

**A GROUNDWATER
PROTECTION PROGRAM
FOR THE CITIZENS OF
NORTH CAROLINA**



North Carolina Department of Environment and Natural Resources
Division of Water Quality
Groundwater Section

September 1999

TABLE OF CONTENTS

Page Number

I.	Summary	1
II.	Purpose Statement	2
III.	North Carolina's Groundwater Resources	3
IV.	Groundwater Section History	5
V.	Groundwater Section Mission	7
VI.	Groundwater Section Organizational Structure	8
VII.	Groundwater Protection Program Description	11
	A. Pollution Management Program	11
	B. Technical Assistance	11
	C. Well Program	12
	D. Information and Administrative Services	12
	E. Resource Evaluation and Development	13
	F. Other State Programs with Groundwater Protection Roles	14
VII.	Action Plan for Groundwater Protection	15
	A. Resource Evaluation	15
	B. Incident Management	17
	C. Waste Discharged to the Land Surface or Subsurface	20
	D. Pollution Prevention	20
	E. Well Program	21
IX.	Conclusion	23

I. SUMMARY

North Carolina can be divided into two regions that have similar, geology, and groundwater aquifer characteristics. In the eastern region, called the Coastal Plain, groundwater occurs in layer-cake formations of consolidated and unconsolidated sedimentary materials composed of sand, gravel, shells, clay or limestone. In the western region, known as the Piedmont and Mountains,



groundwater occurs in the pores of soil and weathered rock and in the fractures of the underlying consolidated rock. Groundwater supply wells in the Coastal Plain are high yielding (up to a million gallons per day or more) in comparison to wells in the Piedmont and Mountains (typically less than a seventy thousand gallons per day). While natural groundwater quality in a few areas across the state has high iron or is hard or saline; the overall groundwater quality is good. More than half of the citizens in North Carolina use groundwater as a source of drinking water. The major threat to the good quality of natural groundwater comes from pollution that moves into the subsurface and is not removed. A strong groundwater protection program is necessary to ensure a future with good quality groundwater for the citizens of North Carolina.

The groundwater protection program in North Carolina began in 1937 with a focus on groundwater use issues in the Coastal Plain. These groundwater issues dominated the program until the 1970s when groundwater quality issues became a priority. In the 1980s, groundwater in the state was classified for use, and protection standards were established. From 1988 to 1998, the federally mandated Underground Storage Tank program consumed a large percentage of the Groundwater Section's resources. When this program was transferred to the Division of Waste Management in 1998 with attendant reduction in staff, the Groundwater Section set about to redefine groundwater protection priorities for North Carolina.

The mission of the reorganized groundwater program is to promote stewardship of North Carolina's groundwater resources for the protection of human health and the environment by preventing pollution, managing and restoring degraded groundwater, and protecting the resource. To accomplish this mission, the Groundwater Section will maintain as its first priority, the protection of human health and the environment as they may be impacted by groundwater usage.

In the arena of human health and groundwater pollution, the Section has historically placed emphasis on responding to reports of pollution. The major emphasis of the program in the future will be groundwater pollution prevention. Regulatory actions will be used whenever they are appropriate, but education and outreach will be the focus of additional staff effort. Pollution response activities will concentrate first on those areas where groundwater is or will be used as a drinking water source and where cleanup is technically achievable.

The Groundwater Section has been assigned a number of important groundwater protection responsibilities and may receive more in the future. Current responsibilities include: permits for waste discharged to groundwater, compliance monitoring at permitted sites, pollution incident management, enforcing well construction standards, underground injection control, field exploration and investigations (drilling unit), resource evaluation, and Environmental Management Commission regulatory support (classifications and standards, groundwater cleanups).

The Groundwater Section has established ambitious program goals at a time when reorganization resulted in a reduced staff and an increased workload. The new mission will call

on the energy and talents of every member of the Groundwater Section, but in some instances, existing staff will have difficulty meeting all of the demands. The groundwater protection problems facing the State in the years ahead are formidable. The groundwater resources, which millions of North Carolinians depend upon for drinking water supplies, are being polluted or are threatened with pollution by planned and unplanned surface activities conducted by business, agriculture, industry, government, and individuals.

II. PURPOSE STATEMENT

This document was developed by the Groundwater Section of the Division of Water Quality to provide an overview of the Groundwater Section from the past to the present and describe a vision for the future. It is intended to serve as a long-term planning and information document for Groundwater Section staff, management, and interested members of the public. This document will be updated and revised periodically.

III. NORTH CAROLINA'S GROUNDWATER RESOURCES

More than one-half of the citizens of North Carolina rely on groundwater as a source of drinking water. Virtually all private residential water supplies depend upon groundwater as do over one million of the State's citizens that use community water systems. In many rural counties, more than 90 percent of the citizens rely on groundwater as their sole source of drinking water.

North Carolina's groundwater, although generally abundant, is not inexhaustible and is not evenly distributed or of uniform quality. The groundwater resource, regardless of depth, is vulnerable to contamination introduced at the land surface. Shallow groundwater is the most vulnerable to contamination. Once contaminated, groundwater quality is extremely difficult to restore and the cleanup process is usually expensive and slow.

The occurrence and movement of groundwater is governed largely by climate, the type of rocks that make up the geology of the subsurface and by the topography. There are two principal types of groundwater reservoir rocks (aquifers) in North Carolina. The Piedmont and Mountain regions are underlain principally by consolidated rocks such as granite, gneiss, schist and slate. In these regions, groundwater occurs in the fractures of the consolidated rocks, and in pore spaces of the residual soil and weathered rock (saprolite). Groundwater also occurs in the pore spaces of the alluvium found in the stream valleys. In the Coastal Plain, aquifers are composed of stratified formations of consolidated and unconsolidated sand, gravel, shells, clay, limestone and combinations of these. Groundwater is contained in the pore spaces of these sediments.



