HYDROGEOLOGIC REPORT

FOR THE

BARNES OUTWASH PLAIN AQUIFER

PERTAINING TO

GROUNDWATER CONTAMINATION POTENTIAL

BEC

PREPARED BY

BAYSTATE ENVIRONMENTAL CONSULTANTS INC.

FOR J.D.S, INC.

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TABLE OF CONTENTS

LIST OF FIGURES, TABLES AND EXHIBITS

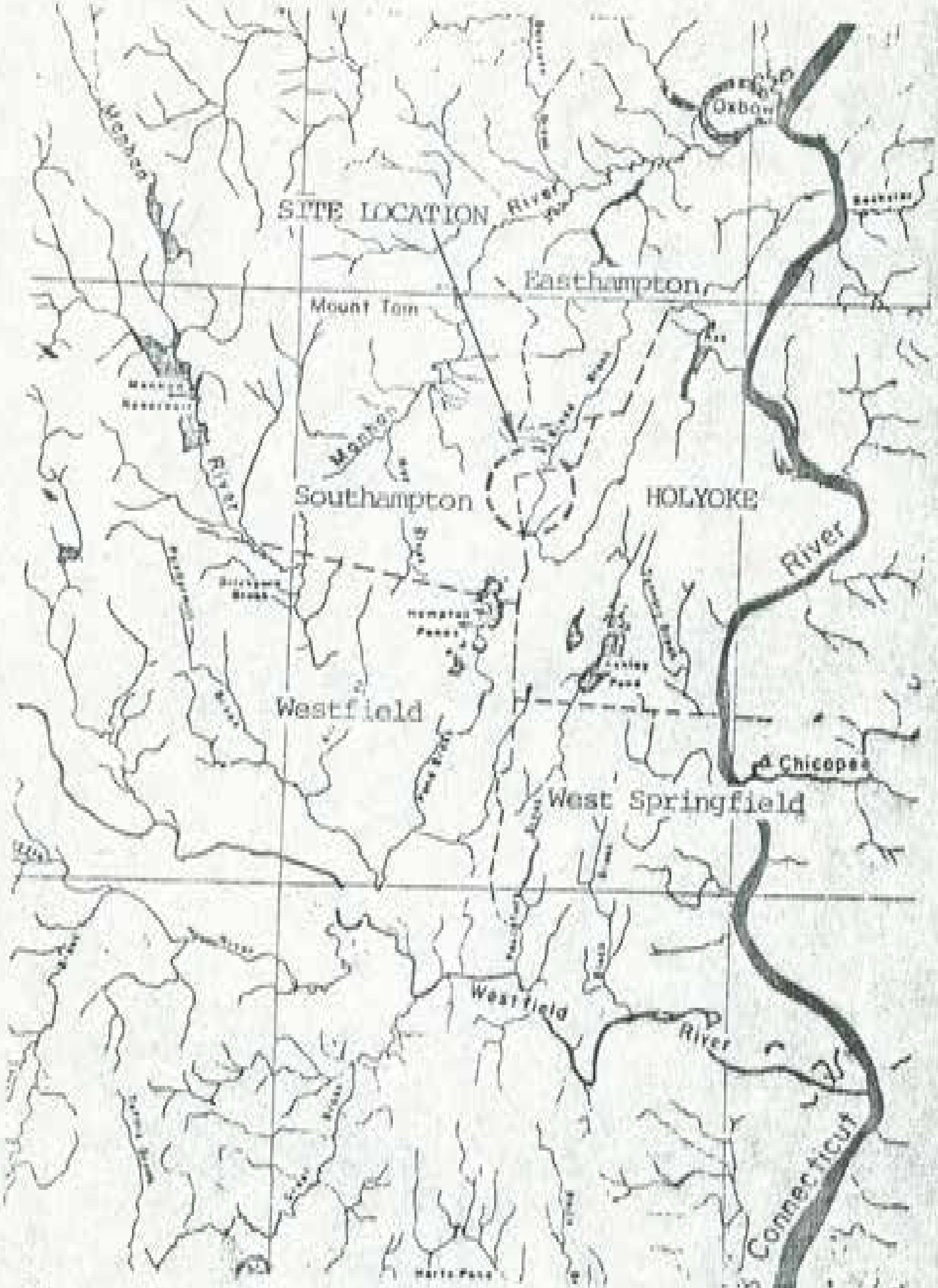


Figure 1 indicates regional drainage features for the area of the U.S.G.S. Mt. Tom Quadrangle Map

North

SITE LOCUS MAP

FIG. 1

Scale : 1 in. = 2½ mi.

I. INTRODUCTION AND SCOPE OF STUDY

In October and November of 1983, Baystate Environmental Consultants, Inc. conducted a Hydrogeologic Study of the proposed Country Acres Subdivision Development to be situated along Southampton Road in Holyoke, MA. The purpose of the study was to identify and determine if a potential exists for contamination of the underlying Pequot Aquifer* groundwater by the proposed J.D.S. Properties 48 unit subdivision which will utilize individual septic disposal systems (see Exhibit 1). Basically, the study methodology consisted of a phased approach during investigation which allowed any potentially serious environmental impacts which are likely to result from the proposed action to manifest themselves. Three possible scenarios utilized in this approach are listed below:

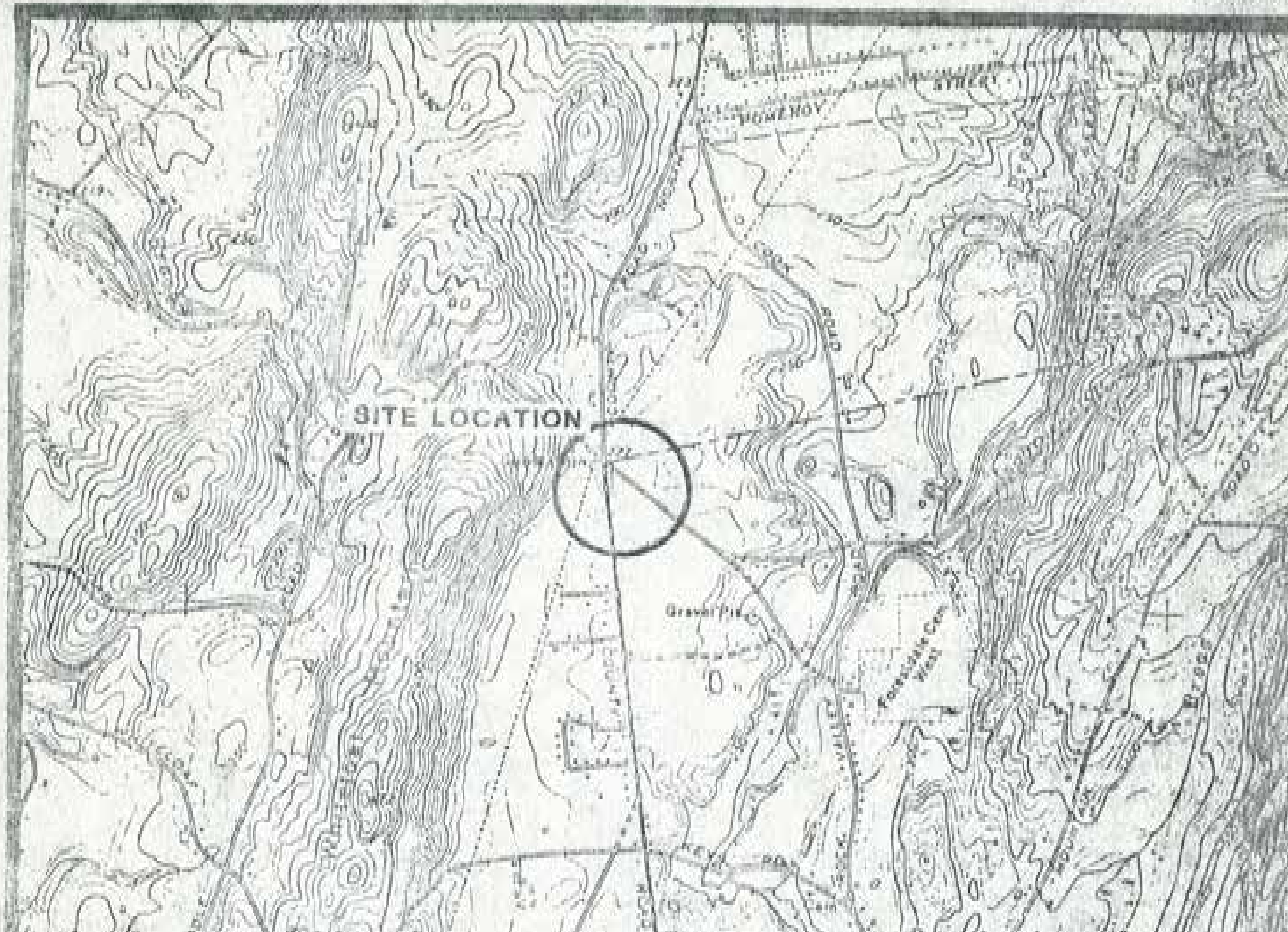
Scenario A - There is no potential for goundwater contamination based upon existing information.

Scenario B - There is a reasonable probability of some potential for groundwater contamination based upon existing information; additional supplemental information is required.

Scenario C - There is a high degree of probability of groundwater contamination and some project modification is required to mitigate the effects. Additional supplemental information is necessary to fully answer the groundwater contamination questions.

The hydrogeologic study was prepared for Mr. Henry F. Spadoni, Jr. of J.D.S., Inc. in direct response to a request from the City of Holyoke Board of Health, the Massachusetts Department of Environmental Quality Engineering and the Lower Pioneer Valley Regional Planning Commission.

*Also known as the Barnes Outwash Plain Aquifer.



PROJECT LOCATION MAP

U.S.G.S. MOUNT TOM QUADRANGLE

SCALE

1" = 2000'

N

FIG. 2

II. EXISTING CONDITIONS

A. SITE LOCATION AND NATURE OF THE PROPOSED ACTION

The Proposed Country Acres Development will consist of 48 individual 0.5 Acre Lots to be located in the Northwestern area of Holyoke, Massachusetts, approximately 175 feet East and South of the Hampshire/Hampden County boundary line (see Figures 1, and 2). The proposed single family residences will be constructed on privately owned land situated at the rear areas of existing homes on the North and South sides of Southampton Road. Each lot will be located on one of five proposed streets, which will have access from Old County Road and from Southampton Road. Additionally, each lot will be serviced with water from the Pequot Water Co. (recently purchased by the City of Holyoke) and contain individual sanitary disposal facilities designed in accordance with Massachusetts Title 5, and City of Holyoke Board of Health provisions.

At the present time, the Pequot Wells serve approximately 100 individual lots located along the following streets near or adjacent to the area of the proposed Country Acres Development:

- Bayberry Drive
- Blackberry Circle
- Applewood Lane
- Cranberry Drive
- Holly Grape Circle
- Blossom Lane
- Winterberry Circle
- Southampton Road
- Ross Road
- Old County Road South

Each single family residence presently existing along the above list of streets has been constructed within the last 10 years.

B. TOPOGRAPHY

The area of the proposed development is situated in a broad northeast-southwest elongated lowland referred to as Rock Valley (see Figure 2). Rock Valley is bounded by Whiteloaf Mt. to the West and East Mt. to the East and extends from Pomeroy Street South to the area of Hampton Ponds, Westfield, maintaining a consistent width of approximately 5,000 feet for a distance of 2.5± mi..

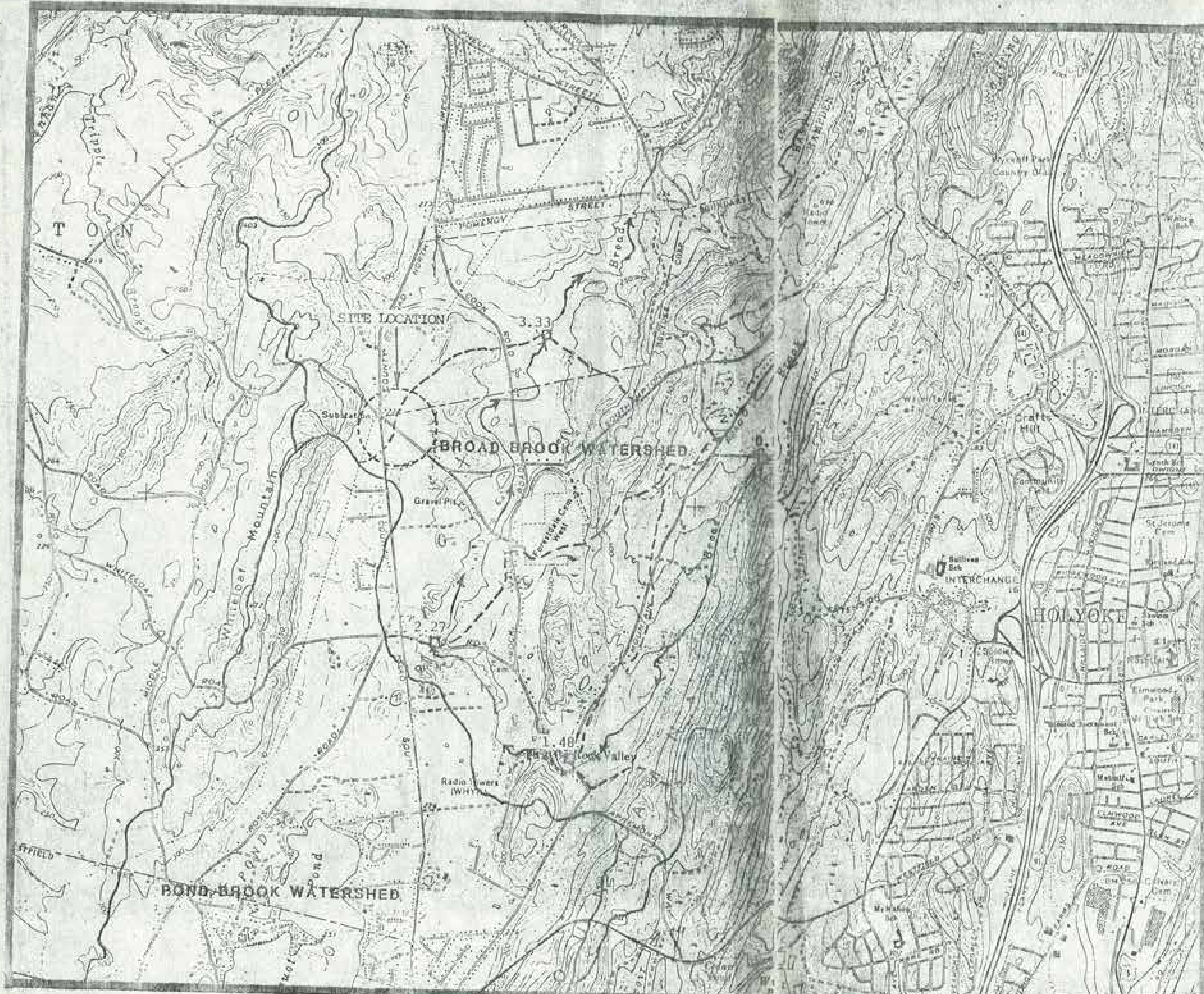
Maximum topographic relief in the valley varies from side to side with approximately 240±ft of relief between the valley floor and Whiteloaf Mt. and as much as 550±ft of relief between the valley and highest elevations of East Mt. By contrast, only 50-60±ft. of topographic relief is present in the valley close to the project site, as the land surface in the area of the proposed development is essentially flat and heavily forested, having elevations ranging from 285-290±ft above sea level. The entire site contains gradual 0-3% slopes which direct overland flow of storm runoff in a easterly direction toward Broad Brook.

In the area of Broad Brook East of the project site, the 280±ft elevations drop off abruptly toward the brook where 50-60±ft high slopes of 25% are present along both sides of Broad Brook. Additionally, two areas exist along the North and South side of Ross Road where sand and gravel has been excavated in the past (see Figure 2). The site situated South of Ross Road contains several cut scarps ranging from 30-35±ft. in height with slopes commonly 25% to vertical.

C. SITE WATERSHED AND DRAINAGE

Broad Brook serves as a major drainage feature for the area of the proposed development flowing in a Southerly direction from its source area along Easthampton Road (U.S. Route 141) through the Village of Rock Valley (see Figure 3). From Rock Valley, Broad Brook flows in a Northerly direction through Easthampton and eventually into the Manhan River at the Oxbow area.

The site of the proposed activity is contained within the lower one sixth of a 3.33± mi^2 watershed contributing to Broad Brook. Approximately two-thirds of



LEGEND

Watershed Boundary

Sub-Watershed Boundary

2.27 □ Gauging Station
= Area of watershed (mi²) upstream from

Flow direction for Broad Brook

North

Scale 1 in. = 2000 ft

SITE DRAINAGE & WATERSHED MAP

FIG. 3

this watershed is contained in the higher hilly areas along the East side of the valley, where bedrock is very close, or at the surface, while the lower one-third of the watershed exists within Rock Valley where bedrock is at substantially greater depth. Much of the total 3.33± mi^2 watershed is essentially an underdeveloped hilly ridge area, or rural areas with the largest concentrations of single family dwellings situated in Rock Valley itself. Adjacent to the project area, Broad Brook flows to within 100± ft. of existing residential developments built in 1974. Rock Valley, by its very name, gives us a first hint of the actual geologic nature of the valley. Basically, the valley is bedrock controlled, having bedrock at, or very close to, the ground surface on either side. Available geologic mapping and field observations indicate the presence of rock exposures at elevations greater than 300± ft. above sea level for Eastern slopes of Whiteloaf Mt. and Western facing slopes of East Mt. By contrast, bedrock is not exposed in Rock Valley where glacial sand and gravel deposits are present (see Figure 4).

D. EXISTING GEOLOGIC CONDITIONS

The area of Rock Valley has formed as a result of extensive pre-Glacial erosion on the bedrock surface some 70,000-100,000 years ago. Erosion during this time has produced an elongated trough in the bedrock surface throughout the area of Rock Valley. Elevations on the surface of bedrock in central areas of the valley are 0 to 50± ft. below sea level (see Figure 4). During more recent Glacial time (18,000 years ago), the bedrock valley trough has become filled with unconsolidated glacial silt, sand and gravel deposits to elevations as high as 300± ft. above sea level. As a result of valley filling during late Glacial times, the present day area of Rock Valley contains a layer of unconsolidated silt, sand and gravel that is very thin (10± ft. along either edge of the valley gradually thickening to 200 to 300 feet or more in thickness toward central portion of the valley (see Figures 5, 6 and Exhibit #2).

<u>GLACIOFLUVIAL (MELTWATER) DEPOSITS</u>

Throughout this report, the above mentioned silt, sand and gravel filled deposits will be termed glaciofluvial or glacial meltwater deposits.

LEGEND

— 300 — Elevation of the bedrock surface above sea level

A

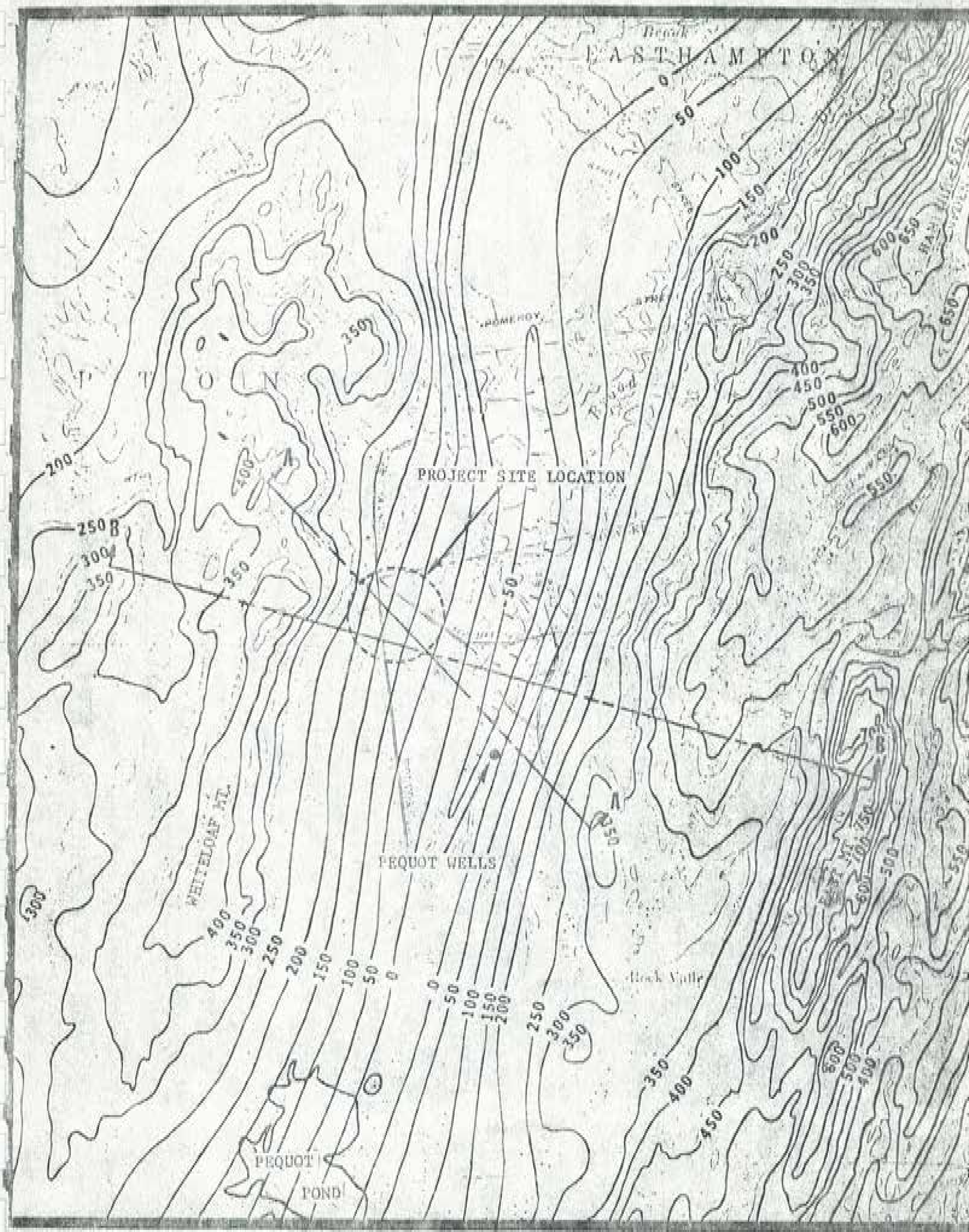
Geologic section profiles

North

Scale 1 in. = 2000 ft.

CONTOUR MAP OF THE BEDROCK SURFACE

FIG. 4

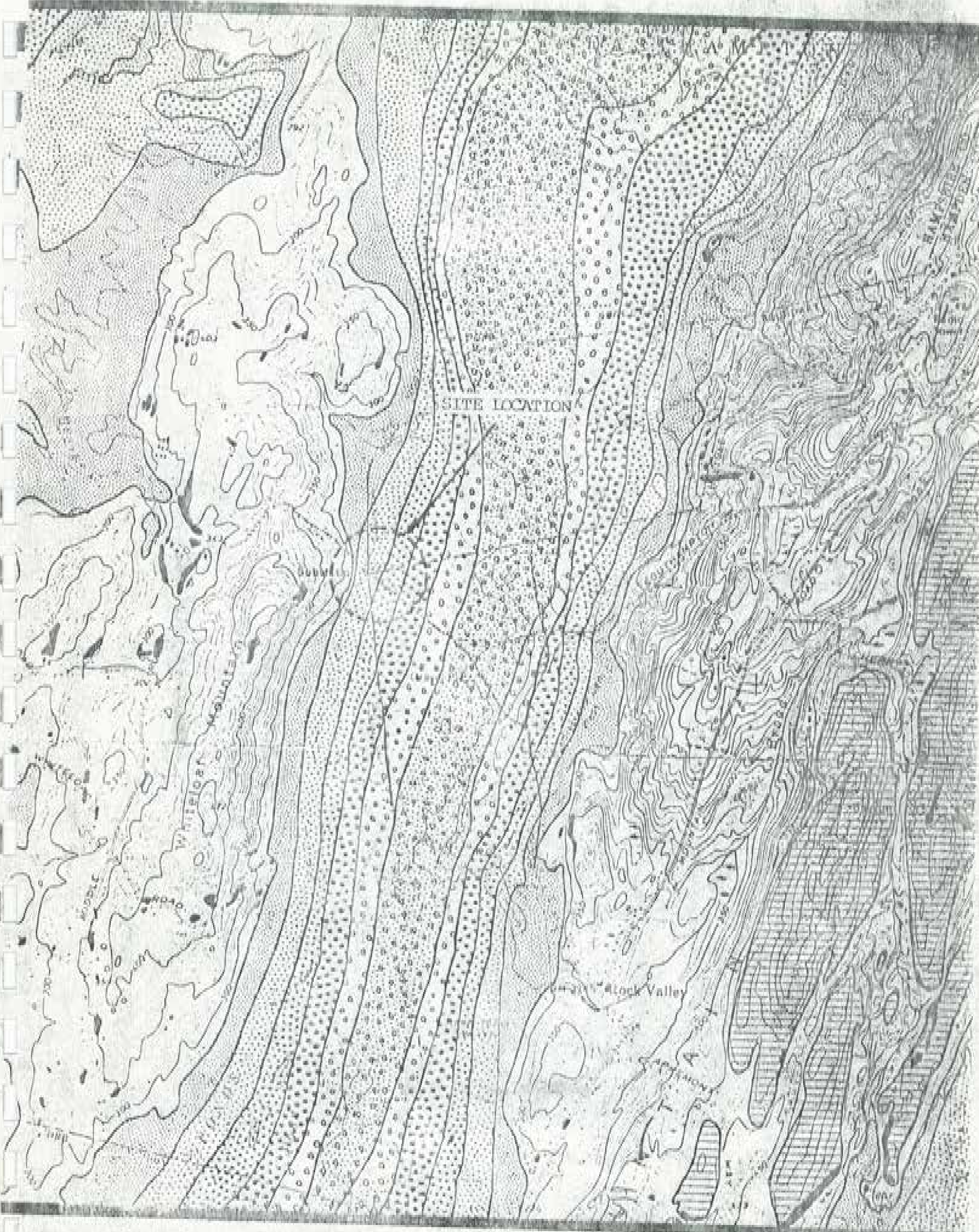

EASTHAMPTON
PROJECT SITE LOCATION
PEQUOT WELLS
WHITELOAF MT.
PEQUOT
POND
Rock Valley
POMEROY

DEPTH

TO

BEDROCK MAP

FIG. 5


SITE LOCATION

Glacial Meltwater Deposits are present in large thicknesses in the Rock Valley area, and are comprised of stratified silt, sand, and gravel which was deposited from Meltwater Streams flowing in a Southerly direction off the edge of a retreating glacier ice front perhaps 18,000 years ago. As the ice front retreated to the North of Rock Valley near Pomeroy St., layer upon layer of stream laden silt, sand, and gravel gradually were deposited in the area of Rock Valley.

