D 046

IMPLEMENTATION PROJECT FOR THE MANAGEMENT OF GREAT POND EASTHAM, MASSACHUSETTS: GROUNDWATER MONITORING PROGRAM

BAYSTATE
ENVIRONMENTAL
CONSULTANTS
INC.

IMPLEMENTATION PROJECT
FOR THE MANAGEMENT OF GREAT POND,
EASTHAM, MASSACHUSETTS:
GROUNDWATER MONITORING PROGRAM

PREPARED FOR:

THE TOWN OF EASTHAM
TOWN HALL,
2500 STATE HIGHWAY,
EASTHAM, MASSACHUSETTS 01642

AND THE

DIVISION OF WATER POLLUTION CONTROL
WESTVIEW BUILDING, LYMAN SCHOOL GROUNDS
WESTBORO, MASSACHUSETTS 01581

PREPARED BY:

BAYSTATE ENVIRONMENTAL CONSULTANTS, INC.
296 NORTH MAIN STREET
EAST LONGMEADOW, MASSACHUSETTS 01028

JULY, 1991

DISCLAIMER

This report was funded under a cost sharing Substate Agreement between the Commonwealth of Massachusetts through its Division of Water Pollution Control (Division), Clean Lakes Program (Chapter 628, Acts of 1981) and the town of Eastham (Grantee). As stated in the Substate in the Substate Agreement (Paragraph A.3.11), the Grantee is required to submit a draft Final Report for the Division's review and comment. Subsequently, the Grantee must submit a Final Report that incorporates the Division's comments and corrections. Final payment of a 10% retainable would be released upon acceptance of the Final Report by the Division (Paragraph 1.7 of the Substate Agreement).

Prior to the completion of this Phase I project, most of the resources and staff of the Clean Lakes Program were reallocated by the Department of Environmental Protection. As one consequence of these actions a thorough and timely review of this report was not feasible. Since the Grantee and its subcontractor(s) should not be burdened unduly, the Division adopted an interim procedure of checking draft final reports solely to determine whether the Scope of Work (Appendix A of the Substate Agreement) had been met. This Draft Final Report has been checked by the Division, any discrepancies have been rectified by the Grantee or its subcontractor(s) and, at a minimum, it does fulfill all requirements specified in the Scope of Work. The Division has, therefore, accepted this report in accordance with Paragraphs 1.7 and A.3.11 of the Substate Agreement and released the 10% retainage to the Grantee and its subcontractor(s).

It should be emphasized, however, that this report has <u>not</u> been subjected to a full and thorough review by the Division as in the past and, therefore, the quality and completeness of this report, and the assessments and recommendations contained therein, represent primarily the work and judgments of the subcontractor.

TABLE OF CONTENTS

INTRODUCTION

Concern for groundwater quality has heightened in recent years with closings of public wells and increasing public awareness of the fragility of our groundwater resources. The relationship between activities on the land surface and the quality of the groundwater reserves below is being studied extensively, and regulations intended to protect groundwater are being formulated and implemented. Nowhere is the need for background data and protection programs more critical than on Cape Cod, where groundwater not only serves as a source of water for domestic purposes but also interacts freely with surface water resources of great value to each community. Concern in Eastham for groundwater resources and the condition of multiple ponds prompted a study of Great Pond under the Massachusetts Clean Lakes Program. The pond and related water resources in its watershed were the subject of an intensive study in 1985 and 1986. Baseline conditions were established and recommendations for future study and management were offered.

The Diagnostic/Feasibility Study report (BEC 1987) recommended that a grid of monitoring wells be established in the postulated groundwater drainage area of Great Pond. It was suggested that these wells be sampled seasonally for a year and less frequently thereafter. Some portion of the wells were to be clusters of three at different depths to provide a vertical profile as well as horizontal profile of groundwater quality. Water table elevations determined from measurements in the wells were to be used to more accurately delineate the groundwater drainage basin of Great Pond. Water quality data were to be used to assess potential sources of contamination of the pond. The overall intent of the groundwater assessment program was to augment the existing groundwater data base and to facilitate evaluation of possible threats to pond condition via groundwater contamination.

METHODOLOGY

Groundwater Assessment Via Wells

In Phase I of this project, BEC utilized the preliminary groundwater elevation map from the 1987 study report, which was based on a map prepared by the Cape Cod Planning and Economic Development Commission, to site possible well locations. In Phase II, we augmented this information with data for fourteen pond gauges collected by Town of Eastham personnel. Maps generated from data provided to BEC by Town of Eastham personnel are contained in Appendix A.

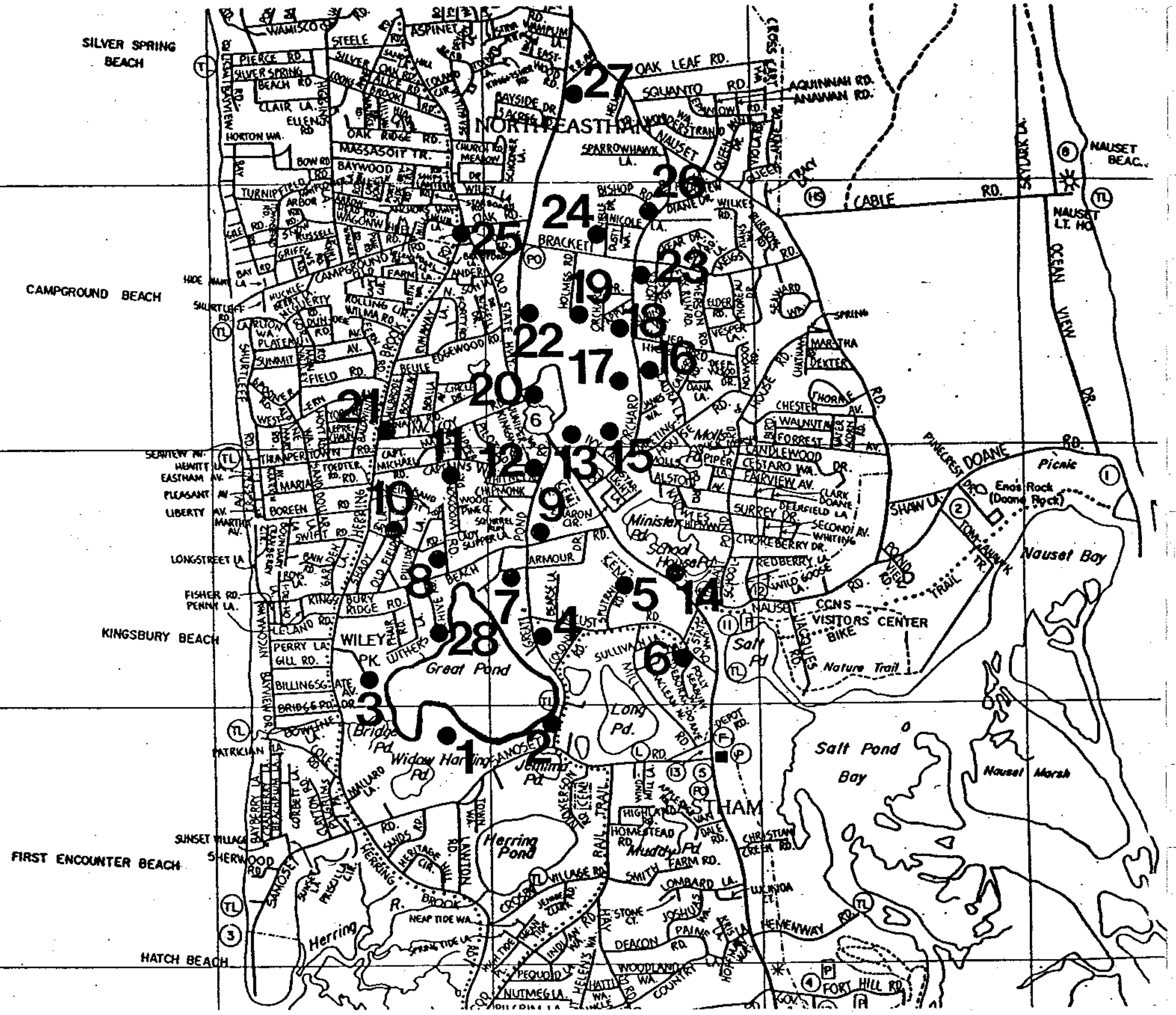
BEC also viewed the Eastham area groundwater contour map in preparation by Paul Barlow of the United States Geological Survey in Boston. While Mr. Barlow's map was not approved for public release at the time, he provided us with the data upon which his map was based. Additional water table elevation data was provided by Mr. Douglas Heath of the United States Environmental Protection Agency, Region I, in Boston, MA. The data provided by Messrs. Barlow and Heath contained very little information for the Great Pond drainage area, however, particularly at the scale necessary for this project. Typically, data for three or four wells within the study area were available. The data generally support the maps drawn from the Town of Eastham data.

BEC proposed general locations for new monitoring wells and the use of seven existing wells in an October 1988 quarterly report. The proposal was reviewed by the Department of Environmental Quality Engineering, Division of Water Pollution Control (DEQE, DWPC), the United States Geological Survey (USGS), and the United States Environmental Protection Agency (USEPA). Several sites were adjusted as a result of this review. Letters were then sent to five property owners in the vicinity of each general well location, requesting approval for installation of a well on the corresponding property (Appendix B). Letters were followed up by phone calls and visits, where appropriate. A list of consenting property owners was compiled and supplemented where necessary by door to door inquiries. Selected respondents were then notified and asked to sign a permission/release form (Appendix B).

Wells were installed between February 27 and March 15, 1989, by T.E. Desmond Well Drilling Company of Brewster, MA. Well installation was observed by BEC personnel. Resultant well locations are presented in Figure 1. More detailed information on well locations is contained in Appendix B. The elevation of the top of each well casing was surveyed by Schofield Brothers, Inc. of Orleans, MA, by mid-April, 1989. The elevation of the top of each well casing is given in Table 1, along with other general information about the wells.

FIGURE 1

WELL LOCATIONS FOR THE GREAT POND GROUNDWATER MONITORING PROGRAM



1 CM = 310 M

N
↑

TABLE 1

LOCATIONS, ELEVATIONS AND DEPTHS OF INSTALLED WELLS

WELL #	LOCATION	TOC ELEV. (ABOVE MSL)	WELL DEPTH (ft.)
1a	30 Clark's Point Rd.	23.75	35
b			55
c		23.76	75
2	305 Great Pond Rd.	13.13	15
3 (EGW-37)	Entrance to Wiley Park	26.86	20
4	360 Great Pond Rd.	34.45	40
5	35 Split Rail Rd.	21.63	25
6a	65 Deborah Doane Way	25.86	30
b			50
c			70
7a	25 Great Pond Place	23.86	25
b			45
c			63
8	320 Weir Rd.	28.78	30
9	347 Kingsbury Beach Rd.	44.53	43
10	55 Grove Rd.	35.59	37
11	55 Wood Song Drive	42.93	45
12a	Kingswood Rd.	45.18	45
b			65
c			85
13a	Atlantic Oaks Camp Ground	46.55	44
b			62
c	Town Crier Motel	46.50	70
14a	R2-3280 Rt.6	44.12	45
b			65
c			83
15 (HJ-2)	Town Landfill	16.75	12.30
16	320 Old Orchard Rd.	54.76	55
17 (HJ-1)	Town Landfill	19.38	7.90
18 (HJ-3)	Town Landfill	27.58	15
19a	Eastham Ready Mix, Holmes Rd.	37.95	45
b			60
c			80
20a	Eastham Common, Rt.6	37.83	25
b			55
c			75
21	Herring Brook & McKoy Rd.	38.10	40
22	Gift Land, Rt.6	42.32	40
23a	720 Old Orchard Rd.	54.01	50
b			70
c			90
24a	25 Danielle Drive	47.17	50
b			70
c			90
25	540 Massasoit Rd.	41.86	40
26	15 Bishop Rd.	47.00	45
27	Captains Quarter Motel, Rt.6	50.97	46
28	Wiley Park, Beehive Rd.	30.17	30

Wells designated with a, b or c are part of a cluster; the tops of all wells within a cluster are at the same elevation unless otherwise noted.

A single borehole was made with a hollow stem auger mounted on a drill rig at each selected well location. For all single monitoring wells, the hole was drilled to 10 ft below the contacted groundwater table at that specific location. For cluster wells, the hole was drilled to 50 ft below the contacted water table. Encountered soils included coarse and fine sands, brown clays and grey clays. Nearly all cluster well boreholes and many shallow single well boreholes penetrated clay layers. A few planned well screen depths had to be altered to avoid clay layers which would have greatly limited water entrance into the associated wells. Most cluster wells incorporated wells above and below the encountered clay layer. Additional information regarding associated soil features is contained in the boring logs in Appendix B.

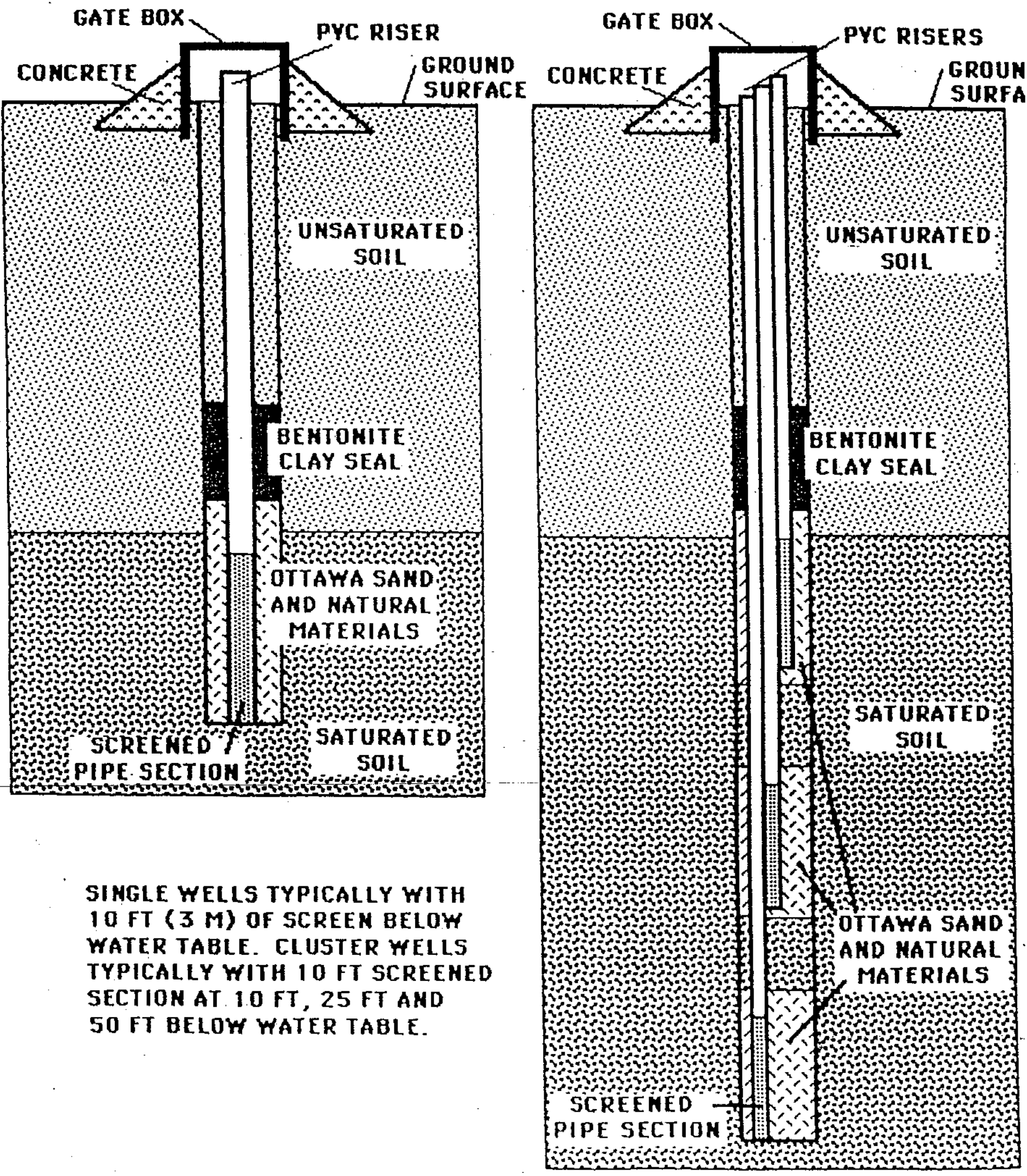
Well casings were constructed from ten-foot sections of two-inch Sch40PVC flush threaded joint riser; no glues or other solvents were applied. The bottom 10 ft of each well casing was constructed from two-inch 0.010 slot screen. In the case of cluster wells, three casings were put in each borehole. The shortest casing extended to 10 ft below the contacted groundwater table, the intermediate casing terminated 25 ft below the water table, and the longest casing ended 50 ft below the water table (Figure 2). The natural annual fluctuation in the water table elevation is two to three feet in this area of Cape Cod (MDEQE 1980). Even if the water table was near its highest annual elevation at the time of well installation, none of the wells installed in this project should go dry at any time.

Ottawa sand was poured into each borehole to a depth of 10 ft, providing a porous medium through which groundwater could reach the well screen. Some collapsed natural formation is mingled with the sand in most wells. The sand addition was followed by an input of approximately five feet of bentonite clay seal to prevent vertical movement of water alongside the well casing. For single casing wells, the remainder of the borehole was filled with natural soils removed during drilling. For cluster wells, the sand additions were repeated for the intermediate and shallow casings, beginning at the bottom of each casing, but the bentonite seal was applied only above the shallowest casing (Figure 2).

Each single well or cluster arrangement installed in this project was covered with an iron gate box set in concrete (Figure 2). The plate on the top of each gate box is secured with a bolt which can be removed by a pentagonal gate box wrench. Removal of the top plate allows access to the well casings for sampling. The seven pre-existing wells added to the well grid for this project have alternate cover arrangements; five are secured by padlocked pipe covers and two have screw top caps.

FIGURE 2

MONITORING WELL INSTALLATION ARRANGEMENTS


SINGLE WELL ARRANGEMENT

CLUSTER WELL ARRANGEMENT

SINGLE WELLS TYPICALLY WITH 10 FT (3 M) OF SCREEN BELOW WATER TABLE. CLUSTER WELLS TYPICALLY WITH 10 FT SCREENED SECTION AT 10 FT, 25 FT AND 50 FT BELOW WATER TABLE.

In total, 23 boreholes were drilled, and 41 casings were installed. Nine three-well clusters and fourteen single wells were installed. The monitoring program takes advantage of an additional seven wells installed previously. Four of these pre-existing wells are driven steel wellpoints, one at Wiley Park and three single wells in the landfill. The other three pre-existing wells were installed along the power line access road behind the Town Crier Motel and the Atlantic Oaks Campground, and functionally constitute another cluster arrangement (Table 1). Two casings are situated in one borehole and one single well is located several hundred feet away; the varied elevations of the well screens provide the vertical profile established in the BEC wells. This brings the total number of wells for sampling to 48, with 10 three-well clusters and 18 single wells (Figure 2, Table 1).

Each well was visited by BEC personnel on May 8-10, 1989, at which time the depth to water in each well was recorded and at least three times the standing volume of water in each well was pumped out. This verified that each well was established; water refilled the wells in all cases, although recovery rates varied substantially. In most cases it was not possible to detectably reduce the water level in the well with the foot-valve pump employed (pumping 0.5 to 1.5 gpm). The water in the wells became turbid after no more than one well volume was pumped out, and cleared again only after prolonged pumping in the most sandy locations.

Discontinuous use of wells on Cape Cod invariably leads to a return of turbidity (inflow of fine sediments) upon resumed pumping (Desmond 1989, Hanson 1989, Moran 1989). The presence of clays at most well sites also ensures that fine sediment will be available to enter wells upon purging. As fresh aquifer water does enter each well upon removal of more than one well volume of standing water, it was decided not to develop wells further, but to filter samples for nutrient analyses.

The existing grid of 48 wells was sampled in summer and fall of 1989 and spring of 1990. Well #18, a shallow pre-existing well in the landfill, was dry during the second and third samplings. Additionally, well #19, a cluster set, was damaged by heavy equipment after the first sampling; only the deepest of the three wells in this cluster (19c) could be sampled all three times; well #19a was sampled twice and well #19b only once. All other wells were sampled three times.

Depth to water in each well was measured prior to any pumping. Removal of well water was performed by manual operation of a one-inch outside diameter Delrin plastic foot-valve pump attached to an appropriate length of high density polyethelene tubing with an outside diameter of five eighths of an inch and an inside diameter of one half inch (Figure 3, Rannie and Nadon, 1988). Wells were purged until stable conductivity was achieved or a minimum of three well volumes had been removed. Sampling took place immediately after purging, and all sampling was done in a consecutive four-day period. Decontamination between uses consisted of internal and external rinses with methanol followed by acidified distilled water. The purging process served as an additional decontamination process for the pump/sampling tube/receiving bucket.

Conductivity and pH were assessed by BEC on site on unfiltered samples. Samples were analyzed for total dissolved phosphorus, nitrate nitrogen, ammonium nitrogen and dissolved kjeldahl nitrogen (two dates only) by Berkshire Enviro-Labs; samples for these parameters were filtered on site through pre-washed 0.45 um membrane filters, placed in amber bottles, preserved with mercuric chloride, and kept on ice until delivered to the lab at the end of the sampling period. Samples were analyzed for sodium and VOC's by Dr. Joseph Moran's laboratory at Cape Cod Community College, although not all samples were analyzed on all dates. These samples were unfiltered, and the VOC samples were collected in septum vials. Samples were kept on ice and were delivered to Dr. Moran at the end of each sampling day.

BEC provided a distilled water blank and a triplicate sampling of one well for each of the three sampling runs. The resulting quality control data facilitates an assessment of precision and accuracy.

Data collected through the examination of well water is used to map the elevation of the water table throughout the area covered, facilitating more accurate determination of the groundwater drainage basin serving Great Pond. Flow net analysis is used to evaluate the likelihood of potential pollution sources impacting the pond. Well water quality data provides a data base for groundwater quality which greatly supplements previous information collected by DEQE, USGS, USEPA, BEC and Dr. Moran for the study area. Separation of vertical and horizontal trends is facilitated, allowing testing of hypotheses relating to postulated plumes from specific sources of groundwater contamination.

Groundwater Assessment Via Seepage Meters and LIP Samplers

The Phase I study report recommended additional assessment of groundwater at its points of entry to Great Pond. BEC employed the seepage evaluation approved by the DWPC for recent Phase I studies, as detailed in Mitchell et al. (1988, 1989). Briefly, this procedure involves the temporary installation of modified end sections of 55-gallon drums (Figure 4), through which groundwater seeping into or out of the pond must pass. An attached bag containing a premeasured quantity of water allows

FIGURE 3

SCHEMATIC OF A FOOT VALVE PUMP FOR REMOVING WATER FROM MONITORING WELLS

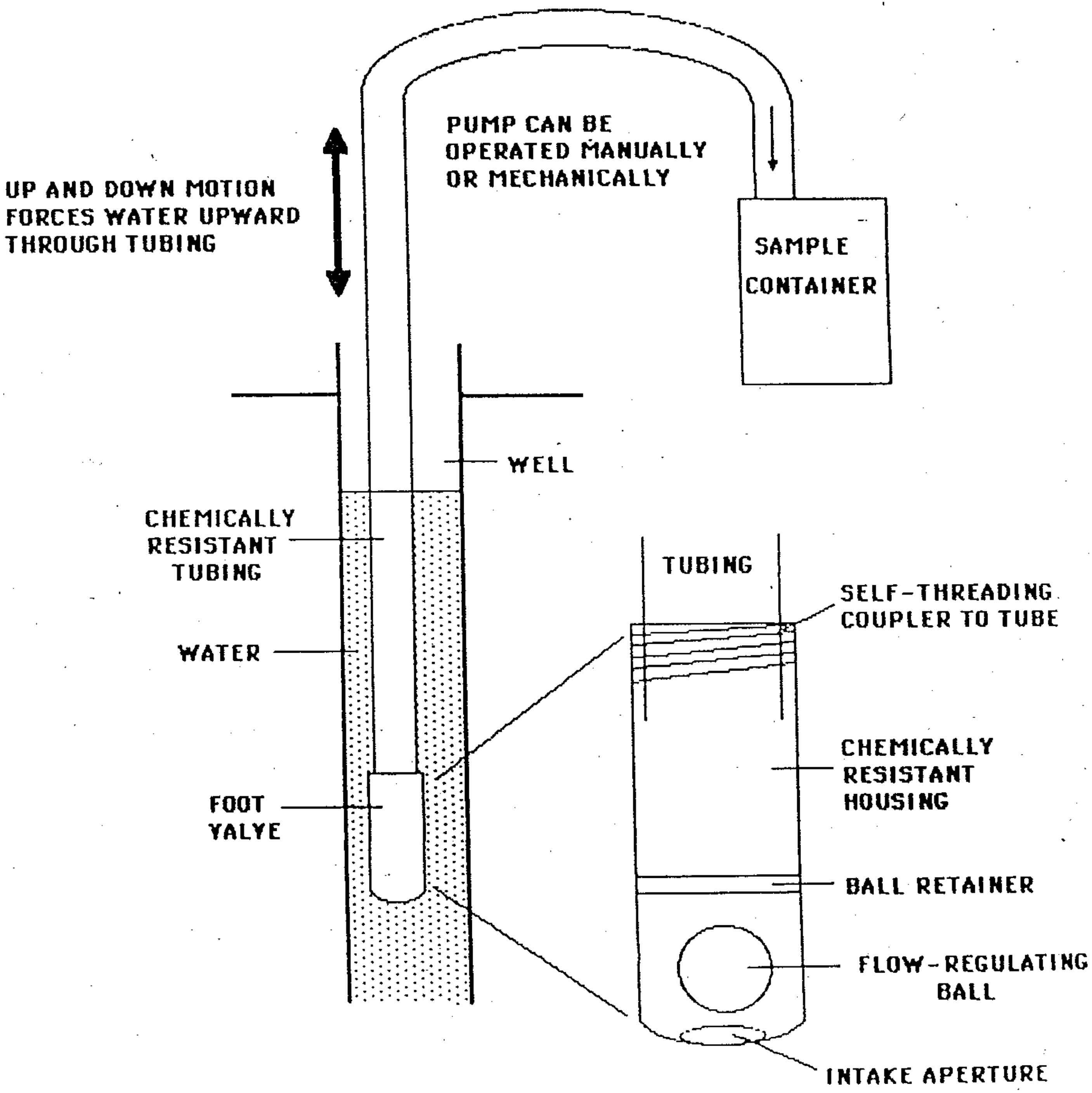
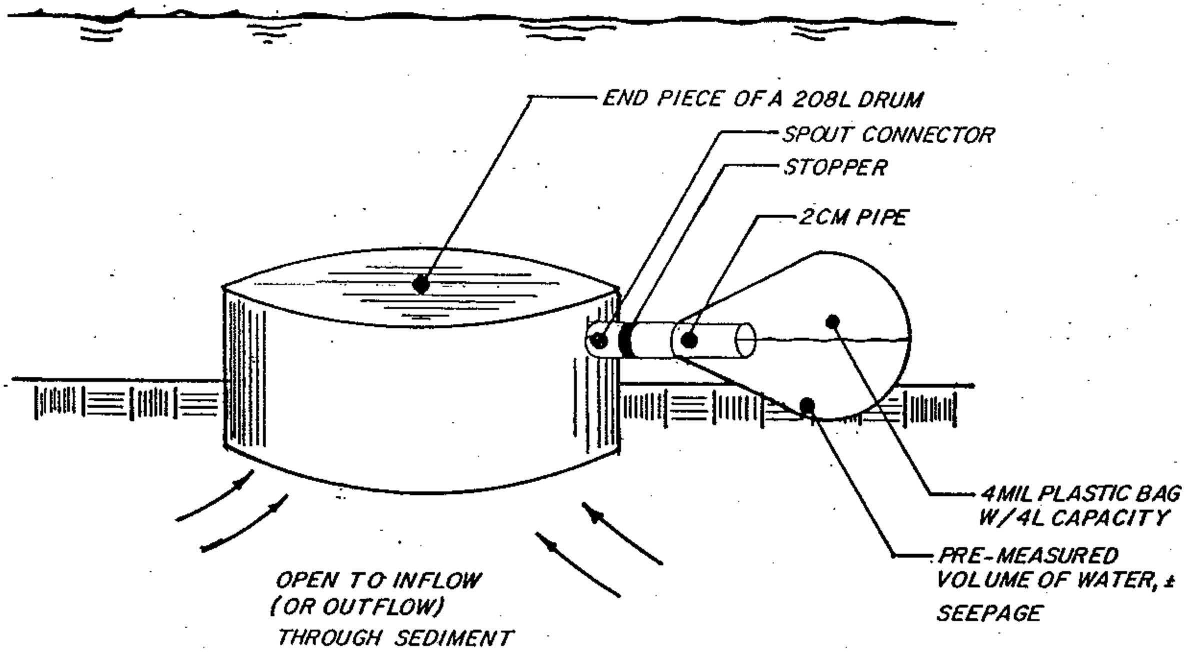


FIGURE 4

Seepage Meter Apparatus for Quantifying Ground Water Flow.



quantitative determination of seepage over time for the area covered. Six transects of four seepage meters each were set up around the pond (Figure 5).

Quality of seepage water was assessed through samples collected with the Littoral Interstitial Porewater (LIP) sampler (Figure 6). One composite sample was collected for each seepage transect and analyzed for the same parameters as assessed for well water samples. Seepage assessment was performed twice, once in each of June and September, 1989.

The quantitative and qualitative evaluation of seepage is used in conjunction with well data to evaluate impacts of groundwater on the pond. Corroboration of measured seepage rates with the Phase I hydrologic budget is desired, with a breakdown of net groundwater income into total income and outflow. Potentially critical factors which may modify certain aspects of incoming groundwater quality include biological and chemical interactions at the sediment water interface and at the thermocline during summer stratification. Groundwater quality assessments were therefore supplemented with additional surface water investigation.

Surface Water Assessment

The water in Great Pond was sampled in June and September, 1989, in conjunction with the seepage measurements. Near surface and near bottom samples were collected on each of the two dates at a location near Station GP-3 of the Phase I study. This is the deepest part of the pond (11 m or 36 ft). Assessed parameters include total phosphorus, total filterable phosphorus, ammonium nitrogen, nitrate nitrogen, total kjeldahl nitrogen, sodium, pH, conductivity, chlorophyll and secchi disk transparency. Additionally, temperature and dissolved oxygen profiles were determined at this site.

FIGURE 5

TRANSECT LOCATIONS FOR GREAT POND SEEPAGE ASSESSMENT

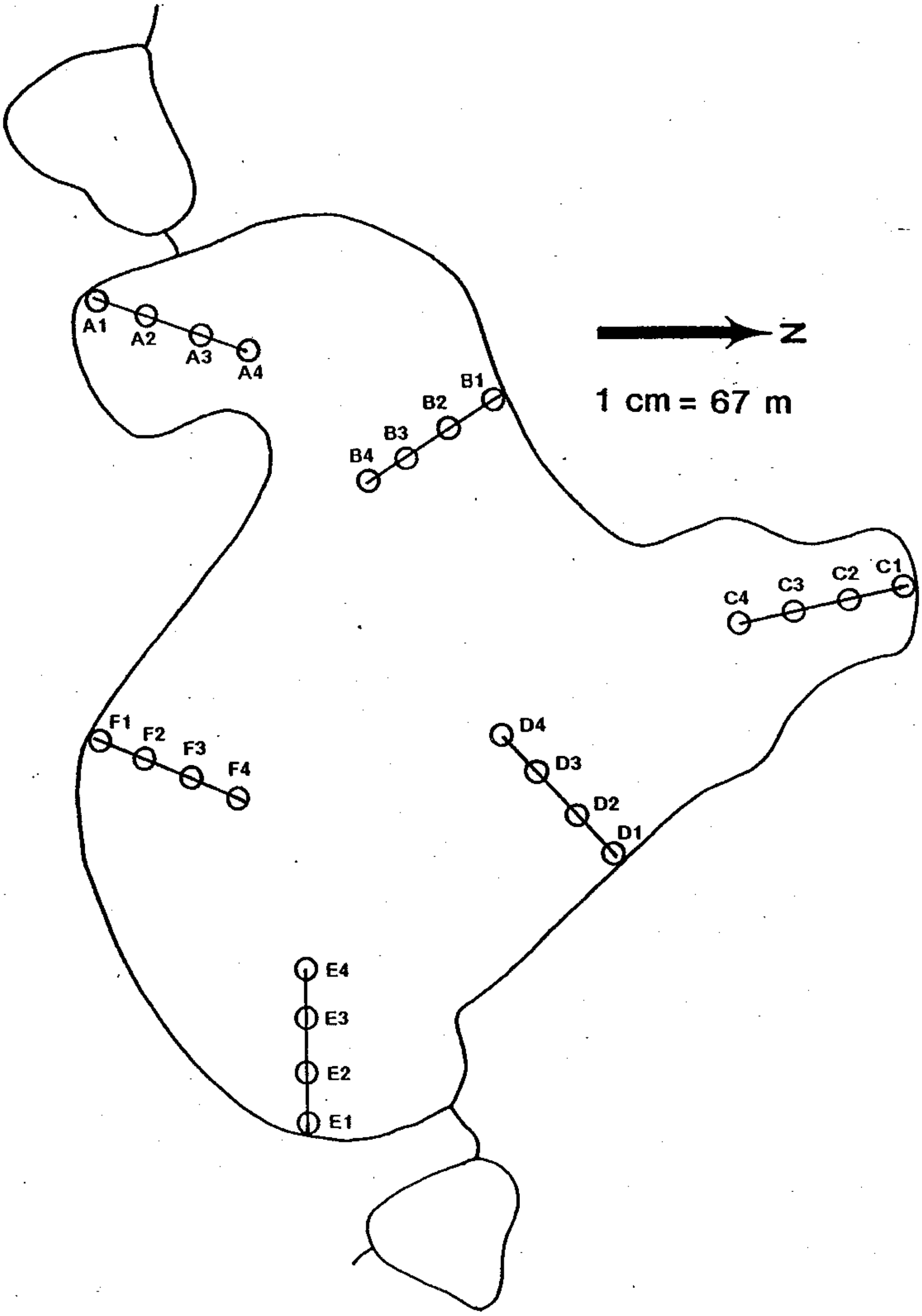
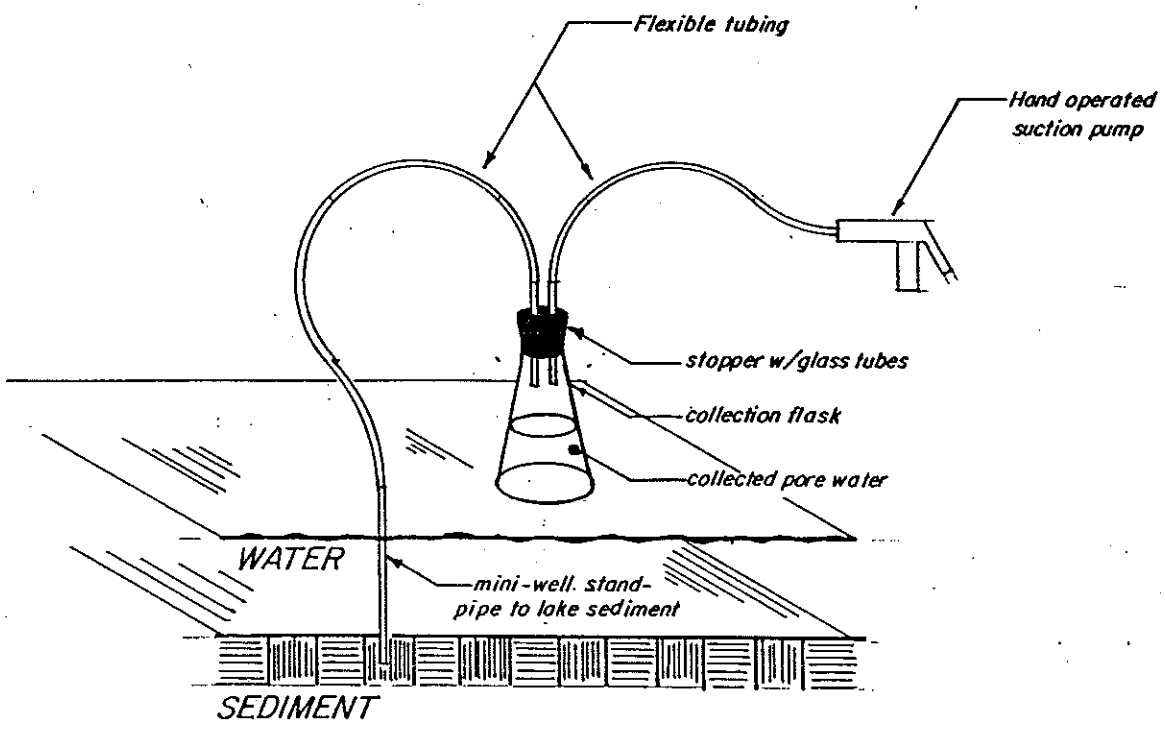
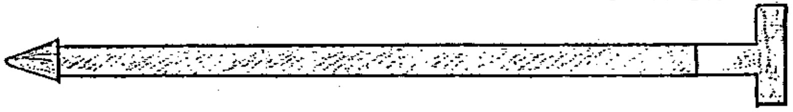


FIGURE 6

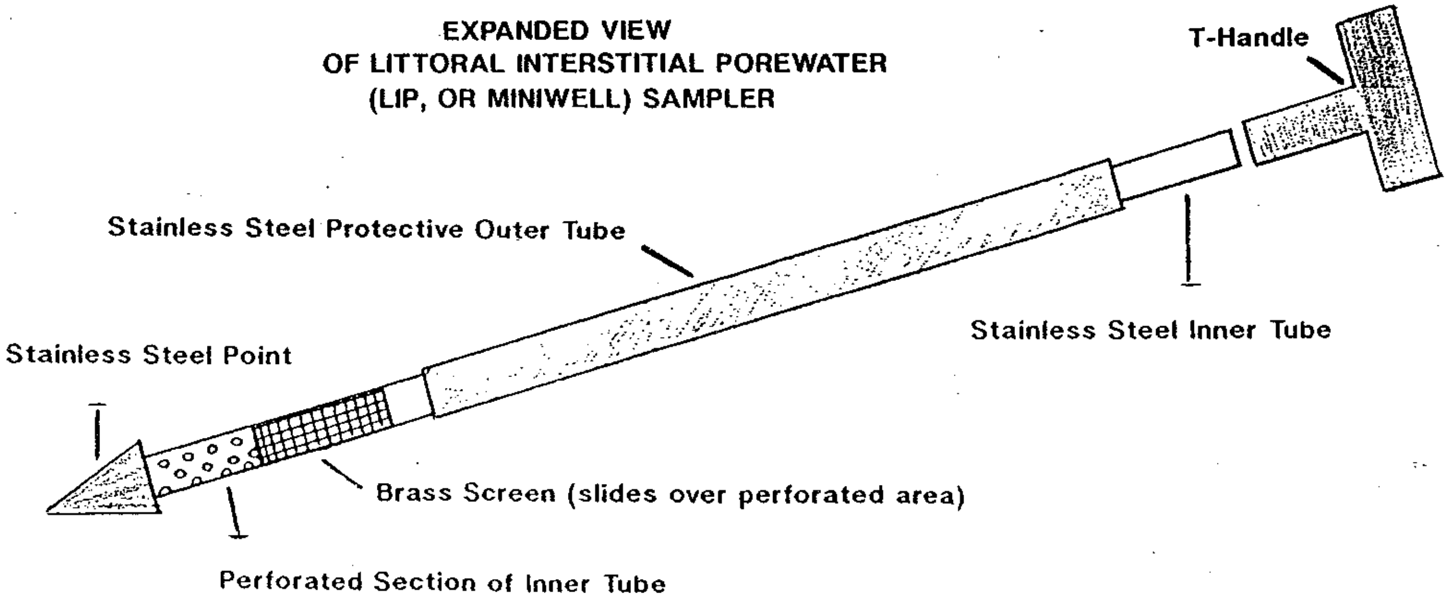
Mini-Well Device for Obtaining Pore Water from Lake Sediments



VIEW OF APPARATUS CLOSED FOR INSERTION



EXPANDED VIEW
OF LITTORAL INTERSTITIAL POREWATER
(LIP, OR MINIWELL) SAMPLER



RESULTS

Groundwater Mapping

The groundwater elevation readings obtained from the wells (Appendix C) allowed construction of contour maps for each of three dates (Figures 7-9). These maps agree well with those constructed from data provided by other studies (Appendix A); the position of contours varies seasonally, but a clear pattern is evident. In general, there is a groundwater divide which runs from a point north of Brackett Road along Route 6 to Herring River Marsh, passing through Great Pond and sloping southward as it progresses. As a result, groundwater flows southeast or southwest from the divide, or almost due south along it. Localized groundwater flow patterns may vary considerably, however, as a function of clay lenses and surface water interception of groundwater.

At the northern end of the study area the groundwater attained an elevation of approximately 16 feet above sea level (ft MSL), while at the southern end the groundwater level was less than 8 ft MSL. The distance between these points is about 3.3 km (10,700 ft or about two miles), resulting in a groundwater table slope of 0.00075 in the north-south direction. Water table slopes are steeper along the east-west axis at up to 0.003.

Groundwater Drainage Area to Great Pond

The groundwater drainage area contributing to Great Pond is basically a tear-drop shaped piece of land aligned in a north-south direction (Figures 10 and 11). This area begins slightly north of Brackett Road just east of Route 6 and extends southward to Great Pond with an eastern boundary roughly coincident with the old railroad bed. The western boundary cuts across Route 6 and passes through largely residential area, enclosing a drainage area which includes several of the major hotels along Route 6.

The solid boundary line drawn in Figures 10 and 11 encloses the area which apparently contributes groundwater to Great Pond on a regular basis. The dashed line in these figures encloses additional area which may contribute groundwater to the pond on a seasonal or intermittent basis. The existence of clay lenses and other non-conformities in the generally sandy soils of the area can cause substantial localized alteration of the overall groundwater flow pattern. Great Pond appears to intercept groundwater from its entire perimeter, passing the excess of inflow over evaporation and intermittent outseepage as surface outflow into Bridge Pond. Groundwater mounding as a consequence of elevated inputs (e.g., at the Sheraton Hotel on Route 6) is also known to alter localized groundwater flow patterns.

