,339,36 S.E. 373 (1900) held that a riparian owner is not entitled to have water flowing to his land in a pure state and approvingly quoted from Mayor of Baltimore v. The Warren Mfg. Co., (59 Md. 96), "All running streams are, to a certain extent, polluted; and especially are they so when they flow through populous regions of country, and the waters are utilized for mechanical and manufacturing purposes . . ." (59 Md. 96) (As cited in Walker and Cox 1968).

¹³ It is interesting to note that native Indian tribes in the west, when given an opportunity to manage water resources, have approached the problem in an integrated manner -- never assuming that quality and quantity are separable. See Anne W. Squier 1991, 1082.

Virginia courts did occasionally grant legal protection to riparian owners where pollution damage was extensive and the source of the pollution clearly ascertainable. A chemical company in 1912 argued that its pollution of the waters of a natural water course was a necessary consequence of a beneficial use of the property that also provided economic growth for the community (Arminius Chemical Co. v. Landrum (113 Va. 73 S.E. 459 (1912))). The Virginia court in this case rejected the chemical company's argument and held the company liable for damages caused by the pollution. But as a rule, Virginia courts tended to rule in favor of the polluter. In 1945 a case concerning pollution of groundwater reached the Virginia courts (Oakwood Smokeless Coal Corp. v. Meadows, 184 Va. 168 34 S.E. 2d 392 (1945)), and, in that case, no liability accrued to the corporation causing the pollution because the corporation was engaged in the legitimate and rightful use of its property (Walker and Cox 1968, 102).

That the resolution of groundwater contamination cases would be heavily weighted toward industry is understandable in a post-war period with industry expanding rapidly in a pro-growth state, particularly when industry was operating in accordance with established laws. After their review of percolating ground water cases in Virginia in 1968, Walker and Cox stated, "At present, the only general legal principle concerning the use of percolating water which has been established with any degree of certainty is that any reasonable, legitimate use of one's land which

interferes with the flow of percolating water to another's land produces no liability." Percolating groundwater rights were in an undefined state, which created a basic weakness in the State's system of water law. While scholars recognized a need to more fully-develop Virginia groundwater rights, there was little interest in the subject by the public or the General Assembly.

Virginians continued to be blessed with an abundance of water resources as Virginia grew during the post-World War II era, and the protection of surface water and groundwater received little attention. Virginia wanted a pro-growth image -- one that encouraged economic development and therefore continued a heavy emphasis on landowner rights. The basic American land use concept supports a landowner's right to develop land for its most profitable use, and this right is constitutionally protected against unreasonable regulation (Goldblatt v. Hempstead, 369 U.S. 590 (1962)). The development of land for economic or social use included placing increasing demands on existing water resources.

Unbelievable as it may seem, some Virginians interpreted water pollution as a welcome sign that progress was finally coming their way: "Its good when the rivers are polluted because that means progress is occurring." (interview file: site 1, int.# 3, 126). Except for a few suffering poor people in rural areas who had polluted their own wells, the general citizenry and Virginia institutions have exhibited a general lack

of concern about groundwater protection. Furthermore, no constituencies with the political clout to move the General Assembly toward specific legislative action for the protection of groundwater existed (interview file: site 8, int.#23, 160-247).

1946 State Water Control Law

In 1946, the Virginia General Assembly enacted a State Water Control Law with the stated purposes of the restoration of state waters to a high level of quality and the safeguarding of state waters from pollution. The original Act contained specific definitions of different types of pollution and particularly addressed the definition of groundwater: "State Waters" means all water, on the surface and under the ground, wholly or partially within or boarding the State or within its jurisdiction . . . (Va Code Ann., section 62-11 (4) (1950)). The Act also reaffirmed the principle that no one had any right to pollute state water: "No right to continue existing pollution in any State water shall exist nor shall such right be or be deemed to have been acquired by virtue of past or future pollution by any owner." (section 62-11 (6) 1950).

Protection of Groundwater Resources in the Post-war Era

Protection of groundwater resources during Virginia's post-war era was limited, and continued to be accomplished primarily through the actions of the courts relying upon doctrines associated with property rights. Although the State had begun to take tentative steps in moving toward the protection of its groundwater resources, progress in that direction was very slow. To use property rights as a means of protection, a lawsuit had to be initiated by a party who had already suffered damage or otherwise had been adversely affected, or where groundwater use was directly threatened. This made the use of property rights as a control mechanism for groundwater protection ineffective (Cox 1976; Rogers 1977).

The difficulties present in using common law to win a suit concerning groundwater pollution for damages are well-recognized on a national level (Grad 1983). To win in a nuisance, negligence, or a strict liability case, the plaintiff must, at some point, be able to establish a positive causal connection between the observable pollution and the actions of the defendant. Because of the complexities of various hydrogeological settings and the difficulty in positively identifying a specific source of contamination among many possible polluters, it can be extremely difficult to prove to the satisfaction of a court that the source of contaminants under question did in fact come from a particular defendant (Scarow 1989).¹⁴

¹⁴ Groundwater modeling is now being used in the courts in two major ways for groundwater contamination cases: (1) To "qualitatively" establish the link between the defendants chemicals and subsequent groundwater pollution; and (2)

The intergovernmental strategic-planning process, which is a necessary starting point in the regulatory process and eventually provides protective measures for groundwater resources, was missing in Virginia's post-war era. The use of a judicial process based on property rights was not a satisfactory means to ensure the quality of the Commonwealth's groundwater. "The application of after-the-fact constraints primarily in the form of monetary damage awards on a discontinuous, case-by-case basis does not provide an adequate foundation for a comprehensive program of controls necessary to afford actual protection to the resource." (Cox 1976, 144)

Federal clean water legislation in the post-World War II era focused on surface pollution and viewed pollution control as primarily a state function funded by state resources. Although water pollution began to draw increasing attention on a national scale, state water protection efforts experienced little federal assistance. The Water Pollution Act of 1948, the Federal Water Pollution Control Act of 1956, the 1961 amendments to that Act, the Water Quality Act of 1965, and the Clean Water Restoration Act of 1966, all placed the primary responsibility for the regulation of pollution and enforcement of programs on the states, yet the laws did little more than provide funds for research and financial assistance to state programs (Barth, 1990).

"quantitatively" to show a history of contamination levels. Yet, modeling is recognized by the courts as an inexact science when trying to prove causal links in groundwater contamination cases. See James W. Scarrow 1989, 185-205.

The Establishment of State Water Centers

In 1964, Congress passed legislation establishing 54 water centers throughout the nation. The Centers were charged with the responsibility of identifying and conducting research on the most important water problems in their jurisdictions. Virginia Water Resources Research Center (VWRRC) at Virginia Tech, Blacksburg, Virginia was among those established in 1965. VWRRC began to play an important role in the collection of information and conduct of research on water problems in Virginia, and also served in a coordinating role among the eleven different regulatory agencies in Virginia that had the potential to affect the quantity or quality of water resources (Clara Cox 1981). In the early years of the VWRRC, groundwater quality was not particularly viewed as a major problem and did not receive priority in research efforts.

SECTION TWO - RISE OF NATIONAL ENVIRONMENTAL CONSCIOUSNESS 1970-1980

During the 1970s Virginia, along with other states, found itself pushed and pulled into an increasing environmental consciousness by the passage of a variety of

federal legislation dealing with environmental issues.¹⁵ The enactment of the National Environmental Policy Act, Clean Air Act, Clean Water Act, Endangered Species Act, and Resource Conservation and Recovery Act, among others, began a trend in federal legislation that required states to react to major federal environmental policies. Public concern over environmental threats increased sharply, as did the membership and political clout of environmental groups. The decade of the 1970s was a remarkable period for the passage of federal environmental policy and legislation. Noted legislators such as Senator Edmund Muskie, D-Maine, and Representative Morris Udall, D-Arizona, lead the way and formed legislative coalitions for policy enactment, most of which was accomplished before many members of Congress had a clear understanding of the broad implications and ramifications of such policies (Vig and Kraft 1990).

FEDERAL FRAMEWORK

Federal statutes and actions of the Environmental Protection Agency (EPA) that assisted in the protection of groundwater are outlined in the following federal framework section. Comments are directed toward how the individual statutes contributed to the overall process of protecting the nation's groundwater.

¹⁵ President Nixon signed the National Environmental Policy Act (NEPA) as his first official act in 1970. The Act established the Council on Environmental Quality (CEQ) to advise the President and Congress on environmental matters.

1972 FEDERAL WATER POLLUTION CONTROL ACT

The Federal Water Pollution Control Act of 1972 became the first major federal legislation to seriously address the problems of pollution in the nation's waters. With its primary regulatory focus limited to surface water, it established a pollutant discharge elimination system with national water quality goals, and increased federal grants to states for the construction of sewage treatment plants. Section 208 of the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, became the vehicle used by several states to gather data for groundwater protection. Section 208 required that an area-wide watershed or aquifer approach be taken regarding water pollution problems. In some cases, data generated by Section 208 planning efforts became the base for groundwater protection programs, as in the specific case of Long Island, New York (Page 1987, 377).

The old Federal Water Pollution Control Act was renamed and strengthened in 1977. The new Clean Water Act (CWA) PL 95-217 contained five major sections: (1) a permit program, (2) a system of minimum national effluent standards for each industry, (3) water quality standards, (4) provisions for special problems such as toxic chemicals and oil spills, and (5) a construction grant program for publicly-owned treatment works. The Act gave states increased flexibility in determining priorities, and the Act helped the clean-up of many of the nation's most seriously polluted

waters. The Act is criticized by environmental groups because of various discharge permitting methodologies, such as Mixing Zones, and Zones of Initial Diffusion, that have resulted in ever-increasing amounts of pollutants being legally introduced into the nation's waters. At some point during the implementation phase of the Act, policy deliverers apparently forgot that a major stated goal of the Act was the "elimination of the discharge of pollutants into the navigable waters . . . by 1985" (1977 CWA, section 101). Citizen suits are allowed under the Clean Water Act, which, in comparison with seven other federal environmental laws, has the highest number of private-citizen suits against environmental violators or, against regulatory agencies, for failure to perform legal responsibilities (EOP Environmental Quality Report 1989).

The Federal Water Pollution Control Act of 1972 was amended again in 1987 (PL 100-4) to expand EPA enforcement authority and extend and revise water pollution control programs. The establishment of a national estuary program and implementation of mandated nonpoint-source pollution management plans were additions. Most significantly, a major thrust of these Clean Water Act Amendments are nationwide guidelines for controlling pollution discharges at their sources.

EPA is responsible for allowing states to accept primacy of the administration of certain clean-water programs. For example, one of the most important programs is

the control of permits that allow pollutants to be discharged into the nation's water. The National Pollutant Discharge Elimination System (NPDES) is designed to be passed to the states with EPA retaining oversight responsibilities. Unfortunately, states have not moved as quickly as expected to accept responsibility in critical pollution control programs. As of January 22, 1990, only 24 states had received approval for a complete state program including an approved State NPDES permit program, approval to regulate Federal facilities, and an approved State Pretreatment Program. Virginia is one of the twenty-four states receiving approval to administer all three programs (Barth 1990).

A stated objective of the Clean Water Act was to restore and maintain the chemical, physical and biological integrity of the nation's waters. It did strengthen the federal oversight role for required programs and provided some federal money to the states. But the Act (section 101) also made it clear that the states would continue to have primary responsibility for the achievement of the Act's water quality goals and policies: "It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources, and to consult with the Administrator in the exercise of authority under this Act." The Clean Water Act does provide protection for groundwater resources by giving EPA authority to act in certain

situations. For example, section 303 requires the establishment of groundwater standards in states where a clear interrelatedness is established between surface water and groundwater.

1974 SAFE DRINKING WATER ACT¹⁶

The Safe Drinking Water Act (SDWA) of 1974, as amended, instituted protection standards for the quality of drinking water at the tap, regardless of its source. The standards apply only to public systems that regularly supply water to the public or to at least 15 connections or 25 people for at least 60 days a year. The law requires EPA to set nationwide primary (health based) and secondary (welfare-based) groundwater quality standards for all drinking supplies, and also authorized the federal government to regulate state programs for protecting underground water sources.

The SDWA contains the Underground Injection Control Program (UIC) (1980) designed to help protect groundwater by regulating programs that use wells for the disposal of wastes. It also gives EPA the authority to designate "sole source aquifers" to help communities in protecting their water supplies. The Safe Drinking Water Amendments of 1986 are a major step forward in protecting underground drinking

¹⁶ 42 U.S.C.A. Secs. 300f-300j.

water supplies. The 1986 Amendments to the Safe Water Drinking Act require the monitoring of 83 water contaminants for which the EPA is establishing water quality standards, with the addition of 25 regulated contaminants every three years.¹⁷ As the new requirements are enforced in stages during the next several years, all water systems will be required to disinfect and most surface water systems required to filter during water treatment. In Virginia, an estimated 850 additional small water systems will be brought under the new federal monitoring regulations (VWRRC, 1989). The Amendments (Section 1428) also require each state to develop a program for involving local government in defining wellhead protection areas around public drinking water supply wells to protect the wells from possible contaminants.

The reauthorization of the Safe Drinking Water Act of 1974 (PL 99-339) provided enforcement schedules that established maximum contaminant levels in public drinking supplies for eighty-three toxic pollutants, as well as public notification guidelines for instances where such contaminants exceeded prescribed levels. While, from a public health standpoint, this was a step in the right direction, the requirement that small rural water supplies comply with the eighty-three contaminant ceilings is expected to place severe economic burdens on small Virginia communities. The Reauthorization does contain grant money to assist the states in enforcement of

¹⁷ Carolyn Kroehler's (1990) "What Do The Standards Mean?" is an example of efforts to increase the knowledge of the average citizen about federal water resource requirements.

drinking water standards, as well as grant money for state groundwater protection programs.

1975 FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT¹⁸

The 1975 Act is an amended and expanded version of the older Federal Environmental Pesticide Control Act of 1972, PL 92-516 (amended the Federal Insecticide, Fungicide, and Rodenticide Act of 1947) that had required registration of all pesticides in U.S. commerce. The focus of the Act changed from assuring that insecticides, fungicides, and rodenticides kill pests to one that assures that such products do not harm human health or the environment. The 1975 Act gave the EPA expanded powers in order to control insecticides, fungicides and rodenticides, placing new emphasis on the environmental effects associated with the use of these products. EPA has the power to regulate the application of pesticides and to completely ban specific pesticides. The reauthorization of the Federal Insecticide, Fungicide and Rodenticide Act that takes new measures to protect groundwater and calls for speeding up the testing of pesticides. The testing of pesticides has, since 1981, been effectively blocked by the failure of environmentalists, chemical companies, and agriculture interests to reach a compromise on a comprehensive pesticide bill (Vig and Kraft 1990).

¹⁸7 U.S.C. Sec. 135

1976 RESOURCE CONSERVATION AND RECOVERY ACT, PL 94-580

The Resource Conservation and Recovery Act is designed to manage hazardous materials and waste from cradle to grave by regulating those enterprises that generate, transport, store, treat, or dispose of hazardous materials. Federal assistance is available for state hazardous waste programs. Subtitle D, that governs state and regional waste plans, requires state programs to be managed under federal guidelines. If such programs do not adhere to set guidelines, the EPA has authority to withdrawal approval and take control of them.

In 1984, the Resource Conservation and Recovery Act (RCRA) was amended to require regulation of new and old underground storage tanks. The Underground Storage Tank (UST) program, administered by EPA, responded to the problem of old, mostly forgotten, buried steel storage tanks that were leaking chemicals and petroleum products into groundwater. New standards and regulations mandate the identification of tanks, tank design, methods for detecting releases, corrective actions, and financial responsibility. The Hazardous and Solid Waste Amendments of 1984 (HSWA) focused new regulatory attention on small facilities that generate hazardous waste, such as printing shops, service stations, and body shops. The 1984 RCRA amendments also addressed the problems of hazardous waste leaching into the nation's groundwater and have placed new restrictions on those who generate hazardous waste.

The amendments also required EPA to develop new minimum guidelines for solid waste landfills.

1976 TOXIC SUBSTANCES CONTROL ACT ¹⁹

This Act assists in protecting groundwater from toxic substances by authorizing the EPA to test new chemicals and to control and prohibit the manufacture, use, storage, distribution, or disposal of a substance if it poses an unreasonable risk to public health or the environment. The Act was amended in 1986 to include the Asbestos Hazard Emergency Response Act (AHERA) that authorized EPA to set asbestos standards and certify training of inspectors and workers. TSCA referrals to the Department of Justice have never been extensive; it reached a high of 24 cases in 1986 (Environmental Quality Report 1989). Most TSCA actions are administrative in nature and they have resulted in the banning of chemicals; for example, the banning of polychlorinated biphenyls (PCBs) that posed an unreasonable risk to human health and the environment.

¹⁹ 15 U.S.C. Sections 2601-2829.

1980 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT²⁰

This Act provided a "Superfund" of 1.6 billion dollars and authorized the federal government to establish liability, as well as clean-up sites that posed a clear danger to the environment. The federal government was also authorized to respond to hazardous waste emergencies. By allowing quicker response to hazardous waste emergencies, the Act was beneficial to groundwater protection efforts. It reduced the chances of groundwater contamination and initiated the clean-up of numerous chemical dump sites that were contaminating groundwater resources. The Act, as amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA), requires parties who contaminate sites with hazardous materials to conduct cleanups under government supervision. The Emergency Planning and Community Right-to-Know Act (EPCRA), Title III of SARA, requires certain facilities to report any incident where one or more of 300 toxic chemicals are released into the environment. It also provides citizens with information about particular hazardous materials that are used in their communities (PL No. 99-499, 300-330).

EPA's Groundwater Protection Strategy (1984)

²⁰ 42 U.S.C.A. 9601-9657

By the middle of the 1980s, a variety of actions among different agencies made groundwater issues increasingly visible at the federal level. In 1984, the Office of Technology Assessment (OTA) of the U.S. Congress completed a study that assessed current knowledge about groundwater pollution in the nation. The study helped disseminate information that alerted the public and national legislators to a growing problem. The OTA study identified known sources of contaminated groundwater and estimated the significance of each threat (OTA-O233, 1984). In response to the growing concerns, EPA issued a Ground-Water Protection Strategy in August of 1984, which had a goal of coordinating groundwater-quality activities at all levels of government. Later that year, EPA established an Office of Groundwater Protection as a means to assist EPA's ten regional offices, other EPA program offices and concerned federal agencies. The office also endeavored to help the states with the implementation of the new strategy.

In its Groundwater Protection Strategy, EPA believed the most effective and broadly-acceptable way to increase national institutional capability to protect groundwater was to place emphasis on developing and strengthening state programs. Four areas receive assistance under the federal strategy: (1) State Program Development Assistance, (2) Studies of Unregulated Threats, (3) Guidelines for Consistent EPA Management of Groundwater under the Different Laws, and (4) Programs to Improve Intra- and Inter- agency Institutional Organization (U. S.

Environmental Protection Agency, 1984). The present thrust of the federal strategy is on the establishment of new state programs but limited federal funds are available to help in the implementation of new programs or the implementation of groundwater protection programs previously established by states. The Strategy was instrumental in placing the spotlight on and directing federal attention to many significant sources of groundwater pollution, such as septic systems, sinkholes, and underground storage tanks. But the Strategy's lack of federal assistance in implementation phases of state and local protection programs may prove to be a critical weakness of the Environmental Protection Agency's goal of protecting the nation's groundwater.²¹, ²²

Federal Framework Summary

The proliferation of federal legislation during the 1970s that directly or indirectly addressed the issue of protection of the nation's waters was impressive.

²¹ Leroy C. Paddock (1991) contends that environmental enforcement by the turn of the century will be quite different than today, with a greatly expanded role for local government. The wide array of federal and state environmental laws plus the huge number of large and small facilities to be regulated will dictate that local governments fill the regulatory void.

²² Daniel A. Mazmanian and David L. Morell (1991) contend the Environmental Protection Agency (EPA) will be unable to meet the challenges of the twenty-first century unless the agency welcomes the involvement of business, environmental, health, and local community interests in the development and implementation of environmental policy. Local communities will fulfill a role as partners and guardians of a community's overall health, environmental, and economic interests.

Serious attempts were made to curtail and control activities such as the use of pesticides and the disposal of hazardous wastes known to be degrading the quality of the nation's groundwater. The Clean Water Act and Safe Drinking Water Act were employed by states and communities in attempts to better control the quality of their drinking water. Yet many threats to groundwater remained unregulated, the true threat to the nation's groundwater was undetermined, and no national strategy for the protection of groundwater existed. The decade of the 1980s saw the establishment of a national strategy for groundwater protection, and amendments to the Safe Drinking Water Act and Clean Water Act stressed a new relationship between surface water and groundwater with a renewed national emphasis on controlling pollutant discharges at the source.

SECTION THREE - RECENT VIRGINIA LAWS AND ACTIONS AFFECTING GROUNDWATER PROTECTION

VIRGINIA GROUNDWATER PROTECTION FRAMEWORK

As states began to develop strategies to protect their groundwater resources, three types emerged; nondegradation, limited degradation, and differential protection (Henderson et al. 1984). Differential protection policies, which allow states to use their resources to protect their most valuable aquifers and place less attention on

protecting other areas (industrial), are currently the most popular policies among the states (Page 1987). Virginia developed groundwater statutes and water quality protection around an anti-degradation policy. The anti-degradation policy mandates the protection of existing high-quality waters and provides for the restoration of all other State waters to such condition of quality that any such waters will permit all reasonable public uses (Va. 62.1-44.4 (2)).

1973 VIRGINIA GROUNDWATER ACT

In 1973, Virginia passed a Groundwater Act (GWA) that was criticized by environmental and academic interests for its many exemptions, its orientation toward the use of the resource by industrial users, its weakness as an effective tool for the management and protection of the resource, and its failure to recognize the interrelatedness of ground and surface waters. As summed up by Clara Cox, "The Groundwater Act of 1973 at best offers protection to existing industrial users against encroachment by other industrial users" (Clara Cox, 1981). While the 1973 Groundwater Act for Virginia states a concern for the preservation of the public welfare, safety and health, the initial regulatory focus of the Act was primarily on the use of administrative allocation procedures for the control of groundwater assets, although water quality concerns can be addressed. Groundwater is defined in the Act as:

Groundwater -- Any water, except capillary moisture, beneath the land surface in the zone of saturation or beneath the bed of any stream, lake, reservoir, or other body of surface water within the boundaries of this State, whatever may be the subsurface geological structure in which such water stands, flows, percolates or otherwise occurs. (sec. 62.1-44.85)

The 1973 Act did mandate special treatment for areas that were seen as possessing critical groundwater resources, but the Act did not contain any statutes that would allow surface water to be managed along with groundwater. Nor would the total water resources of an area be managed conjunctively. From a groundwater perspective, the major weakness of the 1973 Act was that, during the time the Act was drafted, there was not a great deal of emphasis at the legislative and institutional levels on the interrelatedness of surface water and groundwater.

Virginia's water resources literature has long reflected the need for Virginia water law to recognize the interrelationships between the different phases of the hydrologic cycle and that adverse quantity and quality impacts on groundwater would eventually have an adverse impact on supplies from other sources (Walker and Cox 1968; Cox and Shabman 1984). The cumulative impact from a large number of "reasonable use" withdrawals of groundwater could easily create "cones of depression" affecting stream flows, resulting in severe impacts on spring flows in a given area. In an article discussing eastern water law, George Sherk contends that "Any effective state water management and allocation system must reflect this

relationship because uses of ground water may affect surface water levels (and vice versa) depending on the hydrogeology of a specific area" (Sherk 1991, 290).