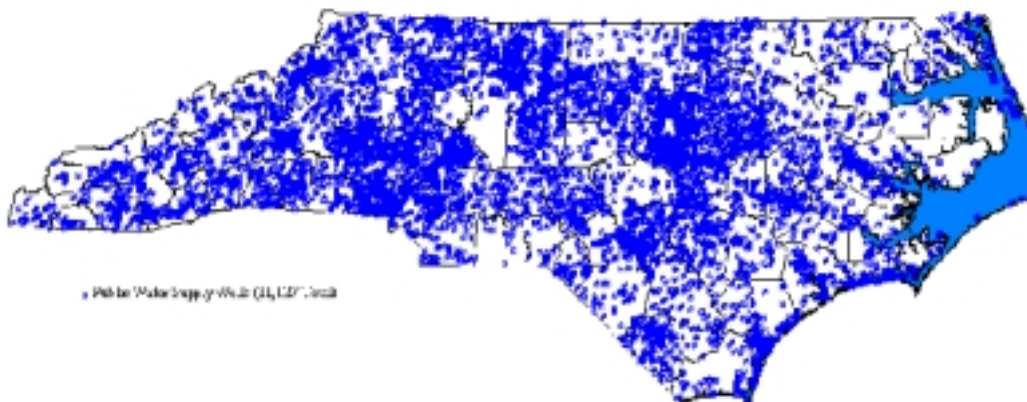
The rock formations of the State may be subdivided into eight major hydrogeologic systems based on differences in geology and groundwater characteristics. The principal hydrogeologic systems in the Mountain and Piedmont regions are the Blue Ridge-Inner Piedmont Belt, Charlotte Belt, Carolina Slate Belt and Triassic Basins. In the Coastal Plain region, the principal aquifer systems are the Cretaceous, Tertiary limestone, Tertiary sand, and the surficial aquifer (which includes the Sandhills). Natural groundwater discharge ranges from about 60,000 gallons per day per square mile in some areas of the Triassic Basins to as much as one million gallons per day per square mile from some shallow sand aquifers of the Coastal Plain. Individual water supply wells have yields ranging from less than 1,000 gallons per day for small domestic wells to more than a million gallons per day for high capacity wells located in the most productive aquifers.

The natural quality of groundwater in North Carolina is generally very good. With the exception of a few coastal areas, potable groundwater occurs throughout the state. The natural mineral content of the water in the Mountain region and much of the Piedmont is very low, having generally less than 100 mg/l (milligrams per liter) total dissolved solids. In the eastern Piedmont and western part of the Coastal Plain region, the total dissolved solids content ranges from about 100 to 300 mg/l. In the eastern-most part of the Coastal Plain, the mineral content of the water increases with depth toward the coast because of its brackish content.

The groundwater protection standards of North Carolina have been established at a level adequate to allow its use for drinking water without the necessity for treatment. Most residences not connected to public water supplies rely on untreated groundwater for their drinking water source. In addition, most public water supplies in North Carolina that use groundwater do not treat the water, except for disinfection prior to use. More than 50 percent of the citizens of North Carolina use groundwater from public or private supply wells. State standards for groundwater quality protection must be used by every agency in North Carolina that has responsibilities for managing facilities and substances that contaminate groundwater.

The following figure demonstrates the distribution of public water supply wells throughout North Carolina. A map of private wells is not available because the location of private supply wells is not maintained in a comprehensive database; therefore a map of these wells could not be prepared.

Public Water Supply Ground-Water Intakes in North Carolina



IV. GROUNDWATER SECTION HISTORY

Program Evolution: 1941-1969

The beginnings of the present Groundwater Section can be traced to a 1937 state planning report acknowledging the lack of existing groundwater data and recommending a series of comprehensive groundwater investigations. In 1941, a cooperative program was initiated between the state and the United States Geological Survey (USGS) to monitor groundwater levels at selected wells and conduct a series of reconnaissance investigations. Hurricanes and drought in the 1950s, coupled with a driving force for economic development, led to the formation of a N.C. Department of Water Resources in 1959 and a three-person Groundwater Division within it.

The directive to the newly formed Groundwater Division was to organize and execute a program to appraise the groundwater resources of the state, with regard to both quantity and quality, and to promote the most beneficial development of these resources. During the 1960s the Groundwater Division expanded, opening six regional offices and initiating a program to construct multi-well research stations throughout the Coastal Plain. Ultimately, more than 150 research stations were established, providing stratigraphic, geophysical, quantity, and quality data about the major Coastal Plain aquifer systems. Also during this period, the last of the reconnaissance investigations (multi-county groundwater resource investigation reports) of the state were completed. The research station program ultimately provided the raw data upon which to develop a hydrogeologic framework for the Coastal Plain.

The Well Construction Act was established in 1967 and formed a general set of well construction standards and permit requirements for certain types of wells. Also in 1967 the Water Use Act was enacted which authorized the state to declare and delineate capacity use areas where aggregate ground or surface water use required coordination, or would otherwise threaten groundwater renewal or replenishment. In such designated areas, regulations for water management could be established and permits required for any withdrawals in excess of 100,000 gallons per day.

The catalyst for the legislation that led to the creation of the Water Use Act came from concerns over phosphate mining in the central Coastal Plain and the associated heavy groundwater withdrawals from the Castle Hayne aquifer resulting from pit dewatering operations. A Board of Consultants, hired to investigate the impact of dewatering operations on groundwater resources, aided in passage of the Water Use Act. The Board was comprised of nationally known groundwater experts: C. E. Jacob, Roger De Wiest and Nelson Sayre, former chief of the USGS Ground-Water Branch.

Shifting Responsibilities and Needs: 1973-1982

By 1973, the Groundwater Division had been moved to a Section within a much larger Natural and Economic Resources Department and had grown to a staff of 42 people, primarily concerned with resource monitoring and evaluation, and with enforcing well construction standards. During the 1970s many of the original goals established for the groundwater program in the early years came to fruition. However, also during this period, the environmental focus was shifting from a predominant concern about water resources development and the problems

associated with drought, to a national concern over air and water pollution. The driving force for environmental programs shifted during this period from the state to the federal level with emphasis on the implementation of federal clean air and surface water legislation.

In the late 1970s, as groundwater quality concerns began to emerge in North Carolina, increased emphasis was placed on water quality monitoring, inventory of potential groundwater pollution sites, and initial development of groundwater classifications and standards. The Groundwater Program during this period was exclusively state funded, and with primary state environmental program emphasis being placed on federally funded programs, groundwater resources lacked the visibility to sustain program growth. In 1978 the state's air, water and groundwater programs were reorganized along functional lines so that permitting, compliance, monitoring and enforcement were grouped together by job function rather than by environmental media. For example, an environmental technician in a regional office would respond to any complaint handled within the Division whether the complaint dealt with air quality concerns, surface water concerns, or groundwater concerns. With the 1978 reorganization the Groundwater Section ceased to exist.

This reorganization resulted in the submergence of the mostly state funded air and groundwater programs to a heavily federally funded surface water quality program. This organizational structure lasted three years, and in 1981 state environmental programs were reestablished and the Groundwater Section was restored.