More specifically, various types of glacial meltwater sediments are recognized and described as deltaic, lacustrine, ice contact, or outwash deposits depending upon the method of deposition. The entire area of Rock Valley below elevation 300± ft. above sea level comprises a very extensive areal sequence of glacial meltwater deposits better known to geologists as the Barnes Delta/Outwash Plain Sequence* This sequence extends the full length of Rock Valley from Pomeroy St, South to the area of Barnes Airport in Westfield, MA.

Test pit logs from the site of the proposed development, in addition to Pequot well logs, and individual exposures of sand and gravel at various gravel pits in Rock Valley confirm the presence of this large thickness of stratified silt, sand, and gravel (see Appendix A).

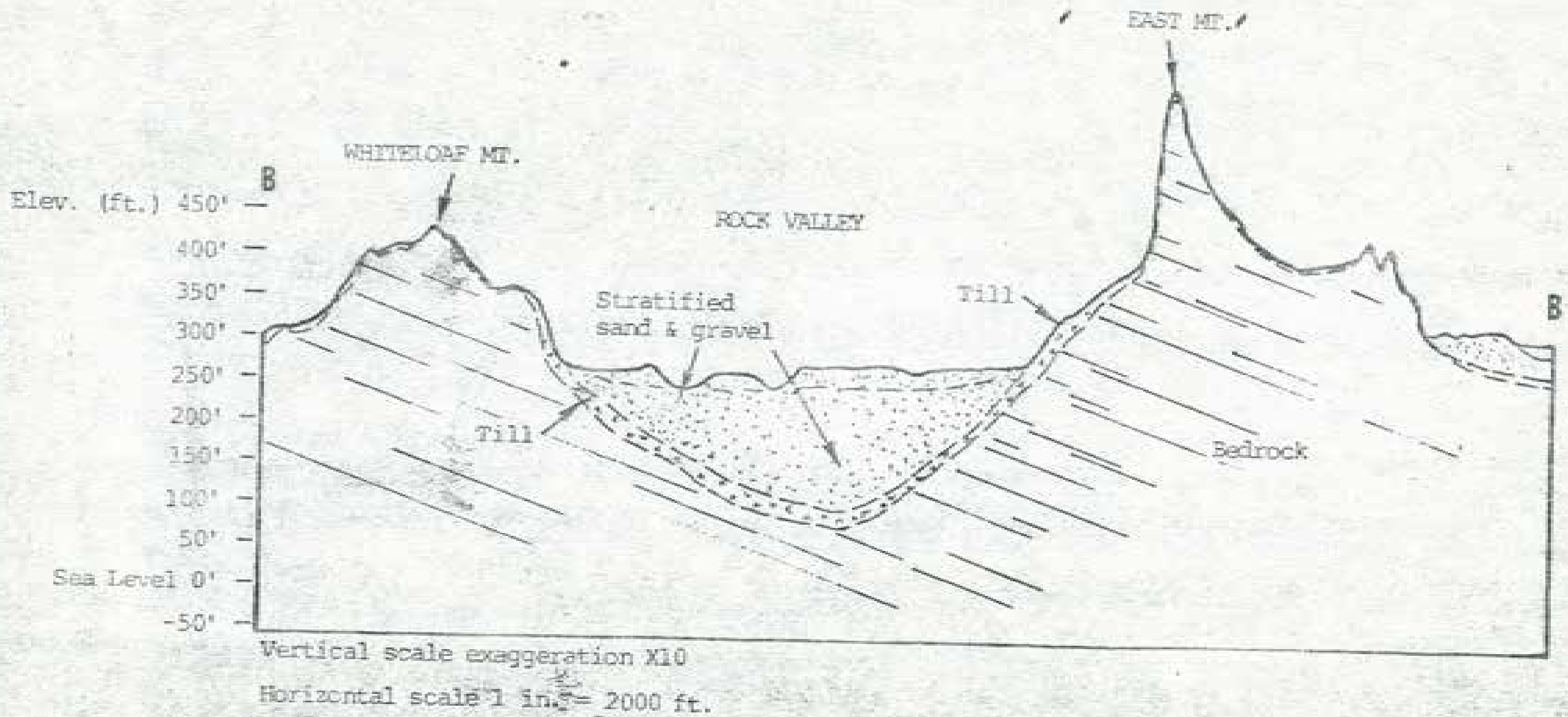
GLACIAL TILL DEPOSITS

Throughout the entire area of Rock Valley, a relatively thin mantle of glacial till underlies glacial meltwater deposits at depth, directly overlying bedrock (see Figure 6 and Exhibit #2). Glacial till deposits consist of a dense red brown-brown poorly sorted mixture of sand, gravel, cobbles, and boulders suspended in a matrix of silt and clay. Glacial till is present at the ground surface at elevations above 300 ft. above sea level.

UNDERLYING BEDROCK

The entire area of Rock Valley is underlain at depths of up to 300 ft, by reddish-brown sedimentary rocks, consisting of interlayered sandstone, arkose, mudstone and shale (see Figure 6 and Exhibit #2). Bedrock exposures are present only at higher elevations above the valley floor on the slopes of Whiteloaf and East

*After Laren, Ph.D. 1972



GEOLOGIC SECTION B-B

FIG. 8

Mountains. Bedrock in this area is referred to as the Sugarloaf Arkose (more properly, the New Haven formation) which is present underlying much of the land area in the Connecticut River Valley West of East Mountain.

Individual bedrock exposures at Whiteloaf Mt. and East Mt. indicate that the bedrock is distinctly layered and regionally inclined toward the East at 10-20°. Additionally, bedrock exposures appear to contain numerous fracture surfaces that are nearly perpendicular to the inclined layering (joint surfaces).

E. HYDROGEOLOGIC CONDITIONS

At least 100 single family dwellings adjacent to the proposed development are serviced with water from the Pequot wells (see Exhibit #1). Additionally, 18 private wells are present in the same area along Southampton Road and on the East side of Old County Road South. Each of the above residences has been constructed within the last ten years. However, homes along the West side of Old County Road South also have private wells; but, in most cases, were constructed prior to ten years ago.

It has long been known that the abundant thickness of sand and gravel present in the Rock Valley area contains substantial amounts of potable water. Public and private wells over the years have been drilled across the valley in many different places and at various depths yielding copious amounts of high quality water. Geologically speaking, when sand and gravel strata contain enough water which can be pumped out of the ground for public or private use, the sand and gravel water bearing strata is termed an aquifer. Throughout the remainder of this report, the aquifer present in Rock Valley will be referred to as the Barnes Outwash Plain Aquifer.*

Individual wells in the Rock Valley area range from shallow hand driven well points to moderately deep 80-90± ft. gravel packed wells and deep 180-300± ft. artesian wells drilled in bedrock. In the area of the proposed development, most wells encountered in the field were deep artesian wells that were situated on the front lawn areas of an individual residence. By contrast, a small amount of the older

*Barnes Outwash Plain describes the geologic nature of the large thickness of stratified silt, sand and gravel present in Rock Valley.

homes, trailers, cottages, etc. have shallow hand driven wells. In this case, the well covers were buried at depth; and, in certain instances, the land owner was unsure of the actual well location.

HYDROGEOLOGIC PROPERTIES OF UNDERLYING GEOLOGIC MATERIALS

Because the Barnes Outwash Plain Aquifer is comprised of stratified silt, sand, and gravel, ground water is able to flow with relative ease at depth with permeabilities expected to range from 10-10,000 gal/day/ft.^{2}. These values are consistent with percolation test data in the same stratified drift where values are less than two minutes per inch.

It is important to realize that because the silt, sand, and gravel is stratified (layered), the expected permeability in a direction parallel to an individual saturated strata may be significantly greater than determined strictly from gravity considerations. By contrast, the dense underlying glacial till would not be expected to store and transmit copious amounts of potable water. This is partly related to the dense compact characteristics of the till; and, also, because of the poorly sorted mixtures of clay, silt, sand, cobbles and boulders constituting the till.

Sedimentary bedrock underlying the Rock Valley area contains interlayered strata of sandstone, arkose, mudstone and shale with certain individual layers of shale that are distinctly fractured and broken parallel to the layering. Both the above broken shale layers and additional steeply inclined fractures provide a network of inter-connected fracture porosity in the rock that can store and transmit substantial quantities of ground water. For this reason most artesian wells which are driven into the underlying bedrock yield substantial quantities of water. Water encountered in the bedrock is under pressure and is pumped to the surface from a rock aquifer that is independent from the Barnes Outwash Plain Sand and Gravel Aquifer.

F. DESCRIPTION OF THE BARNES OUTWASH PLAIN AQUIFER

The Barnes Outwash Plain Aquifer extends North and South of the project area covering approximately 2.5± mi.^{2} and maintaining a constant width of 5,000± ft.

The aquifer has a maximum thickness of 300-350± ft., and an average thickness of sand and gravel across the site of the proposed development of approximately 200± ft..

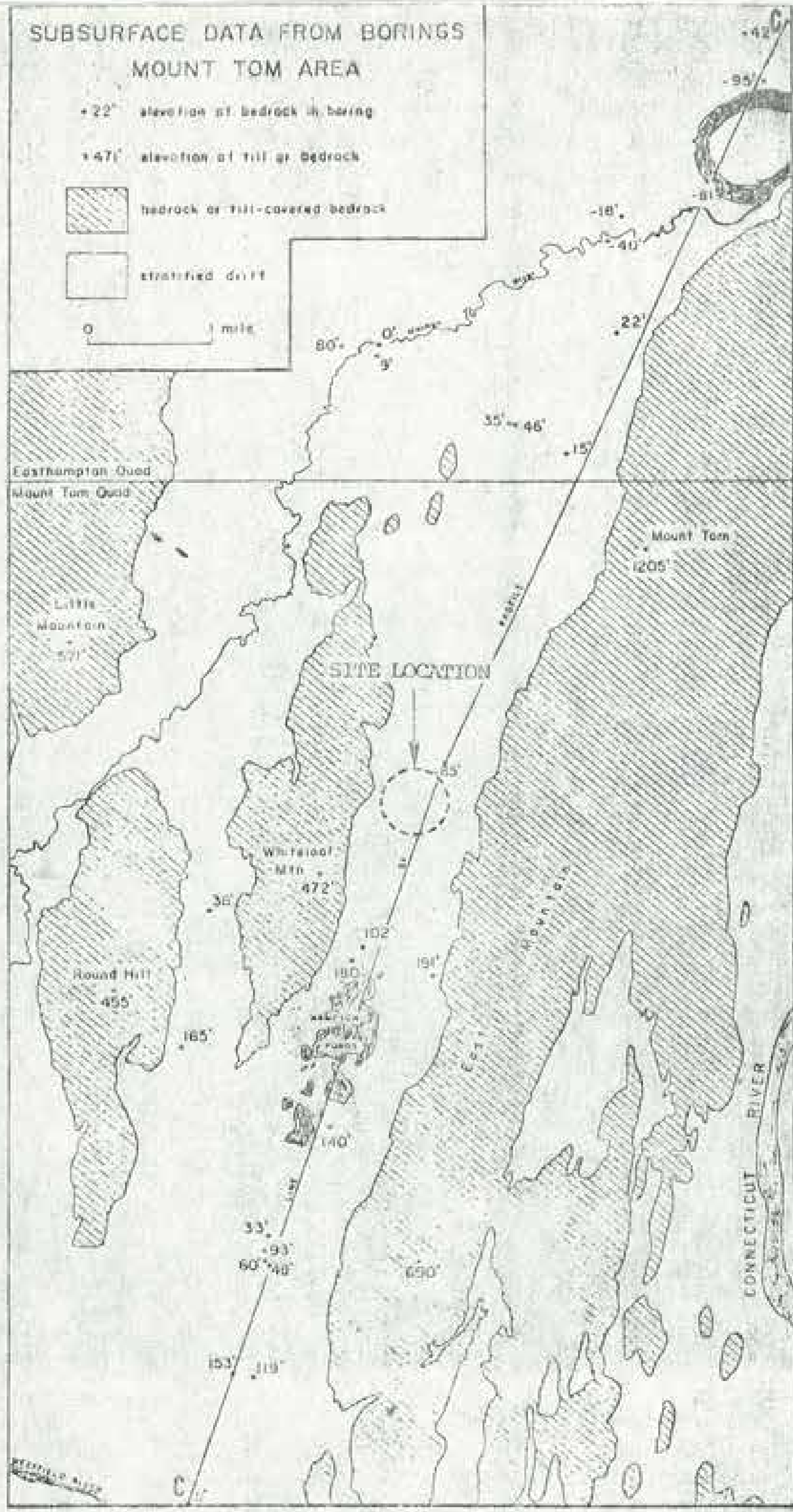
Field observations at a gravel pit situated South of Ross Road, and an excavated area between Old County Road South and Southampton Road, indicate that from 35-50± ft. of unsaturated sand and gravel exists throughout the site of the proposed development (see Exhibit #1). Moreover, the static water level in wells penetrating the Barnes Aquifer at the Pequot well site shows them to be 2-4 ft. below the surface or roughly at the wetland surface in this area. The difference in elevation between the wetland and highest elevations at the top of slope on either bank of Broad Brook indicates that at least 30± ft. of unsaturated sand and gravel is present above the water table here (see Exhibit #2). Finally, a static water level for a 131 ft. deep well located at Keyes and Old County Road South indicates that 48± ft. of unsaturated sand and gravel is present above the water table. This water level is very close to the elevation of a small farm and pond located 500± ft. South of Keyes Road. Although the above data tends to indicate that the unsaturated thickness of sand and gravel ranges from 30-50± ft., a small number of shallow private wells along Old County Road South adjacent to the project area have static water levels reported to be at 15-20± ft. and perhaps closer to the surface. It is not clear as to whether these wells are related to the main aquifer body in terms of regional characteristics or whether they are related to a localized water table. If the water levels reported above truly represent an actual unsaturated thickness related to the Barnes Aquifer, the possible discrepancies between the two sets of data should be resolved.

The entire area of Rock Valley serves as both primary and secondary recharge areas for the Barnes Outwash Plain Aquifer. Realizing that the site of proposed development is located in an area receiving an average annual precipitation of 42 in., an undetermined percentage of this amount drains away from the aquifer as storm runoff while a substantial amount is utilized by plants during the evapotranspiration processes. Because of underlying soil conditions, areas on either side of the valley serve as water gathering (secondary recharge areas), By contrast, precipitation falling in the highlands gradually flows down into Rock Valley where a substantial amount infiltrates directly into the sand and gravel aquifer. The unsaturated sand and gravel deposits along the valley sides serve as the primary recharge area permitting precipitation to percolate directly downward to the zone of saturation. It is estimated that the till-bedrock water gathering areas situated on either side of Rock Valley contribute half the average annual precipitation as recharge to the aquifer. Some of this recharging ground water eventually becomes base stream flow to Pond Brook and Broad Brook.

Pond Brook and Broad Brook serve as the principal line discharge sources for the Barnes Outwash Plain Aquifer in the vicinity of the proposed development. At the project area, Broad Brook flows Northward through Rock Valley at elevations of 240-250± ft. above sea level. Based upon available geologic information, it appears that ground water contained within the aquifer may exhibit deeper at underflow toward the North and South of the project area above the bedrock surface (see Figures #7, #7A). Therefore, at least four possible paths of discharge from the aquifer appear to be evident - two at the surface in wetlands and brooks contained within them, and two in the subsurface to the North and South. Given the large areal extent of the aquifer, and its highly variable thickness of stratified sand and gravel, as well as probable bedrock irregularities, determination of ground water flow, especially at depth, would appear very complicated and require a complex array of subsurface data not presently available.

ANALYSIS OF EXISTING WELL INFORMATION AT THE SITE OF PROPOSED DEVELOPMENT

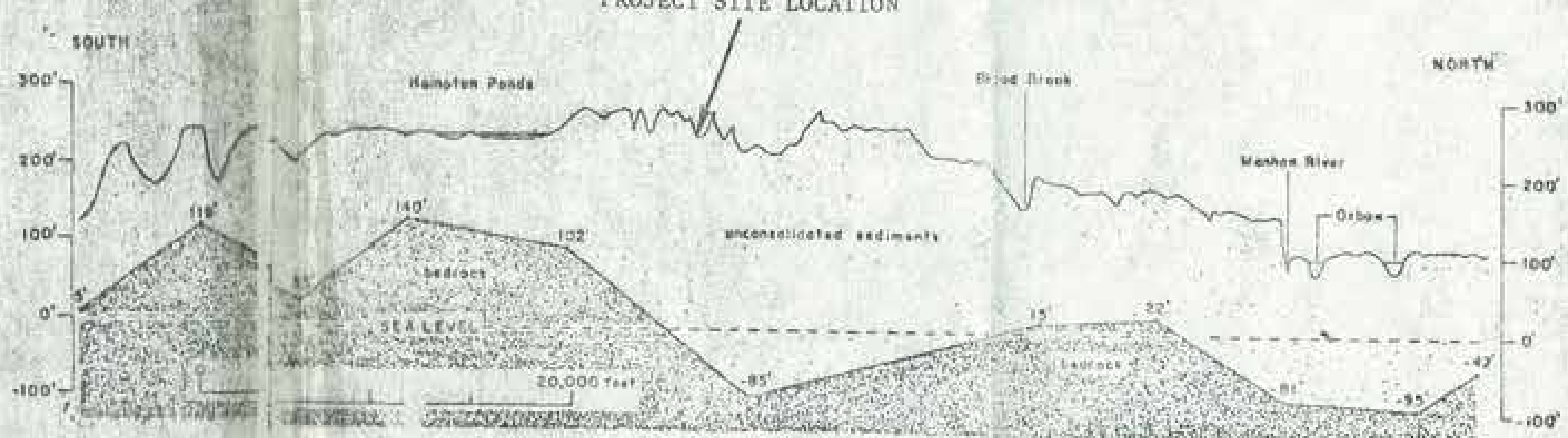
Two eight-inch diameter gravel packed wells comprise the Pequot well system which is located approximately 1,500± ft. East of the proposed development. A pumping test performed over a nine day period from July 6 to July 15, 1974, with pumping rates of 949 gpm. indicated that a static water level from 2-4 ft. below the ground surface will decline 1.8± ft. in an observation well situated 250 ft. West of the pumped wells. The static water level for the pumped wells dropped 7.6 ft. following pumping. A conservative outward limit for a cone of depression is, therefore, 350 ft. from the pumped well. Actual pumping rates for one of the two wells during normal opertion ranges from 300-350 gpm. Normal pumping of one well at this capacity would produce a cone



GEOLOGIC MAP & CROSS SECTION

FOR

THE ROCK VALLEY AREA



SECTION C-C

of depression that is substantially smaller than the cone produced from two wells. Obviously, neither the present nor maximum sustained pumping rate will result in a cone of depression which will intercept areas beneath the proposed development. However, the present cone of depression is possibly influenced by the existing development.

Apart from the public water supply provided by the Pequot wells, private wells located along Old County Road South are present which could pump at the rate of 9-12 gpm.. These wells could realistically be within 200± ft. from a newly constructed septic system proposed by the Country Acres Development. If these wells are pumped at 9-12 gpm., the excessive permeability of the sand and gravel would allow a cone of depression to form which is, for all practical purposes, negligible in the local water table and limited to within a few 10's of feet from the well location.

G. EXISTING POTENTIAL SOURCES OF POLLUTANTS NEAR THE SITE OF THE PROPOSED DEVELOPMENT

Several areas presently exist in and adjacent to the project area where past and present land use practices may result in the creation of a potential for contamination of ground water. Prior to 1974, reports from area residents and the developer for the existing Fruitwood Development indicate that a large pig farm existed in the area of the proposed development. At one point, approximately 1,000 cy. of pig carcass remains and other associated animal wastes were excavated in the area of Bayberry Circle to facilitate home construction*. Given this fact as historical background, one must wonder how many other similar areas exist or existed in the vicinity of the project area which are still potentially impacting the Barnes Aquifer.

Additional land use practices in the Rock Valley area may also pose potential threats to the existing ground water supply that should be of concern. Field reconnaissance and aerial photo interpretation has indicated the presence of large cultivated fields containing stockpiled manure, an underground fuel storage facility, a septic tank repair and cleaning operation, and power transmission lines adjacent to the site of the proposed development. Each of these areas may possess potential for contaminating ground water supplies in Rock Valley. These sources appear to be upgradient of discharge points

*Oral communication with Puffer Construction Co.

to the Pequot wells; thereby, in areas of thin outwash cover, elevating their potential for pollution. However, no data presently exists to implicate any of these potential sources.

H. EXISTING WATER QUALITY

A substantial amount of water quality analysis data exists for the Pequot wells adjacent to the site of the proposed development. Water samples have been analyzed from the individual wells or from a ground tap located at 68 Old County Road from 1974 to 1983 (see Appendix B). During the eleven year period of sampling, individual water samples were tested for bacteria and chemical constituent criteria applicable to Massachusetts Safe Drinking Water Standards.

Review of the available well and stream data indicates that levels of most of the chemical constituents tested throughout the eleven year period have been well below the safe drinking water standards for wells. However, there are a small number of inconsistencies for the years 1974, 1975, 1976 and 1983 for the well data in which concentrations of Ammonia (Nitrogen) and Nitrate (Nitrogen) reached elevated levels (see Appendix B). However, no trends in any of the data could be discovered over time.

Water quality analysis from a private well situated on Lot 14, Old County Road, indicates excessively high concentrations of Nitrogen (Ammonia) for the spring and summer of 1983 (see Appendix). At the time of this report preparation, the Lot 14 data became available to the Consultant by oral communication with the owner of the well. The data are, therefore, not totally documented.

During 1983, a water sample was taken from Broad Brook to characterize the existing surface water quality in the area. Again the data indicated that while most chemical constituents were within the range normally encountered in surface waters in Western Massachusetts, concentrations of Sodium, Nitrogen (Ammonia) and Nitrogen (Nitrite) were elevated. Obviously, if the stream is recharging the aquifer, then there should be some concern - particularly with sodium entering the potable water (see Appendix B).

From existing data, it is evident that ground water and stream waters have been somewhat subject to mobile chemical contaminant effects primarily from Sodium, and to a lesser degree, from Nitrogen. Obvious potential sources of such contamination in the area include road salting, storm water runoff infiltration, septic tank effluent infiltration and agricultural pollution. At present, the situation insofar as drinking water is concerned, is not a problem; but long range planning dictates that the potential for sodium pollution be monitored.

I. POLLUTANT RENOVATION CAPACITY OF THE UNSATURATED THICKNESS OF SAND AND GRAVEL

This analysis essentially deals with the pollutant renovation capacity of a 30-50± ft. unsaturated thickness of stratified silt, sand and gravel. Above the static water table, pollutant renovation in the unsaturated zone occurs by a combination of absorption on mineral grains, filtration, bio-oxidation, chemical oxidation, and ion-oxidation. Beneath the site, absorption and filtration are probably the major renovation processes available. Due to the excessive permeabilities and the highly stratified characteristics of the unsaturated strata at the site of the proposed development, one must consider some potential magnification of pollutional impacts brought about by favored permeability zones in the direction of the Pequot wells. Such magnification would modify normal gravity descent of percolating waters in the unsaturated zone, and perhaps limit dispersal to more localized areas. This allows analysis of worst case conditions.

RENOVATION OF SEPTIC EFFLUENT

Septic leach field effluent percolating downward through the soil would flow from the area of the leaching trenches downward approximately 30-50 ft. through unsaturated strata of interlayered silt, sand and gravel before encountering the water table. The percolation rate of 2 min/in is well under the thresholds for sewage disposal set by Massachusetts Title V regulations. However, the excessive permeability could be expected to work against the pollutant renovation capabilities of soils beneath the leaching areas of the proposed septic systems by permitting certain mobile contaminants to travel considerable distances prior to assimilation. Table #1 depicts a breakdown of typical septic tank effluent and an approximate percent reduction for rapid permeability soils

RENOVATION OF SEPTIC TANK EFFLUENT
THROUGH THE SOIL, RAPID PERMEABILITY*

Chemical Constituents***	Typical Septic Tank Effluent	Average Concentration**	Approximate Percent Reduction
Biochemical Oxygen Demand	160	24	85
Chemical Oxygen Demand	323	248	24
Phosphates as P	34	34	Insignificant
MBAS	7.6	7.6	Insignificant
Total Solids	378	192	49
Total Suspended Solids	90	5	95
Total Dissolved Solids	288	187	35
Ammonia as N	27	27	Insignificant
Nitrate as N	0.14	0.14	Insignificant
Sodium	55	55	Insignificant
Potassium	11	11	Insignificant
Calcium	11	11	Insignificant
Sulfate	20	20	Insignificant
Chlorides	95	95	Insignificant
Coliforms, Total Colonies per 100 ml	6.05×10^6	6.05×10^3	99.9

* Permeable soils include medium to coarse sand and gravels, very little (0-10%) fine sand or silt, permeability of 0.63 x 3 in/hr, 3×10^{-4} cm/sec or greater.

** Concentration of pollutants after the effluent passes through 4 feet (1.2 m) of unsaturated soil.

*** All units in mg/l except where specified.

TABLE 1

It is interesting to note that while certain chemical and biological constituents are reduced substantially, although bacterial die away and most chemical assimilation is readily achieved in passage through a relatively small thickness or unsaturated granular soils, there are several chemical constituents such as Ammonia (NH_4), Nitrate (NO_3), Sodium, Potassium, and Chlorides which pass through the soil relatively undiminished. Of these potential contaminants, Sodium is of utmost importance in drinking waters because of its relationship to hypertension.

If pollutants pass through the unsaturated zone to the water table by modified gravity flow, they are then transmitted in the direction of ground water flow at that particular location in accordance with Dary's Law. As they travel down gradient in the direction of ground water flow, contaminants are subsequently diluted and dispersed by the larger body of ground water (i.e. 170± ft. of saturated sand and gravel passing beneath the project area) in the direction of ground water flow.

In the zone of saturation horizontal permeabilities should exceed vertical tendencies by perhaps 100-1000 times due to the stratified nature of the aquifer materials. A preferred direction of contaminant transport could therefore exist; caused by piping along preferred permeability zones. It is also possible that if this flow is intercepted by a pumping well, contamination of a private or public water supply could result. If this condition were to occur in the area of the proposed development, only the most mobile chemical constituents such as Sodium, Nitrate, Chlorides and Complex Hydrocarbon not degraded in the saturated area would be of concern.

