

AQUIFER AND RESERVOIR WATERSHED PROTECTION

THE REPORT OF THE

AQUIFER/ WATERSHED PROTECTION PLANNING COMMITTEE

JANUARY, 1990

Committee Members:

James G. Brooks, City Council
Nancy Duseau, Chair, Planning Board (Associate Member)
David Gengler, Chair, Conservation Commission
James Holeva, Planning Board
Mayor David B. Musante, Jr. (Ex-Officio)
Michael Parsons, Board Of Health
John Richards, Chair, Board of Public Works
Susan Roy, Vice Chair, Conservation Commission (Associate Member)

Staff:

Wayne M. Feiden, Planner, Office of Planning and Development
Paul O. Hadsel, Director, Department of Public Works (left September, 1989)
Peter McErlain, Health Agent, Board of Health
Peter McNulty, Acting Director, Department of Public Works

EXECUTIVE SUMMARY

The Aquifer/ Watershed Protection Planning Committee recommends the following actions be undertaken to protect the sources of Northampton's municipal water supply:

1. The City should develop a **public education program** on the water supply and its vulnerability to damage.
2. The City should **acquire key parcels of land** in the aquifer and the primary surface water supply watersheds.
3. The Department of Public Works should **consider policies to prevent potential adverse impacts** from DPW projects and DPW maintenance of City services on Northampton's water supply.
4. Regulatory and advisory boards, including the Planning Board, Conservation Commission, Zoning Board, Board of Public Works, and Board of Health, should **insure that projects reviewed under those boards' authority do not adversely impact** the water supply.
5. **Regulatory changes** and additions should be made to the zoning ordinance, Board of Health Regulations, and other city ordinances to protect the resource.
6. Northampton should continue to **work with the host communities** where surface water watersheds are located to protect the source.
7. Northampton should continue to **examine the need and potential for an additional water source** in the distant future.
8. Northampton should **adopt an emergency inter-municipal water connection plan** (through the PVPC planning process).
9. Northampton should take steps to improve **water conservation**.
10. The Board of Public Works plans to build a transmission line between the West Whately and the Mountain Street Reservoirs and a second transmission line between Mountain Street and Leeds should be strongly supported.

INTRODUCTION

The Aquifer/ Watershed Protection Planning Committee was established by the Office of Planning and Development and the Department of Public Works in February, 1989 to devise an overall strategy for the protection of the sources of water that feed Northampton's municipal water supply. The Committee recommends that the City adopt this water protection strategy.

The Committee is an ad hoc committee with members from the Board of Health, Board of Public Works, City Council, Conservation Commission, and the Planning Board. It is staffed by the Office of Planning and Development (OPD), the Department of Public Works (DPW), and the Board of Health (BOH).

The Committee's original charge was to create a strategy to protect the City's drinking water aquifer (the groundwater that feeds two municipal wells). At the urging of the DPW and OPD, the Committee decided to include recommendations for protecting the City's surface water supplies.

The Committee was not involved with any analysis of water treatment, transmission, or distribution networks, which are currently being examined in detail by the Board of Public Works. The Committee strongly supports, however, the Board of Public Works plans to build a transmission line between the West Whately and the Mountain Street Reservoirs and a second transmission line between Mountain Street and Leeds so the City's primary water supply no longer flows through an easily contaminated stream and is no longer so vulnerable.

This report draws on detailed reports of various aspects of Northampton's municipal water supply. It does not attempt to repeat those studies, but rather includes the recommendations that can and should be implemented in the next few years and should be adopted as policy. Other significant reports include:

Hydrogeology and Aquifer Protection Study of Northampton, Ward Motts and Sarah Johnson (October, 1987)

Report on Water Supply Treatment and Distribution, Anderson-Nichols & Company (November, 1989)

Priorities for Watershed Protection in the Francis P. Ryan/Mountain Street Watershed and Roberts Meadow Watershed, Karl Davies (April, 1988)

NORTHAMPTON WATER SYSTEM

The City of Northampton currently obtains its public water supply from three surface water reservoirs located north of the City and one groundwater aquifer located in the City. There is adequate water to meet current and projected needs, but the quality of the water, while adequate, is threatened.