Groundwater Management Areas

The main purpose of the Groundwater Management Areas to date is the Virginia Water Control Board's regulation of non-agricultural groundwater withdrawals. The regulatory measures of the Act do not apply statewide; they are applicable only to those areas where groundwater management problems are identified. An area may be designated as a Groundwater Management Area through Virginia Water Control Board proceedings when any of the following conditions are present: declining groundwater levels in an area; evidence of substantial well interference; areas where there is a danger of overdrawing the aquifers; and where there are known or expected pollution problems (Va. Code 62.1-44.95). Once a Groundwater Management Area is designated, withdrawals are by permit only (with some exemptions), and the permits are granted on a first-come, first-served basis.

Two areas were initially declared groundwater management areas in 1975 and 1976: (1) a major portion of the state's southeastern corner including the counties of Prince George, Southampton, Surry, Sussex, and Isle of Wright, and the cities of Chesapeake, Franklin, Hopewell, Norfolk, Portsmouth, Suffolk, and Virginia Beach,

and (2) the Eastern Shore of Virginia that included the counties of Northampton and Accomack. Because of the recent emphasis on groundwater quantity and quality, as well as the beginnings of the realization that quantity affects quality, the old Southeastern area was expanded in 1990 to include the York-James City County peninsula area.

Groundwater Management Areas have not been established through use of the prevention aspects of the Code " . . .the groundwater in the area in question has been or reasonably may be expected to become polluted" (Va. Code 62.1-44.95 (a)(4). Consequently, the capability of the Virginia Water Control Board to use the Act to enforce groundwater protection remains unclear. The ability of the Act to control groundwater usage in the Commonwealth is also questionable because of the number of users exempt from permitting. Agricultural and livestock watering, human consumption or domestic purposes, or any single industrial or commercial purpose in an amount not exceeding 50,000 gallons a day are all exempt from the Act's requirements, even though the activity may take place in a Groundwater Management Area (Va. Code 62.1-44.87). The current language of the Act allows a commercial activity in a Groundwater Management Area to withdraw over eighteen million gallons of groundwater a year without a permit.

Surface Water Management Areas

The State Water Control Board has the responsibility for designating and administering Surface Water Management Areas. Like Groundwater Management Areas, the regulatory focus is on use of the resource. Surface water withdrawals are regulated by permit (with exemptions) once the designation is in place. Virginia statutes say the State Water Control Board must designate a Surface Water Management Area if all the following three conditions exist: 1) a stream has substantial instream value as indicated by evidence of fishery, recreation, habitat, cultural or aesthetic properties; 2) historical records or current conditions indicate that a low-flow condition could occur which would threaten important instream uses; and 3) current or potential offstream uses contribute to or are likely to exacerbate natural low flow conditions to the detriment of instream values (Va. Code 62.1-246A). While no designation of Surface Water Management Areas has occurred in Virginia (by the end of 1991) and the regulatory focus of the statute is on quantity of the resource, one could expect the designation of Surface Water Management Areas to have a beneficial impact on the quantity and quality of the groundwater resources in future designated areas.

Virginia 1979 Clean Water Act

Virginia passed a Clean Water Act in 1979, partially in response to federal requirements mandating the regulation of discharge of pollutants into receiving bodies

of waters. The National Pollutant Discharge Elimination System (NPDES) was established in Virginia and administered by the State Water Control Board with a focus on point source discharges to surface waters. The 1981 Amendments to sec. 62.1-44.38 of the Virginia Code required the State Water Control Board to develop river basin plans that assess current and future use. These amendments were viewed as a first step in the development of comprehensive State water planning and the eventual adoption of a State Water Plan (Walker and Bridgeman 1985, 16).

Virginia Water Resources Research Center's Five Year Plan, FY 1982-FY 1987

Much of the impetus for protection of water resources in Virginia has come from the efforts of the Virginia Water Resources Research Center at Blacksburg, Virginia. In the spring of 1980, the Virginia Water Resources Research Center organized an impressive group of nearly 150 academicians; government officials; and interested citizens from industry, agriculture and environmental groups, to apply expertise to Virginia's most serious water problems. Using consensus-building techniques developed by the Rand Corporation, conference participants rated the water problems of the Commonwealth according to their perceived magnitude, scope, and urgency (Clara Cox 1981). Although the focus on water issues during this period in the Commonwealth's history still appeared to be driven by the desire to make the most effective use of the resource (management of the resource was given the highest

priority rating by conference participants), the need to develop methodologies that would determine the extent of pollution of surface and ground waters by both point and non point sources was recognized by conference participants.

The potential for pollution and waste of groundwater was considered a matter of statewide concern. Many of the techniques employed by waste disposal facilities to protect surface water were seen as having the potential to pollute groundwater. Heavy withdrawals of groundwater in the Tidewater area of the state were also identified as a potential problem. Pumping of the aquifers in excess of recharge was leading to saltwater intrusion, excessive de-watering of aquifers was affecting the abilities of aquifers to recharge to original capacities, and excessive pumping was seen to produce the threat of subsidence of surface areas (Ibid).

Recommendations from the conference were used in the drafting of the Virginia Water Resources Research Center's first five-year research plan (FY 1982-1987), and included the following research goals:

1. assist in the development of a comprehensive state water resources management plan;
2. assist in the development of land management measures to protect surface and ground waters;
3. develop cooperation among ongoing water quality monitoring programs in both the public and private sectors;

4. assist in the development of a disposal policy for sludge from publicly owned treatment works; and
5. assist state agencies in the development of a public education program to reduce litter on and vandalism of the property of private landowners who allow access to floatable streams.

Many rural counties experiencing residential and industrial growth were becoming increasingly aware that major problems were beginning to develop regarding available water resources and also urged state agencies to take action. A member of the James City County Board of Supervisors testified before the State Water Study Commission in the fall of 1985:

In the past ten years, James City County has struggled almost continuously with a multitude of water supply and water resource issues. As a formerly rural county, now experiencing both industrial and residential growth, water supply has been at the center of many County issues For almost four centuries, Virginia has had so much more water than needed. This resulted in a lack of formation of needed policies. Water was plentiful. This is no longer the case and James City County is acutely aware of that. We look at our growing water needs, and the very limited resources which may be available to us, and we are frightened. (As quoted in A Groundwater Protection Strategy for Virginia, 1987, p. viii)

1987 GROUNDWATER PROTECTION STRATEGY FOR VIRGINIA

By the mid 1980s, legal protection of Virginia's groundwater was dependent on a variety of federal and state laws, and uncoordinated actions by various state agencies. The State Water Control Law, State Water Board permit programs and

regulations, the Virginia Oil and Gas Act, the Groundwater Act of 1973, hazardous and solid waste laws, coal wastewater injection regulations, and applicable federal laws all played a part in protecting the Commonwealth's groundwater (Jacks 1984). With the aid of funds from Section 106 of the Clean Water Act and EPA's Groundwater Strategy Program, Virginia took steps to develop a coherent strategy for the protection of the state's groundwater resources. A designated Groundwater Protection Steering Committee (GPSC) composed of representative members of Virginia's State Water Control Board and other concerned agencies in Virginia formed in late 1985. Its purpose was to develop a Groundwater Protection Strategy for Virginia. The initial goal of the 1987 Strategy emphasized protection of the State's groundwater by building upon the State's anti-degradation policy:

The Groundwater Protection Strategy should confirm and advance the legislatively mandated anti-degradation policy of the Commonwealth by initiating anticipate-and-prevent strategies' designed to protect the state's groundwater from any degradation that would be harmful to human health or the natural environment, now or in the future. (Groundwater Protection Strategy for Virginia 1987)

This Strategy is based on the use of a cross-media approach (integrated environmental management) for the protection of groundwater. Such an approach views environmental protection as a careful choice among the various media (air, surface water, groundwater, land) and seeks to avoid posing serious threats to one

medium while protecting another.²³ The efforts of one agency to protect one medium, for example air quality, can lead to increasing amounts of contaminants being transported to groundwater. Integrated environmental management is particularly important for the protection of groundwater, which is "out of sight, out of mind," and becomes a handy receptor for (the disappearance of) many unaccounted-for pollutants. The Strategy calls for increasing intergovernmental cooperation.

To illustrate the complexity of the intergovernmental issue, the Groundwater Protection Steering Committee's initial review of agencies identified eleven state agencies that play an important role in the protection of the State's groundwater. Most of the agencies administer programs that could potentially impact groundwater quality. The eleven state agencies are:

Groundwater Protection Steering Committee (GWPSC) -- Provides guidance and coordination for groundwater protection programs.

Virginia Department of Health (VDH) -- Included in the department's responsibilities are the regulation of onsite sewage systems and private wells.

Virginia State Water Control Board (VWCB) -- Regulatory agency with the primary responsibility for the quality of state waters.

Virginia Department of Mines, Minerals and Energy (VDMME) - Regulation of wastewater discharges that may endanger surface or groundwater.

²³ See "EPA: Coping with the new Political Economic Order" by Daniel A. Mazmanian and David L. Morell (1991) for an argument that the U.S. Environmental Protection Agency (EPA) must break out of its monomedia myopia and embrace a true cross-media focus for the political-economic order of the twenty-first century.

Virginia Council on the Environment (VCOE) -- Provides special programs to assist local governments with environmental problems.

Virginia Resources Authority (VRA) -- Assists in providing funding to local communities for sewer and water improvements.

Division of Soil and Water Conservation (DSWC) -- Primary agency in Virginia for the control of nonpoint source water pollution.

Department of Waste Management (DWM) -- Regulates the disposal of hazardous and solid waste.

Department of Emergency Services (VDES) - Provides round-the-clock response to spills of hazardous materials.

Department of Housing and Community Development (DHCD) -- Helps local government in the development of plans for local groundwater protection.

Chesapeake Bay Local Assistance Board (CBLA) -- Assists in the development and implementation of water quality regulations for the Tidewater area.

The Groundwater Protection Strategy for Virginia issued in May 1987, as well as its 1990 Supplement, sets the overall course of groundwater protection for the Commonwealth of Virginia. The Strategy calls for an annual report to the Governor, the Legislature, and the citizens of the Commonwealth.

Anti-Degradation Policy

Virginia's Groundwater Protection Strategy uses an anti-degradation policy as the foundation for protective efforts. The anti-degradation policy for groundwater, as currently interpreted by the Virginia Water Control Board, is set forth in the Board's

Water Quality Standards. Natural quality is emphasized as the desired standard for anti-degradation. Yet, variances to the policy can be granted whenever " . . .it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development, that the degree of waste treatment necessary to preserve the existing quality cannot be economically or socially justified, and that the present and anticipated use of such water will be preserved and protected." (Virginia Water Control Board Water Quality Standards, Anti-degradation Policy for Groundwater, Section 1.09.)

Statutory language that allows the legal pollution of groundwater because of desired economic or social development, as well as additional language in Section 1.09 that allows mixing zones (for the known addition of pollutants), illustrates what can be viewed as serious weaknesses in Virginia's anti-degradation groundwater policy. The 1990 Supplement to the Strategy states that "anti-degradation should continue to be the cornerstone of state policy," but it also advocates a policy that "allows limited degradation under carefully controlled conditions." One could argue that if Virginia law allows limited degradation, then no anti-degradation policy exists.

1986 - Creation of the Secretary of Natural Resources

In 1986, the position of Secretary of Natural Resources was created. The Secretary's responsibilities extend to the Virginia Water Control Board, the State Air Pollution Control Board, the Council on the Environment, the Department of Conservation and Historic Resources, the Marine Resources Commission, and the Commission of Game and Inland Fisheries. This reorganization should present a better organizational framework within Virginia for the planning, management, and coordination of the complex issues of groundwater quality.

FY 1988-1993, Five Year Plan, Virginia Water Resources Research Center

The goals of the Virginia Water Resources Research Center second Five Year Plan (FY 1988-1993) can be compared to the goals of the first Five Year Plan (FY 1982-1987) in terms of suggesting broad trends in water protection. The second Five Year Plan was developed from a list of 50 current water resources problems identified by the Water Resources Research Committee, academic researchers, Center personnel, and the Center's Statewide Advisory Board. The goals of the FY 1988-1993 Five Year plan are:

1. water resources planning;
2. land-use effects on water resources;
3. land application of sewage sludge; and
4. water-related health concerns.

As the goals suggest, an emphasis on use of the resources maintains priority although health-related concerns are beginning to get more attention. The number of confirmed groundwater problems is on the rise. If such trends continue, one would expect to see the health of the citizens of the Commonwealth begin to move towards the top of local and state political agendas at some point in the future, with subsequent attention directed toward protection of groundwater resources. Goal 2 of the first Five Year Plan (assist in the development of land management measures to protect surface and ground waters) had the potential to make a tremendous positive impact on the quality of water resources; yet as a goal, it is de-emphasized in the latest Five Year Plan.

RECENT LEGISLATIVE ACTIONS RELATED TO GROUNDWATER PROTECTION

1988 VIRGINIA POLLUTION ABATEMENT (VPA) PERMIT

These permitting regulations apply to the hydrogeological design and management of ponds, pits, and lagoons that may be potential sources of groundwater contamination. The focus is on agricultural and industrial waste storage pits, ponds, and lagoons that do not discharge directly into state waters or sewage treatment facilities, and may pose a threat to groundwater. (Older pits, ponds, and lagoons are

not covered by the new regulations and may pose a significant threat (especially old waste lagoons) to the groundwater.)

1988 SOLID WASTE DISPOSAL REGULATIONS²⁴

New Virginia regulations, calling for compliance by 1992, are efforts to reduce the magnitude and toxicity of waste going into landfills by requiring the recycling of twenty-five percent of the current waste stream. The twenty-five percent reduction of the current waste stream may be a worthy goal, but it ultimately may not have much effect on the pollution danger to groundwater. The easiest way to reduce the waste-stream going into landfills is to control paper products, landscape refuse (grass and branches), and cans and bottles, none of which have a major impact on groundwater quality.

The 1988 regulations do require new stringent requirements for design, construction, operation, and closure of solid waste management facilities that should help eliminate known threats to groundwater. The regulations specifically address the threats to groundwater from leachate and require groundwater monitoring around landfills, double liners in the landfills, a leachate detection system between the liners, as well as a leachate collection system.

²⁴ Virginia Waste Management Act, Va. Code 10.1-1408 et seq.

1988 CHESAPEAKE BAY PRESERVATION ACT

While specifically focused on the Chesapeake Bay, the Bay Act is making a major positive contribution toward the protection of groundwater in Virginia as any local government may use the Act to protect water resources.²⁵ The Act established the Chesapeake Bay Local Assistance Board (and Department) and charged the department with developing criteria to assist local governments in developing regulations that would protect water quality. Consequently, many long-neglected issues impacting on the quantity and quality of groundwater are being addressed. While these issues are specifically being addressed in designated Chesapeake Bay Preservation Areas. Issues such as septic tanks, drainfields, wetlands, landfills, sewage lagoons, and groundwater recharge areas throughout the Commonwealth are also being considered.

1989 NON-POINT SOURCE POLLUTION MANAGEMENT PROGRAM

The Clean Water Act of 1987 directs states to develop nonpoint source (NPS) pollution control programs. EPA approved Virginia's Non-point Source Pollution Management Program in 1989. It outlines federal, state, and local efforts to control non-point source pollution of surface water and groundwater. The Division of Soil

²⁵ (Va. Code 10.1-2100 et seq.)

and Water Conservation (DWSC) of the Virginia Department of Conservation and Historic Resources is the lead agency in Virginia for the control of nonpoint source pollution. An assessment conducted by the DSWC found that NPS pollutants have made identifiable impacts on about 4,300 miles of rivers and streams and 500 square miles of estuaries in the Commonwealth (VWRRC Research Projects (1988-1989). A study by the EPA identified nutrient runoff as a primary cause of water quality problems in Chesapeake Bay. Agricultural and urban Best Management Practices (BMPs) are considered an important tool by the DWSC for the control of non point source (NPS) pollution such as soil erosion, nutrient and sediment runoff. The effectiveness of BMPs can be questioned: the majority are structured to be voluntary, they are minimally monitored, and mandatory enforcement is considered negligible (Henderson 1984).

1989 UNDERGROUND STORAGE TANK (UST) PROGRAM

A Virginia Underground Storage Tank Program was adopted in 1989 that essentially mirrors EPA regulations. But some areas, such as notification requirements, are more stringent. Performance standards are established for new tanks, with requirements for leak detection, record keeping, and tank closure. Virginia's program is authorized in Articles 9 and 10 of the State Water Law, and

requires owners of underground storage tanks to take corrective action for any releases from their tanks.

1989 PESTICIDE CONTROL ACT

In 1989 Virginia adopted a Pesticide Control Act that established a Pesticide Control Board with broad regulatory powers. The Act improves registration and record-keeping procedures relating to all phases of the pesticide business in Virginia, establishes licensing requirements for pesticide applicators, and gives the Control Board the authority to cancel or deny applications to pesticides that contaminate groundwater above certain levels. The act supports the goals of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and provides for misdemeanor prosecution for the selling of pesticides to unauthorized users.

1990 PRIVATE WELL CONSTRUCTION REGULATIONS

New regulations concerning the construction and location of private wells were instituted by the Virginia Department of Health in 1990. The new regulations require a visit by a sanitarian both before and after construction of the well and also require a satisfactory safe drinking water bacterial test before the new well can be placed in use. While such new well regulations are certainly a step in the right direction,

sanitarians are not required to periodically monitor the operation of newly installed wells. Perhaps most threatening to the overall protection of the quality of groundwater is the lack of any requirement that calls for the inspection of old wells as a means to assess their performance and safety. It may also be important to note that monitoring wells are exempt from the location and construction requirements set forth in the regulations. Monitoring wells are an area of concern in other parts of the nation as they are now identified as an unintended source of groundwater pollution.

Legislative Interest and Actions Concerning The Protection of Water Resources Increase

The General Assembly passed several bills in 1989, 1990 and 1991 that may affect the protection of the state's groundwater. Considering the interrelatedness of surface water and groundwater, major steps were taken toward groundwater protection through the passage of several bills that addressed the protection of in-stream flows. House Bill NO. 1837 established the legal acknowledgement of beneficial uses of in-stream flows beyond the traditional off-stream uses. House Bill NO. 1838 addressed the issue of legal standing in surface water disputes and gave the VWCB authority to intervene in such disputes. House Bill NO. 1839 provided for a state certification process of water withdrawals as required by Section 401 of the CWA, and requires a VWCB determination that in-stream uses will be protected.

House Bill NO. 1840 addressed the collection of irrigation withdrawal data by the VWCB, and House Bill NO. 1841 states conditions under which Surface Water Management Areas may be established to help regulate withdrawals from streams, especially during periods of low flow, and to prevent harm to recognized instream uses. Increased state involvement in the protection of in-stream flows will assist in the protection of groundwater, especially in karst areas of Virginia. A large percentage of a stream's flow in the summertime can come from in-stream springs and extreme periods of drought or low flow can result in a "backflushing" of polluted water into the groundwater.

In 1988 and 1990, the General Assembly also enacted new enabling legislation that granted localities the authority to consider groundwater, surface water, and environmentally sensitive areas when they develop land use comprehensive plans (15.1-446.1) and zoning ordinances (15.1-489). While this is a necessary step in groundwater protection because of Dillion's Rule,²⁶ the ability of the legislation to protect groundwater statewide is weakened in that the comprehensive plan "may (my underline) include ... The designation of areas for the implementation of reasonable groundwater protection measures." The use of the weak verb may instead of the stronger "should" or "shall" may lead localities to see groundwater as another item they may wish to address in their considerations of land use, but not one of any

²⁶ See Summary, page 125 for an explanation of Dillion's Rule.

pressing concern. Section 15.1-489 does say groundwater protection must (my underline) be added to the list of things that local zoning ordinances are designed to consider.

In 1991, Senate Bill NO. 683 amended 62.1-44.15 to make it the duty of the State Water Control Board "to study and investigate all problems concerned with the quality of state waters and to make reports and recommendations." House Joint Resolution (NO. 310) was passed to study the regulation of the more than 2000 underground ejection wells in use in Virginia. Senate Bill NO. 654 created the Virginia Spill Response Council as a means to respond in a timely and coordinated fashion to spills that threaten the environment. House Joint Resolution NO. 463 called attention to the fact that there are still 90,232 privies in the Commonwealth, underscoring the need to augment the Commonwealth's indoor plumbing assistance program.

House Bill NO. 2005 to toughen penalties for the improper disposal of wastes, House Bill NO. 1770 for the regulation of stormwater, and House Joint Resolution NO. 460 requesting the State Water Control Board and the State Board of Health to examine the application and enforcement of regulations for water and waste water treatment, are all indicative of the increased legislative attention water resources are

receiving in Virginia. House Joint Resolution NO. 460 (1991 SESSION) begins by stating:

"WHEREAS, all citizens of the Commonwealth are rightfully entitled to clear, pure drinking water; and

WHEREAS, all citizens of the Commonwealth rightfully expect the several waterways of the Commonwealth to be clean and appropriately maintained for their health, protection, and pleasure; and

WHEREAS, numerous strictly enforced regulations of the Commonwealth and the nation guarantee the purity of the drinking water in the Commonwealth and the cleanliness of its rivers, streams, bays, and indeed, all its waterways; and . . ."

Like a new choir struggling with a difficult cantata, the General Assembly has a long way to go before it knows all the words required for the enforcement of groundwater protection, but at least it is beginning to hum the tune.²⁷

1990-1991 TRI-SECRETARIES TASK FORCE ON SEPTIC SEPARATION

DISTANCE

The 1982 Sewage Handling and Disposal Regulations that are currently in use in Virginia allow, in certain circumstances, as little as two inches of soil from the bottom of the septic trench to the groundwater (separation distance), (Virginia Sewage

²⁷ The State Water Commission began a review of several water related issues in June of 1991 for inputs to the 1992 General Assembly, including the Virginia Water Control Board's (VWCB) request for review of the state's Groundwater Act of 1973.

Handling Regulations, Table 4.5). Recent scientific studies suggest that such a small separation distance is totally unsatisfactory for the treatment of the effluent before it reaches groundwater (Cogger 1988). In 1990, health concerns, the apparent detrimental affect on groundwater, and possible extensive economic impacts of any change to the separation distance were all factors in a decision to direct the Secretaries of Health and Human Services, Natural Resources, and Economic Development to establish the Tri-Secretaries Task Force, in order to address the problems and provide recommendations.

Approximately forty individuals from concerned agencies and affected constituent groups were appointed to a task force to review on-site system data from Virginia and surrounding states with the goal of recommending further regulatory action for on-site systems. The task force worked under the guidance of the Institute For Environmental Negotiation, where it reported its recommendations for more restrictive septic regulations in June 1991. The issue of groundwater protection was considered by the task force to be a major issue. House Bill NO. 1043, which was signed by the Governor in 1990, authorized the Board of Health to consider surface and groundwater quality and economic impacts in developing septic system regulations for the Commonwealth.

1990 SUPPLEMENT (A GROUNDWATER PROTECTION STRATEGY FOR VIRGINIA)

The 1990 Supplement is part of a continuing effort in Virginia to move the Strategy toward a Comprehensive State Groundwater Protection Program. The joint federal, state efforts are supported by funds from Section 106 of the Clean Water Act and the U.S. Environmental Protection Agency's Groundwater Strategy Program. The EPA defines the four elements of a state program: (1) setting goals and documenting progress, (2) characterizing the resource, (3) developing and implementing control programs and (4) defining roles within the state and relationship to federal programs. As previously noted in this chapter, the years from 1987 to 1990 have seen major legislative initiatives and regulatory actions taking place in Virginia in relation to the protection of groundwater quality. Many programs are still new and more time is required before an accurate evaluation of these latest efforts can be made.