III. SUMMARY OF OBSERVATIONS AND CONCLUSIONS

An analysis of the existing conditions at the site for the proposed 48 unit Country Acres Development was based primarily upon available information. This study concludes as follows:

Potential Contamination of the Public Water Supply (Pequot Wells)

The proposed 48 unit subdivision will be located approximately 1,500± ft. West of the Pequot Wells situated South of Ross Road. Investigation of existing published geologic information and Pequot Water Co. well data, water quality analysis and field reconnaissance sets forth four underlying points of information in favor of Scenario A* - i.e., There is no potential for groundwater contamination based upon existing information. These four points are as follows:

1. Unsaturated Thickness of Silt, Sand and Gravel Above The Watertable. Throughout the entire site of the proposed development a 30-50± ft. and possibly greater blanket of unsaturated silt, sand and gravel is present above the water table. The substantial thickness and areal extent of this material allows for maximum renovation of bacteriological and chemical contaminants from septic tank effluent. The unsaturated zone affords the most effective barrier against ground water contamination once water with entrained pollutants has infiltrated the soil.
2. Unusually High Dilution Factor in the Saturated Thickness of Silt, Sand and Gravel. Assuming that certain chemical constituents common to septic effluent will not filter out completely in unsaturated sand and gravel having high permeabilities (i.e., ammonia, nitrate and chlorides), an average saturated sand and gravel thickness of 200± ft. extending throughout the 2.5 mi. aquifer provides a substantial underflow dilution volume to locally derived groundwater enriched in ammonia, nitrate and chlorides.
3. The Large Distance Between a Proposed Septic System and the Maximum Outward Limit of Influence for the Pequot Well. During the nine day pumping test conducted for the Pequot Wells, a maximum outward extent for the cone of depression was approximately 350± ft. The test was

conducted with both the primary well and the auxilliary well pumping at a combined rate of 949 gpm. The actual present rate of pumping for the primary well is between 300-350 gpd. or one-third of the pumping test rate. Thus the actual present day cone of depression obviously extends a considerably shorter distance than 350 ft.

If the pumping test value of 949 gpm. is used to be conservative, the proposed septic systems will be approximately 1,150± ft. horizontally at their closest point and displaced at least 30 ft. vertically through the unsaturated zone. Practically all of the proposed septic systems would realistically be situated 2,000-2,500± ft. away from the Pequot wells, well beyond the maximum cone of depression. While it has been assumed throughout this analysis that groundwater gradients were from the proposed development to the Pequot wells, this fact has never been established.

4. Analysis of Potential Contamination From Existing Development in Close Proximity to the Pequot Wells. At the present time at least 100 single family residences are located on opposite sides of Broad Brook and the Pequot wells. The residences described above were constructed ten years ago on 0.5 acre lots, having an on-site sanitary septic disposal systems. Annalysis of water quality data taken over the last eleven years for the Pequot wells does not indicate any noticeable degradational trends in the quality of the well water. Homes on either side of the Pequot wells are within 100± ft. to Broad Brook with some lots having a minimal thickness of unsaturated sand and gravel above the watertable.

Potential Contamination of Private Water Supplies (Small Domestic Wells)

The proposed 48 unit subdivision will be constructed such that a newly constructed septic system could be within 200± ft. from an existing privately owned well. Field investigation indicates that numerous privately owned wells exist along Old County Road South, some of which are very shallow and which were constructed many years ago. In certain instances, trailers or small cottages contain hand driven wellpoints or dug wells and the landowner is not sure of the actual well location.

At least four points of information are presented which dictate that a second Scenario, Scenario B, may be operational in this area.

Scenario B - "There is a reasonable probability of some potential for groundwater contamination based upon existing information and additional supplemental information may be warranted." However, in view of the special circumstances pertaining to the private wells described below, there is little that points to the proposed development as a cause of the problem.

1. Lesser Thickness of Unsaturated Sand and Gravel Above the Water Table. Land areas situated West of the project area on and West of Old County Road South have less unsaturated sand and gravel above the water table as compared to the proposed project area, and land East of Old County Road South. Individual well owners West of Old County Road have reported groundwater within 15± ft. of the surface (undocumented by well-logs). However, available geologic data indicates that the thickness of unsaturated sand and gravel does pinch out to the West of Old County Road South. of Old County Road South.
2. Hydrogeologic Properties of the Unsaturated Sand and Gravel Layer. Test Pit information, percolation test data, and the geologic character of the sand and gravel layers indicates that the sand and gravel is stratified and contains rapid to very rapid permeabilities. Additionally, an individual strata of uniform coarse sand or gravel may create a condition whereby a preferred flow directions would exist for groundwater in a direction parallel to the strata layering. If a particular very permeable strata is inclined toward a well and upgradient to the well, contaminants could flow directly toward the well (pollutant effect magnification caused by preferred permeability).
3. Past and Present Land Use Practices Near the Project Site. Field reconnaissance and aerial photograph interpretation indicates that several past and present land use conditions may act as potential pollutant sources for the aquifer or private wells. Individual observations are listed below:

°Past use of the land in and adjacent to the site of the proposed development as a large pig farm. At least one disposal site was encountered during construction of the Fruitwood Subdivision in 1972 where approximately 1,000 cy. of pig remains and associated had to be excavated. Possibly others have gone unnoticed.

°Large cultivated fields adjacent to the site of proposed development Annual treatment of farm soils with manure fertilizers, can add substantial quantities of nutrients to the subsoil. Leaching and/or runoff of manure stockpiles such as those located on Old County Road are examples of potential nitrogen sources.

°An underground fuel storage tank: this was observed at a septic tank repair and tank cleaning company located West of Old County Road South approximately 500± ft. from existing shallow wells. Nothing is known of the hydrogeologic conditions at this location except that it is probably upgradient of wells and probably has a thin outwash cover below it.

°Roads in and adjacent to the site of the proposed development: These roads without curbs or storm drains. Winter deicing by road salting along Old County Road South may pose substantial ground water contamination potential, especially with regard to sodium contamination.

4. Actual Private Well Contamination. Oral communication with a private well owner located at Lot 14 Old County Road South indicates that excessive levels of nitrogen (ammonia) and nitrogen (nitrate) have been detected for the spring and summer of 1983. Although additional contaminated wells were not encountered during preparation of this report, it is not impossible that additional trouble spots may exist, though undetected or unreported at the present time.

The four points described above indicate that a potential for contamination does exist. The construction of the proposed Country Acres Development will not significantly add to the future potential contamination of the aquifer or private wells along Old County Road South. Such potential could more likely result from past and present land use practices than from proposed septic systems designed under current Title 5 requirements. If the proposed Country Acres Development is not constructed, the private wells situated along Old County Road South will still remain under a threat of potential contamination.

In addition, no substantial threat to groundwater supplies has really been demonstrated by any of the data reviewed to date. The above discussion has merely pointed out that some potential for upgradient contamination of groundwater exists and the least likely source is the proposed Country Acres Development.

Because the actual flow of groundwater has not been determined along Old County Road South, it is relatively infeasible at this time to determine individual sources of groundwater contamination for a given well.

The liklihood of the proposed Country Acres Development promoting groundwater contamination of the Barnes Aquifer is considered remote because of prevailing hydrologic conditions on the site along with the failure of more closely located homes to create noticeable impacts. The required transport distance and vertical unsaturated flow displacement strongly support the contention of no significant impact generated by the proposed action. The findings also allow commentary on other issues within the Country Acres plans.

1. There is evidence from the pump test data that Broad Brook is not acting as a recharging boundary because of a relatively impervious bottom. This fact could prove useful in storm water management along heavily traveled roadways where avoidance of groundwater contamination could be effected by curbing and positive discharge to surface waters.

2. Any retention basin utilized on-site would leak significantly and thereby recharge the aquifer as a point souce. The use of slotted pipe in subdivision streets to disperse residential storm water to the aquifer as recharge is desirable wherever at least 30 ft. of unsaturated soil exists between the pipe trench and the water table. Such dispersed infiltration may be more effective than a leaky retention basin. Pipes should be sized large enough to provide capacity assuming plugging and a positive pipe outlet provided despite the probability that it will never be needed. The installation of infiltrating catch basins has been successfully utilized in a Wilbraham, MA subdivision since 1981 without plugging problems and without noticeable outflows to surface water courses.

Some municipal officials have expressed concerns about possible water table fluctuations in certain areas of the proposed subdivision which could create a potential for ground water pollution. It has been proposed by these officials that the developer wait five years before proceeding with portions of the subdivision, during which time the water table fluctuations would be monitored. In view of the minimum thickness of the unsaturated zone of thirty feet and the knowledge that the maximum water table fluctuations in stratified drift deposits are typically 2-3± ft., the provision of a five year waiting period to observe potential pollutional effects appears unnecessary.

APPENDIX

APPENDIX

APPENDIX A

TEST PIT LOGS/GRAIN SIZE CURVES

REPORT

This report culminates an extensive ground water exploration and development program that has been conducted for the Pequot Water Company, at its holdings located in West Holyoke, Massachusetts. The Water Company supply is located adjacent to the Broad Brook in West Holyoke, on property owned by the Water Company and having sufficient area to provide adequate protection for the quality of the ground water to be taken as domestic water supply.

The program began in 1971 with initial 2 1/2 inch exploration wells, numbered 1-6, being installed and causing the location of a suitable, high volume, well site. The initial work for wells numbered 1-6 was conducted by the R. E. Chapman Company under the supervision of Almer Huntley, Jr. & Associates, Inc. The materials logs for test wells numbered 1-6 are appended hereto and show that, at the location of wells number 5 and 6, suitable depth and material was located and was found to pump quite freely. On this basis, a short pump test was conducted on wells 5 and 6, the results of which are also appended hereto. At the time of the running of this pump test, samples were taken by the Massachusetts Department of Public Health with the quality of the water found to be suitable for drinking water purposes.

On the strength of the testing conducted in 1971, the Pequot Water Company was formed in 1974 with the intention of utilizing supply from the preliminarily tested well field with desired volumes being in the range of 600 gallons per minute. Necessary contacts were made with the Massachusetts Department of Public Health and the Massachusetts Department of Public Utilities and conferences were held in order to determine the requirements of these two agencies in establishing the Water Company and its ground water supply. An early requirement that was determined was the necessity that two, rather than one well be installed to guarantee backup capability should there be a screen failure or equipment failure in one of the supply units. On this basis, it was decided to install, adjacent to the number 5 and 6 test holes, two eight inch diameter gravel developed wells, to be installed 15 feet apart so that they might be kept within a single pumping station structure. In May of 1974, the F. G. Sullivan Drilling Company was retained by the Water Company to install and develop the dual well supply required for the installation. On May 20, 1974, 2 1/2 inch observation well number 7 was installed for the purpose of guaranteeing suitable depth and material for the installation of the first of the two eight inch permanent wells. This was followed by the installation, on May 12, 1974, of 2 1/2 inch observation well number 8 which was set for observation purposes during pump testing as well as to guarantee suitable material for the second of the eight inch permanent wells. Well number 7 was driven to a total depth of 87 feet with medium to coarse sand found between the depth of 75 and 87 feet. Well number 8 was also driven to a total depth of 87 feet with medium to coarse sand found within the same range. Finally, on May 21 and May 22, in order to provide a complete endrclement of the tested area with observation points, 2 1/2 inch diameter test well number 9 was driven roughly 200 feet to the southeast of the planned permanent well location as an observation well point. Test wells 7 and 8 were each rated by the driller at 75 gallons per minute, each indicating the suitability of the location for permanent well installation. Copies of the driller's logs for these three holes are appended.

On June 17, 1974, installation of eight inch gravel developed well #1 was begun. The well was driven to a total depth of 83 feet with fine gravel being located between 70 and 83 feet. Independent sieve analyses conducted by the driller and this office, showed the material to be capable of accomodating a number 50 slot screen size (see appended copies of driller's analysis). Based upon the volume of water expected to be taken from the well, (300 - 350 gallons per minute), velocity determinations showed that a 10 foot length of 50 slot screen would be proper for the installation. The driller was authorized to purchase that configuration with the screen being set on June 27, 1974, between the depths of 73 and 83 feet with the full ten feet exposed through the use of an extension.

While the screen was being fabricated for the number 1 eight inch well, the driller moved southerly 15 feet, and on the 18th of June, 1974, installed a permanent 8 inch well number 2. Well number 2 was driven to a total depth of 92 feet with fine gravel and medium sand and gravel being located between the depths of 80 and 92 feet. Once, again, independent sieve analyses by the driller and this office were conducted with screen slot sizing of number 50 slot between 80 and 85 feet being determined as suitable and number 40 slot between 85 and 92 feet being found necessary (driller's curve appended). Once again, from velocity determinations, a ten foot length of screen was chosen and the driller authorized to commence with fabrication of the stainless steel screen. This screen was set on July 2, 1974, between the depths of 82 and 92 feet with full ten foot exposure with an extension.

Development of eight inch well number 1 required roughly ten hours on June 27, 1974 with a flow of 330 gallons per minute being achieved at a net draw down of 12 feet 3 inches. Development of eight inch well number 2, began on July 3, 1974, took 15 hours with a lesser flow of 275 gallons per minute at a net draw down of 19 feet being achieved. Copies of the eight inch diameter well drilling logs, complete with development data, are appended.

Upon completion of development of the two 8 inch diameter wells, a conference was held with the Massachusetts Department of Public Health along with a field inspection of the installation and its proposed discharge point. Approval was given by that agency to proceed into the official pump test of the two wells on a tandem basis. On the afternoon of Saturday, July 6, 1974, the pump test was begun. However, after less than four hours of operation, the diesel engine driving the pump for well number 2 failed and the test was terminated temporarily. On the afternoon of Sunday, July 7, 1974, the test was restarted with a newer, larger, diesel connected to the number 2 well pump. The test officially began at 1:00 p.m. on that date and ran continuously for a period of six days and seven hours. The results of the pump test and a running comentary of this operation can be found in the hereto appended copy of the official certified pump test log as well as a draw down graph that has been prepared based upon information provided by that log.

During the course of the pump test, and specifically at the beginning, and immediately prior to shut down of the test, water samples were taken for chemical analysis by the State Department of Public Health Laboratory located in Amherst. In addition, two sets of bacterial samples were taken about mid-way in the test and the water from both wells was found to be free from coliform bacteria. Copies of the laboratory analyses are also appended hereto.

During the test, the output of the wells was varied on two different occasions. Based upon the draw down data collected during development of the wells, it was decided to begin the pump test with well number 1 discharging a total rate of 503 gallons per minute and well number 2; 401 gallons per minute. After roughly two days of operation, it appeared that the wells were beginning to stabilize already, and it was decided to increase the output of the two wells with number 1 being raised to discharge a volume of 548 gallons per minute and number 2 well discharging 448 gallons per minute. The pump test was continued at these rates until Friday, July 12, 1974, when, while it appeared stabilization was near at hand, there was some concern as to whether it could be achieved prior to the weekend at which time other work, of necessity, had to be begun and it was decided to guarantee stabilization prior to the end of the weekend, and, at 11:00 a.m. on Friday, the 12th, the output of well number 2 was returned to 401 gallons per minute. The remainder of the pump test was run in this configuration having a total discharge from the two wells combined being 949 gallons per minute. By 9:00 p.m. that evening, it was noted that stabilization had begun to occur and from that point clear through until the shutdown of the pump test at 8:00 p.m. on the evening of Saturday, July 13, all of the observation wells had, for all intents and purposes, stabilized. The pump test was shut down at 8:00 p.m. on the evening of Saturday, July 13, rather than 9:00 p.m. simply for the advantage of being able to take initial recovery readings while daylight still existed.

Recovery readings were taken at one minute intervals initially then two minute intervals, and finally one hour intervals for a full 24 hour period after the shutdown of the pump test, by which time all of the observation wells had been found to have recovered within 15 inches of their original static elevations.

To sum up; a ground water supply of major proportions has been located at the Pequot Water Company well sites in West Holyoke, Massachusetts. A continuous, closely monitored, certified pump test was conducted and run for a period of 6 days and 7 hours, during which time stabilization of the water bearing aquifer was achieved at a total combined output of the two 8 inch diameter test wells of 949 gallons per minute or 1.4 million gallons per day. The water supply located was found to be of good quality, free of iron or manganese, relatively low in chlorides and carbon dioxide and bearing desirable levels of hardness. While the pH of the supply remained slightly acidic throughout the pump test, the moderate hardness coupled with low carbon dioxide should preclude any potential agressiveness of this supply. Bacterial analysis conducted upon the water from both wells during the course of the pump test found the supply to be coliform free. Recovery of the water levels in the well field, upon shutdown of the pump test, while gradual, were within 15 inches of the original static elevations after 24 hours, indicating good strength in terms of recharge capability of the surrounding area.

In anticipation that the supply would be suitable for use and that the eight inch test wells would be converted into permanent installations, the screens that were set in these wells were of permanent stainless steel construction and were swaged tightly into the walls prior to development. After the completion of recovery readings, the test pumps were restarted and the two wells were checked for sand-free operation. Surprisingly enough, the number 2 well, that which was founded in finer material and required a combination slot size for its screen, was determined to be sand-free while the number 1 well was found to produce minor quantities of sand upon start-up. The number 1 well was put into a fine development program through starting and stopping of the test turbine for a period of roughly four hours, after which time this well, too, proved to be sand-free and the driller was permitted to remove the test pumps.

Since approval of the site and the protective land provided for the wells has already been received from the Massachusetts Department of Public Health, the only concurrence and approval that is now needed applies to certification as to suitable quality as a domestic water supply and as to volume for which the value of 1.4 million gallons per day is felt to be reasonable.

UM TE LO ... Lancaster, Mass. 01523

CUSTOMER | ENG.- OR- MAN-IN-CHARGE

TOWN PEQUOT WATER CO

STREET W. HOLYOKE   STATE MASS

OWNER OF PROPERTY PEQUOT WATER CO.

OPERATORS STEVE SULLIVAN — TERRANCE O'TOOLE

SIZE & TYPE OF PUMP #1 - 5" TURBINE   #2 - 5" TURBINE

DISCHARGE LINE: Size 6" in. Length 200' feet

ORIFICE PIPE 6" in.; SIZE ORIFICE PLATE 5" in.

DESCRIPTION OF WELL BEING PUMPED: #1 & #2 - 8" Gravel Wells

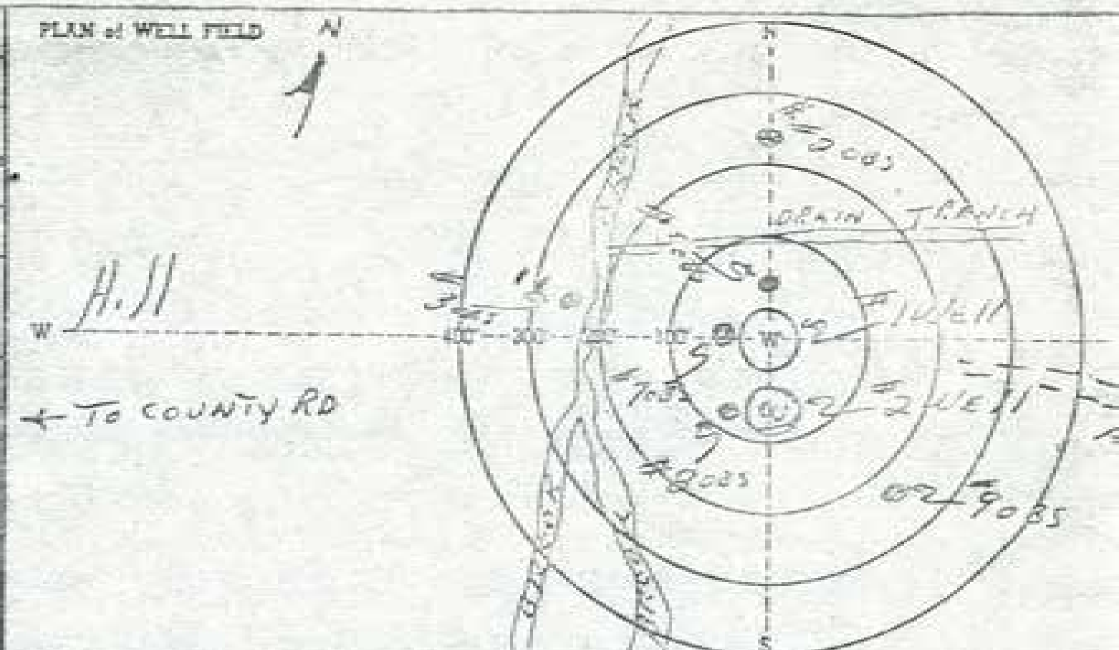
LENGTH OF DUNKER ON TAPE 3" in. ADD TO READINGS (When you make read.)

LENGTH OF ALTITUDE LINE FROM CENTER OF GAUGE ft. in.

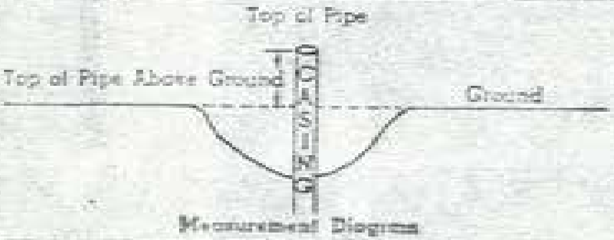
#1 Well Guage 42'

#2 Well Guage 54"

PLAN of WELL FIELD



ALL MEASUREMENTS TO BE MADE FROM TOP OF CASINGS



			Observation Wells Information			
FINISHED WELL NO.	#1 Well	#2 Well	No. 7 OBS	No. 8 OBS	No. 9 OBS	No. 3 OBS
DEPTH OF WELL	83'	92'	Depth 85'	Depth 85'	Depth 87'	Depth ?
TOP OF PIPE ABOVE GROUND	18" Guage	18" Guage	Pipe AG 7"	Pipe AG 9"	Pipe AG 22"	Pipe AG 3'-[illegible]
STATIC READING Alt Guage	4'	4'	Static 3'-1½"	Static 3'-¾"	Static 5'-4"	Static 4'-7[illegible]

START 1 PM —

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt Gauge Reading 1	[illegible] In Well 2	Orifice Head in Inches #1	Orifice Head in Inches #2	GPM #1	GPM #2	Water Level	Water Level	Water Level	Water Level
July 7, 1974	1:05	51°	23'-6"	36'-6"	#1	#2	#1	#2	8'-2¾"	9'-9½"	5'-7"	5'-0"
Sunny — Hot	1:30		23'-6"	36'-3"	16½	40"	503	401	8'-5"	9'-9¾"	5'-7¾"	5'-2¼
Samples Taken	2: PM		23'-6"	36'-3"	16½	40	503	401	8'-5¼"	9'-11½"	5'-8¼"	5'-1½
	3 PM		23'-6"	36'-3"	16½	40	503	401	8'-6"	10'-½"	5'-9"	5'-2½
	4 PM		23'-9"	36'-6"	16½	40	503	401	8'-7"	10'-2"	5'-9½"	5'-3½
	5 PM		23'-9"	36'-6"	16½	40"	503	401	8'-7½"	10'-2¼"	5'-10"	5'-4"
	6 PM ✓		23'-9"	36'-6"	16½	40"	503	401	8'-8½"	10'-3"	5'-10½"	5'-4½"
	7 PM		23'-9"	36'-6"	16½	40"	503	401	8'-8½"	10'-3½"	5'-10¾"	5'-5"
	8 PM		23'-9"	36'-6"	16½	40	503	401	8'-9¾"	10'-4"	5'-11"	5'-5½

PUMP-TEST LOG / Pequot Water Co.
W. Holyoke, Mass

CUSTOMER #1 + 2 - 8" wells

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

D. TRIPP
ENG.-OR-MAN-IN-CHARGE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Air Gauge Reading 1	Air Gauge Reading 2 In Wells	Orifice Head In Inches #1	Orifice Head In Inches #2	GPM #1	GPM #2	#7 Water Level	#8 Water Level	Water Level 9	# Water Level
STATICS		STATICS	4'	4'	#1	#2	#1	#2	3'-1½"	3'-¾"	5'-4"	4'-7½
	9 PM		33'-9"	36'-6"	16½	40"	503	401	9'-10⅛"	10'-4¾	5'-11¾"	5'-5¾
	10 PM		33'-4"	36'-6"	16½	40"	503	401	8'-11"	10'-5"	6'-0"	5'-6"
	11 PM		33'-9"	36'-6"	16½	40"	503	401	8'-11"	10'-5¼"	6'-⅛"	5'-6"
CLEAR + WARM	12 MID	✓	33'-9"	36'-6"	16½"	40"	503	401	8'-11¼"	10'-5½"	6'-½"	5'-6½
	1 AM		33'-9"	36'-6"	16½"	40"	503	401	8'-11½"	10'-5¾"	6'-¾"	5'-7"
LIGHT RAIN	2 AM		33'-9"	36'-6"	16½"	40"	503	401	8'-11½"	10'-6"	6'-1"	5'-7½
	3 AM		33'-9"	36'-6"	16½"	40"	503	401	8'-11¾"	10'-6¼"	6'-1¼"	5'-7½
	4 AM		33'-9"	36'-6"	16½"	40"	503	401	8'-11¾"	10'-6½"	6'-1½"	5'-8"
	5 AM		33'-9"	36'-6"	16½"	40"	503	401	9'-0"	10'-7"	6'-1¾"	5'-9½
	6 AM ✓		33'-9"	36'-6"	16½"	40"	503	401	9'-¼"	10'-7¾"	6'-2"	5'-9½
	7 AM		33'-9"	36'-6"	16½	40"	503	401	9'-2"	10'-8½"	6'-3½"	5'-10"
	8 AM		33'-9"	36'-6"	16½	40"	503	401	9'-2"	10'-8½"	6'-3¾"	5'-10½
	9 AM		33'-9"	36'-6"	16½	40"	503	401	9'-2"	10'-8¾"	6'-4"	5'-10½
CLEAR + HOT	10 AM		33'-9"	36'-6"	16½	40"	503	401	9'-2"	10'-8½"	6'-4½"	5'-11"
STATE SAMPLE TAKEN	11 AM		33'-9"	36'-6"	16½	40"	503	401	9'-2"	10'-9"	6'-4½"	5'-11"
	12 NOON		34'-0"	37'-0"	16½	40"	503	401	9'-2¼	10'-9¾	6'-4"	5'-9½
July 8 1974	1 PM		34'-0"	37'-0"	16½	40"	503	401	9'-2"	10'-8¾"	6'-4"	5'-9½
	2 PM		34'-0"	37'-0"	16½	40"	503	401	9'-2¾"	10'-9"	6'-4½"	5'-10"
Sunny + HOT	3 PM		34'-0"	37'-3"	16½	40"	503	401	9'-3"	10'-9¼"	6'-4½"	5'-10¼
	4 PM		34'-0"	37'-3"	16½"	40"	503	401	9'-3"	10'-9½"	6'-4¾"	5'-10¼
	5 PM		34'-3"	37'-3"	16½	40"	503	401	9'-2"	10'-9¼"	6'-5"	5'-10½
	6 PM ✓		34'-3"	37'-3"	16½	40"	503	401	9'-2"	10'-9½	6'-5½"	[illegible]
	7 PM		34'-3"	37'-3"	16½	40"	503	401	9'-2"	10'-9½"	6'-5½"	5'-10¾
	8 PM		34'-3"	37'-3"	16½	40"	503	401	9'-4"	10'-10½"	6'-5¾"	5'-11¼
	9 PM		34'-3"	37'-3"	16½	40"	503	401	9'-4¼"	10'-10¼	6'-6¼"	5'-11½
	10 PM		34'-3"	37'-3"	16½	40"	503	401	9'-4½"	10'-11"	6'-6½"	5'-11½
	11 PM		34'-3"	37'-3"	16½	40"	503	401	9'-5"	10'-11¼	6'-6¾	5'-11
	12 MID		34'-3"	37'-3"	16½	40	503	401	9'-5½"	10'-11½"	6'-6¾"	5'-11
July 9 1974	1 AM		34'-3"	37'-3"	16½	40	503	401	9'-5½	10'-11¾"	6'-6¾"	5'-11½

PUMP-TEST LOG P.__ W. Holyoke Mass. #1 & 3 - 8" wells.