Regulatory Period: 1983 - 1987

In 1983 the State adopted groundwater quality classifications and standards, and by 1987 the reorganized groundwater program was primarily focused on regulatory activities patterned after the state's surface water program. The federal Underground Injection Control (UIC) program was adopted as a program in 1981. The Governor designated the Groundwater Section the status as lead agency for groundwater issues in 1984. Groundwater Section staffing was significantly increased in 1985 (the first such increase since 1973) primarily to investigate pollution sites.

Underground Storage Tank Period: 1988 - 1998

In the late 1980's, resource evaluation activities focused on administering a greatly reduced ambient monitoring program, developing wellhead protection and pesticide monitoring programs, and researching shallow groundwater hydrogeology

Also beginning in the late 1980's the Groundwater Section was delegated the federal program for regulating underground storage tanks (UST's). The UST program became the major focus of the Groundwater Section. Primary activities carried out by the UST program included regulating cleanups from leaking UST's, administering leaking tank cleanup funds (both state and federal), inspecting UST facilities, issuing UST operating permits, and permitting the disposal and treatment of petroleum contaminated soil.

Because the UST program made many landowners liable for the costs associated with cleanup from petroleum underground storage tank contamination, an offshoot industry of environmental audits was created. Lending institutions became reluctant to lend money for the purchase of property with groundwater and soil contamination, and required audits on practically all commercial property purchases. The result was a marked increase in the number of pollution

sites discovered and reported in North Carolina.

By the end of 1995, the Section had over 150 staff. Beginning in 1997, the Department of Environment, Health and Natural Resources underwent a major reorganization and was renamed the Department of Environment and Natural Resources (DENR). The Division of Environmental Management was split into the Division of Water Quality (DWQ) and the Division of Air Quality. The DWQ Groundwater Section Capacity Use Program was transferred in 1997 to the Division of Water Resources. In 1998, the Groundwater Section's Wellhead Protection Program was transferred to the Division of Environmental Health's Public Water Supply Program. On July 1, 1998 the entire UST program was transferred to the Division of Waste Management. These changes left the Groundwater Section with 60 staff and a mandate to re-establish a groundwater protection program for North Carolina. The programs and activities of this newly reorganized Groundwater Section are detailed in the following segment.

V. GROUNDWATER SECTION MISSION

The mission of the Groundwater Section is to:

Promote stewardship of North Carolina's groundwater resources for the protection of human health and the environment by preventing pollution, managing and restoring degraded groundwater, and protecting the resource.

The Groundwater Section's program objectives are premised on the following concepts:

1. That there will be a sound, clearly articulated State policy toward groundwater protection supported by adequate and specific legislation;
2. That the major emphasis of the State groundwater protection program will be to prevent groundwater pollution;
3. That there will be a clearly defined operational relationship among agencies responsible for actions that might prevent groundwater pollution;
4. That the State will seek to identify, assess, and manage polluted groundwaters for the protection of public health and the environment;
5. That the State will determine the conditions under which its groundwater resources occur, assess the quality and potential for use of those resources, and make that information available to groundwater users; and
6. That there will be maintained a comprehensive database for the assessment and management of groundwater contamination sites.

Within this broad operational framework, the Groundwater Section will strive to maintain and enhance groundwater quality for the beneficial use by the citizens of North Carolina. Where the groundwater is degraded, the state strategy is to manage, and where possible, restore the

quality of degraded groundwaters to the highest practical level commensurate with the need to protect human health and the environment.

VI. GROUNDWATER SECTION ORGANIZATIONAL STRUCTURE

The Groundwater Section consists of a central office in Raleigh, seven regional field offices and an investigative drilling unit (see the map on the next page). As shown on the functional organizational chart on page 10, there are over 75 Groundwater Section employees working across the State to protect groundwater.

North Carolina - Department of Environment & Natural Resources

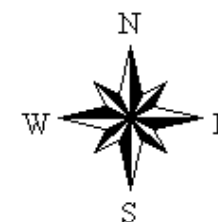
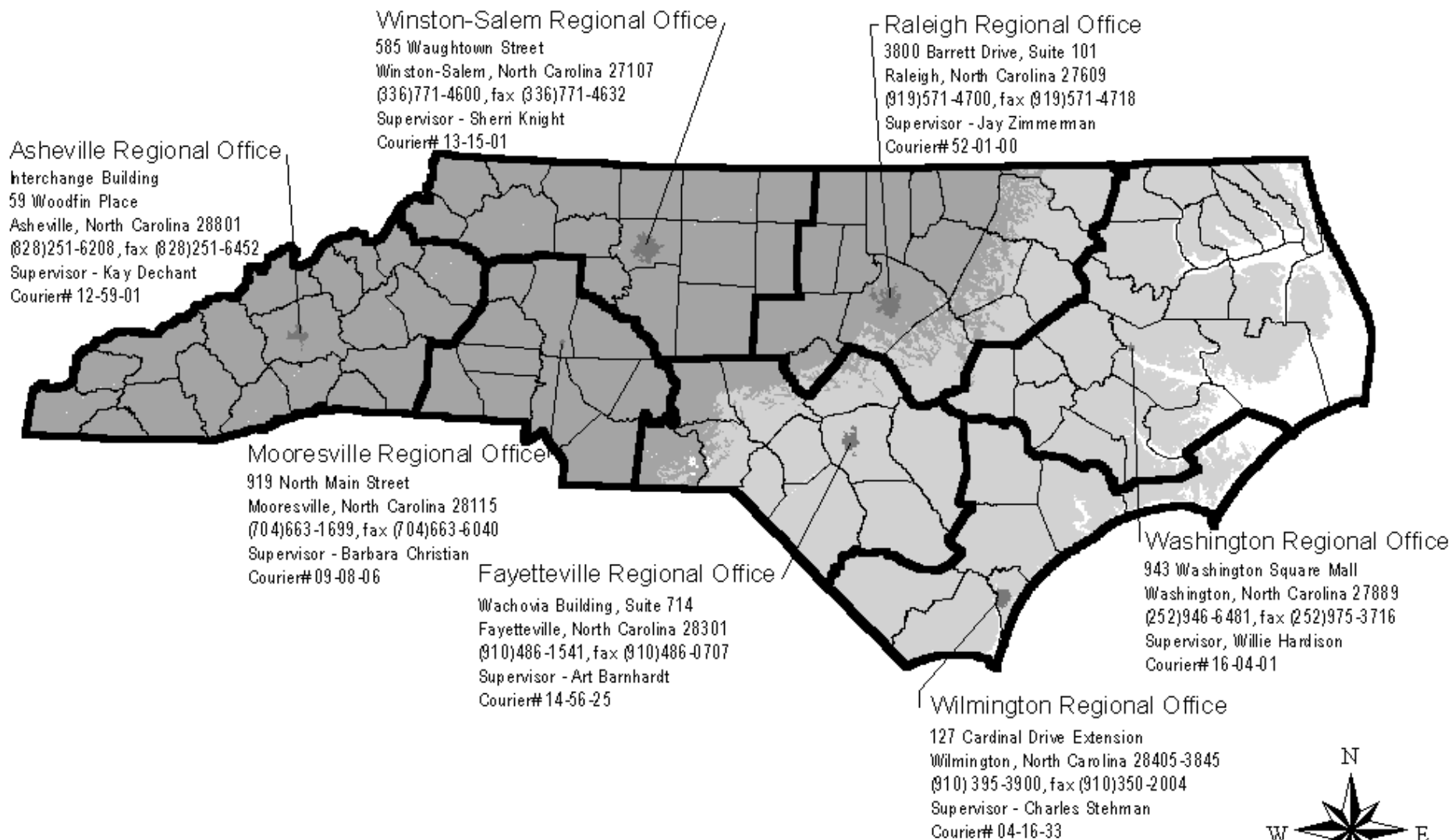
Division of Water Quality