Primary Surface Water Reservoirs

Three surface water reservoirs (Francis P. Ryan, West Whately, Mountain Street) are the primary source of Northampton's drinking water and currently provide approximately 85 percent of Northampton's public water supply. The reservoirs and their watersheds are located in the towns of Conway, Hatfield, Whately, and Williamsburg. The Department of Environmental Management (Conway State Forest) and the City of Northampton own and protect a great deal of land in the watersheds. Much of the privately owned land in the watersheds is undeveloped, but there are some development pressures. In addition, there are several roads that pose threats to the water supply. The Ryan/West Whately and Mountain Street Reservoirs are linked together by an open stream that is at risk

of contamination from an adjacent stream.

The Northampton Department of Public Works is currently planning major and critically needed capital improvements to the delivery pipe system that brings water to Northampton from the reservoirs. When this work is all completed, the Ryan/West Whately Reservoirs can be isolated from the Mountain Street Reservoir in the event of a spill or contamination in one of the reservoirs.

Williamsburg has adopted and Hatfield is considering adopting water supply zoning by-laws that partially protect the watershed within Williamsburg. Conway and Whately zoning regulations do not specifically provide any protection for Northampton's surface water supplies.

Emergency Surface Water Reservoir

Northampton has a relatively low yield emergency reservoir system (Upper/Roberts Meadow Reservoirs) within the City limits and owns much of the land around the reservoir. The watershed feeding the reservoir is located in the towns of Chesterfield, Westhampton, and Williamsburg, as well as Northampton.

Much of this land is under development pressure and water quality is poor. It is likely this water source will not be used again unless and until water treatment and filtration is provided.

Northampton and Williamsburg have adopted, and Chesterfield and Westhampton are considering adopting, water supply protection zoning ordinances/bylaws that partially further protect this water source.

Aquifer

A groundwater aquifer (the area of groundwater that feeds the City's wells) located completely in Northampton currently supplies approximately 15 percent of Northampton's public water. Pumping water from the aquifer into the water system also supplements relatively low water pressure in the area around and to the south of the wells.

Only a small percentage of the land in the aquifer is publicly owned and much of the aquifer is already developed with single family homes on City sanitary sewers.

The aquifer has been partially protected through the water supply district section of the zoning ordinance, Board of Health Regulations (and DPW water system cost-share) buried oil tanks regulations, and other regulatory programs and city policies. There are, however, major threats to the aquifer from possible hazardous material spills and general degradation of water quality as the area is developed.

Even if the aquifer was ever contaminated to the extent it could not be used as an untreated water supply, it still has the potential to serve as a future water supply with filtration and treatment.

Future Water Sources

The water study performed under contract to the Board of Public Works indicates that even with the modest population and water use increases that are likely over the next thirty years, existing water supplies will be adequate to serve Northampton's needs.

The DPW study identifies a potential new water source, the upper reaches of the East Branch of the Mill River, that could be used when the City needs an additional or replacement source of water.

The hydrogeological study of Northampton's aquifer indicated that pumping rates could be increased somewhat in the existing aquifer without drawing in Mill River water, but major increases in aquifer yield is not possible unless the water quality in the Mill River is improved and protected. No other high-grade usable aquifers exist within Northampton. Potential municipal aquifers may exist in some of the communities around Northampton that could be examined if additional water sources were needed in the future, if they are not developed.

Treatment System

Northampton's water is currently chlorinated but not filtered or otherwise treated. If the City built a treatment and filtration plant there would be somewhat less concern about raw water quality. In the relative near future Northampton will need to build a water treatment plant for surface water and provide chlorination for groundwater to comply with drinking water standards, but the cleaner the water supply the less treatment that will be needed. Protection of the water supply is usually the most cost effective way of providing safe drinking water.

Regional Water Inter-Connections

Northampton's water system serves only Northampton. There have been limited temporary connections with Easthampton and Hatfield for emergency water needs. There is the potential for emergency connections to Williamsburg.

Threats to Public Water Supplies

Among the threats to the quality of water in Northampton's reservoirs and aquifer are:

1. **Sedimentation and turbidity** that result from uncontrolled or excessive amounts of development or developing land, logging, agriculture, and gravel and mineral extraction;
2. **Nutrient loading** from on-site sewage disposal systems, leaking sanitary sewers, lawn fertilizers, and runoff from developed or developing land, forested and agricultural land, driveways and roads;
3. **Trace metals, volatile organics, other toxic materials** from sewage disposal, roads, inappropriate oil changing and car maintenance operations, waste dumping, industrial/ commercial operations, vehicle spills, pesticide and herbicide application, and driveways and roads.

RECOMMENDATIONS TO PROTECT MUNICIPAL WATER SOURCES

The City's surface water reservoirs provide 85 percent of the City's drinking water, and could provide more. Protecting this source of this water is critical, regardless of future treatment and piping system improvements. Treatment of surface water, which will soon be mandated by federal and state regulations, will be less expensive and more effective if the surface water remains relatively uncontaminated.