Both the 1987 Groundwater Protection Strategy For Virginia,²⁸ and the 1990 Supplement,²⁹ highlight the important role played by local governments in groundwater protection, as well as the need for new tools that can be used by local

²⁸ Referred to as 1987 Strategy henceforth

²⁹ Referred to as 1990 Supplement henceforth.

governments. The 1987 Strategy identified the " . . . need to involve local governments in making land use and public service decisions in ways that achieve groundwater protection," and also viewed local land-use decisions " . . . as a critical link in an effective groundwater protection program." In 1988, Virginia's Council on the Environment also established a Local Assistance Program with a goal of providing technical assistance to help local governments develop approaches to groundwater management.

The Virginia Council on The Environment (COE) identified the most frequent obstacles to development of local groundwater protection programs as; lack of data, level of public awareness, and financial resources (Supplement 1990, 13). By wielding their authority over land use, local governments are assuming, sometimes intentionally and sometimes unintentionally, an increasingly critical role in the protection of the Commonwealth's groundwater. The COE sees a need to support local governments with the appropriate resources to fulfill this critical role and have established a Local Environmental Planning Assistance Program. The 1990 Supplement to A Groundwater Protection Strategy for Virginia states: "The Groundwater Protection Steering Committee believes it is essential to continue to stimulate and support increased state/local cooperation for groundwater protection" (Supplement 1990, 2).

SUMMARY -- A LACK OF FEDERAL/STATE/LOCAL COOPERATION

When an intergovernmental perspective in regard to groundwater protection is taken from the local level, federal and state legislation often appear uncoordinated. The goals and statutes of various federal and state agencies often appear at odds with the overall goal of protecting the nation's groundwater. Well-defined policies do exist for specific areas of concern and desperately need implementation in some local areas. But limited funds, technical skills, and other resources are available to aid in the task. At the same time, while some localities in Virginia have the resources to move toward a better groundwater protection policy, they are hampered by Dillion's Rule. Excellent regulations do exist in some rural areas, but a lack of resources curtail most enforcement efforts.

The emphasis on federal/state/local cooperation in the 1987 Strategy and its 1990 Supplement is important. Rural localities with a limited tax base must rely on assistance from the state and federal government for planning, financing of projects, and assistance in regulation. A Water Code for Virginia identifies a lack of communications between the various federal, state, and local governmental agencies involved in water resource development and regulation as one of the greatest impediments to proper planning (Walker and Bridgeman 1985). A wide variety of federal, state, and local government regulatory powers operate independently from

any water resource structure. In some situations, these independent powers may prevent the implementation of water development projects under Virginia law (Cox and Shabman 1984, 191-194).

Virginia is a Dillion's Rule state (*City of Winchester v. Redmond*, 93 Va. 711, 25 S.E. 1001 (1896)). This has broad consequences for local communities that wish to take the lead in groundwater protection issues. Through the years, Virginia courts have ruled that under Dillion's Rule: (1) communities only have those powers expressly granted to them by the state legislature; (2) those powers necessarily and fairly implied from an express grant; and (3) those powers essential and indispensable (*Supervisors of Fairfax County v. Horne*, 215 S.E. 2d 453, 455-56 (1975)). Judge Dillion's mid-nineteenth century rule also inhibits local involvement by allowing the courts to construe any doubt about the existence of authority against localities in the Commonwealth (*Commonwealth v. County Board of Arlington*, 217 Va. 558 232 S.E. 2d 574 (1977)).

While legislators see Dillion's Rule as a means of preventing communities from making costly policies choices in a direction not preferred by the state, community actors often view Dillion's Rule as effectively preventing local governments from taking innovative regulatory action on a variety of issues (interview file: site 1, int.# 1, 95-106). Local governments are afraid to move into a new

regulatory area without specific legislative approval because such actions can be challenged as beyond the scope of local authority. In 1988 and 1990, the General Assembly granted localities the option of taking groundwater, surface water, and environmentally sensitive areas into consideration during the development of their comprehensive plans and zoning ordinances. They did so in order to make reasonable provisions for the protection of groundwater and surface water (Va. Code, 15.1-446.1 & 15.1-489). In 1990, the General Assembly granted ten counties and two cities the authority to require testing for evidence of potable water prior to the issuance of building permits in instances where groundwater would be the primary drinking water source. Legislation of this nature, which should be applicable throughout Virginia in order to protect the health and financial interests of all the citizens of the Commonwealth, is a concrete example of what some localities (who do not have the financial resources or political power to challenge powerful developers) see as the pervasive unfairness of Dillion's Rule.³⁰

The federal/state statutes and responsible organizations that affect groundwater protection at the local level in Virginia form a bewildering array that is, at best, a complex maze that only the most skilled individuals can successfully traverse. The

³⁰ Virginia legislators considered repudiating Dillion's Rule when Virginia's Constitution was re-written in 1969; as this was not done, the Virginia Supreme Court has interpreted that failure as a reaffirmation of the rule ("Planning Law Basics in Virginia," C. Timothy Lindstrom, (1990) Contemporary Land Use Law Issues for Virginia Practitioners).

statutes can form a quagmire where the best intentions of dedicated local citizens and public officials are often bogged down, become trapped, and eventually disappear. Groundwater protection is a difficult policy issue for local governments, yet it is becoming increasingly clear that small, rural governments will have a most critical role in the protection of one of the Commonwealth's, and one of the nation's, most vital resources.³¹

³¹ See LeRoy C. Paddock's (1991) "Environmental Enforcement at the Turn of the Century" for an analysis of the critical role both local government and citizens will need to play in the enforcement of state and federal environmental laws.

CHAPTER FIVE

THE FINDINGS

CLARKE COUNTY GROUNDWATER PROTECTION -- THE VIEW THROUGH THE FRAMEWORK

Chapter five presents the findings of the case study. The research was structured to find answers to "how" and "why" questions about Clarke County's demonstrated ability to initiate and implement groundwater protection policies above and beyond those of its neighbors. Implementation does not begin or end with the statutory initiation of a program. Implementation cannot move to dependent variable stages such as policy outputs and compliance by target groups unless earlier actions (independent variables) lay the foundation for subsequent implementation actions. The independent variables of the Sabatier and Mazmanian framework were used to guide and structure the research to reveal those factors and forces most important in the Clarke County groundwater protection process.

The Ethnograph software allowed information gathered from interviewees in Clarke County's groundwater policy subsystem to be sorted and cataloged around the independent variables of the Sabatier and Mazmanian framework. Factors that affected the achievement of, and are helpful in explaining the dynamics of, the

groundwater protection process in Clarke County as perceived by the interviewees are presented. Sabatier and Mazmanian's three main categories of independent variables (tractability of the problem, ability of the statute to structure implementation, and nonstatutory variables affecting implementation) frame the analysis for this chapter. The discussion brings focus to specific events relating to the process that resulted in the establishment of groundwater protection policies in Clarke County.

A. Tractability of the Problem (Sabatier and Mazmanian Framework)

Groundwater pollution as a social problem is a far less manageable or tractable problem than, for example, developing a "barking dog" ordinance for a neighborhood. It is easy to identify the dog that barks and the behavior modification required may be as simple as modifying the behavior of the owner (don't chain the dog outside), or by removing the dog to the pound. The problem of groundwater pollution is more complex. The true extent of groundwater pollution in most areas remains unknown, the actual health hazards posed by various groundwater pollutants remain questionable, and pollution sources are difficult to trace and positively identify. Moreover, the extent of behavioral changes necessary to resolve pollution

problems range from modest changes of an individual nature to extensive behavioral changes by a major subset of the population.³²

(A1) - Availability of valid technical theory and technology
(Sabatier and Mazmanian)

The availability of technical theory and technology can be a particularly difficult area for small rural governments concerned with regulatory programs dealing with groundwater pollution. Modification of the behavior of target groups requires theories and technologies that identify the extent of the problem and what must be done to ameliorate the problem (Loux 1987). If valid causal theories are not available, or needed technologies appear to be too expensive for local budgets, local citizens become reluctant to support costly programs that, from their perspective, may or may not solve current or projected groundwater pollution problems. The availability of valid technical theory and technology, diversity of target-group behavior, target group as a percentage of the population, and the extent of behavioral change required were all found to be important factors in the groundwater protection events of Clarke County.

³² The recent report, Environmental Management in Montgomery County's Karst Terrain (March 1991), by the Virginia Council on the Environment's Local Environmental Assistance Program, summarizes the extraordinary groundwater pollution problems counties with karst terrain can expect and provides recommendations to reduce environmental risks.

At an early date, the County Administrator and the Chairman of the Planning Commission recognized that if efforts to protect the groundwater resources of the county were to be successful, current pollution problems and any potential problems would need to be scientifically researched and documented. The county's efforts to protect its groundwater fell into two major phases: (1) a data collection phase and (2) the drafting of the elements of a groundwater protection plan (interview file: site 1, int. #1, 40-353). The Lord Fairfax Planning District (see map Appendix H), as well as several state and federal agencies, participated with Clarke County in gathering and compiling data. According to County Administrator G. Robert Lee, the data needed to demonstrate "first, that groundwater in Clarke County was at risk; and second, valid local measures should be adopted to protect groundwater." (interview file: site 1, int. #1, 214)³³

Unfortunately, events in Clarke County like many other places in the United States suggest that it takes some type of a triggering event to demonstrate to a community its vulnerability to groundwater pollution. Clarke County had several events through the 1980s that captured the attention of citizens and public officials: the public water supply (wells) for the county seat (Berryville) became contaminated with nitrates, phenols and herbicides; dye tracings demonstrated the vulnerability of a

³³ Pages 1 through 23 in the Clarke County Groundwater Protection Plan detail the assessment processes and the areas of concern as Clarke County, with the help of the Lord Fairfax Planning District, began to develop their protection plan.

public water supply (Prospect Hill Spring) to contamination; ten wells were polluted by petroleum leaks in an area known as Pine Grove; and a crossroads area by the name of Waterloo, and a village by the name of White Post, suffered groundwater contamination by fuel oil or gasoline (see map Appendix G; interview file: site 1, int. #1, 15-30, 365-437, 838-849).^{34,35} Clarke County officials successfully used these events to move in an action-forcing direction by beginning a dialogue about the need to establish a protective framework for the county's groundwater.

The degree of success obtained by Clarke County in its first initial steps of addressing groundwater protection and creating a countywide dialogue about the subject should not be minimized, as such steps may be difficult to achieve in other jurisdictions. County officials were able to articulate their concerns to the citizenry and take actions they believed necessary to protect the groundwater.³⁶ Paul E. Bailey

³⁴ Numerous articles in the Clarke Courier such as "Town Asked to Abandon Contaminated North Well" (October 23, 1980) by Chris Levi, "Water Problems are Costly, Frustrating" (October 31, 1985) by Val Van Meter, to Val Van Meter's recent "Wells Show Coliform" (June 13, 1991) document Clarke County's long struggle with groundwater quality.

³⁵ Weigmann and Kroehler's (1988) article a "Puddle of Prevention Worth Ocean of Cures," in Threats to Virginia's Groundwater (1988), p.8., and the Clarke Courier article "Town Breaks Ground For \$2.5 Million Water Facility" by Val Van Meter present an overview of the many difficulties a small town (population 1800) with polluted groundwater may face.

³⁶ Janne Hukkinen's et al. (1990) "A Salt on the Land" article, shows that many areas of contention in water related policy issues are not technical but primarily organizational and political. Policy-makers become reluctant to move in action-forcing directions, thus they order more studies.

is a Senior Vice President of ICF, a Washington D.C. based firm known for its leadership role in influencing federal policy and working with different levels of government on difficult environmental problems. He states ICF is finding that local citizens harbor a tremendous amount of distrust with regard to statements made by public and private officials about the environment:

" . . . one trend that is disturbing but seems to be real, is the tremendous distrust of public agency officials in addition to distrust of industry. . . . How can you conduct a dialogue if there is so much lack of trust?" (interview file: site 2, int. #27, 532)

Conducting the dialogue and getting the dialogue "up to speed" among rural decision makers is difficult, particularly with an issue as complex as groundwater protection where there is an interrelatedness among land use issues and a large number of technical factors. Furthermore, most rural counties in Virginia do not have a water study group. The establishment of such a group is a recommendation of most groundwater protection action guides, and is the first recommendation County Administrator Lee makes when people call for advice in asking how to start protecting the water resources in their area: "Have your Planning Commission create a water study commission" (interview file: site 1, int. #1, 940). It may take a year or two to place the water study commission in operation, but this approach is a most effective way to collect technical data, create an awareness of any current or potential groundwater problems, and start the dialogue among decision makers about groundwater protection.

Clarke County tapped a variety of sources during its initial data gathering. After determining that Virginia STORET data presented an inaccurate picture of well locations in the county, local resources were recruited to gather new data, with the Clarke County League of Women Voters volunteering to assist. They visited well drillers and collected data from well drillers' logs for placement in a Geological Information System. This was a tedious task, with valuable information being gathered from sources that have now disappeared. The University of Virginia Department of Environmental Sciences conducted studies of the impact of agriculture chemicals on groundwater in Clarke County. Consulting hydrologists, working under grant monies provided by the Environmental Protection Agency (EPA) through the Virginia Water Control Board (VWCB), documented the high-risk aspects of the groundwater in Clarke County due to the county's geological nature. The Richmond office of the U.S. Geological Survey (USGS) initiated a major three-year study to compile a comprehensive analysis of groundwater resources in Clarke County. It also identified those resources that could be determined to be significantly at risk from pollution (Ground-water Hydrology and Quality in the Valley and Blue Ridge Physiographic Provinces of Clarke County, VA, 1991).

The ever-present question of how much technical data a local government needs to justify a certain course of action had to be answered in Clarke County. Initial data indicated much of the county geology was karst with limestone and

—

dolomite rock that dissolves in water providing solution channels, cracks and fissures for pollution to reach groundwater.³⁷ The situation was compounded by thin soils in the western side of the county allowing water quicker access to bedrock.

Groundwater was in fact at risk to a variety of pollution sources (interview file: site 1, int. #1, 219-231). While data relating to risk assessments of a number of known specific threats was not available, two positive factors led to the development of a groundwater protection plan: public recognition and acknowledgement of threats and the type of grant funding available at the time.³⁸ Clarke County officials decided to move forward with a program even though they did not, at the time, have a satisfactory amount of data to justify such an action:

"We would have preferred to have all research completed before moving into a groundwater protection program, but the nature of the grant funding and available resources, and some of the known threats, prompted us to impose a number of regulatory mechanisms before we completed the research which later, sort of, provided a justification." (Ibid, 333)

Although Clarke County is small and rural, technical theory and technology that documented groundwater problems was necessary in order to secure support for a specific course of action from the public and local officials. The technical

³⁷ The Virginia Division of Mineral Resources (DMR) had already begun (1985) a geological mapping project in Clarke County.

³⁸ The public was kept well informed of tests and surveys conducted and the results of such surveys. For example: "Study Shows Groundwater Endangered: Two Year Study Demonstrates Vulnerability of Wells Springs" by Val Van Meter Clarke Courier, October 15, 1985 is an example of red flags being waved that suggested it was time for "some serious rethinking of the county's zoning and future growth policies."

information reinforced groundwater protection efforts in two major ways. First, it provided a means to increase the awareness among public and concerned officials. Second, it provided hard evidence for officials who could use it to justify long term, cost-effective commitments of money and resources, particularly for problems or potential problems that may not be at the top of the local political agenda. For example, the development and use of a Geological Information System (GIS) was a breakthrough that raised the level of citizen awareness of the intricacies of groundwater contamination. It provided demonstrative evidence about risk areas in a format understandable by decision-makers (Interview file: site #1, int.#20, 78-92).

The need for caution in providing technical information to decision makers became apparent. Obtaining the best information and facts available does not guarantee the use of the information by rural decision-makers in the manner expected. A former Chairman of the Clarke County Planning Commission cautioned that one needs to be aware that those who make decisions from a political base may wish to reserve the option to make a decision as opportunistic as possible. They do not always welcome factual information contrary to an established political position.

"One of the things information systems can show is where a decision has no relationship to the facts. Most politicians who want to keep their options open will have an aversion to information, or will wish to control it, so they can use it at the time they wish for the purpose that they have."
(interview file: site 2, int. #18,741-748)

Well-presented technical information raises the level of awareness about an issue. As Clarke County decision makers became more aware of the dangers of various pollution sources to groundwater resources, local officials tended to require those promoting a specific course of action to demonstrate that public health would not be adversely affected. For example, instead of relying upon the old practice of accepting the developer's word that there would be no problem, officials asked a recent applicant for a subdivision zoning to demonstrate scientifically, to the best of his ability, that adjacent groundwater resources would not be negatively-impacted by subdivision septic fields (interview file: site 1, int. #20, 525-550). Clarke County has also demonstrated its willingness to bring in outside expertise to clarify complex situations, by acquiring assistance from U.S. Geological Survey personnel and consulting hydrologists.

Clarke County's willingness to spend money and request technical studies in order to seek expert opinion sets Clarke County apart from many of its neighbors. Not only did the county establish policies addressing groundwater protection, but it invested necessary time and money to develop researched and documented facts that provided the rationale behind its protection policies. Ned Burks, a reporter who covered the political scene in Clarke County commented:

"Clarke County has always been willing to spend money on planning. Lots and lots of money on planning. They go out and get experts, real experts, and experts do not come cheap." (interview file: site 6, int. #6, 670)

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Instead of the county trying to implement policies derived from in-house studies, it established a regulatory framework supported by factual data and recommended courses of action from acknowledged experts in the field.

Tom Christoffel, Director of the Lord Fairfax Planning District, characterizes groundwater protection planning as more sophisticated than other types of planning. He calls it a "maturity of the planning process" (interview file: site 7, int.# 2, 227). The Lord Fairfax Planning District was instrumental in obtaining funds from the Virginia Water Control Board for use in identifying and possibly dealing with some of the groundwater issues facing Clarke County. Initial attempts to acquire funding for groundwater protection efforts were unsuccessful. Funding became available only after Clarke County's needs were tied into Chesapeake Bay pollution issues (interview file: site 7, int. #2, 39-54). In 1985, the state was beginning to establish policies about groundwater protection but provided little real guidance to help local officials decide what options should be enforced. Karst areas comprise 27 percent of Virginia's geology, and Clarke County was awarded funds by the Virginia Water Control Board to develop a groundwater protection plan that could be used as a model for other karst areas of the state.

In Clarke County, groundwater protection planning became valued as a part of the total resources planning process. Groundwater issues and parts of the

groundwater protection problem were integrated into the overall resources protection process taking place in the county. Tom Christoffel contends that "Planning is the keynote." He sees Clarke County's current groundwater protection policies as the result of many years of building a planning consciousness. People must have goals, as well as an idea of how to get from where they are to where they want to go. Even "lots of money" can't solve problems if there isn't a plan to properly manage the changes that must take place (interview file: site 7, int. #2, 881-921). Clarke County's "plan" provided a structure and a means by which the very complex issues of surface water and groundwater protection could be addressed. In a karst area "promiscuous intermingling" (G. Robert Lee's term) of surface waters and groundwater occurs. The "plan" became justification, and a drawing card, for outside help from those in various agencies throughout the state who desired to see Virginia move forward in groundwater protection.

As Clarke County focused its planning program on groundwater protection, technical experts from a variety of agencies stepped forward to assist, including the U.S. Geological Survey (USGS) in Richmond, the Virginia Water Control Board, The Virginia Water Resources Research Center, and the Virginia Water Projects in Roanoke. They supported a county that showed its willingness to do something to protect its groundwater. For example, a graduate student from the University of Virginia, a qualified hydrologist experienced at dye tracing, documented the potential

for pollution associated with the fractured nature of limestone, and provided the necessary information needed to designate a sole source aquifer. The student conducted several dye trace tests around the Prospect Hill Spring, and Waterloo area, and showed that the Prospect Hill Spring (a major Virginia spring and Clarke County public drinking water source) was susceptible to pollution from a variety of sources. Virginia Polytechnic and State University graduate students also assisted in the accumulation of data for USGS representatives.

(A2) - Diversity of target group behavior
(Sabatier and Mazmanian)

Diversity of target group behavior was not a major factor in Clarke County. Like many other rural areas, the county does not have the pollution source diversity (and constituents) of a major urban/industrial area requiring behavior changes among many different groups. Consequently, the county could write clear regulations targeted at a specific group.

The development of industry in a county also leads to the development of other commercial interests, businesses, and developers who have a vested interest in land planning and whose members may sit on the County Board of Supervisors. As Clarke County did not have the diversity of commercial interests and wide range of special

interest groups many of its neighbors have, much of the political conflict normally surrounding groundwater protection issues was mitigated. This is not to say that special interests did not come to play in county land use decisions. As in many other rural counties, the Clarke County Board of Supervisors consisted of members from a variety of economic backgrounds.

During the time groundwater policy was being formulated, the Board included a dairy farmer, a dentist, a member with real estate interests, a former federal employee, and a member who owned a heating and plumbing business. One member was a Yale graduate, and others had graduate-school experience. The Board's decision-making processes were not always favored by proponents of groundwater protection. Some Clarke County citizens considered it a "terrible conflict of interest" to have members with real estate interests on both the Board of Supervisors and the Planning Commission. The issue appeared to be most sensitive whenever the particular supervisor was a realtor because of a commonly-held view that "It's hard to be a realtor and not be a developer" (interview file: site 2, int. #18, 727).

A prevailing belief was that realtors and large landowners would work to develop weak regulations that could, whenever the opportunity presented itself, be politically manipulated for economic gain instead of working to get defensible regulations in place. Furthermore, as pointed out by a member of Virginia's Water

Control Board, "When members of the Board of Supervisors and the Zoning Board are large land-owners and have the most to gain economically from making pro-development decisions, it doesn't take an Einstein to figure out how those decisions are going to be weighed" (interview file: site 3, int. #7, 656).

(A3) - Target group as a percentage of the population
(Sabatier and Mazmanian)

Sabatier and Mazmanian contend it is easiest to mobilize political support when the target group is small and easily-identifiable, and abuses are specific. If one small manufacturing firm pollutes a stream, public and political support can readily be mobilized for the purposes of halting the polluter's action. While target groups were easy to identify in Clarke County and the abuses to be corrected specific, the large percentage of population of some rural target groups (e.g., farmers), along with the typical rural stance against any type of bureaucratic regulation, resulted in the formulation of some groups who opposed almost any type of regulatory activity that may affect them.

Articles concerning groundwater pollution are now commonly found in farming magazines such as the Progressive Farmer, yet the Virginia agriculture community as a whole is very reluctant to accept regulations that address the issues of

water quality or water quantity. Clarke County farmers are typical of farmers in other states in that they are protected from many environmental regulations. Such protection stems from a commonly-held agency view that " . . . agriculture is America's sacred cow and will be for some time in the future" (interview file: site 3, int. # 1230).

Target group as a percentage of the population can be expected to remain large in Clarke County as the county exhibits qualities of homogeneity and singularity of purpose that are missing among its neighbors to the west. Part of the reason for this homogeneity consists of historical differences with neighboring areas that led to the break-up of Frederick County and the formation of Clarke County. Even today, people in Clarke County are viewed as being different than their neighbors, and the difference apparently plays a role in groundwater protection.

(A4) - Extent of behavioral change required
(Sabatier and Mazmanian)

Both the amount of change required by an individual in a target group and the total number of people whose behavior needs to be modified influence this variable. "The amount of behavior modification required to achieve statutory objectives is a function of the (absolute) number of people in the ultimate target groups and the

amount of change required of them" (Sabatier and Mazmanian 1980, 545). Chances of successful implementation diminish when large amounts of behavioral change are required of large numbers of people. Conversely, chances of successful implementation should increase if the amount of behavior modification is minimal and/or the behavior modification is required of small numbers of people.