Groundwater Section

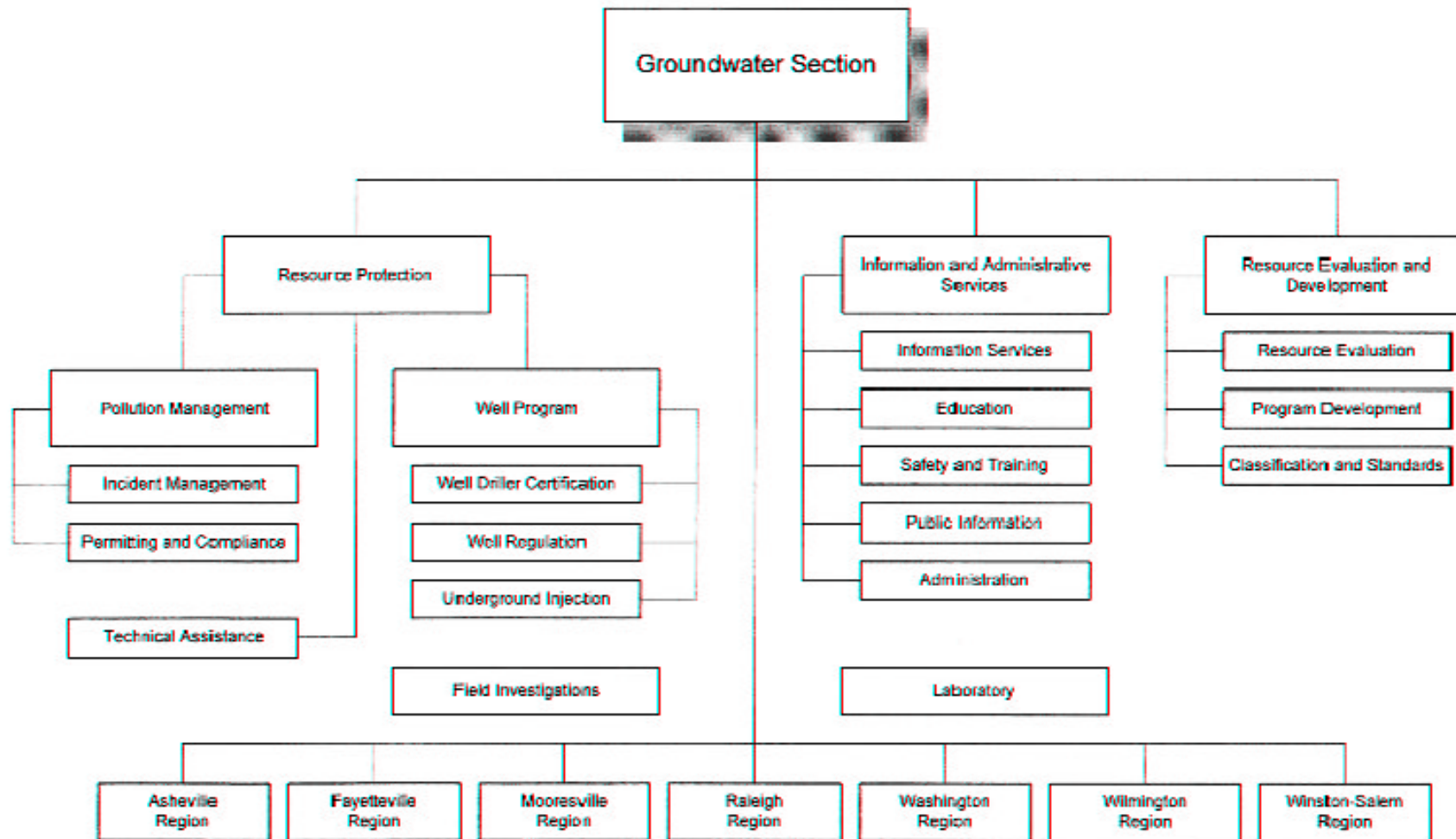
Located at:
2728 Capital Boulevard
Raleigh, NC 27604

(919)733-3221, fax (919)715-0588

Mail address:
1636 Mail Service Center
Raleigh, NC 27699-1636
Courier: 52-01-03



Groundwater Section Functional Organization



VII. GROUNDWATER PROTECTION PROGRAM DESCRIPTION

The Groundwater Section administers the following programs, which are designed to protect the groundwater quality of the State to the benefit of its citizens:

A. Pollution Management Program

Incident Management

This program area responds to groundwater pollution incidents that are not regulated by other agencies and involve pollutants such as those from commercial activities, industrial processes, highway accidents, agricultural activities, and above ground storage tanks. The Groundwater Section maintains an incident management database that contains information on all groundwater contamination incidents reported to the Groundwater Section.

Permitting and Compliance

The Water Quality Section of the Division of Water Quality administers a permit program to prevent pollution from wastes that are discharged to the waters of the state. The Groundwater Section is responsible for reviewing these permits and recommending conditions and limitations for many activities that potentially threaten groundwater. Many of these activities are permitted by other state agencies. Such projects include wastewater spray irrigation systems, groundwater remediation systems, land application of sludge, large septic systems, surface waste impoundments, and other systems that potentially impact groundwater.

Compliance monitoring includes oversight of permitted facilities that are required to monitor groundwater. If a facility is found to be causing pollution of groundwater, the facility will be required to evaluate the extent of the impact and modify their activities to stop the impact. If the impact is significant, the facility may be required to restore the area affected.