Protection of the aquifer is also critical, although it provides a smaller percentage of the City's drinking water. If the groundwater is protected, treatment of groundwater sources will not be required. In addition, groundwater is a relatively drought-proof water source and provides an emergency source of water should contamination, treatment, or piping problems temporarily limit available water from the surface water reservoirs.

Education:

Public education is critical to the protection of municipal water sources, especially in developed areas. Several areas of the aquifer, for example, appear to be prime locations for changing car oils and fluids by dumping the old (and toxic) oil onto the ground.

1. Encourage on-going media coverage of the sensitivity of water supplies.
2. Place "Entering/ Leaving Water Supply Protection Area" street signs at entrances to surface water watersheds and the aquifer.
3. Work with schools and neighborhood and civic groups to prepare and distribute educational materials. Include educational materials with water billing, and all permits issued within the water supply protection area.
4. Develop educational signs for conservation and publicly used lands within water supply areas.
5. Copies of all water reports and studies should be donated to the City and school libraries.

Land Acquisition:

Land should be acquired by the City to protect the most sensitive areas of the water supply areas. Land acquisitions are only recommended for a small percent of privately owned lands, but include the most critical parcels for resource protection.

1. The Conservation Commission and the Board of Public Works should attempt to acquire all undeveloped land in the aquifer within Zone 2 (as defined by the Department of Environmental Protection and identified in the Motts/Johnson hydrogeological study of the aquifer), and other critical parcels of undeveloped land, such as Zone 3 sites with stratified drift soils and wetlands, if any, which serve as significant groundwater recharge areas into the aquifer. Zone 2 parcels should have a higher priority than Zone 3.

These lands should be purchased with general City funds and with DPW water system funds when possible, with eventual reimbursement for some Zone 2 lands possible under the Commonwealth's Aquifer Land Acquisition program. The parcels will serve to protect the water supply and can serve other conservation, recreation, and open space goals.

Contamination of Zone 2 and Zone 3-stratified drift sites pose the greatest risk to groundwater supplies because of the relatively rapid movement of contaminants to wells with minimal treatment and dilution.

Loss of recharging wetlands (wetlands usually serve as groundwater discharge points, but some recharge is likely, especially in the summer months) would reduce the volume of and, because of their filtration capabilities, the quality of groundwater supplies.

There is approximately 30 to 40 acres of undeveloped Zone 2 parcels (although in many cases it would be difficult to subdivide these parcels, so the City would need to purchase more land to protect all of Zone 2). There is approximately another 20 to 30 acres of critical Zone 3 parcels.

2. The DPW should continue their efforts to purchase critical parcels of land in the watersheds feeding the primary surface water

reservoirs, with consultation with the Davies' study of land acquisition priorities for the watershed (although much of the land along the reservoir or feeder streams should have a high priority for protection). The source of funds for purchasing these lands should be grants, when possible, and from the water system enterprise funds, with eventual reimbursement for critical lands possible under the Commonwealth's Aquifer Land Acquisition program. DPW should continue to encourage DEM to purchase watershed properties bordering on Conway State Forest.

3. Public land acquisition within the Roberts Meadow Reservoir System should not be a priority at this time because of the standby nature of that system and the greater needs elsewhere.

Department of Public Works Policies:

1. The DPW's should continue to manage timber sales in DPW watershed and aquifer properties to minimize soil erosion. Logging contracts should continue to include provisions to insure best management practices to minimize soil erosion and, whenever possible, natural vegetated buffers immediately adjacent to waterways should not be cut.
2. The DPW should investigate reducing the use of conventional road salt (sodium chloride) within the aquifer. This can be done through increasing the use of sand/salt mixture instead of road salt and using calcium chloride and other salt substitutes instead of sodium chloride. Calcium chloride is far more expensive, and increased city funding for ice removal is needed to fund this alternative. The DPW should consider reducing the application of conventional road salt by a minimum of 50 percent within two years. Future road salting policies should be re-examined in two years.
3. DPW should consider altering their schedule of street sweeping/cleaning so the aquifer is the first area swept in the spring. Street cleaning within the aquifer will reduce contamination from sediment, salt, petroleum, and heavy metals. Street sweepings (with nutrients and heavy metals) should not be dumped within the aquifer.
4. New catch basins within the aquifer which are built, replaced, or upgraded by or will be maintained by the DPW should incorporate gas traps to remove petroleum contaminants, subject to engineering review. The city should provide funding to DPW to purchase the necessary equipment for cleaning out these catch basins.
5. New detention ponds which will be maintained by the DPW should incorporate sediment stilling basins (wet detention) to remove sediment and related nutrients and other contaminants.
6. DPW should consider expanding their current efforts to trace sanitary sewer leaks within the aquifer and repair any leaks that are found. The main trunk line serving the Ryan Road/Acrebrook Drive area should be the top priority. Sanitary sewers in the aquifer should be designed with watertight fittings and pipes.