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

D. TRIPP

CUSTOMER ENG.-OR-MAN-IN-CHARGE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Air Line Reading #1	Air Line Reading #3	Orifice Head in Inches #1	Orifice Head in Inches #3	GPM #1	GPM #3	Water Level #7	Water Level #8	Water Level #9	Water Level #
STATICS		STATICS	4'	4'	#1	#3	#1	#3	3'-1⅛"	3'-3⅜	5'-4"	4'-7
	3AM		34'-3"	37'-3"	16½"	40"	503	401	9'-5"	10'-11½"	6'-7½"	5'-11½
July 9 1974	4AM		34'-3"	37'-3"	16½"	40"	503	401	9'-5"	10'-11½"	6'-8"	6'-0"
	5AM		34'-3"	37'-3"	16½"	40"	503	401	9'-5"	10'-11½"	6'-8"	6'-½
	6AM		34'-3"	37'-3"	16½"	40"	503	401	9'-5"	10'-11½"	6'-8"	6'-5"
	7AM		34'-3"	37'-3"	16½	40"	503	401	9'-5½"	10'-11½"	6'-8"	6'-⅜"
	8AM		34'-3"	37'-3"	16½	40"	503	401	9'-5½"	10'-11½"	6'-3"	6'-1"
	9AM		34'-6"	37'-3"	16½	40"	503	401	9'-5½"	11'-0"	6'-5"	6'-1"
Hot & Humid	10AM		34'-6"	37'-6"	16½"	40"	503	401	9'-6"	11'-0"	6'-5"	6'-⅛
	11AM		34'-6"	37'-6"	16½"	40"	503	401	9'-6"	11'-0"	6'-7⅝"	6'-2"
Output increased in	12 NOON		36'-6"	41'-6"	30"	50"	548	448	10'-⅛"	11'-9⅛	6'-8⅞"	6'-3
both wells by DAT	1PM		36'-9"	41'-6"	30"	50"	548	448	10'-¾"	11'-10"	6'-9"	6'-3⅛
@ 11:30 AM. #1	2PM		36'-9"	41'-6"	30"	50"	548	448	10'-1"	11'-10"	6'-9"	6'-3⅛
increase from 16½"	3PM		37'-0"	41'-6"	30"	50"	548	448	10'-1⅛"	11'-10⅛"	6'-9¼"	6'-3⅛
to 20"; output: 548	4PM		37'-0"	41'-6"	30"	50"	548	448	10'-2"	11'-10¾"	6'-9½"	6'-3¾
#3 increase from 40"	5PM		37'-0"	41'-6"	30"	50"	548	448	10'-1⅛"	11'-10⅞"	6'-9⅞"	6'-3
to 50"; output: 448	6PM		37'-0"	41'-6"	30"	50"	548	448	10'-2"	11'-11"	6'-9¾"	6'-3¼
	7PM		37'-0"	41'-6"	30"	50"	548	448	10'-3⅛"	11'-11"	6'-10"	6'-3½
	8PM		37'-0"	41'-6"	30"	50"	548	448	10'-3¼"	11'-11"	6'-10⅛"	6'-3½
Warm & Humid	9PM		37'-0"	41'-6"	30"	50	548	448	10'-3⅛	11'-11¼	6'-10⅛"	6'-3⅛"
	10PM		37'-0"	41'-6"	30"	50"	548	448	10'-3"	11'-11⅛"	6'-10⅛"	6'-3⅛
	11PM		37'-0"	41'-6"	30"	50"	548	448	10'-3⅛"	12'-0"	6'-10¾"	6'-3¾
	12 MID		37'-0"	41'-6"	30"	50"	548	448	10'-3¾"	12'-½"	6'-10½"	6'-3¾
July 10 1974	1AM		37'-0"	41'-6"	30"	50"	548	448	10'-4"	12'-¾"	6'-10¾"	6'-4"
	2AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-¾	6'-11"	6'-4"
	3AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-1"	6'-11"	6'-4"
	4AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-1"	6'-11¼"	6'-4½
	5AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-1"	6'-11½"	6'-4¾
	6AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-1"	6'-11¾	6'-5"
	7AM		37'-0"	41'-6"	30"	50"	548	448	10'-4½"	12'-1"	6'-11¾"	6'-5"

PUMP-TEST LOG P... W HOLYOKE MASS. F. G. SULLIVAN DRILLING CO. D. TRIPP

Lancaster, Mass. 01523

CUSTOMER #1 & 2 — 8" WELLS

ENG.-OR-MAN-IN-CHARGE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	#1 Gauge Reading	#2 Gauge in Well	Water Head in Inches #1	#2	GPM #1	#2	#7 Water Level	#8 Water Level	#9 Water Level	#3 Water Level
STATICS		STATICS	4'	4'	#1	#2	#1	#2	3'-1½"	3'-3¾"	5'-4"	4'-7
	9 AM		27'-0"	41'-6"	20"	50"	549	449	10'-4½"	12'-1"	7'-½"	6'-5½
JULY 10, 1974	10 AM		27'-0"	41'-6"	20"	50"	549	449	10'-4½"	12'-1"	7'-½"	6'-5½
	11 AM		27'-0"	41'-6"	20"	50"	549	448	10'-4½"	12'-1"	7'-½"	6'-6"
	NOON		27'-3"	41'-6"	20"	50"	548	448	10'-5"	12'-1½"	7'-½"	6'-5½
	1 PM		27'-3"	41'-6"	20"	50"	548	448	10'-5"	12'-1½"	7'-¾"	6'-5½
WARM + Humid	2 PM		27'-3"	41'-6"	20"	50"	548	448	10'-5½"	12'-2"	7'-¾"	6'-5¾
	3 PM		27'-3"	41'-9"	20"	50"	548	448	10'-5½"	12'-2"	7'-1"	6'-5¾
	4 PM		27'-3"	41'-9"	20"	50"	548	448	10'-5¾"	12'-2½"	7'-1"	6'-6"
	5 PM		27'-3"	41'-9"	20"	50"	548	448	10'-5½"	12'-2¾"	7'-1¼"	6'-6"
	6 PM		27'-3"	41'-9"	20"	50"	548	448	10'-5½"	12'-2¾"	7'-1¼"	6'-6"
	7 PM		27'-3"	42'-0"	20"	50"	548	448	10'-6"	12'-3"	7'-1½"	6'-6¼
	8 PM		27'-3"	42'-0"	20"	50"	548	448	10'-6"	12'-3"	7'-1¾"	6'-6
	9 PM		27'-3"	42'-0"	20"	50"	548	448	10'-6¼"	12'-3"	7'-2"	6'-6
CLEAR + COOL	10 PM		27'-6"	42'-0"	20"	50"	548	448	10'-6½"	12'-3½"	7'-2½"	6'-7"
	11 PM		27'-6"	42'-0"	20"	50"	548	448	10'-6¾"	12'-3½"	7'-2½"	6'-6
	12 MID		27'-6"	42'-0"	20"	50"	548	448	10'-6½"	12'-3½"	7'-3"	6'-6
July 11 1974	1 AM		27'-6"	42'-0"	20"	50"	548	448	10'-6½"	12'-3½"	7'-3"	6'-[illegible]
DUNKER BROKE	2 AM		27'-6"	42'-0"	20"	50"	548	448	10'-6½"	12'-3½"	7'-3¼"	6'-[illegible]
OFF TAPE Add	3 AM		27'-6"	42'-0"	20"	50"	548	448	10'-6½"	12'-3¾"	7'-3¼"	6'-7½
only 8 in. To	4 AM		27'-6"	42'-0"	20"	50"	548	448	10'-7"	12'-4"	7'-3½"	6'-7
READINGS STAR	5 AM		27'-6"	42'-0"	20"	50"	548	448	10'-7¼"	12'-4"	7'-3½"	6'-8
TING AT 12 MID	6 AM		27'-6"	42'-0"	20"	50"	548	448	10'-7½"	12'-4"	7'-3½"	6'-5¾
	7 AM		27'-9"	42'-0"	20"	50"	548	448	10'-7½"	12'-4½"	7'-4"	6'-8½
	8 AM		27'-9"	42'-3"	20"	50"	548	448	10'-7¾"	12'-4½"	7'-4"	6'-8¾
	9 AM		27'-9"	42'-3"	20"	50"	548	448	10'-7¾"	12'-4½"	7'-4¼"	6'-8½
CLEAR + Cool	10 AM		27'-9"	42'-3"	20"	50"	548	448	10'-8"	12'-4¼"	7'-4¼"	6'-8¾
STATE SAMPLED	11 AM		27'-9"	42'-3"	20"	50"	548	448	10'-8"	12'-4½"	7'-4½"	6'-9"
TAKEN	12 NOON		27'-9"	42'-3"	20"	50"	548	448	10'-8¼"	12'-4¾"	7'-4½"	6'-9
	1 PM		27'-6"	42'-0"	20"	50"	548	448	10'-8"	12'-5"	7'-4½"	6'-8

PUMP-TEST LOG W. HOLYOKE MASS. F. G. SULLIVAN DRILLING CO. Lancaster, Mass. 01523 D. TRIPP

CUSTOMER #1 + 2 - 8" wells ENG.-OR-MAN-IN-CHARGE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	#1 Air Gauge Reading	#2 Tape Reading in Well	Orifice Head in Inches #1	Orifice Head in Inches #2	GPM #1	GPM #2	#7 Water Level	#8 Water Level	#9 Water Level	# Water Level
STATICS		STATICS	4'	4'					3'-1½"	3'-3¾"	5'-4"	4'-7¾
	3PM		37'-6"	43'-0"	30"	50"	548	448	10'-8¼"	13'-5"	7'-4½"	6'-9"
July 11 1974	4PM		37'-6"	43'-0"	30"	50"	548	448	10'-8¼"	13'-5¼"	7'-4¾"	6'-9¼
	5PM		37'-6"	43'-0"	30"	50"	548	448	10'-8½"	13'-5½"	7'-5"	6'-9¼"
	6PM		37'-6"	43'-0"	30"	50"	548	448	10'-8¼"	13'-5¼"	7'-5"	6'-9½
	7PM		37'-6"	43'-0"	30"	50"	548	448	10'-8¾"	13'-5½"	7'-5"	6'-9½
	8PM		37'-6"	43'-0"	30"	50"	548	448	10'-8¾"	13'-5½"	7'-5¼"	6'-9½
CLEAR+COOL	9PM		37'-6"	43'-0"	30"	50"	548	448	10'-9"	13'-5½"	7'-5¼"	6'-9½
	10PM		37'-6"	43'-0"	30"	50"	548	448	10'-9"	13'-5½"	7'-5¼"	6'-9½
	11PM		37'-6"	43'-0"	30"	50"	548	448	10'-9"	13'-5½"	7'-5¼"	6'-9½
	12MID		37'-6"	43'-0"	30"	50"	548	448	10'-9"	13'-5½"	7'-5½"	6'-9½"
July 12 1974	1AM		37'-6"	43'-0"	30"	50"	548	448	10'-9"	13'-5½"	7'-5½"	6'-9¾"
	2AM		37'-6"	43'-0"	30"	50"	548	448	10'-9½"	13'-5½"	7'-5½"	6'-9¾"
	3AM		37'-6"	43'-0"	30"	50"	548	448	10'-9½"	13'-5⅞"	7'-5½"	6'-9¾"
	4AM		37'-6"	43'-0"	30"	50"	548	448	10'-9¾"	13'-6½"	7'-5½"	6'-9¾"
CLEAR+COOL	5AM		37'-6"	43'-0"	30"	50"	548	448	10'-10"	13'-6½"	7'-5½"	6'-10"
	6AM		37'-6"	43'-0"	30"	50"	548	448	10'-10"	13'-6½"	7'-5¾"	6'-10"
	7AM		37'-6"	43'-0"	30"	50"	548	448	10'-10"	13'-6½"	7'-6"	6'-10"
	8AM		37'-6"	43'-0"	30"	50"	548	448	10'-10"	13'-6¾"	7'-6"	6'-9¾"
LAKER BREAKOFF	9AM		37'-6"	43'-0"	30"	50"	548	448	10'-10½"	13'-6¾"	7'-6½"	6'-9½"
ARE AND ONLY	10AM		37'-6"	43'-0"	30"	50"	548	448	10'-9½"	13'-6⅞"	7'-6⅞"	6'-9½"
½" IN. TO READINGS	11AM		37'-6"	38'-6"	30"	40"	548	401	10'-9¼"	13'-1"	7'-8¼"	6'-11½"
STARTING AT 9AM	12NOON		37'-6"	38'-6"	30"	40"	548	401	10'-9¼"	13'-1¼"	7'-8"	7'-0"
SET #2 PUMP BACK	1PM		37'-6"	38'-6"	30"	40"	548	401	10'-9¼"	13'-1¼"	7'-8"	7'-0"
TO 40" OR 401	2PM		37'-6"	38'-6"	30"	40"	548	401	10'-9¼"	13'-1½"	7'-8"	7'-0"
@ 10:15AM. DAT	3PM		37'-6"	38'-6"	30"	40"	548	401	10'-9½"	13'-1½"	7'-8¼"	7'-¼"
	4PM		37'-6"	38'-6"	30"	40"	548	401	10'-9½"	13'-1½"	7'-8½"	7'-¼"
CLEAR+COOL	5:30PM		37'-6"	38'-6"	30"	40"	548	401	10'-9¾"	13'-1¾"	7'-8½"	7'-¼"
	6PM		37'-6"	38'-6"	30"	40"	548	401	10'-9¾"	13'-1¾"	7'-8¾"	7'-¼"
	7PM		37'-6"	38'-6"	30"	40"	548	401	10'-9½"	13'-1½"	7'-8¾"	7'-½"

PUMP-TEST LOG W. Holyoke Mass — E O R C

CUSTOMER #1 + 2 - 8" WELLS

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

D. TRIPP.
ENG.-OR-MAN-IN-CHARGE

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Air Line Reading	Tape Reading in Feet	Orifice Head in Inches #1	Orifice Head in Inches #2	GPM #1	GPM #2	Water Level #3	Water Level #6	Water Level #9	Water Level #[illegible]
STATICS		STATICS	4'	4'	#1	#2	#1	#2	3'-1½"	3'-3⅞"	5'-4"	4'-7
	9 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10"	13'-3¼"	7'-8¾"	7'-½
July 13, 1974	10 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-3¼"	7'-8¾"	7'-¼
	11 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-3⅛"	7'-8¾	7'-¾"
	12 MID.		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¾"	7'-8¾"	7'-¾"
July 13, 1974	1 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¾"	7'-8¾"	7'-¾"
	2 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¾"	7'-8¾"	7'-¾"
	3 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-8½"	7'-¾"
	4 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10"	13'-2½"	7'-8¾"	7'-¾"
	5 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-9"	7'-¾"
	6 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-8¾"	7'-¾"
	7 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¾"	7'-9"	7'-¾"
CLEAR + WARM	8 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¾"	7'-9"	7'-¾"
	9 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-9"	7'-¾"
	10 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10½"	13'-2½"	7'-9"	7'-1"
	11 AM		27'-6"	38'-6"	20"	40"	548	401	10'-10½"	13'-2½"	7'-9"	7'-1"
	12 Noon		27'-6"	38'-6"	20"	40"	548	401	10'-10½"	13'-2½"	7'-9"	7'-1"
	1 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10½"	13'-2½"	7'-9"	7'-1"
13 July 74	2 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¼"	7'-9¼"	7'-1"
	3 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10"	13'-2¼"	7'-9½"	7'-1"
	4 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¼"	7'-9½"	7'-1"
	5 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¼"	7'-9½"	7'-1¼"
CLEAR + WARM	6 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2¼"	7'-9½"	7'-1¼"
	7 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-9½"	7'-1¼"
SHUT DOWN TEST	8 PM		27'-6"	38'-6"	20"	40"	548	401	10'-10¼"	13'-2½"	7'-9½"	7'-1
@ 8 PM	SHUT DOWN PUMP TEST — START RECOVER READ											
SAMPLES TAKEN												
	8.01		7'	7'	—	—	—	—	5'-9½"	6'-3"		
	8.02		7'	7'	—	—	—	—	5'-9½"	5'-9¾"		
	8.03		6'-6"	6'-9"					5'-6¾"	5'-8¼"		

PUMP-TEST LOG PEQUOT WATER CO — F. G. SULLIVAN DRILLING CO., Lancaster, Mass. 01523 — RECOVERY RE…

JSTOMER W. Holyoke, MASS — ENG.-OR-MAN-IN-CHAR…

START PUMP TEST READINGS BELOW THIS LINE

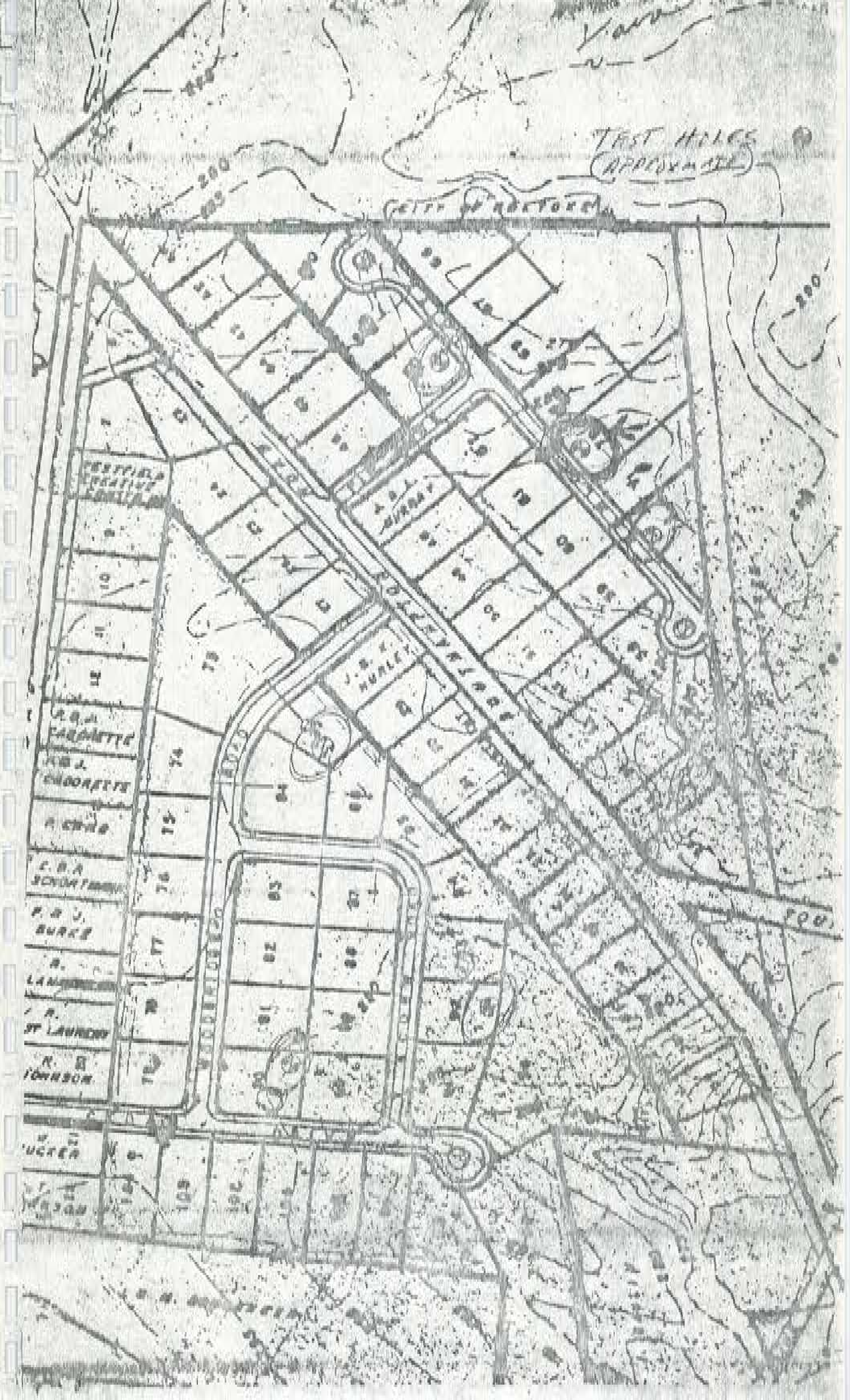
Date, Weather and Sample Taken	Time	Water Temperature	#1 Gauge Reading	#2 Tape Meas't in Well	Orifice Head in Inches	GPM	#7 Water Level	#5 Water Level	#9 Water Level	#5 Water Level
	STATICS		4'—	4'—	—	—	3'-1 1/2"	3'-3 3/4	5'-4"	4'-7 3/4
3 JULY 74	9.05		6-3"	6-3"			5'-5 3/4"	5-5 3/4		
pm	9.07		6'-3"	6'-3"			5'-5 1/4"	5'-5 1/2"		
	9.09		6-3"	6'-3"			5'-5"	5'-5"		
	9 11		6-3"	6'-3"			5'-5"	5'-5"		
	9 13		6-3"	6'-3"			5'-4 3/4"	5'-4 3/4"		
	9 15		6-3"	6'-3"			5'-4 3/4"	5'-4 1/2"		
	9 30		6-3"	6'-3"			5'-3 3/4"	5'-2 1/2"	7'-4"	6'-6 1/2
CLEAR - WARM	9.00		6'—	6'—			5'-2 3/4"	5'-1 3/4	7'-3 1/2"	6'-5 1/2
	10:00						5'-1"	5'—	7'-3"	6'-5
	11:00						5'—	4'-11 1/2"	7'-2"	6'-4"
	12:00		6'-0	6-0			4'-11"	4'-10"	7'-1 1/2"	6'-3
4 JULY 74	1:00						4'-10 1/2"	4'-9 1/2	7'-1/2"	6'-3 1/2
am	2 00						4'-9 1/2"	4'-9	7'-1/2"	6'-2 1/2
	3 00						4'-9"	4'-8 3/4	7'—	6'-1 1/2
	4.00						4'-9"	4'-9"	6'-11 1/2"	6'-3/4
	5 00						4'-8 1/2"	4'-8"	6'-11"	6'-1/2"
	6.00						4'-7 1/2"	4'-7 1/2"	6'-10 1/2"	5'-11 1/2
"	7 00						4'-7 1/2"	4'-7 1/2"	6'-10 1/2"	5'-11 1/2
	8 00		5'-0"	5'-0"			4'-7"	4'-6 1/2"	6'-9 3/4"	5'-11"
	9.00						4'-6 1/2"	4'-6"	6'-9 1/2"	5'-11"
CLEAR - WARM	10 00						4'-6 1/4"	4'-5 1/2"	6'-9 1/2"	5'-10 1/2
	11 00						4'-6"	4'-5 1/2	6'-9"	5'-10 1/2
	12 00		5-0	5-0			4'-5 1/2"	4'-5"	6'-9 3/4"	5'-10
PM.	1.00						4'-5 1/2	4'-5"	6'-9 1/2	5'-10"
	2.00						4'-5 1/2	4'-5	6'-9 1/2	5'-10"
	3.00						4'-5"	4'-4 1/2"	6'-9"	5'-9 3/4
	4.00						4'-4 3/4	4'-4"	6'-7 3/4"	5'-9 3/4
"	5.00						4'-3 3/4	4'-3 3/4	6'-7 3/4	5'-9 3/4

PUMP-TEST LOG Pequot Water Co. **F. G. SULLIVAN DRILLING CO.** Recovery Readin[gs]

JSTOMER W. Holyoke, Mass Lancaster, Mass. 01523 ENG.-OR-MAN-IN-CHAR[GE]

START PUMP TEST READINGS BELOW THIS LINE

Date, Weather and Sample Taken	Time	Water Temperature	Alt. Gauge Reading	Tape Meas'nt in Well	Orifice Head in Inches	GPM	T Water Level	3 Water Level	4 Water Level	3 Water Level
	STATICS		—	—	—	—	3'-1½"	3'-3¾"	5'-4"	4-7
14 July 74	7.00						4'-4"	4-3"	6-7"	5-9
	8.00						4'-4"	4'-3"	6-7"	5'-8¾
15 July 74	8 AM						4'-4"	4'-3¼"	6-7	5-9


TEST HOLES
(APPROXIMATE)
BURKE
JOHNSON

THOMAS F. PITONIAK
REGISTERED SANITARIAN
PERCOLATION TESTING

HONEY POT ROAD
WESTFIELD, MASS. 01085
562-4341

June 1, 1981

Westfield Savings Bank
Westfield, Massachusetts

Attention: Mr. Arthur Knapp

Gentlemen:

These are the test results on building lots on County Road, Southampton Road and Ross Road (according to the plan of Ronald Collins) in the City of Holyoke.

Lots 1-5 Ross Road were tested on 8-9-79. Because of the ground water encountered at 5½ feet on Lots 2,3,4, Mr. Cortis (of the Holyoke Health Department) wants the lots retested during the wettest period possible.

On the following lots, all deepholes were excavated to a depth of twelve feet and no ground water was encountered. Percolation rates were all less than two minutes per inch.