In addition to the permits for discharge to the subsurface, the Groundwater Section reviews various other plans and projects submitted to the State for compliance with groundwater standards and to suggest appropriate pollution management practices.

Field Investigations

The Groundwater Section supports a 10-person investigative drilling unit. Current primary duties include well construction for groundwater resource evaluations and monitoring, and investigations at existing and suspected pollution sites.

B. Technical Assistance

The Groundwater Section is committed to protecting the groundwater resource of the State of North Carolina. The Section will provide assistance to other state and federal agencies, municipalities, consultants, and the public in solving groundwater quality problems by conducting site contamination and hydrogeologic investigations and assisting the public through the regulatory process.

C. Well Program

Well Protection

The Groundwater Section administers regulations that specify standards by which water supply wells and monitoring wells are constructed, maintained and abandoned. Permits are required for certain types of monitoring wells. The regional field offices respond to well construction related complaints, provide technical assistance to local governments and citizens and perform well inspections to investigate cases of improper well construction, and ensure that appropriate action be taken to correct problems. Drilling contractors are required to submit a record to the appropriate regional office on any well they construct or abandon. The Central Office maintains copies of these records.

Well Driller Certification

The Section is currently assisting the newly formed Well Contractor Certification Commission to develop rules for certification, training and continuing education requirements for well contractors. Final rules developed by the Certification Commission require that after December 31, 1999, well contractors must be certified to operate in North Carolina.

Underground Injection Control

The Underground Injection Control (UIC) program, established under the Federal Safe Drinking Water Act, controls the underground injection of fluids or solid substances through wells. The Groundwater Section issues permits for Class V injection wells used in such operations as heat pumps and for closed loop groundwater remediation systems.

Except for the above listed wells, the State of North Carolina has determined that the underground injection of wastes through wells presents a hazard to the public welfare and therefore this activity is prohibited by statute.

D. Information and Administrative Services Program

Information Services

The Groundwater Section maintains databases that contain information about pollution incidents, waste disposal permits and groundwater quality. The computerized incident management database contains information about many groundwater contamination incidents including those of other state agencies. Much of this information can be accessed on the Groundwater Section's web page at <http://gw.ehnr.state.nc.us/>. Section staff perform computer modeling of waste disposal operations and generate GIS maps for internal use.

Public Information and Education

The Groundwater Section encourages public participation and maintains mailing lists of those individuals, agencies and organizations which ask to receive notification about rulemaking. It also maintains a webpage that has general program information as well as direct public access to some Groundwater Section databases and publications. The Section prepares an Annual Program Review, which serves as another public education tool. In addition, the Division's Public Affairs Office prepares information regarding rulemaking and other groundwater protection activities.

Safety and Training

Safety and training requirements from the Occupational Safety and Health Administration (OSHA) are met through Division level support staff. Internal and external training is provided on an as needed basis by contract or internal staff assignments.

E. Resource Evaluation and Development

Resource Evaluation

The Groundwater Section participates with the Water Quality Section in developing basin-wide water quality management plans through Section 319 grants funded under the federal Clean Water Act. Current major activities include the development of groundwater recharge/discharge maps and characterization of the impact of animal waste lagoons on groundwater quality.

The Groundwater Section conducts groundwater studies about special issues of concern to the State and its citizens. Examples of these are the DENR/N.C. Department of Agriculture Interagency Pesticide Study; the Buxton Woods Groundwater Investigation; River Basin Groundwater Recharge-Discharge studies; Carbon Isotope Studies of Groundwater Discharge Into Rivers, Estuaries, and the Coastal Ocean; and the Study of the Impact of Animal Waste Lagoons on Groundwater Quality.

Pollution Prevention

The Section is developing a plan for working with the Division of Pollution Prevention to identify common industrial and commercial site circumstances where groundwater pollution often occurs and to establish a program of technical assistance to develop pollution prevention plans for these facilities.

Classification and Standards

North Carolina's rules for groundwater protection (15A NCAC 2L) establish classifications for groundwater resources and establish groundwater quality standards. These rules protect groundwater for use as drinking water. The Department of Environment and Natural Resources appointed a workgroup in November 1995 to develop a risk-based approach for contaminated sites, and to make recommendations as to how these sites should be assessed and cleaned up. The Groundwater Section is participating in this continuing effort.

North Carolina recently implemented rules for a risk based approach for the assessment and cleanup of groundwater contamination resulting from releases from petroleum underground storage tanks. The intent of these risk based rules is to provide the State with flexibility in determining the need for and extent of any cleanup required based on the risk that the contamination may pose to human health and the environment.

F. Other State Programs with Groundwater Protection Roles and Partnerships



Department of Environment and Natural Resources:

Division of Water Quality - Water Quality Section

Permits facilities that discharge wastes to surface waters or holding ponds.

Division of Land Resources - Land Quality Section

Oversees mining activities including mine drainage and tailings pond leachate.

Division of Coastal Management - Coastal Area Management Act

Issues permits for development in coastal areas of environmental concern.

Division of Waste Management

Administers programs that manage solid and hazardous wastes and underground storage tanks.

Division of Environmental Health- Onsite Wastewater Section

Permits large ground absorption septic systems.

Provides oversight for county onsite wastewater programs.

Division of Environmental Health -Public Water Supply Section

Regulates public water supplies and public water supply wells.

Administers the Wellhead Protection Program and the Source Water Protection Program.

Division of Water Resources

Responsible for the Capacity Use Program.

Collects data on the use of groundwater statewide.

Provides technical assistance to local governments that use or are considering groundwater as a source of supply for public-water systems.

Division of Radiation Protection

Monitors water supplies for the presence of certain radioactive isotopes.

Division of Soil and Water Conservation

Administers a statewide program for conserving soil and water resources.

Provides technical and educational assistance to the agricultural community and the public.

North Carolina Department of Agriculture:

Food and Drug Protection Division - Pesticide Section

Pesticide registration authority, applicator certification, and regulation of use, sales, storage and disposal.

Lead agency in the development of Pesticide State Management Plans.

VIII. ACTION PLAN FOR GROUNDWATER PROTECTION

The Groundwater Section has defined five major priorities in groundwater protection for the future. These priorities are as follows:

A. Resource Evaluation

Objectives:

- 1) Identify aquifers across the state that contain groundwater of suitable quality for use as drinking water.
- 2) Identify recharge areas where groundwater contaminated from the surface could flow into deeper, high quality drinking water aquifers.
- 3) Identify recharge areas where groundwater contaminated from the surface could flow through the shallow subsurface to nearby streams and contribute to poor surface water quality.
- 4) Identify aquifer and recharge areas that are vulnerable to contamination and develop plans for protecting these resources.