Small industries are prevalent in Clarke County. The majority of the workers are employed in manufacturing, agriculture, services, and the wholesale and retail trades (Comprehensive Plan of Clarke County 1988, 13). But even small commercial interests such as agricultural supply stores, fast food restaurants, and filling stations pose a significant threat to groundwater. The small Clarke County community of White Post has experienced numerous incidents of gasoline contamination over the last several years. The Virginia Water Control Board continues to be unsuccessful in its attempts to locate, clean up the sources of the pollution, and establish a responsible party (interview file: site 3, int. #8. 221-259).

While some people believe their businesses suffer from over-regulation, the consensus among the commercial community appears firm with regard to the need to protect groundwater. There is a general sense that "it is the right thing to do;" therefore, large amounts of behavior modification should not be necessary (interview file: site 6, int. #6, 519-524). However, the behavior modification of the large

agriculture community, which is comprised of landowners with both small and large acreage, is a recognized problem. The importance of taking a conservative approach to change and doing things piece by piece was mentioned several times by Clarke County interviewees. A former Chairman of the Board of Supervisors emphasized traditional advice "Don't bite too much off -- get one thing done and then go on" (interview file: site 1, int. #4, 170). Behavior modification requests addressed to the agriculture community to this point in time are of a minor nature (such as the sinkhole ordinance), and little actual follow-through or regulatory enforcement has occurred.

Clarke County officials saw a continuing necessity for educating those whose behaviors need to be changed. For example, the sinkhole ordinance requires meeting with landowners and discussing with them the reasons a specific sinkhole presents a significant subsurface water pollution hazard, and the need for corrective and protective measures.³⁹ The two ideas behind the landowner briefing are "that first, you are not going to change people's way of doing things unless you first educate them; and second, you must make them realize there are sanctions that can be enforced if they don't change their established practices" (interview file: site 1, int. #1, 1009).

³⁹ Clarke County Code, Article IV. Sinkholes, Sec. 12-66 - Sec. 12-72.

Clarke County, located on an urban/rural fringe, now has a mixture of citizens including those from families who have centuries of farming experience, owners of long-established small businesses, and relatively new arrivals from the cities. A large number of people who move from cities to the county each year often are not familiar with the design and function of wells and septic systems. Consequently, the county provides many layman documents to homeowners that discuss the proper installation and care of such systems.

Clarke County resource protection efforts have slowed the development of some constituencies that could, in the future, become large target groups whose behavior would need to be extensively modified to support groundwater protection measures. For example, failing on-site septic systems are one of the primary causes of groundwater contamination nationally, and if not properly monitored, are an especially dangerous pollution source in karst areas. Although much of the geological make-up of the Valley region consists of soils with limited "perkability," local health officials may be subjected to severe personal and political pressure to approve septic field sites in marginal soils. Clarke County's "trailer ordinance" limits house trailers to certain areas and thereby effectively controls the excessive proliferation of house trailers on small lots throughout the county. The trailer ordinance has not only effectively diminished the threat to groundwater from failing on-site systems, but has prevented the development of a constituency who at some time would most likely

oppose stricter on-site septic regulations. Interestingly, the Virginia General Assembly is proposing to pass a law in 1992 that will mandate that counties accept house trailers situated on permanent sites in rural areas. While such a law may do much to support the house trailer business in Virginia, it can also be expected to be detrimental to the quality of groundwater in sensitive geological areas.

Construction activities associated with the establishment of subdivisions were also identified as activities in the county that could endanger the quantity and quality of groundwater. Because of its fragile limestone terrain, Clarke County has an ordinance that prohibits dynamite blasting for most septic field excavations. Blasting in karst terrain can contribute to diminished or completely disrupted flows from springs and small streams. Because the Clarke County's development community is still small, its behavior has been easy to target and effectively modify, even when major changes to its normal modes of operation are involved.

B. Ability of Statute to Structure Implementation
(Sabatier and Mazmanian Framework)

From the perspective of the Sabatier and Mazmanian framework, the possibilities for attaining statutory objectives are enhanced to the extent that the statute (1) stipulates a set of clear and consistent objectives, (2) incorporates a sound theory

relating behavioral change to the stated objectives, and (3) then helps to structure the implementation process in such a manner that the desired behavioral change is obtained. The policy process is "structured" by selecting implementing institutions, providing legal and financial resources, biasing policy orientations of agency officials, and regulating opportunities for the participation of nonagency actors in the implementation process.

(B1) - Validity of the causal theory underlying the statute
(Sabatier and Mazmanian)

A statute implies, explicitly or implicitly, an underlying causal theory as it stipulates objectives, assigns rights and responsibilities to implementing institutions, and bases the attainment of those objectives on the prescribed behavior of target groups. Sabatier and Mazmanian also emphasize the components of "technical validity" and "implementation effectiveness" that need to be contained within the causal theory. "Technical validity" is an essential and difficult area for groundwater pollution statutes. The demonstrated risks to public health from a wide range of contamination types sources remain difficult to assess, yet technical justification for a specific course of action is a key factor if behavior modification of target groups is to occur.

Ideally, one could look for an integrated causal theory underlying federal, state, and local groundwater protection statutes with explanations of how that theory affects implementation at the local level. This ideal approach was deemed impracticable for this research, because, unlike the surface water side of the issue, a combined umbrella of state and federal legislation for groundwater protection does not exist. State and federal groundwater legislation did not play a major role in the initiation of Clarke County groundwater protection efforts. The few exceptions consisted of instances where Clarke County identified a usable federal program or rule that, with or without state help, furthered its goals. A neat framework of federal statutes with well-structured causal theory that stipulates objectives and assigned responsibilities to state actors does not exist.⁴⁰ This fact made it difficult for Clarke County as it attempted to move forward on their own with groundwater protection. Nor is there any programmatic federal and state legal framework within which the localities may operate (interview file: site 3, int. #8, 79-82).

The federal "Sole Source Aquifer" law enabled Clarke County to accomplish a degree of groundwater protection where such protection was unavailable through state or local law. The sole source designation does not by itself provide much protection.

⁴⁰ Velma Smith (1988) in testimony before the Senate Committee on Environment and Public Works, Subcommittee on Water Resources, Transportation and Infrastructure, and Subcommittee on Hazardous Wastes and Toxic Substances, argued that the very nature of groundwater and diversity of groundwater contamination sources demands significant federal involvement to protect the resource.

But it does keep federal money from being spent for projects in the area of the sole source aquifer until there is proof such expenditures will not degrade the quality of the aquifer. Clarke County's desire to achieve sole source designation for the Prospect Spring area was not prompted by an effort to move towards federal controls on Prospect Spring, but by a desire for federal, state, and local recognition that the source was unique. Such recognition would thereby provide a mantle of "technical validity" that could be used for future protective actions (interview file: site 1, int. #1, 553-569).

(B2) - Precision and clear ranking of statutory objectives.
(Sabatier and Mazmanian)

Delays in the implementation of policies are reduced when a clear relationship exists among precise statutory objectives that provide guidance to implementing agencies. If ambiguous policy directives cause a struggle among officials who are trying to determine legislative intent, or if it is unclear as to where the program may fit in the overall scheme of the typically limited resources of an agency, the implementation of the program will be difficult. Groundwater protection programs also create the added potential for a fair amount of "bureaucratic shuffling," as groundwater does not respect geographical or political boundaries. If jurisdictional questions are present and a problem develops, an overworked agency with limited

resources may try to pass the problem on to a companion agency, as happened in the county when questions relating to the destruction of a stream were passed back and forth between the State Health Department and the Virginia Water Control Board with no action or answers for the citizens (interview file: site 2, int. #18, 158-165).

Clarke County's Groundwater Protection Plan with its six main elements (sinkhole protection, underground storage tanks requirements, well construction requirements, on-site wastewater management, establishment of GIS, and community education) assisted in providing guidance and setting priorities for local implementing officials. The existence of the Groundwater Protection Plan also provided a buffer between those affected by the new regulations and implementing officials, as required actions were supportive of the county's theory that its karst terrain required special efforts to protect groundwater.

(B3) - Financial resources available to the implementing agency
(Sabatier and Mazmanian)

From a small rural government perspective, groundwater protection programs are often considered "money-hungry" programs. Initial studies that define the extent of contamination problems; the acquiring of necessary technical expertise, and the eventual establishment of some type of regulatory program, permitting systems, and

field inspectors to ensure compliance are all elements competing for local funds that already may be designated for sidewalks or schools. Because implementation of groundwater protection programs are costly for small governments, the availability of external financial assistance to help establish and maintain groundwater protection programs is critical. According to Sabatier and Mazmanian:

In general, a threshold level of funding is necessary for there to be any possibility of achieving statutory objectives, and the level of funding above this threshold is (up to some saturation point) proportional to the probability of achieving those objectives (Sabatier and Mazmanian 1980, 546).

A threshold level of funding, as defined by Sabatier and Mazmanian, is the essential element of any rural groundwater protection program. The County Board of Supervisors, who control resources, play a central role in the establishment of local protection programs. Throughout the period studied, the Clarke County Board of Supervisors was willing to spend money in order to assist in protecting the resources of Clarke County (interview file: site 6, int. #6, 1032-1045). The commissioning of studies, the hiring of planners, and the cost sharing of grants, while not always directed at groundwater protection, were all events that promoted the protection of the county's resources. And, the initiation of such events would have been extremely difficult without the strong support of the Board of Supervisors.

Paul Bailey, of ICF Incorporated, believes the financial side of the groundwater protection problem cannot be overemphasized. Most communities now

desire to do something about protecting their groundwater, and while technical limitations exist (especially in remediation of groundwater problems), the protection side of the groundwater equation is driven primarily by what the communities can afford to do. As federal laws that regulate the quality of water become more restrictive, either Congress or the state need to be able to provide funding. For example, grants or low- interest loans would help communities move toward compliance (interview file: site 2, int. #27, 98-116). A candid assessment by G. Robert Lee is that without the help of Tom Christoffel of the Lord Fairfax Planning District (LFPD) in acquiring grant monies, the groundwater protection plan for Clarke County most likely would not have happened.

When local funding to support a specific groundwater protection goal was not available in Clarke County, the County Administrator teamed up with the Director of the Lord Fairfax Planning District to explore other funding opportunities, such as those of the Virginia Water Control Board (VWCB) or the Environmental Protection Agency (EPA). They also networked for additional resources (interview file: site 7, int. #2, 43-54, 828-839). Although EPA funding is normally used for planning efforts related to surface water resources, the Director of the Lord Fairfax Planning District acquired an EPA 205(j) grant through the Virginia Water Control Board to initiate the development of a groundwater protection program for karst areas (interview file: site 1, int. #1, 287-300). According to Velma Smith (currently with

Friends of the Earth), Clarke County did not always try to start out building a Cadillac. Instead, they were interested in getting the "biggest bang for the buck" and became very good at developing constructive relationships with students and volunteers as a means to keep costs down while still producing a quality product (interview file: site 2, int. #14, 86-94).

(B4) - The extent of hierarchial integration within and among implementing institutions
(Sabatier and Mazmanian)

Sabatier and Mazmanian contend that one of the most important attributes of any statute is the extent to which it hierarchically integrates the federal, state, and local agencies responsible for implementation efforts. Behavioral compliance by target groups and among implementing officials is affected by the compliance incentives present throughout the hierarchy.

The degree of hierarchical integration among implementing agencies is determined by (a) the number of veto/clearance points involved in the attainment of statutory objectives and (b) the extent to which supporters of statutory objectives are provided with inducements and sanctions sufficient to assure acquiescence among those with a potential veto (Sabatier and Mazmanian 1980, 546).

From the perspectives of the interviewees in Clarke's groundwater protection subsystem, hierarchial integration of statutes that specifically apply to groundwater

through federal, state, and local agencies was considered almost non-existent.

Previous chapters have commented on the lack of any type of federal "umbrella" or comprehensive framework of statutes that address groundwater issues and allow states and localities to move quickly and confidently to protect their groundwater resources. At the federal level, groundwater has not received the same level of attention that surface water has, nor has there been strong guidance from federal agencies with regard to the protection of the quantity and quality of the nation's groundwater resources.

Groundwater issues have only recently begun to move to the forefront of the federal agenda (Vig and Kraft 1990). One of the known reasons for federal and state officials' aversion toward groundwater protection enforcement was stated by John Randolph of the Virginia Coal Center: "Federal and state officials are reluctant to get into mandatory groundwater protection regulations as they do not want to be involved in dictating land use." (interview file: 57-61). The existence of high-level veto points where an actor (apart from those with legal authority) can impede statutory objectives, can be expected to be a continuing problem for groundwater protection programs; because the process of protecting the quality and quantity of the nation's groundwater will eventually require behavior modification of much of the nation's most politically powerful segments. At this point in time, federal, state, and local hierarchies contain

very few compliance incentives that provide a means to modify the behavior of many known groundwater polluters.⁴¹

The groundwater protection cooperation problem most often cited dealt not with hierarchical integration, but with interagency cooperation within the state. Many individuals in Clarke County had the distinct impression that, when one was trying to get answers to the "hard" problems dealing with groundwater, it was too easy to get shuffled back and forth between the Virginia Health Department and the Virginia Water Control Board. Tom Christoffel, who had served on a state groundwater committee, believes a major problem with groundwater protection in Virginia is that there are areas in the state code where the functions of the Virginia Health Department (VHD) and the Virginia Water Control Board (VWCB) overlap. In such cases, the easiest course of action for an agency (that is normally short of both financial and physical resources) may be to try to push any overlapping problem off as the other agency's responsibility. If an agency does take responsibility and moves forward in such an ambiguous situation, state law may be violated. Consequently, there is a reluctance by the agency to take action until the law is clarified (interview file: site 7, int. #2, 539-579). A recent example was the lack of authority for

⁴¹ A series of essays in Hamilton's (1990) Regulatory Federalism, Natural Resources, and Environmental Management (1990), illustrate the difficulties in moving toward intergovernmental environmental management where environmental values would replace techno-economic, legalistic ideas about how the world works.

Virginia Health Department (VHD) officials to go on private property and inspect certain types of alternative on-site septic systems that required discharge permits from the Virginia Water Control Board (VWCB). Even if such systems happened to be malfunctioning, the VHD was reluctant to take any action against them. In June 1991, the Department received a memo from the Deputy Health Commissioner which stated the law had now been interpreted in a manner that allowed health officials to go on private property (with prior notification) and inspect alternative systems (interview file: site 6, int. #16, 62-70).

(B5) - Extent to which decision rules of implementing agencies are supportive of statutory objectives
(Sabatier and Mazmanian)

The formal decision rules of state and local implementing agencies need to be seen from a local perspective as consistent with statutory objectives. Many of the areas concerned with groundwater protection rely on some type of permitting/licensing process, and the decisions of agencies involved in those processes should be consistent with the applicable statutes. If, dependent upon whom the applicant is, the rules seem to change or if the findings of authorities appear to be inconsistent with statutory objectives, then stringent regulation of local behavior becomes difficult.

Local citizens in rural areas often see the formal decision rules of state and local implementing agencies as "Nanny Laws," a characteristic perception that state and local officials are doing nothing more than trying to tell you what you have to do for your own good (interview file: site 7, int. #2, 598-610). For example, the decision rules of the Health Department are supportive of statutory objectives, but they always seem to be saying "no" to most individual requests for septic sites. Septic site approval has historically been one of the more volatile issues in Clarke County, as well as in surrounding counties, because the improvement of property with dwellings is normally dependent upon soil scientists from the Health Department who approve septic site locations. During a June 1991 citizens meeting with Virginia Health Department officials in neighboring Frederick county concerning the use of alternative septic systems, many members of the audience felt treated unfairly by Health Department officials in charge of approving septic sites. Such individuals apparently believed the chances of getting site approval were more dependent upon whom one knew rather than the merits of a particular case.

Clarke County officials believed Loud Fairfax Health Department personnel enjoyed working in their county, because, unlike other surrounding jurisdictions, the county requested that regulations affecting groundwater quality be vigorously enforced to the fullest extent. The approach to enforcement was based on a long-term perspective rather than meeting some short-term goal (interview file: site 1, int. #20,

400-404). Such an approach to groundwater protection makes it easier on the sanitarians involved. They know where they stand and that their decisions will be supported. Furthermore, the consistency of a long-term perspective to the issue makes it more palatable for those whose applications are denied.

(B6) - Assignment to implementing agencies officials committed to statutory objectives
(Sabatier and Mazmanian)

Until local officials "buy in" to the achievement of policy objectives, very little is apt to be accomplished in terms of behavior modification of local individuals, regardless of how well a groundwater protection statute may be designed. It is too easy for local officials to overlook the questionable behavior of neighbors, friends, and economically and politically powerful local individuals. On the other hand, it is extremely difficult for committed local officials to enforce new regulations without a strong commitment from specific state and federal officials upon whom they may call for advice, assistance, and support. Observers of events in Clarke County believe most local officials are firmly committed to the protection of groundwater and are able to justify their commitment to the citizens of the county (interview file: site 1, int. #20, 872-876; interview file: site 1, int. #5, 747-772).

Whether state agency officials will be strongly committed to Clarke's groundwater protection goals remains questionable. Compared to other states, Virginia adopted the unique option of placing responsibility for the drafting and development of a groundwater protection strategy in the hands of a neutral third party committee rather than an established agency such as the Virginia Water Control Board (VWCB). This approach may have degraded the possibilities of obtaining strong commitments from agency personnel. Almost everyone has seen cartoons depicting objects (such as a tree swing) designed by committee, and the committee-oriented design of Virginia's groundwater protection strategy may not provide the statutory substance needed by local officials to build their groundwater protection programs. Some local regulatory officials believe they may be laying their jobs on the line when they make unpopular decisions. If they do not know their decisions will be fully supported at higher levels, they are not likely to support new regulations. Commitment to statutory objectives will be difficult, especially if the new regulations require extensive behavior modification by their friends or the community.

(B7) - Extent to which opportunities for participation by actors external to the implementing agencies are biased toward support of statutory objectives (Sabatier and Mazmanian)

Sabatier and Mazmanian contend the statute can bias the implementation process by either providing or denying participation by groups of actors external to the implementing agencies. Two prominent groups of actors are defined by Sabatier

and Mazmanian: (1) the potential beneficiaries and target groups of the program and (2) the legislative, executive, and judicial sovereigns of the agencies.⁴²

Citizens in Clarke County, the potential beneficiaries of water quality protection efforts, were denied opportunities, in some instances, to support statutory objectives related to water quality because of the issue of "legal standing." Margaret Maizel, a former Chairman of the Planning Commission, remembers the frustrations experienced by environmental groups when they tried to acquire due process during the granting-of-the-permit phase for new industrial size septic fields located in Clarke County. Current Virginia septic regulations provide an appeal process only after the denial phase. Applicants who have their permits denied can have their day in court, and an opportunity to participate in the implementing agencies process, but neighbors unhappy with the project do not. No appeal mechanism currently exists for those who oppose the granting of a specific permit to a developer, nor is there any requirement stating health officials must enforce particular county standards that may be more restrictive than state standards (interview file: site 2, int. #18, 371-417).

⁴² Sabatier and Mazmanian define the sovereigns of an implementing agency as those "institutions which control its legal and financial resources" (Sabatier and Mazmanian 1980, 551). Sovereigns may include the chief executive, the legislature, the courts, and hierarchically superior agencies.

Goode (1991) in "The Public's Role in Formulating Virginia's Water Policy" contends that citizens have opportunities throughout the legislative and regulatory process to express their opinions. These opportunities range from defining the issue and finding a legislator to sponsor legislation, to providing comments and suggestions to the implementing agency. While this may be true, citizens such as Patty Jackson, Executive Director of the Lower James River Association, maintains water standards enacted in Virginia continue to be skewed in favor of industry rather than protection of the environment.⁴³

Virginia courts and the Virginia Commonwealth Attorney have not moved solidly behind efforts to ensure all actors have their day in court when it comes to protecting the waters of the Commonwealth. Most of those in the Shenandoah Valley familiar with the Avtex (manufacturing firm) long-term pollution of the Shenandoah River at Front Royal believe the performance of state agencies in terms of reacting to citizen complaints range from bad to indifferent, and few kind words are directed toward state officials and legislators (interview file: site 1, int. #3, 116-121). The Avtex incident included over a thousand documented violations of discharge permits, but no real action by the state of Virginia to halt the pollution until the state was forced to do so by the Environmental Protection Agency (EPA), after a suit by the

⁴³ Associated Press (1992), "Pollution Standards Adopted for Waters," Northern Virginia Daily, March 31.

Environmental Defense Fund (EDF). The site is now on the EPA's Superfund list.

Supporters of clean water and groundwater protection efforts are often individuals or environmental-issue groups who lack the degree of legal standing required in Virginia to contest what they may view as inappropriate agency actions. The Virginia Administrative Process Act (APA) process does provide time to review and comment on proposed state regulations for external actors who are organized to respond to changes in regulations.⁴⁴ The Code of Virginia (section 9-6.14:.17) requires each agency with regulatory powers to develop, adopt, and utilize public participation guidelines for soliciting the input of interested parties in the formulation and development of its regulations. In the spring of 1992 agencies in the Secretariat of Natural Resources were directed to draft new regulatory Public Participation Guidelines which would require an expanded notice of regulatory action (NOIRA) and ensure greater participation by citizens during the entire formation, promulgation, and final adoption process.⁴⁵

C. Non-Statutory Variables Affecting Implementation (Sabatier and Mazmanian Framework)

⁴⁴ Chapter 1.1:1 (9-6.14 et seq.), Title 9, Code of Virginia.

⁴⁵ Secretariat of Natural Resources, "Example Regulatory Public Participation Procedures," Commonwealth of Virginia, April 22, 1992.

According to Sabatier and Mazmanian, non-legal variables interact with the basic legal structure of a statute and help drive policy implementation during the interaction between legal structure and the political process. The policy output of implementing agencies, target group compliance with those decisions and the eventual achievement of statutory objectives are affected by major exogenous and intervening variables. Changes in socio-economic conditions, attitudes of sovereigns, and the leadership skills of implementing officials are but a few of the non-legal variables that have a considerable capacity to affect the behavioral changes desired by a statute. Sabatier and Mazmanian view implementation as a dynamic process that is driven by at least two important processes: one, the need of any program that seeks to change behavior to receive constant and/or periodic infusions of political support to keep those who were adversely affected from regaining control; and two, the effect of continuous changes in socio-economic and technological conditions on the reservoir of support for those objectives among the general public, interest groups, and sovereigns. (Sabatier and Mazmanian 1980, 548)

(C1) - Variation over time and among governmental jurisdictions in social, economic and technological conditions affecting the attainability of statutory objectives (Sabatier and Mazmanian)

Social, economic, and technological conditions are among the most important exogenous variables affecting the attainment of groundwater protection statutory

objectives. Implementing officials respond to changes in interest group, public, legislative, and executive demands as the perceived importance of the problem varies; and as they sense changes in the political or technological environment that may be supportive of the approach they wish to take on a particular problem.⁴⁶ Sabatier and Mazmanian list at least four ways that variations in local settings can, over time, substantially affect the political support for statutory objectives. Each of the four were operative in Clarke County:

(C1-1) Variations in socio-economic conditions can affect perceptions of the relative importance of the problem addressed by the statute, especially as local resources become scarce.
(Sabatier and Mazmanian)

Although Clarke County is relatively close to Washington, D.C., it has not succumbed to the "mall and Mac Donald's" mentality of some counties closer to the nation's capital thus leading to conflicts in attitudes and values (Patton and Stabler 1979). Clarke County enjoys relatively stable socio-economic conditions. Newcomers to the county have "bought in" to the county's established life style and have joined in attempts to protect what is seen as an exceptional quality of life (interview file: Site 6, int. # 45-50). Local resident Charles Burwell believes that

⁴⁶ John Brotchie et al. in The Future of Urban Form (1985) are greatly concerned with the way socio-technical changes have a capacity for altering urban development. Their argument is that the microelectronic-information technology revolution is producing changes in our patterns of living as profound as those caused by the industrial revolution. If so, Clarke County is an ideal location for new "electronic cottage" knowledge-based enterprises.

area newcomers are attracted to Clarke because of the presence of a certain type of socioeconomic tradition and quality of life; one that recognizes the need for custodianship and preservation of the county's resources.