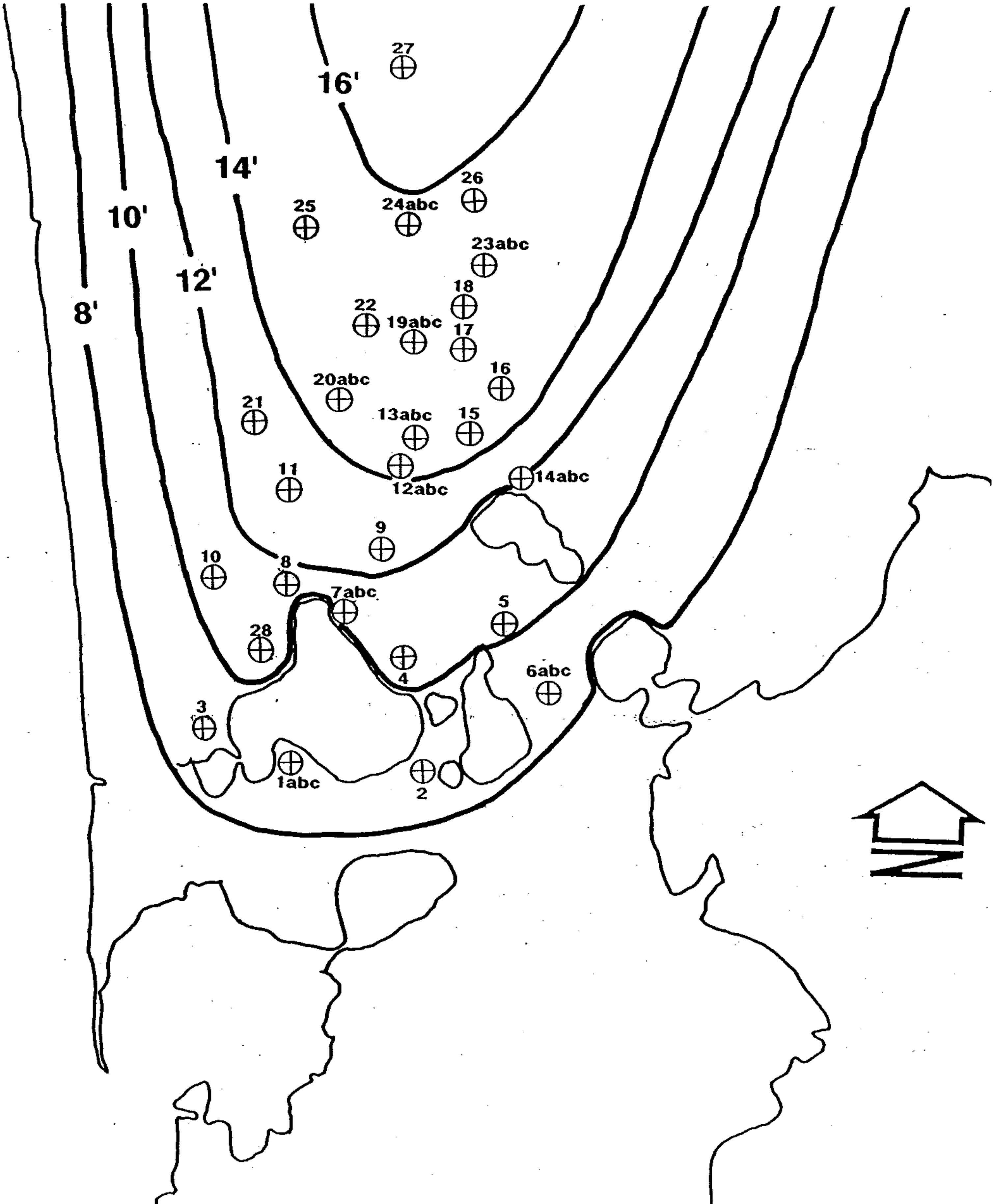


FIGURE 7

GREAT POND GROUND WATER MAP

AUGUST 1989

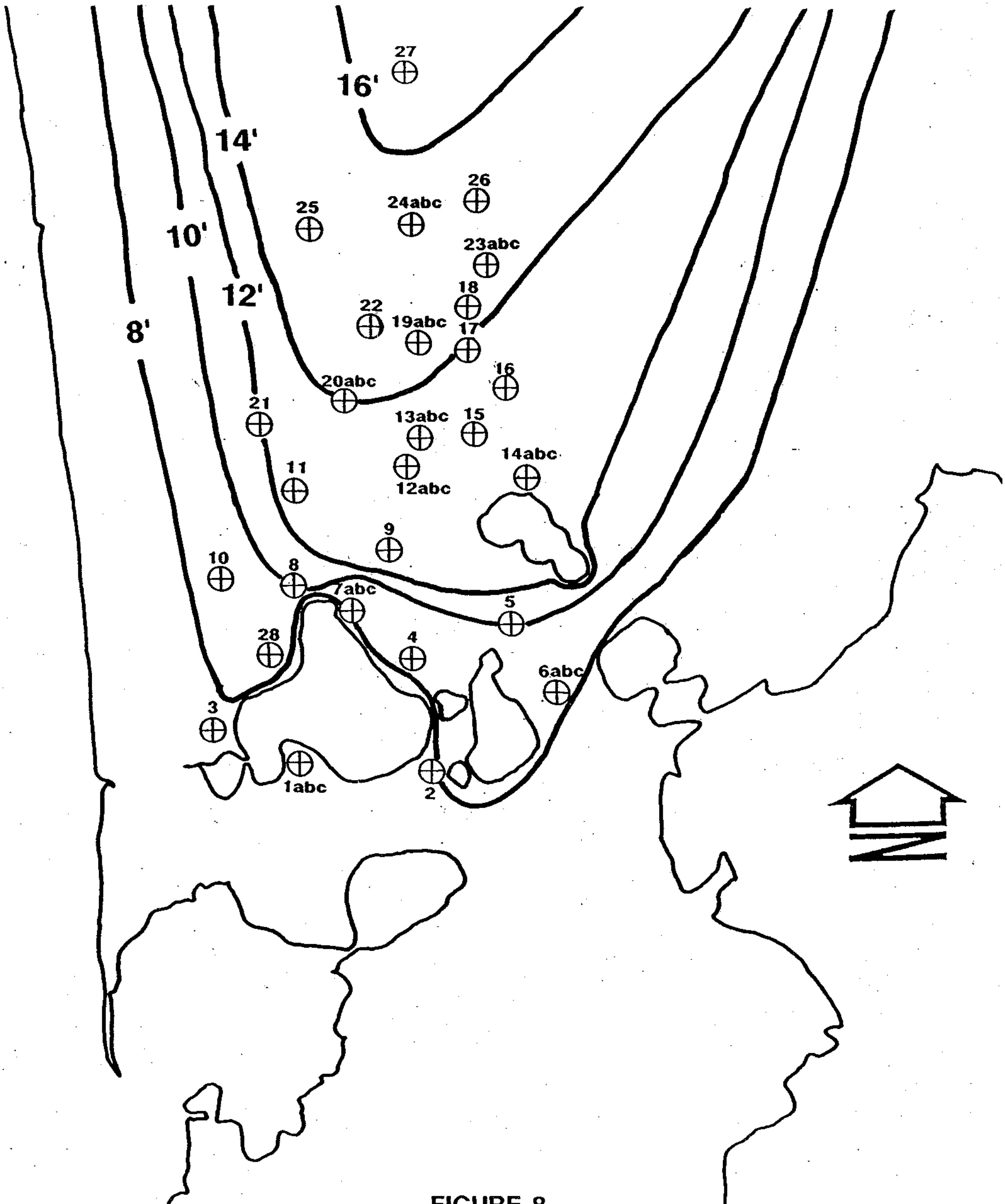


FIGURE 8

GREAT POND GROUND WATER MAP

OCTOBER 1989

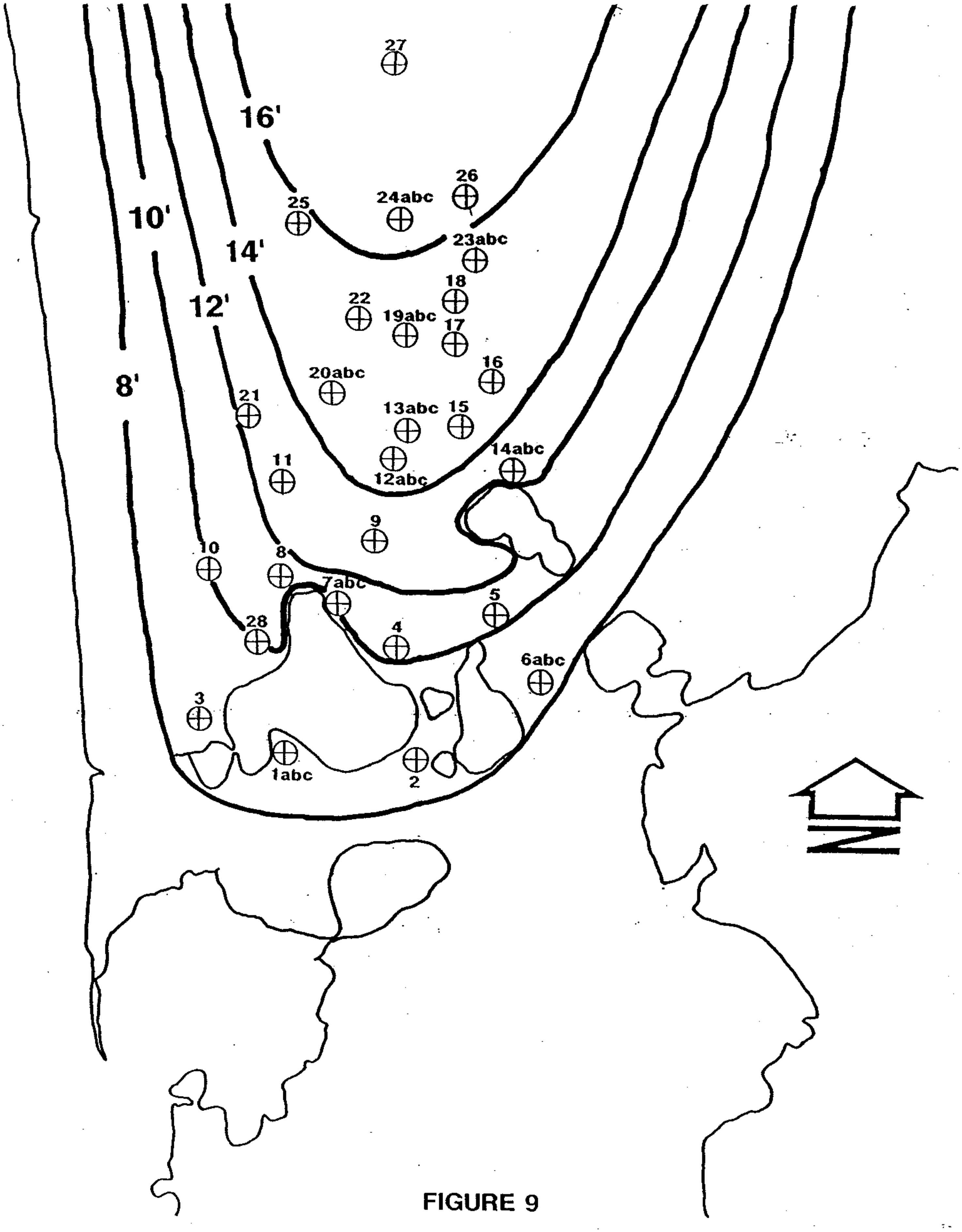


FIGURE 9

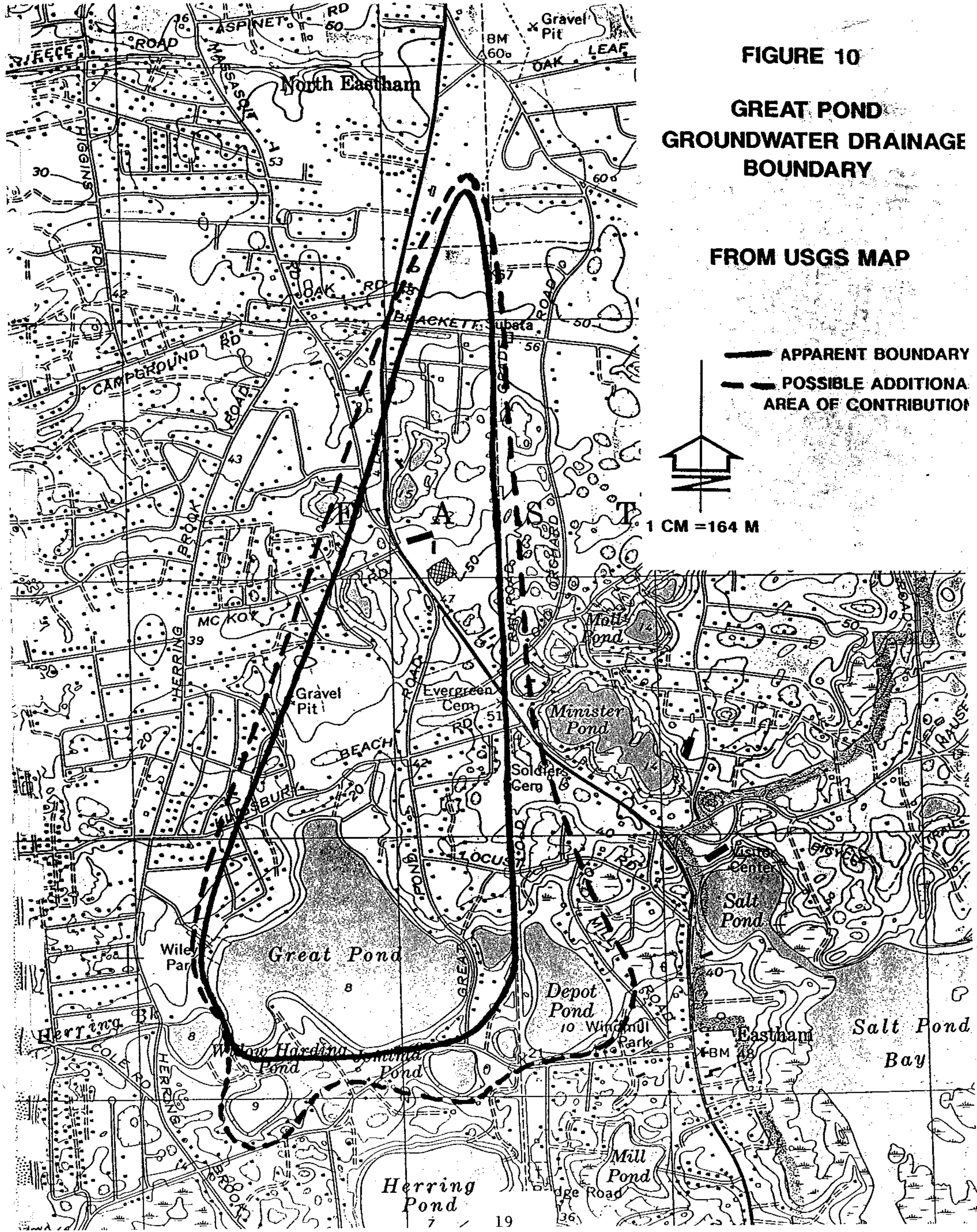
GREAT POND GROUND WATER MAP

MAY 1990

FIGURE 10

GREAT POND GROUNDWATER DRAINAGE BOUNDARY

FROM USGS MAP



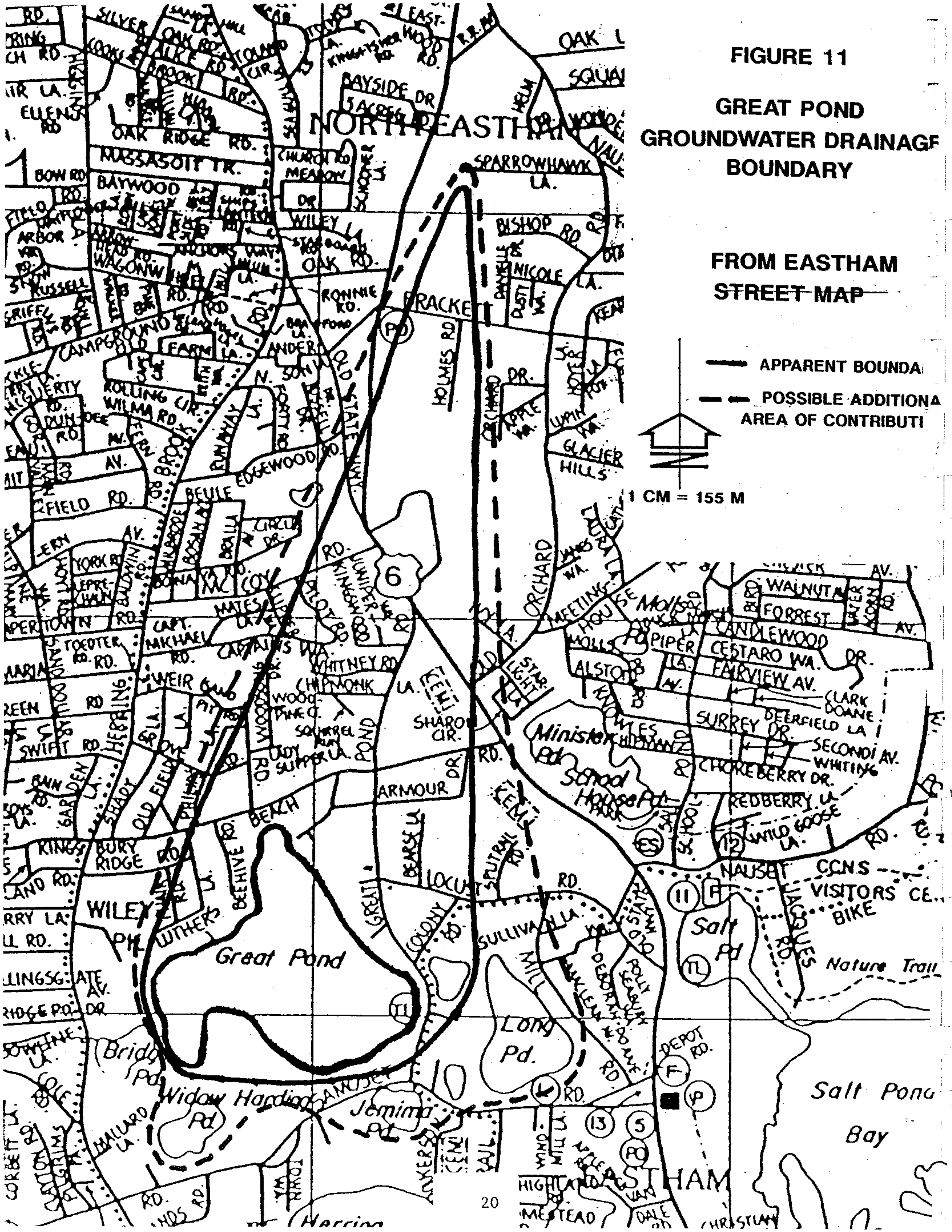


FIGURE 11

GREAT POND GROUNDWATER DRAINAGE BOUNDARY

FROM EASTHAM ~~STREET MAP~~

A wide range of land uses is encompassed by the approximately 500 acre (solid line) to 720 acre (dashed line) groundwater drainage basin boundary. The area nearest Great Pond, to the southwest of Route 6, is primarily residential. Lot sizes are highly variable, with substantial quantities of undeveloped land in this area. Average house density is on the order of one per two acres of land excluding the pond area from the calculation, but including wetlands, cemeteries and other landforms.

The Route 6 corridor is generally commercial, with several large hotel complexes, multiple restaurants and numerous shops. The area northwest of Route 6 includes some residential land, a small industrial park (including a concrete operation and several building trade shops), and possibly the western edge of the Eastham Town Landfill, which is within the dashed but not the solid boundary line. The Route 6 corridor and the landfill have been the subject of considerable discussion and allegation in Eastham with respect to impacts on groundwater quality.

Well Water Quality

Average water elevation and values for selected water quality parameters are presented in Table 2. Soluble inorganic nitrogen in Table 2 is the sum of nitrate and ammonium nitrogen from Appendix C. As ammonium nitrogen is converted to nitrate nitrogen in the presence of oxygen and certain common bacteria, it is assumed that the measured ammonium will become nitrate at some distance from the source. Application of nitrate concentration standards to the soluble inorganic nitrogen level is therefore considered appropriate.

Average soluble inorganic nitrogen concentrations ranged from less than 0.1 mg/l to just under 5 mg/l. As no mean value (and in fact no individual value) exceeded the health standard of 10 mg/l, no imminent health risk is implied. However, many communities on Cape Cod employ a warning limit of either 2 or 5 mg/l; no average values exceeded 5 mg/l, but 8 of the means exceeded 2 mg/l. Concentrations above 1 mg/l are uncommon under natural circumstances, and 17 out of 48 means (over a third) exceeded 1 mg/l.

Total Kjeldahl Nitrogen (TKN) is a measure of the ammonium nitrogen plus all organically bound forms of nitrogen. As the samples from this project were filtered prior to testing, only dissolved nitrogen forms are represented by the TKN values. TKN values are generally low in the collected samples, with 21 out of 48 mean values less than 0.1 mg/l and only two means greater than 1 mg/l. Ammonium nitrogen typically accounts for the great majority of the measured TKN (Appendix C), with urea and amino acids suggested as the most likely additional components.

TABLE 2

MEAN VALUES FOR SELECTED WATER QUALITY PARAMETERS

WELL #	WATER ELEVATION (feet)	SOLUBLE INORGANIC-N (mg/l)	TOTAL KJELDAHL-N * (mg/l)	TOTAL FILTERABLE-P (mg/l)	pH (su)	CONDUCTIVITY (umhos/cm)	SODIUM ** (mg/l)
1a	8.48	.21	.14	.11	6.9	90	4.0
b	8.24	.36	.79	.13	7.0	107	5.0
c	8.33	.20	.47	.11	7.1	102	5.0
2	8.90	.39	.46	.15	6.2	127	12.0
3	8.49	1.14	.59	.13	6.2	153	13.0
4	12.24	2.33	<.10	.13	6.3	194	19.0
5	11.23	.95	<.10	.07	6.2	156	12.0
6a	9.14	2.74	2.81	.06	6.1	145	10.0
b	9.01	1.25	.73	.07	6.3	176	11.0
c	8.79	.37	.10	.10	6.4	116	9.0
7a	9.36	.32	.22	.08	6.3	155	12.0
b	10.96	.63	.55	.07	6.5	219	16.0
c	10.96	.20	.14	.05	6.8	108	11.0
8	11.61	.42	.48	.13	6.1	114	15.0
9	13.58	1.47	<.10	.13	6.3	116	15.0
10	11.99	2.06	<.10	.12	6.1	145	11.0
11	13.06	1.92	<.10	.09	6.0	260	39.0
12a	14.11	.41	<.10	.09	6.0	176	20.0
b	14.08	2.31	<.10	.03	6.0	283	42.0
c	13.56	2.35	.31	.05	6.0	284	21.0
13a	14.33	.20	.19	.58	6.1	137	9.0
b	14.33	.14	<.10	.26	6.1	103	13.0
c	11.60	1.72	<.10	.11	7.4	141	17.0
14a	12.36	.61	.15	.21	6.1	321	50.0
b	11.40	.23	.15	.05	6.1	280	14.0
c	10.45	.44	<.10	.13	6.3	120	13.0
15	11.35	2.21	3.10	.05	6.6	171	4.0
16	8.99	2.11	<.10	.18	5.8	170	13.0
17	13.43	1.47	.14	.07	6.2	82	4.0
18	14.48	1.81	.25	.05	6.7	100	-
19a	14.73	1.38	.18	.05	6.0	199	11.0
b	14.73	.61	<.10	.04	6.4	190	-
c	14.70	.10	<.10	.12	6.3	144	11.0
20a	14.88	.28	.34	.04	6.0	117	6.0
b	14.88	.28	.95	.09	5.9	273	40.0
c	14.86	.10	.20	.05	5.9	361	40.0
21	12.38	.05	<.10	.06	6.1	90	10.0
22	15.27	.46	<.10	.07	6.2	114	8.0
23a	14.76	.26	.11	.05	5.9	177	20.0
b	14.81	.40	<.10	.06	6.2	83	8.0
c	14.81	.07	.11	.04	6.1	115	10.0
24a	15.55	.06	<.10	.08	6.1	136	11.0
b	15.55	.12	.10	.08	6.2	126	10.0
c	13.95	.09	<.10	.05	6.1	316	32.0
25	15.41	1.21	<.10	.10	6.1	110	11.0
26	15.48	.40	<.10	.07	6.3	63	4.0
27	16.77	4.85	<.10	.04	5.9	197	15.0
28	10.05	.12	.10	.06	6.3	200	28.0

*- sampled only in August & October of 1989.
**- sampled only in May of 1990.

Total filterable phosphorus values were low relative to concentrations typically associated with sewage or industrial discharges, but were moderate to high relative to desired levels in surface water for the control of eutrophication. Means ranged from 0.04 to 0.58 mg/l, while values greater than 0.05 mg/l are considered excessive in lakes and values over 0.1 mg/l are considered high in streams or rivers.

Phosphorus is readily adsorbed onto positively charged soil particles; sandy soils typically hold about 100 ug P per gram of soil, which equates to over 2000 mg P per liter of soil. Relative to these levels, the observed filterable phosphorus concentrations are not especially high. They may be an artifact of the sampling and filtration process (some dissociation may have occurred), or may indeed suggest that the soils in some areas are becoming saturated with phosphorus.

Log mean pH values ranged from 5.8 to 7.4, a fairly wide range considering that each pH unit represents a ten-fold change in the hydrogen ion concentration. Most values were between 6.0 and 6.5, however, a range commonly associated with natural groundwater pH on Cape Cod.

Conductivity means ranged from 63 to 361 umhos/cm, indicating a fairly wide range of dissolved solids levels. Most values were between 100 and 200 umhos/cm. Values lower than 100 umhos/cm are generally assumed to represent waters of low ion concentration, while values much above 200 umhos/cm suggest substantial concentrations of nutrients, chloride, or other contaminants. Values on Cape Cod can vary tremendously as a consequence of natural factors, primarily the influences of saltwater and acidity. The conductivity-raising influence of urbanization may therefore be obscured.

Sodium levels, measured only for the last set of samples, ranged from 4 to 50 mg/l. The health criterion for consumptive purposes is 20 mg/l, above which there is a danger of elevated blood pressure in a significant portion of the population. Ten of the observed values were in excess of 20 mg/l, and six more values fell between 15 and 20 mg/l. While human activities are known to raise the sodium level (e.g., road salting and septic system discharges), the natural influence of salt spray from the nearby ocean and bay may be more influential.

The results of the VOC analyses provided by Dr. Joseph Moran are most encouraging from a health perspective, as few compounds were detected (Appendix C). Of the 50 compounds detectable with EPA Method 502.1, only chloroform was detected with any regularity, appearing in 31 out of 55 samples at concentrations up to 6 ppb (ug/l). As the Massachusetts Office of Research and Standards recommends a maximum value of 5 ppb in drinking water, one well (#23a) exceeds this allowable limit for potable water. A recommended but unofficial federal criterion for chloroform is 1.9 ppb, a level exceeded by four additional wells (#8, 13b, 16 and 28).

Chloroform is one of four commonly assessed trihalomethanes, the USEPA drinking water standard for which 100 ppb (all trihalomethanes combined). The observed levels of all trihalomethanes do not even approach 100 ppb, suggesting no overall health hazard. According to the Barnstable County Laboratory, chloroform is commonly found in Cape Cod groundwater at 0.2 to 5 ppb. Chloroform is a solvent and cleansing agent as well as an anasthetic. The most probable route to groundwater is via septic systems, as solutions containing chloroform are dumped down drains by homeowners or business operators.

Five other compounds were detected in up to three samples each, with little overlap in occurrence and no concentrations of health concern. Although there is a threat of significant groundwater pollution from the landfill and Route 6 businesses, the pattern (or lack thereof) of VOC values indicates that contamination from individual residence septic systems is just as likely, but that overall there is only a nominal health threat based on the data collected during this study.

Examination of the vertical distribution of contaminants within cluster well sets revealed no consistent pattern. Contaminant levels exhibited no discernible pattern among the three vertical levels sampled (0-10 ft, 15-25 ft, and 40-50 ft into the groundwater). The depth-concentration relationship for soluble inorganic nitrogen is illustrated in Figure 12, along with the spatial distribution of mean values over the area sampled.

Examination of the temporal distribution of contaminant levels suggests that contaminant levels do appear to increase markedly over the summer and decline over the winter. For example, the highest soluble inorganic nitrogen value (ammonium plus nitrate nitrogen) for each well sampled three times occurred in August 24 times, in October 18 times, and in May 3 times. Variability among dates was substantial (Appendix C), with changes of more than 1 mg/l occurring in the August-October period at 14 wells and in the October-May period at 13 wells.

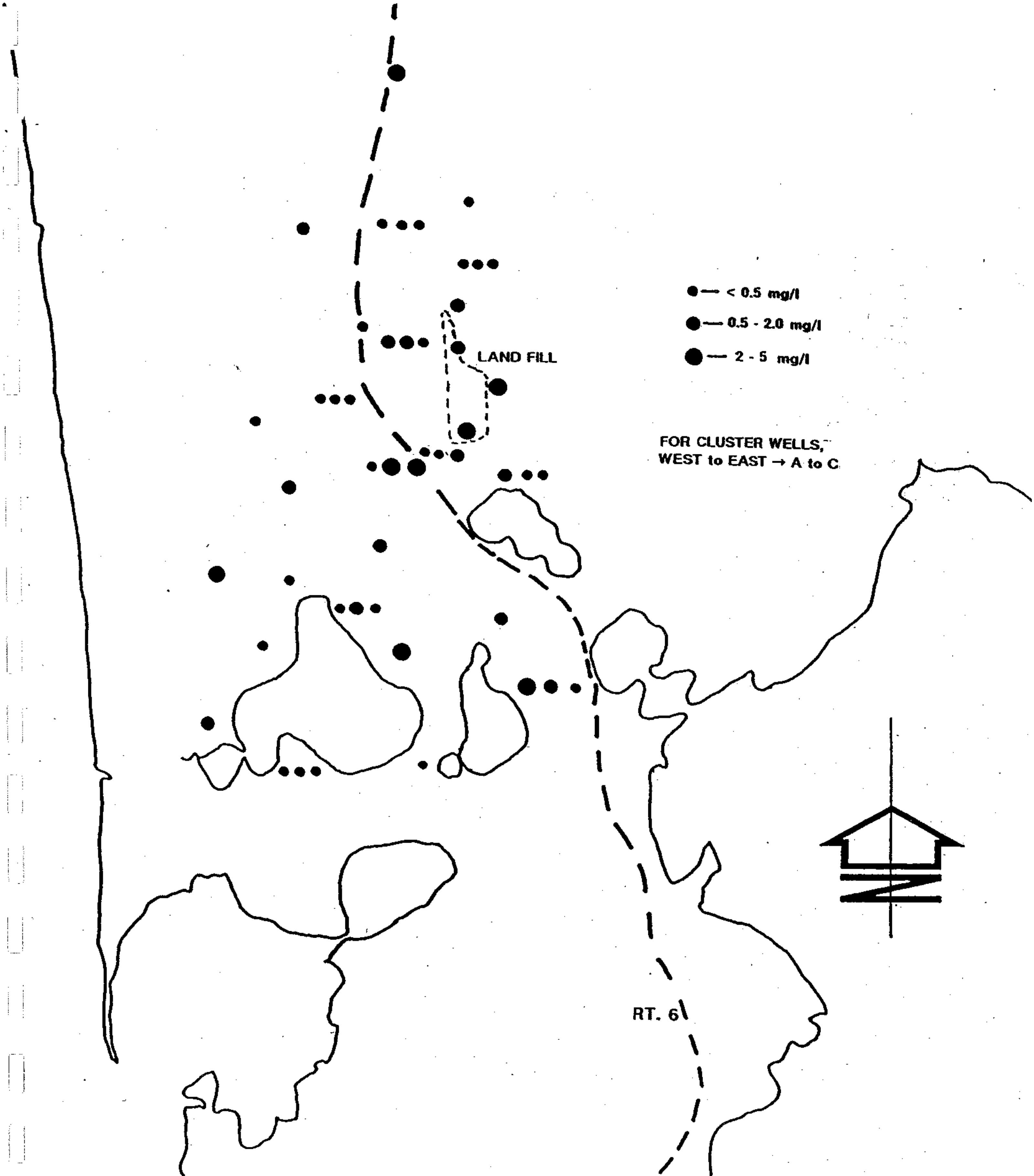


FIGURE 12

SOLUBLE INORGANIC NITROGEN
IN GREAT POND MONITORING WELLS

EASTHAM, MA

Quantity and Quality of Seepage into Great Pond

Seepage measurements at 24 points (Figure 5) around Great Pond indicated groundwater inflows of 2.3 (Table 3) and 1.0 (Table 4) cubic meters per minute, or 1.4 and 0.6 cfs, respectively. Outflow via groundwater was minimal on both dates. Inseepage was highest along the northeastern segment of the pond, between transects C and E (Figure 5), but inseepage was detected all around the pond.

The groundwater inflow estimates obtained in this study are about equal to the net groundwater inflow assumed in the Diagnostic/Feasibility study (BEC 1987). The 1987 study, however, assumed a larger absolute inflow and some outflow via groundwater, based on calculations using Darcy's equation. Actual measurements, however limited, appear to controvert any assumption of substantial groundwater outflow and suggest a smaller actual inflow of groundwater to Great Pond.

The zones of greatest contribution are generally consistent with the apparent path of groundwater flow in the drainage area, although greater inflow from the north into the vicinity of transect C might be expected. This inflow is seemingly reduced by a thick layer of organic material in the northern cove; similar deposits are encountered in the southwestern cove, but the rest of the nearshore area of the pond is relatively sandy.

During most of the year the water level in Great Pond is apparently slightly lower than that of the surrounding groundwater table, resulting in groundwater inflow from all around the pond. This is a consequence of observed rapid percolation of rainfall into the soil (Great Pond receives very little surface flow, even during storms) and much greater evaporative influence on the pond than the groundwater.

Captured groundwater is passed as surface flow through an unregulated channel into Bridge Pond, which overflows through a weir into a small tidal creek. The only time that groundwater outflow is expected to be significant is during times of high water level and substantial precipitation (typically early spring). During such times the surface water level in Great Pond is higher than the groundwater table and the porous sandy soils around the pond facilitate water level equilibration.

The quality of the groundwater entering Great Pond is somewhat variable (Table 5). Total filterable phosphorus concentrations range from the lower detection limit of 0.01 mg/l to 0.18 mg/l, with a marked difference between June and September samples. The average phosphorus level in June was an acceptable 0.025 mg/l, while that for September was a fairly high 0.072 mg/l, almost a threefold increase.

TABLE 3

GREAT POND SEEPAGE, JUNE 1989

GREAT POND SEEPAGE

Date	Meter #	Dist. from shore (M)	Seepage time (HR)	Volume change (L)	Seepage (L/SQ.M/D)
06/13/89	A1	1.5	4.60	.55	11.48
	A2	8.0	4.60	1.50	31.30
	A3	15.0	4.60	.76	15.86
	A4	19.0	4.60	1.16	24.21
	B1	3.0	4.65	.40	8.26
	B2	13.0	4.65	.53	10.94
	B3	24.0	4.65	.63	13.01
	B4	40.0	4.65	.65	13.42
	C1	1.5	4.77	1.42	28.58
	C2	12.0	4.77	.45	9.06
	C3	17.0	4.77	1.22	24.55
	C4	25.0	4.77	2.94	59.17
	D1	3.0	5.80	.24	3.97
	D2	33.0	5.80	-.08	-1.32
	D3	66.0	5.80	1.86	30.79
	D4	76.0	5.80	7.35	121.66
	E1	2.0	4.42	.65	14.12
	E2	5.0	4.42	.31	6.73
	E3	11.0	4.42	.49	10.64
	E4	30.0	4.42	.81	17.59
	F1	6.0	4.00	.48	11.52
	F2	18.0	4.00	.19	4.56
	F3	25.0	4.00	.54	12.96
	F4	33.0	4.00	3.10	74.40

GREAT POND SEEPAGE CALCULATIONS

TRANSECT	SEEPAGE L/SQ.M/D	LENGTH ALONG SHORELINE (M)	DISTANCE FROM SHORE (M)	AREAL SEEPAGE (L/D)
A	20.7	500	25	258913
B	11.4	500	45	256645
C	30.3	500	30	455094
D	38.8	500	85	1647828
E	12.3	500	35	214751
F	25.9	500	40	517200

INFLOW 3350431 = 2.327 CU.M/MIN
OUTFLOW 0 = 0.000 CU.M/MIN

TABLE 4

GREAT POND SEEPAGE, SEPTEMBER 1989

GREAT POND SEEPAGE

Date	Meter #	Dist. from shore (M)	Seepage time (HR)	Volume change (L)	Seepage (L/SQ.M/D)
09/12/89	A1	1.5	2.93	.21	6.88
	A2	8.0	2.82	.23	7.83
	A3	15.0	2.80	.01	.34
	A4	19.0	2.77	-.03	-1.04
	B1	3.0	2.85	.46	15.49
	B2	13.0	2.82	.50	17.02
	B3	24.0	2.80	.12	4.11
	B4	40.0	2.75	.25	8.73
	C1	1.5	2.75	-.10	-3.49
	C2	12.0	2.73	.04	1.41
	C3	17.0	2.67	.44	15.82
	C4	25.0	2.70	.23	8.18
	D1	3.0	3.18	.74	22.34
	D2	33.0	3.17	.18	5.45
	D3	66.0	3.15	.02	.61
	D4	76.0	3.12	.78	24.00
	E1	2.0	3.23	.30	8.92
	E2	5.0	3.28	1.10	32.20
	E3	11.0	3.22	.61	18.34
	E4	30.0	3.25	1.00	29.54
	F1	6.0	3.17	.01	.30
	F2	18.0	3.15	.21	6.40
	F3	25.0	3.20	.14	4.20
	F4	33.0	3.22	.67	19.98

GREAT POND SEEPAGE CALCULATIONS

TRANSECT	SEEPAGE L/SQ.M/D	LENGTH ALONG SHORELINE (M)	DISTANCE FROM SHORE (M)	AREAL SEEPAGE (L/D)
A	3.5	500	25	43792
B	11.3	500	45	255136
C	5.5	500	30	82176
D	13.1	500	85	556753
E	22.2	500	35	389311
F	7.7	500	40	154390

INFLOW 1481559 = 1.029 CU.M/MIN
OUTFLOW 0 = 0.000 CU.M/MIN

TABLE 5

GREAT POND SEEPAGE AND IN-LAKE WATER QUALITY

GREAT POND POREWATER AND SURFACE WATER SAMPLE ANALYSIS RESULTS: JUNE 15, 1989

		GP-3S	GP-3B	LIP SAMPLE LOCATIONS (BY TRANSECT)					
PARAMETER	UNITS	(SURFACE)	(BOTTOM)	A	B	C	D	E	F
Tot. Phosphorus	mg/l	.02	.01						
Tot. Filt. Phosphorus	mg/l	.01	.01	.01	.01	.01	.09	.01	.02
Ammonium nitrogen	mg/l	.02	.22	.06	.30	.52	.74	.09	.02
Nitrate nitrogen	mg/l	.06	.01	.07	.08	.06	.02	.24	.09
Total Kjeldahl Nitrogen	mg/l	.70	1.00						
Total Alkalinity	mg/l			12	23	30	33	22	22
Sodium	mg/l	6.6	6.4	4.4	9.4	6.6	7.0	6.6	6.7
pH	SU	6.9	6.9	6.8	6.5	6.6	6.5	6.6	6.6
Conductivity	umhos/cm	131	115	89	151	139	142	139	135
Fecal Coliform	#/100 mi	2		<10	<10	<10	<10	<10	<10

GREAT POND POREWATER AND SURFACE WATER SAMPLE ANALYSIS RESULTS: SEPTEMBER 15, 1989

		GP-3S	GP-3B	LIP SAMPLE LOCATIONS (BY TRANSECT)					
PARAMETER	UNITS	(SURFACE)	(BOTTOM)	A	B	C	D	E	F
Tot. Phosphorus	mg/l	.02	.02						
Tot. Filt. Phosphorus	mg/l	.02	.02	.04	.08	.04	.04	.05	.18
Ammonium nitrogen	mg/l	.01	.28	.07	.05	.05	.42	.58	.73
Nitrate nitrogen	mg/l	.01	.01	3.80	1.10	4.00	.06	.01	.01
Total Kjeldahl Nitrogen	mg/l	.41	.89						
Total Alkalinity	mg/l			14	10	5	23	21	36
Sodium	mg/l			16.4	11.0	7.5	15.5	12.0	15.0
pH	SU	6.0	5.9	5.7	5.9	5.8	5.8	5.9	5.8
Conductivity	umhos/cm	130	141	210	145	135	162	146	172
Fecal Coliform	#/100 ml	4		<10	<10	<10	<10	20	<10

	JUNE 15, 1989		SEPTEMBER 15, 1989	
DEPTH (M)	TEMP (C)	DO (MG/L)	TEMP (C)	DO (MG/L)
0	19.0	8.3	23.1	8.7
1	19.1	8.3	23.1	8.7
2	19.1	7.9	23.1	8.8
3	19.1	7.9	22.8	8.8
4	19.1	8.2	22.0	9.0
5	19.1	8.3	21.5	8.9
6	18.6	7.1	21.2	8.0
7	17.9	4.9	19.8	.8
8	14.7	.7	15.8	.6
9	13.1	.5	13.2	.5
10	13.0	.4	12.1	.4
SECCHI READING (M)		3.9		3.2
CHLOROPHYLL (MG/L)		1.3		3.3

A similar pattern was observed for soluble inorganic nitrogen (SIN), the sum of ammonium and nitrate nitrogen values. The average June SIN concentration was a relatively low 0.33 mg/l, while the September values averaged 1.81 mg/l. High values for nitrate nitrogen in three of the September samples were responsible for this change.

Alkalinity levels ranged from 5 to 36 mg/l, and decreased slightly on average between June and September; obvious decreases in the areas associated with transects B and C were responsible. Sodium concentrations ranged from 4.4 to 16.4 mg/l, and increased almost twofold from an average of 6.8 mg/l in June to 12.9 mg/l in September. The pH declined markedly between sampling dates at all stations, averaging 6.6 SU in June and 5.8 SU in September. Conductivity increased somewhat between samplings, averaging 133 umhos/cm in June and 162 umhos/cm in September, but there were substantial changes at only two stations (A and F). Fecal coliform levels were consistently low, with all but one sample (E in September) exhibiting values below the 10 FC/100 ml detection limit.

Surface Water Quality

Although there is a substantial data base for this aspect of the Great Pond system (BEC 1987), continued monitoring is useful in the detection of trends and in assessing management progress. As this process has just begun, there are few valid comparisons which can be made. The results of the limited testing (Table 5) suggest no obvious change in water quality since the 1985-86 sampling program, and no such change would be expected.

Nutrient levels are low to moderate, pH and conductivity values are moderate, and sodium and fecal coliform concentrations are low. Hypolimnetic oxygen depletion continues to occur, although not at exceptionally severe rates. Oxygen deficiency in the hypolimnion results in a slight build-up of ammonium and TKN near the bottom of the pond, but phosphorus levels at the surface and bottom of Great Pond are not discernibly different. Water clarity and chlorophyll levels (generally inversely proportional to each other) are moderate and quite acceptable for the desired uses of Great Pond.

Quality Control Assessment

The quality control sample results (Appendix C) are not encouraging from a research perspective, but suggest ample accuracy and precision for detection of major differences in contaminant levels. The least impressive results were for nitrate nitrogen, where an apparently blown lab test in the May 1990 batch of QC samples resulted in a standard deviation of over 1 mg/l. Standard deviations for nitrate nitrogen from the August 1989 and October 1989 sample batches were 0.53 and 0.35 mg/l, respectively. This suggests that compared values must exhibit more than a 0.7 mg/l difference (and as much as a 2 mg/l difference) to be 95% sure that the difference is not a function of laboratory error.

Values for the distilled water blank were not always indicative of distilled water, but only the distilled water used in the first round was fresh; results from the first batch of QC samples were the best in this regard. Again, it appears that order of magnitude differences are readily detectable, but more subtle variations in water quality cannot be separated from potential lab error.

DISCUSSION

Sources of Contamination

There are basically two modes of groundwater contamination within the study area: contaminants are carried by precipitation from the air or land surface into the ground or discharged to the ground through waste disposal systems (solid or liquid). Where solid waste is involved, the percolating rainwater will aid leaching, thereby linking the two mechanisms.

Within the study area, fertilizer, accumulated road pollutants (metals and hydrocarbons) and deicing compounds (mainly salt) are the primary man-made pollutants washed from the land surface by precipitation. Wastewater from private residences, hotels, and restaurants comprise the great majority of liquid discharges to the ground. The Eastham landfill represents a more complicated situation, being a repository for a wide variety of largely solid wastes along with septage pumped from area septic tanks.

All of the above sources have the potential to affect Great Pond via the groundwater, but to varying degrees, based on the results of the monitoring program. Key factors include the direction of groundwater flow, the depth to groundwater under the pollutant source, the magnitude of inputs, the frequency of inputs and the distance from the source to the pond.

Most of the landfill appears to be outside the groundwater drainage area for the pond (Figures 11 and 12), but there is some potential for groundwater mounding associated with the septage disposal area to cause contaminated water to flow into the drainage area for Great Pond. It is also possible that clay lenses, frequent in Eastham, could alter local flow patterns enough to divert some of the landfill-influenced groundwater into the Great Pond drainage area. Further study would be necessary to verify these possibilities. Large, regular flows are unlikely, however, as the direction of flow for groundwater leaving the landfill is generally to the east. If southerly flow did occur, the contaminated water would have to travel over 4500 ft through purifying sands, mixing with groundwater to a high dilution factor, prior to entering Great Pond. Although nitrates and certain other less reactive compounds might form a substantial plume, a sustained, detectable impact on Great Pond is unlikely.

The vertical distance to groundwater is over 10 ft in all but three wells (one adjacent to Great Pond and two in the landfill), and averages close to 25 ft for all wells. This distance is sufficient to remove large quantities of pollutants by biological uptake, filtration and adsorption processes, although nitrates are only minimally affected once they move below the root zone of the vegetative cover. It is possible to exhaust the pollution removal capacity of the soil, but breaks provided by seasonal variations in pollutant loading allow soil rejuvenation. For this reason, only fertilizer or road runoff originating very near the pond has any appreciable opportunity to affect the pond.

On-site wastewater disposal facilities, or septic systems, are subject to the same soil transport and removal processes as the surface contaminants, with somewhat less opportunity for biological uptake. These systems are quite pervasive throughout the study area, however, and provide a seasonally intense source of nutrients and other contaminants. Type of system, the number of people using it, and the seasonal pattern of use are added variables which determine the impact of septic system effluents on the groundwater and Great Pond.

The larger septic systems associated with hotels, restaurants and other businesses along the Route 6 corridor within the Great Pond groundwater drainage area have received considerable scrutiny in recent years. While these systems are fairly high above the groundwater table, lay over 3000 ft from Great Pond, and may not be continuous high level contributors, they are highly visible summer sources of contaminants and contribute at lower levels during the remainder of the year.

Of particular concern are the inputs associated with the Sheraton Hotel; the water inputs alone cause detectable mounding and temperature changes in the groundwater (Moran 1989), and the results for Well #12 in this study suggest that impacts extend beyond the property boundary in the direction of Great Pond. High nitrate values for other wells in the area suggest problems from other establishments as well, but the extent of impact beyond their respective boundaries is uncertain.

The many smaller septic systems associated with individual private residences are of definite concern as well, although no one system is an overwhelming threat. The conversion of seasonal homes to year round dwellings and the great expansion of many residences in the 1970's and 1980's increased the loading potential without a commensurate increase in treatment or dilution potential. Systems closer to the pond are more likely to impact the pond than those systems further away, but in terms of public health these systems should all be considered threats. Most high nitrate levels in sampled wells appear related to contamination by nearby septic systems; in some cases the septic system on the same property as the well may very well be responsible for the observed contamination.

The seasonal use of septic systems is reflected in the pattern of values for many contaminants between spring, summer and autumn samples (Appendix C). Although inputs from nearly all described pollution sources increase during summer, the increase in septic system use is most obvious, as the population swells by an order of magnitude. The spatial pattern of contaminant concentrations (Table 2, Figure 12, Appendix C) is consistent with widespread pollution from smaller sources, although the impacts from the single larger sources noted above cannot be ignored.

Plume Formation

There is no detectable plume extending from any discernible source all the way to Great Pond. Any contamination from the landfill is not differentiable as such even in the Route 6 corridor within the Great Pond drainage area (Figure 12, Appendix C). Although the businesses in the Route 6 corridor appear to provide inputs which should be detectable across Route 6 to the south, even the apparent plume from the Sheraton dissipates halfway to the pond, or at least its differentiation is confounded by likely inputs from smaller septic systems. A considerably greater number of wells would be necessary in the predicted path of the Sheraton plume to trace it and conclusively demonstrate its existence as a threat to Great Pond.

There is no distinct plume from the landfill within the study area, and the pattern of contaminant values does not suggest any single source to be an overriding influence within this system. The high average nitrate value for Well #4 and the intermediate value for Well #7b could be a consequence of a plume from the Route 6 corridor or more local septic system influences. After all the effort expended, it is somewhat disappointing to get less than conclusive results, but the complexity of the system and the lack of a single, overwhelming pollutant source are underscored.

Groundwater Impact on Great Pond

Given the observed water quality in the monitored wells and in Great Pond, it is apparent that although much of the pond water (about half) is derived from groundwater, its quality is more affected by in-lake processes than the quality of seepage. An increase in nitrogen loading over the course of the summer from groundwater appears evident (Table 5), but the in-lake and porewater levels of various forms of nitrogen suggest substantial modification from the primarily nitrate-dominated groundwater nitrogen load.

Phosphorus concentrations appear to be determined largely by sediment-water interactions and biological uptake. The slight increase in average dissolved phosphorus concentration between June and September is not statistically significant. There is a substantial reserve of phosphorus in the sediments, based on the 1987 BEC study, but little of this reserve seems to reach the water column. As primary productivity in Great Pond is believed to be largely dependent on phosphorus dynamics, groundwater inputs are not as influential as might be expected, given the importance of groundwater in the hydrologic budget.

In general, the quality of water in Great Pond is entirely appropriate to its varied uses; alteration through management appears unnecessary at this time. Preservation does not equate to lack of management, however. If impacts on groundwater increase, impacts on the pond can be expected to increase as well. Great Pond seems to have a fairly strong biological buffering system comprised of an active microbial community in the sediment and a healthy rooted plant assemblage (BEC 1987). This system should be protected. As groundwater contamination is typically a long-term process with long-term consequences, prevention of such contamination is in the best interest of the pond as well as the health of the Eastham community.

RECOMMENDATIONS

Based on the results and discussion above, very little in-lake management appears necessary. Control of nuisance growths of rooted aquatic plants in swimming areas does not represent a serious threat to the biological system, but widespread reduction in plant densities is not advisable. Within the watershed, efforts to isolate sources of groundwater contamination are warranted, but could be expensive. Reduction of such contamination would be even more expensive, although the resulting health and ecological benefits may make such expenditures worthwhile.

If the Town of Eastham is serious about tracking plumes from major contaminant sources, it will be necessary to install additional wells along the flow lines predictable from this study. Consideration should first be given to the likely remedial action when the source has been quanitifed and thoroughly evaluated, and how such action will affect the community socially, economically and politically. It may not be worthwhile to pinpoint a source and its impacts if the Town is not prepared to force or take the necessary remedial action. Groundwater contamination is a community level problem which warrants community level participation in its prevention and/or solution.

Although groundwater problems are evident in the study area, there is no marked threat to Great Pond at this time. The threat to potable water supplies is more pervasive, although it is no more severe than in many other Cape Cod communities. If groundwater resources can be protected as potable water supplies, Great Pond should be in no danger. Continued monitoring of the established well grid is recommended on an annual basis, with soluble inorganic nitrogen (nitrate plus ammonium) as the primary indicator parameter. Sampling in late summer would reveal the worst possible conditions in most wells. Additional sampling should be considered for chronically contaminated wells (SIN >2 mg/l), with remedial action recommended on a case by case basis.

ADDENDUM

Although the orignial contract for this project called for four samplings of the wells in a one-year period, non-payment by the Commonwealth of Massachusetts resulted in cancellation of the winter 1989-90 sampling. To meet contract requirements and provide additional information to the Town of Eastham, a fourth round of well sampling was conducted in late June of 1991. the results are contained in Appendix D.

In general, the results were similar to those obtained in the other samplings. Water levels in the wells were slightly lower, a consequence of a very dry June. No nitrate levels in excess of the 10 mg/l health standard were detected, but 15 values over 1 mg/l were obtained, suggesting human influence on water quality in the associated wells. Potential problem wells were almost all the same as in previous samplings. This suggests a relatively constant source of contamination, and not the passage of a slug from some past accident or environmental abuse. Variability in the data set indicates substantial fluctuations in nitrate (and other parameter) values even at problem wells, however, with some indication of a seasonal pattern. As suggested previously, on-site wastewater disposal systems are the most likely route for groundwater pollution in the Great Pond watershed.

REFERENCES

APHA, AWWA and WPCF. 1985. Standard Methods for the Examination of Water and Wastewater (16th Edition). Published jointly by the authoring associations.

Baystate Environmental Consultants, Inc. 1987. Diagnostic/Feasibility Study for the Management of Great Pond, Eastham, Massachusetts. BEC, East Longmeadow, MA.

Desmond, T.E. 1989. Personal communication with the President/Owner of an experienced well drilling firm on Cape Cod.

Hanson, D. 1989. Personnel communication with an engineer with Schofield Bros. Engineering firm of Cape Cod.

Massachusetts Department of Environmental Quality Engineering. 1980. Annual ranges of groundwater level and index well areas for Cape Cod, east part. MDEQE, Boston, MA.

Mitchell, D.M., K.J. Wagner, C. Asbury. 1988. Direct Measurement of Groundwater Flow and Quality as a Lake Management Tool. Lake Reserv. Manage. 4:169-178.

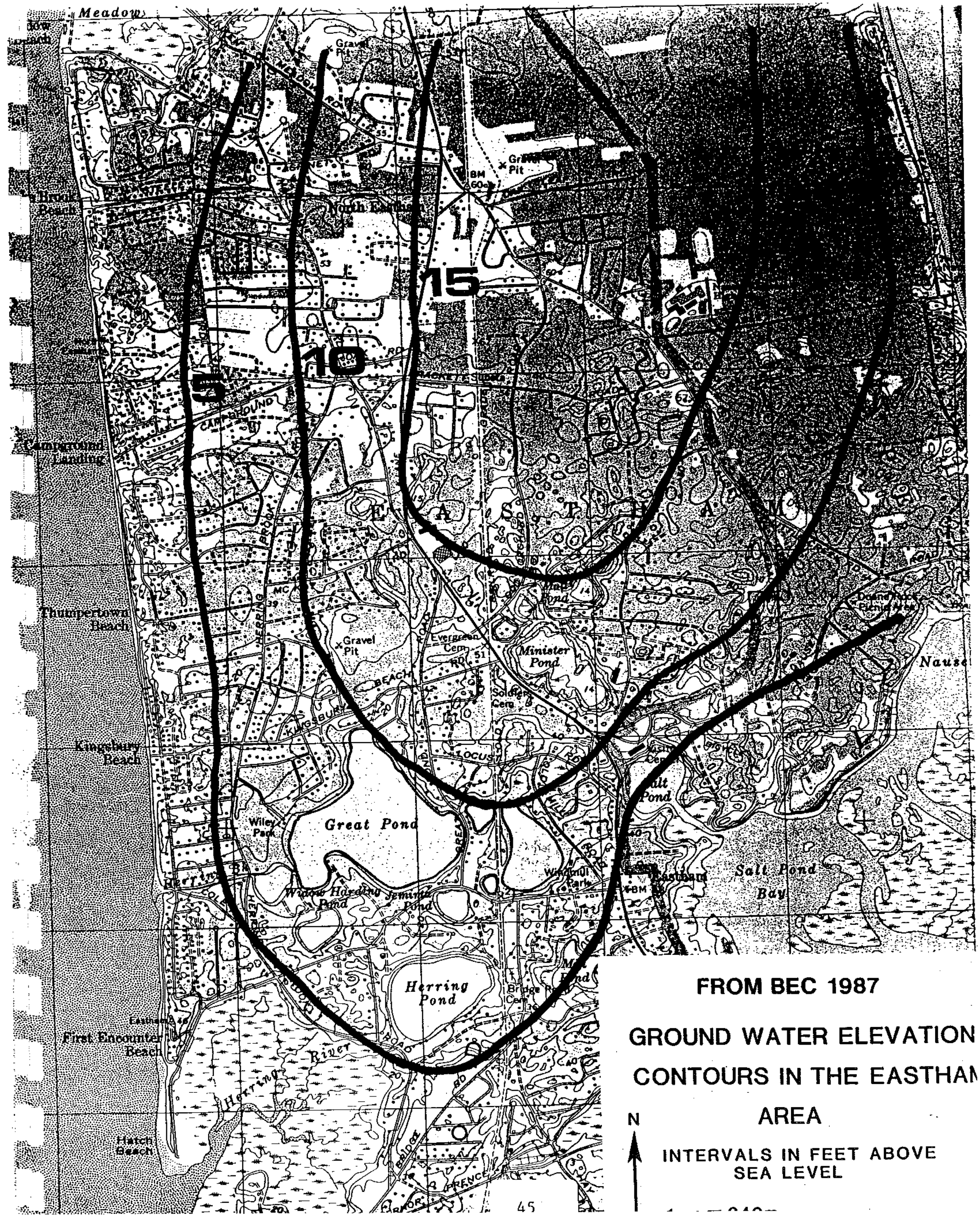
Mitchell, D.M., K. J. Wagner, W.M. Monagle, and G.A. Beluzo. 1989. A Littoral Interstitial Porewater (LIP) Sampler and its Use in Studying Groundwater Quality Entering a Lake. Lake Reserv. Manage. 5(1):121-128.

Moran, J. 1989. Personal communication with a professor at Cape Cod Community College and Public Health Inspector.

Rannie, E.H. and R.L. Nadon. 1988. An Inexpensive, Multi-use, Dedicated Pump for Groundwater Monitoring Wells. Ground Water Monitoring Review, Fall 1988:100-107.