The State cannot provide appropriate protection for groundwater unless aquifers are accurately defined, their characteristics determined, and the quality and availability of the resource is known. Knowledge of the shallow groundwater system where contaminants are leaked and spilled, and an understanding of the relationship between the shallow groundwater that recharges the drinking water aquifers and discharges to the state's streams is necessary to establish appropriate levels of protection for groundwater and surface water resources. To provide appropriate levels of protection for present and future use of groundwater, a program needs to be established to define the aquifers that need quality protection, to determine their vulnerability, and recommend methods for protection of high quality, existing groundwater resources.

The Groundwater Section established more than 60 research stations, with over 300 wells in the Coastal Plain in the 1960's and 70's to provide aquifer characterization information. The Groundwater Section, in cooperation with the U. S. Geological Survey originally used the collected data to describe the quality and quantity of groundwater in the confined coastal aquifer systems used by many communities as sources of drinking water. Since the 1970's, these research wells have been used primarily by the USGS as a part of the State-USGS Cooperative Program, to monitor trends in the availability of groundwater that is used for drinking water.

At this time the existing groundwater research station well network does not extend into the aquifers of the Piedmont and Mountains of North Carolina. With recent funding approved by the General Assembly for staff and supplies, the Section is initiating an aggressive program to characterize Piedmont and Mountains area hydrogeology in cooperation with the U.S. Geological Survey. The USGS has indicated that federal staff and money will be available as cost share if the state will provide 50 percent of the funding as additions to the State-USGS cooperative program.

Because of program priorities, state agencies have only developed limited data about the groundwater system in the shallow aquifers in either the Coastal Plains, Piedmont or Mountains.

The Groundwater Section believes that now is the time to begin the task of characterizing the shallow groundwater system that is most vulnerable to contamination, before this critical part of the resource can become irrevocably contaminated. Some of this work has already begun through the Section's efforts in the Basinwide Water Quality Management program. However, a critical part still needed is to develop a better understanding of the relationship between land use and changes in groundwater quality characteristics. Also, better knowledge is needed about the movement of contaminated groundwater into the deeper drinking water aquifers and impact of groundwater discharge on the quality of surface waters. The proposed Piedmont and Mountain groundwater research stations are the first step in addressing these needs.

B. Incident Management

Objectives:

- 1) Focus Section oversight efforts on assessment and cleanup in areas where groundwater is or will be used for drinking water.
- 2) Consolidate DENR lists and databases of pollution sites into one master list and make it readily available to all users and the public.
- 3) Geo-locate pollution sites statewide and make this information available in a graphic (map) format.

North Carolina has more than 14,000 documented soil and groundwater pollution sites. The map above indicates the incidents with known locations. The numbers show that approximately 70 percent of the groundwater contamination incidents result from underground storage tank leaks. It is no surprise that so many underground storage tank releases were discovered because quite a large amount of staff resources have been directed toward compliance and enforcement. However, the vast majority of the known contaminated supply wells have been contaminated by sources other than from underground storage tanks.

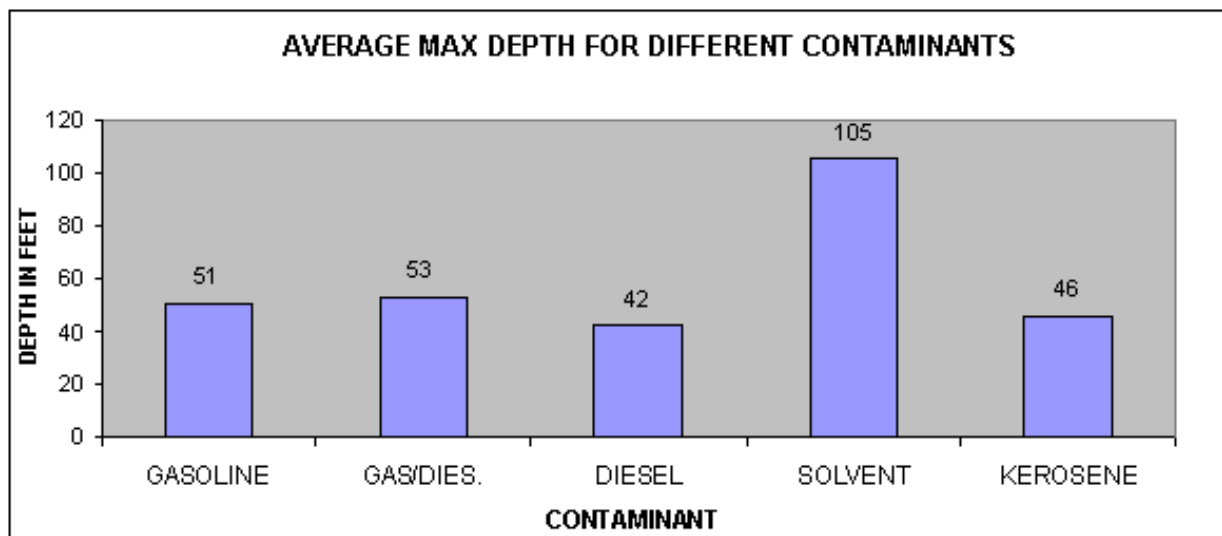
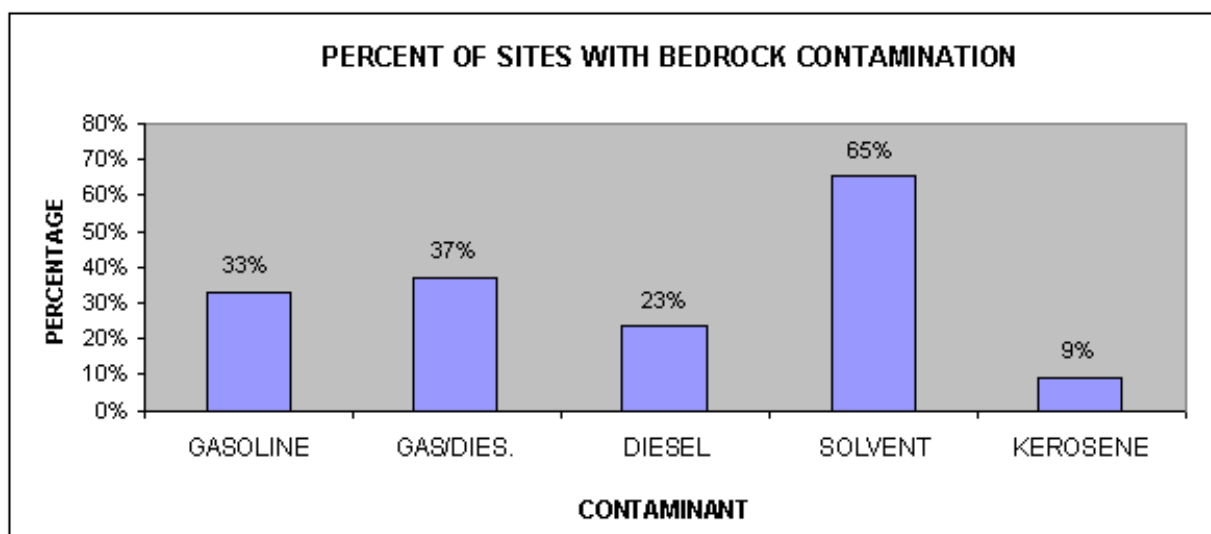
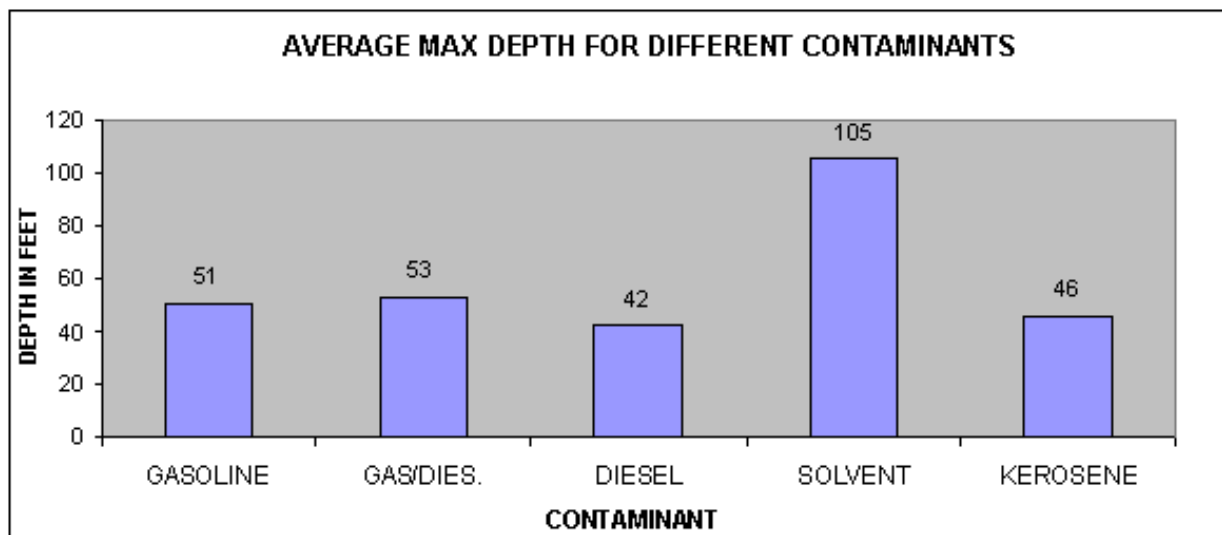
A Section study completed in 1998 shows that when water supply wells become contaminated, about half of the well owners have no alternate source for a safe water supply. These well owners are forced to use bottled water, have costly filter systems installed, or go to a neighbor or relative's house for baths and showers. The Section has identified a need to establish a trust fund to pay for, or offset the cost of developing safe water supplies.