Planning Board, Conservation Commission, and Zoning Board Policies:

1. The Conservation Commission should recognize that any work in Northampton's aquifer or Roberts Meadow Reservoir watershed may impact on groundwater or surface water supplies, which are interests

under the state Wetlands Protection Act and Northampton's Wetlands Protection Ordinance.

2. Subject to engineering review on a case by case basis, the boards should require that all catch basins and detention ponds in the aquifer or water supply watershed should be built with gas traps and sediment stilling basins.
3. Whenever practicable, clean and pure water drainage from new projects should be directed at recharging groundwater through the use of wet detention ponds, retention ponds, and drywells. When drainage is likely to be at risk of being contaminated, however, it should not be directed at recharging groundwater.
4. Whenever possible, under permit granting authority, land use permits should prohibit the use of herbicides, pesticides, and fertilizers, and require natural vegetated buffers around water courses and primary recharge zones.

Regulatory Changes:

1. The Zoning Ordinance should be amended to reflect all of the DEP, Division of Water Supply's recommendations for protecting an aquifer. These recommendations will probably be mandatory in the near future. The recommendations include regulating the use and storage of pesticides and herbicides and limiting the percent of impervious surface to fifteen percent. The Ordinance should also be amended to prohibit all underground fuel and oil tanks in the aquifer (already prohibited by Board of Health Regulations) and to regulate all excavations within the aquifer within three feet of the seasonal high groundwater table, even if such excavation is incidental to other permitted uses. Proposed Zoning Ordinance revisions are attached to this report.
2. Board of Health Regulations should be written to require gates on access roads to gravel pits and borrow pits, to prevent oil changes and dumping of toxic materials within existing gravel pits. Gates for pre-existing gravel and borrow pits can not be regulated under the zoning ordinance.
3. Existing hazardous materials laws and regulations should be examined by the Board of Health to insure that they include easily administered penalties for illegal dumping of hazardous and potentially hazardous materials (including the ability to issue fines through the non-criminal disposition ordinance) and should mandate rapid cleanup of contaminated soil and groundwater in the event of a hazardous waste spill.

Cooperative Efforts to Protect Principal Surface Water Watersheds:

Protecting these sources will require cooperation with the communities where the watersheds are located. Those community's concerns about the burden of supplying water to Northampton should be addressed.

1. The DPW should continue to work with the host communities and attempt to have some roads in the watersheds discontinued or moved. Discontinuance or relocation is only practical in limited areas which pose the greatest threat to the most sensitive areas of the watershed. Northampton would need to pay the cost of relocation.
2. Northampton should cooperate and contribute to communities' efforts

to increase regulatory protection of the resource.

Future Water Sources:

The East Mill River Watershed has been identified by the DPW as a potential future water source. Because Northampton has an adequate water supply for many years, protection of this site is only practical if the impoundment site and other land in the watershed can be acquired by the Commonwealth or by Northampton in conjunction with some of the neighboring communities in the area that will need additional water in the future. Construction of an impoundment and associated delivery system would be many years in the future, after all needed improvements at the primary reservoirs were completed and when a new water source was needed.

The potential of other aquifers outside of Northampton should be examined before committing to develop a new surface water supply.

Inter-municipal Water Connections:

Northampton should continue to plan future water distribution expansions so pipes can interconnect with neighboring communities (especially Easthampton, Hatfield and Williamsburg) and communities where current and proposed surface water watersheds and reservoirs are located. This would also reduce the need for each community to have their own excess water capacity for emergencies.

An emergency inter-municipal water connection plan should be written, in conjunction with the Pioneer Valley Planning Commission (PVPC) Pioneer Valley Water Supply Task Force to insure that in times of emergency or drought, there is not a delay in transferring water. Interconnections should, ideally, be made with connecting pipes, not hydrant to hydrant connections, with formal written agreements signed before any emergency. Existing informal inter-connection agreements could be formalized with written agreements.