APPENDIX A

GROUNDWATER INFORMATION FROM PREVIOUS STUDIES



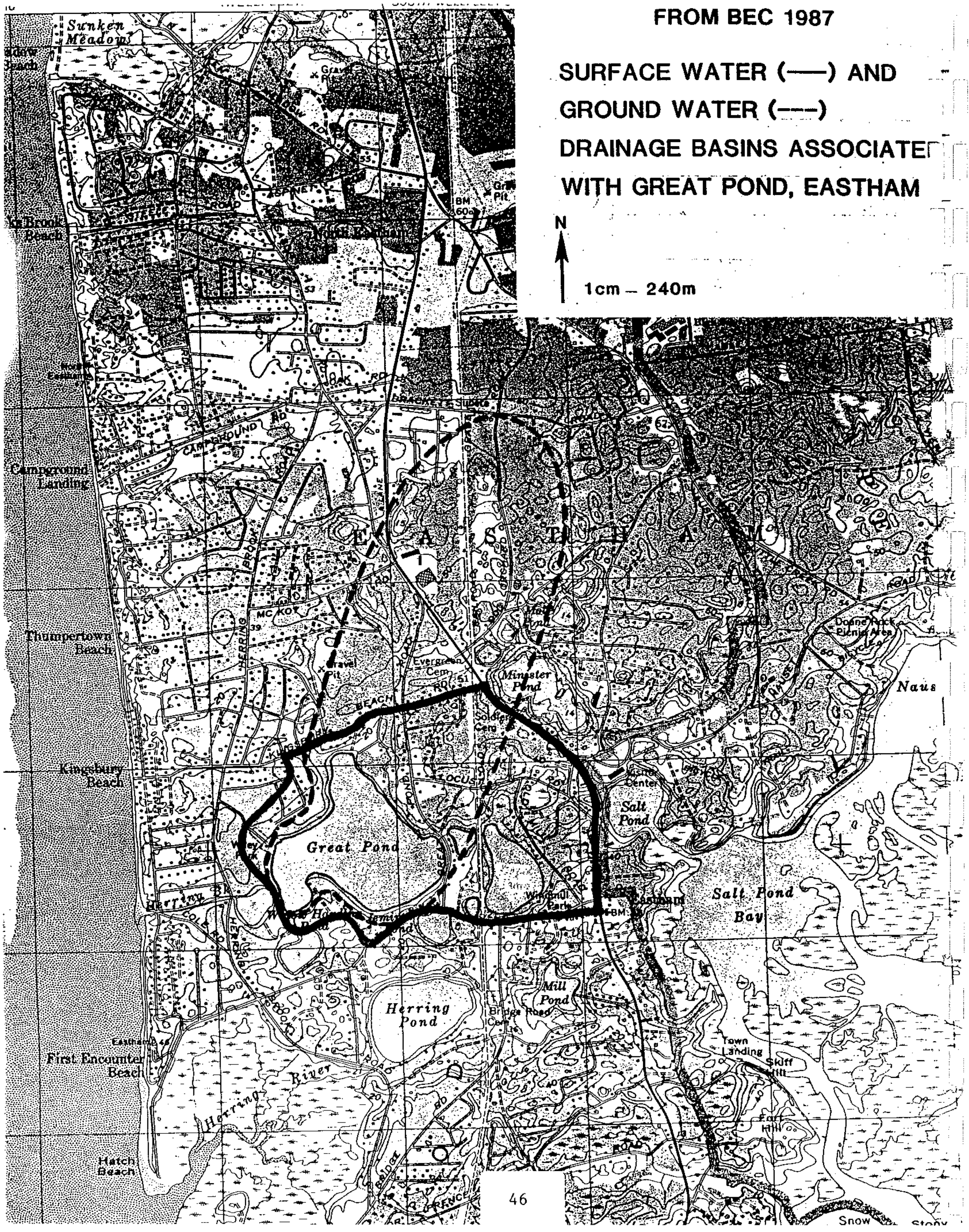
FROM BEC 1987

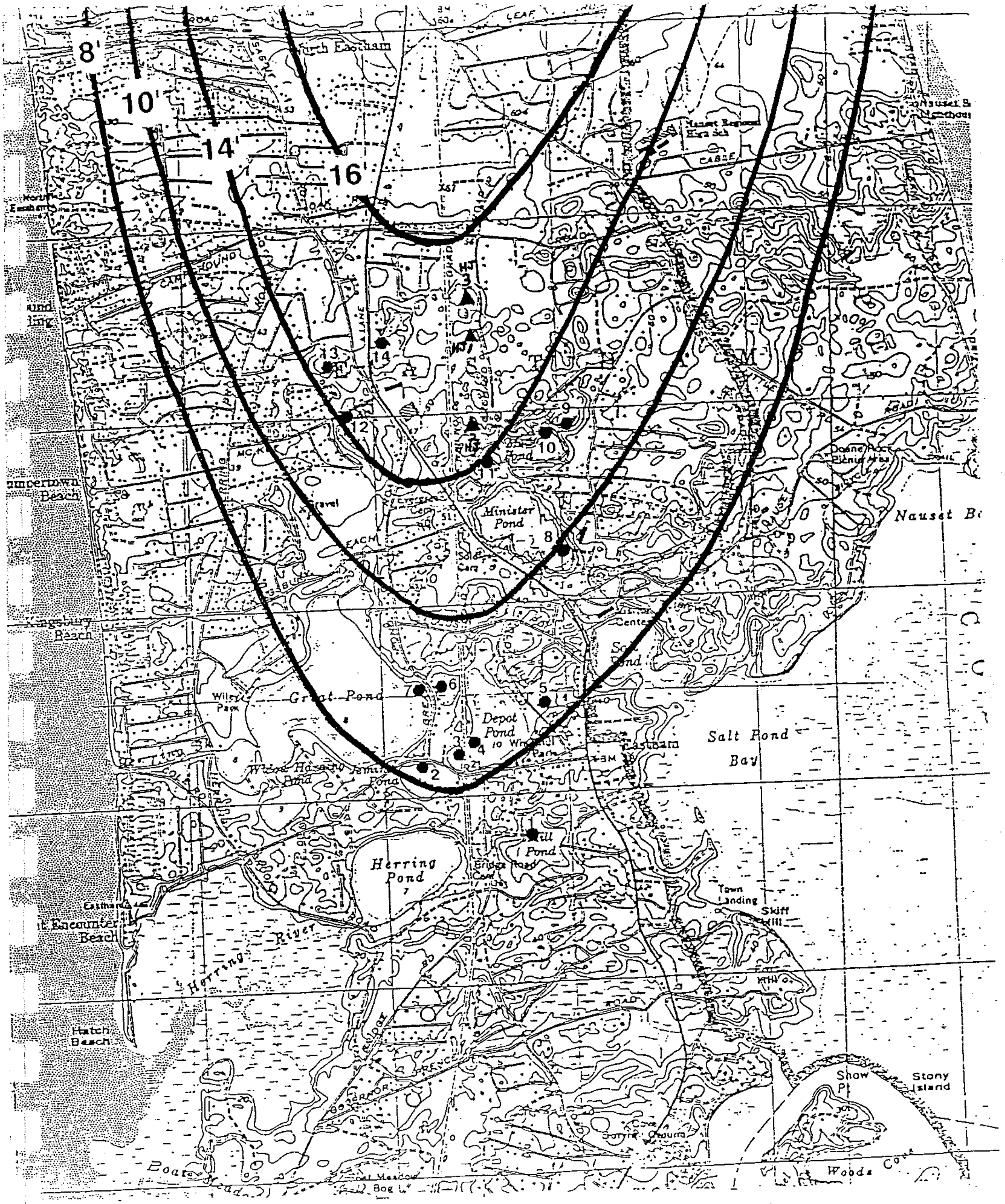
GROUND WATER ELEVATION CONTOURS IN THE EASTHAM AREA

INTERVALS IN FEET ABOVE SEA LEVEL

FROM BEC 1987

SURFACE WATER (—) AND
GROUND WATER (---)
DRAINAGE BASINS ASSOCIATE
WITH GREAT POND, EASTHAM

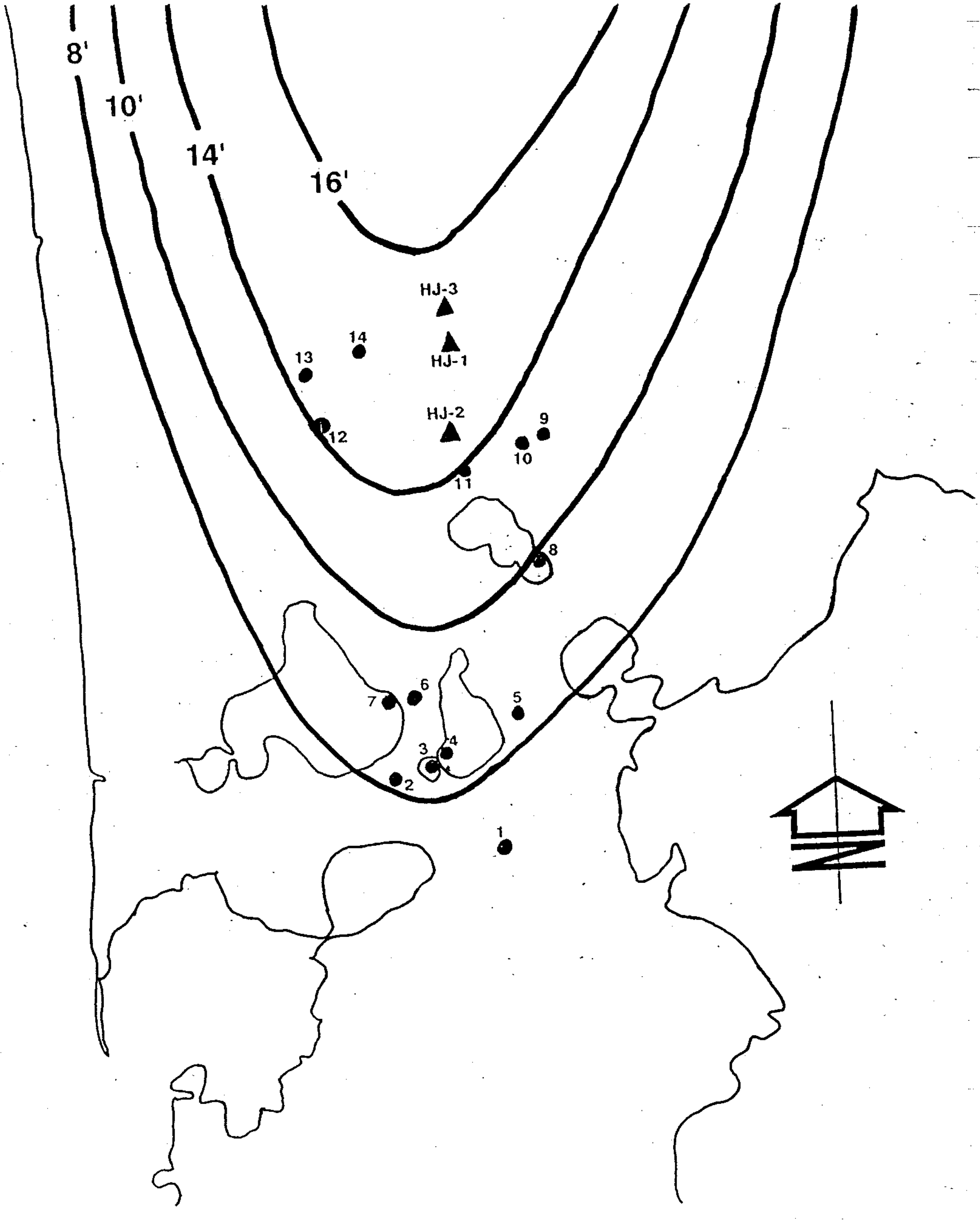




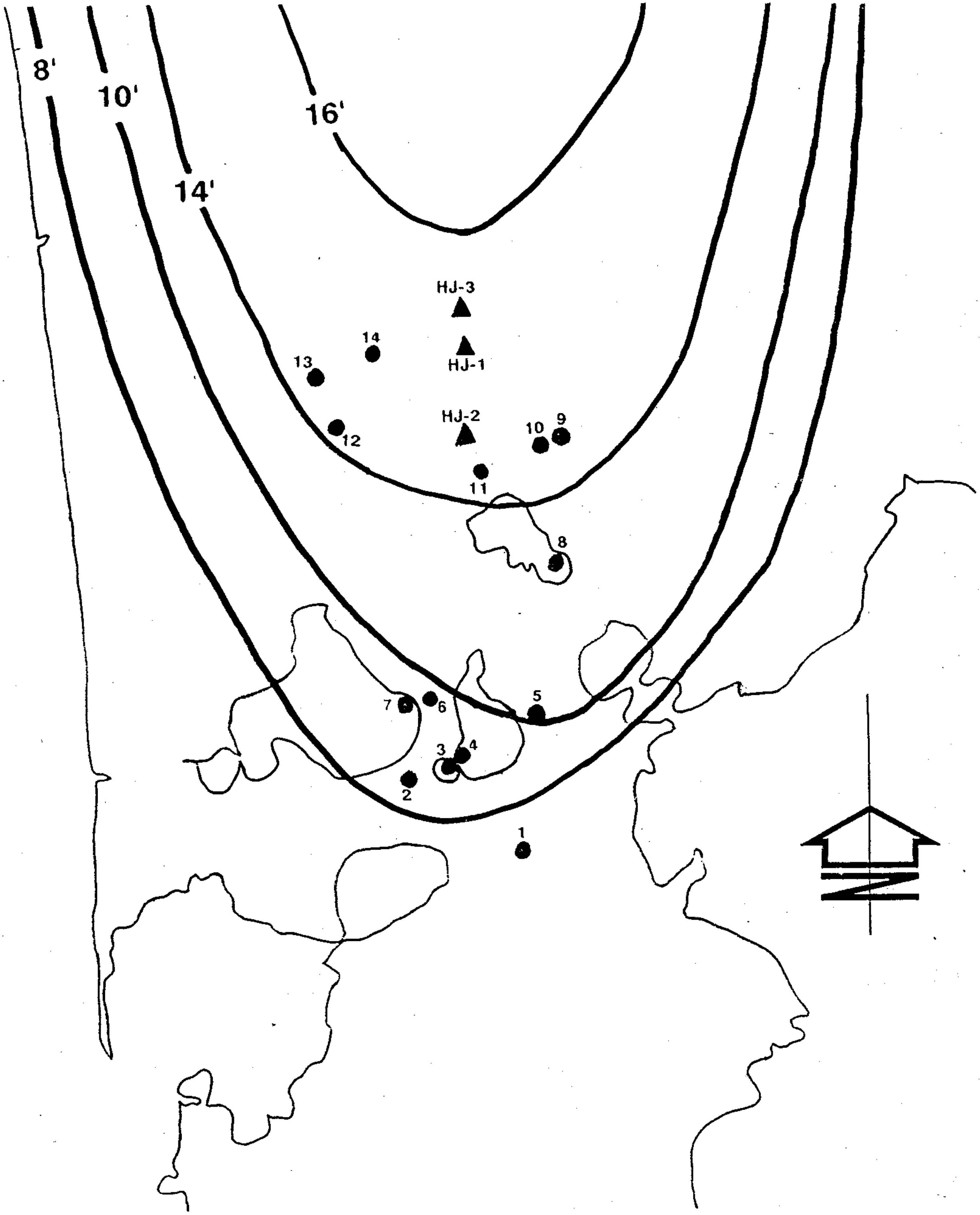
GREAT POND GROUND WATER MAP

COMPOSITE ON USGS TOPOGRAPHIC MAP

BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



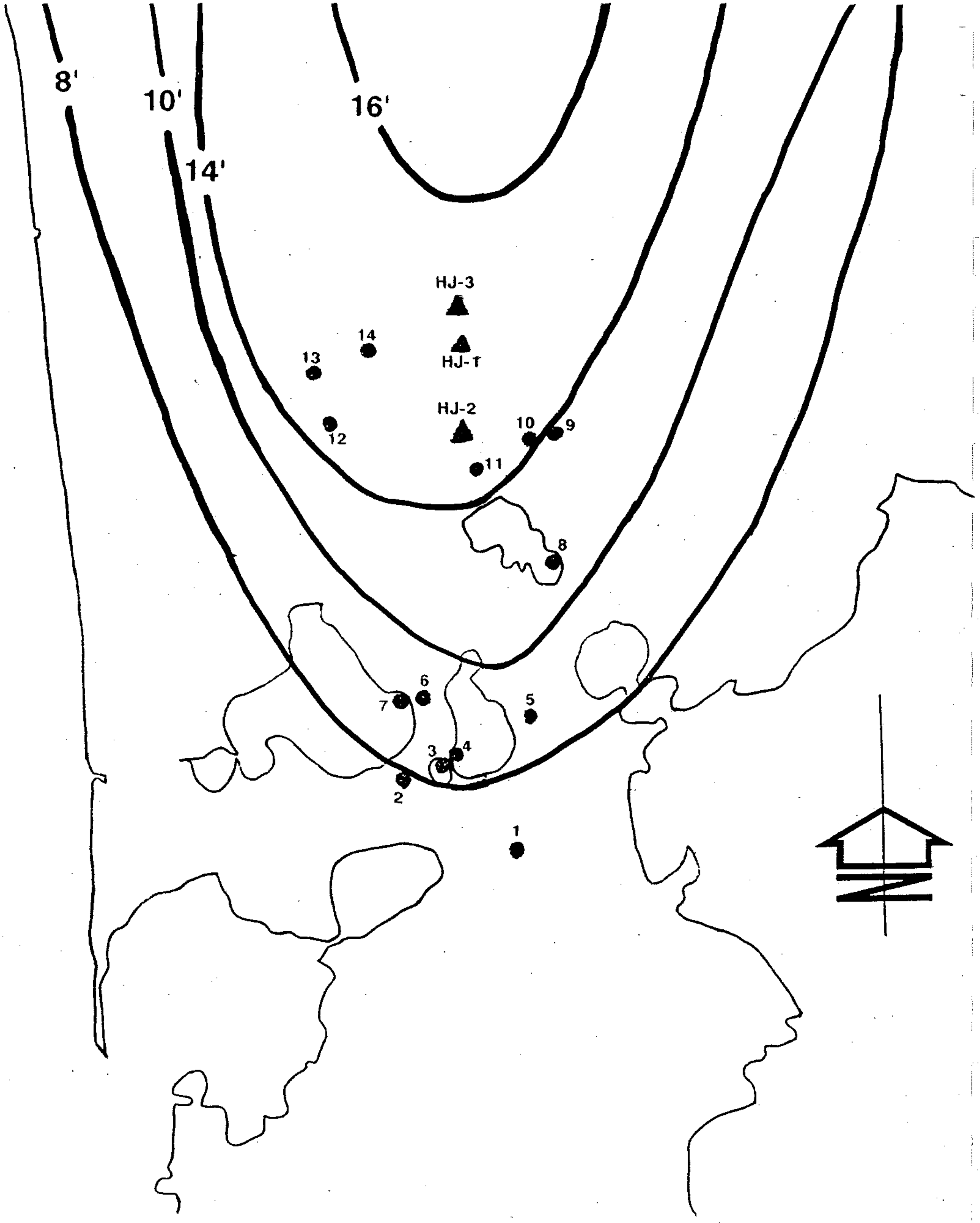
GREAT POND GROUND WATER MAP
COMPOSITE
BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



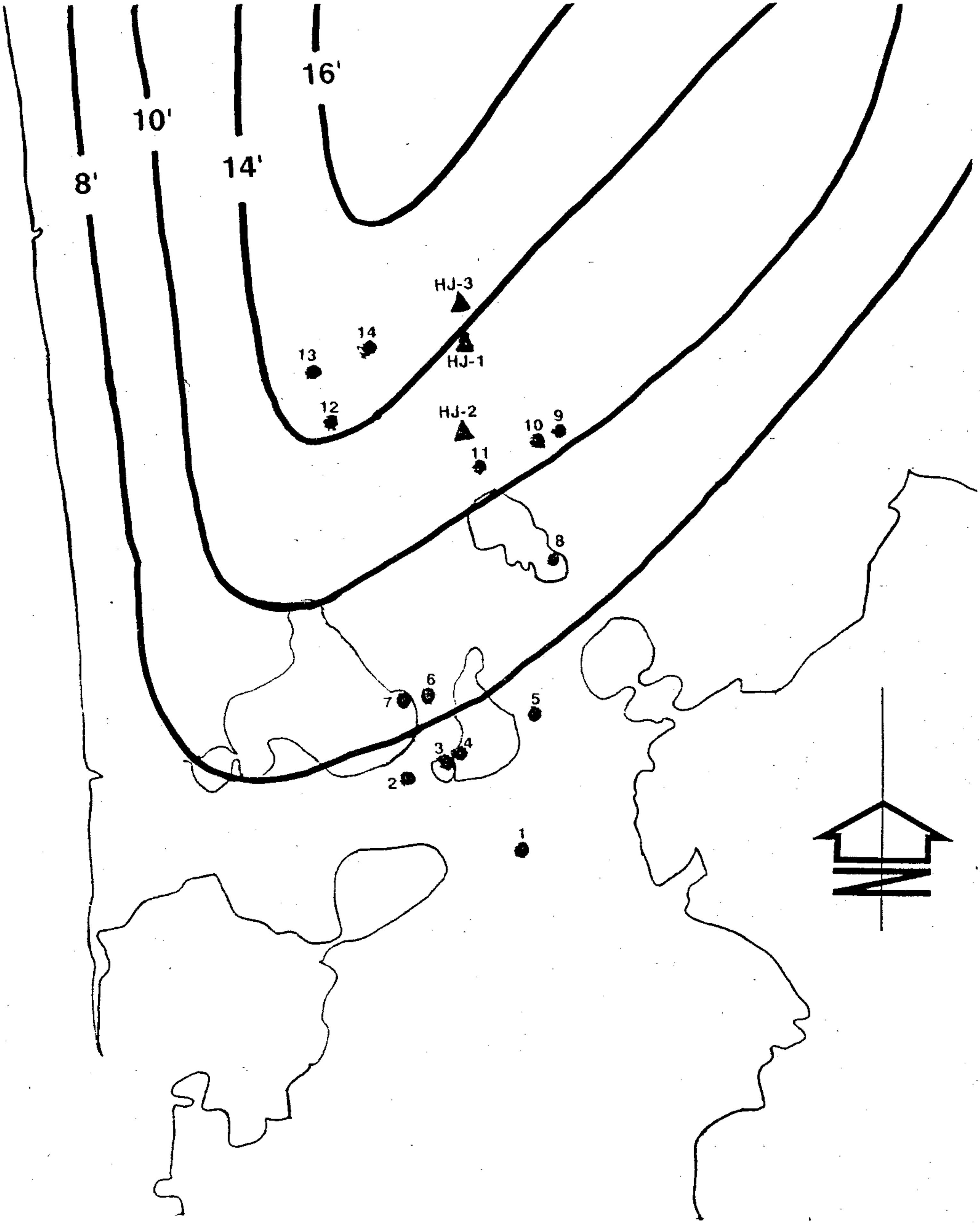
GREAT POND GROUND WATER MAP

NOVEMBER 1987

BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



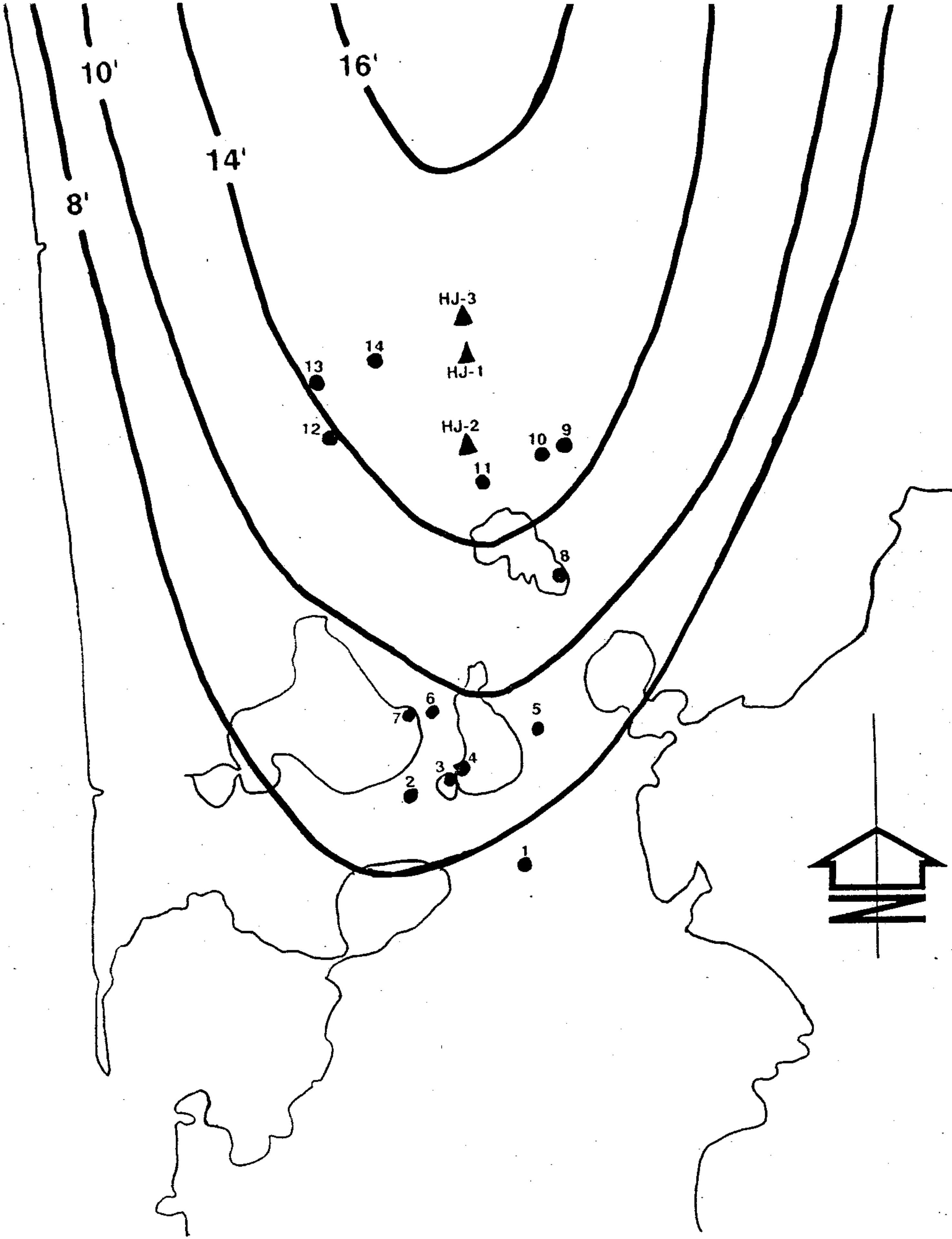
GREAT POND GROUND WATER MAP
DECEMBER 1987
BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



GREAT POND GROUND WATER MAP

JANUARY 1988

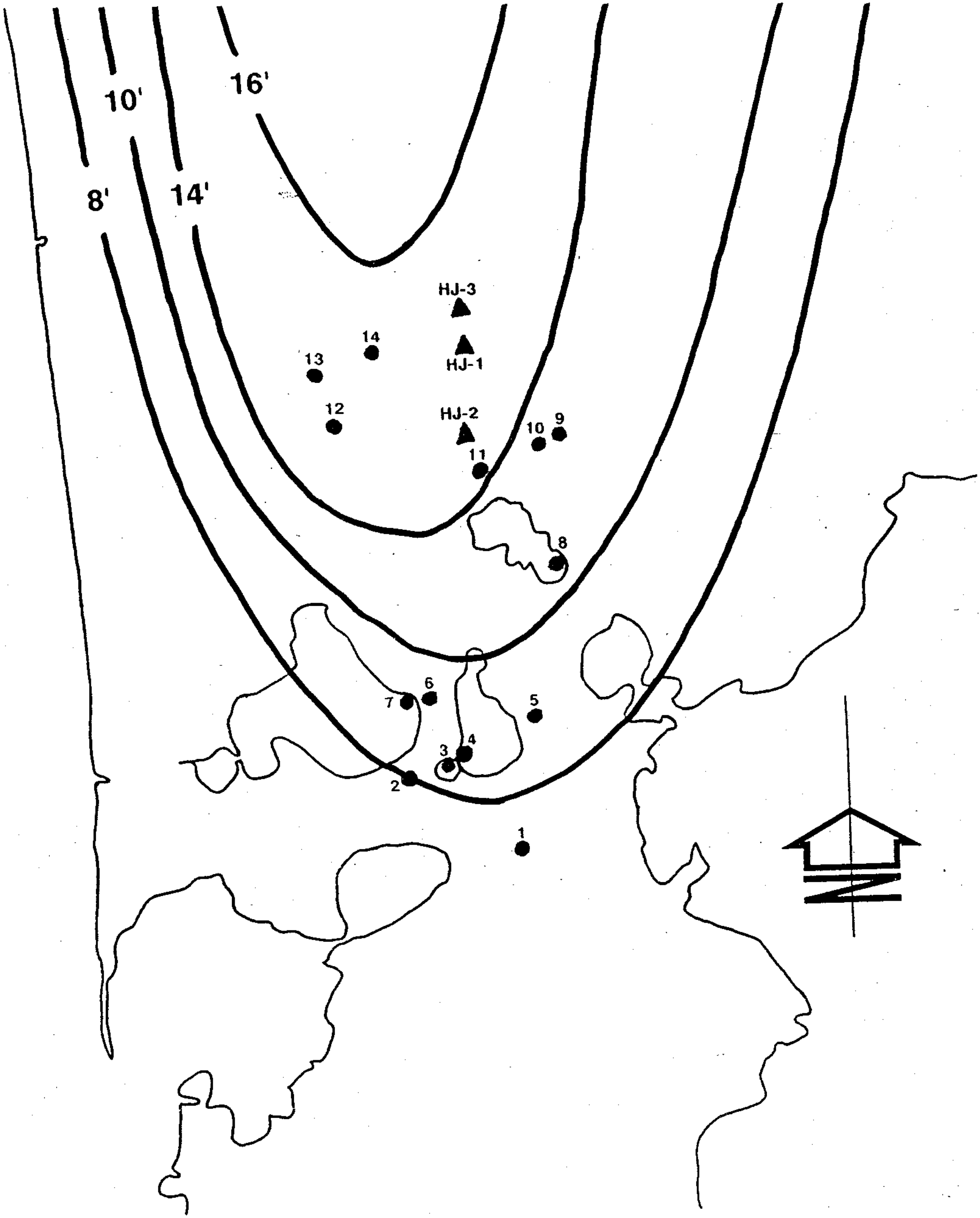
BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



GREAT POND GROUND WATER MAP

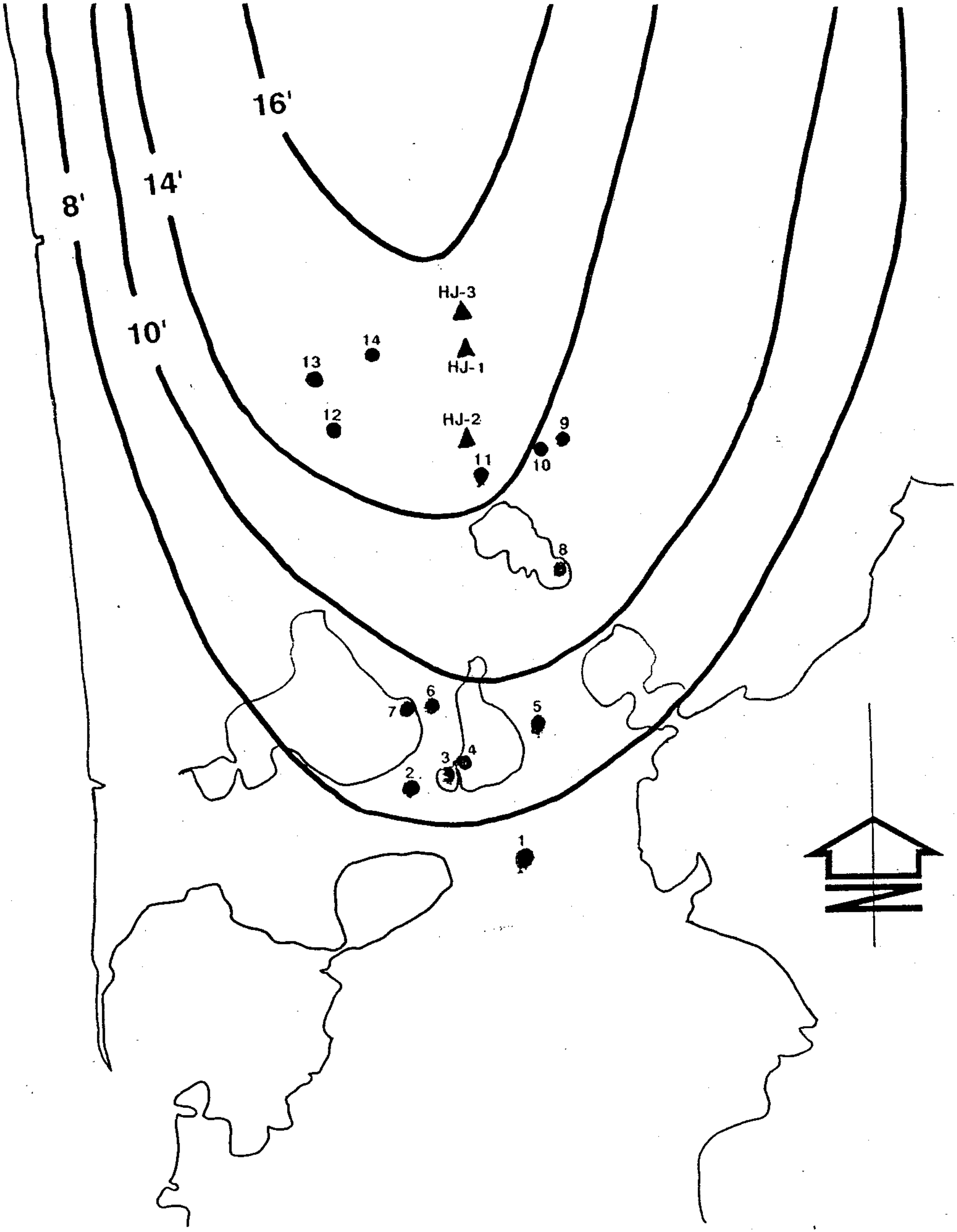
FEBRUARY 1988

BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



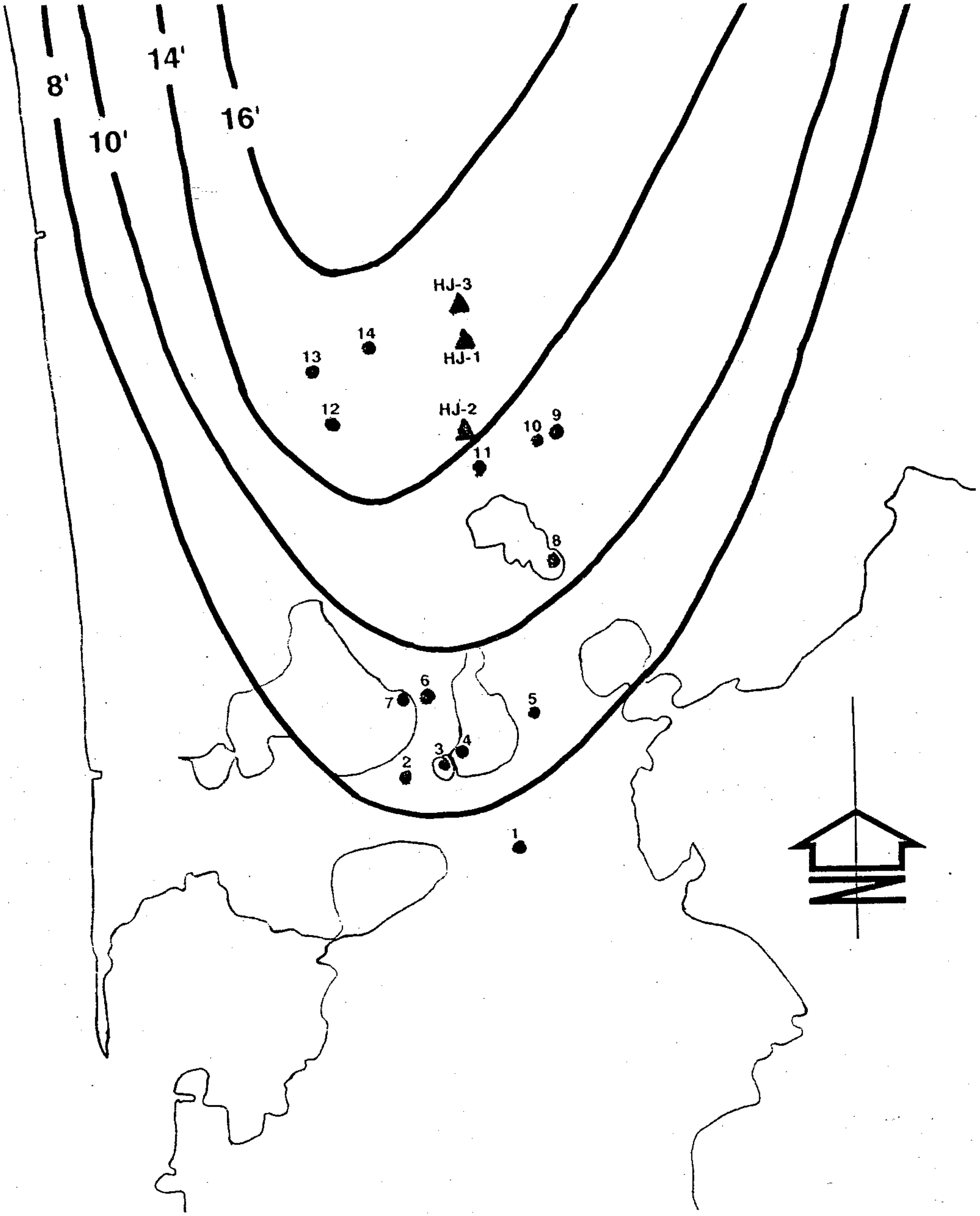
GREAT POND GROUND WATER MAP

MARCH 1988



GREAT POND GROUND WATER MAP

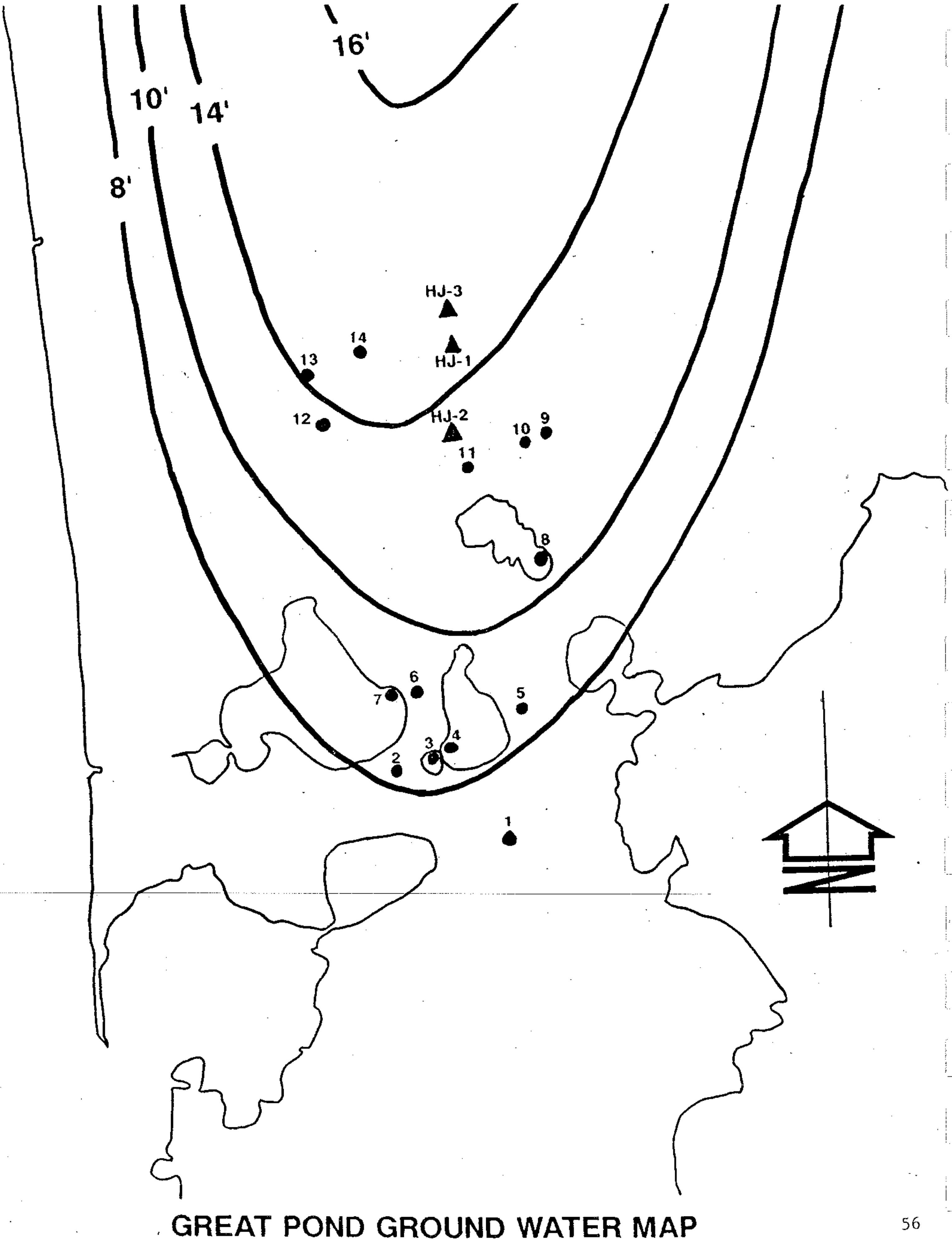
APRIL 1988
BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



GREAT POND GROUND WATER MAP

MAY 1988

BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS



GREAT POND GROUND WATER MAP

JUNE 1988

BASED ON DATA FOR EASTHAM POND GAUGES AND THREE WELLS

APPENDIX B

LOCATIONS AND BORING LOGS FOR INSTALLED OR MONITORED WELLS

BAYSTATE
NVIRONMENTAL
CONSULTANTS
INC.

Scientists
Engineers
Planners

Dear Resident:

Baystate Environmental Consultants, Inc (BEC) of East Longmeadow, MA are currently working for the Town of Eastham to perform a Phase II study of Great Pond. As part of the study we are attempting to assess the ground water elevation, movement, and water quality. This information will be used to help assess the ground water influence to Great Pond. In order to do this 40 wells must be installed. There will be 13 single wells and 9 Piezometer "Cluster" wells. A monitoring program will be conducted and each well will be sampled 4 times, once each season. The results of water quality will be available for each resident with a well on his/her property.

The property referenced below is one of several locations that has been chosen as a possible site to have a well installed. We would like to install this well in an unobtrusive area of your choice (along the roadway or the corner of your property). If your are at all interested in participating in this project and you are willing to have a well installed on your property we would appreciate you contacting our office at (413) 525-3822.

The goal of the entire study is to make Great Pond a better facility for you. We can do little without your cooperation and assistance. We look forward to working with you.

Very truly yours,

BEC, INC.

Kenneth J Wagner

Kenneth J. Wagner, Ph.D.
Associate

KJW/ble

296 North Main Street
East Longmeadow, MA 01028
(413) 525-3822

BAYSTATE
ENVIRONMENTAL
CONSULTANTS
INC.

Scientists
Engineers
Planners

January, 1989

Mr. Resident
Address
Town, Mass. Zip Code

Dear Mr. Resident,

Enclosed you will find a map of your property along with a permission letter. We, Baystate Environmental Consultants, Inc., (BEC) have chosen a location on your property to have the monitoring well installed, with your approval. At this time you may choose to move the well and mark the new location on the map, or approve the location given. Bear in mind that a drill rig must access the well site. Return the map with the signed permission letter to our office at your earliest convenience.

All of the locations selected to have a monitoring well installed are within the ground water drainage basin of Great Pond and were chosen after BEC, Inc. reviewed the ground water data collected over the past year. The ground water appears to be flowing in a south-westerly direction, leading to the orientation of the sampling (well location) grid set up by BEC, Inc.

The monitoring wells will be sampled once each season, a total of four times a year. The parameters to be assessed include the following: phosphorus, nitrogen series, pH, conductivity, alkalinity, sodium, fecal coliform and fecal streptococci. The chemical data will be made available to each property owner. The results will help the Town of Eastham protect Great Pond and improve ground water quality in Eastham.

The duration of the study is 2 years, which means BEC, Inc. personal will examine and sample each well 8 times, requiring access onto your property each time the well is to be sampled. Our presence will be unobtrusive, and no damage will be done to the property.

If you have any questions regarding this letter please contact our office at (413) 525-3822.

Very truly yours,

BEC, INC.

Todd L. Bachand

Todd L. Bachand

296 North Main Street
East Longmeadow, MA 01028
(413) 525-3822

BEC

BAYSTATE
ENVIRONMENTAL
CONSULTANTS
INC.

I hereby give Baystate Environmental Consultants, Inc. of East Longmeadow, MA. permission to access my property and to install a monitoring well within the boundaries of my property. I understand that BEC, Inc. will need access to my property for the next two years in order to sample the monitoring well on a quarterly basis.

NAME:

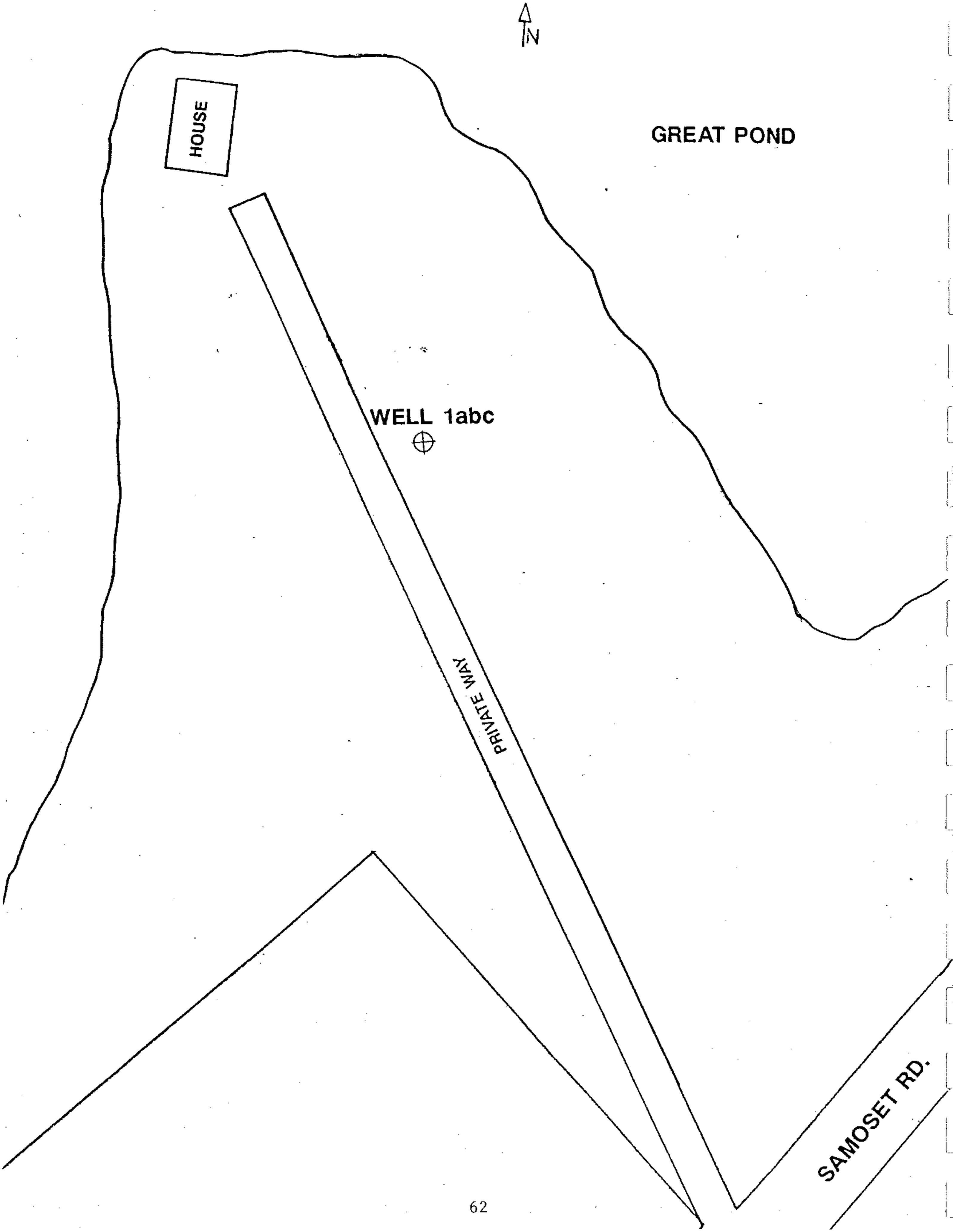
PROPERTY
LOCATION:

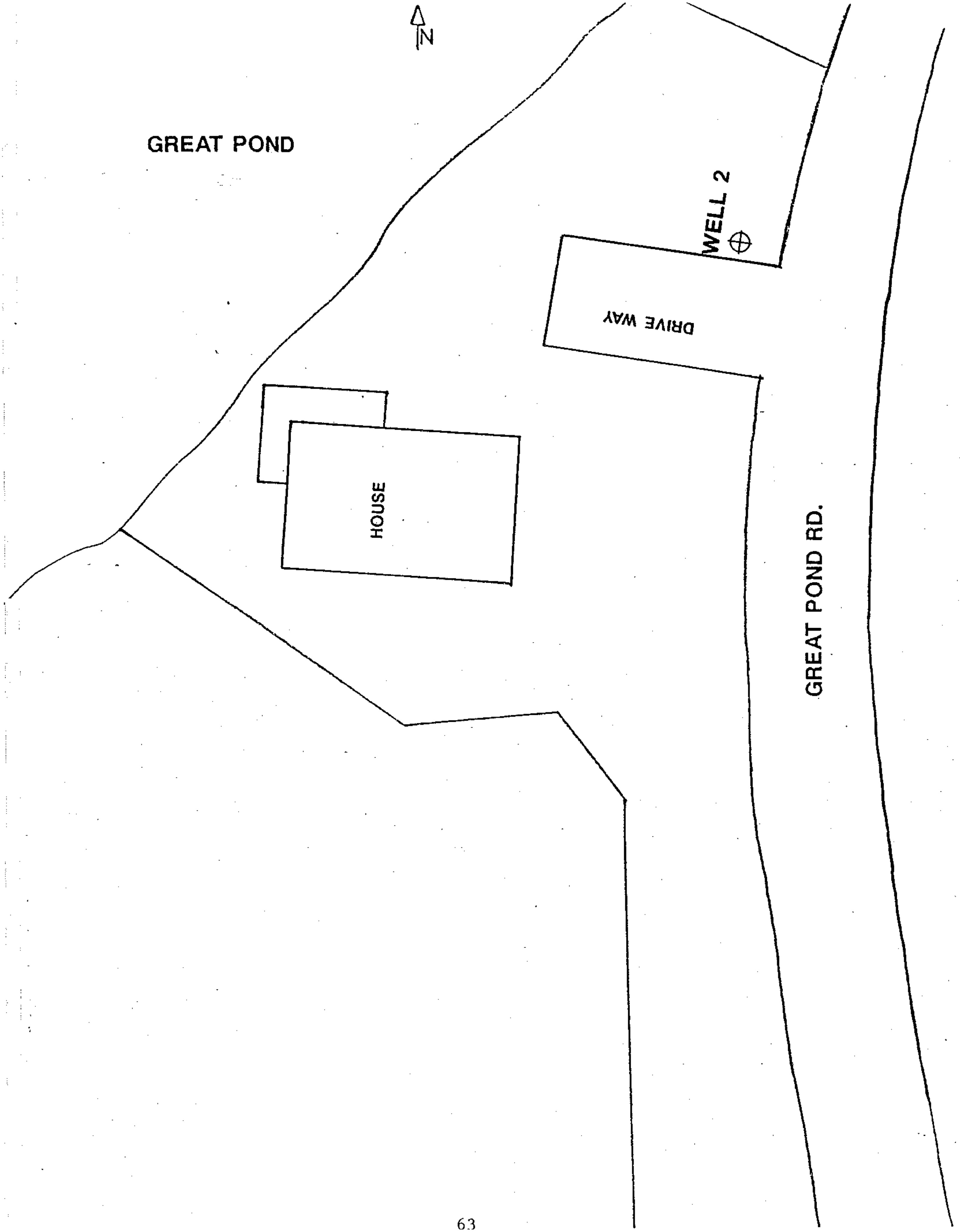
SIGNATURE:

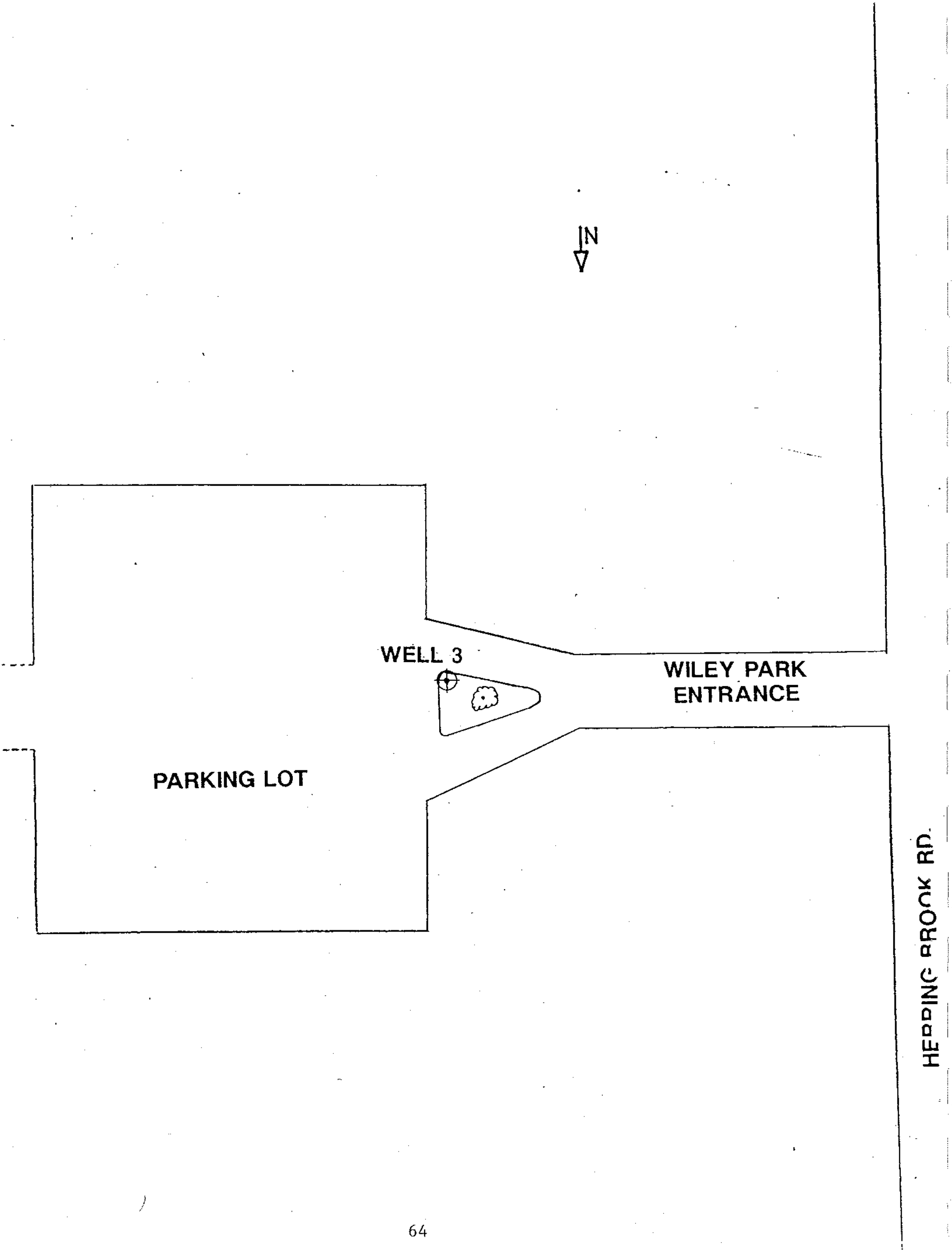
DATE:

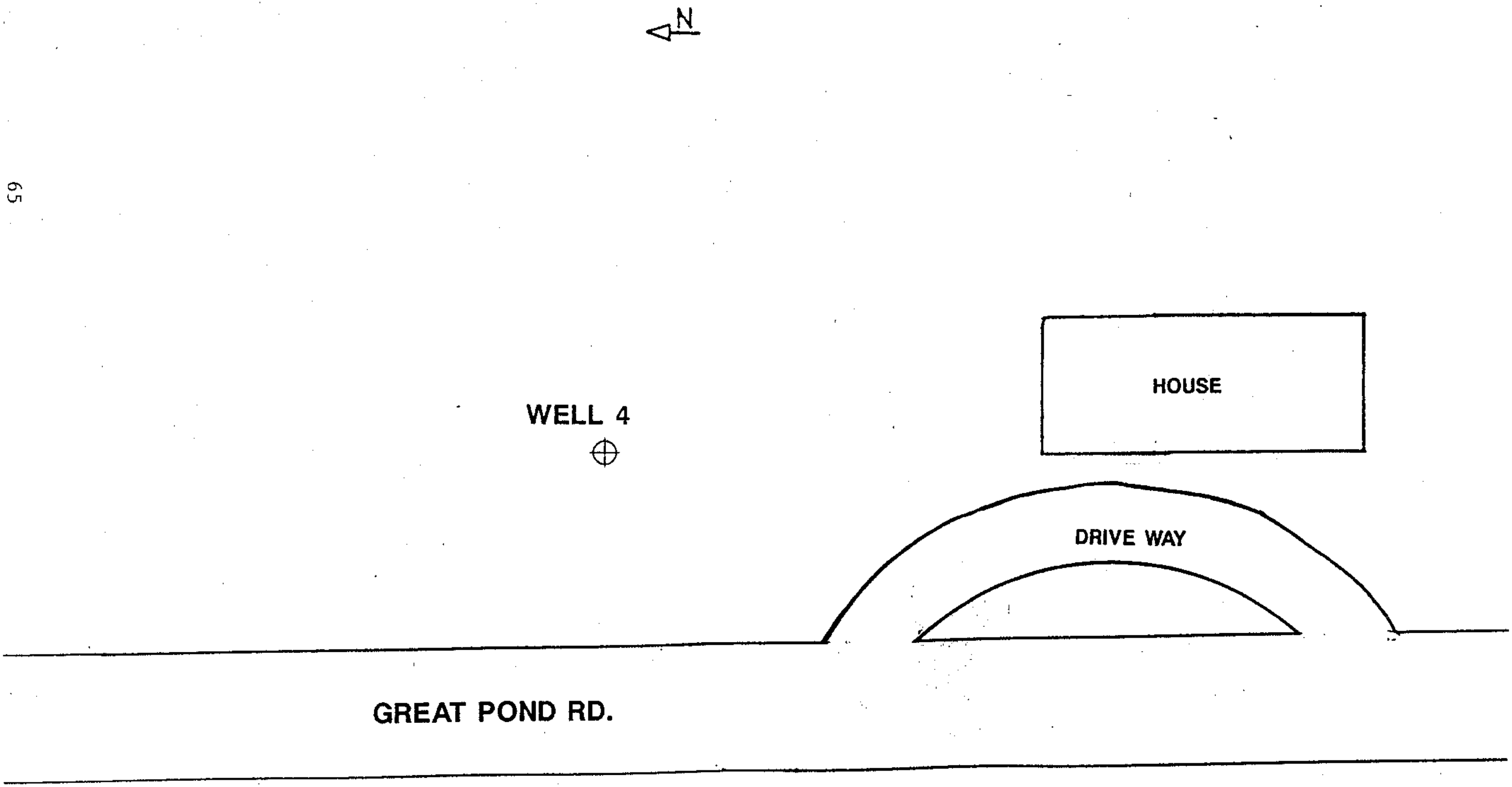
Copies of signed slips are on file with the Eastham Board of Selectmen

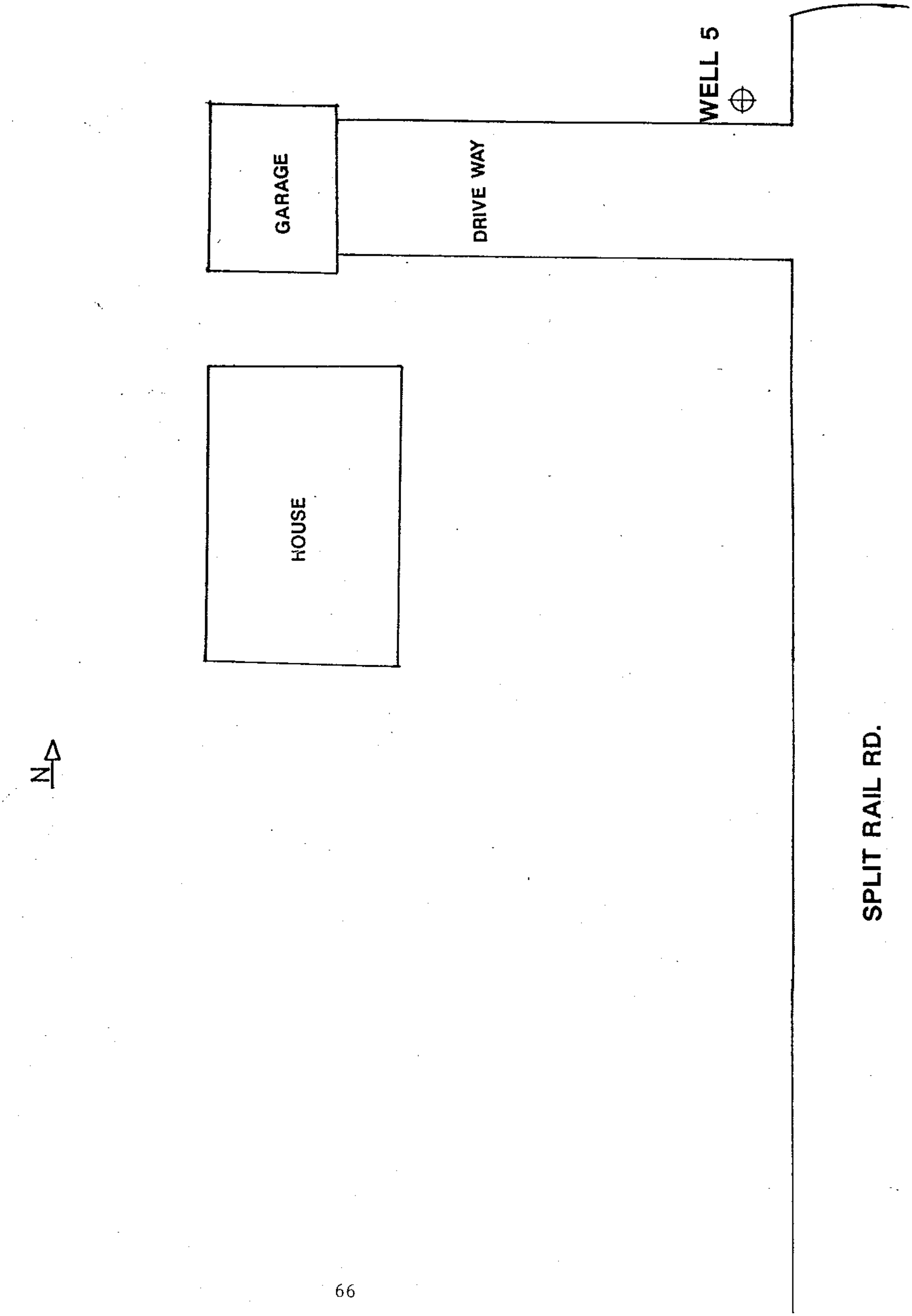
296 North Main Street • East Longmeadow, MA 01028 • (413) 525-3822

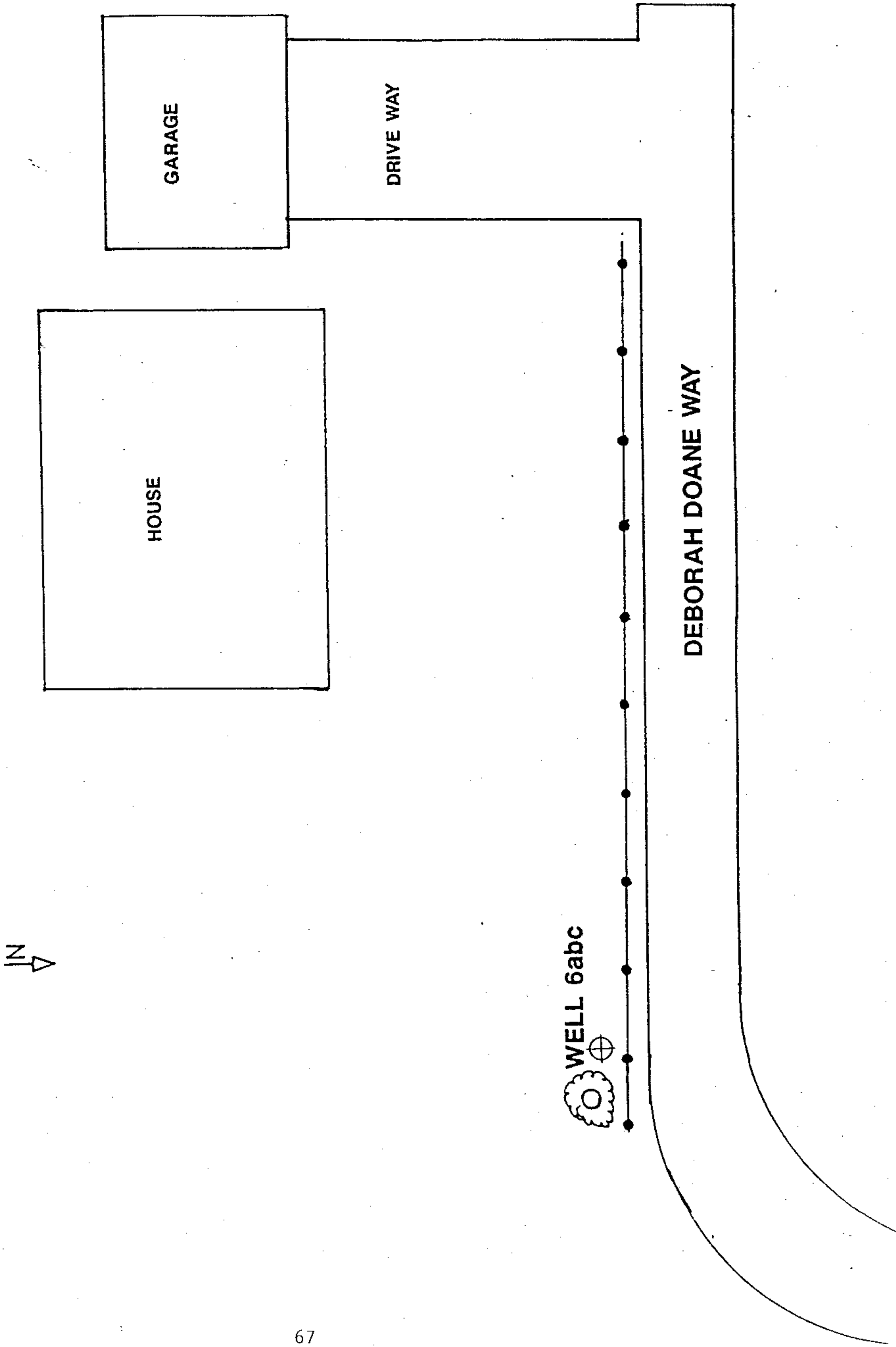

N
HOUSE
GREAT POND
WELL 1abc
PRIVATE WAY
SAMOSET RD.

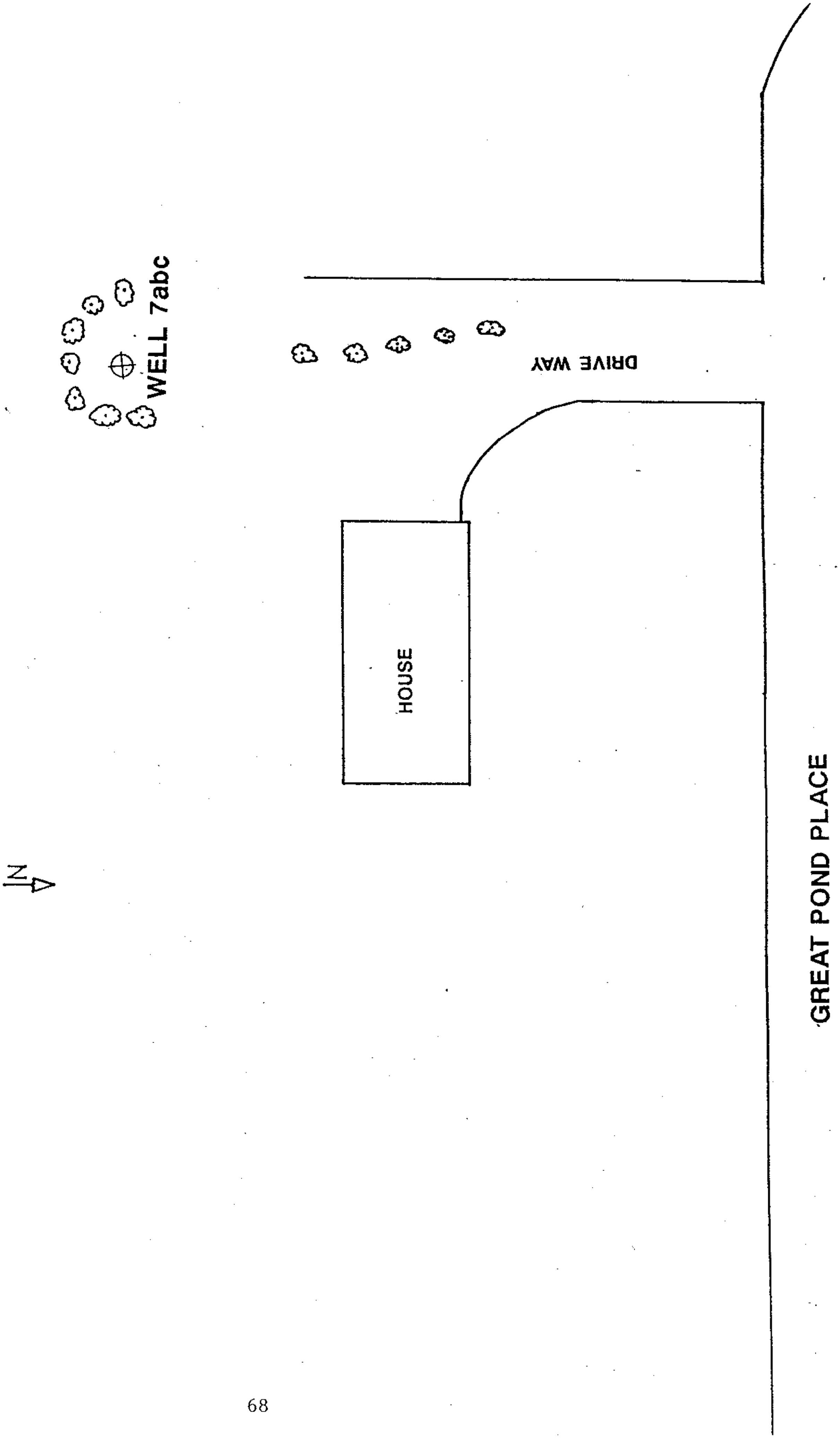

N
GREAT POND
WELL 2
DRIVE WAY
HOUSE
GREAT POND RD.

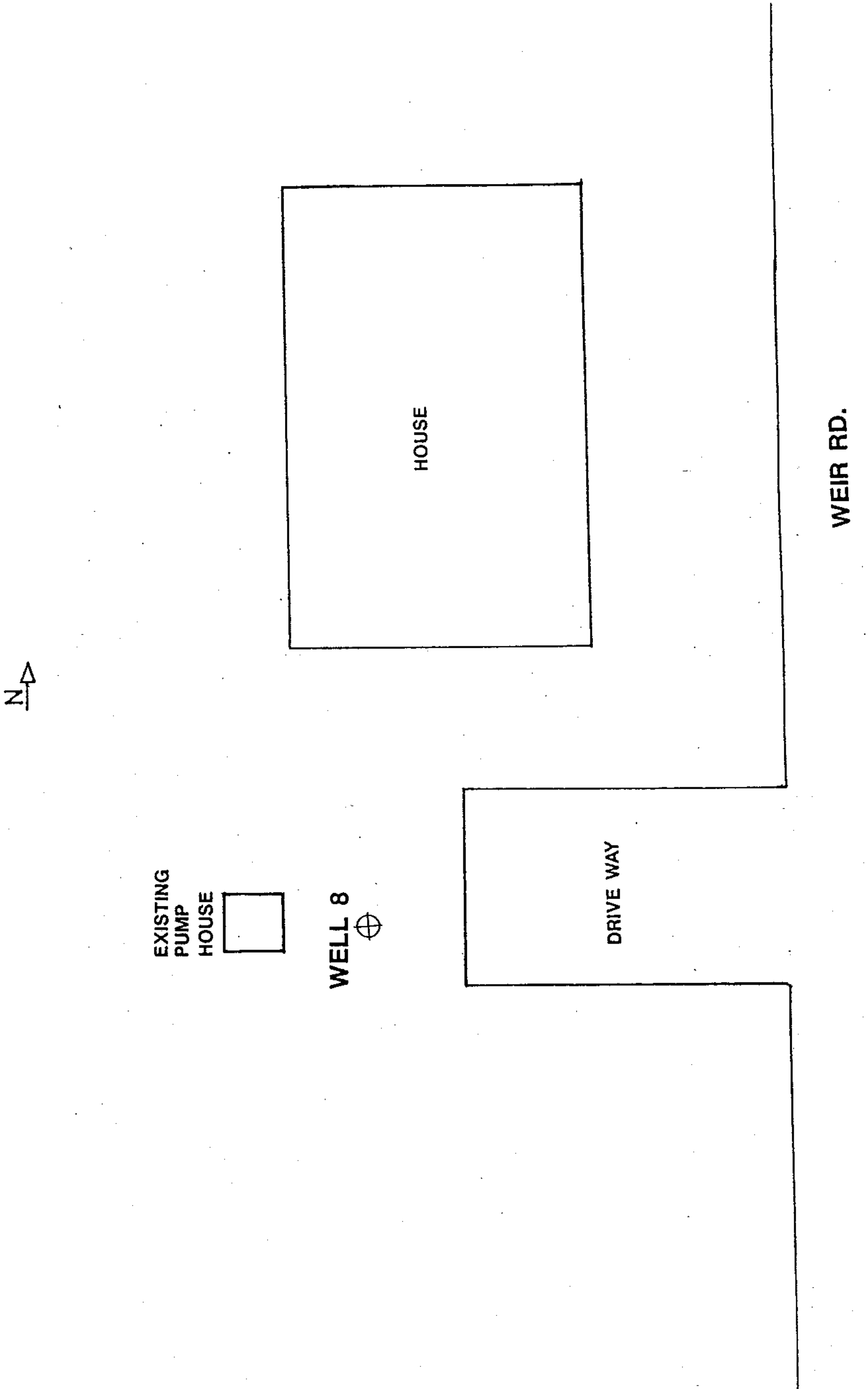

N
WELL 3
WILEY PARK
ENTRANCE
PARKING LOT
HERRING BROOK RD.

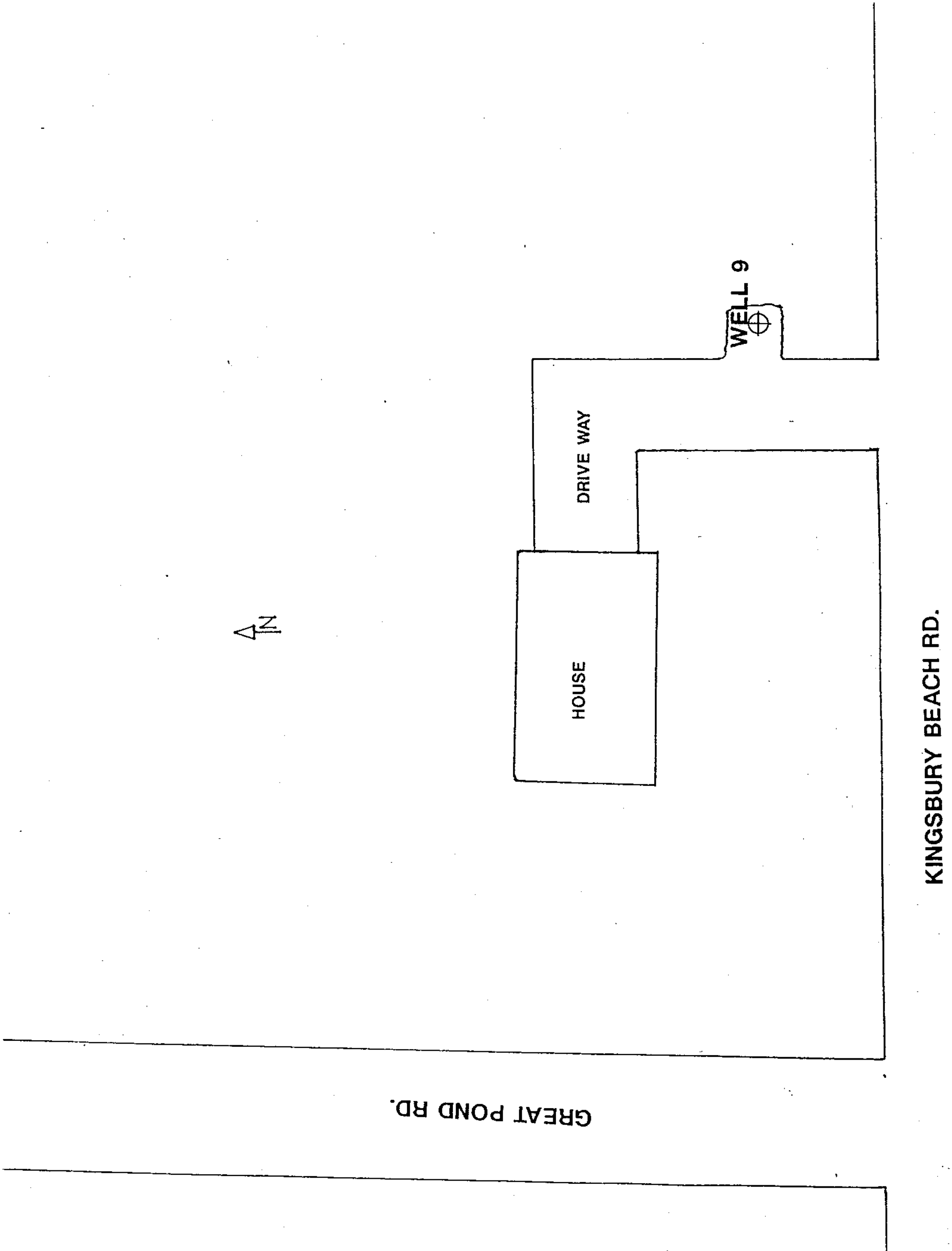

N
WELL 4
HOUSE
DRIVE WAY
GREAT POND RD.

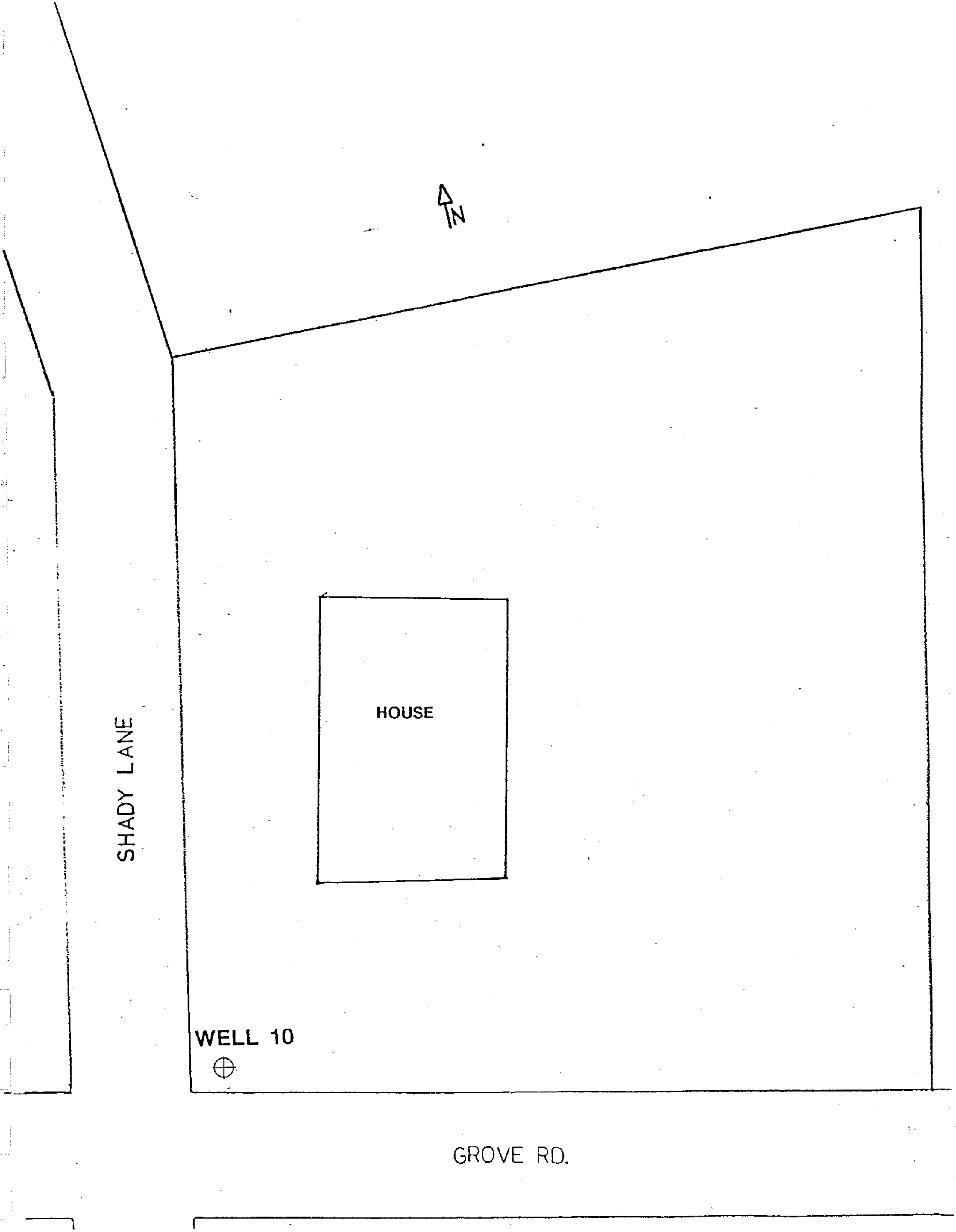

WELL 5
GARAGE
DRIVE WAY
HOUSE
N
SPLIT RAIL RD.

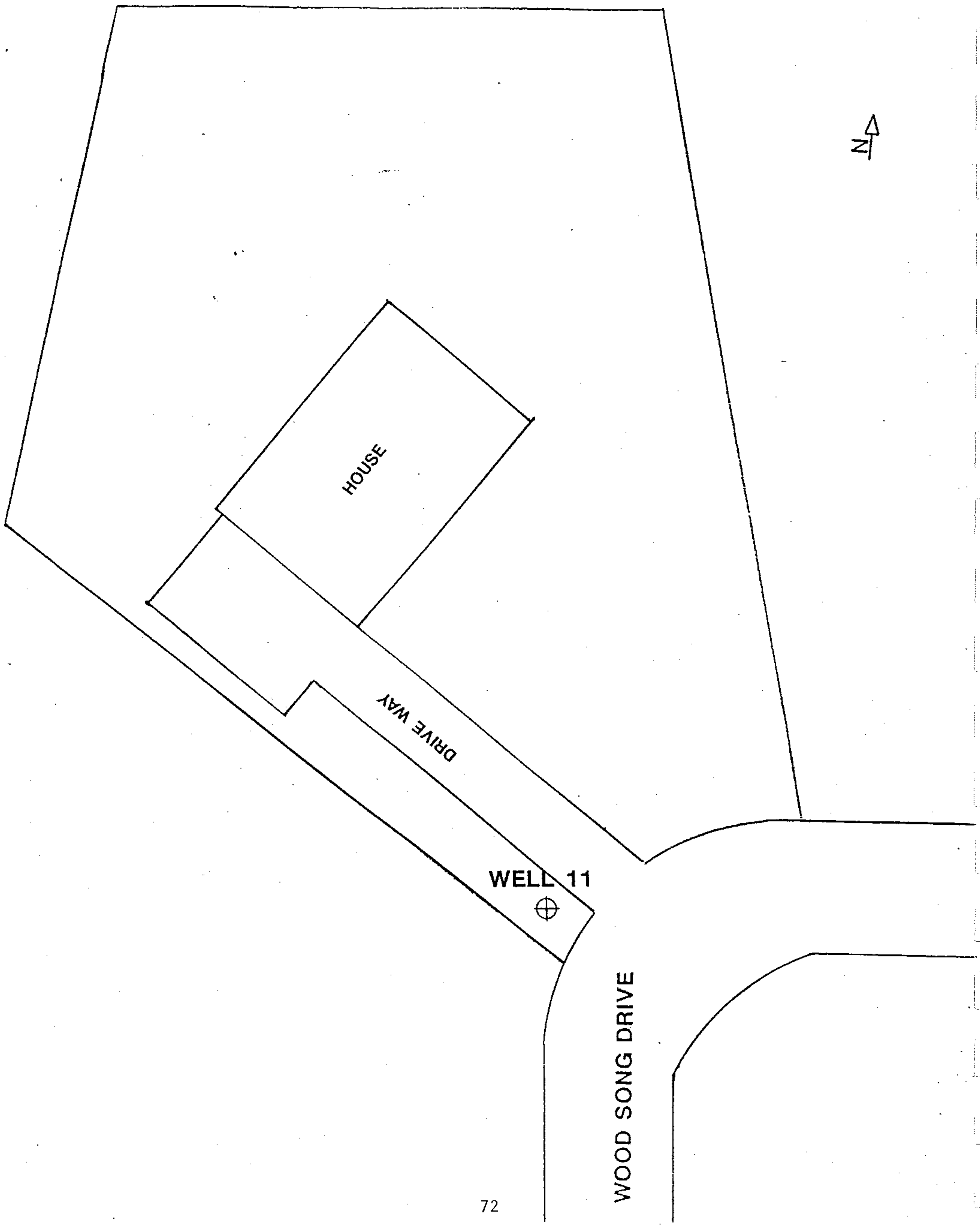

GARAGE
DRIVE WAY
HOUSE
DEBORAH DOANE WAY
WELL 6abc
N

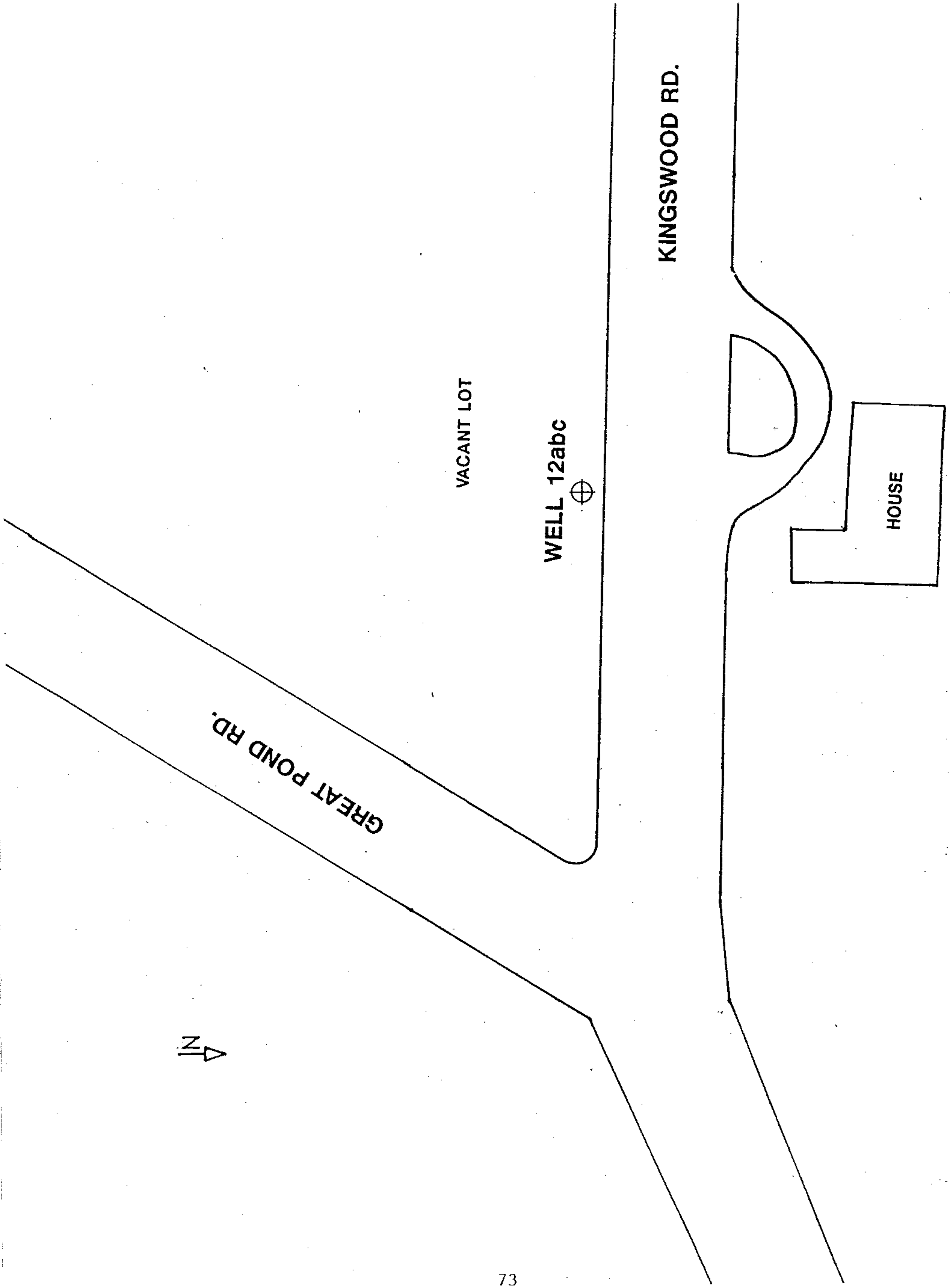

WELL 7abc
DRIVE WAY
HOUSE
GREAT POND PLACE
N

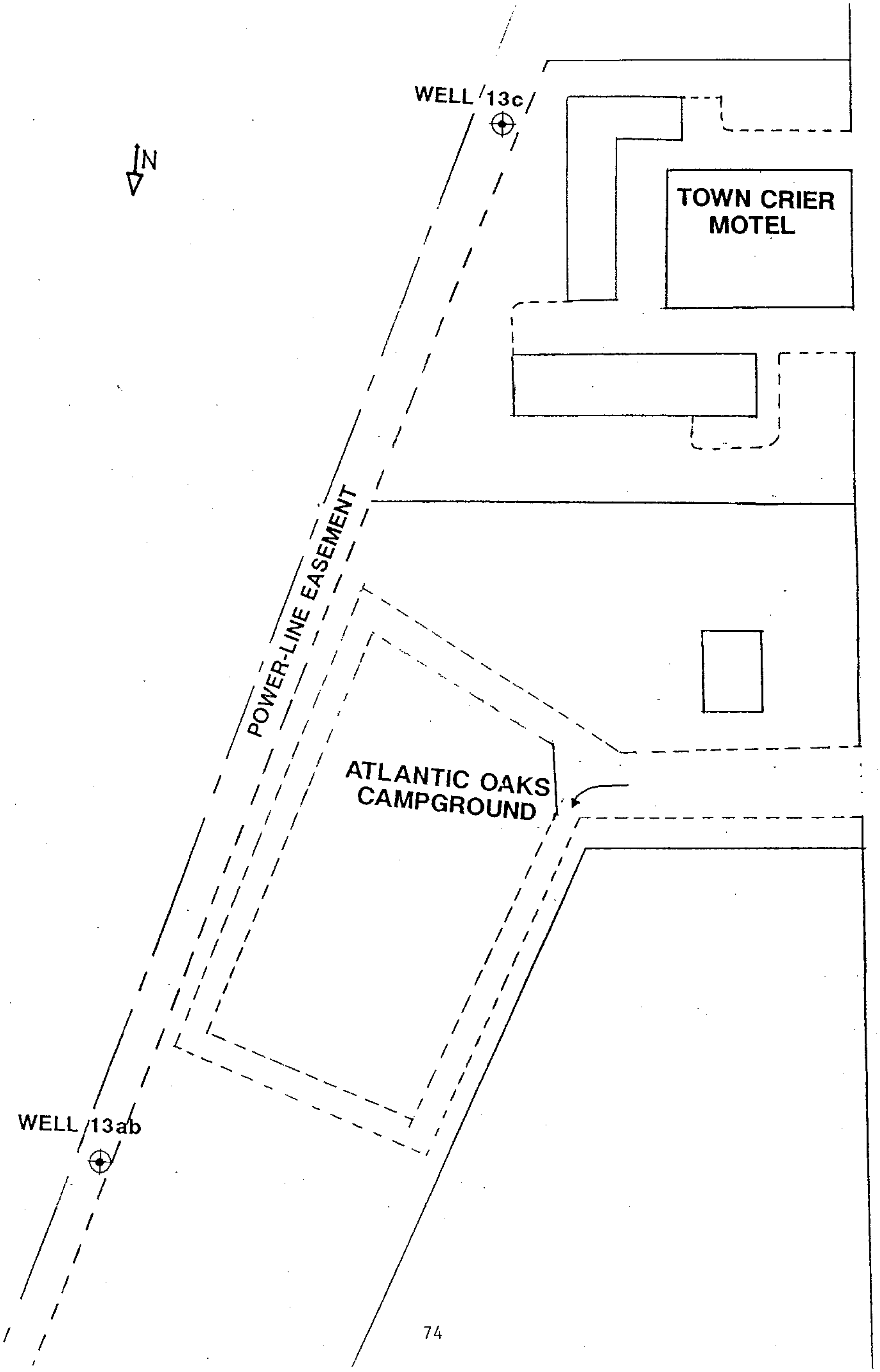

WEIR RD.
HOUSE
N
DRIVE WAY
EXISTING PUMP HOUSE
WELL 8

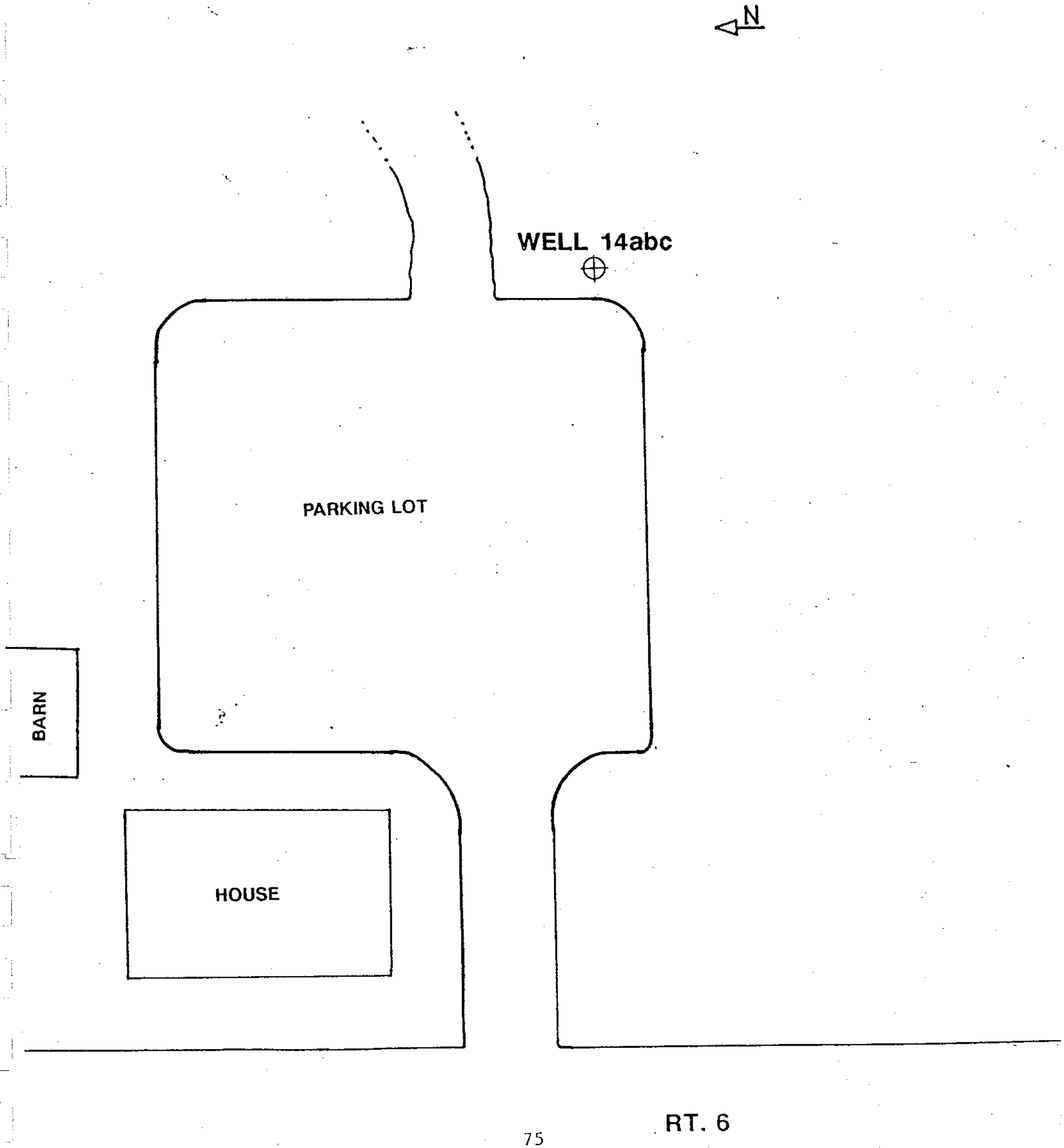

WELL 9
DRIVE WAY
HOUSE
N
KINGSBURY BEACH RD.
GREAT POND RD.

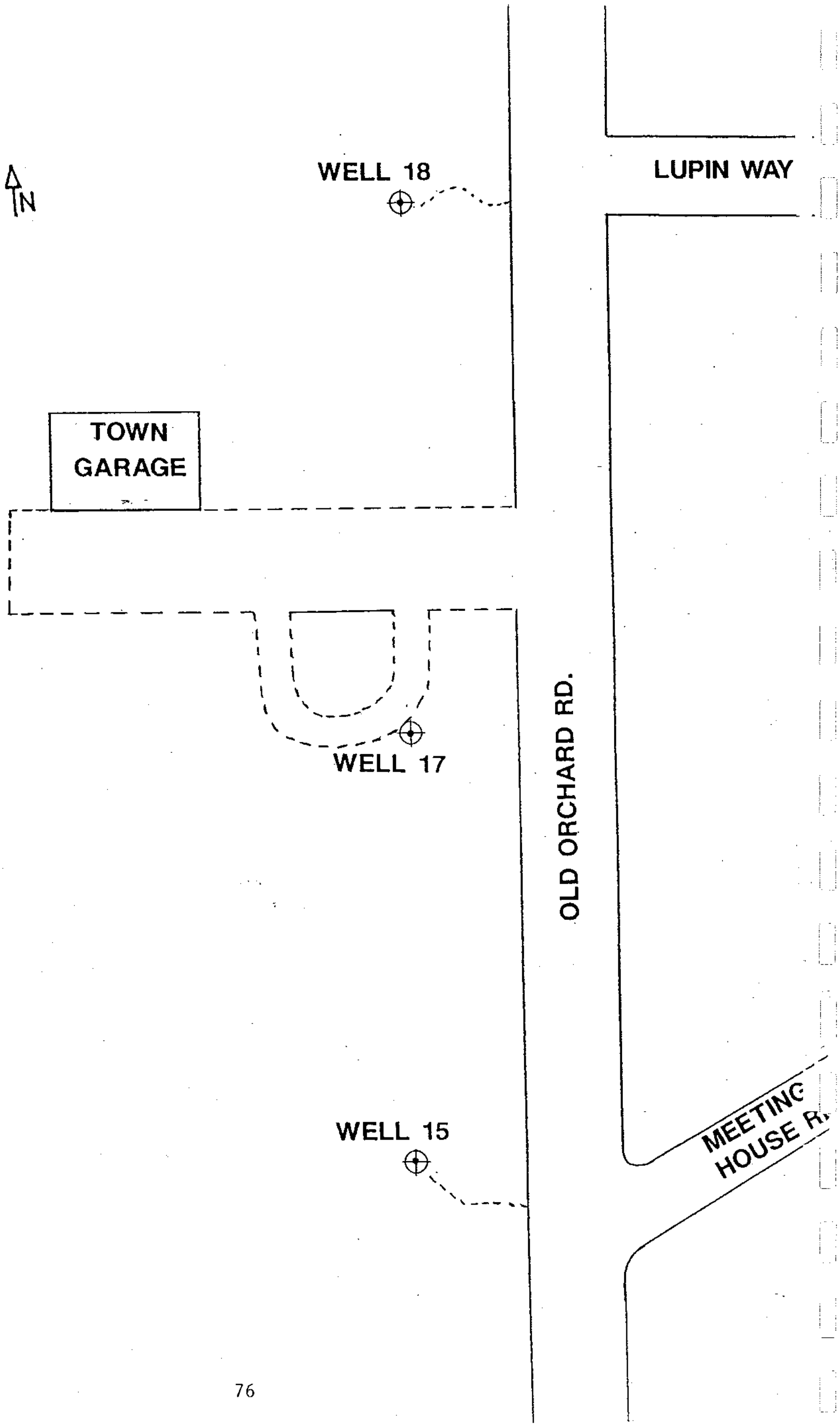

N
HOUSE
SHADY LANE
WELL 10
GROVE RD.