Like-minded people are drawing other like-minded, highly educated and professional people to an area where stewardship of the land and a certain quality of life are still high on the public agenda. Mary Morris is a researcher in the Clarke County Museum who sees the influence of British heritage still present in Clarke County, reflecting the idea that, when one has a place, "it is not so much your place as you're the steward of the place for your son, and grandson, and great grandson, and it will be kept in the family from now until forever" (interview file: site 1, int.# 11, 139). Groundwater is recognized as a county resource deserving of protection; perhaps highlighted because of the adverse financial ramifications associated with not protecting the resource.^{47, 48}

⁴⁷ Unknown is the role local financial institutions played in Clarke's groundwater protection. It should be noted that "Clarke's real-estate dealers and banks have been insisting for some time on demonstrations of potable water as a prerequisite for home loans, and Health Department test of private wells have been showing a high incidence of fecal coliform." (The Clarke Courier, March 24, 1988, reporter Daphne Hutchinson.)

⁴⁸ Because of the pollution of the town wells, Berryville required U.S. Farmers Home Administration financial assistance of a \$1,100,000 grant and \$1,250,000 loan, with \$460,000 requested from Clarke County. (Town of Berryville letter, May 6, 1982)

(C1-2) Enormous pressures for "flexible" regulations may be generated as a result of large variations in socio-economic conditions and perceptions of the problem, which would decrease chances for achieving statutory objectives.
(Sabatier and Mazmanian)

The economically and politically incestuous "good-old-boy" network is alive and well in the Shenandoah Valley. The economic and political pressures placed upon those responsible for enforcing regulations in a rural, small-town atmosphere where everything is tied together around family, church, and community should not be minimized. Clarke County was not totally immune from such pressures. Regulations were seen as good ideas until they keep some local powerful individual (whose family members may have been doing exactly as they pleased for several hundred years) from doing what they wished to do. When that occurred, the Planning Commission could count on an effort to modify, or just disregard, the regulations.

(C1-3) Support for regulation aimed at environmental protection seems to be correlated with the economic viability of target groups and their relative importance to the local economy.
(Sabatier and Mazmanian)

One of the most effective actions relating to groundwater protection taken by Clarke County was the Land Evaluation and Site Assessment (LESA), a technique developed by the Soil Conservation Service (SCS) and U.S. Department of Agriculture (USDA) to evaluate agriculture land. The LESA study identified the importance of agricultural lands in the county, highlighted the economic contributions of the agricultural community, and helped to move the farmers (a future groundwater

protection target group) into the forefront of protecting their resources for future generations. While the LESA study is not directly aimed at the protection of groundwater, it is an excellent tool for demonstrating to farming communities the true value of their agricultural land resources. It also assists in identifying (by technical methodology) those areas of a county most suitable for development.

(C1-4) In the case of policies that are directly linked to technology, such as the health risks or clean-up costs associated with specific contaminants, changes in the technological state of art over time, coupled with the ability of implementing officials to take advantage of those changes, will have a critical impact on the achievement or non-achievement of statutory objectives.
(Sabatier and Mazmanian)

The technological state of the art pertaining to the identification and classification of contaminants in groundwater is advancing rapidly. The Environmental Protection Agency (EPA) is in a continuous process of trying to accurately identify the actual health risks certain contaminants pose to a community. The process is not an exact science, and EPA's risk evaluations of contaminants has been criticized. The current situation creates a confusing picture for rural counties who seek the best technical advice for a proposed course of action. The explosion in the numbers of synthetic organic chemicals after World War II, as well as the wider spectrum of pesticides, herbicides, and fertilizers in use by the agricultural community, have made EPA's task immeasurably more complicated.

Compounds now formed in the rural and urban environments (for example, the chemical soup "leechate" from landfills) are not only difficult to identify, but no one knows the real dangers such new compounds pose to mankind. As it becomes more commonly possible to measure contaminants in parts-per-billion and improving scientific techniques allow the positive identification of sources of contaminants, the public will certainly demand stricter enforcement of environmental laws as a means of stopping pollution at its source. Clarke County found it easier to develop a local umbrella of protection for its groundwater when threats to the public health from groundwater contamination were accurately identified and assessed.

(C2) - The amount and continuity of media attention to the problem addressed by a statute (Sabatier and Mazmanian)

Sabatier and Mazmanian contend that, for at least two reasons, the media are important to the implementation process:

First, they are generally a crucial intervening variable between changes in socio-economic conditions and perceptions of those changes by the general public and, to a lesser extent, political elites. Secondly, the tendency for most television stations and newspapers to play an issue to the hilt and then go on to something else is a real obstacle to the constant infusion of political support from the very diffused beneficiaries of most environmental and consumer protection programs (Sabatier and Mazmanian 1980).

Since the inception of our nation, newspapers have played a major role in shaping the perceptions of those who live in rural areas. Clarke County does not have a TV station. Consequently, local problems were analyzed, defined, and

solutions proposed in the local and regional newspapers. Environmental issues are complex, making them difficult for the average reporter to cover. Environmental issues were well covered by the local newspaper, even though the "specialty" reporter approach taken in other areas of the state was not used. A "specialty" reporter who writes a series of articles about a particular environmental subject can present a long-term view making it easier for the public to understand the issue.⁴⁹ Television coverage of events in Clarke County came from neighboring counties and, as groundwater pollution problems usually do not create a "burning building" visual imagery, TV coverage that did take place typically addressed the political events surrounding such issues.

Newspapers have the option of printing whatever they wish, and while their creed may still be "all the news that is fit to print," the management of a newspaper can be selective. Some events of a volatile political or economic nature may be purposely ignored in order "not to embarrass anyone." Suffice it to say that the owners of some of the Valley's newspapers are among the richest individuals in Virginia. According to the Virginia Business magazine (August 1991), former U.S. Senator Harry F. Byrd, Jr. (worth about \$53 million) owns all of the Harrisonburg

⁴⁹ Staff reporter Dwayne Yancey of the Roanoke Times & World News spent four months doing research in 1987 to write a series of articles about groundwater in the Roanoke area. Some of his titles were: "Crimes of the Past Haunt State's Water," "Poison in Our Wells," and "A Farm Once Prized, Now is Poisoned." (Roanoke Times & World News, February 21, 1987)

Daily News-Record and 10% of the Winchester Star, and publisher Arthur W. "Nick" Arundel (worth about \$63 million) publishes the Clarke Courier, Rappahannock News, and the Front Royal News.

While inherent difficulties restrict making groundwater protection a newsworthy item, the use of the newspapers as a means to disseminate groundwater issues information is another area where, in comparison to its neighbors, Clarke County excelled. The county has only one weekly newspaper the Clarke County Courier, although daily newspapers in surrounding counties, such as the Winchester Star and Northern Virginia Daily, carried articles about the county. The County Administrator served as a liaison between the politicians and the media. Reporters interviewed indicated the politicians were sophisticated enough to use the media and knew how to get their point of view across to the press.

"On groundwater policy they managed to articulate that in such a way that it was clearly something important to Clarke County, and clearly very different from what was going on in other areas that the Winchester Star covered. . . ." (interview file: site 6, int. # 6, 441).

Clarke County's relationship with reporters was one of cooperation; a two-way street of sophisticated give-and-take of honest facts for an honest story. Consequently, groundwater protection was seen by reporters as a legitimate, interesting issue worthy of coverage. The relationship made it easy for reporters to

develop stories about groundwater issues, including the river, the fragile geology of the county, and why it was important to preserve the county's water supply (interview file: site 6, int. # 6, 486-505).⁵⁰

(C3) Variations over time and jurisdiction in public support for statutory objectives. (Sabatier and Mazmanian)

Sustained political support for any issue requiring prolonged behavioral change is difficult. Changing socio-economic and political environments will result in different issues that are cyclically pushed to the forefront. Sabatier and Mazmanian discuss three ways the general public influence the implementation process:

- (1) Public opinion (and its interaction with the mass media) can strongly affect the political agenda, i.e., the issues to be discussed by legislators.
- (2) There is substantial evidence that legislators are influenced by their general constituents on issues of salience to those constituents, particularly when opinion within the district is relatively homogenous.
- (3) Finally, public opinion polls are often employed by administrators and sovereigns to support particular policy positions. (Sabatier and Mazmanian 1980, 550)

Sustained political support for statutory objectives associated with groundwater protection has remained high in Clarke County. The support exists in spite of the fact

⁵⁰ "Clarke County leads Virginia in policies to protect its underground water supply" by Arundel Newspapers specialty writer Daphne Hutchinson The Clarke Courier (March 24, 1988), and Ned Burks' "Clarke Studies Tougher Groundwater Protection" Winchester Star (November 13, 1986), are typical of the excellent coverage Clarke's groundwater issue received both locally and in neighboring counties.

that some citizens, such as long-time County Clerk Jim Wood, do not believe that everyone in the county is an environmentalist, or even that environmental issues are major issues for the man on the street. Mr. Wood also believes there remains in the county a strong aversion toward zoning, which may be a result of the rural attitude that "this land is my land, I should be able to put it to any legal use I see fit" (interview file: site 1, int. #17, 33-422). While groundwater protection is not a constant, conspicuous issue in the county, other observers believe the county exhibits an underlying philosophy that is definitely pro-environment and pro-groundwater protection. This trend is most likely reinforced by the "birds of a feather flock together" phenomena, as newcomers moving in with similar beliefs lend stability to the established socioeconomic and political environment. A researcher with the Institute of Environmental Negotiation, Barbara Jean Bowry, described the people she met in Clarke County as better educated with a tendency to fight harder for their environment. In Clarke County, one does not hear the old excuse, "I've been drinking it for years and it ain't hurt me yet" (interview file: site 3, int.# 26, 47-63).

The "local" population is still reluctant to attend public meetings and speak out about what is taking place in the county. While this is an established characteristic in many other rural areas, there is some speculation that this reluctance to speak one's mind may be a hold-over from a time when extreme deference was shown to the "gentry" of old (interview file: site 1, int. #5, 777-815). There was an expectation

that one's "betters" who were elected to public service, would do the best they possibly could for the well being of the county and its citizens. Most of the action generated at the town meetings comes from relative "newcomers" to the county who are well-educated and are sophisticated enough to speak their piece in a rational manner.

(C4) - Changes in the resources and attitudes of constituency groups toward statutory objectives and the policy outputs of implementing institutions.
(Sabatier and Mazmanian)

Support for environmental regulatory programs that seek changes in behavior can be expected to wane as the true costs of such programs become known, particularly in terms of resources required and impacts on certain target groups. As timelines for implementation become extended, opponents become better-organized and gain access to legislators and the courts. They also become more skilled in articulating their case in the media. Through a variety of methods, such as public comment or influencing decisions that impact on agency resources, individuals and groups can intervene directly in the decisions of implementing agencies (Sabatier and Mazmanian 1980, 550). To insure survival in a political environment, agencies may see it in their best interests to become more accommodating to various interests than the original legislation had intended.

Clarke County appears to be fortunate in terms of groundwater protection. The most active special-interest groups in the county are ones supporting environmental or conservation positions. These special-interest groups do not actively promote the position of a builder's association or call for more industrial development. The farming community has remained largely on-board by supporting restrictive land use and other policies designed to protect groundwater, because it is clearly in the interests of large estate-holders to keep things the way they are. The county also made accommodations in particular policy areas that caused discomfort among farmers or where farmers thought the regulations would be too restrictive. For example, initial plans for water well testing in the county called for pesticide scans. But this requirement was dropped after the farmers argued that it would be difficult to pinpoint the source of pollution, and that farmers in general would be blamed for any contamination that might be found (interview file: site 1, int. #20, 870-889). Nevertheless, the local farmers also realized that if their way of life is to be protected, one of the best means to do so is by a long-term plan for the county that recognizes the importance of agricultural land.

While Sabatier and Mazmanian suggest that, as time passes, public officials may find the need to become more accommodating in a political environment, the opposite may also happen. After the use of dye tracing studies identified the Prospect Hills Spring area as needing protection, the county established a protective natural

resources conservation zoning district (overlay) around the spring source. After local land owners became upset and threatened litigation over land use controls and possible limitations on the use of pesticides and other toxics close to a public water source, the county pushed for a sole source aquifer designation from the federal government instead of becoming more accommodating to the local landowners (interview file: site 1, int. #1, 361-495). The desire to place Prospect Hills spring under federal sole source aquifer protection was taken by the county for three primary reasons: (1) a reaction to demonstrated potential threats to a significant water source (over one million gallons per day of potable water), (2) to raise local and state consciousness of the importance of the source, and (3) to validate previous actions taken to protect a significant water supply.

(C5) - Continued support for statutory objectives among the sovereigns of implementing institutions via the (a) amount and direction of oversight, and (b) extent of new (i.e., after original statute) and conflicting legal mandates (Sabatier and Mazmanian)

The sovereigns of intergovernmental programs include hierarchically superior agencies, the legislature, the chief executive, the courts and other institutions that control legal and financial resources. In the world of groundwater protection, implementing agencies face conflicting direction and directives from intergovernmental superiors and coordinating sovereigns. Sabatier and Mazmanian suggest that in such cases of conflict, the agency will ultimately lean toward the

directives of the sovereign who will affect its legal and financial resources over the longest period (e.g., a state agency would give its primary loyalty to the sovereign most likely to affect its vital resources, the state legislature).

The Environmental Protection Agency (EPA) is sensitive to the fact that each state differs in its ability to manage its groundwater resources, and also realizes that each state should have the right to manage its own resources within established federal guidelines (interview file: site 2, int. #22, 22-30). Support from sovereigns may remain a questionable issue in Virginia for the future. Virginia, as opposed to other states, did not designate an established state agency to develop the state's groundwater protection strategy. Virginia's governor did not direct a state agency to take the lead and create memorandums of understanding and designate committees, nor was a structure created for the administration of groundwater protection. Instead, the leadership role was given to a neutral third party (interview file: site 2, int. #22, 220-262). Dr. Norbert Dee, Director Source Assessment and Management Staff, Office of Groundwater, U. S. Environmental Protection Agency, does not see Virginia's approach to the development of its groundwater protection strategy as either right or wrong, but it is a different approach than that taken by other states. The bright side of the picture is that such an approach did lead to the generation of a Groundwater Protection Strategy for Virginia, with designated agencies involved in an information exchange. "So the strategy has been a good document in terms of the agencies all

recognizing that they have the potential to contaminate groundwater . . ." (interview file: site 3, int. #8, 276-281). Dr. Dee believes that only the future will indicate whether the approach was a politically-savvy approach that will simplify coordination, provide financial and other resources, and lead to the actual protection of the State's groundwater.

As those on the groundwater protection committee revisit the Strategy and review accomplishments, it is becoming clearer that local involvement is essential (interview file: site 3, int. #7, 50-57). Support from sovereigns is needed to provide resources, strengthen, and increase local involvement. But at the same time, those at the state level believe the impetus for groundwater protection must come from the communities themselves. Fred Cunningham, Groundwater Program Manager of the VWCB Groundwater Office, argues that federal or state initiated programs will not work " unless the localities recognize that protection of groundwater resources is for their benefit and something they need to do" (interview file: site 3, int. #7, 57-62).

One could argue, in light of Clarke County's experience in promoting groundwater protection, that the amount and direction of oversight obtained from the legislature and hierarchically superior agencies does play a crucial role if the resources and desire to make programs work are present. Local officials have little desire to spend their time in support of a groundwater protection issue without some

evidence of continued support from other concerned agencies and patrons who are available to assist with resources. Groundwater protection is a complex issue that can have major impacts on land use decisions. How statutes are interpreted by the courts (and especially for groundwater contamination issues, how questions of legal standing are answered) will all ultimately affect the desire and resolve of state and local implementing officials.

Dillion's Rule was viewed as the biggest single stumbling block, currently in place in Virginia, that hampers local attempts to protect groundwater. Persons interviewed at the federal, state, and county levels were unanimous in their dislike for Dillion's Rule, which is seen as keeping localities from taking innovative steps to protect groundwater resources. It thereby becomes too easy for communities to sit around saying, "we can't, we can't" (interview file: site 2, int. #14, 180-212). Before they take a desired course of action, counties and communities that wish to be innovative must ensure they are on firm legal ground by securing implied or direct authorization from the General Assembly. Dr. Dee, summed up his perspective of the way Virginia views groundwater protection issues in this manner:

"My personal feeling is that in some respects they're living in the 17th century, because they're making decisions, micro decisions, micro-managing the state of Virginia instead of providing broad policy and direction. They are worried about nitty, gritty, individual things that happen because of the way the state is; it is a Dillion state. [They] Refuse to give authority to where the local level is. If Bob's program [Clarke County's program] can somehow

move Virginia forward into the twenty-first century, that would be a significant benefit (interview file: site 2, int. #22, 489-506).

While comments in this chapter addressing support from Virginia sovereigns have a somewhat negative tone, the fact remains the Virginia Water Control Board, through the Lord Fairfax Planning District, did support Clarke County in its efforts to initiate a groundwater protection plan. Considering the realities of current state budget restraints, Virginia localities in the near future will most likely see very little in the way of structured programs or financial assistance designed to help localities implement groundwater protection programs. Moreover, localities wishing to move in such a direction will need to continue to find ways to do it on their own (interview file: site 3, int. #7 & #8, 358-377).

(C6) - Commitment and leadership skill of (supportive) implementing officials (Sabatier and Mazmanian)

Sabatier and Mazmanian consider this to be the variable most directly affecting the policy outputs of implementing agencies. It is the level of commitment agency officials have toward the realization of statutory objectives, one that can be influenced by many factors. Among the influencing factors are the capacity of the statute to create and institutionalize a bias in the implementing agencies through its selection of the agencies and top officials, as well as the own personal and professional biases of implementing officials that relate to the obtainment of statutory objectives in a

positive manner. Historical data show that official enthusiasm for programs will wane as bureaucrats become burned out on an issue, or when they view policy objectives as abandoned by interest groups and sovereigns.

To relate Sabatier and Mazmanian's commitment and leadership skill variable to the events in Clarke County, one must begin by placing the focus on the County Board of Supervisors, the County Planning Commission, and the County Administrator. The Clarke County Board of Supervisors portrays a cross section of what one would come to expect of the dominant interests in a small rural community: a dairy farmer, real estate broker, dentist, craft professional and a retired public transportation official from Washington. Several have a tenure of over ten years on the board, and all possess the ability to ask tough questions, even though they know they may be at logger-heads on the issue with another board member. The Chairperson of the Planning Commission had an impressive technical and scientific background and extensive practical experience in state-of-the-art planning tools for rural areas. The County Administrator was a strong administrator with a background in planning who was characterized as "one of the best county administrators west of the Mississippi; an extraordinarily gifted and talented person for such a small county" (interview file: site 1, int. #5, 104-125). It may have been a case of the right people being in the right spot at the right time, developing the synergism necessary to start the county moving toward groundwater protection. Both the Chairperson of the

County Planning Commission and the County Administrator had a seldom-seen ability to bring relevant facts to bear, explain complex issues and articulate the dangers to groundwater in a manner the citizens and the Board of Supervisors could readily understand.

While the concept of leadership continues to generate debate in the literature, Sabatier and Mazmanian note both the political and managerial aspects that comprise the leadership skills necessary to make the best use of the assets at hand. Political skills are required to present the county's position to both seniors and juniors alike, and to engender support for that position from needed constituents. The managerial skills required include the ability not to be overwhelmed with personnel, fiscal and program issues. Intertwining political and managerial skills are necessary to develop the inter and intra relationships necessary to move programs forward and obtain policy goals.⁵¹ One must be able to go beyond what could be reasonably expected in using available resources. Don Alexander, Director, Bureau of Sewage and Water Sources of the Virginia Department of Health, attributes the strides Clarke County has made toward groundwater protection to the efforts of two active people, Margaret Maizel, past Chairman of the Planning Commission, and G. Robert Lee, the past County Administrator. Mr. Alexander believes that it is very difficult for upper-level

⁵¹ Michael Lipsky (1978) suggested in "Standing the Study of Public Policy Implementation on its Head" that implementation scholars should spend more time focusing on the behavior of policy deliverers.

bureaucrats, who must operate in the political arena, to promote certain programs. Consequently, the key to practical implementation is in the field. He sees Margaret and Bob as true leaders in their professions; with a vision of where they wished to go. Mr. Alexander contends the main difference between a leader and a manager is that a leader has a vision and can articulate that vision to those around him (interview file: site 3, int. #25, 17-36).

Velma Smith, past Chairperson of the Virginia Water Control Board, believes a major strength of the Clarke County approach to groundwater protection is that the county did not treat groundwater protection as something that had to be accomplished by a certain deadline -- and then forgotten about as other issues rose to the top of the county agenda. Perhaps the officials in Clarke County had a personal and professional bias toward planning, zoning, and resource protection. Land use planning for the community was seen as an ongoing process with groundwater protection just one element of the total resource protection vision. It is a process of "do what you can do today and keep looking for things you can do tomorrow." It is a process of "keep with it." (interview file: site 2, int. #14, 320). Some say it was not a process where Clarke County was an innovator in groundwater protection, it was a process of Clarke County doing something to protect its groundwater -- and doing so while most of their neighbors were doing nothing (interview file: site 1, int. #20, 47-169).

The Director of the Lord Fairfax Planning District, Tom Christoffel, contends that one of the main reasons for Clarke County's success story in groundwater protection was its ability to focus on the groundwater issue and network to get other people interested. By networking with other people with common goals in the scientific and research communities, resources were shared and much valuable time and effort placed on the issue without a great deal of money required. Clarke County's belief in a need to protect its groundwater led to the idea of creating a model Groundwater Protection Plan for karst areas that generated interest and support in the academic and water protection communities. The development of the plan also became a project the Virginia Water Control Board willingly supported financially.

Kathy Sevebeck, of the Virginia Water Resources Research Center, believes that local programs considered important, especially those related to the well-being of an entire community, should be depoliticized as much as possible (interview file: site 4, int. #10, 707-716). Clarke County took steps toward making groundwater protection a less-sensitive political issue by taking a long-term perspective and by enfolded groundwater protection into its overall goals of protecting all the resources of the county. The comprehensive planning and groundwater policy of the county were not something that was pushed on the Board of Supervisors by staff personnel; it came from the elected and appointed officials themselves (interview file: site 1, int. #20, 589-597).

THE CRITICAL FACTORS

Paul Bailey of ICF was asked if there was any one thing that seemed to stand out in his firm's experience at the local level between the successful and the not-so-successful programs. His answer was, "Yes, a program champion." That is, someone who believes in the program, carries the flag for the program, sensitizes others to the importance of the program and puts in the effort to establish and support the program. His comment is in concert with ideas of bureaucratic entrepreneurship; "fixers" and "double agents" long recognized as critical in the implementation literature.

In a strong endorsement of the importance of a champion, Bailey believes a program champion is more important than the statute, and does more than the statute does to drive implementation at the local level. "Whether the law is there or not is less important than having a champion . . ." (interview file; site 2, int. #27, 321). Interestingly, Bailey's idea of the most important skills needed by the champion were not technical skills, but the necessary communication skills that would allow the champion to raise the consciousness of the community, develop support for a needed course of action and coordinate as necessary among various factions to see the course of action through to a successful conclusion (interview file: site 2, int. #27, 311-320).

Dr. Dee summarized his thoughts about why Clarke County was able to move forward in groundwater protection by concluding: "It was a person, it was the champion who made it happen; mainly because the state was not moving, and in that kind of scenario you really do need a champion to push it through" (interview file: site 2, int. # 22, 39). Dee sees the idea of a champion as a common theme across the United States, especially where environmental issues require negotiation and potential conflict; where such issues call for "being a kind of person, or group of people that make it happen" (interview file: site 2, int. #22, lines 111).