In the future, water sharing could be done in several ways:

1. Limited to water loans or sales for emergencies only (loans could be in either direction);
2. Communities with projected water needs could make capital investments to acquire and protect the resource (including the East Mill River Watershed) in return for a share of the water yield;
3. Northampton could offer to sell water to neighboring communities for a limited term (for example 10 years) without making any longer term commitment to supply water.

Conservation

Water usage could be somewhat reduced with water conservation. DPW is implementing some measures to reduce water waste, such as their leak detection study, and encouraging all municipal water use to be metered so more accurate figures on leaks and water usage can be obtained, but conservation efforts by water users can be increased. Unfortunately, because the largest percentage of the costs of providing water are fixed costs, especially without a water treatment plant, there is little incentive for the City to discourage water use. Eventually, however, water conservation may be critical to avoid the need for an additional, and very costly, water supply. Water conservation may also allow Northampton to sell excess water to neighboring communities on a relatively short term basis.

1. Water conservation can be encouraged by increasing water rates to

fund on-going operations and bonds, pay for needed improvements, and purchase land to protect the supply. (Lifeline rates could be instituted to insure that water is still affordable for moderate residential water use.)

- 2) The City can encourage water users, through regulations, education, and assistance in retro-fitting, to implement water saving measures. The PVPC Water Supply Task Force study will examine conservation measures that can be adopted. The City should work with Mass Save to encourage water conservation.

Adopted: January 9, 1990

Unanimously approved by the Aquifer/Watershed Protection Committee members present.

(a:\subdivision.reg\water.rpt 1/25/90)



DANIEL S. GREENBAUM
Commissioner
JOHN J. HIGGINS
Regional Director

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

Department of Environmental Protection

Western Region

436 Dwight Street, Springfield, Mass. 01103

(413) 784-1100

October 23, 1991

RECEIVED

NOV 04 1991

OFFICE OF PLANNING
& DEVELOPMENT

Mr. Charles Borowski, Superintendent
Northampton Water Department
Board of Public Works
125 Locust Street
Northampton, MA 01060

Re: Northampton Water Department
PWS ID #1214000
Zone II Delineation Approval

Dear Mr. Borowski:

The final revised Zone II map for Wells #1 and #2 (the Clark and Spring Street Wells, respectively) was submitted on the City's behalf by Dr. Ward Motts and received by the Department (DEP) on March 3, 1991.

The Zone II delineation is based on the following documents and meetings between Dr. Motts, Ms. Sarah Johnson and Division of Water Supply (DWS) personnel:

1. "Hydrogeology and Aquifer Protection Study of Northampton, Massachusetts," by Dr. Ward S. Motts and Sarah F. Johnson, October, 1987 (received by DEP March 10, 1988).
2. March 1, 1990 meeting attended by S. Johnson, W. Motts, Nancy Caffall (DEP-DWS-WERO) and B. Bouck (DEP-DWS-Boston) to discuss the report review and revisions of the Zone II map.
3. February 12, 1991 meeting attended by W. Motts and N. Caffall to discuss final revisions and submittal requirements for the Zone II map.
4. Zone II map, dated February, 1991 and received by DEP on March 5, 1991.

Based on the above documents and discussions, the Department, acting under the authority of Chapter 111, Section 17 of the Massachusetts General Laws and 310 CMR 22.00 of the Drinking Water Regulations of Massachusetts, hereby grants approval of the zone II delineation for Northampton's Wells #1 and #2 (source ID #s 1214000-01G and 1214000-02G) as illustrated on the February, 1991 map.

Please be advised that the recommendations for aquifer protection made in the 1987 document will need to be revised to become consistent with current regulations. The 1987 report based aquifer protection recommendations on areas designated Zones 1 through 5 which did not conform to the DEP definitions. The February, 1991 Zone II map was revised to conform to these definitions, and, therefore the recommended controls (1987) do not coincide with the newly revised map.

Any aquifer protection district and/or by-law or ordinance must be consistent with present Massachusetts Drinking Water Regulations, 310 CMR 22.00. If the City would like assistance in developing an aquifer protection by-law, please contact Tara Gallagher, Tech Assistance, DWS, Boston.