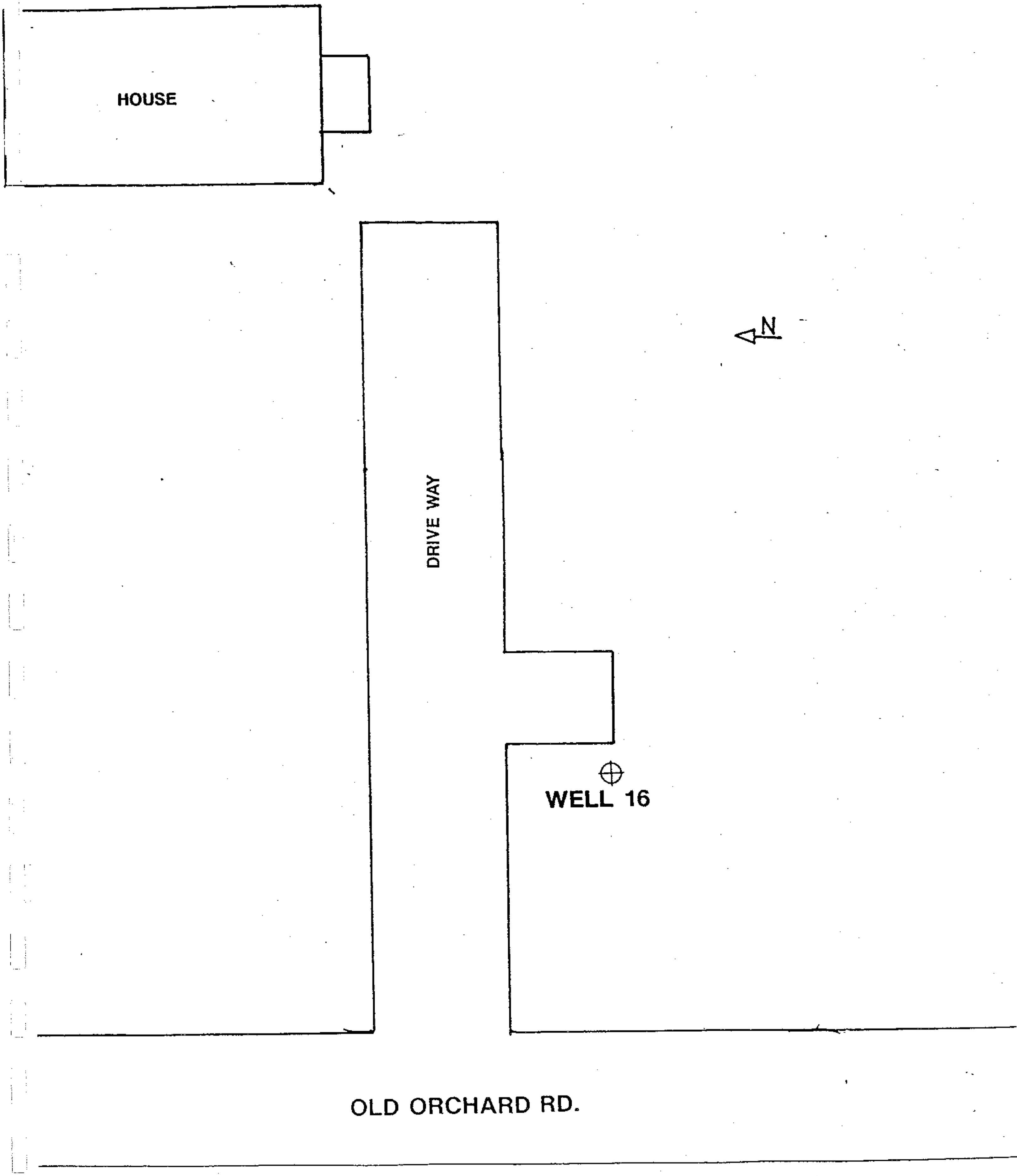

N
HOUSE
DRIVE WAY
WELL 11
WOOD SONG DRIVE

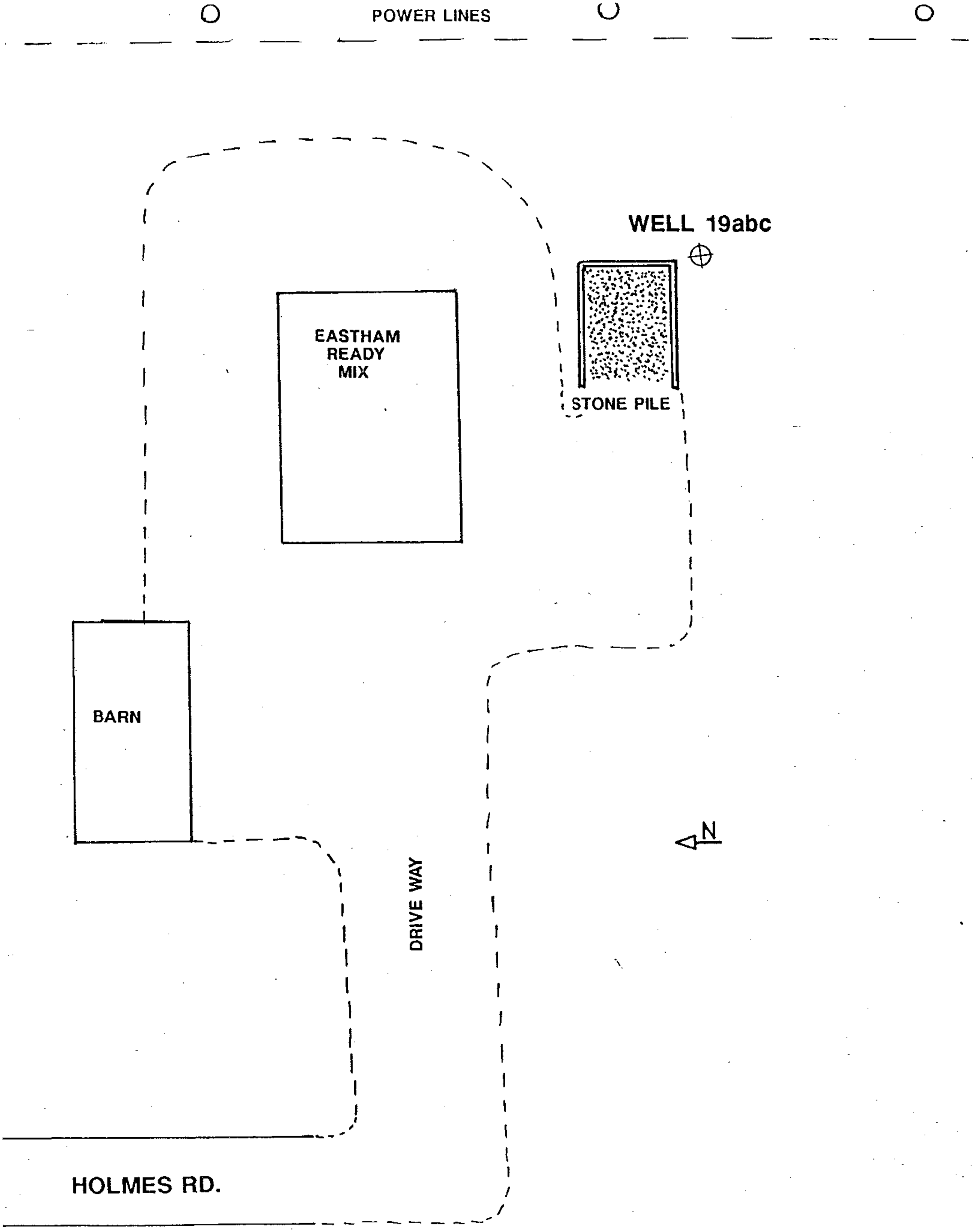

KINGSWOOD RD.
VACANT LOT
WELL 12abc
HOUSE
GREAT POND RD.
N

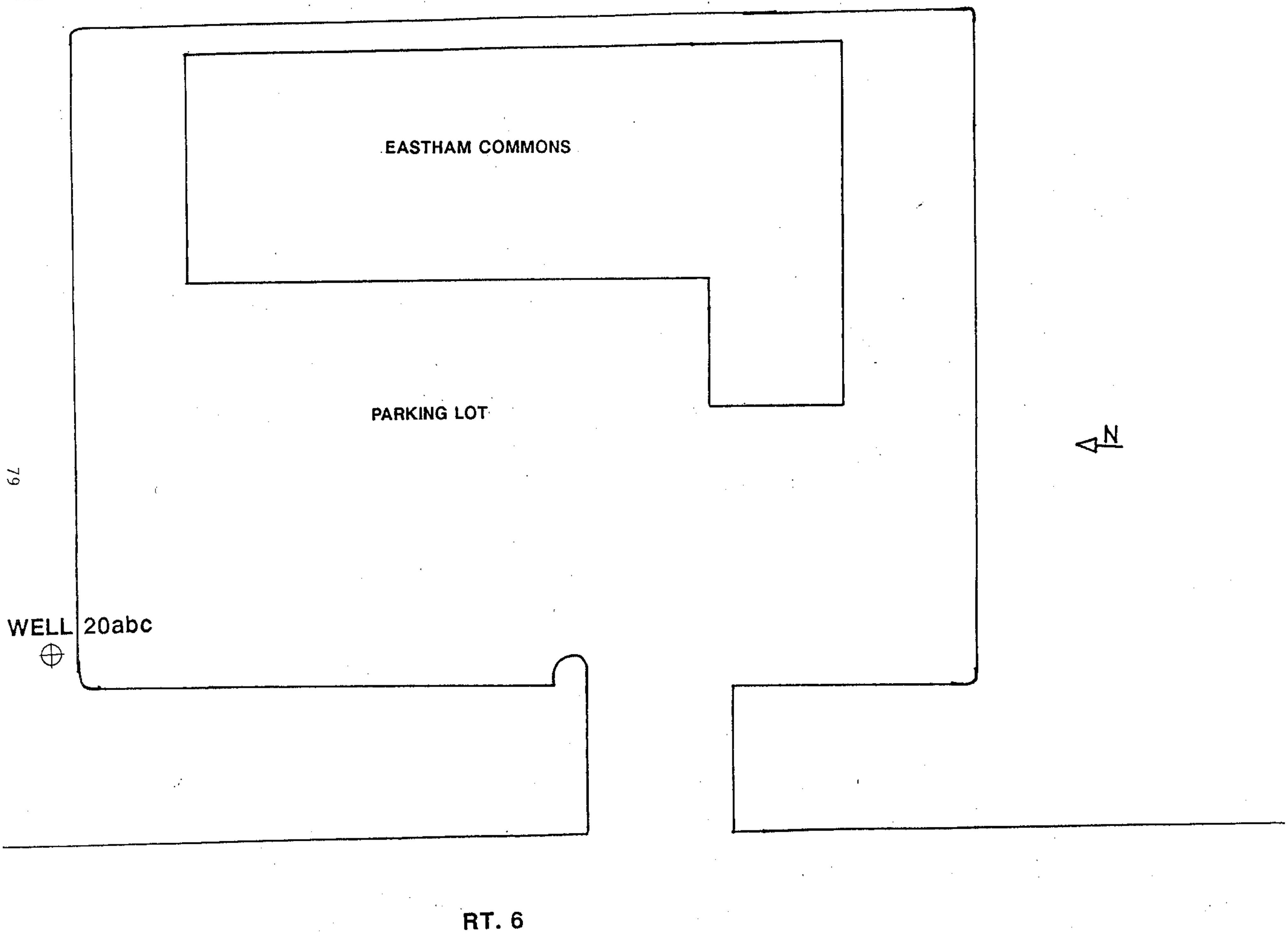

WELL 13c
N
TOWN CRIER MOTEL
POWER-LINE EASEMENT
ROUTE 6
ATLANTIC OAKS CAMPGROUND
WELL 13ab


N
WELL 14abc
PARKING LOT
BARN
HOUSE
RT. 6

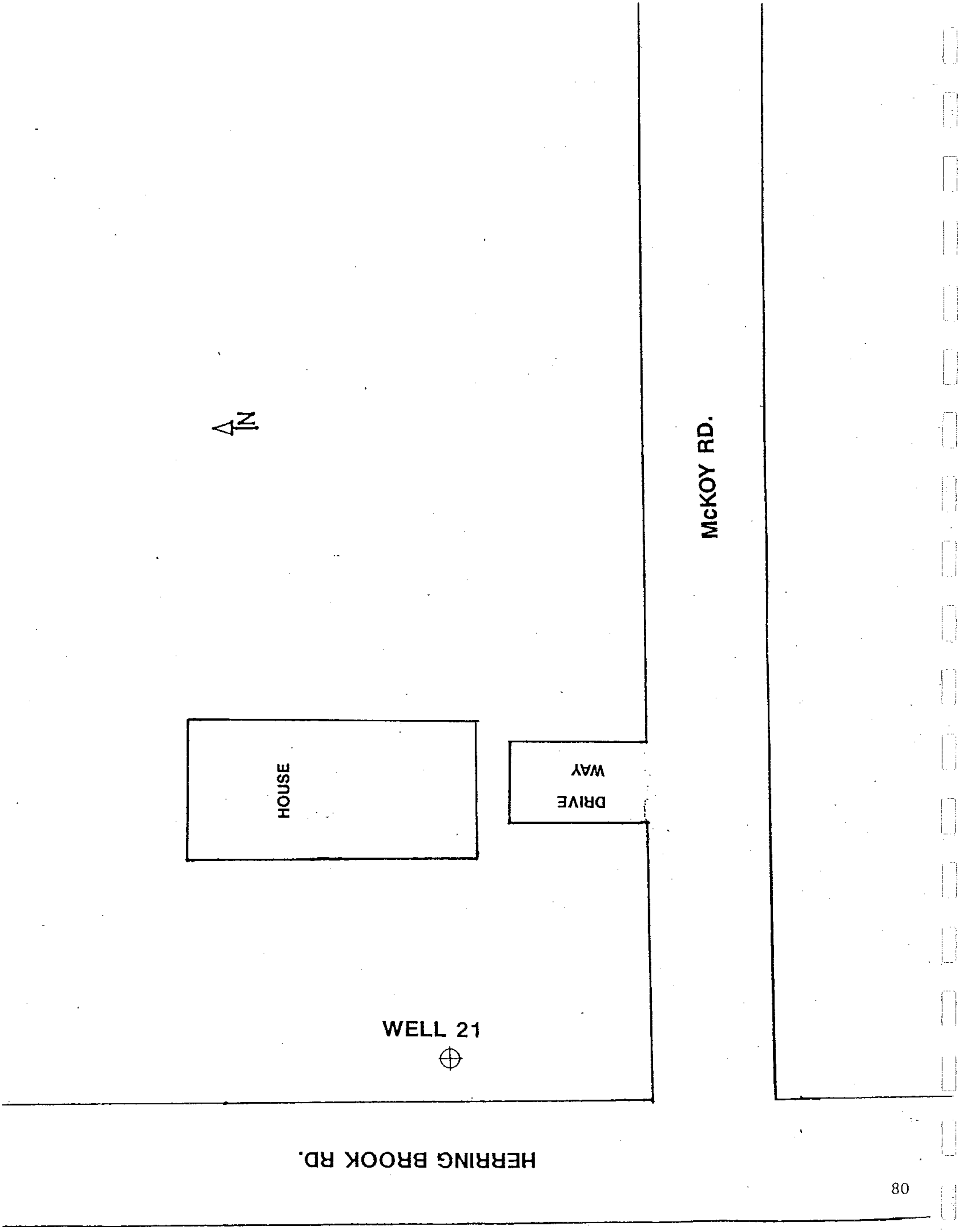

N
WELL 18
LUPIN WAY
TOWN GARAGE
WELL 17
OLD ORCHARD RD.
WELL 15
MEETING HOUSE R

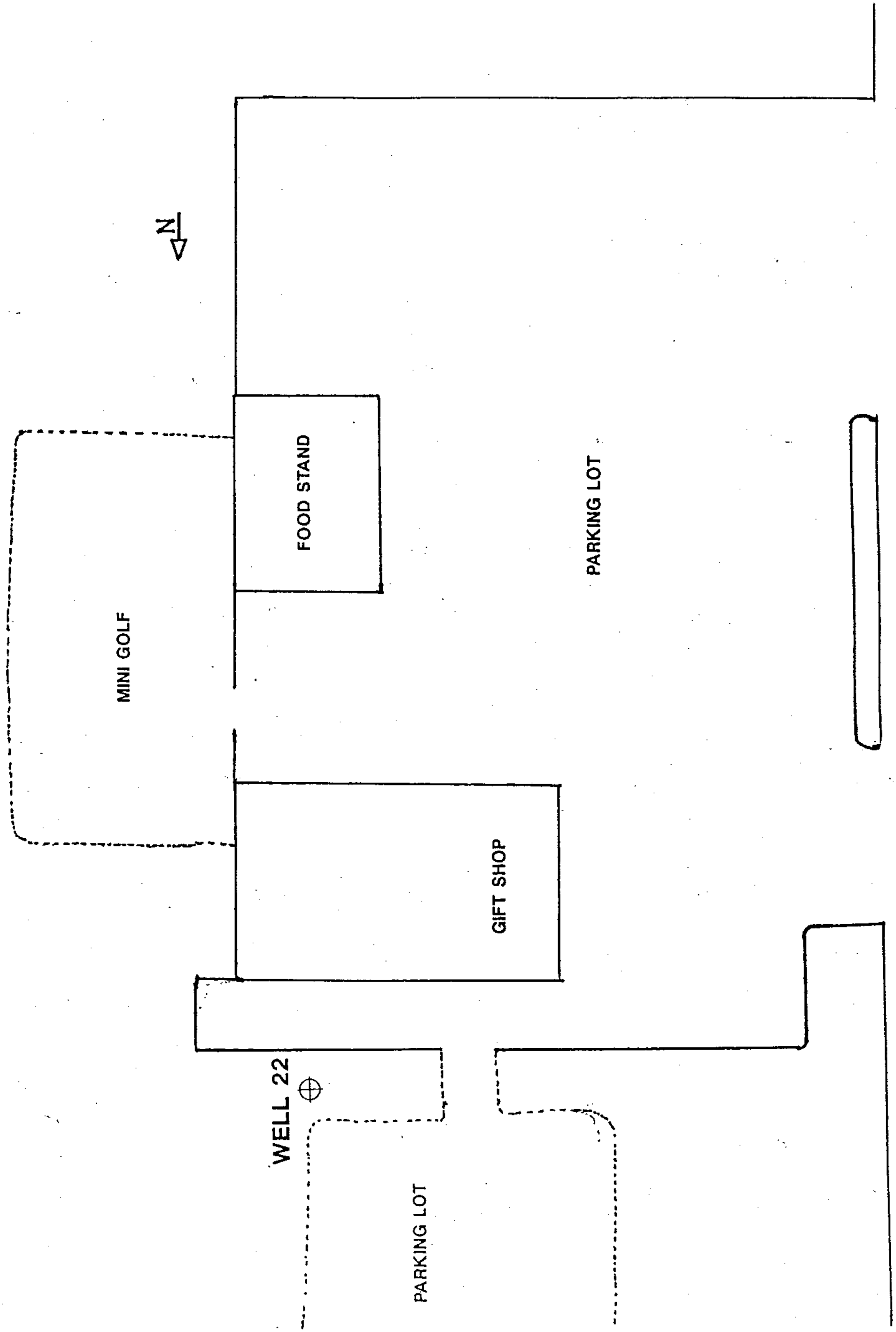

HOUSE
N
DRIVE WAY
WELL 16
OLD ORCHARD RD.


POWER LINES
WELL 19abc
EASTHAM READY MIX
STONE PILE
BARN
N
DRIVE WAY
HOLMES RD.

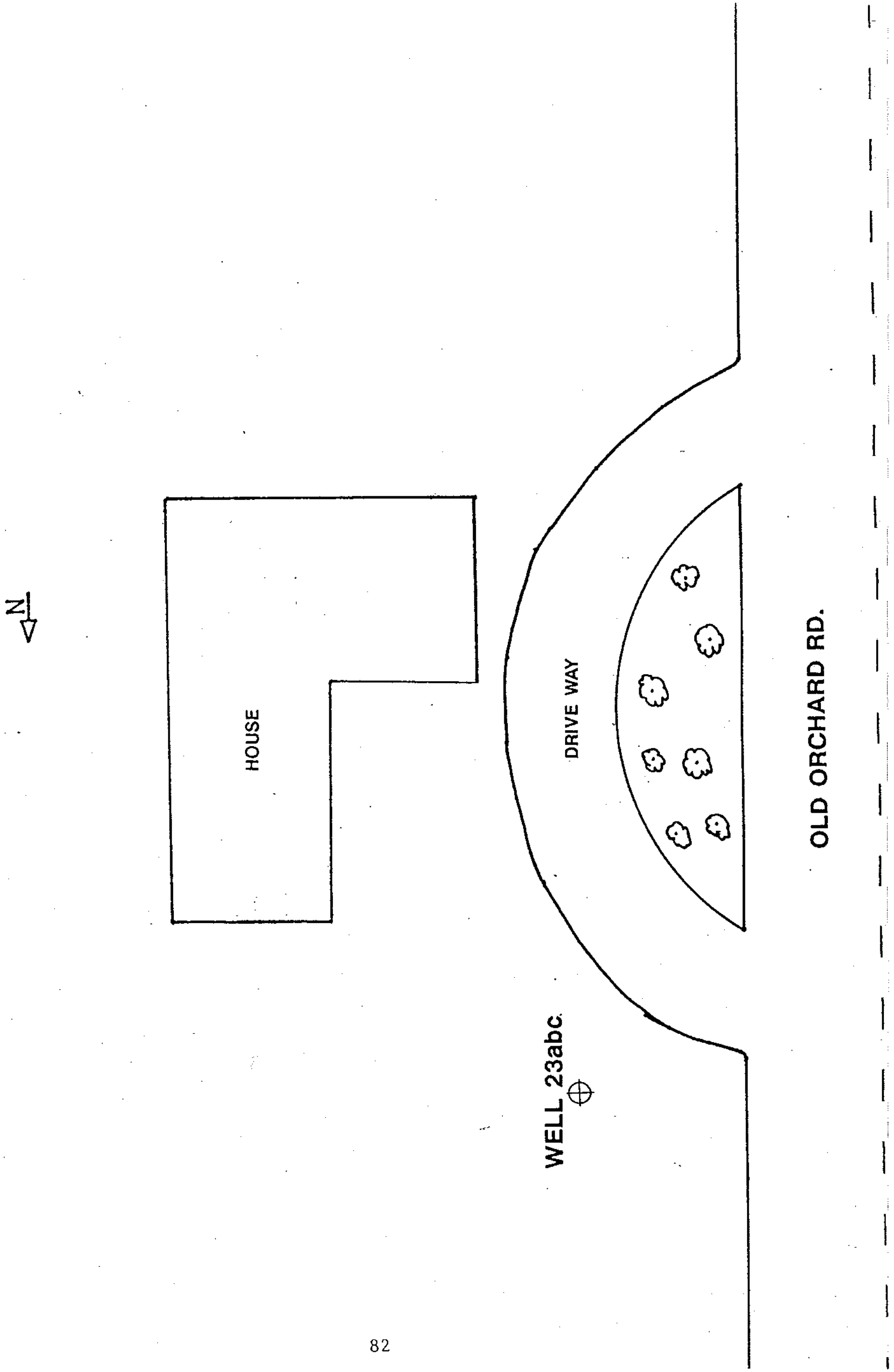


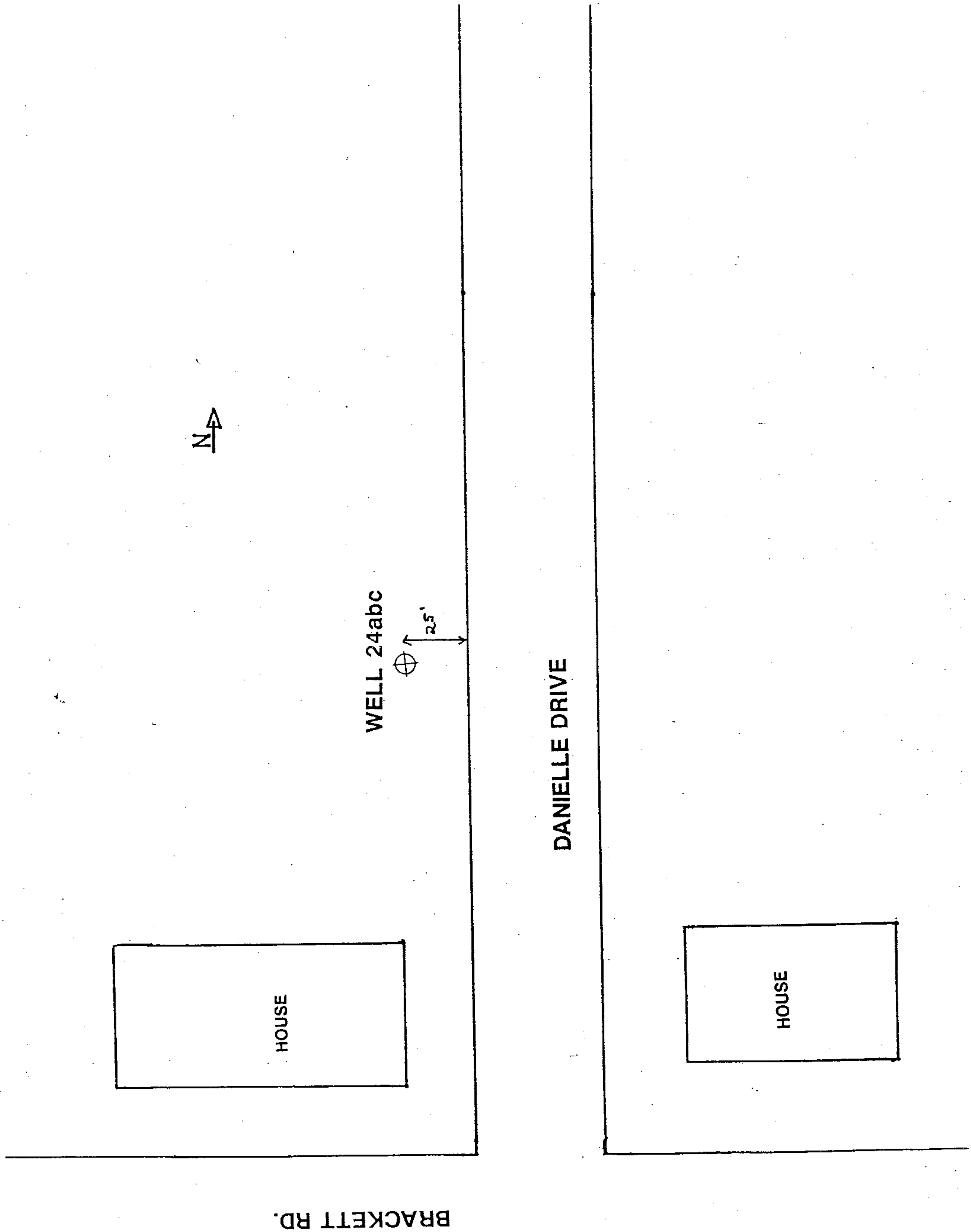
EASTHAM COMMONS
PARKING LOT
N
WELL 20abc
RT. 6

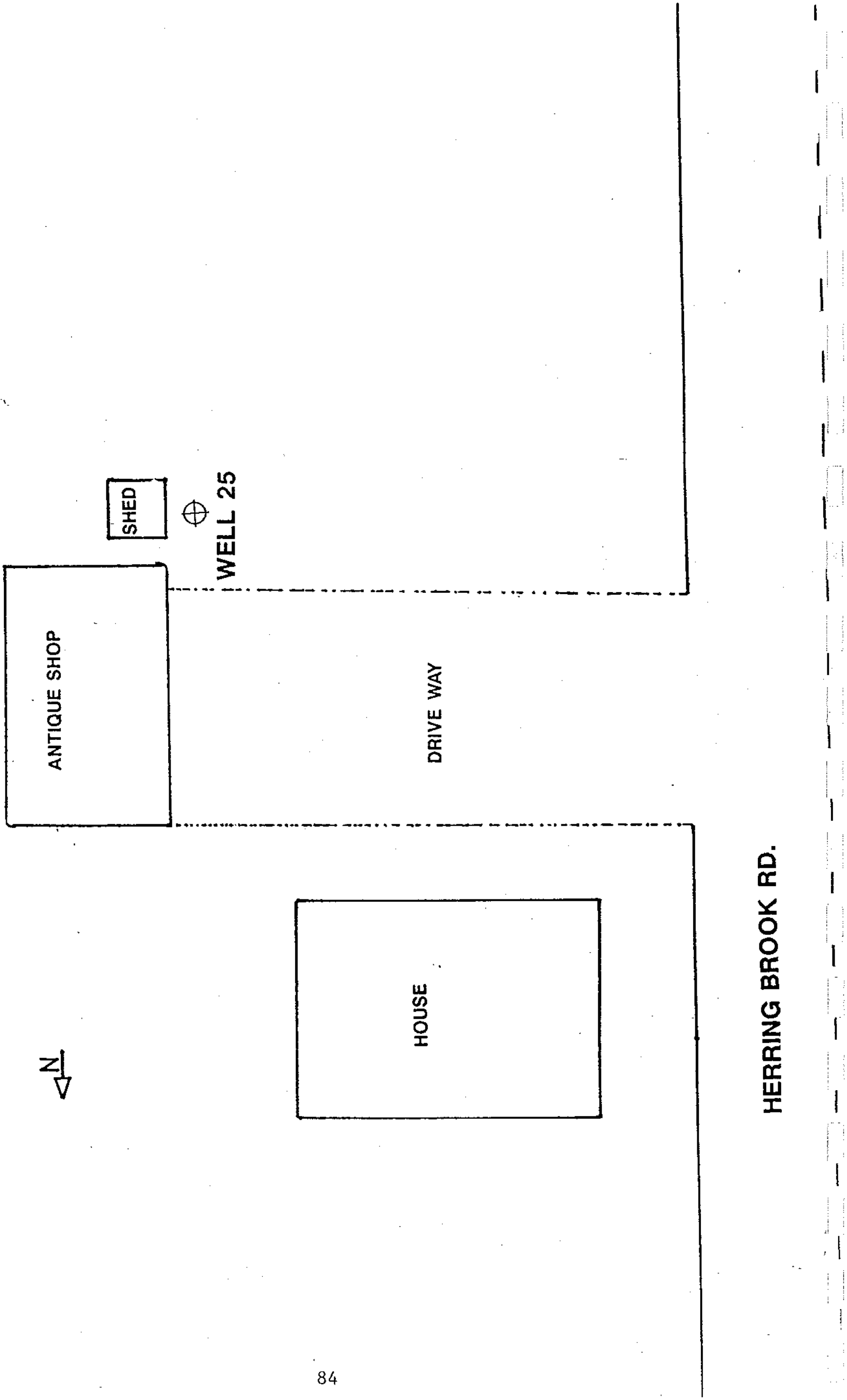

N
McKOY RD.
HOUSE
DRIVE WAY
WELL 21
HERRING BROOK RD.

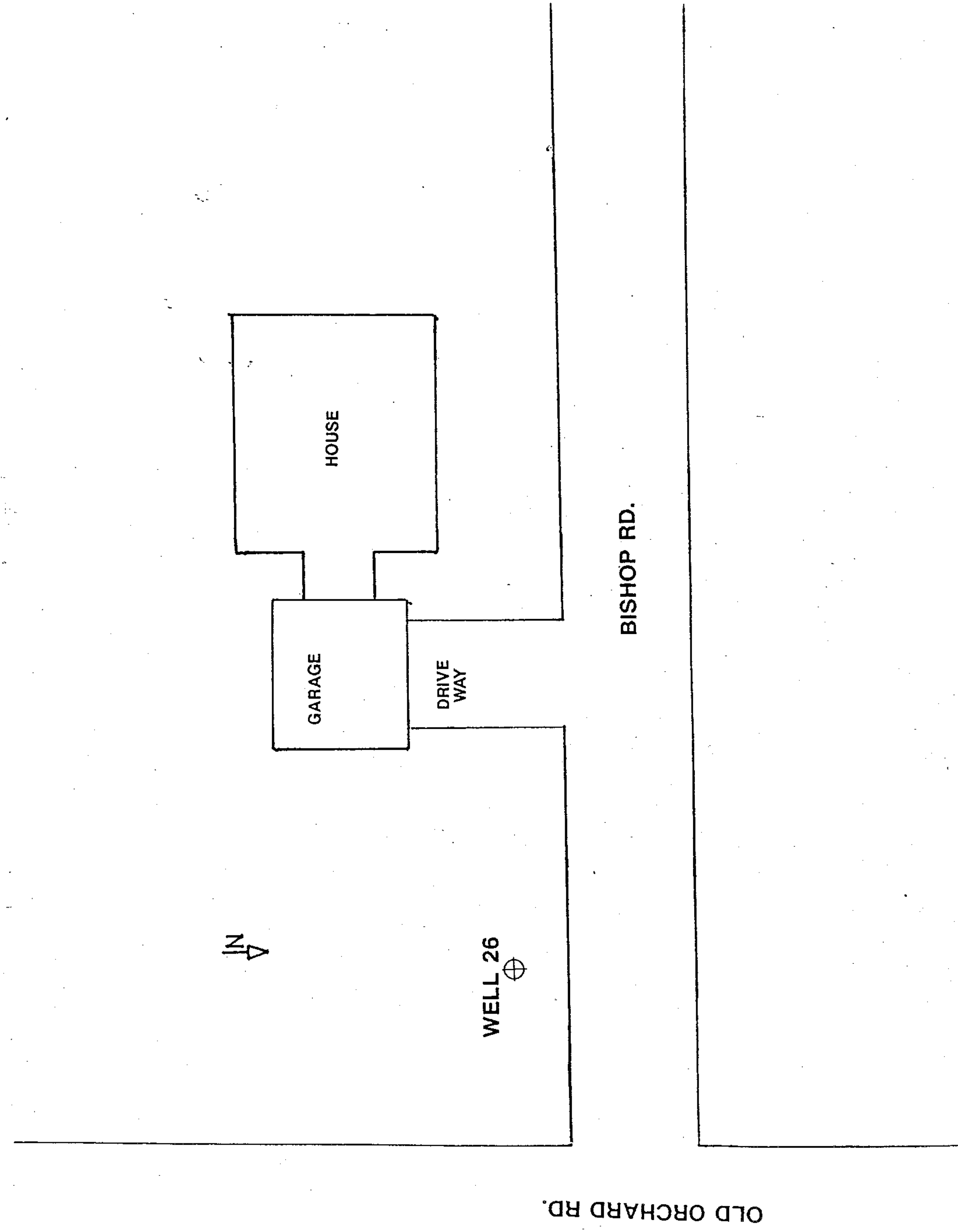


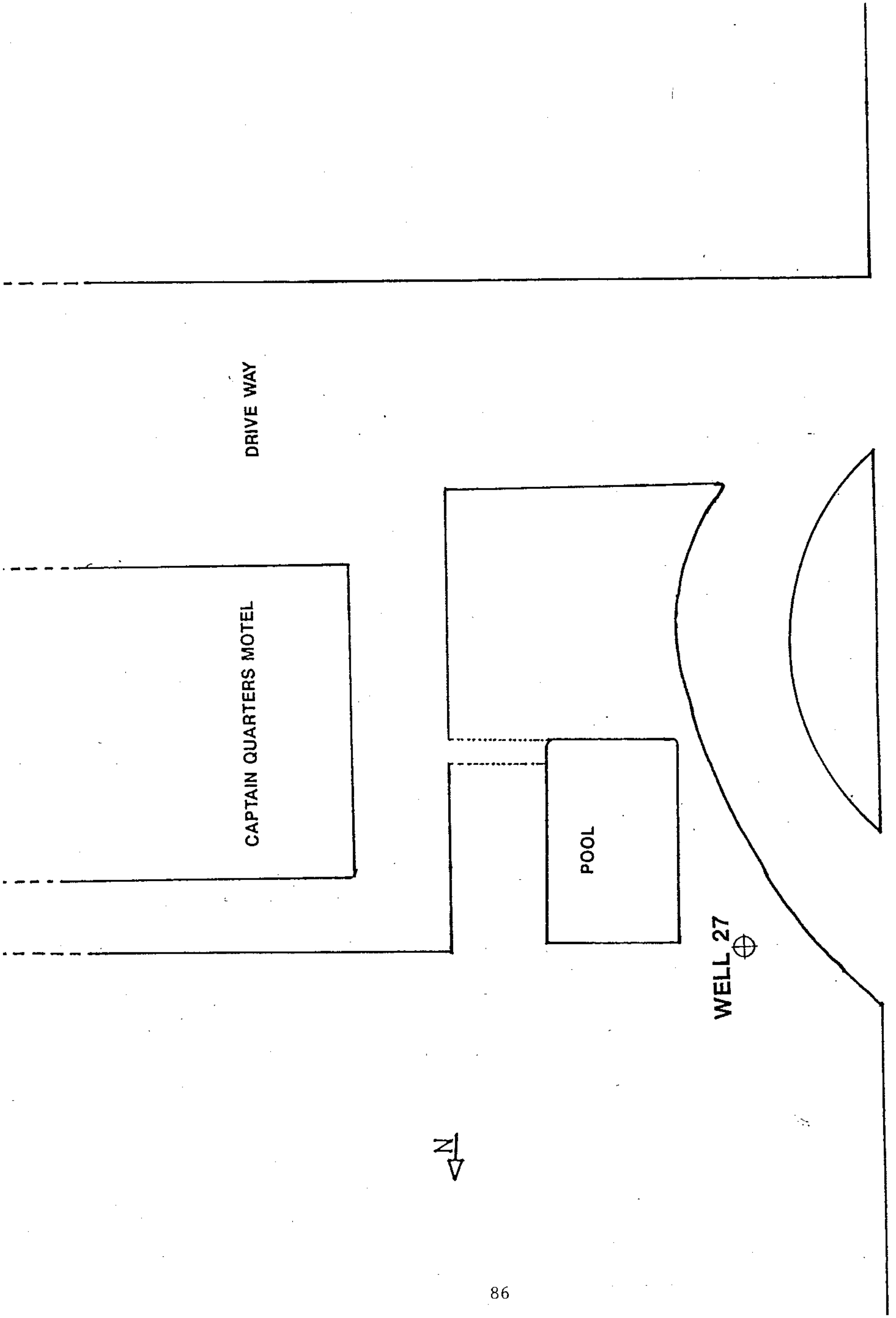
N
MINI GOLF
FOOD STAND
PARKING LOT
RT. 6
GIFT SHOP
WELL 22
PARKING LOT

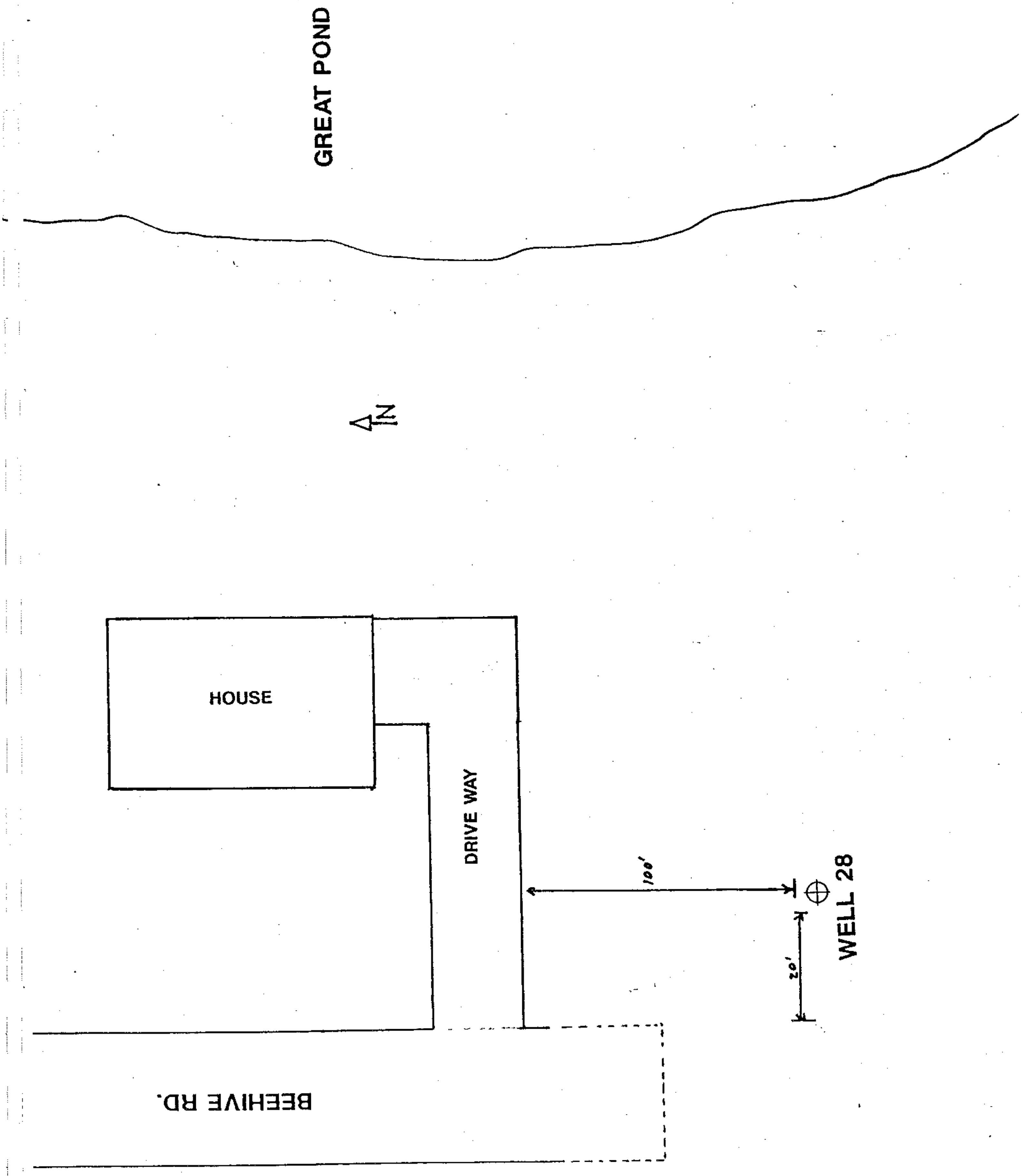

N
HOUSE
DRIVE WAY
OLD ORCHARD RD.
WELL 23abc


N
WELL 24abc
25'
DANIELLE DRIVE
HOUSE
HOUSE
BRACKETT RD.


SHED
WELL 25
ANTIQUE SHOP
DRIVE WAY
HOUSE
N
HERRING BROOK RD.


HOUSE
GARAGE
DRIVE WAY
BISHOP RD.
N
WELL 26
OLD ORCHARD RD.


DRIVE WAY
CAPTAIN QUARTERS MOTEL
POOL
WELL 27
RT. 6
N


GREAT POND
N
HOUSE
DRIVE WAY
100'
20'
WELL 28
BEEHIVE RD.

PROJECT Great Pond Phase II

SITE Clark's Point Rd, Eastham.

COORDINATES N/A

DATE COMPLETED 3/1/89

SUPERVISED BY BEC

WELL NO. 1a

AQUIFIER

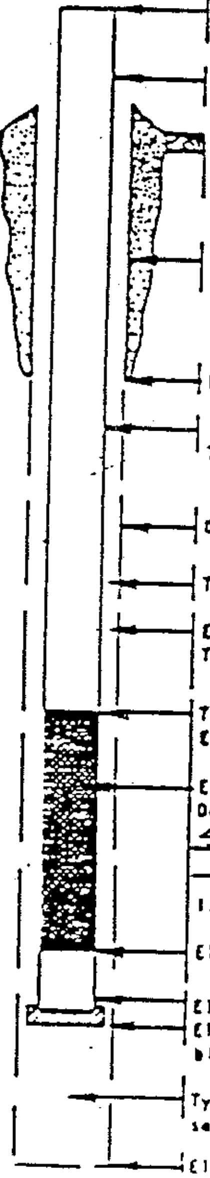
GROUND ELEVATION

GENERALIZED STRATIGRAPHY

0-60' Fine-Med./brown Sand

?55-65' clays apparent

65-75' Fine Grey Sand and silt



Elevation of reference point 23.75

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: Sand

Elevation / depth of top of seal 7.75

Type of seal: Bentonite

Type of gravel pack Sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 3.75

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -6.25

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -51.25

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Clark's Point Rd., Eastham

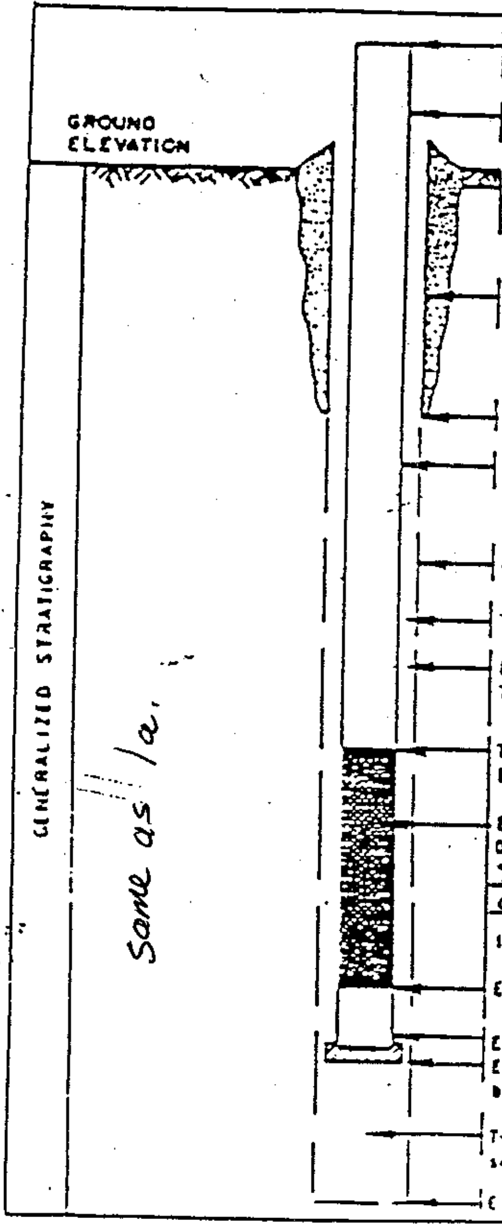
COORDINATES N/A

DATE COMPLETED 3/1/89

SUPERVISED BY BEC

WELL NO. 1b

AQUIFER



Elevation of reference point 23.75

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 7.75

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -21.25

Description of screen Sch.40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -31.25

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -51.25

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Clarks Point Rd., Eastham

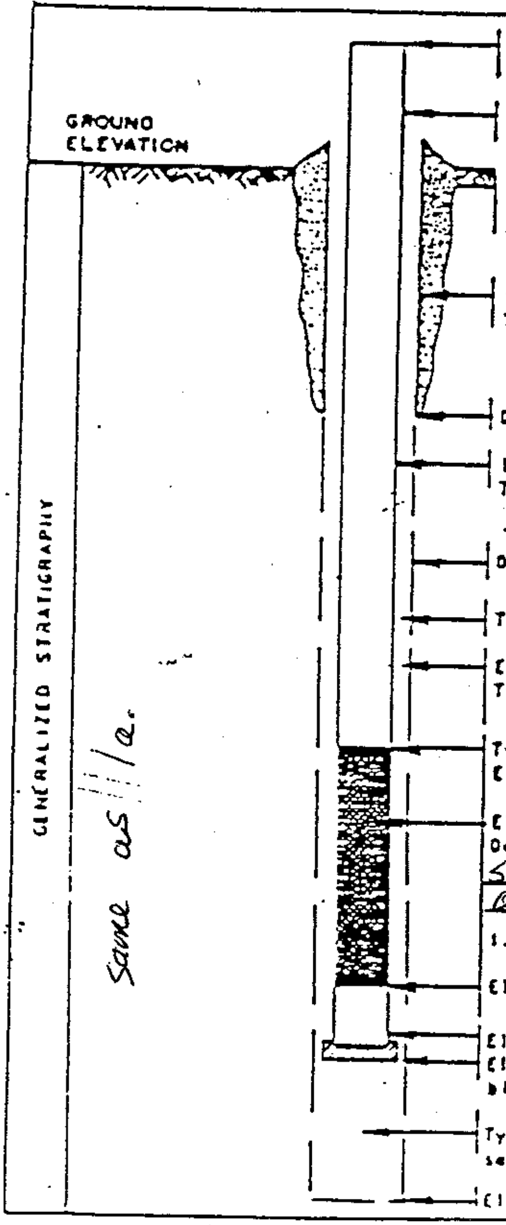
COORDINATES N/A

DATE COMPLETED 3/1/89

SUPERVISED BY BEC

WELL NO. 1c

AQUIFER



Elevation of reference point 23.76

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 7.75

Type of seal: Bentonite

Type of gravel pack Sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -41.25

Description of screen Sch.40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -51.25

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

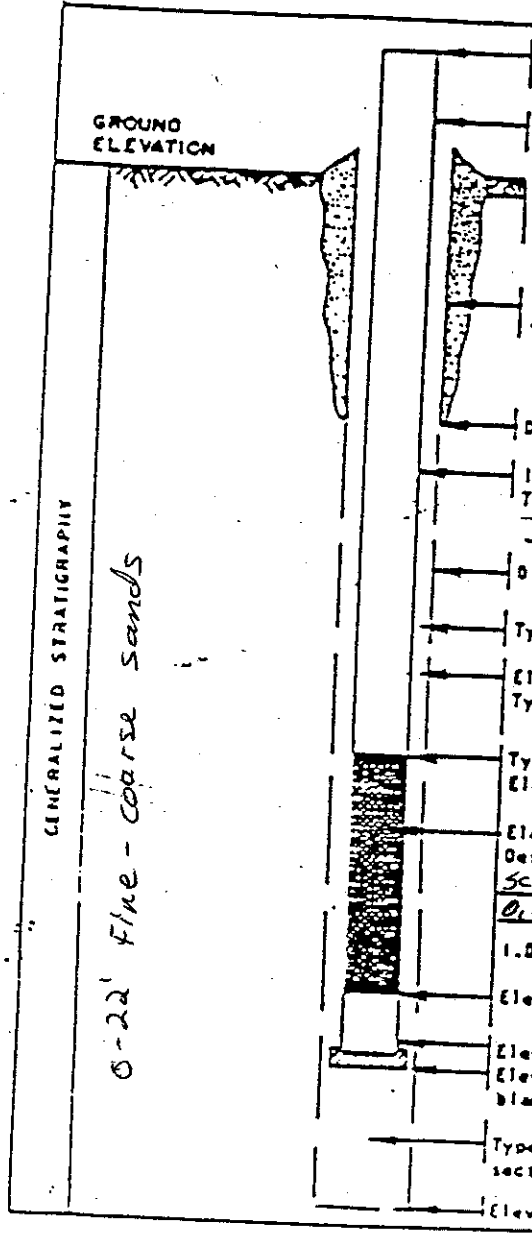
Type of filler below plugged section N/A

Elevation of bottom of borehole -51.25

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Great Pond Rd., Eastham
COORDINATES N/A
DATE COMPLETED 2/28/89
SUPERVISED BY BEC

WELL NO. 2
AQUIFER



Elevation of reference point 13.13
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.5'
Type of surface seal: Concrete
I.D. of surface casing 3"
Type of surface casing: cast gate Box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 9.13
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 8.13
Description of screen sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -1.87
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -8.87

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Wiley Park, Eastham

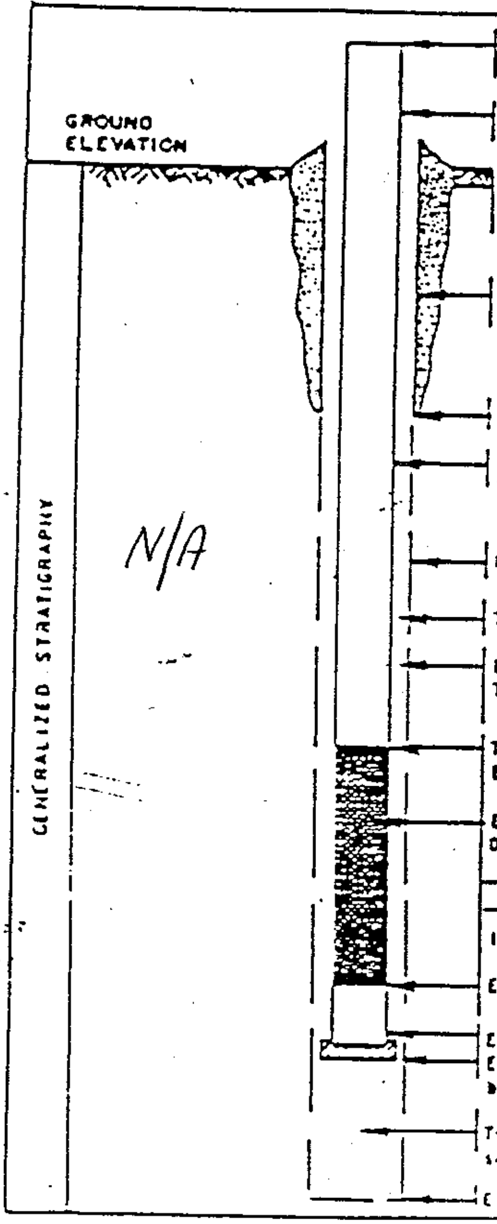
COORDINATES Lat. 41-49-59 Long. 69-59-50

DATE COMPLETED 6/18/75

SUPERVISED BY USGS

WELL NO. 3 (existing)

AQUIFER



Elevation of reference point 26.86

Height of reference point above ground surface Flush

Depth of surface seal N/A

Type of surface seal: N/A

I.D. of surface casing 2"

Type of surface casing: steel

Depth of surface casing N/A

I.D. of riser pipe 1.25"

Type of riser pipe: black PVC

Diameter of borehole N/A

Type of filler: N/A

Elevation / depth of top of seal N/A

Type of seal: N/A

Type of gravel pack N/A

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 1.16

Description of screen Slotted

I.D. of screen section 1.25"

Elevation / depth of bottom of screen -0.34

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Great Pond Rd., Eastham

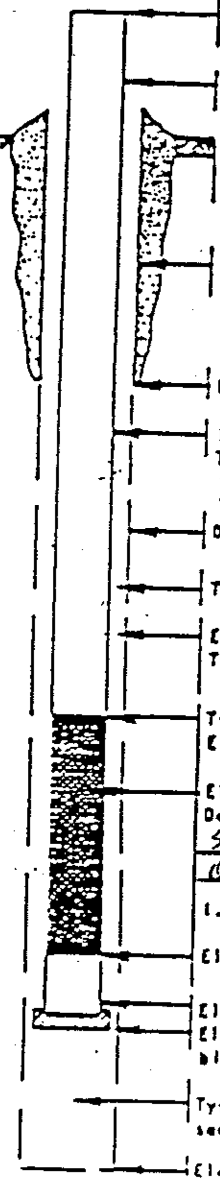
COORDINATES N/A

DATE COMPLETED 3/8/89

SUPERVISED BY BEC

WELL NO. 4

AQUIFIER



GROUND ELEVATION

GENERALIZED STRATIGRAPHY

0-27' Fine med sand

27-31' grey clays

31-5' med coarse sand

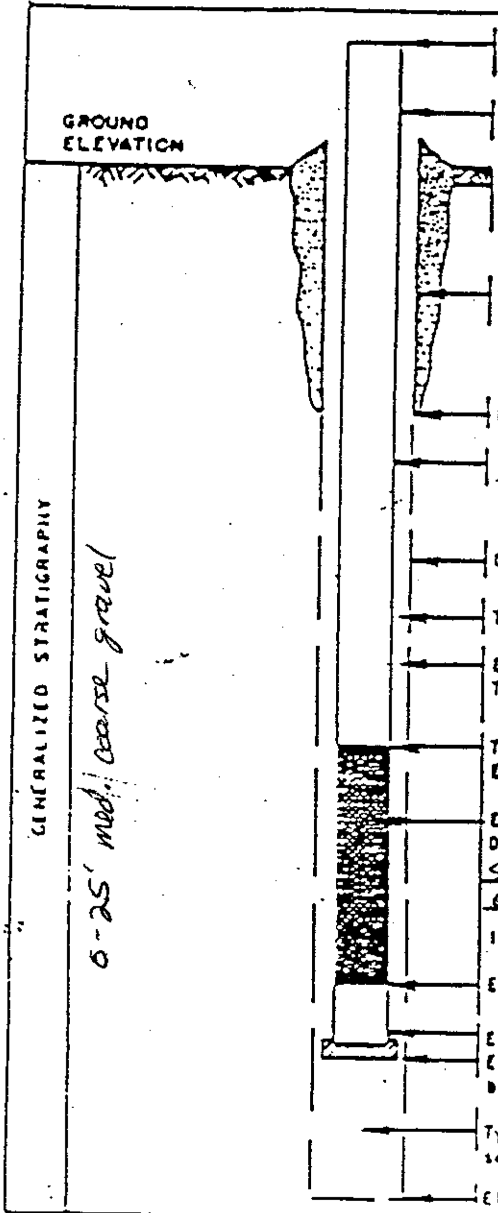
Elevation of reference point	34.45
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.5'
Type of surface seal: concrete	
I.D. of surface casing	3"
Type of surface casing: cast gate box	
Depth of surface casing	2.0'
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	4"
Type of filler: sand	
Elevation / depth of top of seal	18.45
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	4.45
Description of screen sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-5.55
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-15.55

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Split Rail Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/3/89
SUPERVISED BY BGC

WELL NO. 5
AQUIFER



Elevation of reference point 21.63
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.5'
Type of surface seal: concrete
I.D. of surface casing 3"
Type of surface casing: cast gate box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 11.63
Type of seal: Bentonite
Type of gravel pack Sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 6.63
Description of screen sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -3.37
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -3.37