Dr. John Randolph, editor/co-author of the series Managing Water Resources by Virginia Localities (1991) contends that for a rural county to move forward in groundwater protection, three conditions must be present: (1) capable administrators with technical (planning) backgrounds, (2) a member of the Board of Supervisors who understands the issues and becomes an advocate and (3) a supporting constituency (interview file: site 4, int. #15, 31). There is a typical scenario in rural counties where many members of the Board of Supervisors (two year terms) are large landowners who have the most to gain economically from zoning decisions that favor development. A short-term decision to develop the land can look economically sound, and may look very advantageous from a two-year political term perspective. Therefore, it is difficult to mesh two-year political perspectives with the long-term technical realities of groundwater protection.

Clarke County did possess a champion (or champions), as defined by Bailey, and the three components Randolph considers critical for a county to move toward groundwater protection were also present. There were more than a few public officials in the county who had the ability to go beyond what was reasonably expected of them, had a vision of the future, and devoted their time and energies in making extraordinary use of internal and external resources to promote a program they believed in. "There's just been individuals who have hung in there and worked to make their neighbors and their local government aware of the vulnerability of their resources and what the options are" (interview file: site 2, int. #14, 49).

Even though the Sabatier and Mazmanian framework was designed for a federal statute perspective, it was an excellent vehicle for examining actions and events that helped to shape groundwater protection policy in a rural county. The framework helps to explain "why" and "how" things happened. Champions, resources, and support from the Board of Supervisors and the citizens appear to be more critical factors for Clarke County, and perhaps other rural areas of Virginia, than well-structured federal or state statutes.⁵² In order to answer the question of "why" Clarke County was able to make greater strides toward groundwater protection than its neighbors, it was necessary to try and identify the most critical factor in

⁵² Paul Berman and Milbrey McLaughlin (1978) suggested in their study of the implementation of educational innovation that grass root factors were a greater influence on policy implementation than statutes.

Clarke County's groundwater protection process. I agree with those interviewed that the most important factor was the public administration Champion (or Champions) present on the scene.

CHAPTER SIX

CONCLUSIONS

INTRODUCTION

The 1980 conference organized by the Virginia Water Resources Research Center (VWRRC) to address Virginia's "Most Important Water Related Problems" recognized that groundwater was being wasted and polluted, and that "the protection of groundwater should be given equal emphasis with the protection of surface water" (Clara Cox 1981, 4).⁵³ In spite of this recommendation, Virginia has passed through the decade thought necessary for the establishment of a comprehensive management and protection plan for its water resources with little demonstrated gain being made in groundwater protection in one of Virginia's most hydrogeologically sensitive areas -- the Shenandoah Valley. Recognition exists throughout Virginia of the seriousness of a variety of threats to the state's groundwater from rural activities, as well as the Commonwealth's acknowledgement that localities must be more involved in the protection of groundwater. The role of localities is receiving increasing attention as

⁵³ In regard to groundwater, the 1980 conference also noted that Virginia's surface and ground waters are threatened by current land use practices; the short- and long-term impacts of heavy withdrawals of groundwater are unknown; and Virginia law fails to recognize the interrelationship of ground and surface waters (Cox 1981, 2, 5, and 8).

realization grows that the activities of localities can adversely affect groundwater, and that localities are strategically positioned to play a critical role in the management and protection of groundwater resources (A Groundwater Protection Strategy for Virginia, 1987; Hirschman and Roth, 1991).

Yet, many of the rural counties in Virginia's Valley and Ridge physiographic province have minimal or negligible protection policies for groundwater (Appendix I).⁵⁴ Some reasons for the low involvement of rural Virginian governments in groundwater protection policies may be attributed to the rural cultural norms of egalitarianism and individualism that limit willingness to work with others for the common good. There is also an understandable amount of rural reticence to try to dictate to one's own neighbor what he or she must do with their land (interview file: site 1, int. #4, 175-179). Rural Virginia governments have the problems of local government that associated with responding to diverse interest groups in a political environment as they try to develop workable policy in the real world of limited budgets and resources. Furthermore, special dysfunctional aspects of Virginia's

⁵⁴ Appendix E (Figure 1, xiv, A Groundwater Protection Strategy for Virginia 1987) shows Virginia's five different Physiographic Provinces; the Cumberland Plateau (PI), Valley and Ridge (VR), Blue Ridge (BR), Piedmont (P), Coastal Plain (CP), and their geological diversity.

intergovernmental system are associated with Dillion's Rule, as well as legal distinctions between counties and cities.⁵⁵

How does a rural government find the time and resources necessary to develop a long range groundwater protection strategy when voting citizens want today's problems solved today? This research has focused on providing new information about forces and factors that may help in development of groundwater protection strategies and policies by those who are interested in rural groundwater protection policy. The research addressed what was seen as a knowledge gap between the threat to groundwater and recommended protection techniques, and how to accomplish what needs to be done in rural areas.

A knowledge gap was seen in the following area:

Are there key forces or factors that drive or impede the groundwater protection process in rural areas of Virginia that should be brought to the attention of those involved in groundwater protection?

The conclusions will be presented as they emerged from the data collected when that data was viewed through conceptual implementation frameworks and was coded and sorted by using The Ethnograph software. The main thrust of the

⁵⁵ See the final statement of the 1990 Virginia Assembly, "The Future of Local Government," and Bruce Mc Dowell's "The Future of Local Government in Virginia: Overview and Context." The University of Virginia News Letter, Vol 67, No. 3 January 1991 Special Issue.

conclusions will be to answer why and how questions about Clarke County's groundwater protection policies and their particular program. Why was Clarke County able to move toward a groundwater protection stance when many of their neighbors could, or did, not? And what methods (how) did Clarke County use to put a groundwater protection framework in place? These conclusions seek to identify critical factors or forces that policy formulators and key actors should focus upon when designing rural groundwater protection programs and policies for areas like those in the Shenandoah Valley in Virginia.

USE OF THE CONCEPTUAL IMPLEMENTATION FRAMEWORKS

Potential problems, in trying to answer why and how questions about the ability of one rural county in Virginia to move to a pro active stance in groundwater protection policy, included: (1) the researcher being focused in a certain direction, thereby neglecting an area that may have had an important impact on the formulation of groundwater protection policy; and (2) not considering all the variables in a particular area that should be addressed, thereby failing to identify what may be one of the most critical variables for the process. Those who seek to explain the reasons for success or failure of public policy have struggled with the same problems since Aaron Wildavsky and Jeffrey Pressman (1973), in Implementation: How Great Expectations in Washington are Dashed in Oakland: or Why its Amazing that Federal

Programs Work at All, and others like Edwards and Sharkansky (1978), pointed out the need to begin serious research on various aspects of the implementation of public policy.

Implementation scholars continue to debate the best way to focus on a policy implementation problem in order to explain successes or failures and to provide guidance for the future. Should a "top-down" perspective be taken starting with the policy decision by high level government officials and asking questions related to policy objectives and impacts (Van Meter and Van Horn 1975; Sabatier and Mazmanian 1980; Nakamura and Smallwood 1980)? Or is it more appropriate to start at the bottom ("bottom-up") and concentrate on the goals, strategies, activities, and contacts the service delivery actors were concerned with in the policy network (Lipsky 1978; Elmore 1978; Levin 1981; Mazmanian and Sabatier 1983)? Should one use a combination of the top-down and bottom-up approaches to ensure that policy instruments, as well as all actors, are included (O'Toole 1986; Sabatier 1986; Coggin 1986)? Not only is the best type of approach a matter of continuing debate, but important questions such as "Is it possible to distinguish policy implementation from policy making?" and "When does implementation really begin?" remain collectively unanswered in the literature (Lester et al. 1987; Yanow 1987).

The particular difficulties involved in implementing environmental policies are well documented (Hardin 1968; Ingram and Mann 1978 & 1980; Brady 1983), and major constraints to the implementation of local groundwater protection programs are identified (Tripp 1983; Mosher 1984; David 1988; Rail 1989). The implementation of policy to protect groundwater in rural areas can be especially complex and difficult for many of the reasons previously discussed in this chapter, and for reasons well documented by others who are concerned with the special problems generated by environmental policy (Anderson 1970; Rosenbaum 1973; Paulson & Denhardt 1973; Lowi & Stone 1978; Ingram & Mann 1978; Vig & Kraft 1990). The special complexion of rural government, local values, a lack of active constituents, unknown economic and social costs, lack of technical expertise, ambiguous guidelines, questions of political feasibility, unquantifiable benefits, administrative conflicts, the true complexity of the problem, and the inevitable legal challenges are but a few of the items and issues that must be addressed and successfully grappled with by small rural governments if coherent implementation of groundwater protection policy is to occur. The decade of the 1990s is now being characterized as an environmental policy "implementation era," where the relationships among the federal, state, and local governments take on more significance than ever before (Lester and Bowman 1989; Vig and Kraft 1990).

Before the research for this dissertation began, discussions in the implementation literature led this researcher to believe that a critical area for scrutiny would be the role of federal and state statutes in moving Clarke County toward groundwater protection (Mazmanian and Sabatier 1983; Sabatier 1986; McFarlane 1989). Vague, flawed statutes could be expected to hinder the process, and well-crafted statutes could be expected to provide coherent and consistent advice that would assist in the establishment and implementation of groundwater protection policies.⁵⁶ To ensure appropriate emphasis upon the role of the statute in the events of Clarke County, the 1980 conceptual implementation framework of Sabatier and Mazmanian, supplemented by Helen Ingram's 1990 conceptual framework were employed. Helen Ingram's "Flexible Framework For Implementation Studies" (Lynn and Wildavsky 1987, 470), is a framework that is responsive to the nature of the statute and the nature of the policy implemented. It was used along with the Sabatier and Mazmanian framework to view, filter, and analyze data received.

The use of Ingram's framework in this study was found to be unwieldy for one major reason: it was difficult to find anyone, anywhere, in Clarke County's groundwater protection policy network who believed federal or state statutes

⁵⁶ For amplification of the statutory coherence hypothesis, and the importance of framing statutes, see: Deborah R. McFarlane's (1989) Testing The Statutory Coherence Hypothesis, and Helen Ingram and Anne Scheider's (1988) Improving Implementation Through Framing Smarter Statutes.

contributed greatly to the events in Clarke County. Certain individuals were conscious of various federal and state statutes related to groundwater protection, and used applicable statutes when possible. But the collective opinion was that such statutes had not provided the impetus for the groundwater protection policies in Clarke County.⁵⁷ Ingram's implementation framework may have been a poor choice for a study mainly concerned with policy at the local level. Her framework was built upon research directed at federal policies with data under the major classifications of: (1) Nature of Decision Costs; (2) Structure of Statute; (3) Appropriate Approach; (4) Criteria for Evaluation; and (5) Critical Variables Affecting Implementation. Consequently, coding of the data for placement in Ingram's framework required a series of subjective judgments by the researcher that ultimately made the utility of the framework questionable for this particular study. (See discussion Chapter 3, and Appendix F). Helen Ingram contends in an earlier article:

That from a grass roots perspective, vague and nonspecific statutes may actually be virtues, not just because clarity is impossible to achieve, but because ambiguity provides maximum leeway to local level implementers permitting them to adopt the statute to local needs (Ingram and Schneider 1988).

The intent of this dissertation was to try to identify those factors and forces that helped to establish the formulation of groundwater protection policies in Clarke

⁵⁷ The fact that it took approximately five years for Clarke County to get its federal Sole Source Aquifer designation in place demonstrates some of the problems involved in expecting federal statutes to drive a local program.

County and move the county into a pro active, rather than a reactive "Muddling Through" (Lindbloom 1959 & 1979) stance regarding groundwater protection. The conceptual implementation framework of Sabatier and Mazmanian (1980) proved to be very useful. The gathered data was coded using Sabatier and Mazmanian's seventeen independent variables within the three major categories of: tractability of the problem, ability of the statute to structure implementation, and non-statutory variables affecting implementation. In the process, important themes related to Clarke County's groundwater protection process began to emerge: (1) a land use ethic; (2) a legal foundation for groundwater protection; (3) a scientific basis for action; (4) the "plan" as a force for dialogue; (5) the securing of funding and resources; and (6) the force of the Quadrumvirate.

The use of the Sabatier and Mazmanian framework to focus and filter the data revealed that about 300% more data was falling into the category of "non-statutory variables affecting implementation" in comparison to the category of "tractability of the problem" or the category of "ability of the statute to structure implementation" (see Appendix B). The researcher believes the factors and forces identified in Chapter Five, through the use of the Sabatier and Mazmanian framework and the Ethnograph software, that helped to guide Clarke County's groundwater protection process can be grouped under six important themes that emerged:

1. a land use ethic
2. a legal foundation for groundwater protection
3. a scientific basis for action
4. the "plan" as a force for dialogue
5. the securing of funding and resources
6. the force of the Quadrumvirate

These themes and the data related to them will be discussed in greater detail.

THE FACTORS AND FORCES

The uniqueness of Clarke County is identified, along with the factors and forces that have allowed Clarke County to gain an enviable position in groundwater protection in the Shenandoah Valley. Why was Clarke County able to initiate plans and policies that would help to protect the county's groundwater when neighboring counties were having a difficult time moving off of ground-zero in terms of groundwater protection?

The Guiding Force of a Land Use Ethic

Clarke County was successful in developing its groundwater protection program because it was guided by an understanding of the county's culture itself. This culture included a deep, and generally accepted appreciation of historical agrarian beliefs, values, and ethical principles established by Tidewater planters, coupled with administrative actions based on the rationalism of generally accepted non-political norms like logic and wisdom. County officials saw a need to plan for the future and were able to develop ordinances designed to protect the individual citizen. The new county well ordinance requires a demonstration of potable water before a building permit is issued.⁵⁸ While assurance of a supply of drinkable water appears logical, a "demonstration of potable water ordinance" is abhorred in neighboring Valley counties by those in political power. While neighboring counties are still having a difficult time, Clarke County was able to move forward on groundwater protection because of an active and recognizable land ethic (Leopold 1983) in the county.

Warren R. Hofstra (1986) pointed out that the county is "a separate place."⁵⁹

⁵⁸ Permission from the Virginia General Assembly was required for the more restrictive well ordinance (Dillion's Rule), and as of 1990 only ten counties and two cities have this authority (A Groundwater Protection Strategy for Virginia: 1990 Supplement).

⁵⁹ For an entertaining and informative explanation of the origins of Clarke County, and the story of the people who made Clarke County a separate place, see Warren R. Hofstra's (1986) A Separate Place : The Formation of Clarke County, Virginia. Two of the main issues that drove the formation of the county in 1836,

The people are "different" and think differently than their county neighbors. The area was settled in the mid-1700s through land grants by Robert (King) Carter, agent of Thomas, Sixth Lord Fairfax. It would eventually contain some of Virginia's most prominent families. There is a strong legacy of the value of the land being in the preservation of that land for future generations. A sense of stewardship flavored by an agrarian perspective exists, rather than the perspective prevalent in neighboring counties where commercial development of land for short-term economic gain is seen as desirable. Since the late 18th Century, a nucleus of highly-educated persons existed in Clarke County, a nucleus that now is expanding as newcomers in higher socio-economic brackets move into the area. These newcomers are also well-educated and have definite pro-environment beliefs. The reservoir of support for groundwater protection in Clarke County continues to grow among the general public, interest groups and supporting sovereigns.

A Legal Foundation For Groundwater Protection

The Planning and Policy Analysis by Coughlin and Keene (1987) that addressed legal considerations related to growth management and resource protection

like-mindedness vs. pluralism, and agrarian values vs. commercial pursuits, continue to play an important role in the political dynamics of the current groundwater protection process in the Shenandoah Valley.

in Clarke County established a legal foundation for groundwater protection actions. While the Coughlin and Keene study concentrated on the protection of agricultural, forestal, and environmentally significant lands, it also established a workable legal, framework for groundwater protection in the county by recommending legal methods to achieve the stated goals.

The policy issues of land use and groundwater protection are inextricable in the Shenandoah Valley. Such inextricability poses a dilemma. Rural politicians tend to painfully regard any policy proposal that denies an individual the right to do as he wishes with his land. Unfortunately, groundwater can be protected only by controlling the actions of humans and their use of the land. By providing legal inputs into the process of developing comprehensive policies for the guidance of development within the County and the protection of its resources, the Coughlin and Keene study provided a firm legal foundation upon which a county groundwater protection plan could be built.

A Scientific Basis to Make the Problem Tractable

The county expended a great amount of effort to document current and potential risks to groundwater in order to develop a valid technical theory on how to proceed to protect the resource. Primarily because of the unknowns involved,

groundwater protection is not one of society's most tractable problems. The same was true for Clarke County. The susceptibility of their groundwater to pollution was not documented. County officials knew groundwater in certain parts of the county was polluted, but the extent of the pollution was unknown and sources of contamination difficult to trace. The susceptibility of major spring contamination within the county, as well as existing health hazards in the groundwater, were also unknowns.

Clarke County made its groundwater protection problems more tractable by moving to a scientific, factual basis as quickly as possible. The U.S. Geological Survey (USGS) began a groundwater resources assessment. The assessment included a comprehensive analysis of the extent of the groundwater resource base, an estimate of what level of quality could be expected from the resource base and an estimate of the susceptibility of various areas of the county to groundwater pollution. Known avenues of groundwater contamination (ie., old wells and sinkholes) were identified, and dye tracings conducted to determine probable contaminant flows. The University of Virginia Department of Environmental Sciences studied the impact of agricultural chemicals, and graduate students from other state universities were assigned specific projects designed to collect data about the county's groundwater. The County Planning Commission implemented a Geographical Information System (GIS) demonstration project to provide a quantifiable methodology that would justify and

support planning decisions. By providing timely GIS and other factual information to decision makers, new policy options became available that helped to remove groundwater protection from the volatile, purely political realm of decision making (interview file: site 2, int. #18, 197-353).

The "Groundwater Protection Plan" as a Force for Dialogue

Developing a sense of the future requires planning. By moving to generate a plan that would lead to the establishment of policies designed to protect groundwater, Clarke County created a framework within which those who wished to help the process could conduct a dialogue. A framework was available where actors could hang their philosophical visions and debate the pro and cons of a specific approach in relation to current laws, institutions, and an overall county groundwater protection strategy. The plan was an essential part of the long-term strategic planning process, and an essential element for the acquisition of funding. In Planning for Groundwater Protection, G. William Page emphasizes the critical role planning plays in the groundwater protection process: "Each municipality, county, regional agency, or state that is planning for groundwater protection faces a unique set of circumstances that will require a planning process to develop a groundwater protection program that is tailored to fit their unique characteristics" (Page 1987). State and federal officials are willing to help with groundwater protection in rural areas, but local government must

have a demonstrated interest in developing their plan for their county. As former County Administrator Lee pointed out, the Virginia Water Control Board (VWCB) gave them the opportunity to "demonstrate that small rural governments that care about groundwater can take appropriate actions to protect the groundwater" (Interview file: site 1, int. #1, 860).

The Securing Of Funding And Resources

Lack of suitable funding sources can become the Achilles' heel of local groundwater protection programs. Consequently, Clarke County tapped a wide range of resources. Groundwater protection does have an edge over some traditionally unpopular public programs (such as welfare), because the issue allows one to take the moral high ground. Therefore, Clarke County officials were able to locate public service organizations that devoted their time and energies to the cause. For example, members of the League of Women Voters of Clarke County contacted individual well-drillers and updated county well records and Virginia well storage and retrieval (STORET) data pertaining to the county.

Potential outside funding sources, technical resources and agencies were investigated and used. Clarke County aggressively pursued funding for groundwater protection, and primarily through the efforts of the Executive Director of the Lord

Fairfax Planning District, obtained grants both from public agencies and private foundations. Federal 205J water resources planning grant money from the Environmental Protection Agency (EPA) was passed to Clarke County through the Virginia State Water Control Board, the first time federal money was used in Virginia to develop a groundwater protection plan. Clarke County was one of twelve counties in the nation selected by the Soil Conservation Service (SCS) in 1981 for a Land Evaluation and Site Assessment (LESA) trial. A prototype geographical information system (GIS), known as GRASSLANDS, was also introduced into Clarke County through private foundation grants by the American Farmland Trust in conjunction with the Harvard Laboratory for Computer Graphics.

The above was not happenstance. Success required months and years of dedicated research and networking by many individuals to identify available resources and bring those resources to bear.⁶⁰ Rural Virginia counties operate within a two-year political system, and it is difficult to balance the required long-term groundwater protection perspective with short-term political realities. Clarke County did not develop its groundwater protection policies and programs by concentrating solely on groundwater protection. Groundwater protection was only one small part of the total county land use and resource protection package.

⁶⁰ The Clarke County Planning Commission established its Water Study Committee in 1982.

The Force of The Quadrumvirate

The Quadrumvirate is a proposed metaphor for the groundwater protection teamwork that took place in Clarke County. It can be visualized as a four horse dray (heavy wagon). The four horses are analogous to; (1) support from the County Board of Supervisors/Planning Commission, (2) support from external patrons, (3) support from citizens, and (4) support from the public administrator groundwater champion(s) (Figure 6-1).

The dray must be capable of carrying a substantial load of federal and state statutes, local ordinances, new technology and other assorted groundwater protection tools. The four healthy dray horses need to be accustomed to putting their shoulders to the harness and pulling for the long haul. The spokes of the wheels of the dray are funding and resources, and it would be almost impossible for the dray to move unless the spokes are in place. The dray moves along the road (smoothed by citizen education) toward a goal of increased groundwater protection, because the horses have a shared vision of where they want to go, just as old time farmers could give the horses their head when going home to the farm after a trip to town.