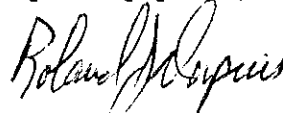
No Groundwater Monitoring Program was proposed in the October, 1987 report. The Department strongly urges the City to design and implement a Groundwater Monitoring Program as per the "Guidelines for Public Water Systems", revised September, 1990 and the Massachusetts Drinking Water Regulations 310 CMR 22.00 in order to adequately protect Wells #1 and #2 in terms of water quality and quantity. This type of program is particularly important in Northampton's case for the following two reasons:

- 1) The 1987 report stated that no water is induced from the Mill River to Wells #1 and #2 when the combined pumping rate of the two Wells is 1.19 million gallons per day (MGD) or less. However, the report claims that when the combined pumping rate from Wells #1 and #2 exceeds 1.19 MGD, Mill River water could be induced to the Wells and could affect the water quality. Because Northampton's water statistics show that the combined pumping rate of Wells #1 and #2 has exceeded 1.19 MGD during times of peak demand, it would be prudent to monitor withdrawal rates for the two pumping wells and water level drawdowns in a monitoring well network to determine the possible effects of induced Mill River water.
- 2) Well #2 has shown evidence of low levels of 1,1,1 trichloroethane and 1,1 dichloroethylene. A groundwater monitoring program which includes testing for VOC's (volatile organic compounds) is highly recommended.

A proposed Groundwater Monitoring Program should be submitted to the regional office of DWS for review and approval.

If you have any questions or would like to discuss these matters, please contact me at my office.

Very truly yours,



Roland J. Dupuis, P.E.
Regional Engineer
Bureau of Resource Protection

NC/gm
WS 036/NNOHOZII

Attachments

cc: DEP-DWS-Boston
Janet Stearns, ALA, Boston
Bruce Bouck, DWS, Boston
Chris Stephens, DWS, Boston
Office of Planning and Development, Northampton
Wayne Feiden, Northampton Planning Board
Dr. Ward Motts, Dept. of Geol. & Geog., U. Mass., Amherst
Sarah Johnson, Dept. Of Geol. & Geog., U. Mass., Amherst
Pioneer Regional Planning Commission
Nancy Caffall, DWS, WERO

Municipality NORTHAMPTON
 PWS Identification # 1214000
 Name of Water Supply NORTHAMPTON WATER DEPARTMENT
 Water Purveyor NORTHAMPTON WATER DEPARTMENT
 Source Identification # 1214000-016 and #1214000-026
 Project Proponent CITY OF NORTHAMPTON
 Title of Study/Purpose of Delineation MOTTS AND JOHNSON (1987)
 USGS Quadrangle Names EASTHAMPTON, MASSACHUSETTS
 Consultant WARRS MOTTS
 Date of Study Submittal FEB 91
 Latitude/Longitude of Source LAT. LONG.
 WELL #1 - 1214000-016 42° 19' 28" 72° 41' 52"
 WELL #2 - 1214000-026 42° 19' 44" 72° 41' 03"
 Signatures: Date: 2/91

Water Purveyor _____
 Consultant WARRS MOTTS
 Project Proponent _____
 Regional Water Supply Chief _____
 & MOTTS, W. S., AND JOHNSON, S. R., 1987, HYDROGEOLOGY AND AQUIFER PROTECTION STUDY OF NORTHAMPTON TOWN, STUDY FOR CITY OF NORTHAMPTON