Lot #6	County Road	Tested July 18, 1979	Medium sand
7	County Road	August 3, 1979	Medium sand.
8	Coupty Road	August 3, 1979	Medium sand
9	County Road	August 3, 1979	Coarse gravel
10	County Road	August 3, 1979	Coarse gravel
11	County Road	August 3, 1979	Coarse gravel
12	County Road	August 3, 1979	Coarse gravel
13	County Road	August 3, 1979	Coarse gravel
Lot 23	Southampton Road	July 18, 1979	Medium sand
24	Southampton Road	July 18, 1979	Medium sand
25	Southampton Road	July 18, 1979	Medium sand
26	Southampton Road	July 18, 1979	Medium sand
27	Southampton Road	July 1.8,1979	Medium sand
29	Southampt@n Road	July 12, 1979	Medium sand.
32	Southampton Road	July 17, 1979	Medium sand
33	Southampton Road	July 25, 1979	Fine gravel
34	Southampton Road	July 25, 1979	Coarse gravel
35	Southampton Road	July 25, 1979	Coarse gravel
36	Southampton Road	July 25, 1979	Coarse gravel
37	Southampton Road	July 25, 1979	Coarse gravel
38	Southampton Road	July 25, 1979	Medium sand
39	Southampton Road	July 25, 1979	Medium sand

- Continued-

THOMAS F. PITONIAK
REGISTERED SANITARIAN
PERCOLATION TESTING

HONEY POT ROAD
WESTFIELD, MASS. 01085
562-4361

June 1, 1981

Westfield Savings Bank - Soil tests - Holyoke

Lot #40 Southampton Road	Tested July 25, 1979	Medium sand
41 Southampton Road	August 3,1979	Medium sand
42 Southampton Road	August 3, 1979	Medium sand
43 Southampton Road	August 3, 1979	Medium sand
44 Southampton Road	July 18, 1979	Medium sand
45 Southampton Road	July 18, 1979	Medium sand
46 Southampton Road	July 18, 1979	Medium sand
48 Southampton Road	July 18, 1979	Medium sand
49 Southampton Road	July 18, 1979	Medium sand
51 Southampton Road	July 18, 1979	Medium sand
52 Southampton Road	July 18, 1979	Medium sand
54 Southampton Road	Tested August 9, 1979	Mediumsand
55 Southampton Road	Agusut 9, 1979	Medium sand
56 Southampton Road	August 9, 1979	Medium sand

The testing was witnessed by Mr. Kagan of the Holyoke Health Department.

Sincerely,

Thomas F. Pitoniak

Thomas F. Pitoniak
Registered Sanitarian #653

TFP:c

MASSACHUSETTS
THOMAS F. PITONIAK
NO. 653
REGISTERED SANITARIAN

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

Driller: STEVE SULLIVAN — Names of Helpers: JAMES LAWSON

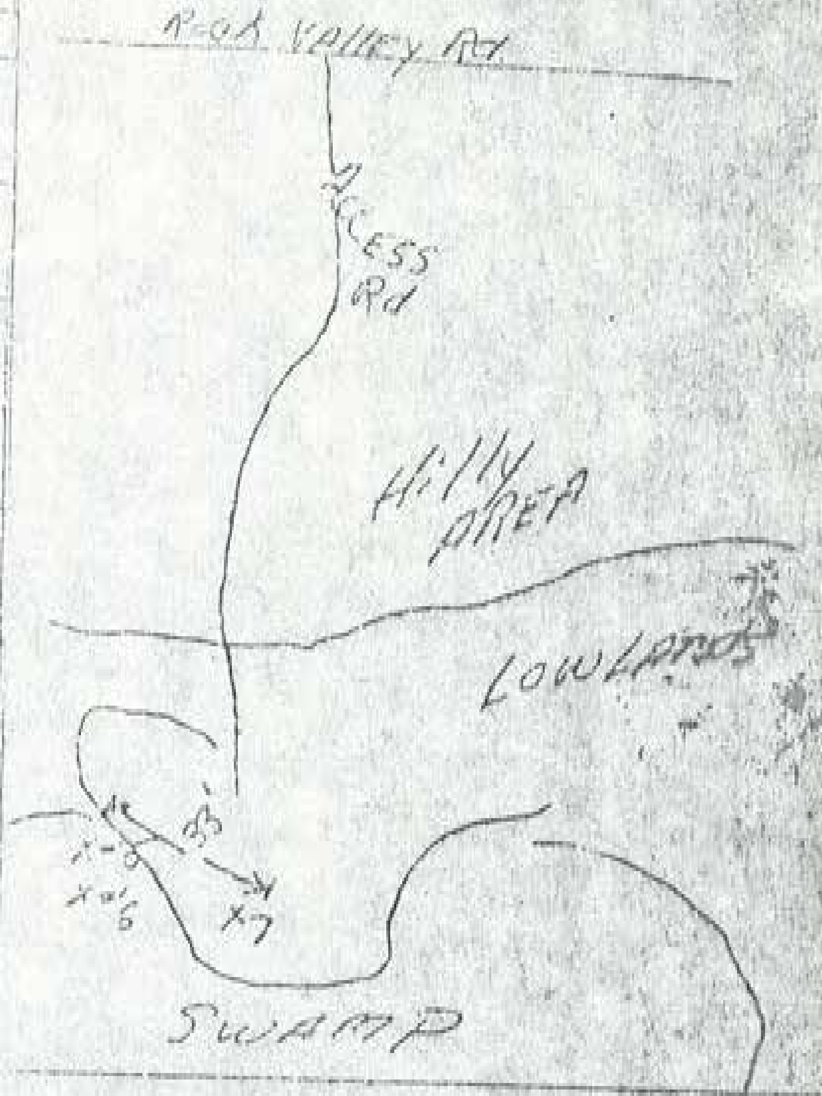
Job & Location: PEQUOT WATER Co. OFF ROCK Valley Rd. W. Holyoke Mass.

Started: 20 MAY 74 — Date Finished: 21 MAY 74

#7 2½" OBS

Classification of Material	
15 MED SAND	**Feet of Screen Exposed** 5
0 MED SAND	
25 MED SAND	**Size of Screen & Slot** 40 SLOT 5' 3' EXT.
0 MED SAND	**Screen Left In**
35 MED SAND	
0 MED SAND	**Screen Pulled Out**
45 FINE SAND	
2 SILTY SAND	**Pipe Left In** 81' OF 2½"
5 SILTY SAND	
0 FINE SAND	**Pipe Pulled Out**
5 MED SAND	
0 COARSE SAND	**Remarks** STATIC 2'9" 1' A.G. G.P.M. 75 DEPTH 87'
5 FINE SAND	
0 COARSE SAND	
5 COARSE SAND	
7 MED SAND	

SITE PLAN



Pump Test on Hole No.

Time	Dr. Down	G.P.M.	Static and Other Info.
MAY 74 SET 40 SLOT 5' SCREEN AT 87' PUMPING 5 G.P.M. FOR 2 HRS.			

Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

...of Driller STEVE SULLIVAN   Names of Helpers JAMES LAWSON

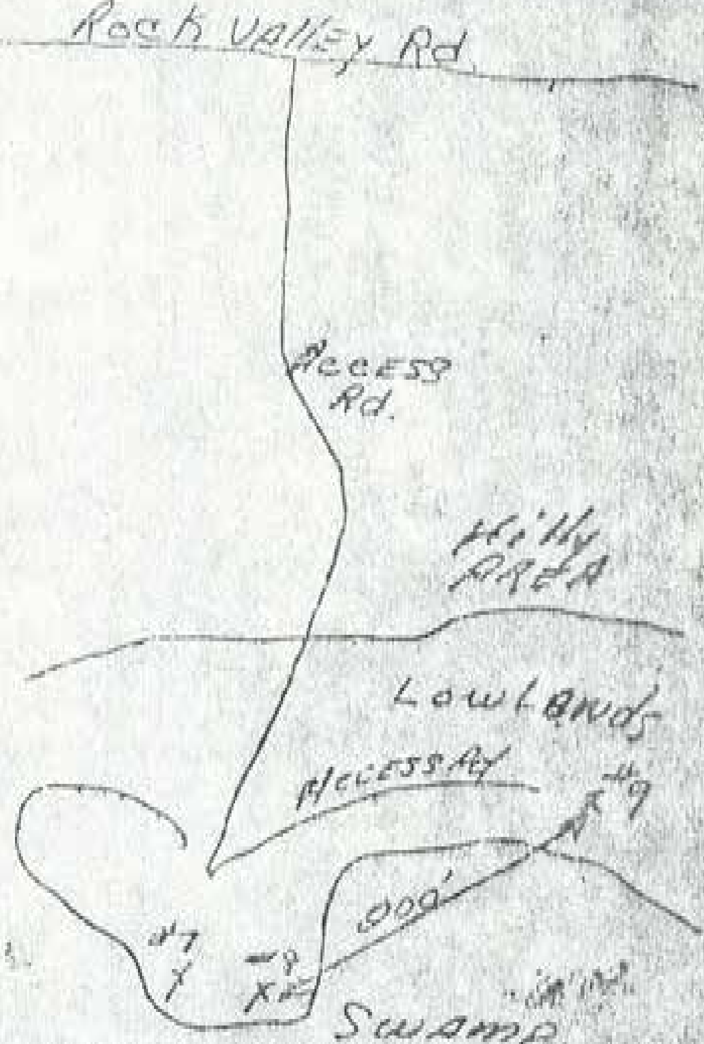
...to Location PEQUOT WATER CO. OFF ROCK VALLEY Rd W. Holyoke

...arted 21 MAY 74   Date Finished 22 MAY 74

...9 2½" OBS.

To	Classification of Material	
5	to MED GRAVEL	Feet of Screen Exposed
10	to MED GRAVEL	Size of Screen & Slot: 30 SLOT 5' 3' EXT.
5	to MED SAND	Screen Left in
20	to MED SAND	
5	to FINE SAND	Screen Pulled Out
30	to FINE SAND	
5	to FINE SAND	Pipe Left in: 85' OF 2½"
40	to Silty Sand	
5	to Silty Sand	Pipe Pulled Out
50	to Silty Sand	
5	to Silty Sand	Remarks: STATIC 4.9½ 0' A.G. G.P.M. 10 DEPTH 88'
70	to Silty Sand	
	to MED SAND	
80	to COARSE Sand	
	to COARSE Sand	
	→ GRAVEL	
	to COARSE SAND	
	↓ GRAVEL	

SITE PLAN



Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.
...ay74 SET 5' 30 SLOT				
SCREEN AT 88' pumping				
G.P.M FOR 2 HRS.				

Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

Name of Driller: FRANK SULLIVAN — Names of Helpers: MIKE HASSELMANN

Name & Location: PEQUOT WATER CO. OFF ROCK VALLEY RD W. HOLYOKE MASS

Date Started: 17 JUNE 74 — Date Finished: 15 JULY 74

Well No.: 1 - 8" GRAVEL WELL

To	Classification of Material
4'	GRAVEL FILL
6'	BLACK LOAM
10'	B/ FINE SAND
20'	B/ MED SAND
30'	B/ MED SAND
36'	B/ COURSE SAND
40'	RED/ MED SAND
50'	RED/ FINE SAND + CLAY
55	RED/ COURSE SAND
60'	RED/ FINE GRAVEL
	B/ MED GRAVEL
65'	+ MED SAND
70'	B/ FINE GRAVEL
75'	B/ FINE GRAVEL
80'	B/ FINE GRAVEL
[illegible]	B/ FINE GRAVEL

Feet of Screen Exposed: 10'

Size of Screen & Slot: 8" - 50 SLOT

Screen Left in: 10' OF 8" - 50 SLOT WITH 2'-9" EXT

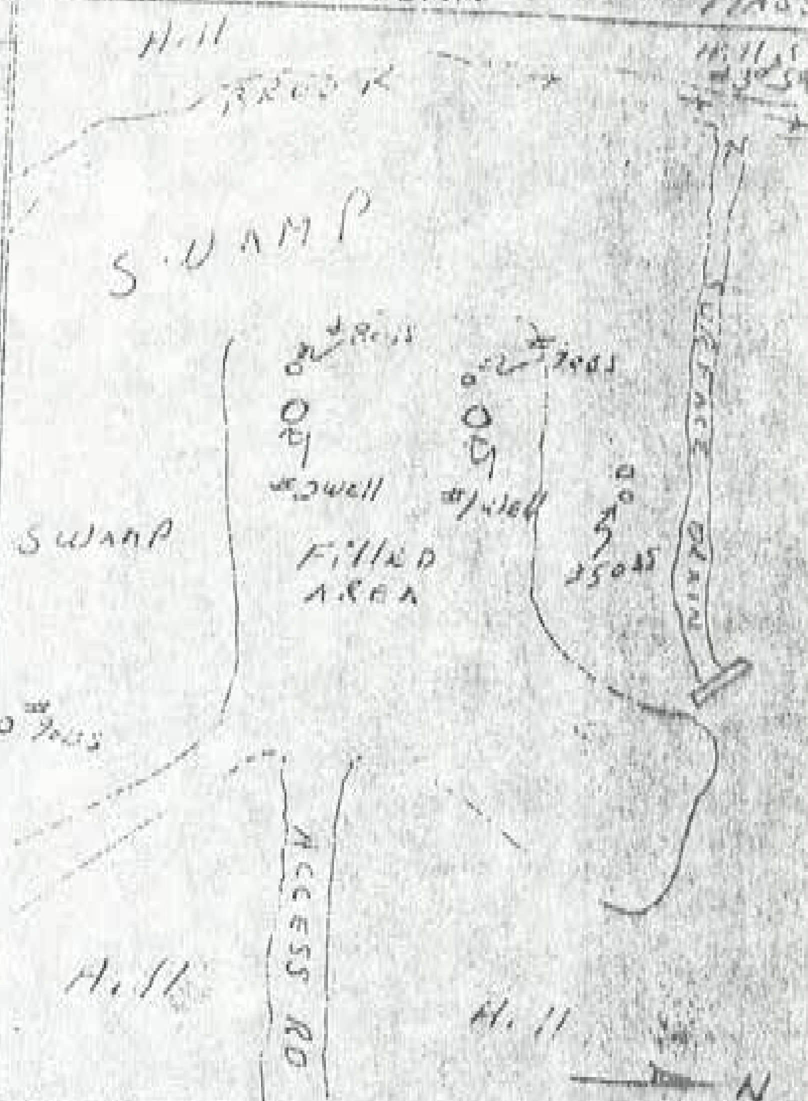
Screen Pulled Out: ______

Pipe Left in: 73' OF 8"

Pipe Pulled Out: 10' OF 8"

Remarks: BOTTOM - 83' TOP OF SCREEN 70'-3" TOP OF 8" PIPE ABOVE GROUND 8"

SITE PLAN



Pump Test on Hole No.

Time	Dr. Down	G.P.M.	Static and Other Info.

[illegible]NE — IN 8" WELL STATIC 3'-1½"
#7 OBS " 3'-½"
PUMP + SURGE 17 HRS
AT 330 G.P.M.
DRAW DOWN IN 8" WELL 15'-4½"
" " IN #2 OBS 5'-7"
" " IN #8 OBS 4'-4½"

[illegible]NE 74 SET 50' OF 5" [illegible]
WITH 300' DISCHARGE LINE
FOR 5 DAY PUMPING TEST

Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.

... DRILLING CO.
Lancaster, Mass. 01523

Name of Driller: FRANK SULLIVAN — Names of Helpers: MIKE HASSELMANN

Name & Location: PEQUOT WATER CO. OFF ROCK VALLEY RD. W. HARTFORD

Date Started: 18 JUNE 74 — Date Finished: 15 JULY 74

Hole No.: 2 - 8" WELL

To	Classification of Material
3'	GRAVEL FILL
4'	BLACK LOAM
10'	B/ FINE GRAVEL
20'	B/ FINE GRAVEL
30'	RED/MED SAND
36'	RED/MED SAND
40'	RED/FINE SAND
50'	R/ FINE SAND
60'	R/ FINE SAND CLAY
66'	R/FINE SAND + CLAY
78'	B/ FINE GRAVEL
80'	B/ MED SAND
85'	B/ FINE GRAVEL
90'	B/ MED SAND + GRAVEL
92'	B/ MED SAND + GRAVEL

Feet of Screen Exposed: 10'

Size of Screen & Slot: 8" — 5' - 50 TOP; 5' - 40 BOTT

Screen Left in 2' 5" ... : 10' OF 8"

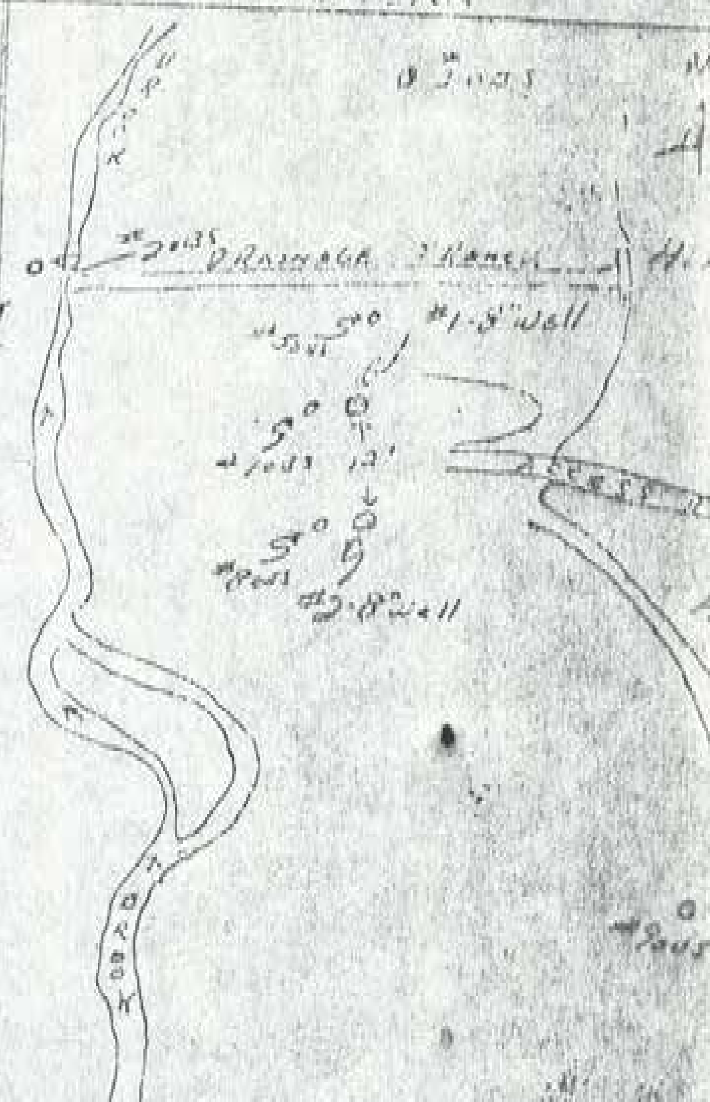
Screen Pulled Out: ______

Pipe Left In: 83' OF 8"

Pipe Pulled Out: 10' OF 8"

Remarks:
BOTTOM - 92'
STATIC - 3'3"
PIPE A.G. - 8"

SITE PLAN



Pump Test on Hole No.

Time	Dr. Down	G.P.M.	Static and Other Info.
STATIC		IN 8" WELL	3'3"
"		" #8 OBS	3'1"
PUMP + SURGE FOR 15 HRS			
PUMP	275	G.P.M.	WITH
DRAW DOWN		IN 8" W	22'3"
	"	IN #8 OBS	6'4"
SET	60'	OF 5"	TURBINE
FOR PUMPING TEST			
	200'	DISCHARGE PIPE	
		6 X 5 ORFICE	

Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.

[illegible] DRILLING CO.
Lancaster, Mass. 01523

Name of Driller: FRANK SULLIVAN — Names of Helpers: MIKE HASS[illegible]

Name & Location: PEQUOT WATER CO. OFF ROCK VALLEY RD. W.[illegible]

Date Started: 18 JUNE 74 — Date Finished: 15 JULY 74

Hole No.: 2 - 8" WELL

To	Classification of Material
3'	GRAVEL FILL
4'	BLACK LOAM
10'	B/ FINE GRAVEL
20'	B/ FINE GRAVEL
30'	RED/MED SAND
36'	RED/MED SAND
40'	RED/FINE SAND
50'	R/ FINE SAND
60'	R/ FINE SAND & [illegible]
66'	R/FINE SAND + CLAY
72'	B/ FINE GRAVEL
83'	B/ MED SAND
85'	B/ FINE GRAVEL
90'	B/ MED SAND + GRAVEL
92'	B/ MED SAND + GRAVEL

Feet of Screen Exposed: 10'±

Size of Screen & Slot: 8" — 5' - 50 TOP; 5' - 40 BOT

Screen Left in: 8'5" [illegible] — 10' OF 8"

Screen Pulled Out: ———

Pipe Left in: 83' OF 8"

Pipe Pulled Out: 10' OF 8"

Remarks:
BOTTOM - 92'
STATIC - 3'3"
PIPE A.G. - 8"

SITE PLAN

Pump Test on Hole No.

Time	Dr. Down	G.P.M.	Static and Other Info.
STATIC		IN 8" WELL	3'3"
"		" #8085	3'1"
PUMP + SURGE FOR 15 HRS			
PUMP 275 G.P.M. WITH			
DRAW DOWN IN 8" W			22'3"
"	"	IN #8085	6'4"
SET 60' OF 5" TURBINE			
FOR PUMPING TEST			
	200' DISCHARGE PIPE		
			[illegible] ORFICE

Pump Test on [illegible]

Date	Time	Dr. Down	G.P.M.

Mailing Address:
P. O. Box 3118
St. Paul, Minn. 55165

SAND ANALYSIS

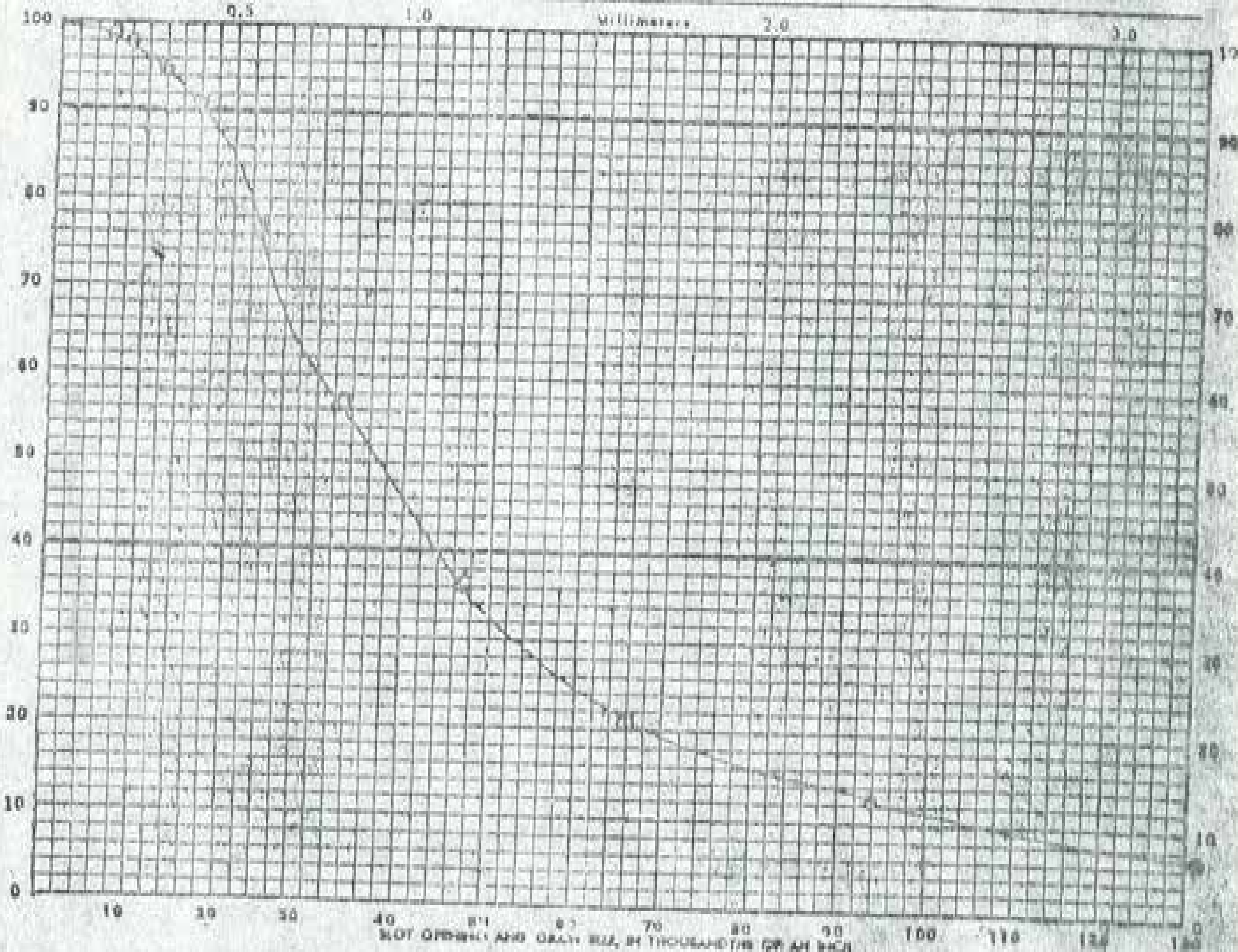
Johnson Division
Universal Oil Products Co.
1950 Old Highway 8
Saint Paul, Minnesota

Sample sent in by: F. G. Sullivan Drilling Co

Town: W. Holyoke   State: MASS   Date: 20 JUNE 74

From well of: PEQUOT WATER Co

Remark: #2 - 8" GRAVEL WELL
80' - TO 85'



SIEVE OPENINGS	CUMULATIVE PER CENT RETAINED		
.132	7		
.094	17½		
.066	31		
.047	37		
.033	57		
.023	77		
.016	91		
.012	96		
.008	98		
.006	99		
	100		

Notes:

Recommended Slot Opening: 50

Recommended Screen: Dia. ____ in. Length ____ Ft.