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Deborah Doane Way, Eastham

COORDINATES N/A

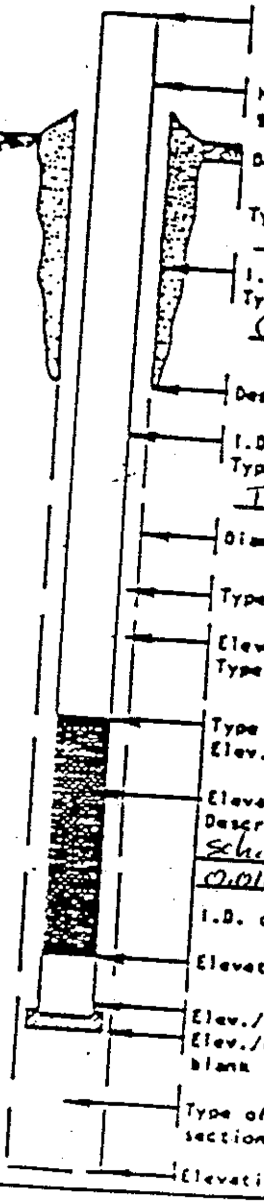
DATE COMPLETED 3/1/89

SUPERVISED BY BEC

WELL NO. 69

AQUIFER

GROUND ELEVATION



Elevation of reference point	25.86
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.0'
Type of surface seal: Concrete	
I.D. of surface casing	8"
Type of surface casing: Cast gate box	
Depth of surface casing	18"
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	8"
Type of filler: Sand	
Elevation / depth of top of seal	N/A
Type of seal: Bentonite	
Type of gravel pack Sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	5.86
Description of screen sch.40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-4.14
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-44.14

GENERALIZED STRATIGRAPHY

0-40' med coarse brown Sand

40-50' blue-grey clay and silt

60-70' med coarse sand

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Deborah Doane Way, Eastham

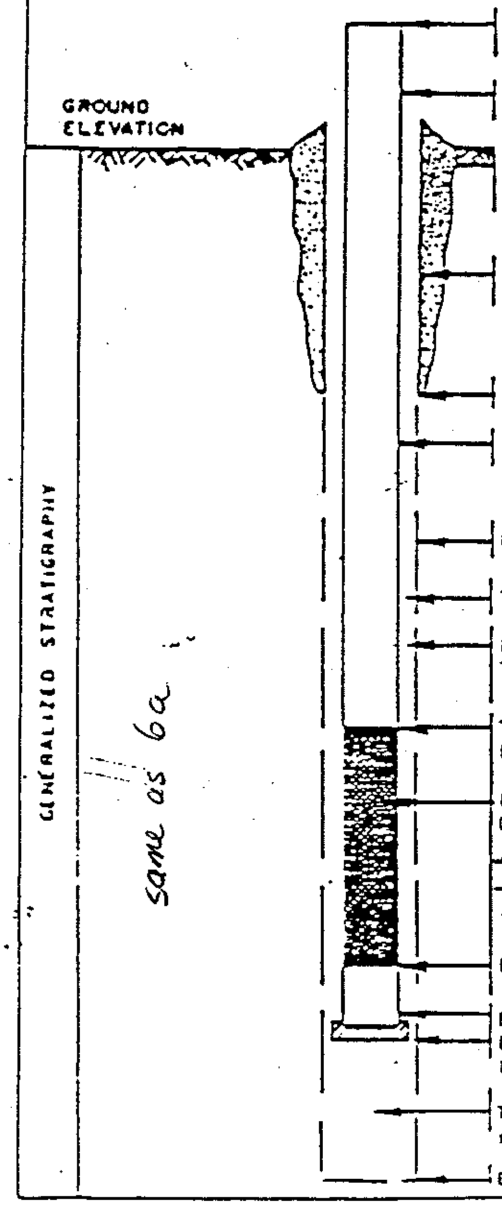
COORDINATES N/A

DATE COMPLETED 3/1/89

SUPERVISED BY BBC

WELL NO. 6b

AQUIFER



Elevation of reference point 25.86

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal N/A

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -14.14

Description of screen sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -24.14

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -44.14

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Deborah Doane Way, Eastham

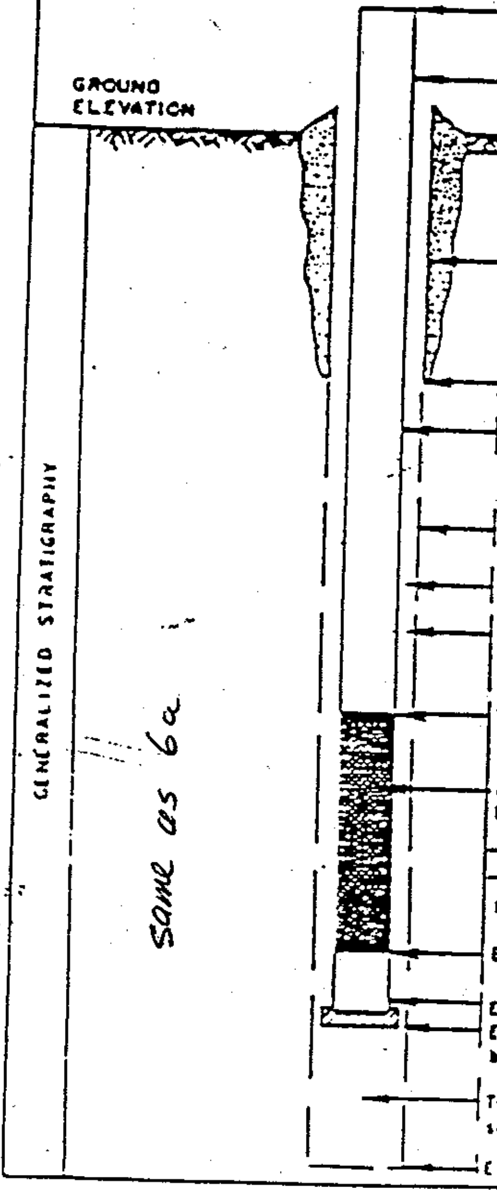
COORDINATES N/A

DATE COMPLETED 3/1/89

SUPERVISED BY BEC

WELL NO. 6c

AQUIFER



Elevation of reference point 25.86

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gat box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal N/A

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -34.14

Description of screen Sch. 40 PVC. with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -44.14

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -44.14

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Great Pond Place, Eastham

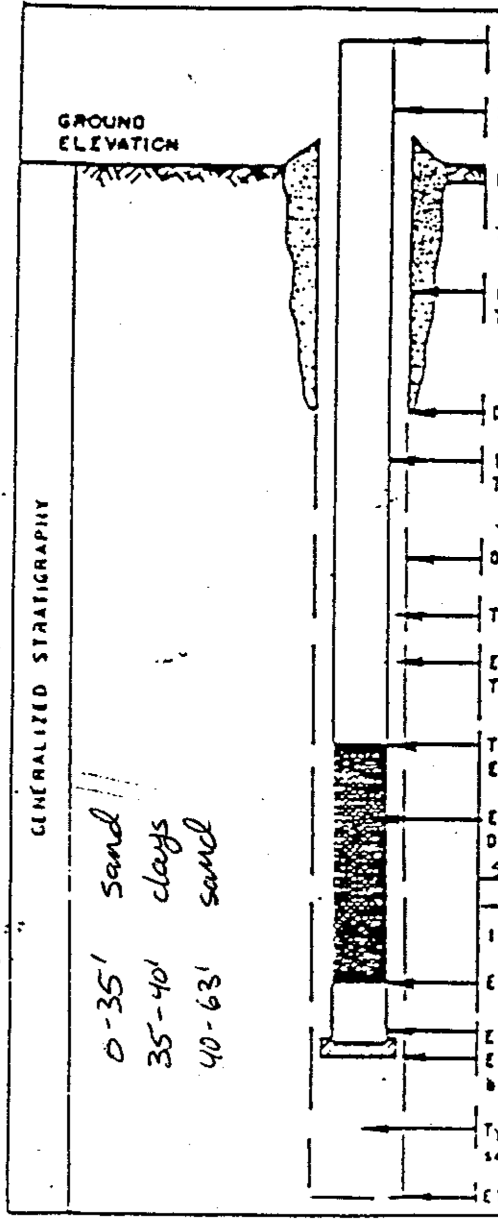
COORDINATES N/A

DATE COMPLETED 3/14/89

SUPERVISED BY BEC

WELL NO. 7a

AQUIFER



0-35' sand
35-40' clays
40-63' sand

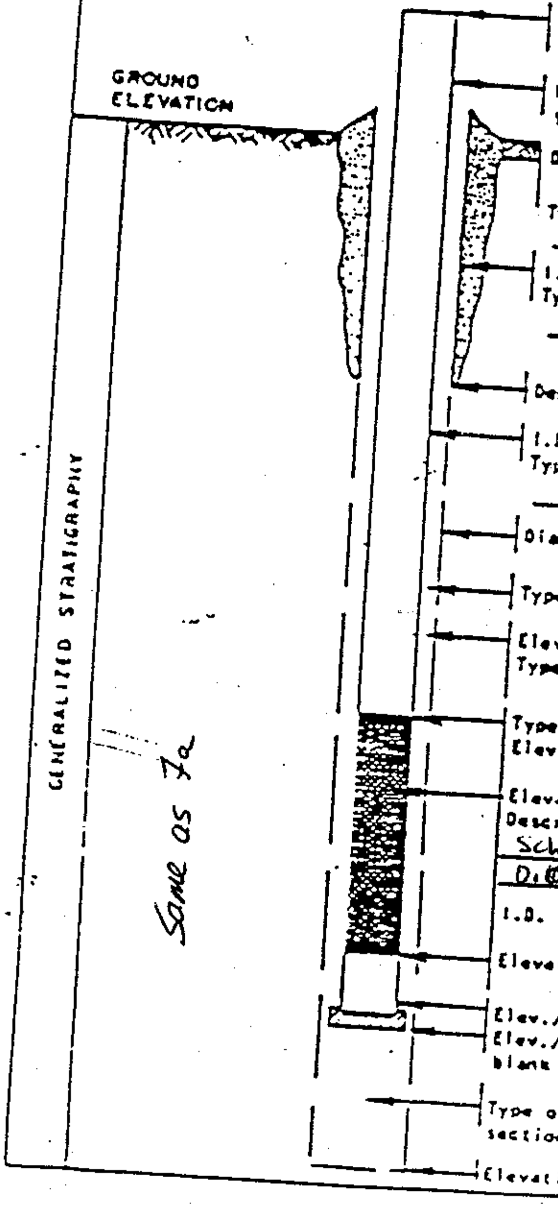
Elevation of reference point	23.86
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-20'
Type of surface seal: concrete	
I.D. of surface casing	8"
Type of surface casing: cast gate box	
Depth of surface casing	18"
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	8"
Type of filler: sand	
Elevation / depth of top of seal	13.86
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	8.86
Description of screen sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-1.14
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-39.14

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Great Pond Place, Eastham
COORDINATES N/A
DATE COMPLETED 3/14/89
SUPERVISED BY BEC

WELL NO. 7b
AQUIFER

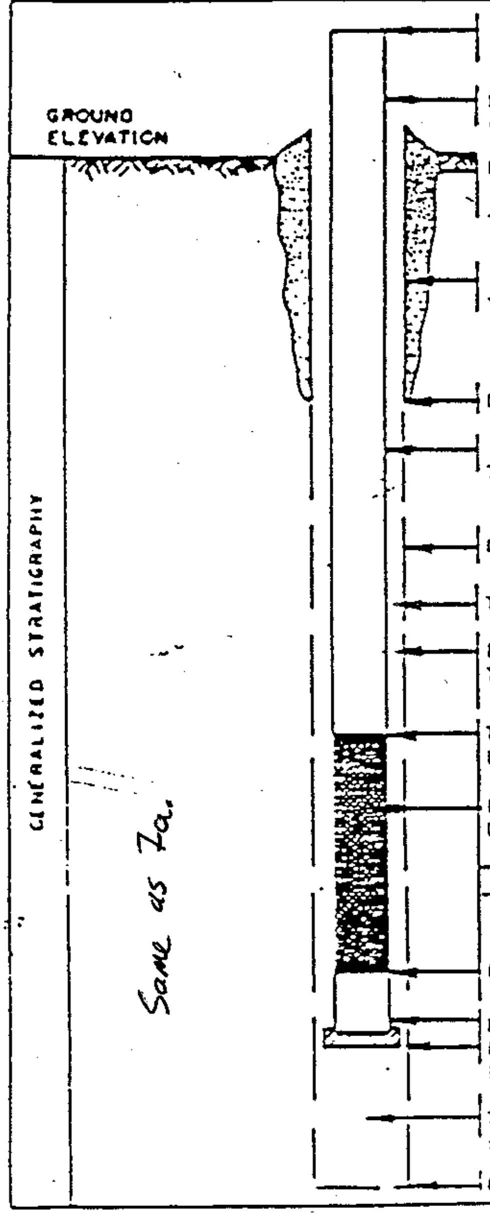


Elevation of reference point	23.86
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.0'
Type of surface seal: concrete	
I.D. of surface casing	8"
Type of surface casing: cast gate box	
Depth of surface casing	18"
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	8"
Type of filler: sand	
Elevation / depth of top of seal	13.86
Type of seal: Bentonite	
Type of gravel pack Sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	-11.14
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-21.14
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-39.14

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Great Pond Place, Eastham
COORDINATES N/A
DATE COMPLETED 3/14/89
SUPERVISED BY BEC

WELL NO. 7c
AQUIFER



Elevation of reference point	23.86
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.0'
Type of surface seal: concrete	
I.D. of surface casing	8"
Type of surface casing: cast gate Box	
Depth of surface casing	14"
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	8"
Type of filler: sand	
Elevation / depth of top of seal	13.86
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	-29.14
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-39.14
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-39.14

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Weir Rd., Eastham

COORDINATES N/A

DATE COMPLETED 3/7/89

SUPERVISED BY BEC

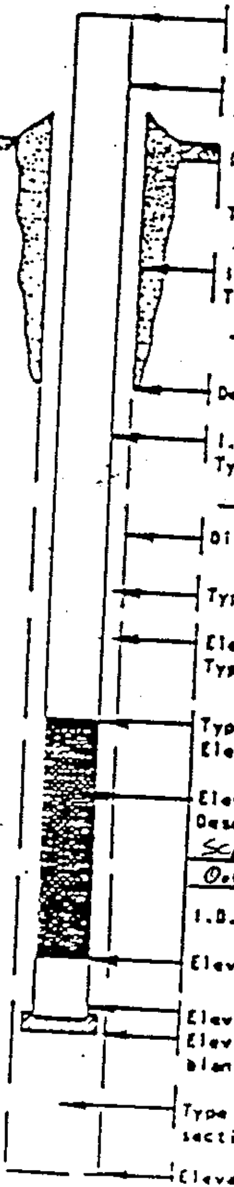
WELL NO. 8

AQUIFER

GROUND ELEVATION

GENERALIZED STRATIGRAPHY

0-38' Fine to Coarse Sand w/ gravel mixed in.



Elevation of reference point	28.78
Height of reference point above ground surface	Flush
Depth of surface seal	
Type of surface seal: Concrete	
I.D. of surface casing	3"
Type of surface casing: cast gate box	
Depth of surface casing	2'
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	4"
Type of filler: Sand	
Elevation / depth of top of seal	11.78
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	8.78
Description of screen sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-1.22
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-9.22

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Kingsbury Beach Rd., Eastham

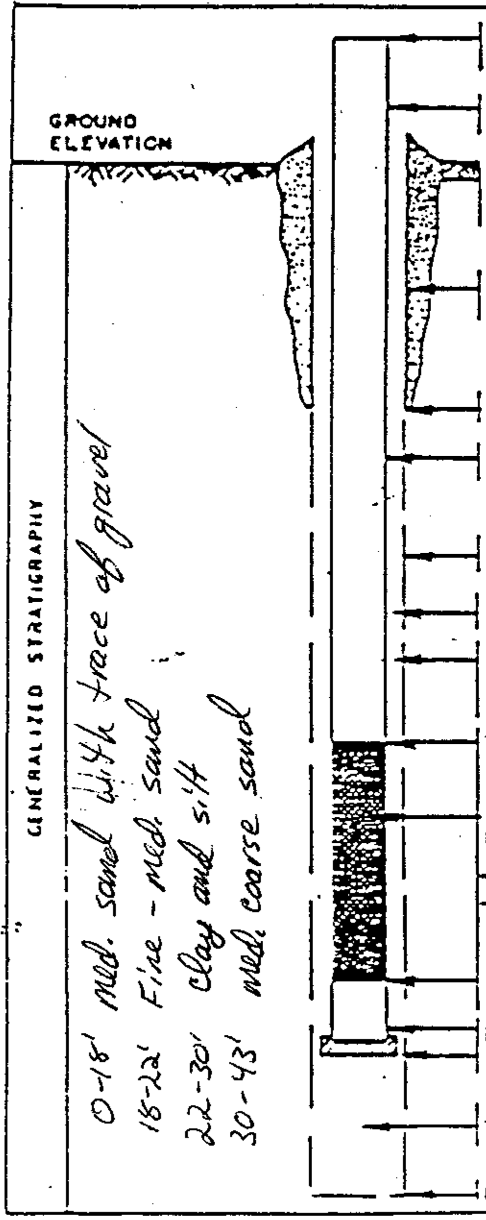
COORDINATES N/A

DATE COMPLETED 2/28/89

SUPERVISED BY BEC

WELL NO. 9

AQUIFER



GENERALIZED STRATIGRAPHY

0-18' med. sand with trace of gravel

18-22' Fine - med. sand

22-30' clay and silt

30-43' med. coarse sand

Elevation of reference point 44.53

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.5'

Type of surface seal: concrete

I.D. of surface casing 3"

Type of surface casing: cast gate Box

Depth of surface casing 2.0'

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 4"

Type of filler: sand

Elevation / depth of top of seal 36.53

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 11.53

Description of screen sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen 1.53

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole 1.53

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Grove Rd., Eastham

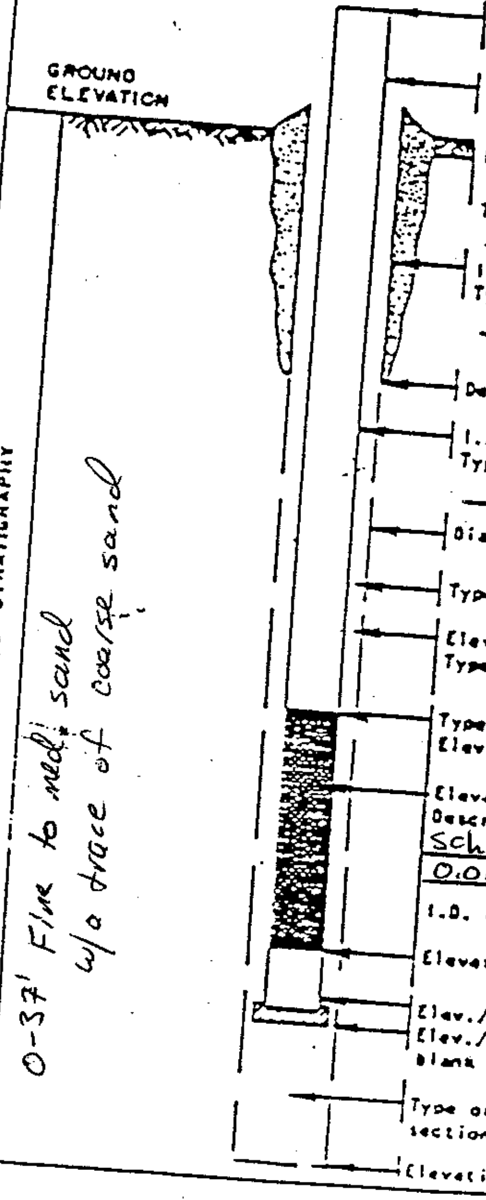
COORDINATES N/A

DATE COMPLETED 2/28/89

SUPERVISED BY BEC

WELL NO. 10

AQUIFER



GENERALIZED STRATIGRAPHY

0-37' Fine to med. sand w/o trace of coarse sand

Elevation of reference point 35.59

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.5'

Type of surface seal: concrete

I.D. of surface casing 3"

Type of surface casing: cast gate box

Depth of surface casing 2.0'

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 4"

Type of filler: sand

Elevation / depth of top of seal 12.59

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 8.59

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -1.41

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

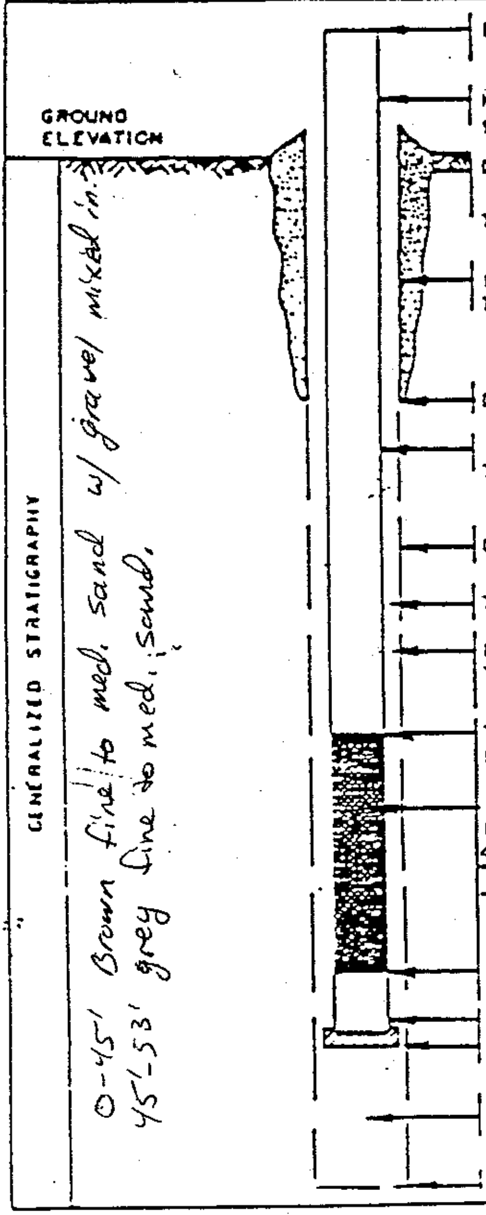
Elevation of bottom of borehole -1.41

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Woodsong Drive, Eastham
COORDINATES N/A
DATE COMPLETED March 2, 1989
SUPERVISED BY BEC

WELL NO. 11
AQUIFER



0-45' Brown fine to med. sand w/ gravel mixed in.
45'-53' grey fine to med. sand.

Elevation of reference point 42.93
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.5'
Type of surface seal: concrete
I.D. of surface casing 3"
Type of surface casing: cast gate box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 15.93
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 7.93
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -2.07
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -10.07

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Kingswood Rd., Eastham

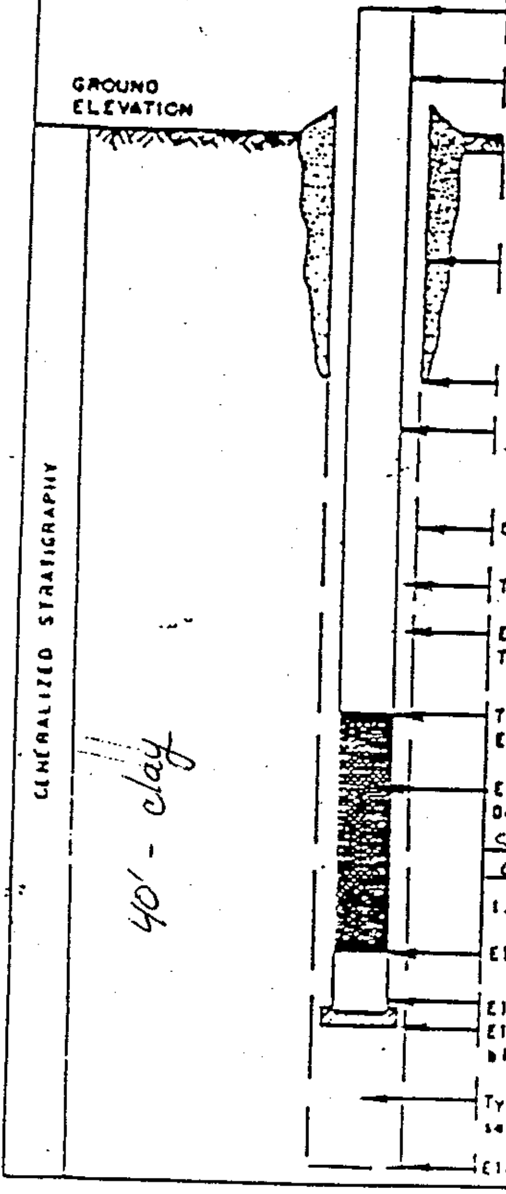
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BEC

WELL NO. 12a

AQUIFER



Elevation of reference point 45.18

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate Box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 23.18

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 10.18

Description of screen sch.40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen 0.18

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

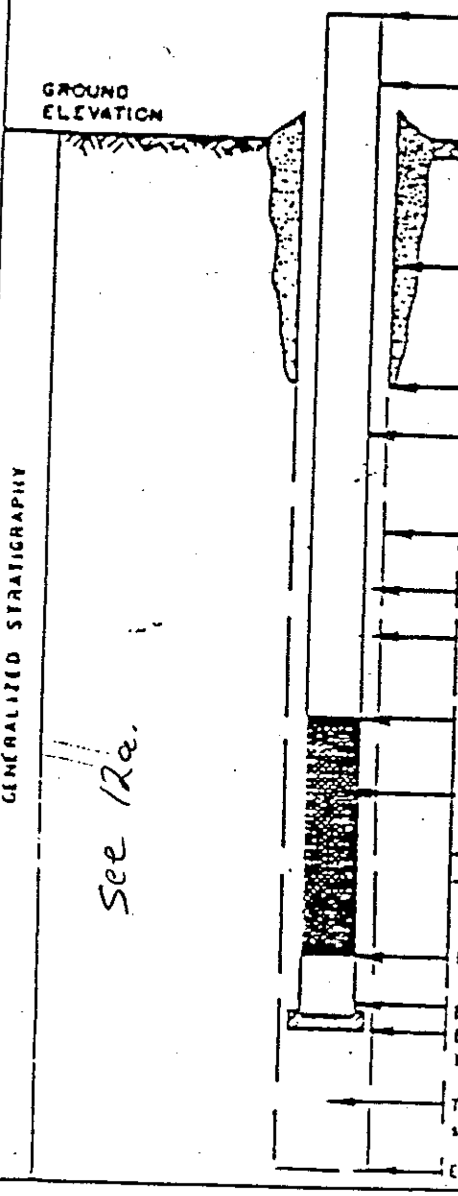
Elevation of bottom of borehole -39.82

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Kingswood Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/13/89
SUPERVISED BY BEC

WELL NO. 12b
AQUIFER

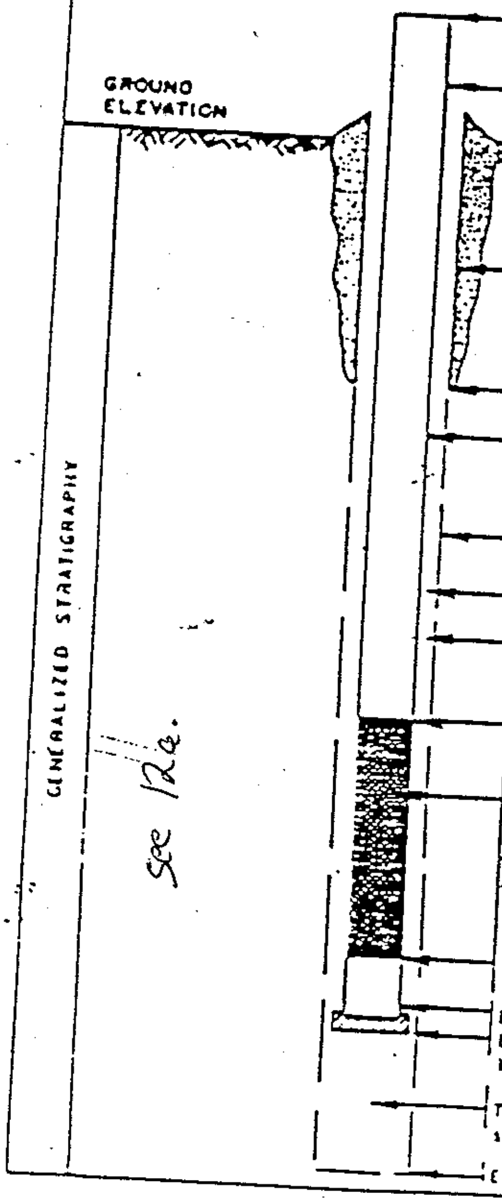


Elevation of reference point 45.18
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: Concrete
I.D. of surface casing 8"
Type of surface casing: cast gate Box
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 23.18
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen -9.82
Description of screen Sch. 40 PVC with 10' of 0.010 Slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -19.82
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -39.82

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Kingswood Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/13/89
SUPERVISED BY BGC

WELL NO. 12c
AQUIFER

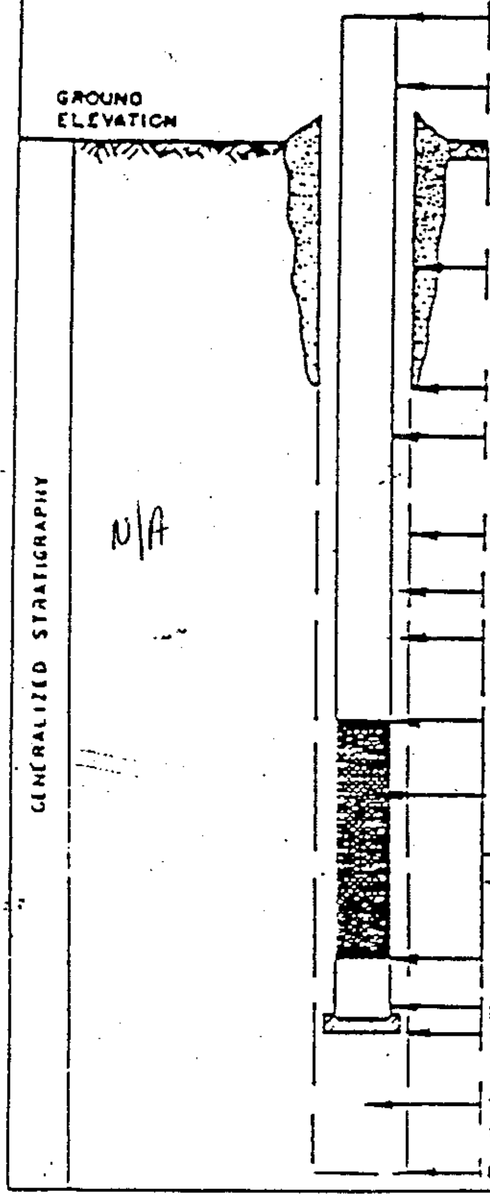


Elevation of reference point 45.18
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 8"
Type of surface casing: cast gate box
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 23.18
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen -29.82
Description of screen
Sch. 40 PVC with 10' of
0.010 slot screen.
I.D. of screen section 2"
Elevation / depth of bottom of screen -39.82
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -39.82

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Atlantic Oaks Camp Ground, Eastham
COORDINATES N/A
DATE COMPLETED N/A
SUPERVISED BY EPA

WELL NO. 13a (existing)
AQUIFER



Elevation of reference point 46.5
Height of reference point above ground surface 2.47
Depth of surface seal N/A
Type of surface seal: N/A
I.D. of surface casing 8"
Type of surface casing: steel well cover
Depth of surface casing N/A
I.D. of riser pipe 1.5"
Type of riser pipe: PVC
Diameter of borehole N/A
Type of filler: N/A
Elevation / depth of top of seal N/A
Type of seal: N/A
Type of gravel pack N/A
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen N/A
Description of screen
I.D. of screen section 1.5"
Elevation / depth of bottom of screen 2.55
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Atlantic Oaks Camp Ground, Eastham

COORDINATES N/A

DATE COMPLETED N/A

SUPERVISED BY EPA

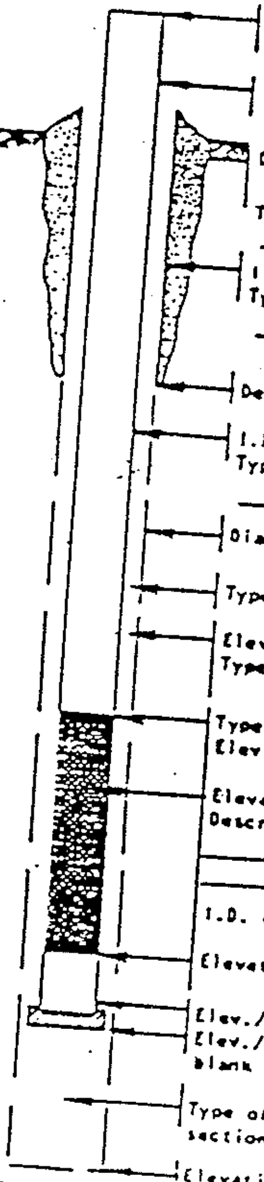
WELL NO. 136 (existing)

AQUIFIER

GROUND ELEVATION

GENERALIZED STRATIGRAPHY

N/A



Elevation of reference point 46.55

Height of reference point above ground surface 2.47

Depth of surface seal N/A

Type of surface seal: N/A

I.D. of surface casing 6"

Type of surface casing: N/A

Depth of surface casing N/A

I.D. of riser pipe 1.5"

Type of riser pipe: N/A

Diameter of borehole N/A

Type of filler: N/A

Elevation / depth of top of seal N/A

Type of seal: N/A

Type of gravel pack N/A

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen N/A

Description of screen N/A

I.D. of screen section 1.5"

Elevation / depth of bottom of screen -15.45

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

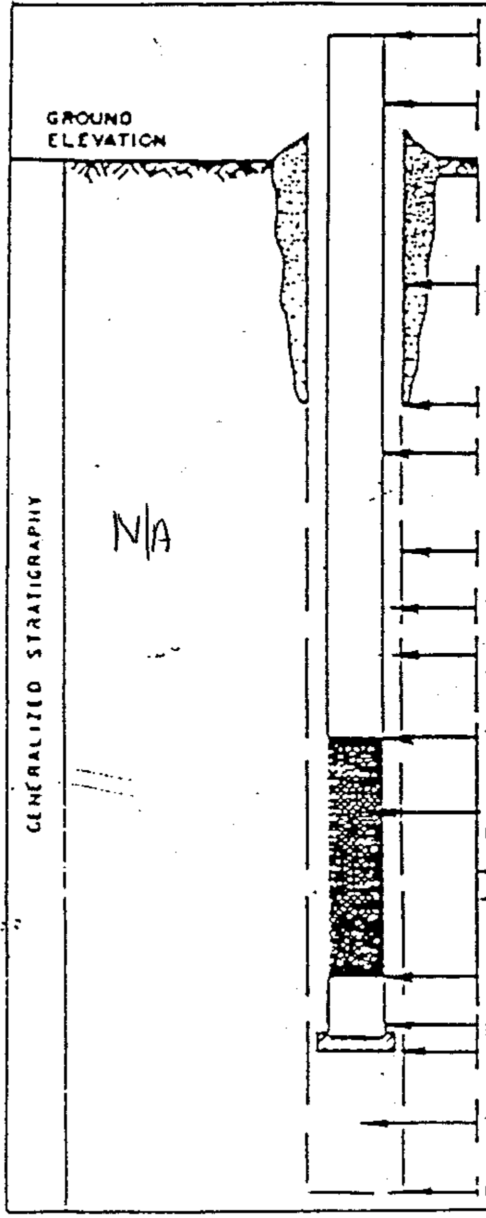
Type of filler below plugged section N/A

Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Town Crier Motel, Eastham
COORDINATES N/A
DATE COMPLETED N/A
SUPERVISED BY EPA

WELL NO. 13c (existing)
AQUIFER



GENERALIZED STRATIGRAPHY
N/A

Elevation of reference point 46.50
Height of reference point above ground surface 1.21'
Depth of surface seal N/A
Type of surface seal: N/A
I.D. of surface casing N/A
Type of surface casing: N/A
Depth of surface casing N/A
I.D. of riser pipe 2"
Type of riser pipe: galvanized steel pipe
Diameter of borehole N/A
Type of filler: N/A
Elevation / depth of top of seal N/A
Type of seal:
Type of gravel pack N/A
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen N/A
Description of screen N/A
I.D. of screen section 2"
Elevation / depth of bottom of screen -23.50
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Rt. 6, Eastham

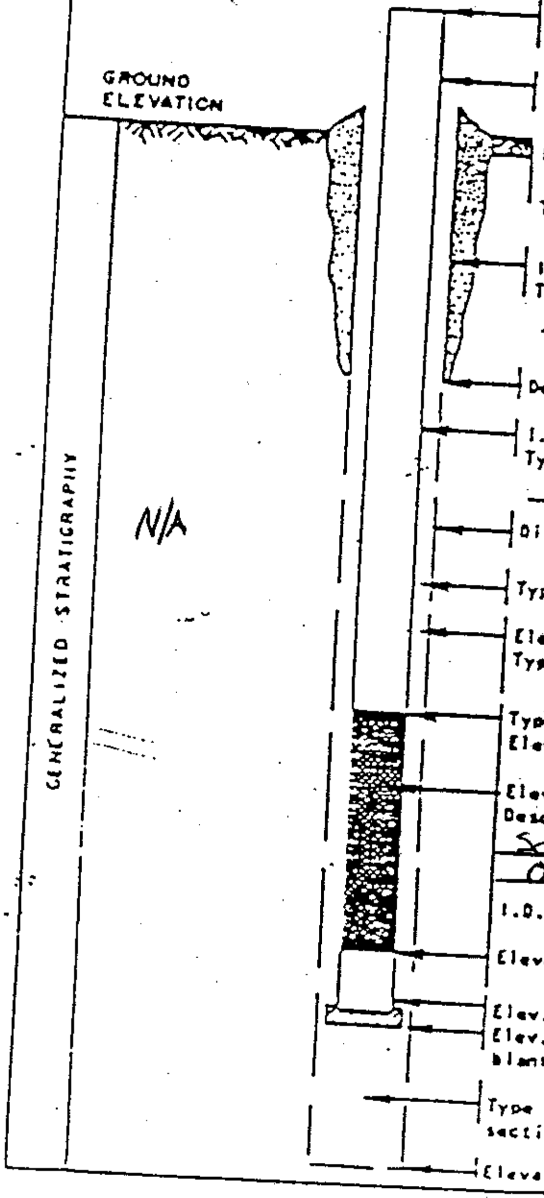
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BGC

WELL NO. 14a

AQUIFER



Elevation of reference point 44.12

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 24.12

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 9.12

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -0.88

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

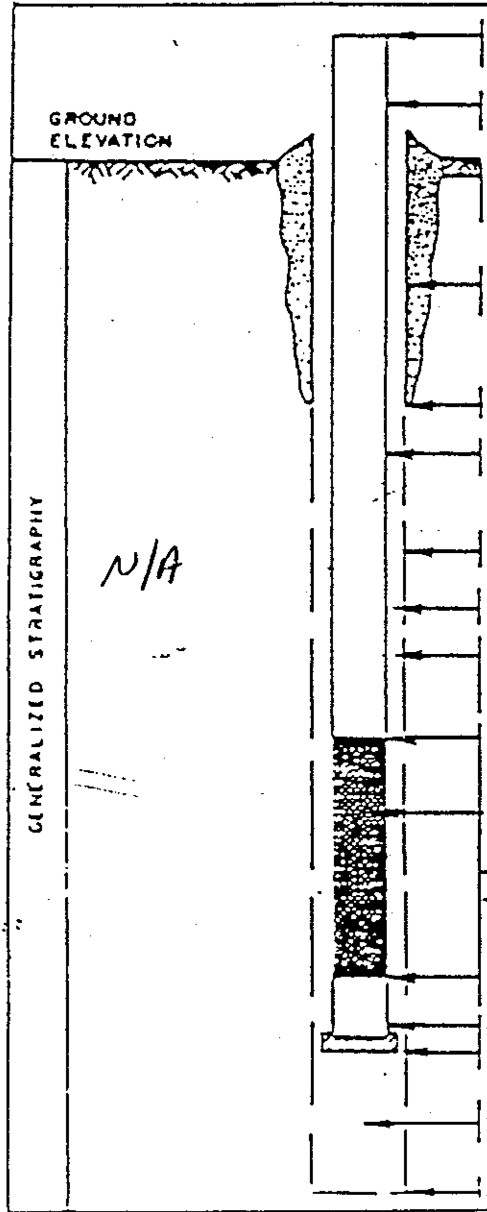
Elevation of bottom of borehole -40.88

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Rt. 6 , Eastham
COORDINATES N/A
DATE COMPLETED 3/13/89
SUPERVISED BY BEC

WELL NO. 14b
AQUIFER



N/A

Elevation of reference point 44.12
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 8"
Type of surface casing: cast gate
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 24.12
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen -10.88
Description of screen sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -20.88
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -40.88

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Rt.6, Eastham

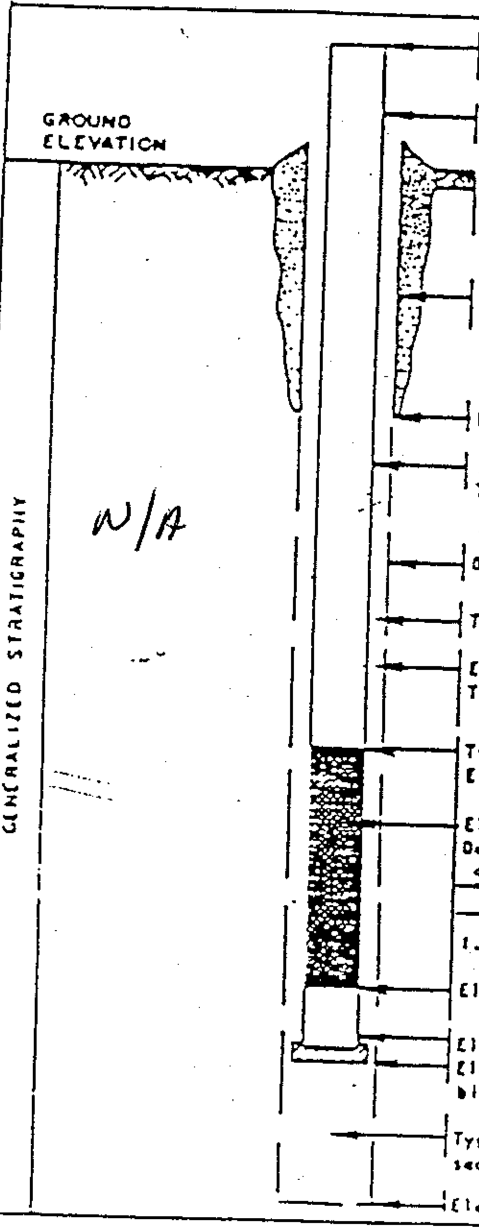
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BEC

WELL NO. 14c

AQUIFIER



N/A

Elevation of reference point 44.12

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 24.12

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack

Elevation / depth of top of screen -28.88

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -38.88

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -40.88

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Town landfill, Eastham

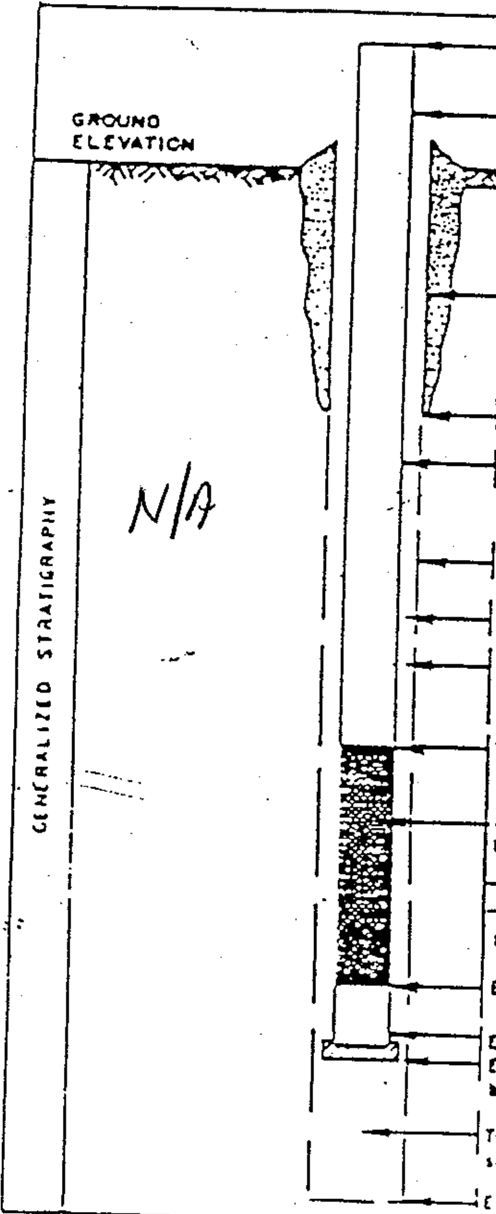
COORDINATES N/A

DATE COMPLETED N/A

SUPERVISED BY EPA

WELL NO. 15 (existing)

AQUIFER



Elevation of reference point 16.75

Height of reference point above ground surface

Depth of surface seal N/A

Type of surface seal: concrete

I.D. of surface casing None

Type of surface casing: —

Depth of surface casing —

I.D. of riser pipe 1 1/4"

Type of riser pipe: steel

Diameter of borehole N/A

Type of filler: N/A

Elevation / depth of top of seal N/A

Type of seal: N/A

Type of gravel pack N/A

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen N/A

Description of screen —

I.D. of screen section N/A

Elevation / depth of bottom of screen 4.45

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

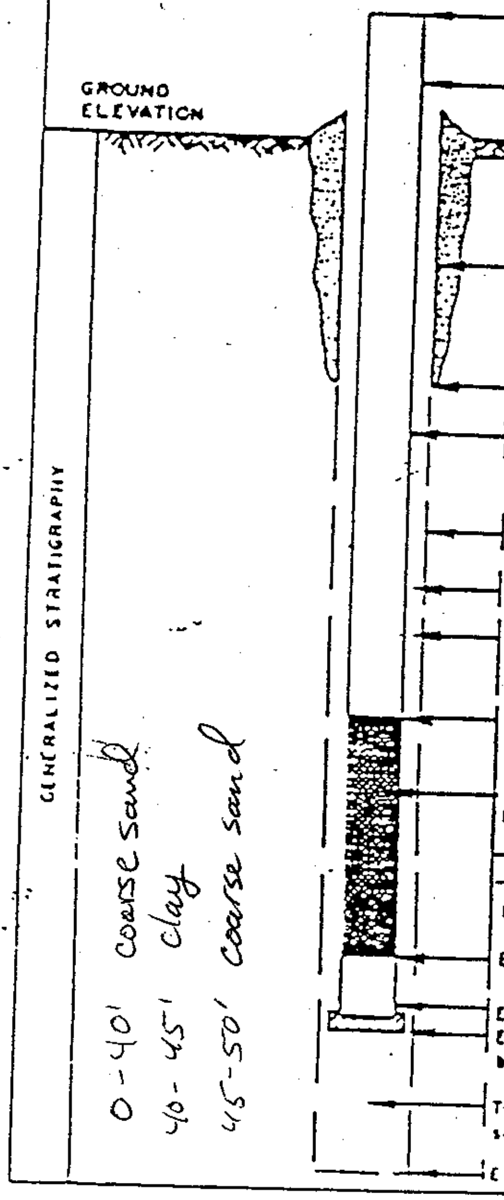
Type of filler below plugged section N/A

Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Old Orchard Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/3/89
SUPERVISED BY BEC

WELL NO. 16
AQUIFER



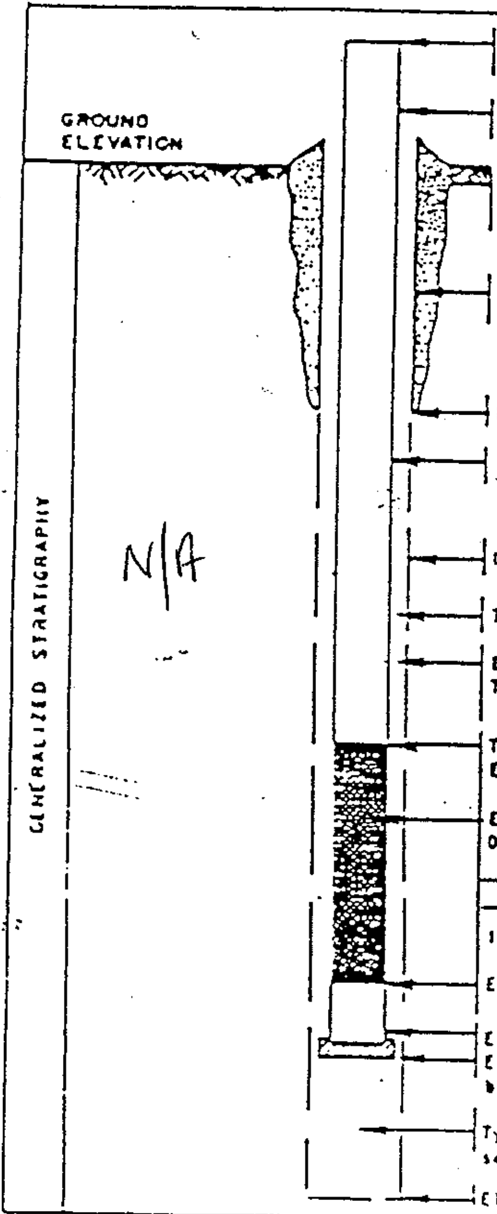
0-40' coarse sand
40-45' clay
45-50' coarse sand

Elevation of reference point 54.76
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.5'
Type of surface seal: concrete
I.D. of surface casing 3"
Type of surface casing: cast gate box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 26.76
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 9.76
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -0.24
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -0.24

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Town land Fill, Eastham
COORDINATES N/A
DATE COMPLETED N/A
SUPERVISED BY EPA

WELL NO. 17 (existing)
AQUIFER

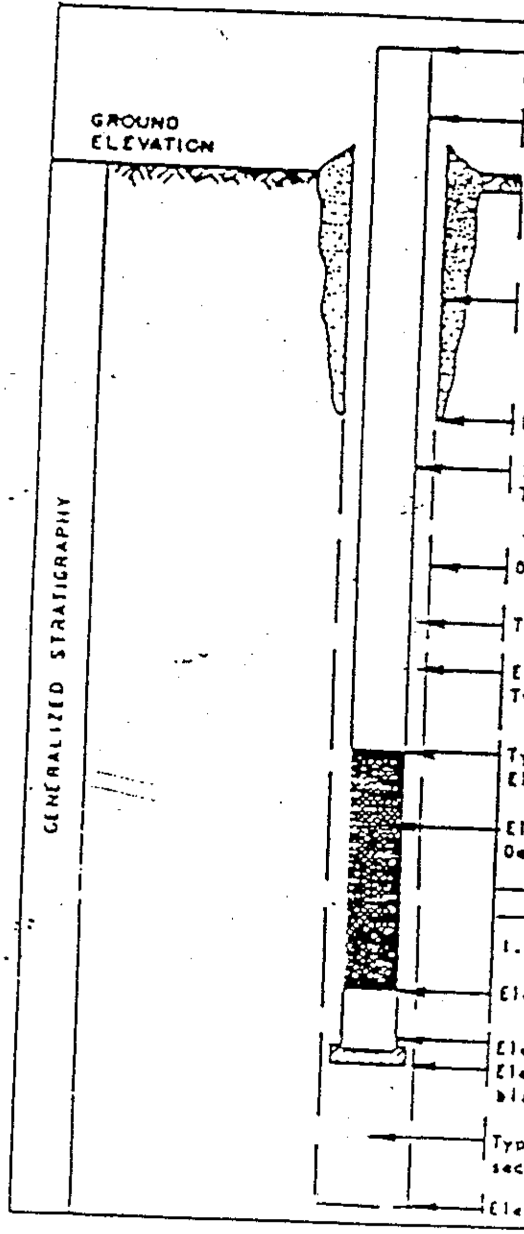


Elevation of reference point 19.38
Height of reference point above ground surface
Depth of surface seal N/A
Type of surface seal: Concrete
I.D. of surface casing N/A
Type of surface casing:
Depth of surface casing N/A
I.D. of riser pipe
Type of riser pipe: steel
Diameter of borehole N/A
Type of filler: N/A
Elevation / depth of top of seal N/A
Type of seal:
Type of gravel pack N/A
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen N/A
Description of screen N/A
I.D. of screen section
Elevation / depth of bottom of screen 11.48
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II
SITE North of Town Landfill, Eastham
COORDINATES N/A
DATE COMPLETED N/A
SUPERVISED BY EPA

WELL NO. 18 (existing)
AQUIFIER



Elevation of reference point 27.58
Height of reference point above ground surface N/A
Depth of surface seal N/A
Type of surface seal: concrete
I.D. of surface casing N/A
Type of surface casing: —
Depth of surface casing N/A
I.D. of riser pipe N/A
Type of riser pipe: Steel
Diameter of borehole N/A
Type of filler: —
Elevation / depth of top of seal N/A
Type of seal:
Type of gravel pack —
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen N/A
Description of screen —
I.D. of screen section
Elevation / depth of bottom of screen 12.58
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole N/A

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Holmes Rd., Eastham

COORDINATES N/A

DATE COMPLETED 3/2/89

SUPERVISED BY BEC

WELL NO. 19a

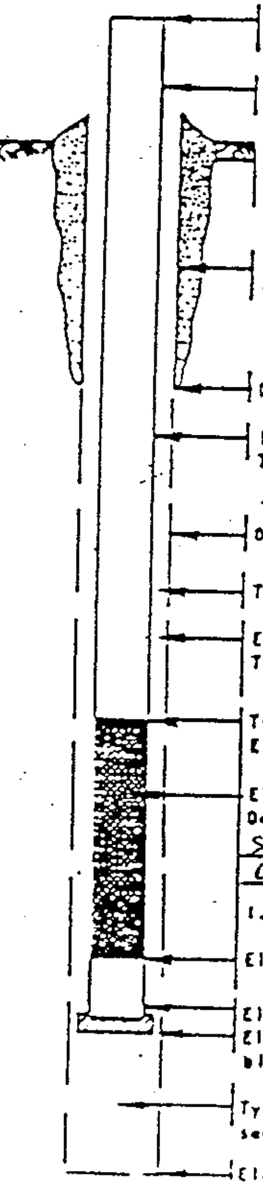
AQUIFER

GROUND ELEVATION

GENERALIZED STRATIGRAPHY

0-30' coarse sand

30-95' sand & clay, material too mixed for elevation determinations.