Explanation of Map Symbols



ZONE 2



ZONE 3

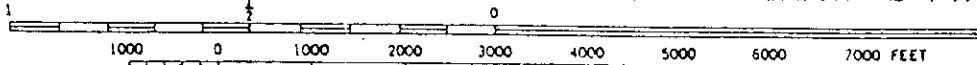
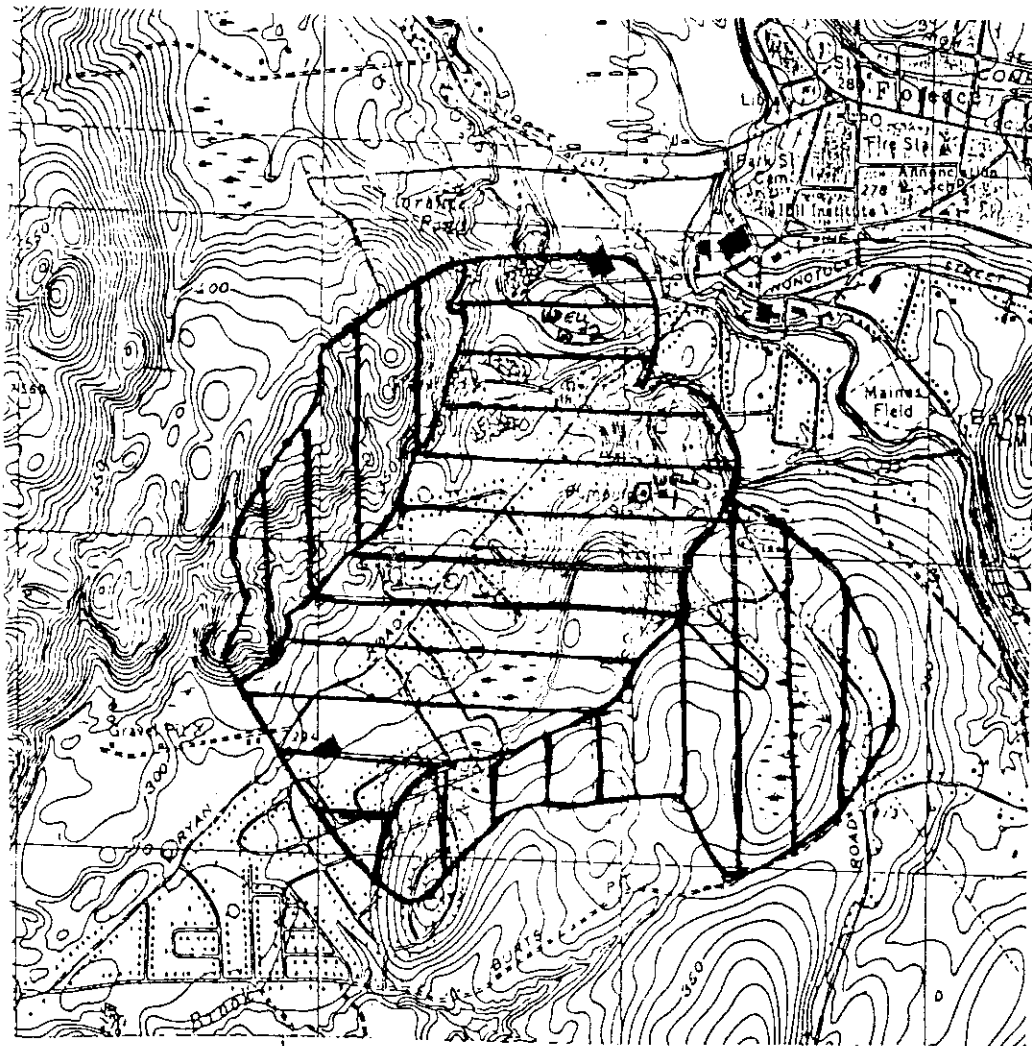
⊙ MUNICIPAL WELL

APPROVED

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Map Scale: 1:25000

Roland R. Repuis DATE 11-1-91



CONTOUR INTERVAL 10 FEET

Municipality NORTHAMPTON
 PWS Identification # 1214000
 Name of Water Supply NORTHAMPTON WATER DEPARTMENT
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 Title of Study/Purpose of Delineation MORTS AND JOHNSON (1987)
 USGS Quadrangle Names EASTHAMPTON, MORTS AND JOHNSON,
 Consultant WAGS MORTS
 Date of Study Submittal FEB 1991
 Latitude/Longitude of Source
 Well #1 - 1214000-01G 42° 19' 28" 72° 40' 53"
 Well #2 - 1214000-02G 42° 19' 44" 72° 41' 03"
 Signatures: _____ Date: 2/91
 Water Purveyor _____
 Consultant WAGS & MORTS
 Project Proponent _____
 Regional Water Supply Chief _____
 * MORTS, W. S., AND JOHNSON, S. F., 1987, HYDROGEOLOGY AND AQUIFER CHARACTERIZATION STUDY OF NORTHAMPTON TOWN, STUDY FOR CITY OF NORTHAMPTON.