The Groundwater Section responds to a wide variety of situations resulting from a diversity of contamination sources. In addition, the responsible parties range from individual homeowners to small businesses to international corporations. A sampling from the pollution database highlights the variety:

Facility	County	Source	Contaminants	Impact
Publishing Company	Wake	Dumping; possibly intentional	1,1-dichloroethene	2 water supply wells downgradient; SBI conducting investigation
Farm Supply Company	Franklin	Above ground storage tanks	Petroleum products	2 water supply wells contaminated; 12 more in area; bedrock contaminated
Pickle Processing	Duplin	Brine lagoons	Vinegar and salts	Threatening public water supply well for Town of Faison; all on-site wells contaminated
Nuclear Fuel Manufacturing	New Hanover	Nuclear fuel manufacturing	Uranium, calcium fluoride, solvents	Groundwater contamination has moved 1,000 feet from the source and has impacted a major aquifer.
Polyester Manufacturing	New Hanover	Wastewater spray field	Acetone, cobalt, xylene, p-dioxane	All on-site wells and some adjacent off-site wells at nearby industries contaminated
Textile Facility	Craven	Leaks, spills or possible dumping	Solvents	2 private water supply wells impacted
Gas Station - injection well	Currituck	Dumping	Petroleum Products	1 public water supply system impacted
Intensive Livestock Operation	Robeson	Wastewater spray irrigation field	Nitrates	8 private water supply wells impacted
Asphalt Plant	Moore	Dumping of testing materials	Solvents	1 public water supply well and 1 private water supply well impacted
A Recent Subdivision Built on Vacant Land	Guilford	Spill or possible dumping	Ethylene Dibromide (EDB)	2 public water supply wells and 7 residential water supply wells impacted

* 9/99 - Information obtained from Groundwater Section Regional Offices

Many of the sites under the Groundwater Section's jurisdiction include non-petroleum contaminant plumes which are larger and sink deep into the subsurface, thus requiring intensive drilling and sampling programs for assessment. These are the most perplexing and challenging sites for groundwater professionals to assess and clean up. As a result, the level of expertise and the overall costs for the assessment and cleanup of these types of sites far exceeds what is typical for an average petroleum underground storage tank release. The graphs on the following page are taken from a 1998 summer internship project and are based on the recorded pollution sites (including underground tanks) from one of the Section's Mooresville Regional Office.



As more contaminated soil and groundwater is left behind while social growth continues to increase, the groundwater dependent population, it has become imperative to know the location of the contamination sites where groundwater has been or could become contaminated. The first step in the process is to consolidate the pollution databases from the different agencies handling soil and groundwater cleanups in the state. The database must be made available to interested parties, and at some point, should be made available graphically through GIS maps accessible via the Internet.

Prior to the July 1, 1998 DENR reorganization, the Groundwater Section relied to some extent on the expertise of underground storage tank staff to help regulate non-underground storage tank incident sites. With that staff being transferred to the Division of Waste Management, the Section finds it difficult to manage the large number of contamination sites for which it has responsibility. In order to meet the needs of the incident management program area, the Section needs additional staff in the regional offices to respond to the demands for protection of public health and the environment.