Elevation of reference point 37.95

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: Concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 14"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 15.95

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 2.95

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -7.05

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

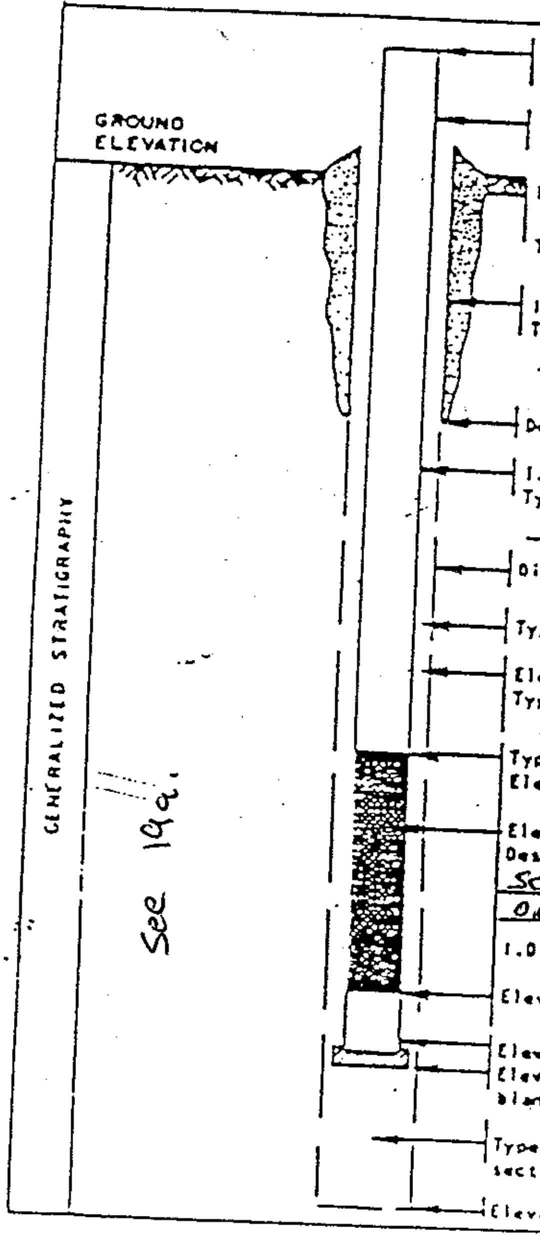
Elevation of bottom of borehole -57.05

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Holmes Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/2/89
SUPERVISED BY BEC

WELL NO. 19b
AQUIFIER



Elevation of reference point	37.95
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.0'
Type of surface seal: concrete	
I.D. of surface casing	8"
Type of surface casing: cast gate box	
Depth of surface casing	18"
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	8"
Type of filler: sand	
Elevation / depth of top of seal	15.95
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	-12.05
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen	
I.D. of screen section	2"
Elevation / depth of bottom of screen	-22.05
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-57.05

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Holmes Rd., Eastham

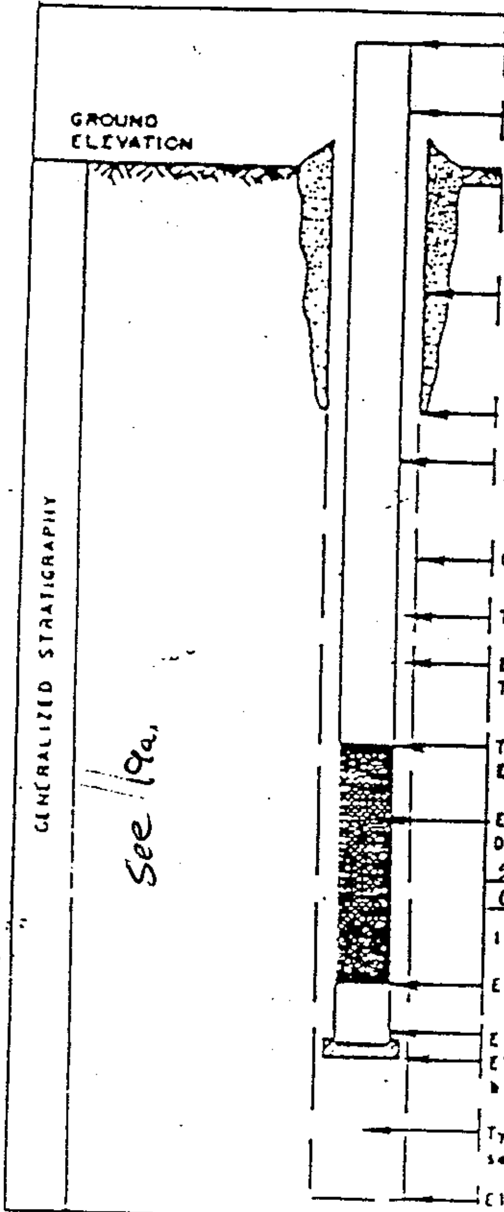
COORDINATES N/A

DATE COMPLETED 3/2/89

SUPERVISED BY BGC

WELL NO. 19c

AQUIFER ______



Elevation of reference point 37.95

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate Box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 15.95

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -32.05

Description of screen Sch.40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -42.05

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -57.05

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Rt. 6, Eastham

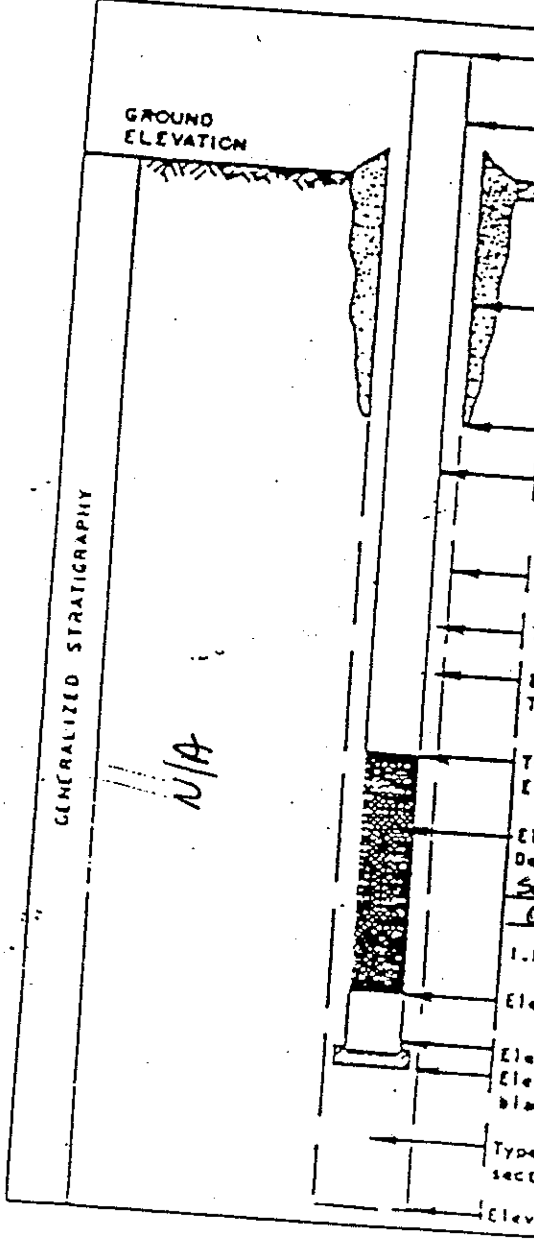
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BEC

WELL NO. 20a

AQUIFIER



Elevation of reference point 37.83

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 25.83

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 22.83

Description of screen Sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen 12.83

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -42.17

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Rt. 6, Eastham

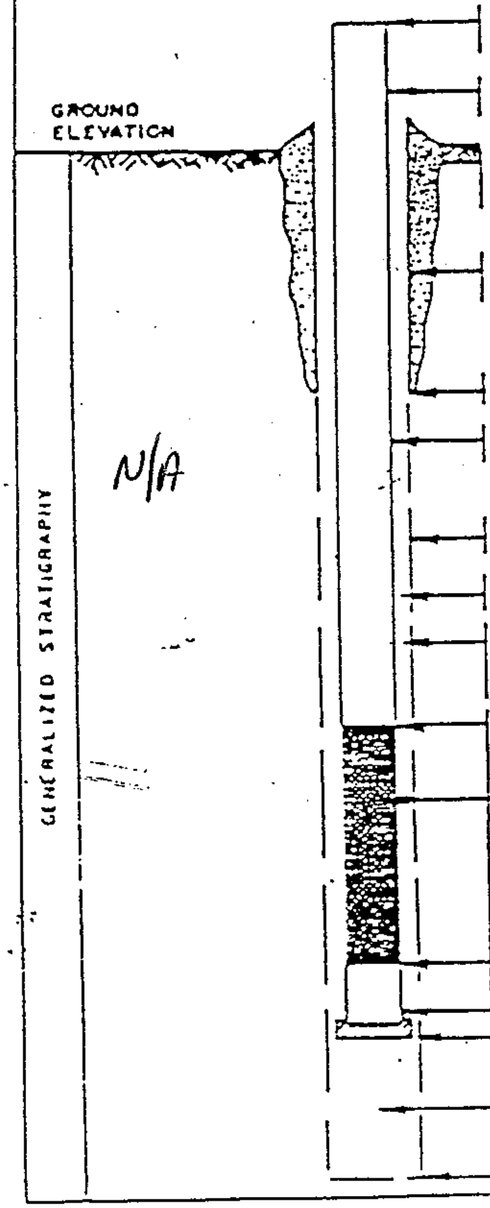
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BEC

WELL NO. 20b

AQUIFER



Elevation of reference point 37.83

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 25.83

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -7.17

Description of screen sch. 40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -17.17

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -42.17

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Rt. 6, Eastham

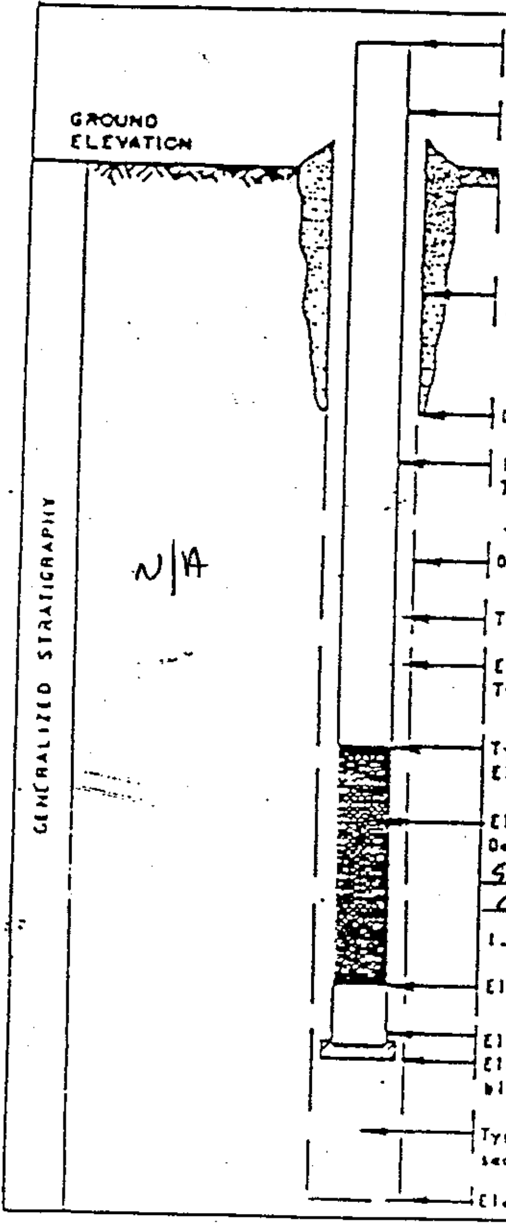
COORDINATES N/A

DATE COMPLETED 3/13/89

SUPERVISED BY BEC

WELL NO. 20C

AQUIFER



Elevation of reference point 37.83

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 25.83

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -27.17

Description of screen sch. 40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -37.17

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -42.17

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Mckoy Rd., Eastham

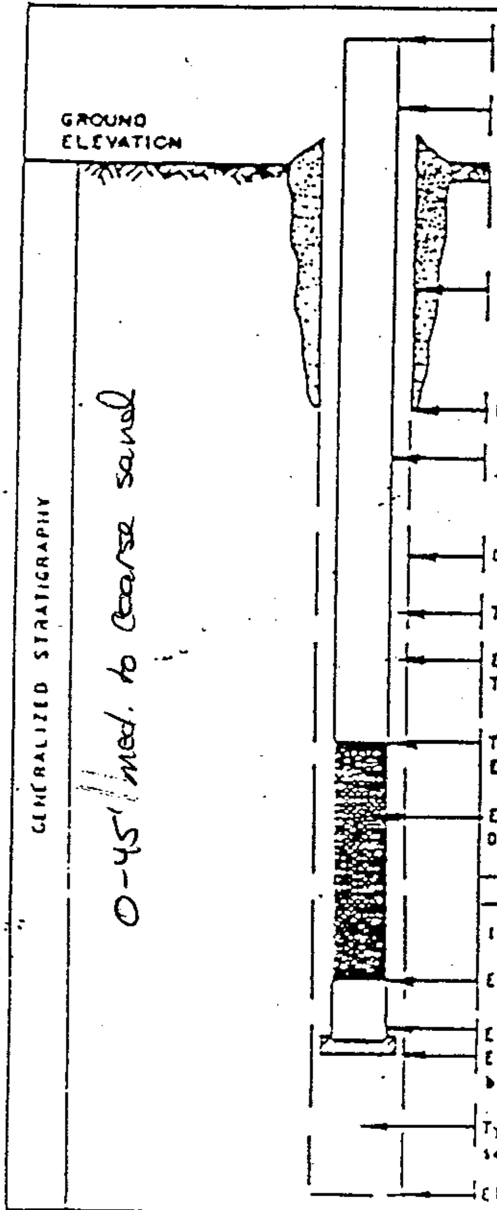
COORDINATES N/A

DATE COMPLETED 3/8/89

SUPERVISED BY BEC

WELL NO. 21

AQUIFER



Elevation of reference point 38.10

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.5'

Type of surface seal: concrete

I.D. of surface casing 3"

Type of surface casing: cast gate box

Depth of surface casing 2.0'

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 4"

Type of filler: sand

Elevation / depth of top of seal 18.10

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 8.10

Description of screen sch.40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -1.90

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

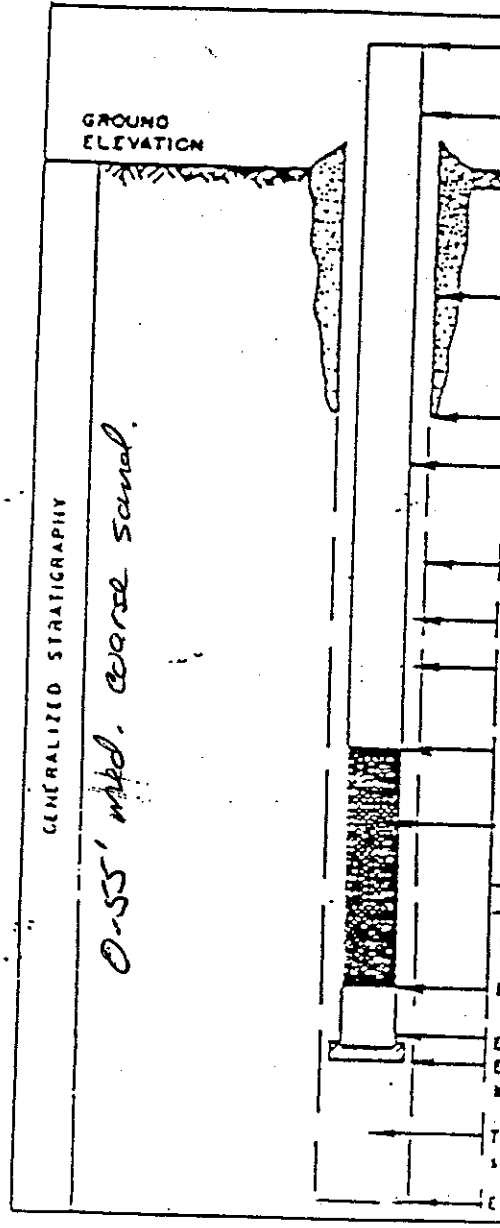
Elevation of bottom of borehole -6.90

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Rt. 6, Eastham
COORDINATES N/A
DATE COMPLETED 3/3/89
SUPERVISED BY BEC

WELL NO. 22
AQUIFER



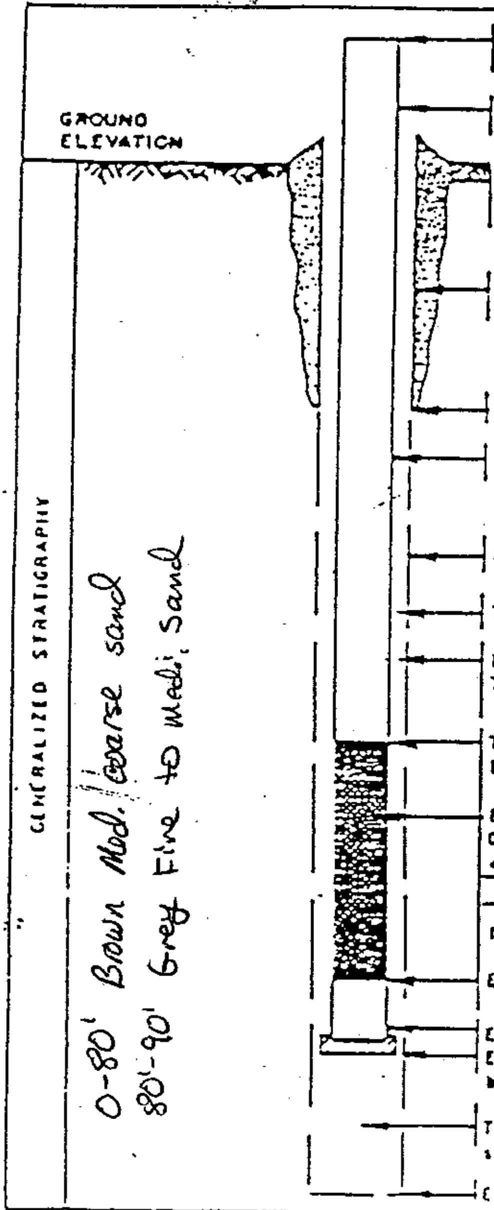
Elevation of reference point 42.32
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.5'
Type of surface seal: concrete
I.D. of surface casing 4"
Type of surface casing: Steel gate Box
Depth of surface casing 20'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC Piping
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 17.32
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 12.32
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen.
I.D. of screen section 2"
Elevation / depth of bottom of screen 2.32
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -7.68

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Old Orchard Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/7/89
SUPERVISED BY BEC

WELL NO. 23a
AQUIFER



Elevation of reference point 54.01
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 8"
Type of surface casing: cast gate Box
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 19.01
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 14.01
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen 4.01
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -35.99

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Old Orchard Rd., Eastham

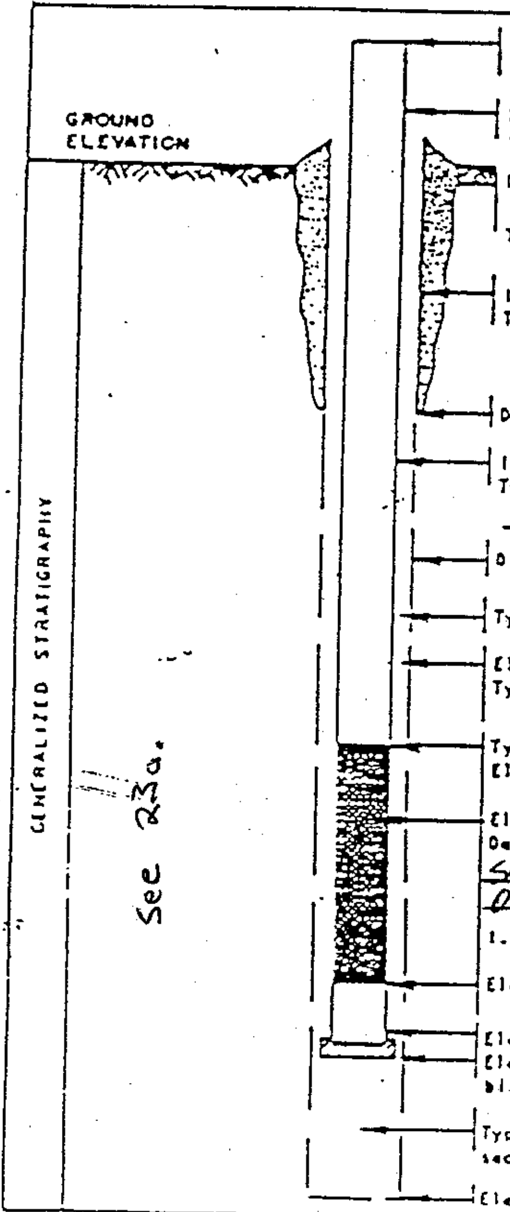
COORDINATES N/A

DATE COMPLETED 3/7/89

SUPERVISED BY BEC

WELL NO. 23b

AQUIFER



Elevation of reference point 54.01

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: Concrete

I.D. of surface casing 8"

Type of surface casing: cast gate Box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 19.01

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -5.99

Description of screen sch.40 PVC with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen -15.99

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

Elevation of bottom of borehole -35.99

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Old Orchard Rd., Eastham

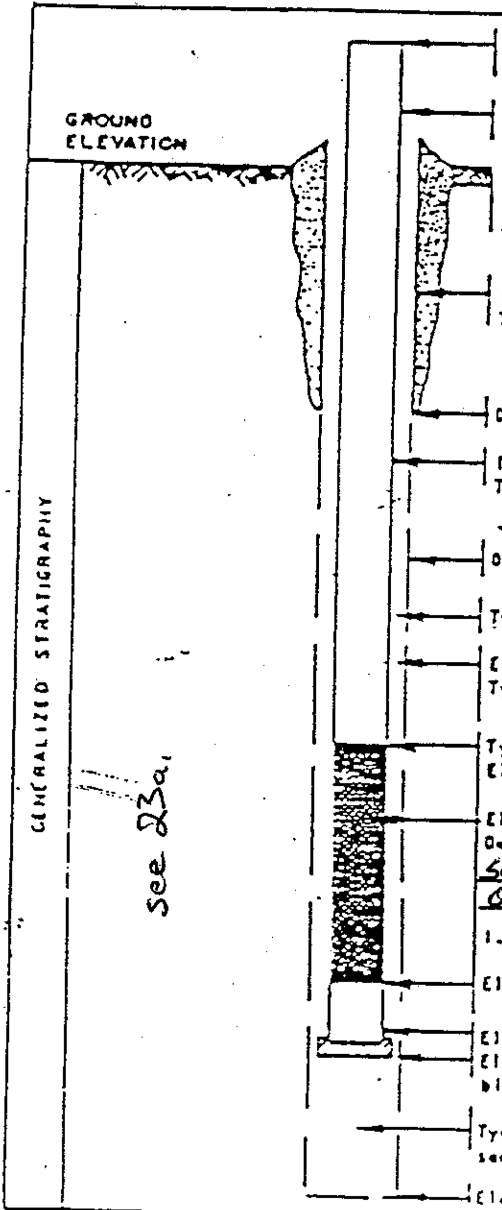
COORDINATES N/A

DATE COMPLETED 3/7/89

SUPERVISED BY BEC

WELL NO. 23c

AQUIFER



Elevation of reference point 54.01

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 19.01

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -25.99

Description of screen sch. 40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -35.99

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

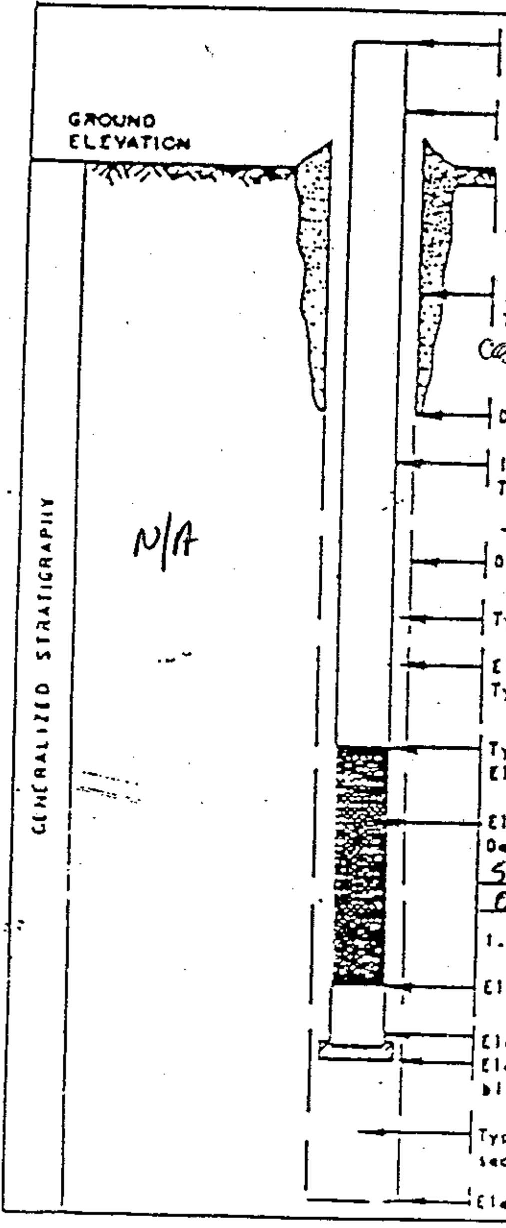
Elevation of bottom of borehole -35.99

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Danielle Drive, Eastham
COORDINATES N/A
DATE COMPLETED 3/3/89
SUPERVISED BY BEC

WELL NO. 24a
AQUIFER



Elevation of reference point 47.17
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 8"
Type of surface casing: Castgate Box
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 17.17
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 7.17
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -2.83
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -42.83

Well Construction Summary.

A-13

PROJECT Great Pond Phase II

SITE Danielle Drive, Eastham

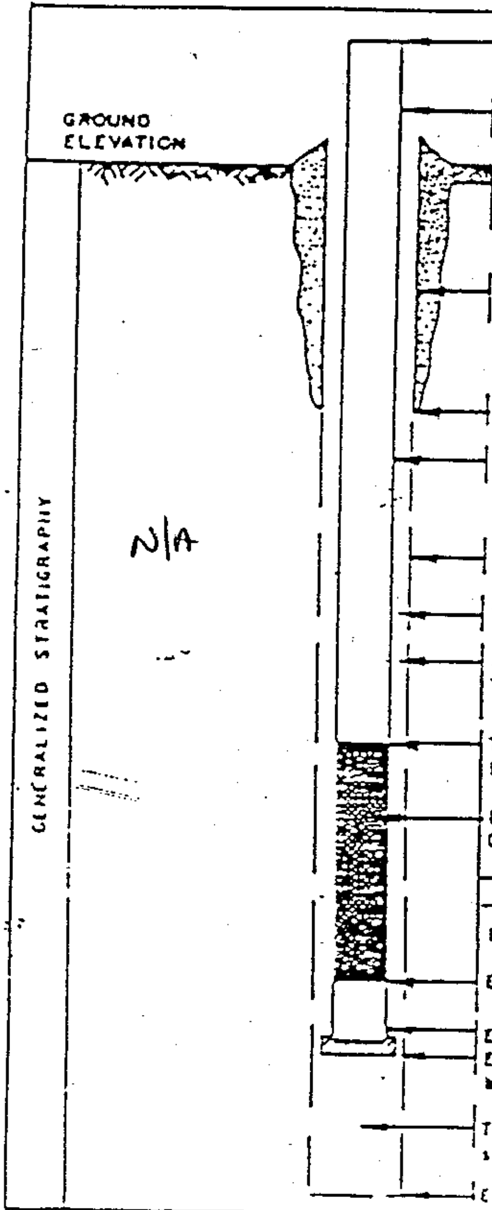
COORDINATES N/A

DATE COMPLETED 3/3/89

SUPERVISED BY BEC

WELL NO. 24b

AQUIFER



Elevation of reference point 47.17

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: concrete

I.D. of surface casing 8"

Type of surface casing: cast gate Box

Depth of surface casing 18"

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 8"

Type of filler: sand

Elevation / depth of top of seal 17.17

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen -12.83

Description of screen sch. 40 PVC with 10' of 0.010 slot screen.

I.D. of screen section 2"

Elevation / depth of bottom of screen -22.83

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

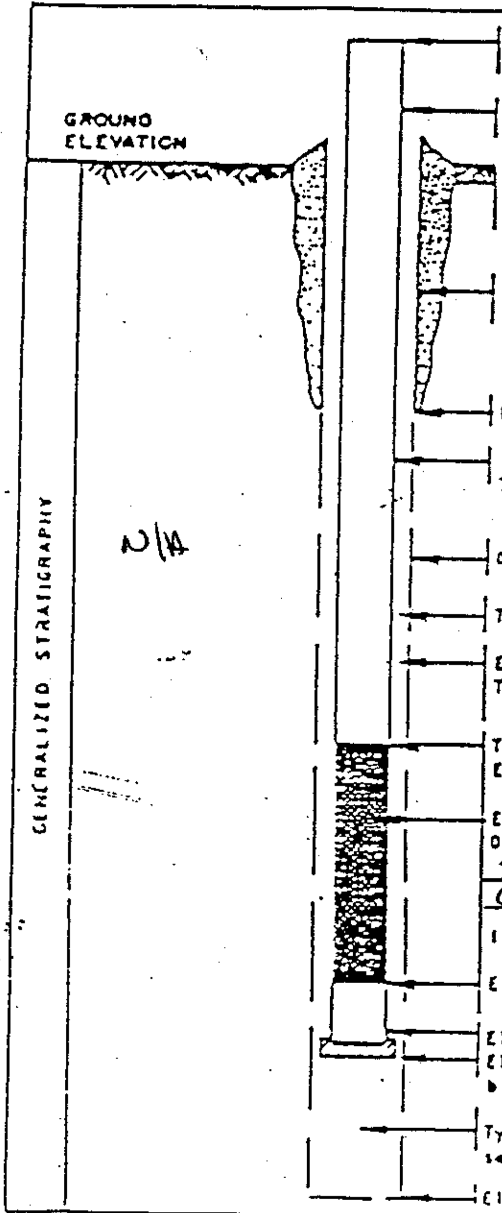
Type of filler below plugged section N/A

Elevation of bottom of borehole -42.83

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Danielle Drive, Eastham
COORDINATES N/A
DATE COMPLETED 3/3/89
SUPERVISED BY BGC

WELL NO. 24C
AQUIFER



Elevation of reference point 47.17
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 8"
Type of surface casing: cast gate Box
Depth of surface casing 18"
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 8"
Type of filler: sand
Elevation / depth of top of seal 17.17
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen -32.83
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen -42.83
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -42.83

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Massasoit Rd., Eastham

COORDINATES N/A

DATE COMPLETED 2/28/89

SUPERVISED BY BEC

WELL NO. 25

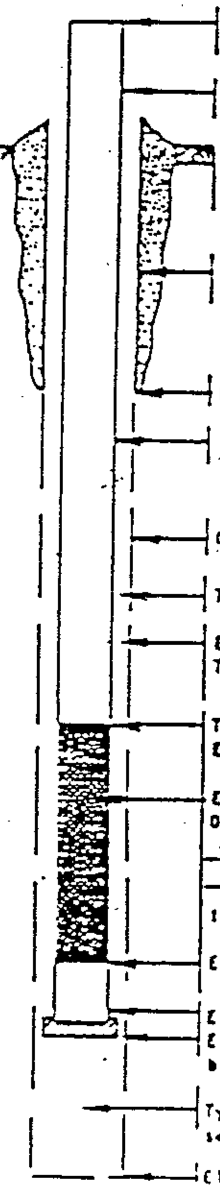
AQUIFER

GROUND ELEVATION

GENERALIZED STRATIGRAPHY

0-30' Fine to Med. Brown Sand

30-40' Fine white & med. Brown sands.



Elevation of reference point 41.86

Height of reference point above ground surface Flush

Depth of surface seal 1.5-2.0'

Type of surface seal: Concrete

I.D. of surface casing 3"

Type of surface casing: cast gate Box

Depth of surface casing 2.0'

I.D. of riser pipe 2"

Type of riser pipe: Threaded PVC

Diameter of borehole 4"

Type of filler: sand

Elevation / depth of top of seal 15.86

Type of seal: Bentonite

Type of gravel pack sand

Elev./depth of top of gravel pack N/A

Elevation / depth of top of screen 11.86

Description of screen sch. 40 pvc with 10' of 0.010 slot screen

I.D. of screen section 2"

Elevation / depth of bottom of screen 1.86

Elev./depth of bottom of gravel pack N/A

Elev./depth of bottom of plugged blank section N/A

Type of filler below plugged section N/A

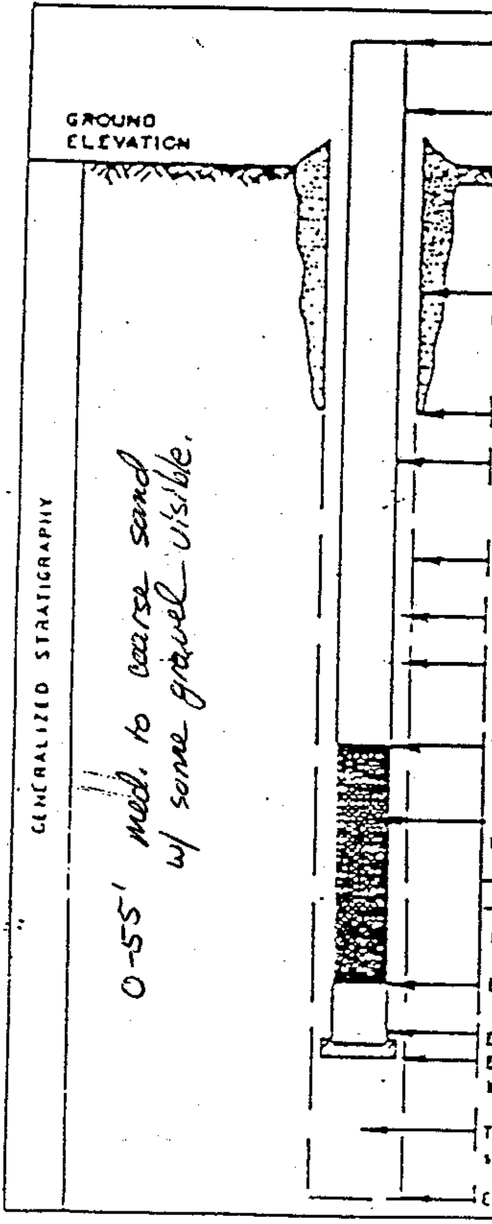
Elevation of bottom of borehole 1.86

Well Construction Summary.

A-13

PROJECT Great Pond Phase II
SITE Bishop Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/8/89
SUPERVISED BY BEC

WELL NO. 26
AQUIFER



Elevation of reference point 47.00
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 3"
Type of surface casing: cast gate Box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 24.00
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 12.00
Description of screen Sch. 40 PVC. with 10' of 0.010 Slot screen
I.D. of screen section 2"
Elevation / depth of bottom of screen 2.00
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -8.00

Well Construction Summary.

PROJECT Great Pond Phase II

SITE Rt. 6, Eastham

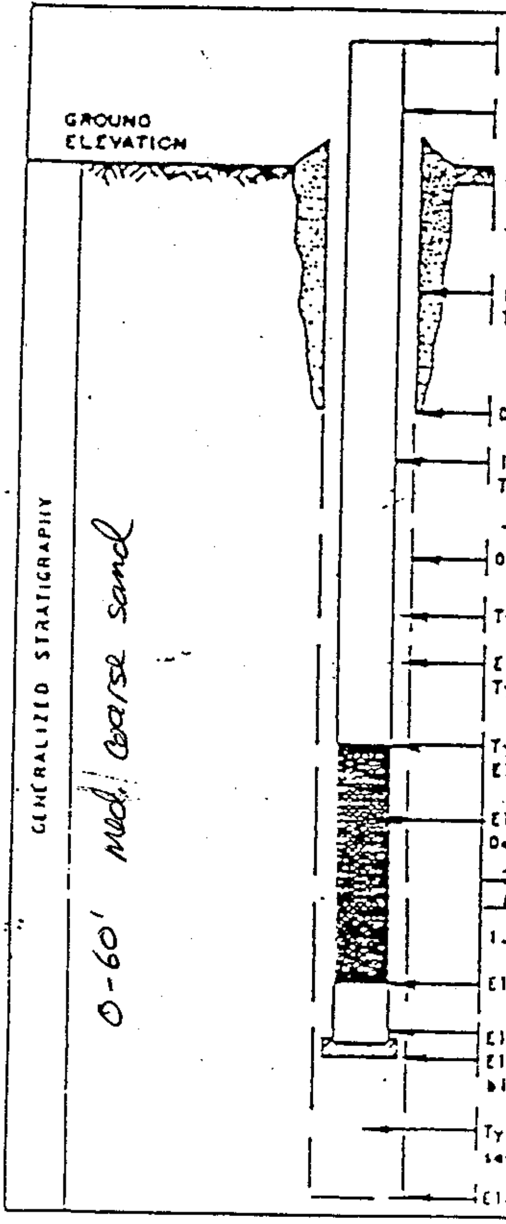
COORDINATES N/A

DATE COMPLETED 3/8/89

SUPERVISED BY BEC

WELL NO. 27

AQUIFER



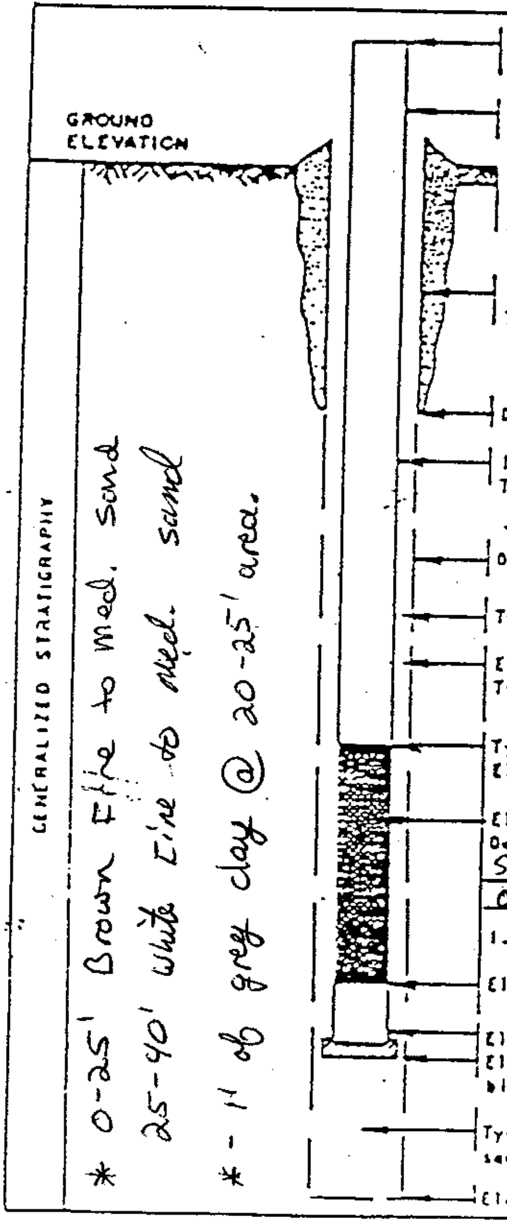
0-60' med/coarse sand

Elevation of reference point	50.97
Height of reference point above ground surface	Flush
Depth of surface seal	1.5-2.0'
Type of surface seal: Concrete	
I.D. of surface casing	3"
Type of surface casing: Cast gate Box	
Depth of surface casing	2.0'
I.D. of riser pipe	2"
Type of riser pipe: Threaded PVC	
Diameter of borehole	4"
Type of filler: sand	
Elevation / depth of top of seal	22.97
Type of seal: Bentonite	
Type of gravel pack sand	
Elev./depth of top of gravel pack	N/A
Elevation / depth of top of screen	14.97
Description of screen sch. 40 PVC with 10' of 0.010 slot screen.	
I.D. of screen section	2"
Elevation / depth of bottom of screen	4.97
Elev./depth of bottom of gravel pack	N/A
Elev./depth of bottom of plugged blank section	N/A
Type of filler below plugged section N/A	
Elevation of bottom of borehole	-9.03

Well Construction Summary.

PROJECT Great Pond Phase II
SITE Beehive Rd., Eastham
COORDINATES N/A
DATE COMPLETED 3/2/89
SUPERVISED BY BEC

WELL NO. 28
AQUIFER



* 0-25' Brown Fine to Med. Sand
25-40' White Fine to Med. sand
* - 1' of grey clay @ 20-25' area.

Elevation of reference point 30.17
Height of reference point above ground surface Flush
Depth of surface seal 1.5-2.0'
Type of surface seal: concrete
I.D. of surface casing 4
Type of surface casing: cast gate Box
Depth of surface casing 2.0'
I.D. of riser pipe 2"
Type of riser pipe: Threaded PVC
Diameter of borehole 4"
Type of filler: sand
Elevation / depth of top of seal 13.17
Type of seal: Bentonite
Type of gravel pack sand
Elev./depth of top of gravel pack N/A
Elevation / depth of top of screen 10.17
Description of screen Sch. 40 PVC with 10' of 0.010 slot screen.
I.D. of screen section 2"
Elevation / depth of bottom of screen 0.17
Elev./depth of bottom of gravel pack N/A
Elev./depth of bottom of plugged blank section N/A
Type of filler below plugged section N/A
Elevation of bottom of borehole -7.83

Well Construction Summary.

APPENDIX C

GROUNDWATER QUALITY DATA AND WATER LEVELS

BEC
BAYSTATE
ENVIRONMENTAL
CONSULTANTS
INC.

Scientists
Engineers
Planners

296 North Main Street
East Longmeadow, MA 01028
(413) 525-3822

TO: All owners of well sites for
the Great Pond Groundwater Study
FROM: BEC, Inc.
REGARDING: Well test results

September 27, 1990

Dear Sirs and Madams:

We at BEC would like to take this opportunity to thank you for your participation in the Great Pond groundwater study, and to apologize for the lengthy delay in supplying you with results. As you are probably well aware, the fiscal crisis in Massachusetts has slowed or eliminated many projects, and the Eastham Clean Lakes Project was subject to substantial payment delays. While we did accomplish three rounds of well sampling, we were unable to pay the laboratory invoices for analysis. The results were therefore not released by the laboratory until recently.

All that aside, enclosed please find the results of three samplings of the well on your property. If your property contains a cluster well (a set of three wells of varying depths), you have three sets of three samplings to review. In each sampling, the depth to water from the top of the well was measured and the elevation of the groundwater level was calculated relative to sea level. Water quality parameters which were assessed all three times included pH, conductivity, phosphorus, nitrate and ammonia. Total kjeldahl nitrogen measurements were made twice, and sodium was measured once.

Maximum, minimum and average values are given on the enclosed data sheet(s). For the water level information, these are based on data for only the well listed at the top of the data sheet. For the water quality parameters, the maximum, minimum, and average are based on all data collected throughout the three samplings. This will enable you to compare your well to others in the study in a general way.

There is a health standard of 10 mg/l for nitrate nitrogen; no values in this study exceeded it, but values over 2 mg/l are cause for additional monitoring in the future, as such values are unnaturally high. There is also a recommended health limit for sodium of 20 mg/l. Values higher than this may be natural in a coastal setting such as Eastham, but people with high blood pressure should not drink this water regularly.

While there are no health standards for the other parameters, we would like to offer a few notes on what various values suggest. Ammonia nitrogen is usually converted to nitrate nitrogen, so the ammonia nitrogen values should be treated like the nitrate nitrogen values for health purposes; the sum of the ammonia and nitrate values is of concern if it is greater than 10 mg/l, and further investigation is warranted if the sum is greater than 2 mg/l. Conductivity is a measure of the quantity of substances dissolved in water; values over about 200 umhos/cm suggest elevated dissolved substance levels and warrant some investigation of the nature of those substances. The pH is a measure of the acid content of the water, with lower values indicating greater acidity. Values lower than 6 SU may cause pipe corrosion and leaching of undesirable materials (like metals) into the water. Further testing for metals such as copper or lead would be advisable where the pH is low, and a water softener may be useful.

While results of testing for organic chemical contamination are not reported on the enclosed summary sheet(s), we did test for a variety of such pollutants on one date, with follow-up checks at selected high-risk sites. No contamination beyond expected background levels was detected in any well.

BEC will now be evaluating the overall pattern of the well data to determine which management methods would best protect the groundwater supply in Eastham. The data collected from the well on your property is extremely valuable in this regard, even if the results show no signs of contamination. Your participation has made this study possible. Copies of the final report should be on file with the Board of Selectmen by the end of 1990, should you wish to examine one.

A business card is enclosed should you have any questions or wish to discuss follow up investigations. Thank you again for your cooperation in this study.

Very truly yours,

BEC, Inc.