By: ____

SO MANY CONSIDERATIONS ENTER INTO THE MAKING OF A GOOD WELL THAT, WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED FROM SAND SAMPLES ARE CORRECT WE ASSUME NO RESPONSIBILITY FOR THE SUCCESSFUL OPERATION OF JOHNSON WELL SCREENS

Mailing Address:
P. O. Box 3118
St. Paul, Minn. 55165

SAND ANALYSIS

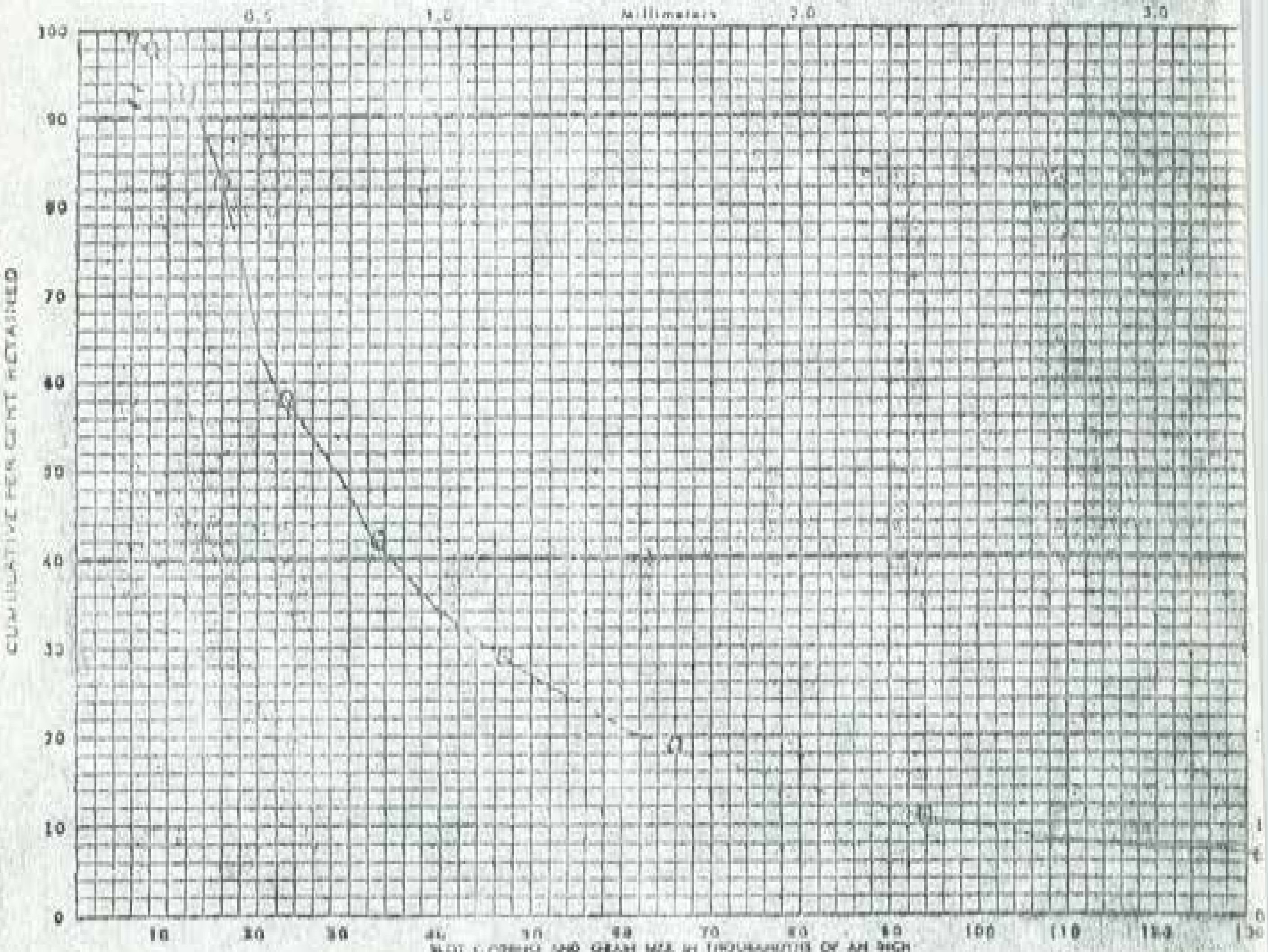
Johnson Division
Universal Oil Products Co.
1950 Old Highway 8
Saint Paul, Minnesota

Sample sent in by F [illegible]

Town [illegible] State [illegible] Date [illegible]

From well of [illegible]

Remark #2 8 [illegible] 35 [illegible]



SIEVE OPENINGS	CUMULATIVE PER CENT RETAINED		
.131	[illegible]		
.094	[illegible]		
.066	[illegible]		
.047	[illegible]		
.033	[illegible]		
.023	[illegible]		
.016	[illegible]		
.012	[illegible]		
.008	[illegible]		
.006	[illegible]		

Notes:

Recommended Slot Opening: [illegible]

Recommended Screen: Dia. ______ in. Length ______ Ft.

By: ______

[illegible] CONSIDERATIONS ENTER INTO THE MAK[illegible] GOOD WELL THAT WHILE WE BELIEVE SLOT SIZES FURNISHED OR RECOMMENDED [illegible] SAND SAMPLES ARE CORRECT WE ASSU[illegible] RESPONSIBILITY FOR THE SUCCESSFUL OPERATION OF JOHNSON WELL SCREENS

F. G. SULLIVAN DRILLING CO.
Lancaster, Mass. 01523

Name of Driller: FRANK SULLIVAN — Names of Helpers: MIKE HASSELMAN

Name & Location: PEQUOT WATER CO. OFF ROCK VALLEY RD W. Holyoke

Date Started: 17 JUNE 74 — Date Finished: 15 July 74

Hole No.: 1 - 8" GRAVEL WELL

Depth To	Classification of Material
4'	GRAVEL FILL
6'	BLACK LOAM
10'	B/ FINE SAND
20'	B/ MED SAND
30	B/ MED SAND
36'	B/ COURSE SAND
40'	RED/ MED SAND
50'	RED/ FINE SAND + CLAY
55	RED/ COURSE SAND
60'	RED/ FINE GRAVEL
	B/ MED GRAVEL
65'	+ MED SAND
70'	B/ FINE GRAVEL
75'	B/ FINE GRAVEL
80'	B/ FINE GRAVEL
83'	B/ FINE GRAVEL

Feet of Screen Exposed: 10'

Size of Screen & Slot: 8" - 50 Slot

Screen Left in: 10' of 8" - 50 Slot WITH 2' 9" EXT

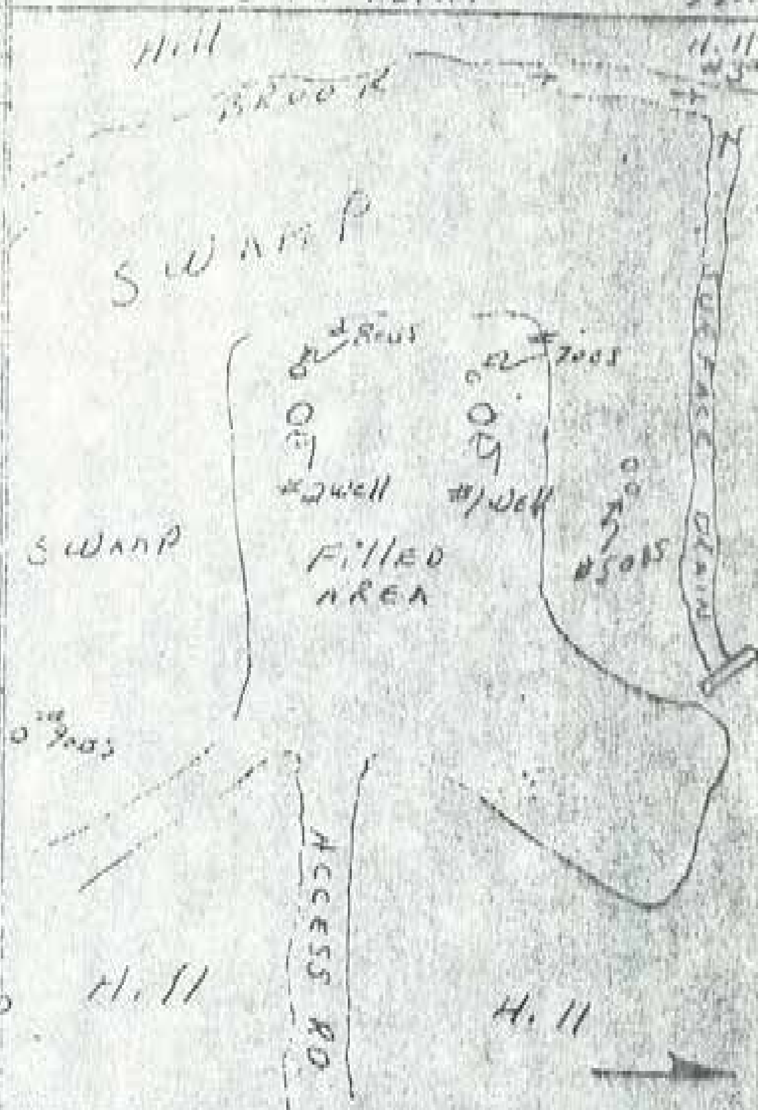
Screen Pulled Out: ———

Pipe Left in: 73' of 8"

Pipe Pulled Out: 10' of 8"

Remarks: BOTTOM - 83' TOP OF SCREEN 70' - 3" TOP OF 8" PIPE ABOVE GROUND 8"

SITE PLAN



Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.
JUNE		IN 8" Well STATIC 3' 1½"		
		#7 OBS		" 3' ½"
PUMP + SURGE 17 HRS				
	AT 330 G.P.M.			
	DRAW DOWN IN 8" well 15' 4½"			
	"	"	IN #7 OBS	5' 7"
	"	"	IN #5 OBS	4' 4½"
JUNE 74	SET 50' OF 5" [illegible]			
	WITH 200' DISCHARGE LINE			
	FOR 5 DAY PUMPING TEST			

Pump Test on Hole No.

Date	Time	Dr. Down	G.P.M.	Static and Other Info.

APPENDIX B

WATER QUALITY DATA

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
WESTERN REGIONAL OFFICE
INTERPRETATION OF RESULTS OF CHEMICAL EXAMINATION OF WATER

Arsenic (As)

This element occurs naturally in the environment, especially in the western United States, and it is also used in insecticides. It is found in tobacco, shellfish, drinking water, and in the air in some locations. The standard allows for 0.05 milligrams of arsenic per liter of water. If persons drink water that continuously exceeds the standard by a substantial amount over a lifetime, they may suffer from fatigue and loss of energy. Extremely high levels can cause poisoning.

Barium (Ba)

Although not as widespread as arsenic, this element also occurs naturally in the environment in some areas. It can also enter water supplies through industrial waste discharges. Small doses of barium are not harmful. However, it is quite dangerous when consumed in large quantities. The maximum amount of barium allowed in drinking water by the standard is 1.0 milligram per liter of water.

Cadmium (Cd)

Only minute amounts of this element are found in natural waters in the United States. Waste discharges from the electroplating, photography, insecticide, and metallurgy industries can increase cadmium levels, however. The most common source of cadmium in our drinking water is from galvanized pipes and fixtures. But the main sources of cadmium exposure are the foods we eat and cigarette smoking. The maximum amount of cadmium allowed in drinking water by the standard is 0.010 milligrams per liter of water.

Chromium (Cr^{+6})

This metal is found in cigarettes, some of our foods, and the air. Some studies suggest that in minute amounts, chromium may be essential to human beings, but this has not been proven. The standard for chromium is 0.05 milligrams per liter of water.

Lead (Pb)

This metal is found in the air and in our food. It comes from lead and galvanized pipes, auto exhausts, and other sources. The maximum amount of lead permitted in drinking water by the standards is 0.05 milligrams per liter of water. Excessive amounts well above this standard may result in nervous system disorders or brain or kidney damage.

Mercury (Hg)

Mercury is found naturally throughout the environment. Large increases in mercury levels in water can be caused by industrial and agricultural use. The health risk from mercury is greater from mercury in fish than simply from water-borne mercury. Mercury poisoning may be acute, in large doses, or chronic, from lower doses taken over an extended time period. The maximum amount of mercury allowed in drinking water by the standard is 0.002 milligrams per liter of water. That level is 13 percent of the total allowable daily dietary intake of mercury.

Selenium (Se)

This mineral occurs naturally in soil and plants, especially in western States. It is found in meat and other foods. Although it is believed to be essential in the diet, there are indications that excessive amounts of selenium may be toxic. Studies are underway to determine the amount required for good nutrition and the amount that may be harmful. The standard for selenium is 0.01 milligrams per liter of water. If selenium came only from drinking water, it would take an amount many times greater than the standard to produce any ill effects.

Silver (Ag)

Silver is sometimes used in disinfecting drinking water but this metal should not pose any problem in this area. Because of the evidence that silver, once absorbed, is held indefinitely in tissues, particularly the skin, without evident loss through usual channels of elimination or reduction by transmigration to other body sites; and because of other factors, the maximum amount of silver allowed in drinking water by the standard is 0.05 milligrams per liter of water.

Fluoride

This is a natural mineral and all drinking water contains some fluoride. High levels of fluoride in drinking water can cause brown spots on the teeth, or mottling, in children up to 12 years of age. Adults can tolerate ten times more than children. In the proper amounts, however, fluoride in drinking water prevents cavities during formative years. This is why many communities add fluoride in controlled amounts to their water supply. The maximum amount of fluoride allowed in drinking water by the standard ranges from 0.4 milligrams per liter of water to 2.4 milligrams, depending on the average maximum daily air temperature. The hotter the climate, the lower the amount allowed, for people tend to drink more in hot climates. In this area, the maximum contaminant level for fluoride is 2.0 milligrams per liter of water.

Nitrate

Nitrate in drinking water above the standard poses an immediate threat to children under three months of age. In some infants, excessive levels of nitrate have been known to react with the hemoglobin in the blood to produce an anemic condition commonly known as "blue baby". If the drinking water contains an excessive amount of nitrate, it should not be given to infants under three months of age and not to be used to prepare formula. The standard allows for 10.0 milligrams of nitrate (as N) per liter of water.

Pesticides

Millions of pounds of pesticides are used on croplands, forests, lawns, and gardens in the United States each year. They drain off into surface waters or seep into underground water supplies. Many of them may pose health problems if they get into drinking water and the water is not properly treated. The maximum limits for pesticides in drinking water are:

Endrin, 0.0002 milligrams per liter
Lindane, 0.004 milligrams per liter
Methoxychlor, 0.1 milligrams per liter
Toxaphene, 0.005 milligrams per liter
2,4-D, 0.1 milligrams per liter
2,4,5-TP Silvex, 0.01 milligrams per liter

Mass and Volume Conversions

1 liter	=	1.057 Quarts
1 Milligram	=	0.001 Gram
1 Gram	=	0.035 Ounce

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
WESTERN REGIONAL OFFICE
INTERPRETATION OF RESULTS OF WATER SUPPLY ANALYSIS

Turbidity

The presence of suspended material such as clay, silt, finely divided organic and inorganic matter, plankton, and other micro-organisms in water is known as turbidity. Light is scattered or absorbed by this suspended matter resulting in loss of clarity. Bacteria may hide in this suspended matter and may even survive disinfection. The maximum contaminant level is 1.0 turbidity unit for surface water sources. (see Regulations)

Sediment

Any organic or inorganic material that settles to the bottom of the container is referred to as sediment. The range is from 0 (no sediment) to 5 (indicating a heavy sediment layer). High levels of sediment are objectionable for esthetic reasons.

Color

Dissolved organic material from decaying vegetation and certain inorganic matter cause color in water. Excessive blooms of algae or other micro-organisms may also impart color. While not usually detrimental from a health standpoint, excessive color is esthetically objectionable. A color of 15 units is the recommended limit.

Odor

Odor in water can be caused by foreign matter such as organic compounds, inorganic salts, or dissolved gases. These materials are derived from industrial, domestic, agricultural, or natural sources. Acceptable waters should be free of any objectionable odor. An odor threshold of 3 is the recommended limit.

pH

pH is a measure of the hydrogen ion (H+) concentration in water. Values range from 0 to 14. A value of 7 indicates neutral water; values less than 7, increasing acidity; and values greater than 7 indicates increasing alkalinity. The pH of water often varies from 4.0 to 9.0. Determination of pH assists in the control of corrosion and in adequate control of disinfection.

Alkalinity

The alkalinity of water is a measure of its ability to neutralize a strong acid. Alkalinity is imparted to water by bicarbonate (HCO_3), carbonate (CO_3), and/or hydroxide (OH). The presence of these compounds is determined by standard methods involving titration with a strong acid using various indicator solutions. The results are reported as milligrams of calcium carbonate ($CaCO_3$) per liter of water. A water with low pH and low alkalinity might be considered to be corrosive. An alkalinity of less than 100 milligrams per liter is desirable for water used for domestic purposes.

Hardness

Hard water and soft water are relative terms. Hard water retards the cleaning action of soaps and detergents. Hardness is caused chiefly by calcium and magnesium ions, and it is expressed as milligrams of calcium carbonate ($CaCO_3$) per liter of water. Hardness may vary from zero to several hundred milligrams per liter. Small concentrations of hardness help combat corrosion of metallic pipes by forming a protective coating. Appreciable amounts of hardness break down on heating to form scale in boilers and on cooking utensils. Water showing a hardness of less than 50 mg/l are relatively soft; 50-100 milligrams per liter are medium hard, and over 100 milligrams are exceedingly hard. Very soft water, usually less than 30 milligrams per liter of hardness, is likely to be corrosive.

Calcium (Ca)

The presence of calcium (fifth among the elements in order of abundance) in water supplies results from water passing through or over limestone and/or calcium-containing mineral deposits. The calcium content may range from zero to several hundred milligrams per liter. Calcium contributes to water hardness; chemical softening or ion exchange is used to reduce calcium and the associated hardness.

Magnesium (Mg)

Magnesium ranks eight among the elements in order of abundance and is a common constituent of natural water. It is an important contributor to water hardness, and is reduced with chemical softening or ion exchange. Concentrations greater than 125 milligrams per liter of water can exert a cathartic and diuretic action.

Sodium (Na)

Sodium ranks sixth among the elements in order of abundance; therefore, it is present in most natural waters. Its level may vary from negligible to appreciable. High concentrations may result from local use of road salt or from water softeners utilizing sodium ion exchange. As recommended by the American Heart Association, persons on low sodium diets should be warned when the sodium level exceeds 20 milligrams per liter of water.

Potassium (K)

Potassium ranks seventh among the elements in order of abundance, but its concentration in drinking water seldom reaches 20 milligrams per liter of water. Potassium and sodium are closely related alkali metals, and they affect the body in much the same way.

Iron (Fe)

Small amounts of iron are frequently present in water because of the large amount of iron present in soil and because corrosive water will pick up iron from cast iron pipes. The presence of high levels is considered objectionable because it stains laundry and porcelain, and it also affects the taste of beverages. The recommended limit for iron is 0.3 milligrams per liter of water.

Manganese (Mn)

Although rarely present in excess of one milligram per liter, manganese imparts tenacious stains to laundry and to plumbing fixtures. A limit of 0.05 milligrams manganese per liter is recommended.

Silica (SiO_2)

Silica exists in the earth's crust as the oxide in many rocks and combined with metals in the form of many silicate minerals. Degradation of these silica-containing rocks results in the presence of silica in natural waters as suspended particles and as the silicate ion. The silica content of natural water is most commonly in the 1 to 30 milligrams per liter range, although concentrations as high as 100 milligrams per liter are not unusual.

Sulfate (SO_4)

Sulfate is widely distributed in nature and may be present in natural waters in concentrations ranging from a few to several thousand milligrams per liter. Because of the laxative effects of magnesium sulfate (Epsom salts) and/or sodium sulfate (Glauber's salt), sulfate content should not exceed 250 milligrams per liter of water.

Chloride (Cl)

Most waters contain some chloride in solution. Chloride concentrations in excess of 250 milligrams per liter of water usually impart a salty taste and are not recommended. An abrupt increase in chloride content in water may indicate possible pollution from sewage sources or from road salting.

Specific Conductance

Specific conductance is a measure in micromhos per centimeter (µmhos/cm) of a water's ability to carry an electric current. This ability increases as the dissolved mineral content of the water increases. Pure distilled water has a specific conductance of 0.5 to 2.0 µmhos/cm. Most potable waters generally range from 50 to 1,500 µmhos/cm.

Nitrogen (Ammonia)

Ammonia nitrogen is naturally present in surface and ground waters. A product of microbiological activity, ammonia nitrogen is sometimes accepted as evidence of pollution when encountered in untreated surface supplies. Its occurrence in groundwater supplies is quite general however, and is found in small concentrations. It is recommended that the ammonia nitrogen (as N) level not exceed 0.050 milligrams per liter of drinking water.

Nitrogen (Nitrate)

Nitrate nitrogen in drinking water above the standard poses an immediate threat to children under three months of age. In some infants, excessive levels of nitrate have been known to react with the hemoglobin in the blood to produce an anemic condition commonly known as "blue baby". If the drinking water contains an excessive amount of nitrate, it should not be given to infants under three months of age and not to be used to prepare formula. The standard allows for 10.0 milligrams of nitrate (as N) per liter of water.

Nitrogen (Nitrite)

Nitrite nitrogen in concentrations greater than 1.0 milligrams per liter is hazardous to infants. The recommended limit is 0.001 milligrams nitrite nitrogen (as N) per liter of water.

Copper (Cu)

Copper is found in some natural waters. Excessive amounts of copper can occur in corrosive water that passes through copper pipes and stain porcelain fixtures. Copper in small amounts is not detrimental to health; however, higher amounts will impart an undesirable taste to the drinking water. For this reason, the recommended limit is 1.0 milligram copper per liter of water.

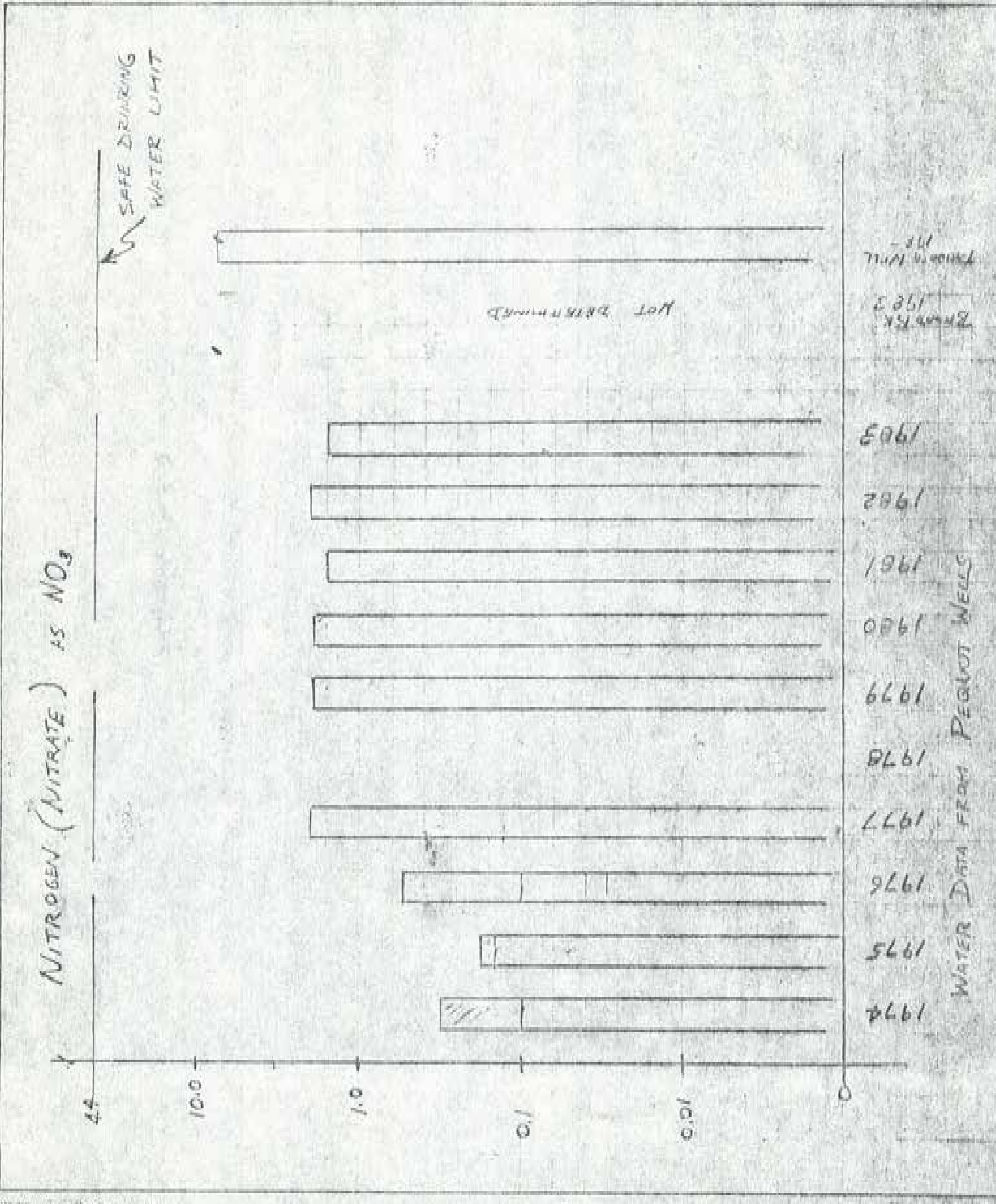
Mass and Volume Conversions

1 Liter	=	1.057 Quarts
1 Milligram	=	0.001 Gram
1 Gram	=	0.035 Ounce

1 Milligram per Liter (mg/l) = 1 Part Per Million (ppm)

BAYSTATE
ENVIRONMENTAL CONSULTANTS, INC.
39 Maple Street
EAST LONGMEADOW, MA 01028
(413) 525-3822

JOB HYDROGEOLOGICAL STUDY 83-1010
SHEET NO. 1 OF 4
CALCULATED BY P. McCOLLUM DATE 12-13-85
CHECKED BY ______ DATE ______
SCALE