To get the heavy dray of groundwater protection moving, all four horses must initially lean heavily into the harness and give their maximum effort, just as it was

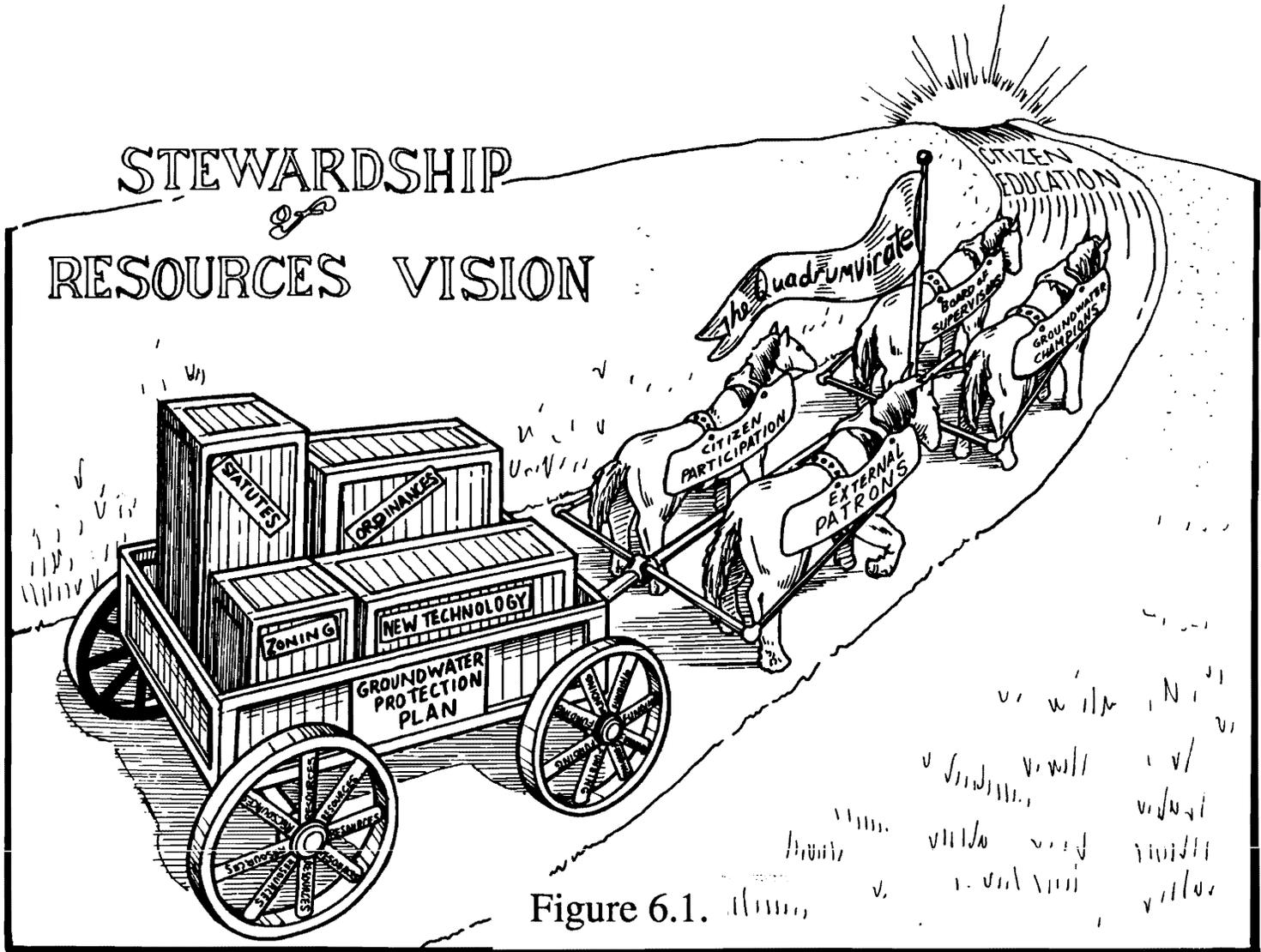


Figure 6.1.

necessary for all four members of the Quadrumvirate to put forth a combined maximum effort to get groundwater protection policies rolling in Clarke County. After the dray is smoothly rolling along on a good road, the horses can relax a little in the harness and focus their attention on keeping the dray (local groundwater protection policies) on track. The dray will travel along, moving toward the shared vision, only if no horse decides to stop or go off in another direction and if the horses do not begin kicking and biting in the traces. If there is trouble in the traces, the dray may continue its way for a short distance, but will eventually come to a stop. The problem will need to be sorted out and corrected and all members of the team placed back in harness before the dray can continue its movement toward the shared vision.

Shared Vision

All members of the Quadrumvirate had a shared vision of where they wished to go. Each member was a conscious participant in determining where he or she wanted to go and provided locomotion for the dray according to his or her ability. There was a sense of accountability among all members of the Quadrumvirate, and they accepted responsibility for the actions they believed correct. Communication between the actors was frequent and the dialogue was characterized by a good deal of trust among all parties. The element of trust was important, because it meant that all

actions did not have to be explained and critiqued in great detail. And so the groundwater protection dray could keep moving along in the right direction, even though one member may not completely understand at any particular time why the other three members wanted to move in a specific direction. Things were fine, as long as the groundwater protection dray continued moving in the general direction of the shared vision. Just as one horse cannot pull the dray by itself, the plans for the protection of groundwater resources are not in place in Clarke County due to the singular efforts of one person. It took the combined force of the Quadrumvirate to put Clarke County's groundwater protection program in place.

Locomotion

The reason the horses leaned into the harness was to achieve locomotion, and Clarke County's mode of locomotion was seen as different from that of most rural programs. It is apparently a rare event whenever a rural program is undertaken for reasons other than someone's short-term political gain or because it puts money in a friend's pocket. If this statement appears too cynical, allow this researcher to apologize in advance to those who may be offended and facts to the contrary will be welcomed. It is a fact that Clarke County is the only county in the Lord Fairfax Planning District with a ban on certain alternative septic systems (mechanical) that pose a known risk to the environment. While one would think that human services

and the protection of health would be excluded from self-serving political decisions, this apparently is not the case. The decision-making process in most of the rural areas of the Shenandoah Valley appears to be motivated by those who stand to gain from growth and development because they own land, or because they wish to sell a product or service to an ever-increasing market.

The locomotion for the groundwater protection dray in Clarke County required a different perspective than the impetus for change seen in other areas of the Valley. Moving toward groundwater protection meant more restrictive, not less restrictive land use, as well as additional restrictions on individual actions. Moving toward groundwater protection meant little or no short-term political gains, and a distinct probability that a rural politician would make some of his good neighbors furious.

Locomotion for the groundwater protection program in Clarke County did not occur because of someone's desire for short-term political or economic gain. The motivating force was a shared vision among the major players of a quality of life that was desirable in the future. They had a demonstrated ability to focus (at least periodically) on the public interest (in terms of a present and future perceived common good), and not solely on desired private interests. The individuals involved seemed to have the ability to think about groundwater protection not as a separate piece, but as part and parcel of what was needed for the good of the community and

long-term health of the county. Major actors in the Quadrumvirate had a shared vision of where the road to groundwater protection would take the county, and were capable of leading others to action in support of that shared vision of the future.

MEMBERS OF THE QUADRUMVIRATE

Clarke County Board of Supervisors

The Clarke County Board of Supervisors was not a congenial county board of supervisors. Several members were known for periodically being at loggerheads with each other, and they could always be counted on to ask the tough questions that needed to be asked regarding another member's pet program. The board was made up of a diverse mixture of occupations during the period when most of the groundwater policies were developed. The board was perceived to be better educated and better able to understand complex issues than other boards in the Valley. There was open admiration of the board for its ability to enter into the dialogue on groundwater and articulate the dangers of groundwater pollution in terms the general public could understand. The board was also admired for its pioneering agenda on a number of groundwater related issues such as minimum well standards, sinkhole identification and restrictions, and the banning of alternative (mechanical) septic systems for general use.

The County Board of Supervisors embraced the concept of planning and, to some members of the general public, it appeared they practiced planning ad nauseam (interview file: site 1, int. # 5). It exhibited a slow, conservative approach to change, and the board worked to put legal mechanisms in place (such as comprehensive zoning and subdivision ordinances) that would enable the county to control growth and protect its resources. The county was fortunate to have individuals with technical skills on its planning commission. Policies to protect water resources that clearly went beyond state requirements and regulations were put in place and enforced. Chapter Five cited several comments received at both the state and local level related to the appropriateness of having members with real-estate interests on the County Board of Supervisors and County Planning Commissions; as it seemed a forgone conclusion on the way they would vote when it came to issues regarding land development or protection of the resource. Clarke County carried this same burden yet was able to move forward on groundwater protection.

External Patrons

The choice of the descriptive noun "patron" rather than "advocate" for this Quadrumvir is intentional. "Advocate" carries with it the sense of a party pleading one's case and defending one's cause. The visionaries in Clarke County themselves pleaded their own case and defended their own cause. "Patron" signifies those parties

chosen by the visionaries in Clarke County as supporters of the cause. Assistance did come from state and federal officials, but it would be difficult to view federal and state officials as advocates for the cause. The Environmental Protection Agency (EPA) is somewhat reluctant to appear heavy-handed in its dealings with the states. There is also the belief in Virginia that federal and state officials are reluctant to push mandatory groundwater protection regulations because they do not wish to get involved in dictating land use policy to local governments.

David Hirschman, co-author of Case Studies of Local Water Resources Management in Virginia (1991), is struck by the ability of Clarke County to find resources to help them with their water resources protection goals.

One of the things I want to stress, and I stressed it in the case study about local capability, most people when they think about capability think about in-house resources. But one of the things that came to light in Clarke County, it wasn't so much the in-house resources but their ability to leverage the resources of other experts, other agencies (Hirschman interview, June 5, 1991).

The list of individuals, public and private organizations, and agencies who helped Clarke County develop their major land use and water protection documents is impressive. Private consultants, private consulting firms, graduate students, universities, private foundations, research laboratories, regional bodies and state and federal agencies have all contributed in some manner to the Clarke County Ground Water Protection Plan (1987), the Comprehensive Plan of Clarke County (1988), and

the Clarke County Water Resources Plan (1990). A synergism appeared to be associated with the groundwater protection process in Clarke County. The more patrons that became involved on a specific project, the easier it became to attract additional patrons. As the number of patrons grew, the product became better. The more dialogue there was about groundwater protection, the more it seemed external patrons and the community wanted to enter into the dialogue.

Citizen Participation

The citizens of Clarke County played a major role in the protection of their groundwater and other county resources. Other sections of this chapter have detailed the emphasis placed by the county administrator on efforts to educate the general public about groundwater, as well as the ability of members of the Board of Supervisors to articulate various sides of water protection issues to the public. While groups such as the League of Women Voters and Friends of Clarke County actively supported efforts in the county to protect water resources, a strong undercurrent of approval of the actions taken by the County Board of Supervisors to protect the groundwater resources of their county appeared to flow among the citizens. The public's interest in Clarke may be due to the fact that about 70 percent of the county's citizens rely on wells for drinking water. It may also be because local newspapers

were more effective in presenting groundwater protection issues to the citizens than newspapers in neighboring counties.

The Director of the Lord Fairfax Planning District believes that Clarke County has done a better job of maintaining a low population density in the county because the local officials enjoy strong support from their citizens. People who ask the Chairman of the Board of Supervisors to bend the rules on a land use or water protection issue will be refused "because the Board and the citizens are together on the policy." General agreement exists within the county that growth should be slow and controlled. Citizens seem to recognize that restrictive land use policies may make it hard on a few individuals in the short-term, but the resources of the county can only be protected for the future common good by sticking to the county comprehensive plan. This does not mean there is total agreement in Clarke County on land use policies. Volatile land use battles have been fought in the past, and virtually each new issue of the Clarke County Courier seems to document another case of a developer who wishes to expand into the county.⁶¹

Groundwater Champion(s) -- An Agential Leader

⁶¹ One of the most recent volatile land use issues in Clarke County was the "Golf Course" issue, where developers, environmentalists, monks, concerned citizens, and agency officials all entered into pitched battle over a site on the Shenandoah River.

Perhaps more important than any other factor, Clarke County has been fortunate to have its share of groundwater champions, as well as a supporting cast and community that stands by to help them. During the research for this paper, it often seemed that not enough good things could be said at the local, state, and federal levels about G. Robert Lee, who was the County Administrator of Clarke County for over twelve years. Clearly, Lee was the unrelenting force that kept plans and policies moving toward groundwater protection, and was the individual responsible for setting the tone of the groundwater protection dialogue.

He was fortunate in having a few high-caliber "technocrats" as elected and appointed public officials such as Margaret Maizel, Chairman of the Clarke County Planning Commission and Water Study Committee and Jim Clarke of the Board of Supervisors, former Transportation Director in the District of Columbia; people who could understand complex issues and use their knowledge and skills to bring technology to bear on the problem. He was also fortunate in receiving support from external public administrators such as the Director of the Loud Fairfax Planning District, Tom Christoffel, who played a critical role in finding grant money for groundwater protection projects.

Sabatier and Mazmanian (1980) and others (Van Meter and Van Horn 1975; Lynn and Wildavsky 1990) emphasize the critical role of commitment and leadership

skills in the initial implementation of public policy and in the continuation of those policies. The events surrounding the groundwater protection program of Clarke County strongly suggest that the personal dedication and capabilities of one public administrator can have a telling impact on public policy. It is also important to note that such programs cannot be a one-person operation and those involved must possess the ability to collaborate and coordinate with constituents on both sides of the issue and the local governing body (interview file: site 2, int.# 18, 260-268). While the requirements for collaborative efforts need to be emphasized, the apparent impact one individual had on the groundwater protection efforts in Clarke County should not be minimized.

Two of the strongest assets brought to the groundwater protection process by former County Administrator Lee were his planning background, and what some viewed as his ability to respond to the bottom-up dynamics of the public will. A background in planning gave Mr. Lee a technical foundation, as well as the long-range perspective necessary to move on groundwater protection issues. He possessed the analytical skills to properly identify problems and issues, and assisted county decision makers in ranking priorities and establishing policies related to groundwater protection. Perhaps most important of all, his training allowed him to look to the future and make recommendations appropriate for all the citizens of Clarke County. Several people commented during the interviews of a sense of vision and commitment

that seemed to exist in Clarke County, and the ability of those involved to lead with a vision. "He had a sense about what was right for future generations, and, like other planners, was infused with that passion for making their community a better place to live" (interview file: site 4, int. #21).

James F. Wolf and Robert N. Bacher (1990) expressed concern over the ambiguous roles of public administrators and the need to move beyond simple "job" and "career" paradigms consisting of the exchange of labor for money and the building of one's career, if the public administrator is to play a role in the governance process. They contend that key to a new transformation is the ability of the individual to see that "one's work activities do affect the lives of others in the community." In essence it is necessary for the individual to recognize that there is something beyond the immediate and selfish gratifications of job and career. It appears that many of those involved in the groundwater protection process in Clarke County did see a tie between their own personal actions and the broader community, and demonstrated a clear commitment to the process.

Tom Christoffel, characterized the groundwater protection planning that took place in Clarke County as a "more sophisticated manner of planning" and a "maturity of the planning process and the people involved." The joint Groundwater Protection Program planning effort between Clarke County and the Loud Fairfax Planning

District was well-recognized in Virginia as a comprehensive approach to groundwater protection. The Plan also won an award from the Virginia Chapter of the American Planning Association. It should be emphasized that it was not groundwater planning per se that was important, as the county's groundwater protection planning was only a foundation stone in the total planning for the county that had, as its goals, the protection of the county's resources and the maintenance of the quality of life of the county's citizens (Clarke County Comprehensive Plan 1988).

Groundwater planning was combined with other planning taking place in the county, but by moving groundwater protection to a separate stage in the planning process, an opportunity was created for a dialogue to begin among various actors in regard to the protection of the county's groundwater. The eventual outcome of the separate process for groundwater protection was that it became what some see as the most acceptable and defensible part of the county's planning agenda (interview file: site 1, int. #1). Planning in a rural setting, as in other settings, is very much a political process. There is a natural conflict in the United States between having the preservation of a beautiful countryside and other long-held American values such as everyone's right to make a dollar, and the belief that landowners are entitled to do as they wish with their property. Clarke County was no exception. Conflict occurred as diverse factions sought to control groundwater protection policies seen as essential land-use decisions for the county.

Because of the interplay, mediation and compromise that takes place between various committees, boards, planners, interested parties and the general public, Lee E. Kappleman contends that planning for groundwater protection must be understood to be primarily a political activity (Page 1987, 194). County Administrator Lee was able to work within this political framework and while viewed as an excellent administrator, he was also viewed as one who was working in the public interest and for the elected officials. He kept things moving through the political system. "He wasn't forcing it on them, he was getting the best out of them. . . . He did it really expertly" (interview file: site 1, int. #5).

Clarke County will be an interesting future study to evaluate whether its groundwater protection plan suffered the gradual erosion scenario often noted by the "death of the fixer" and loss of committed staff and constituency support (Sabatier and Mazmanian 1980, 555). Or will the force of the Quadrumvirate result in a successful regulation scenario (Sabatier and Mazmanian 1980, 556), where staff and constituency support remain strong even though most individuals involved in the initial implementing process have left the scene?

G. Robert Lee, County Administrator

Perhaps Clarke County's G. Robert Lee can be seen as an example of a public administrator who was operating close to the normative guide of "agential leadership" as set forth by Gary L. Wamsley (1990) in Refounding Public Administration. An agent that acted on the behalf of others, yet did so in a vigorous and thoughtful manner and thereby performed a special role in governance. Wamsley lists four qualifications that are required for this special role, and this researcher believes that Mr. Lee has demonstrated them all: (1) expertise in operationalizing policy in the form of specific programs, (2) expertise in creating and sustaining process and dialogue that result in the broadest possible definition of the public interest, (3) skills in community-building politics and the fostering of active citizenship and (4) guardianship (along with other constitutional officers) of the Constitution and constitutional processes (Wamsley et al. 1990).

For example:

(1) Mr. Lee was able to operationalize various groundwater protection policies into established groundwater protection and water resources plans for Clarke County. As pointed out elsewhere in this study, Mr. Lee did have a great deal of assistance. But it is also apparent that he was the key motivating force. For example, the comments of Dr. Dee of the EPA, and others were very specific regarding the motivating force behind Clarke County's groundwater protection policies as being a person, "it was a champion who made it happen."

(2) Mr. Lee was able to initiate and maintain a dialogue among actors in a policy subsystem that related to the broadest sense of the public interest. The dialogue was not self-centered, such as one that responded to the economic self interests of a particular faction. Instead, it was concerned with the common good of present and future generations. He demonstrated an ability to explain complex issues across various socio-economic levels and assisted the planning commission in their natural inclination to move toward a more environmental stance. The comments of Mr. Bailey, Vice President of ICF, Washington, D.C., concerning what he sees as a disturbing current trend of distrust of public agency officials, indicate that a credibility gap may be developing between the public and those who serve the public. Mr. Lee was able to bridge this credibility gap and conduct a dialogue about groundwater protection. Several interviewees saw Mr. Lee's planning background as a key factor in his ability to maintain trust among key actors and the citizens and maintain the groundwater protection dialogue. One can wonder whether Mr. Lee, trained solely as a public administrator, would have acquired the long-range perspective necessary to maintain the dialogue. Or if trained solely as a hydrogeologist, would he have acquired the stewardship-of-resources perspective necessary to maintain the same dialogue with the citizens and across various levels of government.

(3) G. Robert Lee was seen by others involved in protection of water resources in Virginia as a one-man crusade in trying to educate citizens about groundwater. "At a workshop in Lynchburg he chose the subject on education of the citizenry, and was a living example of what could be done. . . . A lot of people did not know what groundwater was, and the interconnection between groundwater and surface water. He was at the beginning of that education; responding to it and moving with it" (interview file: site 4, int# 10, 112, 744). From the beginning of the groundwater protection process in Clarke County, Mr. Lee believed that education of the citizens was a key and would be one of the major ways they could accomplish their goals. It is very difficult to talk with citizens and get their input if they have little or no comprehension of the subject. Education of "all the people" about groundwater was seen as a way to widen the dialogue about groundwater and ensure citizen participation. Clarke's approach to citizen participation in the planning process can be contrasted to Hrezo and Howe's (1985) study of thirty-one states that suggested planners do not want the citizens involved in water resource planning because of the potential for conflict. In her chapter about "Active Citizenship and Public Administration," Camilla M. Stivers (1990) contends that, when talking about the governance aspect of public administration, it is not enough for public administrators to have decided among themselves in what senses public service is legitimate; they must take active measures to ensure a dialogue with the citizens.

Stivers states, "We cannot simply talk about governance; we must talk with the citizens" (Stivers 1990).

(4) To develop agential leadership and play a respected role in governance, legitimate authority must be nurtured. Authority is linked inextricably to legitimacy: "This means a shift in our focus from power to authority." (Wamsley et al. 1990, 145). Mr. Lee was an active participant in Clarke County, working within a legal framework. He helped the citizens, the planning commission, and the board of supervisors further their goals. Webster defines "champion" as "one that does battle for another's right or honor." While I have labeled Mr. Lee as a groundwater champion he was also a known champion for the rights of others, and impressions are that, during Mr. Lee's tenure, there was a working partnership between the local government and the public (interview file: site 4, int. #21, 204-255).

In Refounding Public Administration, other authors (Bacher, Goodsell, Kronenberg, Rohr, Stivers, White, and Wolf) make a collective case (plea) that it is time to recognize and nurture the special role of governance (rather than the mere management or administration of the public sector) available to those in American public administration. The acceptance of the concept of a "social construct" that can serve as an institutional ground-point (agency perspective) for the practicing public administrator and a revived concept of the "public interest" in the broadest sense are

seen as critical -- in order for the public administrator to become a partner in governance rather than a tool or adjunct. While some will disagree on what is required for a public administrator to become a partner in the governance role, the governance argument presented by Wamsley et al. is a powerful one. It is clear that, during his tenure as County Administrator, G. Robert Lee (The Groundwater Champion of Clarke County) was an important part of the governance process in Clarke County.

The governance role that was played by the county administrator in Clarke County in furthering the county's goals of groundwater protection does raise questions about the proper role of a rural county administrator. Is it proper for a rural county administrator to play a more active role, rather than be passively attuned to the politically powerful interests in the county? Should the county administrator be actively promoting dialogue with the general public and interested groups on specific issues of concern? Should a county administrator be an advocate of long-range planning and seek to institutionalize the stewardship-of-resources vision?

STEWARDSHIP-OF-RESOURCES VISION OF THE FUTURE

Leading elders of certain native American tribes in our Northeast were required to consider the impact of any decision they made on the resources of the next

seven generations of offspring. This requirement certainly required a shared vision between the people and appointed leaders of what the future world should look like. Should we expect any less of our elected and appointed officials when they make decisions related to the protection of one of our most precious resources -- groundwater? Can the Shenandoah Valley of Virginia (the United States, or the world) now afford any less than a stewardship-of-resources perspective and a participating role in that vision from our elected officials and public administrators?⁶²

⁶² In addition to those advocating that we should be paying more attention to the implementation of environmental polices; Henderson et al. 1984, Vig and Kraft 1990, and Hamilton 1991, many diverse disciplines are now calling for public officials, agencies, and all levels of government, to move toward collective management and a stewardship of resources perspective in order to protect a wide variety of public resources. See Harlan Cleveland's "Theses of a New Reformation," Oliver A. Pollard, III, "The State as Steward: The Need For Historic Preservation Duties For State Agencies In Virginia," Virginia Environmental Law Journal, Fall 1989, v.1; John Sandor, "Recollections on the Formation of SNREA," (The Section on Environmental and Natural Resources Administration of the American Society for Public Administration) Natural Resources and Environmental Administration, March 1989; and the Worldwatch Institute State of the World series.

APPENDIX A. RESEARCH CODES USED FOR ENTERING DATA INTO ETHNOGRAPH

CODES FROM SABATIER AND MAZMANIAN

TRACTABILITY OF THE PROBLEM

- A1 - Availability of valid technical theory and technology
- A2 - Diversity of target group behavior
- A3 - Target group as a percentage of the population
- A4 - Extent of behavioral change required

ABILITY OF THE STATUTE TO STRUCTURE IMPLEMENTATION

- B1 - Clear and consistent objectives
- B2 - Incorporation of adequate causal theory
- B3 - Financial resources
- B4 - Hierarchical integration with and among implementing institutions
- B5 - Decision-rules of implementing agencies
- B6 - Recruitment of implementing official
- B7 - Formal Access by outsiders

NONSTATUTORY VARIABLES AFFECTING IMPLEMENTATION

- C1 - Socioeconomic conditions and technology
- C2 - Media attention to the problem
- C3 - Public support
- C4 - Attitudes and resources of constituency groups
- C5 - Support from sovereigns
- C6 - Commitment and leadership skills of implementing officials

CODES FROM INGRAM

NATURE OF DECISION COSTS

- H1 - Low negotiation costs/low information costs
- H2 - High negotiation costs/low information costs
- H3 - Low negotiation costs/high information costs
- H4 - High negotiation costs/high information costs

STRUCTURE OF STATUTE

- G1 - Clear goals; procedural flexibility
- G2 - Open-ended goals; procedural flexibility
- G3 - Clear goals; procedural specificity
- G4 - Open-ended goals; procedural specificity

APPROPRIATE APPROACH

- F1 - Command-control; programmed
- F2 - Adaptive; backward mapping
- F3 - Oversight; policy reformulation
- F4 - Bargaining

CRITERIA FOR EVALUATION

- E1 - Achievement of goals
- E2 - Grass-roots creativity; modifying proximate policy behavior
- E3 - Policy learning
- E4 - Broad agreement and support; avoidance of agency capture

CRITICAL VARIABLES AFFECTING IMPLEMENTATION

- D1 - Changes in external circumstances or policy environment
- D2 - Bureaucratic entrepreneurship; "fixers" and "double agents"
- D3 - Administrative capability
- D4 - Clientele relationships

Note: In the Ingram framework it is necessary that the ones, twos, threes, and fours all track together. For Example, it is H2 that leads to G2, that leads to F2, that leads to E2, and finally to the critical variable of D2.