Ken Wagner

Kenneth J. Wagner, Ph.D
Associate

RECORD OF WATER QUALITY DATA

WELL #1a
DEPTH (FT) 35

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	15.4	8.36	6.7	70	.04	.03	.37	.13	
OCT. 14, 1989	15.8	7.96	6.5	130	.14	.08	<.01	.15	
MAY 15, 1990	15.0	8.76	7.5	71	.16	<.01	.12		4.0
MINIMUM FOR ALL DATA	15.0	7.96	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	15.4	8.36	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	15.8	8.76	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #1b
DEPTH (FT) 55

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	15.7	8.06	6.9	120	.06	.35	.02	.75	
OCT. 14, 1989	16.1	7.66	6.4	132	.26	.53	<.01	.82	
MAY 15, 1990	15.2	8.56	7.7	70	.07	<.01	.16		5.0
MINIMUM FOR ALL DATA	15.2	7.66	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	15.6	8.09	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	16.1	8.56	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #1c
DEPTH (FT) 75

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	15.7	8.05	7.2	125	.02	.19	<.01	.36	
OCT. 14, 1989	15.8	7.95	7.0	122	.23	.24	<.01	.58	
MAY 15, 1990	15.1	8.65	7.3	59	.07	<.01	.13		5.0
MINIMUM FOR ALL DATA	15.1	7.95	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	15.5	8.22	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	15.8	8.65	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #2
DEPTH (FT) 15

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	4.6	8.53	7.1	105	.03	.15	.01	.44	
OCT. 14, 1989	4.8	8.33	5.8	155	.30	.15	.48	.48	
MAY 15, 1990	3.6	9.53	5.8	121	.11	.43	.05		12.0
MINIMUM FOR ALL DATA	3.6	8.33	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	4.3	8.80	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	4.8	9.53	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #3
DEPTH (FT) 20

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	18.5	8.36	6.7	159	.03	.47	.21	.80	
OCT. 14, 1989	19.1	7.76	6.0	149	.34	.24	1.80	.39	
MAY 15, 1990	18.1	8.76	5.9	152	.03	.40	.31		13.0
MINIMUM FOR ALL DATA	18.1	7.76	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	18.57	8.29	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	19.1	8.76	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #4
DEPTH (FT) 40

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	24.9	9.55	6.9	190	.06	.13	3.40	<.10	
OCT. 14, 1989	25.3	9.15	6.1	162	.29	.06	.12	<.10	
MAY 15, 1990	24.3	10.15	5.9	229	.05	.08	3.20		19.0
MINIMUM FOR ALL DATA	24.3	9.15	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	24.83	9.62	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	25.3	10.15	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #5
DEPTH (FT) 25

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	10.50	11.13	6.9	140	.03	.05	.19	<.10	
OCT. 14, 1989	11.60	10.03	5.7	205	.07	<.01	2.10	<.10	
MAY 15, 1990	9.80	11.83	5.9	122	.13	<.01	.48		12.0
MINIMUM FOR ALL DATA	9.80	10.03	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	10.63	10.99	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	11.60	11.83	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #6a
DEPTH (FT) 30

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	17.00	8.86	6.7	160	.01	3.10	2.60	5.60	
OCT. 14, 1989	18.00	7.86	5.6	162	.12	.10	.29	<.10	
MAY 15, 1990	16.00	9.86	6.1	113	.05	.02	2.10		10.0
MINIMUM FOR ALL DATA	16.00	7.86	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	17.00	8.86	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	18.00	9.86	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #6b
DEPTH (FT) 50

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	17.00	8.86	6.9	190	.01	.51	.85	.80	
OCT. 14, 1989	17.50	8.36	5.9	230	.17	.43	.03	.66	
MAY 15, 1990	16.60	9.26	6.1	108	.04	.03	1.90		11.0
MINIMUM FOR ALL DATA	16.60	8.36	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	17.03	8.83	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	17.50	9.26	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #6c
DEPTH (FT) 70

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	17.00	8.86	6.8	120	.08	.15	.39	.10	
OCT. 14, 1989	17.70	8.16	6.2	109	.17	.03	<.01	.11	
MAY 15, 1990	16.80	9.06	6.2	119	.05	.03	.49		9.0
MINIMUM FOR ALL DATA	16.80	8.16	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	17.16	8.69	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	17.70	9.06	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #7a
DEPTH (FT) 25

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	14.70	9.16	6.8	140	.05	.34	.01	.26	
OCT. 14, 1989	15.10	8.76	6.1	175	.15	.16	.38	.18	
MAY 15, 1990	14.10	9.76	5.9	151	.05	.05	<.01		12.0
MINIMUM FOR ALL DATA	14.10	8.76	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	14.63	9.23	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	15.10	9.76	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #7b
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	12.90	10.96	6.6	220	.05	.69	.03	.26	
OCT. 14, 1989	13.50	10.36	6.2	228	.11	.75	.04	.85	
MAY 15, 1990	12.40	11.46	6.8	210	.05	.13	.26		16.0
MINIMUM FOR ALL DATA	12.40	10.36	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	12.93	10.93	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	12.40	10.36	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #7c
DEPTH (FT) 63

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	12.90	10.96	6.9	120	.04	.24	.12	.18	
OCT. 14, 1989	13.50	10.36	6.5	108	.06	.05	.02	<.10	
MAY 15, 1990	12.40	11.46	7.1	97	.05	.14	.03		11.0
MINIMUM FOR ALL DATA	12.40	10.36	5.3	51	<.01	<.01	<.01	<.10	.1
AVERAGE FOR ALL DATA	12.93	10.93	6.2	165	.01	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	13.50	11.46	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #11
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	29.80	13.13	6.4	259	.10	.27	2.70	<.10	
OCT. 14, 1989	30.50	12.43	5.9	252	.11	.13	1.70	<.10	
MAY 15, 1990	29.50	13.43	5.7	268	.07	.19	.78		39.0
MINIMUM FOR ALL DATA	29.50	12.43	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	29.93	12.99	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	30.50	13.43	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #12a
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	30.80	14.38	6.3	165	.06	.12	.29	<.10	
OCT. 14, 1989	31.60	13.58	5.7	184	.16	.01	.23	<.10	
MAY 15, 1990	30.70	14.48	6.0	179	.05	.19	.38		20.0
MINIMUM FOR ALL DATA	30.70	13.58	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.03	14.15	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	31.60	14.48	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #12b
DEPTH (FT) 65

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	30.80	14.38	6.5	262	.01	.05	3.70	<.10	
OCT. 14, 1989	31.60	13.58	5.6	346	.04	<.01	2.20	<.10	
MAY 15, 1990	30.80	14.38	6.0	240	.05	.18	.78		42.0
MINIMUM FOR ALL DATA	30.80	13.58	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.06	14.11	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	31.60	14.38	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #12c
DEPTH (FT) 85

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.40	13.78	6.5	320	.04	.18	3.00	<.10	
OCT. 14, 1989	32.00	13.18	5.7	350	.06	.46	3.00	.52	
MAY 15, 1990	31.50	13.68	5.9	183	.05	.16	.25		21.0
MINIMUM FOR ALL DATA	31.40	13.18	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.63	13.54	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	32.00	13.78	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #13a
DEPTH (FT) 44

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.80	14.75	6.2	130	.15	.18	.07	.14	
OCT. 14, 1989	32.60	13.95	6.2	151	.82	.22	.05	.23	
MAY 15, 1990	31.90	14.65	5.9	131	.77	.08	.02		9.0
MINIMUM FOR ALL DATA	31.80	13.95	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	32.10	14.45	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	32.60	14.75	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #13b
DEPTH (FT) 62

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.90	14.65	6.5	82	.01	.05	.29	<.10	
OCT. 14, 1989	32.60	13.95	5.8	114	.18	.03	<.01	<.10	
MAY 15, 1990	31.90	14.65	6.1	113	.61	.02	<.01		13.0
MINIMUM FOR ALL DATA	31.90	13.95	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	32.13	14.42	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	32.60	14.65	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #13c
DEPTH (FT) 70

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	35.00	11.50	6.1	152	.06	.04	3.10	<.10	
OCT. 14, 1989	35.40	11.10	6.7	142	.14	.19	1.30	<.10	
MAY 15, 1990	34.20	12.30	9.3	129	.14	.47	.05		17.0
MINIMUM FOR ALL DATA	34.20	11.10	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	34.86	11.63	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	35.40	12.30	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #14a
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	32.10	12.02	5.9	385	.04	.25	.04	.20	
OCT. 14, 1989	32.90	11.22	6.7	142	.14	.19	1.30	<.10	
MAY 15, 1990	31.90	12.22	5.8	435	.09	.03	.02		50.0
MINIMUM FOR ALL DATA	31.90	11.22	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	32.30	11.82	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	32.90	12.22	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #14b
DEPTH (FT) 65

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	32.70	11.42	6.2	350	.04	.26	.02	.13	
OCT. 14, 1989	33.30	10.82	6.0	350	.03	.14	.03	.16	
MAY 15, 1990	32.40	11.72	6.2	141	.08	.02	.23		14.0
MINIMUM FOR ALL DATA	32.40	10.82	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	32.80	11.32	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	33.30	11.72	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #14c
DEPTH (FT) 83

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	33.60	10.52	6.6	115	.16	.06	.57	<.10	
OCT. 14, 1989	34.20	9.92	6.2	130	.15	.01	.46	<.10	
MAY 15, 1990	33.30	10.82	6.2	115	.07	.02	.21		13.0
MINIMUM FOR ALL DATA	33.30	9.92	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	33.70	10.42	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	34.20	10.82	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #15
DEPTH (FT) 12.30

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	5.2	11.55	6.9	195	.04	2.10	.82	3.45	
OCT. 14, 1989	6.0	10.75	6.9	195	.07	1.70	.10	2.70	
MAY 15, 1990	4.8	11.95	6.1	121	.05	1.90	.01		4.0
MINIMUM FOR ALL DATA	4.8	10.75	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	5.3	11.42	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	6.0	11.95	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #16
DEPTH (FT) 55

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	45.3	9.46	6.3	149	.12	.14	2.30	<.10	
OCT. 14, 1989	46.1	8.66	5.3	220	.36	.03	2.80	<.10	
MAY 15, 1990	45.6	9.16	5.7	140	.05	.05	1.00		13.0
MINIMUM FOR ALL DATA	45.3	8.66	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	45.6	9.09	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	46.1	9.46	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #17
DEPTH (FT) 7.9

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	5.6	13.78	6.7	70	.04	.50	.89	.18	
OCT. 14, 1989	6.2	13.18	5.8	114	.11	.08	2.40	<.10	
MAY 15, 1990	5.7	13.68	6.0	62	.07	.03	.52		4.0
MINIMUM FOR ALL DATA	5.6	13.18	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	5.8	13.54	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	6.2	13.78	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #18
DEPTH (FT) 15

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	12.7	14.88	6.7	100	.05	.61	1.20	.25	
OCT. 14, 1989	13.3	14.28							
MAY 15, 1990	12.8	14.78							
MINIMUM FOR ALL DATA	12.7	14.28	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	12.9	14.64	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	13.3	14.88	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #19a
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.8	15.15	6.3	190	.06	.25	.85	.18	
OCT. 14, 1989	23.8	14.15							
MAY 15, 1990	22.9	15.05	5.8	208	.05	.05	1.60		11.0
MINIMUM FOR ALL DATA	22.8	14.15	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	23.2	14.77	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.8	15.15	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #19b
DEPTH (FT) 60

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.8	15.15	6.4	190	.04	.10	.51	<.10	
OCT. 14, 1989	23.8	14.15							
MAY 15, 1990	22.9	15.05							
MINIMUM FOR ALL DATA	22.8	14.15	5.3	51	<,01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	23.2	14.78	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.8	15.15	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #19c
DEPTH (FT) 80

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.8	15.15	6.6	130	.04	.09	<.01	<.10	
OCT. 14, 1989	23.7	14.25	6.2	148	.28	<.01	.07	<.10	
MAY 15, 1990	22.9	15.05	6.0	153	.04	.04	.09		11.0
MINIMUM FOR ALL DATA	22.8	14.25	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	23.1	14.82	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.7	15.15	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #20a
DEPTH (FT) 35

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.6	15.23	6.6	119	.02	.09	.05	<.10	
OCT. 14, 1989	23.3	14.53	5.6	148	.06	.46	.13	.55	
MAY 15, 1990	22.6	15.23	5.7	83	.05	.10	.01		6.0
MINIMUM FOR ALL DATA	22.6	14.53	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	22.8	14.99	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.3	15.23	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #20b
DEPTH (FT) 55

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.6	15.23	6.4	295	.02	.45	<.01	1.25	
OCT. 14, 1989	23.3	14.53	5.5	309	.20	.14	.02	.66	
MAY 15, 1990	22.6	15.23	5.9	215	.05	.22	.01		40.0
MINIMUM FOR ALL DATA	22.6	14.53	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	22.8	14.99	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.3	15.23	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #20c
DEPTH (FT) 75

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	22.6	15.23	5.9	370	<.01	.06	.03	.10	
OCT. 14, 1989	23.3	14.53	6.0	429	.08	.02	.15	.30	
MAY 15, 1990	22.7	15.13	5.7	284	.05	<.01	.03		40.0
MINIMUM FOR ALL DATA	22.6	14.53	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	22.8	14.96	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	23.3	15.23	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #21
DEPTH (FT) 40

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	25.6	12.50	6.6	89	.01	.01	.05	<.10	
OCT. 14, 1989	26.3	11.80	5.9	81	.14	<.01	.06	<.10	
MAY 15, 1990	25.3	12.80	5.9	100	.06	<.01	.02		10.0
MINIMUM FOR ALL DATA	25.3	11.80	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	25.7	12.36	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	26.3	12.8	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #22
DEPTH (FT) 40

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	26.7	15.62	6.7	72	.01	.03	.57	<.10	
OCT. 14, 1989	27.4	14.92	6.1	162	.11	.03	.63	<.10	
MAY 15, 1990	26.7	15.62	5.9	107	.10	.02	.09		8.0
MINIMUM FOR ALL DATA	26.7	14.92	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	26.9	15.38	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	27.4	15.62	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #23a
DEPTH (FT) 50

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	38.8	15.21	6.2	171	.01	.05	.29	<.10	
OCT. 14, 1989	39.4	14.61	5.6	199	.08	<.01	.35	.12	
MAY 15, 1990	39.1	14.91	6.0	160	.06	.02	.06		20.0
MINIMUM FOR ALL DATA	38.8	14.61	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	39.4	14.91	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	39.4	15.21	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #23b
DEPTH (FT) 70

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	38.8	15.21	6.6	79	.02	.05	.57	<.10	
OCT. 14, 1989	39.4	14.61	5.8	98	.12	.05	.42	<.10	
MAY 15, 1990	38.9	15.11	6.2	81	.05	.01	.09		8.0
MINIMUM FOR ALL DATA	38.9	14.61	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	39.0	14.97	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	39.4	15.21	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #23c
DEPTH (FT) 90

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	38.8	15.21	6.3	115	.01	.09	<.01	<.10	
OCT. 14, 1989	39.4	14.61	5.9	128	.08	.05	.04	.12	
MAY 15, 1990	38.9	15.11	6.1	103	.12	.01	.02		10.0
MINIMUM FOR ALL DATA	38.8	14.61	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	39.0	14.97	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	39.4	15.21	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #24a
DEPTH (FT) 50

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.1	16.07	6.3	130	.01	.07	<.01	<.10	
OCT. 14, 1989	31.9	15.27	6.4	135	.10	.02	<.01	<.10	
MAY 15, 1990	31.3	15.87	5.7	142	.13	.05	<.01		11.0
MINIMUM FOR ALL DATA	31.1	15.27	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.4	15.73	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	31.9	16.07	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #24b
DEPTH (FT) 70

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.1	16.07	6.4	190	.01	.08	.02	<.10	
OCT. 14, 1989	31.9	15.27	6.3	94	.12	.17	.03	.10	
MAY 15, 1990	31.3	15.87	6.0	95	.12	.05	.01		10.0
MINIMUM FOR ALL DATA	31.1	15.27	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.4	15.73	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	31.9	16.07	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #24c
DEPTH (FT) 90

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.1	16.07	6.2	330	.01	.21	<.01	<.10	
OCT. 14, 1989	38.3	8.87	6.4	378	.02	<.01	.01	<.10	
MAY 15, 1990	31.3	15.87	5.8	240	.11	.03	.01		32.0
MINIMUM FOR ALL DATA	31.1	8.87	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	33.56	13.60	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	38.3	16.07	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #25
DEPTH (FT) 40

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	26.1	15.76	6.7	120	.05	.04	1.90	<.10	
OCT. 14, 1989	26.8	15.06	5.6	113	.14	<.01	1.30	<.10	
MAY 15, 1990	26.0	15.86	5.9	98	.10	<.01	.36		11.0
MINIMUM FOR ALL DATA	26.0	15.06	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	26.3	15.56	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	26.8	15.86	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #26
DEPTH (FT) 45

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	31.1	15.90	6.9	70	<.01	.02	.45	<.10	
OCT. 14, 1989	31.7	15.30	5.9	68	.14	.03	.31	<.10	
MAY 15, 1990	31.2	15.80	6.1	51	.06	<.01	.38		4.0
MINIMUM FOR ALL DATA	31.1	15.30	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	31.3	15.66	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	31.7	15.90	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #27
DEPTH (FT) 46

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	33.7	17.27	6.3	189	.01	.03	6.20	<.10	
OCT. 14, 1989	34.2	16.77	5.7	235	.08	<.01	5.30	<.10	
MAY 15, 1990	33.9	17.07	5.7	168	.04	.02	3.00		15.0
MINIMUM FOR ALL DATA	33.7	16.77	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	33.9	17.03	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	34.2	17.27	9.3	435	.82	1.90	5.30	5.60	40.0

RECORD OF WATER QUALITY DATA

WELL #28
DEPTH (FT) 30

DATE	DEPTH TO WATER	WATER ELEVATION	pH	CONDUCTIVITY	TOTAL PHOSPHORUS	AMMONIA NITROGEN	NITRATE NITROGEN	TOTAL KJELDAHL	SODIUM
UNITS	(FT)	(FT)	SU	uMHOS	MG/L	MG/L	MG/L	MG/L	MG/L
AUG. 14, 1989	20.1	10.07	6.9	202	.01	.16	.02	<.10	
OCT. 14, 1989	21.0	9.17	5.8	200	.14	<.01	.10	.11	
MAY 15, 1990	19.9	10.27	6.3	199	.03	.03	.05		28.0
MINIMUM FOR ALL DATA	19.9	9.17	5.3	51	<.01	<.01	<.01	<.10	.6
AVERAGE FOR ALL DATA	20.3	9.83	6.2	165	.10	.18	.78	.34	16.1
MAXIMUM FOR ALL DATA	21.0	10.27	9.3	435	.82	1.90	5.30	5.60	40.0

QUALITY CONTROL SAMPLES: AUGUST 1989

PARAMETER	VALUE FOR DISTILLED WATER (MG/L)	REPLICATE WELL VALUES			WELL MEAN (MG/L)	STD.DEV
		VALUE #1 (MG/L)	VALUE #2 (MG/L)	VALUE #3 (MG/L)		
Tot. Filt. Phosphorus	.01	.09	.09	.06	.08	.017
Ammonium Nitrogen	.01	.09	.13	.13	.12	.023
Nitrate Nitrogen	.01	2.40	2.60	3.40	2.80	.529
Total Kjeldahl Nitrogen	.10	.10	.10	.10	.10	0.000
Sodium						

QUALITY CONTROL SAMPLES: OCTOBER 1989

PARAMETER	VALUE FOR DISTILLED WATER (MG/L)	REPLICATE WELL VALUES			MEAN (MG/L)	STD.DEV
		VALUE #1 (MG/L)	VALUE #2 (MG/L)	VALUE #3 (MG/L)		
Tot. Filt. Phosphorus	.17	.17	.41	.36	.31	.127
Ammonium Nitrogen	.06	.01	.10	.03	.05	.047
Nitrate Nitrogen	.03	2.20	2.20	2.80	2.40	.346
Total Kjeldahl Nitrogen	.10	.10	.10	.10	.10	0.000
Sodium						

QUALITY CONTROL SAMPLES: MAY 1990

PARAMETER	VALUE FOR DISTILLED WATER (MG/L)	REPLICATE WELL VALUES			MEAN (MG/L)	STD.DEV
		VALUE #1 (MG/L)	VALUE #2 (MG/L)	VALUE #3 (MG/L)		
Tot. Filt. Phosphorus	.07	.05	.05	.05	.05	0.000
Ammonium Nitrogen	.01	.10	.06	.02	.06	.040
Nitrate Nitrogen	.04	.07	1.30	2.10	1.16	1.023
Total Kjeldahl Nitrogen						
Sodium	.6	12.0	14.0	10.0	12.0	2.000

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTME
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PH
EX
LA
CLI

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mc
Type of Supply: observation well
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/23/89

	LOCATION		
	C55	C35	C36
COMPOUND	30 ClarksPt.Rd. 35 ft.	30 ClarksPt.Rd. 55 ft.	30 ClarksPt.Rd. 75 ft.
	GP 1a (11-085C)	GP-1b (11-085C)	GP-1c (11-085C)
Dichlorodifluoromethane	NOTHING		NOTHING
Vinyl Chloride	DETECTABLE		DETECTABLE
Trichlorofluoromethane			
Chloroform		0.6	
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response			
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attach is a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Co groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE:
EXT. 330
LAB 337
CLINIC 3

VOLATILE ORGANIC COMPOUNDS REPORT

lient: Eastham Board of Health
ailing Address: Town Office
P. O. Box 385
elephone: Eastham, MA 02642
ample Location: Great Pond Watershed
(Project) Eastham, MA

Collector: K. Wagner/J. Morai
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/23/89; 8/24/89

LOCATION

COMPOUND	C90	C89	C85	C56
	305GreatPondRd. 15 ft.	305GreatPondRd. WILEY PARK 20 ft.	360GreatPondRd.	35Spl. RailRd.
	GP-2 (14-094)	GP-3 (14-031)	GP-4 (11-173	GP-3 (11-065
ichlorodifluoromethane	NOTHING	≤0.3		
inyl Chloride	DETECTABLE	≤0.5		
richlorofluoromethane				
hloroform		0.2		0.2
etrachloroethene			0.2	
ert butyl methyl ether				
ID normalized response		12		
f unidentified compoun				
T 16.9				

values are in micrograms per liter (equivalent to parts per billion, or ppb).
Method 502.1 was used and only those compounds listed above were detected. Attached a list of chemicals which the method is capable of detecting. Detection limits for se compounds are stated on the attachment. Chloroform is commonly found in Cape Cod undwater at levels ranging from 0.2 to several ppb. The drinking water limit for al Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTME
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHO.
EXT.
LAB
CLIN

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Telephone: Eastham, MA 02642
Sample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mo
Type of Supply: observation well
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/12/89

	LOCATION			
	C52	C33	C37	C4
COMPOUND	320 Weir Road 30 ft	65 DeborahDoane Way 30 ft.	65DeborahDoane Way 50 ft.	65D Doa 70
	GP-8 (11-257)	GP-6a (12-028)	GP-6b (12-028)	GP-6
Dichlorodifluoromethane			NOTHING	NOT
Vinyl Chloride			DETECTABLE	DET
Trichlorofluoromethane				
Chloroform	4.7			
Tetrachloroethene				
Tert butyl methyl ether				
PID normalized response	15	1.4		
of unidentified compoun				
RT 16.9				

All values are in micrograms per liter (equivalent to parts per billion, or ppb). PA Method 502.1 was used and only those compounds listed above were detected. Attache s a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Cod roundwater at levels ranging from 0.2 to several ppb. The drinking water limit for otal Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTM
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed
(Project) Eastham, MA

Collector: K. Wagner/J. I,
Type of Supply: observation well
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler *EB*
Date Analyzed: 9/12/89

	LOCATION		
	C44	C23	C20
COMPOUND	25 Great Pond Place 25 ft.	25 Great Pond Place 45 ft.	25 Great Pond Place 63 ft.
	GP-7a (11-202)	*GP-7b (11-202)*	*GP-7c (11-202*
Dichlorodifluoromethane			NOTHING
Vinyl Chloride			DETECTABLE
Trichlorofluoromethane			
Chloroform	0.2		
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response		4.6	
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attac is a list of chemicals which the method is capable of detecting. Detection limits f these compounds are stated on the attachment. Chloroform is commonly found in Cape groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTME
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHO
EXT.
LAB
CLI

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mo
Type of Supply: observation well
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/11/89

		LOCATION	
	C67	B910	B997
COMPOUND	230 Kingsbury Beach Road	55 Grove Road	55 Wood Song Drive
	GP-9 (11-090)	GP-10 (11-060)	GP-11 (11-438)
Dichlorodifluoromethane			
Vinyl Chloride			
Trichlorofluoromethane			
Chloroform	0.9	0.5	0.3
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response of unidentified compound RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attac is a list of chemicals which the method is capable of detecting. Detection limits fo these compounds are stated on the attachment. Chloroform is commonly found in Cape C groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTME
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PH
EX. 3
LAB 3
CLI

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed (Project) - Eastham , MA

Collector: K. Wagner/J. Mc.
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/24/89

	LOCATION		
	C30	C19	C18
COMPOUND	Kingswood Drive 45 ft.	Kingswood Drive 65 ft.	Kingswood Drive 85 ft.
	GP-12a (11-355)	GP-12b (11-355)	GP-12c (11-355)
Dichlorodifluoromethane			
Vinyl Chloride			
Trichlorofluoromethane			
Chloroform	1.6	0.6	0.8
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response			
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attache is a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Cod groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE:
EXT. 33
LAB 33
CLINIC :

VOLATILE ORGANIC COMPOUNDS REPORT

lient: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
elephone: Eastham, MA 02642
Sample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mora
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/07/89; 9/11/89

	LOCATION			
	C34	C24	C58	C47
COMPOUND	Herring Brook McKoy Road	Gift Barn Route 6 - *4180 State Hwy*	Atlantic Oaks Camp Ground 44 ft.	Atl.(Camp 62 ft
	GP-21 (10-090)	*GP-22 (08-137)*	*GP-13a (11-001)*	*GP-13 (11-001*
ichlorodifluoromethane			NOTHING	*13< ne*
Vinyl Chloride			DETECTABLE	
richlorofluoromethane				
loroform	0.8			2.0
etrachloroethene				
Tert butyl methyl ether		1.9		
D normalized response				
of unidentified compound				
16.9				

ll values are in micrograms per liter (equivalent to parts per billion, or ppb). Method 502.1 was used and only those compounds listed above were detected. Attached list of chemicals which the method is capable of detecting. Detection limits for hese compounds are stated on the attachment. Chloroform is commonly found in Cape Cod ndwater at levels ranging from 0.2 to several ppb. The drinking water limit for l Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMEN
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHO
EXT.
LAB 33
CLINIC

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed (Project) Eastham, MA

Collector: K. Wagner/J. Mo
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/11/89

LOCATION

COMPOUND	C60	C91	B915	B91
	Town Crier Motel 3620 State Hwy	EasthamCommon 25 ft.	→ 3970 State Hwy 55 ft.	→ Rte. 75
	GP-13c (11-002)	GP-20a (08-170)	GP-20b (08-170)	GP-
Dichlorodifluoromethane			NOTHING	NOTH
Vinyl Chloride			DETECTABLE	DETE
Trichlorofluoromethane				
Chloroform	1.2	0.2		
Tetrachloroethene				
Tert butyl methyl ether				
PID normalized response				
of unidentified compound				
RT 16.9				

ll values are in micrograms per liter (equivalent to parts per billion, or ppb). PA Method 502.1 was used and only those compounds listed above were detected. Attached is a list of chemicals which the method is capable of detecting. Detection limits for hese compounds are stated on the attachment. Chloroform is commonly found in Cape Co roundwater at levels ranging from 0.2 to several ppb. The drinking water limit for otal Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPART
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed (Project) Eastham, MA

Collector: K. Wagner/J.
Type of Supply: observation we
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/12/89

COMPOUND	LOCATION B212 Nauset Haven Cottages 45 ft. GP-14a (11-049)	C44 Nauset Haven Cottages 65 ft. GP-14b (11-049)	C59 Nauset Haven Cottages 83 ft. GP-14c (11-049)
Dichlorodifluoromethane	NOTHING	NOTHING	
Vinyl Chloride	DETECTABLE	DETECTABLE	
Trichlorofluoromethane			0.4
Chloroform			1.0
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response			
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Atta is a list of chemicals which the method is capable of detecting. Detection limits f these compounds are stated on the attachment. Chloroform is commonly found in Cape groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMEN
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHO
EXT.
LAB 33
CLINI

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed
(Project) Eastham., MA

Collector: K. Wagner/J. Mo
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 9/12/89

		LOCATION		
	C83	C51	C53	C
COMPOUND	Town Landfill 165 Old Orchard 12ft	320 Old Orchard Road, Martin 55ft	Town Landfill 555 Old Orchard Rd. 7.9 ft.	Tow Land 15
	GP-15 (11-012) (HJ-2)	GP-16 (08-110G)	GP-17 (08-089) (HJ-1)	GP- (HJ-3
Dichlorodifluoromethane		≦0.3	NOTHING	NOT
Vinyl Chloride		≦0.6	DETECTABLE	DET
Trichlorofluoromethane				
Chloroform	0.2	3.3		
Tetrachloroethene				
Tert butyl methyl ether				
PID normalized response	1.3			
of unidentified compound				
RT 16.9				

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attached is a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Cod groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE:
EXT. 330
LAB 337
CLINIC 3

VOLATILE ORGANIC COMPOUNDS REPORT

lient: Eastham Board of Health
ailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
elephone:
ample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mora
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/24/89

	B228	LOCATION B973	B227	
COMPOUND	Eastham Ready 45 ft.	Mix, Holmes Rd. 60 ft.	Mix, Holmes Rd. 80 ft.	
	GP-19a (08-172)	GP-19b (08-172)	GP-19c (08-172)	
ichlorodifluoromethane		NOTHING	NOTHING	
Vinyl Chloride		DETECTABLE	DETECTABLE	
richlorofluoromethane				
loroform	0.3			
etrachloroethene				
Tert butyl methyl ether				
D normalized response				
of unidentified compoun				
16.9				

ll values are in micrograms per liter (equivalent to parts per billion, or ppb).
Method 502.1 was used and only those compounds listed above were detected. Attached
list of chemicals which the method is capable of detecting. Detection limits for
hese compounds are stated on the attachment. Chloroform is commonly found in Cape Cod
ndwater at levels ranging from 0.2 to several ppb. The drinking water limit for
l Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMEN
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHOI
EXT.
LAB 33
CLINIC

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mor
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/24/89

LOCATION

COMPOUND	B909 720 Old Orchard Road 50 ft. GP-23a (08-064)	B912 720 Old Orchard Road 70 ft. GP-23b (08-064)	B199 720 OldOrchard Road 90 ft. GP-23 c (08-064)
Dichlorodifluoromethane			NOTHING
Vinyl Chloride			DETECTABLE
Trichlorofluoromethane			
Chloroform	5.9	0.9	
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response			
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Attached is a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Cod groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPART
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
Telephone:
Sample Location: Great Pond Watershed (Project) Eastham, MA

Collector: K. Wagner/J.
Type of Supply: observation we
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler EB
Date Analyzed: 8/24/89

	LOCATION		
	C6	C80	C64
COMPOUND	25 DanielleDr. 50 ft. GP-24a (08-030)	25 Danielle Dr. 70 ft. GP-24b (08-030)	25 Danielle Dr. 90 ft. GP-24c (08-030)
Dichlorodifluoromethane			NOTHING
Vinyl Chloride			DETECTABLE.
Trichlorofluoromethane			
Chloroform	0.8	4.8	
Tetrachloroethene			
Tert butyl methyl ether			
PID normalized response			
of unidentified compound			
RT 16.9			

All values are in micrograms per liter (equivalent to parts per billion, or ppb). EPA Method 502.1 was used and only those compounds listed above were detected. Atta is a list of chemicals which the method is capable of detecting. Detection limits f these compounds are stated on the attachment. Chloroform is commonly found in Cape groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT

SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE:
EXT. 330
LAB 337
CLINIC 34

VOLATILE ORGANIC COMPOUNDS REPORT

lient: Eastham Board of Health
ailing Address: Town Office
P. O. Box 385
Eastham, MA 02642
elephone:
ample Location: Great Pond Watershed
(Project) Eastham , MA

Collector: K. Wagner/J. Mora
Type of Supply: observation wells
Date Collected: 8/14/16/89
Date Received: 8/16/89
Analyst: Eric Butler
Date Analyzed: 9/07/89

	LOCATION			
	C66	C68	C65	C84
COMPOUND	540 Massasoit Rd.	15 Bishop Rd.	Capt.Quarter Motel, Route 6	Wiley Park, Beehi
	GP-25 (08-154)	GP-26 (08-001)	GP-27 (05-120A)	GP-28R (11-223)
ichlorodifluoromethane	NOTHING			
inyl Chloride	DETECTABLE			
richlorofluoromethane				
hloroform		0.2	1.5	3.3
etrachloroethene				
ert butyl methyl ether				
PID normalized response				
of unidentified compoun				
RT 16.9				

l values are in micrograms per liter (equivalent to parts per billion, or ppb). Method 502.1 was used and only those compounds listed above were detected. Attached a list of chemicals which the method is capable of detecting. Detection limits for se compounds are stated on the attachment. Chloroform is commonly found in Cape Cod oundwater at levels ranging from 0.2 to several ppb. The drinking water limit for tal Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

RECEIVED
OCT 30 1989
By

4

PHONE: 362-2
EXT. 330
LAB 337
CLINIC 340

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: P. O. Box 385
Eastham, MA 02642
Telephone: 255-0333
Sample Location: Great Pond Group Landfill Area, Eastham, MA

Collector: Joseph Moran
Type of Supply: observation wells
Date Collected: 10/4/89
Date Received: 10/5/89
Analyst: Eric Butler EB
Date Analyzed: 10/16/89

GP	WELL #	13a (44')	13b (62')	13c (70')	LOCATION 15 (12')	16 (55')	17 (7.9')	
COMPOUND	LOCATION VIAL #	Atlantic Oaks C-40 (11-001)	3700 State Highway C88 (11-001)	TownCrier Motel C28 (11-002)	165 Old Orchard Road C16	Martin B959	555 Old Orchard Road 87	
Chloroform		ND	1.7	0.7	0.4	4.0	ND	
Chlorobenzene		ND	ND	ND	0.2	ND	ND	
Dichlorodifluoromethane		ND	ND	ND	ND	0.3	ND	
Dichloromethane		ND	ND	0.4	ND	ND	ND	

cc Joseph Moran

cc Eastham Board of Health

ll values are in micrograms per liter (equivalent to parts per billion, or ppb). A Method 502.1 was used and only those compounds listed above were detected. Attached s a list of chemicals which the method is capable of detecting. Detection limits for hese compounds are stated on the attachment. Chloroform is commonly found in Cape Cod groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

BARNSTABLE COUNTY HEALTH AND ENVIRONMENTAL DEPARTMENT
SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE: 36
EXT. 330
LAB 337
CLINIC 340

VOLATILE ORGANIC COMPOUNDS REPORT

Client: Eastham Board of Health
Mailing Address: P. O. Box 385
Eastham, MA 02642
Telephone: 255-0333
Sample Location: Old Orchard
Eastham, MA
(Martin)

Collector: J.Moran/E.Butler
Type of Supply: monitoring well
Date Collected: 10/27/89
Date Received: 10/27/89
Analyst: E. Butler EB
Date Analyzed: 10/28/89

E637

COMPOUND	LOCATION			
	Old Orchard Eastham, MA (Martin) 55' GP-16 (08-1106)			
Chloroform	2.4			
Dichlorodifluoromehtane	0.3			

NOTE: Apparently the previous analyses were correct indicating that the "new"sampler works fine.

RECEIVED
NOV 6 1989
By

cc Joseph Moran

All values are in micrograms per liter (equivalent to parts per billion, or ppb).
A Method 502.1 was used and only those compounds listed above were detected. Attached is a list of chemicals which the method is capable of detecting. Detection limits for these compounds are stated on the attachment. Chloroform is commonly found in Cape Cod groundwater at levels ranging from 0.2 to several ppb. The drinking water limit for Total Trihalomethanes, of which chloroform is an example, is 100 ppb.

SUPERIOR COURT HOUSE
BARNSTABLE, MASSACHUSETTS 02630

PHONE: 362-2511
EXT. 330
LAB 337
CLINIC 340

TABLE 1. Compounds Detectable by EPA Method 502.1*

COMPOUND	D.L.	COMPOUND	D.L.
Benzene	0.5	1,1-Dichloroethane	0.5
Carbontetrachloride	0.5	1,1-Dichloropropene	0.5
1,1-Dichloroethylene	0.5	1,3-Dichloropropene	0.5
1,2-Dichloroethane	0.5	1,2-Dichloropropane	0.5
para Dichlorobenzene	0.5	1,3-Dichloropropane	0.5
Trichloroethylene	0.5	2,2-Dichloropropane	0.5
1,1,1-Trichloroethane	0.5	Ethylbenzene	0.5
Vinyl Chloride	0.5	Styrene	0.5
Bromobenzene	0.5	1,1,2-Trichloroethane	0.5
Bromodichloromethane	0.5	1,1,1,2-Tetrachloroethane	0.5
Bromoform	0.5	1,1,2,2-Tetrachloroethane	0.5
Bromomethane	0.5	Tetrachloroethylene	0.5
Chlorobenzene	0.5	1,2,3-Trichloropropane	0.5
Chlorodibromomethane	0.5	Toluene	0.5
Chloroethane	0.5	para Xylene	0.5
Chloroform	0.5	ortho Xylene	0.5
Chloromethane	0.5	meta Xylene	0.5
ortho Chlorotoluene	0.5	Bromochloromethane	0.5
para Chlorotoluene	0.5	Dichlorodifluoromethane	0.5
Dibromomethane	0.5	Fluorotrichloromethane	0.5
meta Dichlorobenzene	0.5	Hexachlorobutadiene	0.5
ortho Dichlorobenzene	0.5	Isopropylbenzene	0.5
trans-1,2 Dichloroethylene	0.5	n-Propylbenzene	0.5
cis-1,2 Dichloroethylene	0.5	Sec-butylbenzene	0.5
Dichloromethane	0.5	Tert-butylbenzene	0.5

D.L. is Detection Limit in micrograms per liter or parts per billion (ppb). This table lists our normal limits of detection. If we report a smaller amount, then our detection limit was lower for that analysis.

*A photoionization detector is used in series with the electroconductivity detector, thus allowing for the analysis of most of the compounds listed in EPA Method 503.1 as well.

TABLE 2. Compounds which have Maximum Contaminant Levels (MCLs) set by the Environmental Protection Agency.

COMPOUND	MCL (in ppb)
Benzene	5.0
Carbontetrachloride	5.0
1,2-Dichloroethane	5.0
1,1-Dichloroethylene	7.0
para Dichlorobenzene	75
1,1,1-Trichloroethane	200
Trichloroethylene	5.0
Vinyl Chloride	2.0
Total Trihalomethanes	100

Chloroform, Bromodichloromethane, Chlorodibromomethane, and Bromoform comprise the total trihalomethanes.

TABLE 1

LOCATIONS, ELEVATIONS AND DEPTHS OF INSTALLED WELLS

WELL #	LOCATION	WELL DEPTH (ft.)	VOC VIAL NUMBER	VOC VIAL NUMBER	MAP/ PARCEL #	WELL
1a	30 Clark's Point Rd. ?	35			14-085C	1a
b		55			"	b
c		75			"	c
2 25	305 Great Pond Rd. ?	15			14-094	2
3 (EGW-37)	Entrance to Wiley Park	20			14-031	3 (
4	360 Great Pond Rd.	40			11-173	4
5	35 Split Rail Rd.	25			11-065	5
6a	65 Deborah Doane Way	30			12-028	6a
b		50			"	b
c		70			"	c
7a	25 Great Pond Place	25			11-202	7a
b		45			"	b
c		63			"	c
8	320 Weir Rd.	30			11-257	8
9 230	~~347~~ Kingsbury Beach Rd. cor G.P. Rd.	43			11-090	9
10	55 Grove Rd.	37			10-060	10
11	55 Wood Song Drive	45			11-438	11
12a 10	Kingswood Rd. Dr	45			11-355	12a
b		65			"	b
c		85			"	c
13a	Atlantic Oaks Camp Ground 3700 State Hwy	44			11-001	13a
b		62			11-001	b
c	Town Crier Motel 3620 State Hwy	70			11-002	c
14a	R2-3280 (Rt.6) State Hwy Nauset Haven Cottages	45			11-049	14a
b		65			"	b
c		83			"	c
15 (HJ-2)	Town Landfill 165 Old Orchard Rd	12.3			11-012	15
16	320 Old Orchard Rd. Martin 08	55			08-110G	16
17 (HJ-1)	Town Landfill 555 Old Orchard Rd	7.9			08-089	17
18 (HJ-3)	Town Landfill "	15			08-089	18
19a	Eastham Ready Mix, 175 Holmes Rd	45			08-172	19a
b		60			"	b
c		80			"	c
20a	Eastham Common, Rt.6 3970 State Hwy	25			08-170	20a
b		55			"	b
c		75			"	c
21	Herring Brook & McKoy Rd (1450)	40			10-090	21
22	Gift Barn Land, Rt.6 4180 State Hwy	40			08-137	22
23a	720 Old Orchard Rd.	50			08-064	23a
b		70			"	b
c		90			"	c
24a	25 Danielle Drive	50			08-030	24a
b		70			"	b
c		90			"	c
25	540 Massasoit Rd.	40			08-154	25
26	15 Bishop Rd.	45			08-001	26
27	Captains Quarter Motel, Rt.6	46			05-120A	27
28	Wiley Park, Beehive Rd.	30			11-223	28

Wells designated with a, b or c are part
wells within a cluster are at the same el

WELL WATER ELEVATIONS ON MAY 9, 1989

WELL #	LOCATION	WELL DEPTH (FT)	ELEV. AT TOP OF CASING	DEPTH OF WATER (FT)	WATER ELEV. (FT ABOVE MSL)
1a	30 Clark's Point Rd.	35	23.76	14.9	8.86
b		55	23.76	15.1	8.66
c		75	23.75	15.1	8.65
2	305 Great Pond Rd.	15	13.13	3.9	9.23
3 (EGW-37)	Entrance to Wiley Park	20	26.86	17.8	9.06
4	360 Great Pond Rd.	40	34.45	24.4	10.05
5	35 Split Rail Rd.	25	21.63	9.7	11.93
6a	65 Deborah Doane Way	30	25.86	15.9	9.96
b		50	25.86	16.3	9.56
c		70	25.86	16.8	9.06
7a	25 Great Pond Place	25	23.86	14.1	9.76
b		45	23.86	12.8	11.06
c		63	23.86	12.8	11.06
8	320 Weir Rd.	30	28.78	16.9	11.88
9	347 Kingsbury Beach Rd.	43	45.53	31.8	13.73
10	55 Grove Rd.	37	35.59	19.4	16.19
11	55 Wood Song Drive	45	42.93	29.7	13.23
12a	Kingswood Rd.	45	45.18	31.2	13.98
b		65	45.18	31.2	13.98
c		85	45.18	31.6	13.58
13a	Atlantic Oaks Camp Ground	44	46.55	32.6	13.95
b		62	46.55	32.5	14.05
c	Town Crier Motel	70	46.50	35.0	11.50
14a	R2-3280 Rt.6	45	44.12	31.9	12.22
b		65	44.12	32.5	11.62
c		83	44.12	33.6	10.52
15 (HJ-2)	Town Landfill	12.3	16.75	5.6	11.15
16	320 Old Orchard Rd.	55	54.76	46.1	8.66
17 (HJ-1)	Town Landfill	7.9	19.38	6.3	13.08
18 (HJ-3)	Town Landfill	15	27.58	13.6	13.98
19a	Eastham Ready Mix, Holmes Rd.	45	37.95	23.4	14.55
b		60	37.95	23.4	14.55
c		80	37.95	23.6	14.35
20a	Eastham Common, Rt.6	35	37.83	23.3	14.53
b		55	37.83	23.3	14.53
c		75	37.83	23.3	14.53
21	Herring Brook & McKoy Rd.	40	38.10	25.7	12.40
22	Gift Land, Rt.6	40	42.32	27.4	14.92
23a	720 Old Orchard Rd.	50	54.01	39.7	14.31
b		70	54.01	39.7	14.31
c		90	54.01	39.7	14.31
24a	25 Danielle Drive	50	47.17	32.2	14.97
b		70	47.17	32.2	14.97
c		90	47.17	32.2	14.97
25	540 Massasoit Rd.	40	41.86	26.9	14.96
26	15 Bishop Rd.	45	47.00	32.1	14.90
27	Captains Quarter Motel, Rt.6	46	50.97	35.0	15.97
28	Wiley Park, Beehive Rd.	30	30.17	19.5	10.67

WELL WATER ELEVATIONS ON AUGUST 14-16, 1989

WELL #	LOCATION	WELL DEPTH (FT)	ELEV. AT TOP OF CASING	DEPTH OF WATER (FT)	WATER ELEV. (FT ABOVE MSL)
1a	30 Clark's Point Rd.	35	23.76	15.4	8.36
b		55	23.76	15.7	8.06
c		75	23.75	15.7	8.05
2	305 Great Pond Rd.	15	13.13	4.6	8.53
3 (EGW-37)	Entrance to Wiley Park	20	26.86	18.5	8.36
4	360 Great Pond Rd.	40	34.45	24.9	9.55
5	35 Split Rail Rd.	25	21.63	10.5	11.13
6a	65 Deborah Doane Way	30	25.86	17.0	8.86
b		50	25.86	17.0	8.86
c		70	25.86	17.0	8.86
7a	25 Great Pond Place	25	23.86	14.7	9.16
b		45	23.86	12.9	10.96
c		63	23.86	12.9	10.96
8	320 Weir Rd.	30	28.78	17.1	11.68
9	347 Kingsbury Beach Rd.	43	45.53	31.8	13.73
10	55 Grove Rd.	37	35.59	24.8	10.79
11	55 Wood Song Drive	45	42.93	29.8	13.13
12a	Kingswood Rd.	45	45.18	30.8	14.38
b		65	45.18	30.8	14.38
c		85	45.18	31.4	13.78
13a	Atlantic Oaks Camp Ground	44	46.55	31.8	14.75
b		62	46.55	31.9	14.65
c	Town Crier Motel	70	46.50	35.0	11.50
14a	R2-3280 Rt.6	45	44.12	32.1	12.02
b		65	44.12	32.7	11.42
c		83	44.12	33.6	10.52
15 (HJ-2)	Town Landfill	12.3	16.75	5.2	11.55
16	320 Old Orchard Rd.	55	54.76	45.3	9.46
17 (HJ-1)	Town Landfill	7.9	19.38	5.6	13.78
18 (HJ-3)	Town Landfill	15	27.58	12.7	14.88
19a	Eastham Ready Mix, Holmes Rd.	45	37.95	22.8	15.15
b		60	37.95	22.8	15.15
c		80	37.95	22.8	15.15
20a	Eastham Common, Rt.6	35	37.83	22.6	15.23
b		55	37.83	22.6	15.23
c		75	37.83	22.6	15.23
21	Herring Brook & McKoy Rd.	40	38.10	25.6	12.50
22	Gift Land, Rt.6	40	42.32	26.7	15.62
23a	720 Old Orchard Rd.	50	54.01	38.8	15.21
b		70	54.01	38.8	15.21
c		90	54.01	38.8	15.21
24a	25 Danielle Drive	50	47.17	31.1	16.07
b		70	47.17	31.1	16.07
c		90	47.17	31.1	16.07
25	540 Massasoit Rd.	40	41.86	26.1	15.76
26	15 Bishop Rd.	45	47.00	31.1	15.90
27	Captains Quarter Motel, Rt.6	46	50.97	33.7	17.27
28	Wiley Park, Beehive Rd.	30	30.17	20.1	10.07

WELL WATER ELEVATIONS ON OCTOBER 2-5, 1989

WELL #	LOCATION	WELL DEPTH (FT)	ELEV. AT TOP OF CASING	DEPTH OF WATER (FT)	WATER ELEV. (FT ABOVE MSL)
1a	30 Clark's Point Rd.	35	23.76	15.8	7.96
b		55	23.76	16.1	7.66
c		75	23.75	15.8	7.95
2	305 Great Pond Rd.	15	13.13	4.8	8.33
3 (EGW-37)	Entrance to Wiley Park	20	26.86	19.1	7.76
4	360 Great Pond Rd.	40	34.45	25.3	9.15
5	35 Split Rail Rd.	25	21.63	11.6	10.03
6a	65 Deborah Doane Way	30	25.86	18.0	7.86
b		50	25.86	17.5	8.36
c		70	25.86	17.7	8.16
7a	25 Great Pond Place	25	23.86	15.1	8.76
b		45	23.86	13.5	10.36
c		63	23.86	13.5	10.36
8	320 Weir Rd.	30	28.78	18.0	10.78
9	347 Kingsbury Beach Rd.	43	45.53	32.5	13.03
10	55 Grove Rd.	37	35.59	25.8	9.79
11	55 Wood Song Drive	45	42.93	30.5	12.43
12a	Kingswood Rd.	45	45.18	31.6	13.58
b		65	45.18	31.6	13.58
c		85	45.18	32.0	13.18
13a	Atlantic Oaks Camp Ground	44	46.55	32.6	13.95
b		62	46.55	32.6	13.95
c	Town Crier Motel	70	46.50	35.4	11.10
14a	R2-3280 Rt.6	45	44.12	32.9	11.22
b		65	44.12	33.3	10.82
c		83	44.12	34.2	9.92
15 (HJ-2)	Town Landfill	12	16.75	6.0	10.75
16	320 Old Orchard Rd.	55	54.76	46.1	8.66
17 (HJ-1)	Town Landfill	8	19.38	6.2	13.18
18 (HJ-3)	Town Landfill	15	27.58	13.3	14.28
19a	Eastham Ready Mix, Holmes Rd.	45	37.95	23.8	14.15
b		60	37.95	23.8	14.15
c		80	37.95	23.7	14.25
20a	Eastham Common, Rt.6	35	37.83	23.3	14.53
b		55	37.83	23.3	14.53
c		75	37.83	23.3	14.53
21	Herring Brook & McKoy Rd.	40	38.10	26.3	11.80
22	Gift Land, Rt.6	40	42.32	27.4	14.92
23a	720 Old Orchard Rd.	50	54.01	39.4	14.61
b		70	54.01	39.4	14.61
c		90	54.01	39.4	14.61
24a	25 Danielle Drive	50	47.17	31.9	15.27
b		70	47.17	31.9	15.27
c		90	47.17	38.3	8.87
25	540 Massasoit Rd.	40	41.86	26.8	15.06
26	15 Bishop Rd.	45	47.00	31.7	15.30
27	Captains Quarter Motel, Rt.6	46	50.97	34.2	16.77
28	Wiley Park, Beehive Rd.	30	30.17	21.0	9.17

WELL WATER ELEVATIONS ON MAY 15-17, 1990

WELL #	LOCATION	WELL DEPTH (FT)	ELEV. AT TOP OF CASING	DEPTH OF WATER (FT)	WATER ELEV. (FT ABOVE MSL)
1a	30 Clark's Point Rd.	35	23.76	15.0	8.76
b		55	23.76	15.2	8.56
c		75	23.75	15.1	8.65
2	305 Great Pond Rd.	15	13.13	3.6	9.53
3 (EGW-37)	Entrance to Wiley Park	20	26.86	18.1	8.76
4	360 Great Pond Rd.	40	34.45	24.3	10.15
5	35 Split Rail Rd.	25	21.63	9.8	11.83
6a	65 Deborah Doane Way	30	25.86	16.0	9.86
b		50	25.86	16.6	9.26
c		70	25.86	16.8	9.06
7a	25 Great Pond Place	25	23.86	14.1	9.76
b		45	23.86	12.4	11.46
c		63	23.86	12.4	11.46
8	320 Weir Rd.	30	28.78	16.7	12.08
9	347 Kingsbury Beach Rd.	43	45.53	31.7	13.83
10	55 Grove Rd.	37	35.59	24.4	11.19
11	55 Wood Song Drive	45	42.93	29.5	13.43
12a	Kingswood Rd.	45	45.18	30.7	14.48
b		65	45.18	30.8	14.38
c		85	45.18	31.5	13.68
13a	Atlantic Oaks Camp Ground	44	46.55	31.9	14.65
b		62	46.55	31.9	14.65
c	Town Crier Motel	70	46.50	34.2	12.30
14a	R2-3280 Rt.6	45	44.12	31.9	12.22
b		65	44.12	32.4	11.72
c		83	44.12	33.3	10.82
15 (HJ-2)	Town Landfill	12.3	16.75	4.8	11.95
16	320 Old Orchard Rd.	55	54.76	45.6	9.16
17 (HJ-1)	Town Landfill	7.9	19.38	5.7	13.68
18 (HJ-3)	Town Landfill	15	27.58	12.8	14.78
19a	Eastham Ready Mix, Holmes Rd.	45	37.95	22.9	15.05
b		60	37.95	22.9	15.05
c		80	37.95	22.9	15.05
20a	Eastham Common, Rt.6	35	37.83	22.6	15.23
b		55	37.83	22.6	15.23
c		75	37.83	22.7	15.13
21	Herring Brook & McKoy Rd.	40	38.10	25.3	12.80
22	Gift Land, Rt.6	40	42.32	26.7	15.62
23a	720 Old Orchard Rd.	50	54.01	39.1	14.91
b		70	54.01	38.9	15.11
c		90	54.01	38.9	15.11
24a	25 Danielle Drive	50	47.17	31.3	15.87
b		70	47.17	31.3	15.87
c		90	47.17	31.3	15.87
25	540 Massasoit Rd.	40	41.86	26.0	15.86
26	15 Bishop Rd.	45	47.00	31.2	15.80
27	Captains Quarter Motel, Rt.6	46	50.97	33.9	17.07
28	Wiley Park, Beehive Rd.	30	30.17	19.9	10.27

APPENDIX D

1991 WELL MONITORING DATA

WELL WATER ELEVATIONS ON JUNE 27, 1991, WITH ASSOCIATED WATER CHEMISTRY DATA

WELL #	LOCATION	WELL DEPTH (FT)	ELEV. AT TOP OF CASING	DEPTH OF WATER (FT)	WATER ELEV. (FT ABOVE MSL)	PH (SU)	CONDUCT. (UMHO/CM)	NITRATE-N (MG/L)
1a	30 Clark's Point Rd.	35	23.76	15.8	7.96	6.6	72	.02
b		55	23.76	15.8	7.96	7.2	300	1.00
c		75	23.75	14.3	9.45	6.8	75	.75
2	305 Great Pond Rd.	15	13.13	5.3	7.83	5.7	269	.06
3 (EGW-37)	Entrance to Wiley Park	20	26.86	17.0	9.86	6.2	353	.02
4	360 Great Pond Rd.	40	34.45	25.0	9.45	5.6	352	4.60
5	35 Split Rail Rd.	25	21.63	***				
6a	65 Deborah Doane Way	30	25.86	17.0	8.86	5.6	123	3.20
b		50	25.86	16.5	9.36	5.8	146	2.60
c		70	25.86	16.5	9.36	6.2	455	.30
7a	25 Great Pond Place	25	23.86	14.0	9.86	6.3	150	.25
b		45	23.86	13.5	10.36	6.0	228	2.53
c		63	23.86	13.3	10.56	6.2	120	.44
8	320 Weir Rd.	30	28.78	17.0	11.78	6.0	232	.14
9	347 Kingsbury Beach Rd.	43	45.53	***				
10	55 Grove Rd.	37	35.59	20.3	15.29	6.2	140	1.70
11	55 Wood Song Drive	45	42.93	31.0	11.93	6.5	452	3.20
12a	Kingswood Rd.	45	45.18	31.0	14.18	6.5	150	.40
b		65	45.18	31.3	13.88	6.0	181	1.60
c		85	45.18	31.8	13.38	6.0	230	1.40
13a	Atlantic Oaks Camp Ground	44	46.55	30.8	15.75	6.1	138	.02
b		62	46.55	30.8	15.75	6.0	113	.02
c	Town Crier Motel	70	46.50	33.9	12.60	7.7	133	.02
14a	R2-3280 Rt.6	45	44.12	32.2	11.92	5.6	390	.44
b		65	44.12	32.2	11.92	5.5	385	.40
c		83	44.12	32.2	11.92	6.0	135	.45
15 (HJ-2)	Town Landfill	12.3	16.75	***				
16	320 Old Orchard Rd.	55	54.76	47.9	6.86	5.4	172	1.60
17 (HJ-1)	Town Landfill	7.9	19.38	7.2	12.18	6.4	183	.80
18 (HJ-3)	Town Landfill	15	27.58	DRY				
19a	Eastham Ready Mix, Holmes Rd.	45	37.95	23.5	14.45	6.6	149	1.80
b		60	37.95	23.7	14.25	5.7	232	1.92
c		80	37.95	24.0	13.95	5.5	155	.49
20a	Eastham Common, Rt.6	35	37.83	24.0	13.83	5.9	458	.10
b		55	37.83	23.7	14.13	5.8	232	.02
c		75	37.83	23.4	14.43	5.9	140	.18
21	Herring Brook & McKoy Rd.	40	38.10	26.4	11.70	6.3	98	.03
22	Gift Land, Rt.6	40	42.32	27.0	15.32	5.9	84	2.18
23a	720 Old Orchard Rd.	50	54.01	38.7	15.31	5.8	139	.16
b		70	54.01	38.5	15.51	6.1	82	.42
c		90	54.01	38.3	15.71	6.0	120	.36
24a	25 Danielle Drive	50	47.17	31.7	15.47	5.9	107	.02
b		70	47.17	31.7	15.47	6.1	92	.10
c		90	47.17	31.5	15.67	5.9	162	.10
25	540 Massasoit Rd.	40	41.86	26.9	14.96	5.9	142	2.00
26	15 Bishop Rd.	45	47.00	32.8	14.20	6.1	60	.55
27	Captains Quarter Motel, Rt.6	46	50.97	31.9	19.07	5.7	250	6.20
28	Wiley Park, Beehive Rd.	30	30.17	20.6	9.57	5.9	418	.05

*** Well inaccessible