Explanation of Map Symbols

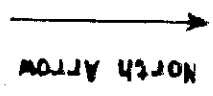


ZONE 2



ZONE 3

① MUNICIPAL WELL

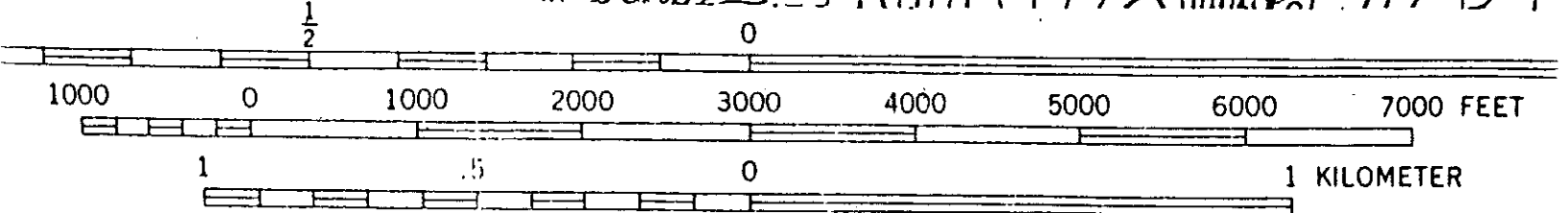
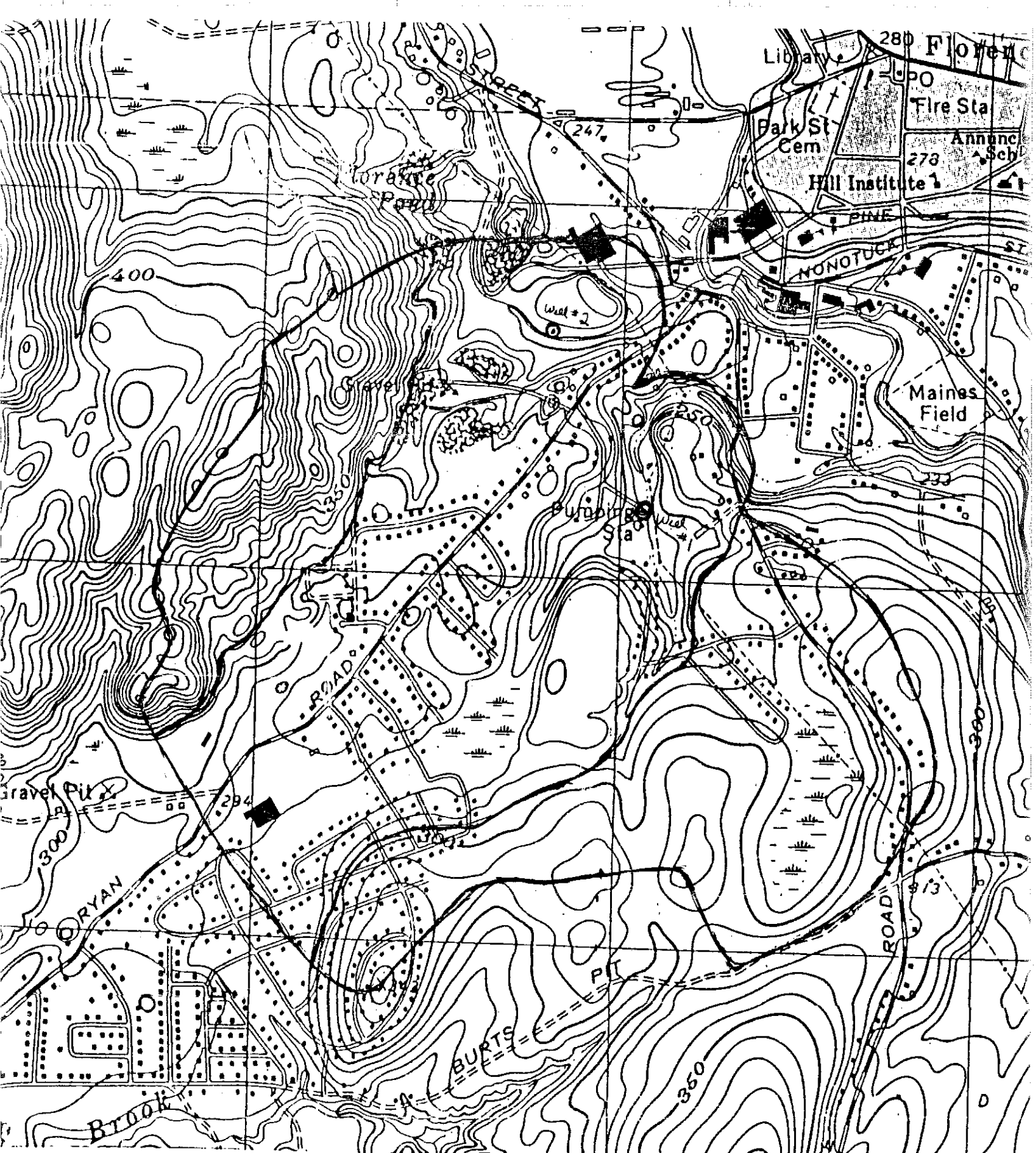


Map Scale 1:25000

APPROVED

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Robert J. Higgins DATE 11-1-91



CONTOUR INTERVAL 10 FEET