OTHER CODES DEVELOPED FROM THE GROUNDWATER PROTECTION AND PUBLIC ADMINISTRATION LITERATURE

ALTSYS - alternative type septic system

COSTS - financial costs

DILLION - Dillion's Rule

EDUCATION - education

FINRES - financial resources

GEOLOGICAL - geological

GNDWTR - groundwater

LNDFILL - landfill

LNDUSE - land use

PLAN - planning

SEPTIC - septic system

SEWERSYS - sewer system

SNKHOLE - sinkhole

TRIGEVENT - triggering event

WELLS - public and private drinking water wells

WSTLAGOONS - waste lagoons

WTRQUAL - water quality

WTRQUANT - water quantity

ZONING - zoning

APPENDIX B. SUMMARY OF MAJOR CODE DATA CATEGORIES

N	CODEWORD	N	CODEWORD	N	CODEWORD
60	A1	25	B1	51	C1
14	A2	0	B2	09	C2
07	A3	18	B3	61	C3
31	A4	27	B4	33	C4
		16	B5	48	C5
		01	B6	99	C6
		04	B7		
----		----		----	
112		91		301	
08	D1	00	E1	00	F1
01	D2	00	E2	00	F2
06	D3	00	E3	00	F3
02	D4	00	E4	01	F4
----		----		----	
17		00		01	
00	G1	00	H1		
00	G2	00	H2		
00	G3	00	H3		
00	G4	00	H4		
----		----			
00		00			

67 GNDWTR/WTR QUAL (GROUNDWATER/WATER QUALITY)
 45 LNDUSE/ZONING/PLAN (LAND USE PLANNING)
 22 SNKHOLE/GEOLOGICAL (SINKHOLE/GEOLOGICAL CONSIDERATIONS)
 19 SEPTIC/ALTSYS/SEWERSYS (SEPTIC SYSTEM/ALTERNATIVE SYSTEMS)
 18 TRIGEVENT (TRIGGERING EVENT)
 16 FINRES/COSTS (FINANCIAL RESOURCES)
 11 DILLION (DILLION'S RULE)
 10 WELLS (PRIVATE AND PUBLIC)
 08 LANDFILL/WASTE LAGOONS
 06 EDUCATION

Note: The above quantitative data is provided with some reluctance but with the realization that there are those who believe things must be counted. It is not intended as a means to quantify qualitative data. The graph only shows the number of times the researcher chose to identify a given segment of information with a given code word. As the analysis of the data is a creative, interpretive, and evolutionary process, it is probable that further passes through the data would result in code additions, deletions and different summary numbers.

APPENDIX C. GUIDING QUESTIONS FOR CLARKE COUNTY POLICY NETWORK INTERVIEWS

1. Why was Clarke County able to move toward a groundwater protection stance? What individual/organizations/ groups/event played the greatest role?
2. How would you assess the impact of various interest groups and the media on groundwater protection in Clarke County?
3. What role did you play in groundwater protection?
4. What do you see as your responsibilities in the groundwater protection process?
5. How did you gain knowledge of these responsibilities?
6. Who do you believe were/are the key players in the groundwater protection decision process for Clarke County?
7. What level of support did Clarke County receive from federal and state officials?
8. How have federal/state statutes helped or hindered the groundwater protection process in Clarke County?
9. How did financial resources impact groundwater protection policy decisions?
10. How has the behavior of the population of Clarke County changed since the adoption of groundwater protection policies?
11. What do you see as the most important item/issue/factor in establishing good rural groundwater protection policies?

12. What are the most effective elements of Clarke County's groundwater protection program?

APPENDIX D. PERSONS

INTERVIEWED/CONTACTED

*Alexander, Don. DIRECTOR, BUREAU OF SEWAGE AND WATER SERVICES, Virginia Department of Health, Richmond Virginia.

Bailey, Paul E., SENIOR VICE PRESIDENT, ICF Incorporated. ICF is a recognized leader in the environmental policy and regulatory field. Recognized by the NATIONAL JOURNAL as one of the "150 Who Make a Difference", a selection of firms that influence the federal government.

*Bowry, Barbara Jeanne., STAFF, Institute for Environmental Negotiation, University of Virginia, Charlottesville, Virginia.

Boyd, Sue. EDITOR (one of) GROUNDWATER: A COMMUNITY ACTION GUIDE, Concern Inc., Washington, DC.

Burks, Ned. REPORTER - WINCHESTER STAR.

Burwell, Charles. Resident of Clarke County, father was the former owner of Carter Hall, Millwood, Clarke County, Virginia.

Christoffel, Thomas J., AICP, EXECUTIVE DIRECTOR, Lord Fairfax Planning District Commission, Front Royal, Virginia.

Cunningham, Fred., GROUNDWATER PROGRAM MANAGER, Virginia State Water Control Board, Richmond, Virginia.

Dee, Norbert, Ph.D., DIRECTOR - SOURCE ASSESSMENT AND INFORMATION MANAGEMENT STAFF, Office of Groundwater Protection, U.S. Environmental Protection Agency, Washington, DC.

Grey, Jason. MANAGER OF ENVIRONMENTAL PROGRAMS, Virginia Water Projects, Inc., Roanoke, Virginia.

Hardisty, Jack. CHAIRMAN, CLARKE COUNTY BOARD OF SUPERVISORS, Berryville, Virginia.

Hirschman, Dave. RESEARCH ASSOCIATE, Department of Urban Affairs and Planning, The Coal and Energy Research Center, VPI&SU, Blacksburg, Virginia.

Johnston, Charles, CLARKE COUNTY PLANNING ADMINISTRATOR, Berryville, VA.

Lee, Robert, E., COUNTY ADMINISTRATOR - CLARKE COUNTY (for over fifteen years). Interviews conducted at Berryville, Clarke County and Warrenton, Farquier County, Virginia.

Lewis, Tom. Past FIRST VICE PRESIDENT, Friends of Clarke County. Current editor, Civil War Journal, Berryville, Virginia.

*Lehr, Jay, Ph.D., PRESIDENT - NATIONAL WATER WELL ASSOCIATION, EDITOR - THE JOURNAL OF GROUND WATER, Columbus, Ohio.

Maizel, Margaret. former, CHAIRPERSON CLARKE COUNTY PLANNING COMMISSION. Currently, PRESIDENT, National Center for Resource Innovation.

Morris, Mary. HISTORICAL LIBRARIAN, Historical Museum, Clarke County Courthouse, Berryville, Virginia.

*Randolph, John, Ph.D., PRINCIPAL INVESTIGATOR, Managing Water Resources by Virginia Localities Project, The Coal and Energy Center, VPI&SU, Blacksburg, Virginia.

Sevebeck, Kathy. EDUCATIONAL DIRECTOR, Virginia Water Resources Research Center, VPI&SU, Blacksburg, Virginia.

Smith, Velma. currently, DIRECTOR - GROUNDWATER PROTECTION PROJECTS, Friends of the Earth. Formally: Chairman, Virginia State Water Control Board, and Director of Groundwater Protection Projects for The Environmental Policy Institute, Washington, DC.

Van Meter, Valerie, EDITOR. Clarke County Courier, Berryville, Virginia.

Wagner, Terry. RESOURCE PROJECT MANGER, State Water Control Board, Richmond, Virginia.

Webb, Rick. DIRECTOR, NATURAL RESOURCES, LOUDOUN COUNTY, Leesburg, Virginia.

Weigman, Diana, Ph.D., ASSISTANT DIRECTOR OF RESEARCH, Virginia Water Resources Center, VPI&SU, Blacksburg, Virginia.

Weiss, Juan DR., DIRECTOR of Lord Fairfax District Health Office, Virginia Health Department, Winchester, Virginia.

Wood, Jim. COUNTY CLERK, CLARKE COUNTY VIRGINIA, Berryville,
Virginia.

* Personal conversation in answer to specific research questions.

**APPENDIX E. GROUNDWATER PROTECTION
EVALUATION MATRIX OF THE LORD FAIRFAX
PLANNING DISTRICT**

GROUNDWATER PROTECTION WEIGHTED MATRIX LORD FAIRFAX PLANNING DISTRICT

243

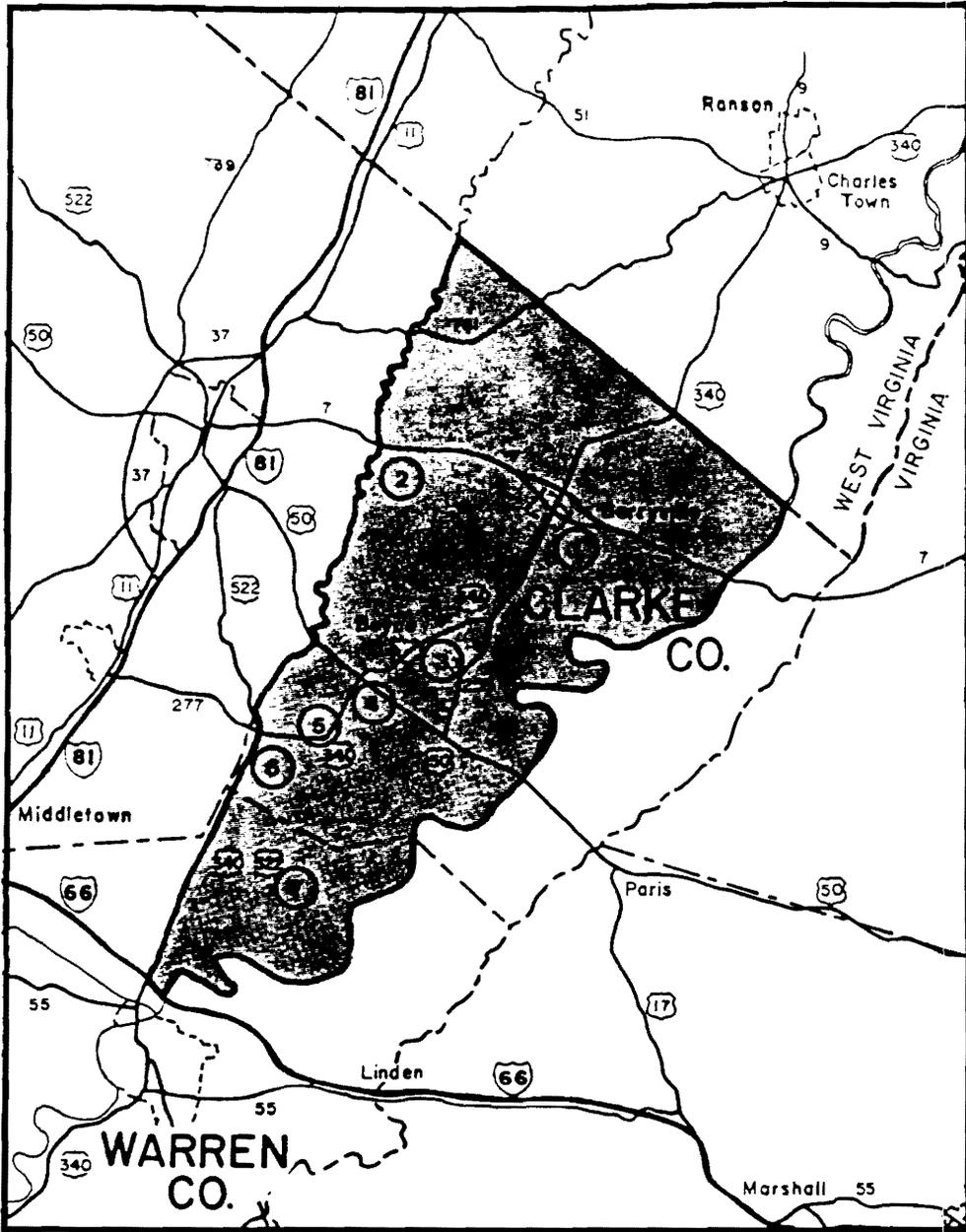
County Protective Actions	CLARKE COUNTY	FREDERICK COUNTY	SHENANDOAH COUNTY	WARREN COUNTY
Sinkhole Ordinance <small>(weight=5)</small>	X	Subdivision Ord Prohibits Building in Sinkhole (5)	0	0
Septic Ordinance <small>(weight=5)</small>	X	0	0	X
Natural Resource Overlay Zones <small>(weight=20)</small>	X	0	0	0
Groundwater Protection Plan <small>(weight=20)</small>	X	0	Shen. Co. Water Res. Assessment Addresses Groundwater Protection (10)	0
Demonstration of Probable Water Before Building Permit Issued <small>(weight=20)</small>	X	0	0	0
Comprehensive Water Resources Assessment <small>(weight=20)</small>	X U.S.G.S. Survey	0	X	0
Water Resources Plan <small>(weight=15)</small>	X	0	0	0
X In Place	100	5	30	5
0 Doesn't have	Source: Lord Fairfax Planning District Date: 3/18/92			

**APPENDIX F. HELEN INGRAM'S FLEXIBLE
FRAMEWORK FOR IMPLEMENTATION STUDIES
(1990)**

Nature of Decision Costs	Structure of Statute	Appropriate Approach	Criteria for Evaluation	Critical Variables Affecting Implementation
Low negotiation costs/ low information costs	Clear goals procedural Flexibility	Command-control; programmed	Achievement of goals	Changes in external circumstances or policy environment
High negotiation costs/ low information costs	Open-ended goals procedural flexibility	Adaptive; backward mapping	Grass-roots creativity modifying proximate policy behavior	Bureaucratic entre- preneurship; "fixers" and "double agents"
Low negotiation costs/ high information costs	Clear goals procedural specificity	Oversight; policy reformulations	Policy learning	Administrative capability
High negotiation costs/ high information costs	Open-ended goals; procedural specificity	Bargaining	Broad agreement and support; avoidance of agency capture	Clientele relationships

Helen Ingram's Flexible Framework for Analyzing Implementation, 1990

APPENDIX G. MAP OF CLARKE COUNTY



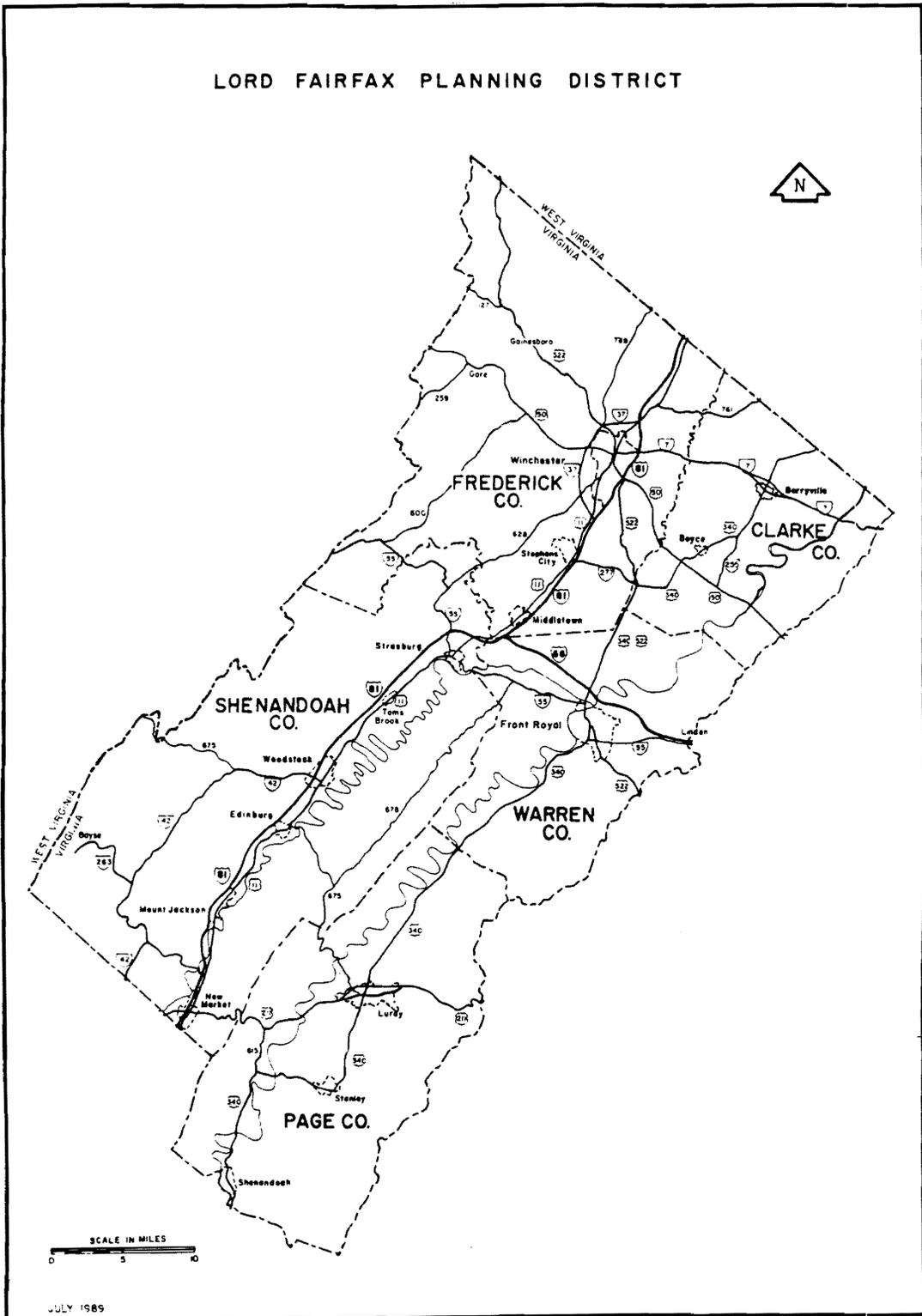
Legend

Source: Clarke County Ground Water Protection Plan (1987)

-  Study Area
-  1 Berryville Abandoned Wells
-  2 Individual Well Problems
-  3 Prospect Hill Spring- Proposed Sole Source Aquifer
-  4 Waterloo- Petrochemical Contamination
-  5 White Post- Petrochemical Contamination
-  6 State Camp 7- High Nitrate Concentration
-  7 Rockland- Individual Well Problems

**APPENDIX H. LORD FAIRFAX PLANNING
DISTRICT**

LORD FAIRFAX PLANNING DISTRICT

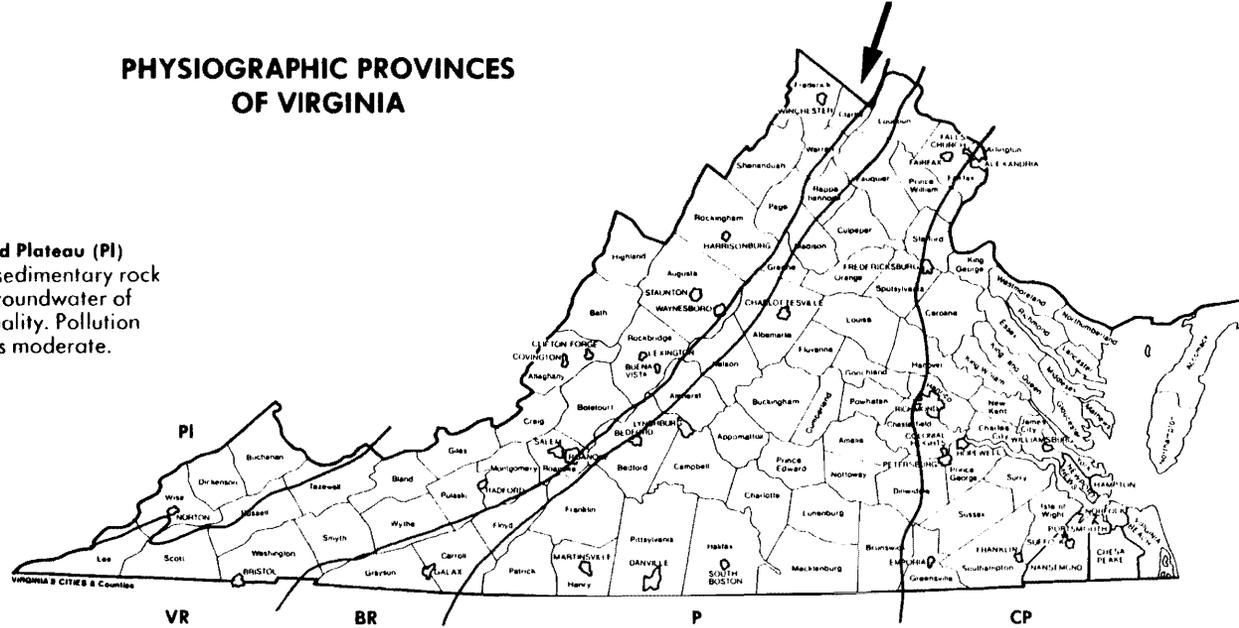


JULY 1989

**APPENDIX I. PHYSIOGRAPHIC PROVINCES OF
VIRGINIA**

PHYSIOGRAPHIC PROVINCES OF VIRGINIA

Clarke County



Cumberland Plateau (PI)
 Geology: sedimentary rock yielding groundwater of varying quality. Pollution potential is moderate.

Valley and Ridge (VR)
 Geology: sedimentary rocks including limestone, dolomite, and shale. In limestone areas, rapid movement of groundwater makes pollution potential high.

Blue Ridge (BR)
 Geology: impervious rock. Well yields are low. Water found in cracks or fissures may move rapidly leading to high pollution potential

Piedmont (P)
 Geology: diverse leading to wide range of water quality and availability. Pollution potential is low to moderate.

Coastal Plain (CP)
 Geology: unconsolidated sand, clay, marl and shell strata. Groundwater is abundant and use is high. Geology and population density make pollution potential high.

Source: Weigmann and Kroehler (1988)

PHYSIOGRAPHIC PROVINCES OF VIRGINIA

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Rodney Alan Bankson

VITA

EDUCATION:

- Ph.D. - Public Administration, Center for Public Administration and Policy, Virginia Polytechnic Institute and State University (1992), Blacksburg, VA.
- M.A. - Public Administration, James Madison University, (1983) Harrisonburg, VA.
- B.A. - Political Science, International Relations, Navy Postgraduate School, (1972), Monterey, CA.
- Graduate, Naval War College, (1978), Newport, RI.

CAREER SUMMARY

Consultant - Associate for a Washington, D.C. based firm engaged in national and international activities. Current activities include executive level strategic planning for human services delivery programs, and the use of computer assisted, hypermedia, technology for innovative problem solving.

Adjunct Professor - James Madison University, Political Science and Public Administration courses.

Planning Department Head - Ship Systems Support and Research Center, Royal Saudi Naval Forces, Jubail, Kingdom of Saudi Arabia. Directed and coordinated the activities of engineers, research analysts, scientific programers, and skilled technicians in the Resources Planning, Alteration Planning, and Research Management, Divisions of the SSSRC Planning Department.

Deputy General Manager - Maintenance Supply Support Team, Little Creek, VA. Supervised and coordinated a work force of 350 personnel engaged in all facets of planned and corrective maintenance, and full supply support.

Military Career - United States Navy, 1957 to 1982, rose through the ranks to Commander. A variety of career enhancing assignments including: Aircrewman in seaplanes, Navy Attack Pilot (over 100 combat missions into North Vietnam), Test Pilot - Chief Operational Test Director at China Lake, CA, Commanding Officer Attack Squadron 75, and Air Boss USS Vinson.