C. Waste Discharged to the Land Surface or Subsurface

Objectives:

- 1) Reduce violations of groundwater standards at permitted facilities that discharge wastes to the land's surface and subsurface.
- 2) Index and geo-locate surface and subsurface waste discharge facilities and track compliance at these facilities.
- 3) Develop and implement effective water and nutrient reuse programs as part of the permitting process.

Given the impact of population and industrial growth along with expanding livestock feeding operations in North Carolina, the Groundwater Section must evaluate the impact of increased wastes from this growth. Facilities disposing wastes by methods which may degrade groundwater must be evaluated and ranked for potential impact and long term non-compliance.

Experience clearly demonstrates that waste disposal facilities can develop non-compliant conditions resulting from over application to the surface, transfer equipment failure, or storage lagoon leakage. North Carolina requires operations with individual permits that have established review/regulatory boundaries to monitor exceedances of groundwater standards. In the future, it may be prudent for the state to establish monitoring at other generally permitted facilities.

D. Pollution Prevention

Objectives:

- 1) Identify pollution prevention practices/measures to mitigate threats.
- 2) Communicate pollution prevention practices to targeted municipal, industrial, commercial, and agricultural sectors.

The Groundwater Section is working with the Division of Pollution Prevention to identify common industrial and commercial site circumstances where groundwater pollution occurs and establish a program of technical assistance to develop pollution prevention plans for these facilities.

The Section proposes to develop prototype groundwater pollution prevention programs for four high risk industrial sectors --- metal plating, coal fired utilities, tank farms and chemical manufacturers--- and three commercial sectors fertilizer distributors, pesticide distributors, and truck wash facilities--- where contamination incidents and groundwater pollution are known to often occur. The prototype effort would review existing pollution prevention approaches and identify opportunities to consider risks of groundwater contamination from commercial and industrial processes, materials storage and materials management activities. The effort would identify industrial and commercial facilities willing to participate in the development of groundwater pollution prevention plans and perform site visits at selected industrial sites and commercial sites, identify facility needs, and develop site specific groundwater pollution prevention plans for each different facility type.

After the program development year, the Section intends to continue to develop pollution prevention prototypes for other high risk industrial and commercial sectors and establish a schedule to promote groundwater pollution prevention for at 300 industrial/commercial facilities per year.

E. Well Program

Objectives:

- 1) Assure proper well location, construction, maintenance and abandonment;
- 2) Increase the number of counties with local well inspection ordinances;
- 3) Implement a certification program for well contractors;
- 4) Develop a plan for identifying and locating existing wells; and
- 5) Develop a program for abandonment of out of service wells.

The ultimate goal of the Well Program is to protect the citizens who use groundwater as a drinking water supply and to eliminate channels for pollution to reach the subsurface. The Groundwater Section proposes to alter the focus of the existing regulatory compliance based well program (permitting, inspections and enforcement) towards one that emphasizes groundwater pollution prevention, consumer protection and consumer services issues.

The refocused well program will include: (1) partnering with county health departments to keep them informed of the assistance that state staff can provide in identifying and resolving well problems that have adverse health implications; (2) cooperative well inspection and training programs for state and local health department staff, and evaluating various regulatory issues that impact well construction or well abandonment activities; (3) presentations to county officials about the advantages of adopting a ordinance and assistance in implementing water well protection programs ; (4) technical assistance to well contractors, upon request, for state staff to conduct complimentary (i.e. non-enforcement related) well inspections at any sites the contractor chooses; (5) concurrently with technical assistance outlined in (4) above, a program of random regulatory compliance inspections, including a select number of wells constructed by every well contractor, that would help ensure that those well contractors who construct safe and proper wells are not put at a financial disadvantage because of other unscrupulous well contractors; (6) letters to trade organizations that deal with the well construction industry (such as home builders/ realtor/ plumbing associations, etc.) that would benefit from information (including short

seminars) on what state and local well rules require for a proper and safely constructed well, along with help to resolve unexpected or emergency well problems encountered in conducting business; and (7) preparation of brochures, pamphlets or other documents that would be targeted to specific technical/regulatory issues and audiences.

Examples of public education and technical assistance information include general consumer advice on choosing a well contractor; what the consumer should know about wells; how to disinfect bacteria in a well; proper installation of sanitary well seals; and advice on dealing with objectionable concentrations of iron, hardness, hydrogen sulfide, bacteria, and other materials in the well water.

IX. CONCLUSION

The Groundwater Section has established an ambitious program goal for itself at a time when a reorganization has left a reduced staff with an increased workload. The new mission will call on the energies and talents of each and every member of the Groundwater Section and new staff. Groundwater protection problems facing the State in the years ahead are formidable. The groundwater resource, which millions of North Carolinians depend upon for drinking water supplies, is being polluted or threatened with pollution by planned and unplanned surface activities conducted by business, agriculture, industry, government, and individuals.

In order to accomplish its mission of protecting human health and the environment, the Groundwater Section must demonstrate effectiveness as it continues to develop its program in five areas:

Resource evaluation identify vulnerable groundwater through characterizing discharge and recharge areas, noting impacts on streams and deeper aquifers and determining areas that are highly vulnerable to contamination.

Pollution management determine accurate locations of groundwater contamination sources and areas where groundwater is or may be used as a water supply, and make data easily available for program development and public review.

Waste disposal issue permits for municipal, industrial and animal waste storage and disposal and follow up on groundwater degradation.

Pollution prevention - encourage safe industrial and commercial practices for groundwater protection.

Well program implement driller certification rules; assure proper well construction; add consumer protection to the resource emphasis; and provide education and outreach to assist local health departments in protecting private drinking water wells.

The mileposts defining the success of the vision given here will be found in the progress of Groundwater Section units responsible for monitoring and tracking each of the management areas above.

Moreover the success of the program should be demonstrated by measurable improvement in the following Key Strategic Objectives:

1 - Reduction in violations of groundwater quality standards at facilities that discharge wastes to the surface and subsurface.

2 - Reduction of the impact to citizens from incidents of contaminated groundwater.

3 - Reduction of contamination incidents in private drinking water wells caused by improper well construction.

4 - Development of established programs which are shown to prevent pollution of North Carolina's groundwater resources

The history of the Groundwater Section demonstrates that it has grown to play an integral role in the protection and restoration of North Carolina's groundwater resources. The agency has developed and now maintains a broadly experienced staff among whom most every issue of the complex nature of groundwater flux and contaminant movement can be confidently evaluated. The existing organization with its projected growth and expansion will be well equipped to continue with the rigorous programs outlined in this document.