BAYSTATE
ENVIRONMENTAL CONSULTANTS, INC.
39 Maple Street
EAST LONGMEADOW, MA 01028
(413) 525-3822

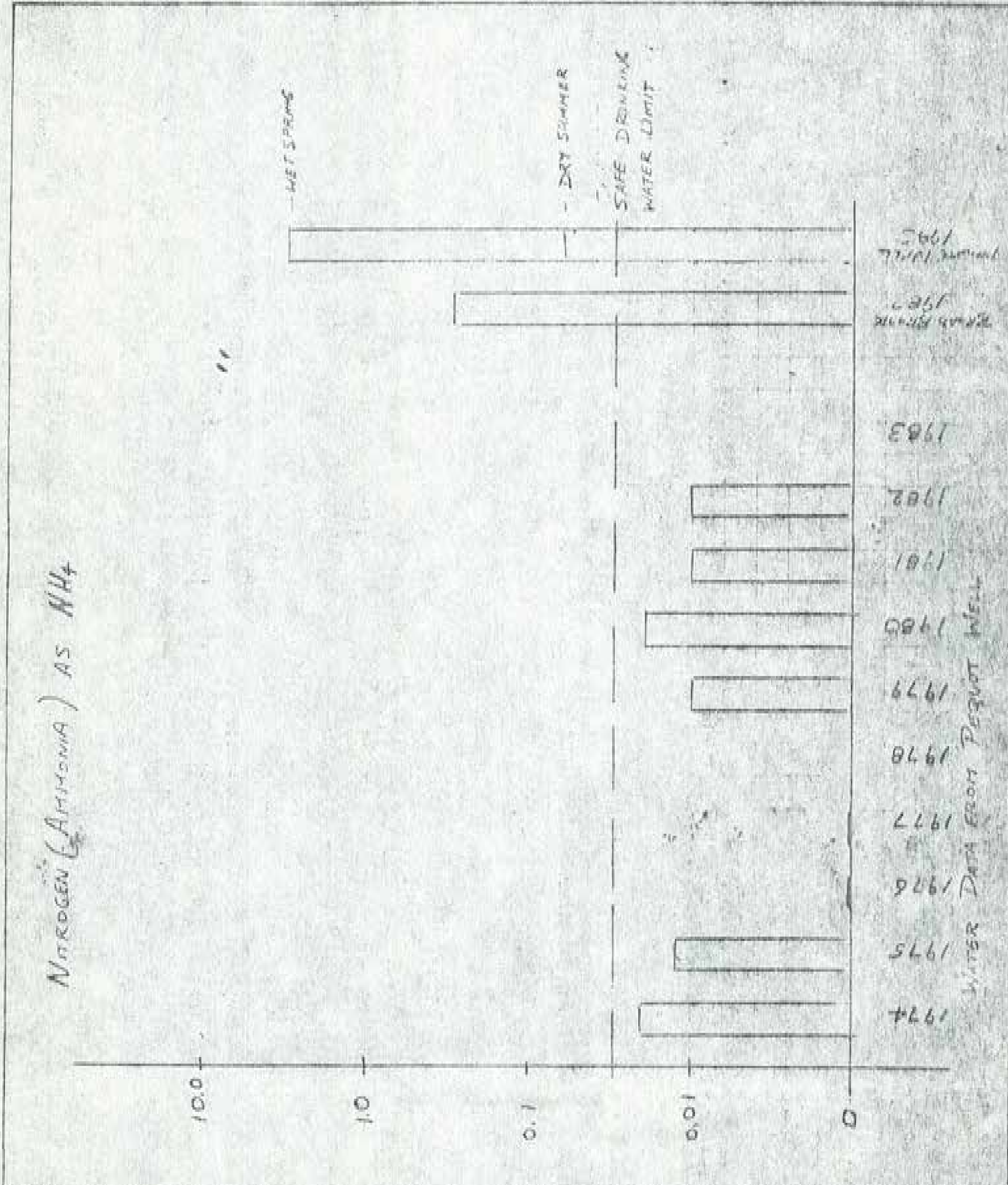
JOB HYDROGEOLOGIC STUDY

SHEET NO. 2 OF 4

CALCULATED BY R. MCCALLUM DATE

CHECKED BY DATE

SCALE



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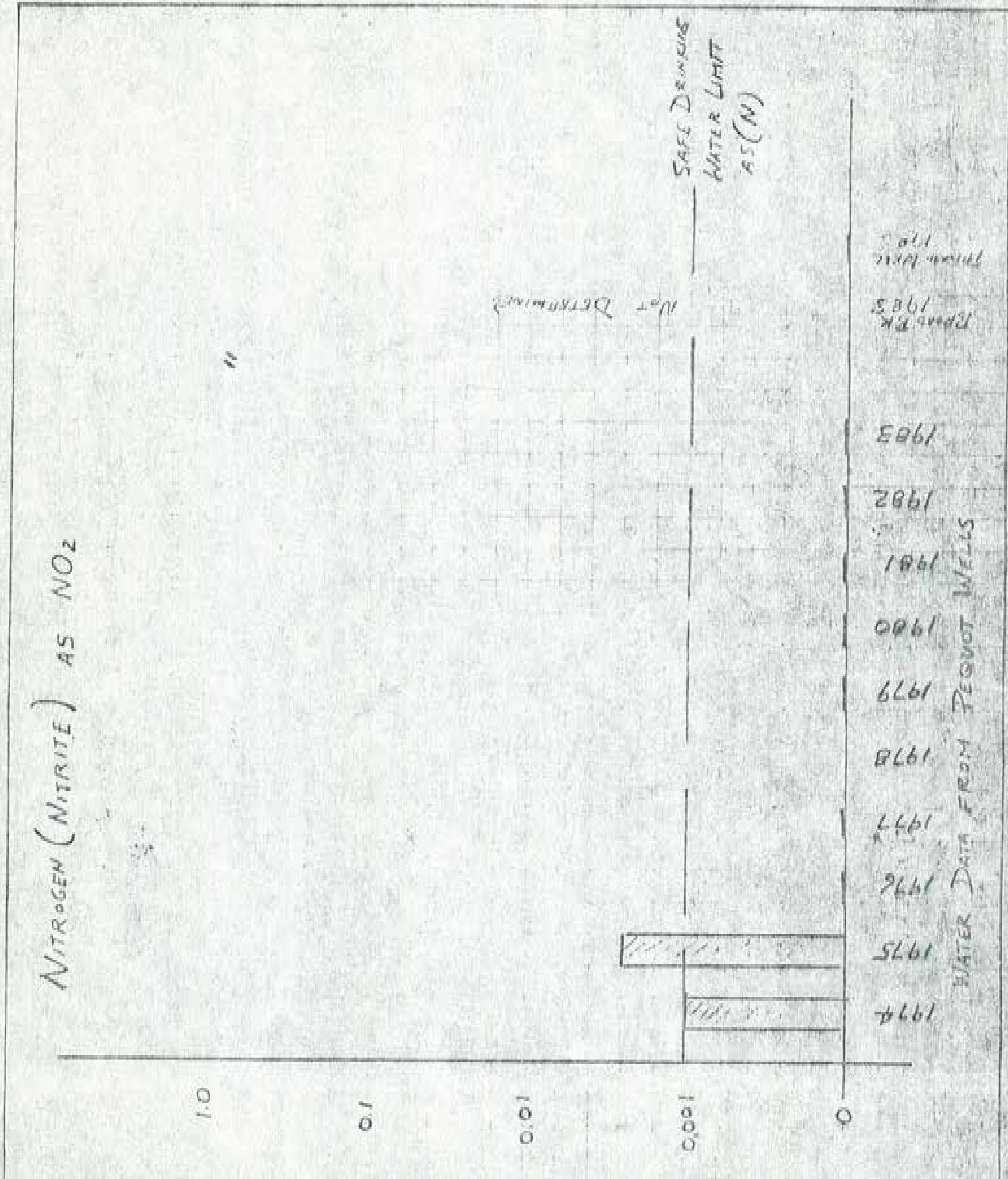
ENVIRONMENTAL CONSULTANTS, INC.
39 Maple Street
EAST LONGMEADOW, MA 01028
(413) 525-3822

JOB HYDROGEOLOGIC STUDY

SHEET NO. 3 OF 4

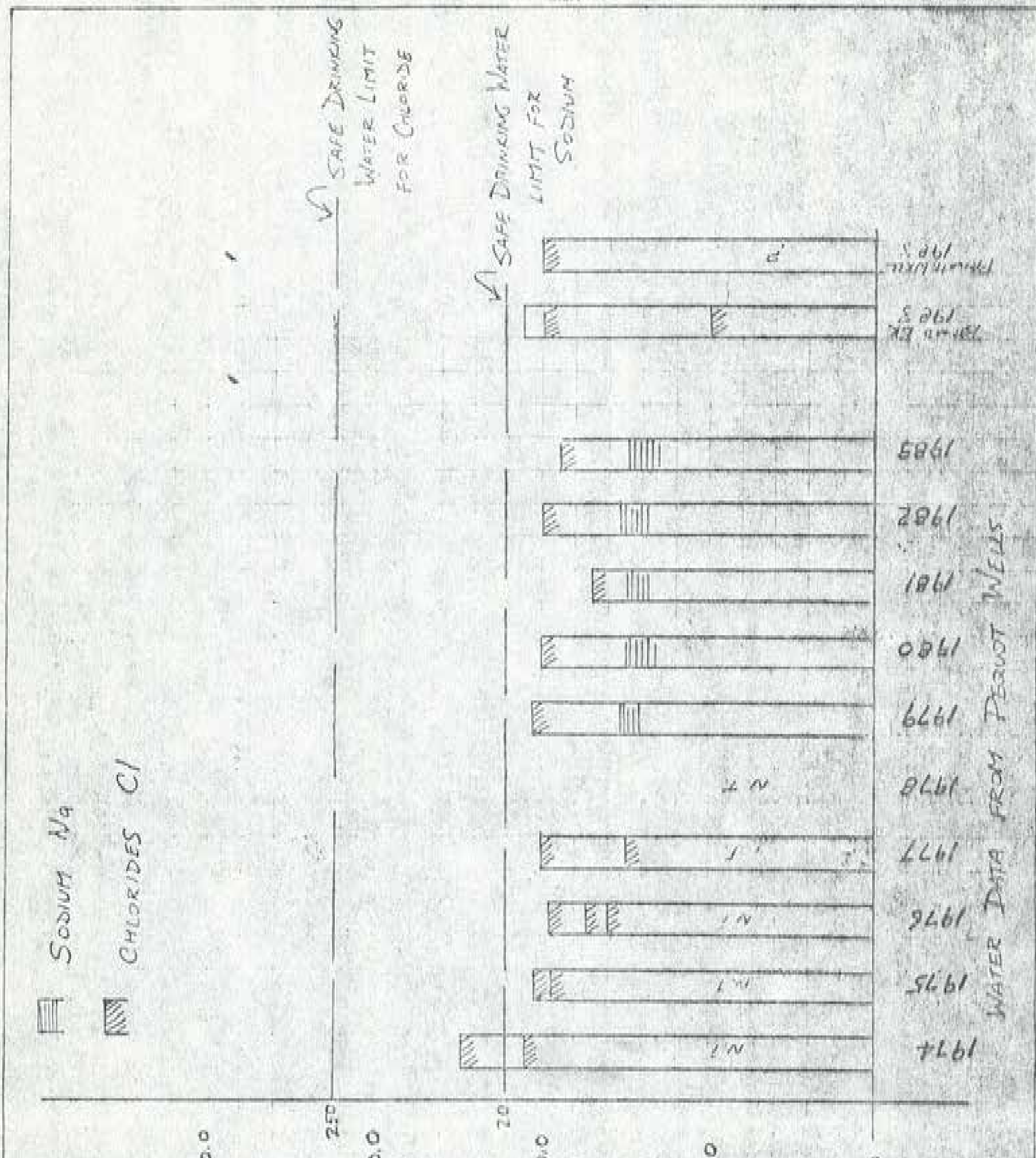
CALCULATED BY P. Mccallum DATE 12-12-85

CHECKED BY DATE



BAYSTATE ENVIRONMENTAL CONSULTANTS, INC.
39 Maple Street
EAST LONGMEADOW, MA 01028
(413) 525-3822

JOB Hydrogeologic Study
SHEET NO. 4 OF 4
CALCULATED BY R. McCallum DATE 12-12-89
CHECKED BY ____ DATE ____
SCALE ____



MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH HOLYOKE

WATER SUPPLY ANALYSIS (mg. per liter)

Collector: Iantosca

Tripp

Mokrzecky

Source A Pequot Park, Well No. 1

Source B Pequot Park, Well No. 2

Source C Pequot Water Co. - 8" well #1

Source D Pequot Water Co. - 8" well #2

Source E Pequot Water Co. - Test well #1

Source F Pequot Water Co. - Test well #2

Sample No.	26109	26110	26116	26117	26124	26125
Date of Collection	7-8-74	7-8-74	7-7-74	7-7-74	7-11-74	7-11-74
Date of Receipt	7-8-74	7-8-74	7-9-74	7-9-74	7-11-74	7-11-74
TURBIDITY	0	0	0	0	0	0
SEDIMENT						
COLOR	5	5	0	0	0	0
ODOR	0	0	0	0	0	0
pH	6.7	6.6	6.1	6.5	7.1	6.8
ALKALINITY Total($CaCO_3$)	32.5	32.5	16.0	27.0	33	36
HARDNESS ($CaCO_3$)	50.0	78.	48.0	50.0	54.	62
CALCIUM (Ca)						
MAGNESIUM (Mg)						
SODIUM (Na)						
POTASSIUM (K)						
IRON (Fe)	.00	.00	.04	.00	0.00	0.00
MANGANESE (Mn)	.00	.00	.02	.00	0.00	0.00
SILICA (SiO_2)						
SULFATE (SO_4)						
CHLORIDE (Cl)	20	22	34.0	20.0	11.5	13.
SPEC COND. (micromhos/cm)						
NITROGEN (AMMONIA)	.000	.000	.000	.001	0.016	0.000
NITROGEN (NITRATE)	0.15	0.21	0.17	0.25	0.24	0.26
NITROGEN (NITRITE)	.000	.000	.001	.001	0.001	0.000
[illegible]						
CO_2	<8	<8			14.	14.
bacterial No.	84362	84361			84435	84436
Date Received	7-8-74	7-8-74			7-11-74	7-11-74
Coliform/100 m.l.	0	0			1	0

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH HOLYOKE

WATER SUPPLY ANALYSIS (mg. per liter)

Collector: Tripp

Source A Pequot Water Co., 8" test well #2, pump test at shutdown

Source B Pequot Water Co., 8" test well #1, pump test at shutdown

Source C

Source D

Source E

Source F

Sample No.	26134	26135				
Date of Collection	7-13-74	7-13-74				
Date of Receipt	7-13-74	7-13-74				
TURBIDITY	0	0				
SEDIMENT						
COLOR	0	0				
ODOR	0	0				
pH	6.3	6.2				
ALKALINITY -Total($CaCO_3$)	36.	32.				
HARDNESS ($CaCO_3$)	64.	52.				
CALCIUM (Ca)						
MAGNESIUM (Mg)						
SODIUM (Na)						
POTASSIUM (K)						
IRON (Fe)	0.00	0.00				
MANGANESE (Mn)	0.00	0.00				
SILICA (SiO_2)						
SULFATE (SO_4)						
CHLORIDE (Cl)	14.5	12.0				
SPEC.COND.(micromhos/cm)						
NITROGEN (AMMONIA)	.016	.032				
NITROGEN (NITRATE)	0.54	0.42				
NITROGEN (NITRITE)	0.001	0.001				
COPPER (Cu)						

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH WEST HOLYOKE
WATER SUPPLY ANALYSIS (mg. per liter)

Collector: Tripp

Source A Pequot Water Co., House tap, cold
Source B Pequot Water Co., House tap, hot
Source C Pequot Water Co., Pump Sta. tap
Source D
Source E
Source F

	A	B	C	D	E	F
Sample No.	27086	27087	27088			
Date of Collection	7-2-75	7-2-75	7-2-75			
Date of Receipt	7-3-75	7-3-75	7-3-75			
TURBIDITY	0	0	0			
SEDIMENT						
COLOR	5	0	0			
ODOR	0	0	0			
pH	9.49	9.70	6.65			
ALKALINITY-Total($CaCO_3$)	46.	35.	22.			
ARDNESS($CaCO_3$)	68.	56.	40.			
CALCIUM(Ca)						
AGNESIUM(Mg)						
ODIUM(Na)						
ASSIUM(K)						
ON(Fe)	.12	.12	.12			
NGANESE(Mn)	.00	.00	.00			
LICA(SiO_2)						
LFATE(SO_4)						
LORIDE(Cl)	12.5	9.5	9.5			
EC. COND. (micromhos/cm)						
TROGEN(AMMONIA)	.014	.016	.00			
NITROGEN(NITRATE)	.187	.187	.25			
TROGEN(NITRITE)	.014	.01[illegible]	.000			
COPPER(Cu)						

16

The Commonwealth of Massachusetts

Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

CITY HOLYOKE

Collector: TRIPP

Source A Pequot Water Co., taken at wells
Source B
Source C
Source D
Source E
Source F

	A	B	C	D	E	F
Sample No.	28355					
Date of Collection	12-12-76					
Date of Receipt	12-13-76					
TURBIDITY	0					
SEDIMENT						
COLOR	0					
ODOR	0					
pH	6.73					
ALKALINITY-Total($CaCO_3$)	9.0					
HARDNESS($CaCO_3$)	32.					
CALCIUM(Ca)						
MAGNESIUM(Mg)						
SODIUM(Na)						
POTASSIUM(K)						
IRON(Fe)	.02					
MANGANESE(Mn)	.00					
SILICA(SiO_2)						
SULFATE(SO_4)						
CHLORIDE(Cl)	6.0					
SPEC.COND.(micromhos/cm)						
NITROGEN(AMMONIA)	.00					
NITROGEN(NITRATE)	.05					
NITROGEN(NITRITE)	.000					
COPPER(Cu)						
Bacterial No.	91950					
Date Rec'd 12-13-76						
Coliform/100ml						

76

The Commonwealth of Massachusetts

Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

CITY: HOLYOKE

Collector: TRIPP

Source A Pequot Water Co., taken at wells

Source B

Source C

Source D

Source E

Source F

	A	B	C	D	E	F
Sample No.	28259					
Date of Collection	10-25-76					
Date of Receipt	10-25-76					
TURBIDITY	8					
SEDIMENT						
COLOR	10					
ODOR	0					
pH	6.68					
ALKALINITY-Total($CaCO_3$)	25.					
HARDNESS($CaCO_3$)	40.					
CALCIUM(Ca)						
MAGNESIUM(Mg)						
SODIUM(Na)						
POTASSIUM(K)						
IRON(Fe)	.20					
MANGANESE(Mn)	.02					
SILICA(SiO_2)						
SULFATE(SO_4)						
CHLORIDE(Cl)	7.5					
SPEC.COND.(micromhos/cm)						
NITROGEN(AMMONIA)	.00					
NITROGEN(NITRATE)	.10					
NITROGEN(NITRITE)	.000					
COPPER(Cu)						
Bacterial No.	91616					
Date Rec'd	10-25-76					
Coliform/100ml	0					

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
WATER SUPPLY ANALYSIS (mg. per liter)

CITY: HOLYOKE

Collector: HUNTLEY

Source A Pequot Water Co.
Source B
Source C
Source D
Source E
Source F

	A	B	C	D	E	F
Sample No.	28107					
Date of Collection	7-28-76					
Date of Receipt	"					
TURBIDITY	0					
SEDIMENT						
COLOR	0					
ODOR	0					
pH	6.42					
ALKALINITY-Total ($CaCO_3$)	22.5					
HARDNESS ($CaCO_3$)	40.					
CALCIUM (Ca)						
MAGNESIUM (Mg)						
SODIUM (Na)						
POTASSIUM (K)						
IRON (Fe)	.16					
MANGANESE (Mn)	.01					
SILICA (SiO_2)						
SULFATE (SO_4)						
CHLORIDE (Cl)	9.[illegible]					
SPEC. COND. (micromhos/cm)						
NITROGEN (AMMONIA)	.00					
NITROGEN (NITRATE)	.75					
NITROGEN (NITRITE)	.000					
COPPER (Cu)						
Bacterial No.	90897					
Coliform/100ml	0					

76

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Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

HOLYOKE

Collector: Lantosca

Source A Pequot Water Company, tap in pumping station

Source B

Source C

Source D

Source E

Source F

	A	B	C	D	E	F
Sample No.	27990					
Date of Collection	6-4-76					
Date of Receipt	6-4-76					
TURBIDITY	0					
SEDIMENT						
COLOR	0					
ODOR	0					
pH	6.40					
ALKALINITY-Total($CaCO_3$)	24.					
HARDNESS($CaCO_3$)	44.					
CALCIUM(Ca)						
MAGNESIUM(Mg)						
SODIUM(Na)						
POTASSIUM(K)						
IRON(Fe)	.15					
MANGANESE(Mn)	.01					
SILICA(SiO_2)						
SULFATE(SO_4)						
CHLORIDE(Cl)	9.5					
SPEC.COND.(micromhos/cm)						
NITROGEN(AMMONIA)	.00					
NITROGEN(NITRATE) – as NO_3	.16					
NITROGEN(NITRITE)	.000					
COPPER(Cu)						
Bacterial No.	90349					
Date Received	6-4-76					
Coliform/100 ml.	0					

77

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Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

HOLYOKE

Collector: TRIPP

Source A Pequot Water Company Source
Source B
Source C
Source D
Source E
Source F

	A	B	C	D	E	F
Sample No.	28225					
Date of Collection	6-20-77					
Date of Receipt	6-20-77					
TURBIDITY	1.2					
SEDIMENT						
COLOR	0					
ODOR Cold	0					
ODOR Hot	0					
pH	[illegible]					
ALKALINITY-Total($CaCO_3$)	[illegible]					
HARDNESS($CaCO_3$)	34					
CALCIUM(Ca)						
MAGNESIUM(Mg)						
SODIUM(Na)						
POTASSIUM(K)						
IRON(Fe)	.05					
MANGANESE(Mn)	.00					
SILICA(SiO_2)						
SULFATE(SO_4)						
CHLORIDE(Cl)	10.5					
SPEC.COND.(micromhos/cm)						
NITROGEN(AMMONIA)	0					
NITROGEN(NITRATE)	[illegible]					
NITROGEN(NITRITE)	0					
COPPER(Cu)						
Bacterial No.	93220					
Date Received	6-21-77					
Coliform/100 ml	0					

77

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Water Supply Analysis (mg. per liter)

HOLYOKE

Collector: TRIPP

Source A Pequot Water Co.

Source B

Source C

Source D

Source E

Source F

	A	B	C	D	E	F
Sample No.	28529					
Date of Collection	3-21-77					
Date of Receipt	3-21-77					
TURBIDITY	14.					
SEDIMENT						
COLOR	0					
ODOR	0					
pH	6.95					
ALKALINITY-Total($CaCO_3$)	23.					
HARDNESS($CaCO_3$)	32.					
CALCIUM(Ca)						
MAGNESIUM(Mg)						
ODIUM(Na)						
POTASSIUM(K)						
RON(Fe)	.65					
ANGANESE(Mn)	.03					
ILICA(SiO_2)						
ULFATE(SO_4)						
HLORIDE(Cl)	5.[illegible]					
PEC.COND.(micromhos/cm)						
NITROGEN(AMMONIA)	.03					
ITROGEN(NITRATE)	2.94					
NITROGEN(NITRITE)	.000					
OPPER(Cu)						
Bacterial No.	92514					
Date Rec'd	3-22-77					
Coliform/100ml	0					

14

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Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

(Pequot W. Co.)
Holyoke

Collector: J.D.

Source A Ground - Tap at 68 County Rd.
Source B
Source C
Source D
Source E
Source F

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	A	B	C	D	E	F
Sample No.	552421					
Date of Collection	10/8/79					
Date of Receipt	10/12/79					
TURBIDITY	0.5					
SEDIMENT	0					
COLOR	0					
ODOR	0					
pH	7.4					
ALKALINITY-Total($CaCO_3$)	37					
HARDNESS($CaCO_3$)	50.					
CALCIUM(Ca)	17.					
MAGNESIUM(Mg)	1.7					
SODIUM(Na)	5.7					
POTASSIUM(K)	0.4					
IRON(Fe)	.06					
MANGANESE(Mn)	.06					
SILICA(SiO_2)	13.					
SULFATE(SO_4)	13					
CHLORIDE(Cl)	13.					
SPEC.COND.(micromhos/cm)	143					
NITROGEN(AMMONIA)	.02					
NITROGEN(NITRATE)	0.3					
NITROGEN(NITRITE)	.003					
COPPER(Cu)	.05					

80

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Department Of Environmental Quality Engineering

Lawrence Experiment Station

37 Shattuck Street, Lawrence, Massachusetts 01843

SOURCE A - Pequot Water Co.
SOURCE B -
SOURCE C -
SOURCE D -
SOURCE E -

HOLYOKE

COLLECTOR Moynihan
DATE COLLECTED July 1, 1980
DATE RECEIVED July 3, 1980

SPOT PROGRAM

	A	B	C	D	E
SAMPLE NO.	001797				
DATE ANALYZED	7/9/80				
Methylene Chloride	nd				
1,1 Dichloroethylene	nd				
1,2 Transdichloroethylene	nd				
Chloroform	nd				
1,2 Dichloroethane	nd				
1,1,1 Trichloroethane	nd				
Carbon tetrachloride	nd				
Bromodichloromethane	nd				
Trichloroethylene	12.1				
Dibromochloromethane	nd				
Bromoform	nd				
Tetrachloroethylene	nd				

Concentrations reported as micrograms per liter - nd= none detected

80

The Commonwealth of Massachusetts

Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

Holyoke-Paquet W.

Collector: ____________

Source A Ground - Tap at 68 County Rd. -

Source B

Source C

Source D

Source E

Source F

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	A	B	C	D	E
Sample No.	554010				
Date of Collection	-----				
Date of Receipt	3/7/80				
TURBIDITY	0.3				
SEDIMENT	0				
COLOR	0				
ODOR	0				
pH	7.2				
ALKALINITY-Total($CaCO_3$)	34				
HARDNESS($CaCO_3$)	47.				
CALCIUM(Ca)	14.				
MAGNESIUM(Mg)	2.9				
SODIUM(Na)	5.2				
POTASSIUM(K)	0.4				
IRON(Fe)	.05				
MANGANESE(Mn)	.00				
SILICA(SiO_2)	13.				
SULFATE(SO_4)	14				
CHLORIDE(Cl)	10.				
SPEC. COND. (micromhos/cm)	130				
NITROGEN(AMMONIA)	.01				
NITROGEN(NITRATE)	0.3				
NITROGEN(NITRITE)	.000				
COPPER(Cu)	.50				

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GROSS ALPHA RADIOACTIVITY

Town/City HOLYOKE (Paquet Water)

Collected By: Berwichers

Collection Period: Calendar [illegible] 1979-1980
(Composite of
Quartarly Samples)

Sample Number	Sample Source	Gross Alpha pci/l	Date of Analysis	Analyst
17-427	Tap at 68 County Road	0.0	5/31/80	E. Childs

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Method of Analysis: Interim Radiochemical Methodology for Drinking Water. EPA 600/475-008, March, 1976.

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
WATER SUPPLY ANALYSIS (mg/ per liter)

1981

Holyoke

COLLECTOR

SOURCE A Ground - Tap at 68 County Rd. - 137E01G
SOURCE B
SOURCE C
SOURCE D
SOURCE E
SOURCE F

	A	B	C	D	E	F
SAMPLE NO.	557581					
DATE OF COLLECTION	-----					
DATE OF RECEIPT	4/10/81					
TURBIDITY	0.7					
SEDIMENT	0					
COLOR	0					
ODOR	0					
pH	6.9					
ALKALINITY-TOTAL (CaCO3)	33					
HARDNESS (CaCO3)	45					
CALCIUM (Ca)	14					
MAGNESIUM (Mg)	2.4					
SODIUM (Na)	5.0					
POTASSIUM (K)	0.3					
IRON (Fe)	.07					
MANGANESE (Mn)	.00					
SILICA (SiO2)	13.					
SULFATE (SO4)	12					
CHLORIDE (Cl)	7.0					
SPEC. COND. (micromhos/cm)	120					
NITROGEN (AMMONIA)	.01					
NITROGEN (NITRATE)	0.2					
NITROGEN (NITRITE)	.000					
COPPER (Cu)	.30					

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Lawrence Experiment Station

37 Shattuck Street, Lawrence, Massachusetts 01843

Pequot Water Co.
SAMPLE SOURCE Tap at 68 County Rd. 137D01D

LABORATORY NUMBER 557043

COLLECTOR D.J.T.
COLLECTION DATE 3-3-81
COLLECTION TIME 1130

INORGANIC CHEMICAL	mg/l	DATE OF ANALYSIS	ANALYST	METHOD
Arsenic	.000	4-7-81	K.H.	1
Barium	0.13	5-7-81	"	1
Cadmium	.00	3-9-81	T.P.	1
Chromium	.00	3-10-81	"	1
Lead	.00	3-11-81	"	1
Mercury	0.0	3-25-81	"	2
Selenium	.000	4-20-81	K.H.	1
Silver	.00	3-12-81	T.P.	1
Fluoride	0.1	3-9-81	G.D.	3
Nitrate	1.3	3-5-81	T.P.	4
Sodium	5.7	3-6-81	E.P.	5

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1) Flameless Atomic Absorption - Graphite Furnace Technique
2) Flameless Atomic Absorption - EPA Methods for Chemical Analysis of Water and Wastes 19
3) Fluoride Electrode, "Standard Methods", 14th Edition 1975
4) Automated Hydrazine Reduction, NERC Analytical Quality Control Laboratory
5) Flame Photometric Method - "Standard Methods", 14th Edition 1975

82

Regular

THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
WATER SUPPLY ANALYSIS (mg/ per liter)

Holyoke-Pequot Wat

COLLECTOR None Recorded

SOURCE A Ground Tap at 68 County Rd. - 1378010
SOURCE B
SOURCE C
SOURCE D
SOURCE E
SOURCE F

	A	B	C	D	E	F
SAMPLE NO.	562213					
DATE OF COLLECTION	--------					
DATE OF RECEIPT	10/25/82					
TURBIDITY	0.3					
SEDIMENT	0					
COLOR	5					
ODOR	0					
pH	6.9					
ALKALINITY-TOTAL(CaCO3)	36					
HARDNESS(CaCO3)	73					
CALCIUM(Ca)	25.					
MAGNESIUM(Mg)	2.4					
SODIUM(Na)	5.4					
POTASSIUM (K)	0.5					
IRON(Fe)	.00					
MANGANESE(Mn)	.00					
SULFATE(SO4)	11					
CHLORIDE(Cl)	10.					
SPEC. COND.(micromhos/cm)	135					
NITROGEN(AMMONIA)	.01					
NITROGEN(NITRATE)	0.3					
NITROGEN(NITRITE)	.000					
COPPER(Cu)	.23					

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81

Holyoke (Pequot Water Co.)

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Department Of Environmental Quality Engineering
Lawrence Experiment Station

37 Shattuck Street, Lawrence, Massachusetts 01843

137a016

SAMPLE SOURCE Tap at 6d County Rd.

LABORATORY NUMBER 562266

COLLECTOR Unknown

COLLECTION DATE 10/25/82

COLLECTION TIME

INORGANIC CHEMICAL	mg/l	DATE OF ANALYSIS	ANALYST	METHOD
Arsenic	0.000	11/10/82	K.A.H.	1
Barium	0.11	11/23/82	T.D.P.	1
Cadmium	0.000	11/29/82	T.D.P. & K.A.H.	1
Chromium	0.001	11/17/82	T.D.P.	1
Lead	0.000	11/29/82	K.A.H. & T.D.P.	1
Mercury	0.0000	11/9/82	A.J.C.	2
Selenium	0.000	11/10/82	K.A.H.	1
Silver	0.000	1/24/83	K.A.H.	1
Fluoride	0.1	10/26/82	C. Donahue	3
Nitrate	0.1	10/26/82	B.E.	4
Sodium	5.5	10/26/82	E. Ross	5

1) Flameless Atomic Absorption - Graphite Furnace Technique.
2) Flameless Atomic Absorption - EPA Methods for Chemical Analysis of Water and Wastes 1974
3) Fluoride Electrode, "Standards Methods", 14th Edition 1975
4) Automated Hydrazine Reduction, NERC Analytical Quality Control Laboratory
5) Flame Photometric Method - "Standard Methods", 14th Edition 1975

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THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
WATER SUPPLY ANALYSIS (mg/ per liter)

Holyoke (Pequot Water Co.)

COLLECTOR -------

SOURCE A Ground Tap at 68 County Rd. - 1378010
SOURCE B
SOURCE C
SOURCE D
SOURCE E
SOURCE F

	A	B	C	D	E	F
SAMPLE NO.	563364					
DATE OF COLLECTION	-------					
DATE OF RECEIPT	2/25/83					
TURBIDITY	0.3					
SEDIMENT	0					
COLOR	5					
ODOR	0					
pH	6.9					
ALKALINITY-TOTAL(CaCO3)	32					
HARDNESS(CaCO3)	38					
CALCIUM(Ca)	11.					
MAGNESIUM(Mg)	2.5					
SODIUM(Na)	4.9					
POTASSIUM (K)	0.6					
IRON(Fe)	.02					
MANGANESE(Mn)	.00					
SULFATE(SO4)	12					
CHLORIDE(Cl)	9.0					
SPEC. COND.(micromhos/cm)	123					
NITROGEN(AMMONIA)						
NITROGEN(NITRATE)	0.2					
NITROGEN(NITRITE)	.000					
COPPER(Cu)	.09					

83

Environmental Testing Laboratory, Inc
170 Montgomery St.
Chicopee, Mass. 01013
(413) 592-2500

Henry Spadoni

J.D.S. 844 Liberty St.

Springfield, Mass.

Date Sample Taken: 8-30-83	Date Sample Received: 8-30-83		Collector: Client	Address: Above
		Sample "A"	Sample "B"	Sample "C"
Turbidity	N.T.U.	29.		
pH		6.4		
Alkalinity - Total	mg/1	28		
Ammonia - Free	mg/1	0.52		
Chlorides	mg/1	1.0		
Iron-Total	mg/1	16.0		
Hardness - Total	mg/1	28		
Nitrates (As No 2)	mg/1	1.3		
Color	Units	40		
Odor		1		
Manganese	mg/1	0.10		
Surfactants	mg/1	0.0		
Sodium	mg/1	17.4		

James M. McCarey

Source Sample "A" C5587 - Stream by J.D.S.

Source Sample "B"

Source Sample "C"

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

68 Grant St. [illegible]

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137661	05	3000	Prospect [illegible]	Howard Labs	H. Howard

1-13 ABOVE	ANALYSIS METHOD	*RESULT	# TUBES	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	8	29	82	0001	68 Grant St.	8	29	82	D	2000	DUP	C. [illegible]
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0 k				82	D	2000	DUP	
DUP	303	0	1			82	0 k				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
	14-16	17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPE

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID 00851 (42-46)

PREPARED BY Harold G. Howard (LAB USE) DATE Feb 14 83

APPROVED BY (D.E.Q.E. USE) DATE

ORIGINAL TO - PUBLIC WATER SYSTEM

PWS ID: 1157001 (1-8)

TRANSACTION CODE: 05 (8-9)

CONTAMINANT ID: 3186 (10-13)

PUBLIC WATER SYSTEM NAME: [illegible]

LAB NAME: [illegible]

SAMPLES ANALYZED BY: [illegible]

SYS REPT	ANALYSIS METHOD	ANALYSIS RESULT*	ANALYSIS SCALE	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	30R	<000	1	04	13	82	[illegible]	[illegible] County Road	04	12	82	D	0800	DUP	[illegible]
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
DUP	30		1											DUP	
14-16		17-20	21	22-27			28-30		31-36			37	38-41		

*COLIF ORM PER 100 ml

*MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

SAMPLE TYPE
C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID: [illegible] (42-46)

PREPARED BY [illegible] DATE [illegible]

APPROVED BY DATE

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1 / 1 3 7 8 6 1	Ø 5	3 [illegible]	[illegible]	[illegible]	[illegible]
1-7	8-9	10-13			

1-13 ABOVE	ANALYSIS METHOD	*RESULT	DECIMALS	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	3 Ø [illegible]	[illegible]	1	[illegible]	[illegible]	82	[illegible]	[illegible] County [illegible]	[illegible]	[illegible]	82	D	[illegible]	DUP	[illegible]
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
	14-16	17-20	21	22-27			29-30		31-36			37	38-41		

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	3 Ø 3
MPN	3 Ø 5

REMARKS

[illegible]	LAB ID
C - CHECK SAMPLE D - REGULAR DISTRIBUTION SAMPLE P - PLANT TAP SAMPLE R - RAW WATER SAMPLE S - SPECIAL SAMPLE	[illegible]
	42-46

PREPARED BY [illegible] DATE [illegible]
(LAB USE)

APPROVED BY DATE
(D.E.Q.E. USE)

ORIGINAL TO – PUBLIC WATER SYSTEM

[illegible]

WADC 010

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

[illegible]

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
[illegible]	Ø 5	[illegible]	[illegible]	[illegible]	[illegible]

1-13 ABOVE	ANALYSIS METHOD	*RESULT	DECIMALS	ANALYSIS DATE MO.	DAY	YR.	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	3 Ø 3	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	D	[illegible]	DUP	[illegible]
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
DUP	3 Ø		1											DUP	
	14-16	17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	3 Ø 3
MPN	3 Ø 5

REMARKS

SAMPLE TYPES

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID (42-46): [illegible]

PREPARED BY [illegible] DATE [illegible]

APPROVED BY DATE

WAQC 010

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

[illegible]

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible]	Howard Labs	H. Howard

1-13 ABOVE	ANALYSIS METHOD	*RESULT	DECIMALS	ANALYSIS DATE MO.	DAY	YR.	COL	LOCATION NAME	SAMPLE DATE MO.	DAY	YR.	CODE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	[illegible]	1	07	09	82	001	[illegible]	07	09	82	D	2000	DUP	C. [illegible]
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
14-16		17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

CODE
- C - CHECK SAMPLE
- D - REGULAR DISTRIBUTION SAMPLE
- P - PLANT TAP SAMPLE
- R - RAW WATER SAMPLE
- S - SPECIAL SAMPLE

LAB ID 00851 (42-46)

PREPARED BY [illegible signature] DATE [illegible]

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

W-A-DC D11

[illegible]

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible] Water Co.	Howard Labs	H. Howard

1-13 ABOVE	ANALYSIS METHOD	RESULT*	VOLUME	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME**	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0	1	08	06	82	001	[illegible]	08	05	82	D	2000	DUP	C. [illegible]
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
	14-16	17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

SAMPLE TYPE KEY
C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID 00851
42-46

PREPARED BY [signature] (LAB USE) DATE [illegible] 82

WASC DID

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible]	Howard Labs	H. Howard

1-13 ABOVE	METHOD	*RESULT	DECIMALS	ANALYSIS DATE MO.	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO.	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	09	18	82	001	18 [illegible] Road	09	17	82	D	2000	DUP	C. [illegible]
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
14-16		17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPE

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID (42-46): 00851

PREPARED BY [signature] DATE [illegible] 82

W-ADC 010

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible], Inc.	Howard Labs	H. Howard

1-13 ABOVE	ANALYSIS METHOD (14-16)	*RESULT (17-20)	SIGNAL (21)	ANALYSIS DATE MO.	DAY	YR. (22-27)	CODE (28-30)	LOCATION NAME	SAMPLE DATE MO.	DAY	YR. (31-36)	TYPE (37)	SAMPLE TIME* (38-41)	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	10	14	82	0001	68 County Rd.	10	14	82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPES
- C - CHECK SAMPLE
- D - REGULAR DISTRIBUTION SAMPLE
- P - PLANT TAP SAMPLE
- R - RAW WATER SAMPLE
- S - SPECIAL SAMPLE

LAB ID (42-46): 00851

PREPARED BY: [signature] DATE: 1?/?/82

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1197 [illegible]	Ø5	3000	[illegible]	Howard Labs	H. Howard

1-13 ABOVE	METHOD	*RESULT	[illegible]	ANALYSIS DATE MO.	DAY	YR.	CODE	LOCATION NAME	SAMPLE DATE MO.	DAY	YR.	[illegible]	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	ØKK5	1	11	05	82	ØK1		11	25	82	D	2000	DUP	
DUP	303	Ø	1			82	Ø				82	D	2000	DUP	
DUP	303	Ø	1			82	Ø				82	D	2000	DUP	
DUP	303	Ø	1			82	Ø				82	D	2000	DUP	
DUP	303	Ø	1			82	Ø				82	D	2000	DUP	
DUP	303	Ø	1			82	Ø				82	D	2000	DUP	
DUP	303		1			82	Ø				82	D		DUP	
DUP	303		1			82	Ø				82	D		DUP	
DUP	303		1			82	Ø				82	D		DUP	
DUP	303		1			82	Ø				82	D		DUP	

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

LAB ID: 00851

[illegible]
D - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

PREPARED BY ____ DATE ____

APPROVED BY ____ DATE ____

22

ORIGINAL TO - PUBLIC WATER SYSTEM

WAUC 010 WAUC 401

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
[illegible]	05	3000	[illegible]	Howard Labs	H. Howard

	ANALYSIS			ANALYSIS DATE				LOCATION	SAMPLE DATE				SAMPLE	LAB ID BELOW	SAMPLE COLLECTED BY
	METHOD	RESULT	# SAMPLES	MO.	DAY	YR.	CODE	NAME	MO.	DAY	YR.		TIME*		
DUP	303	[illegible]	1	12	16	82	051	[illegible]	12	16	82	D	2000	DUP	[illegible]
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303	0	1			82	0				82	D	2000	DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	
DUP	303		1			82	0				82	D		DUP	

14-16 17-20 21 22-27 28-30 31-36 37 38-41

*COLIFORM PER 100 ml *MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID 00851

PREPARED BY DATE

APPROVED BY DATE

BACTERIOLOGICAL ANALYSIS REPORT

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1157801	05	3000	[illegible]	HOWARD LABS	H. HOWARD

1-13 REPORT	ANALYSIS METHOD	*RESULT		ANALYSIS DATE MO	DAY	YR.	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR.		SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	Ø[illegible]	1	03	12	83	Ø[illegible]	[illegible]	03	1	83	D	0900	DUP	C
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83	D	0900	DUP	
DUP	303	Ø	1			83	Ø				83			DUP	
DUP	303	Ø	1			83	Ø				83			DUP	
DUP	303	Ø	1			83	Ø				83			DUP	

14-16 17-20 21 22-27 28-30 31-36 37 38-41

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID: 00851

PREPARED BY [signature] DATE Mar. 30, 83
(LAB USE)

APPROVED BY DATE
(D.E.Q.E. USE)

ORIGINAL TO – PUBLIC WATER SYSTEM

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

BACTERIOLOGICAL ANALYSIS REPORT

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
[illegible]	05	3000	[illegible]	HOWARD LABS	H. HOWARD

1-13 ABOVE	ANALYSIS METHOD (14-16)	*RESULT (17-20)	DECIMALS (21)	ANALYSIS DATE MO	DAY	YR (22-27)	CODE (28-30)	LOCATION NAME	SAMPLE DATE MO	DAY	YR (31-36)	TYPE (37)	SAMPLE TIME** (38-41)	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1	[illegible]	[illegible]	83	0				83	D	2000	DUP	
DUP	303	0006	1	04	11	83	081	[illegible]	04	11	83	D	1400	DUP	[illegible]
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPE:
- C - CHECK SAMPLE
- D - REGULAR DISTRIBUTION SAMPLE
- P - PLANT TAP SAMPLE
- R - RAW WATER SAMPLE
- S - SPECIAL SAMPLE

LAB ID (43-48): 00851

PREPARED BY [signature] (LAB DIRECTOR) DATE [illegible] 83

APPROVED BY (D.E.Q.E. USE) DATE

ORIGINAL TO — PUBLIC WATER SYSTEM

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

BACTERIOLOGICAL ANALYSIS REPORT

P.O. Box D
N. Amherst, Mass 01059

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible] Water Co. [illegible]	HOWARD LABS	H. HOWARD

LAB ID ABOVE	ANALYSIS METHOD	*RESULT	# SAMPLES	ANALYSIS DATE MO.	DAY	YR.	CODE	LOCATION NAME	SAMPLE DATE MO.	DAY	YR.	TYPE	SAMPLE TIME**	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	05	04	83	001	65 County Rd.	05	04	83	D	2000	DUP	1100
DUP	303	0	1			83	0				83	D	2000	DUP	C. Warner
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	

*COLIFORM PER 100 ml
**MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPE:
- C - CHECK SAMPLE
- D - REGULAR DISTRIBUTION SAMPLE
- P - PLANT TAP SAMPLE
- R - RAW WATER SAMPLE
- S - SPECIAL SAMPLE

LAB ID: 00851

PREPARED BY [signature] DATE [illegible]

APPROVED BY DATE

ORIGINAL TO – PUBLIC WATER SYSTEM

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

No. Andover, Mass. P.O. Box D

PWS ID (1-7)	TRANSACTION CODE (8-9)	CONTAMINANT ID (10-13)	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137501	05	3000	Regent Water Co.	HOWARD LABS	H. HOWARD

1-13 ABOVE	ANALYSIS: METHOD (14-16)	RESULT* (17-20)	DECIMALS (21)	ANALYSIS DATE: MO	DAY	YR (22-27)	CODE (28-30)	LOCATION NAME	SAMPLE DATE: MO	DAY	YR (31-36)	(37)	SAMPLE TIME** (38-41)	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	06	03	83	001	165 County Rd.	05	03	83	D	2000	DUP	12:??
DUP	303	0	1			83	0				83	D	2000	DUP	C. Ware
DUP	303	0	1			83	0				85	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2040	DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

[illegible]
C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID (42-45): 00851

PREPARED BY Harlan A. Howard (LAB USE) DATE 4/4/85

APPROVED BY (D.E.Q.E. USE) DATE

ORIGINAL TO - PUBLIC WATER SYSTEM

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

P.O. Box D N. Amherst, Mass.

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137001	05	3000	[illegible]	HOWARD LABS	H. HOWARD

5-13 ABOVE	ANALYSIS METHOD	RESULT*	SIGNALS	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME**	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	07	20	83	0001	68 Grant St.	07	20	83	D	0900	DUP	14 C [illegible]
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	2000	DUP	
DUP	303	0	1			83	0				83	D	0940	DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	
DUP	303	0	1			83	0				83			DUP	
14-16		17-20	21	22-27			28-30		31-36			37	38-41		

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

SAMPLE TYPE
C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID 00851 (42-46)

PREPARED BY (LAB USE) [signature] DATE 9.16.83

APPROVED BY (D.E.Q.E. USE) DATE

ORIGINAL TO - PUBLIC WATER SYSTEM

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

BACTERIOLOGICAL ANALYSIS REPORT

P.O Box D Mt. Amherst, Mass 01059

PWS ID	REGION	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLED/ANALYZED BY
1137001	05	3000	Report Water Co.	HOWARD LAB	H. Howar[illegible]

TYPE SAMPLE	ANALYSIS METHOD	RESULT*	NO. SAMPLES	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME**	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	000.0	1	08	08	8	001	68 County Rd. Holyoke	08	08	8	D	1030	DUP	C. [illegible]
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	
DUP	303	0 .	1			8	0				8	D		DUP	

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

SAMPLE TYPE:
- C - CHECK SAMPLE
- D - REGULAR DISTRIBUTION SAMPLE
- P - PLANT TAP SAMPLE
- R - RAW WATER SAMPLE
- S - SPECIAL SAMPLE

LAB ID: 00851

PREPARED BY Harlan A. Howard DATE Sept [illegible]

APPROVED BY DATE

ORIGINAL TO: PUBLIC WATER SYSTEM

D_ AR_ ME_ C_ N_ C_ E_ AL Q_ JA_ Y _ C_ E_ C

BACTERIOLOGICAL ANALYSIS REPORT

PWS ID	TRANSACTION CODE	CONTAMINANT ID	PUBLIC WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1 1370661	05	3000	Report Water Company	HOWARD LAB	H. HOWAR[illegible]

LAB ID BELOW	ANALYSIS METHOD	RESULT*	VOLUME	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME**	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	09	09	83	001	68 County Rd	09	09	83	D	245	DUP	C. Wome[illegible]
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	
DUP	303	0	1			8	0				8	D		DUP	

*COLIFORM PER 100 ml

**MILITARY TIME

METHOD CODE	
MF	303
MPN	305

REMARKS

C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID: 00851

PREPARED BY Harlan A. Howard DATE Oct 15 [illegible]

APPROVED BY DATE

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
BACTERIOLOGICAL ANALYSIS REPORT

P.O. Box D. N. Amherst, Ma 01059

PWS ID	TRANSACTION CODE	CONTAMINANT ID	WATER SYSTEM NAME	LAB NAME	SAMPLES ANALYZED BY
1137080 1	05	3000	Aqua Water Co. Inc.	HOWARD LAB	H. HOWARD

DUP	METHOD	RESULT	TUBES	ANALYSIS DATE MO	DAY	YR	CODE	LOCATION NAME	SAMPLE DATE MO	DAY	YR	TYPE	SAMPLE TIME*	LAB ID BELOW	SAMPLE COLLECTED BY
DUP	303	0000	1	08	27	83	3061	of Const Pond Intake	08	27	83	D	1200	DUP	C. Howard
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	
DUP	303	0	1	"	"	8	0		"	"	8	D		DUP	

*COLIFORM PER 100 ml

*MILITARY TIME

METHOD CODE
MF 303
MPN 305

REMARKS

SAMPLE TYPE
C - CHECK SAMPLE
D - REGULAR DISTRIBUTION SAMPLE
P - PLANT TAP SAMPLE
R - RAW WATER SAMPLE
S - SPECIAL SAMPLE

LAB ID 00851

PREPARED BY Harlan A. Howard DATE May 11

APPROVED BY DATE

APPENDIX C

STORM WATER CONTAMINANTS

Characteristics of Storm Waters, City of Springfield, Massachusetts*

Parameter	Range of Values	Mean	Std. Dev.	No. of Samples
pH	6.4-7.8			20
Diss. O_2	1-10	7.2	2.1	27
% Sat. O_2	10-107	82	24.1	27
Temperature	17-28	[illegible]	--	27
Turbidity	15-185	55	29	27
Apparent Color	60-500	200	96	27
Copper	.05-0.72	.32	.13	18
Tannin & Lignin	3-11	4.0	1.3	14
Total Iron	.28-1.55	.62	.34	20
Aluminum	.09-.4	.175	.67	10
Ammonia-N	.95-10.0	2.64	1.78	22
Nitrite-N	.1-.125	.35	.33	18
Nitrate	0-5	1.0	1.2	17
Total Phosphate	.25-2.2	1.02	.50	19
Ortho-P	.25-1.75	0.65	.29	19
Meta-P	0.0-0.95	0.34	.19	19
Total Hardness	8.5-68	23	16	24
Chlorides	10-500	46	46	23
Carbon Dioxide	10-200	39	27	27

*Data obtained in 1971 at Allen Street and Plumtree Road, and from Quaker Road.

All values are expressed in mg/l per liter except pH, % Sat. of O2, temp. (^{o}C), turbidity (JTU), and apparent color (APHA units). All analyses are based on Standard Methods, 13th Ed., 1971.

CHARACTERIZATION OF THE AVERAGE QUALITY OF LAKE, STREAM, AND STORM WATERS

PARAMETER	MOUNTAIN LAKE	FEEDER STREAMS	STORM WATERS
pH	6.5-7.0 (5.5-9.5)	6.5-7.0 (6.2-7.2)	6.5-7.0 (4.5-8.0)
Temp. °C.	0-25	-2 - 21	-2 - 23
Spec. Cond. (mmhos/cm.)	.20 (.10-.30)	.20 (.15-.30)	.35 (.1-10)
D.O. % of Sat.	80 (70-90)	75-80 (20-90)	60-65 (0-80)
B.O.D. mg/l	3 (0-18)	4-5 (1-20)	10 (3-110)
Turbidity JTU	5-15 (3-100)	15 (8-1000)	35 (5->1000)
% Transmittance	90-95 (60-98)	90-95 (0-98)	80 (0-98)
Color A.P.H.A.	30 (5-200)	40 (5->500)	150 (3->500)
Suspended Solids mg/l	20 (10-130)	30 (15-3000)	200 (20-3300)
Total Iron mg/l	0.6 (0.2-1.5)	0.5 (0.3-5.0)	1.5 (0.5-20)
Copper mg/l	0.8 (0.3-1.5)	0.5 (0.3-1.5)	1.2 (0.3-22)
Total Hardness (mg/l as $CaCO_3$)	50 (30-150)	40 (28-75)	50 (28-2000)

EXHIBIT IV-8

PARAMETER	MOUNTAIN LAKE	FEEDER STREAMS	STORM WATERS
Calcium mg/l	37 (30-100)	28 (25-65)	40 (25-2000)
Magnesium mg/l	13 (4-100)	12 (3-75)	10 (4-100)
Sulfate mg/l	20 (12-40)	20 (6-40)	12 (6-40)
Total Phosphates mg/l	0.4 (0.2-1.5)	0.2 (0.2-37)	1.5 (0.4-14)
Total Dissolved Solids (mg/l as NaCl)	75 (35-1000)	75 (30-500)	170 (40-100,000)
Ammonia-N mg/l	0.1 (0.0-1.1)	0.3 (0-5)	1.1 (0-26)
Nitrite-N mg/l	0.01 (0-0.3)	0.03 (0-0.8)	0.2 (0-8)
Nitrate-N mg/l	2 (0-18)	2 (0-20)	3 (0-154)
Tannin and Lignin mg/l	0.2 (0-1.6)	0.1 (0-3.5)	1.1 (0-5.6)
Silica mg/l	5 (0-8)	5 (0-8)	5 (0-9)
Chlorides	20 (0-600)	16 (0-300)	75 (10-50,000)

The first number given in each category is the average value or range of values; the numbers in parentheses indicate the range of values.

Carranza and Bemben, 1973 (9)

EXHIBIT IV-8.1