Appendix B

Chatham Airport Groundwater Management Plan

CHATHAM AIRPORT COMMISSION
CHATHAM, MASSACHUSETTS

GROUNDWATER MANAGEMENT PLAN

NOVEMBER, 1989

PREPARED BY
DUFRESNE-HENRY, INC.
WESTFORD, MASSACHUSETTS

LIST OF FIGURES

LIST OF TABLES

WATER CONTROL LABORATORIES
A DIVISION OF COOPERATING MANAGEMENT INC.
HOPKINTON INDUSTRIAL PARK
106 SOUTH ST.
HOPKINTON, MA 01748
508-435-6824
Mass Cert No 313 * Conn Cert No PH-0515 * EPA ID No MA059

WCI ID	ACCOUNT #	CODE	PAGE #
91325734	000512		1

SAMPLE IDENTIFICATION INFORMATION

CHATHAM AIRPORT (MW 5)
GROUNDWATER STUDY

REFERRED BY:

GENE SCHRAGER

DUFRESNE HENRY, INC.
239 LITTLETON RD.
SUITE 1A
WESTFORD, MA.

COLLECTED	RECEIVED	REPORTED
05/11/89 15:40	05/12/89	06/04/89

REPORT: FINAL REPORT

COMMENT:

TESTS	RESULTS	UNITS	DETECTION LIMIT	METHOD
*** GENERAL INFORMATION				
(COLLECTOR: DUFRESNE HENRY)				
*** SAMPLE PREPARATION				
DIGESTION METALS	5/12/89			
DIGESTION HYDRIDES	5/12/89			
DIGESTION MERCURY	5/15/89			
*** NUTRIENTS				
NITRATE	<0.5	MG/L	0.5	353.3
*** TRACE METALS	WATER			
ARSENIC	0.121	MG/L	0.005	7061
BARIUM	0.62	MG/L	0.010	6010
CADMIUM	<0.001	MG/L	0.001	7131
CHROMIUM, TOTAL	0.540	MG/L	0.001	7191
LEAD	0.104	MG/L	0.001	7421
MERCURY	<0.001	MG/L	0.001	7471
SELENIUM	<0.005	MG/L	0.005	7741
SILVER	0.001	MG/L	0.001	7760
*** VOLATILE ORGANICS				
VOA ANALYSIS DATE:	5/24/89			
*** PESTICIDES	WATER			
PEST ANALYSIS DATE:	6/2/89			
PEST EXTRACTION DATE	5/19/89			
ALDRIN	ND	UG/L	0.20	8080
ALPHA-BHC	ND	UG/L	0.20	8080
BETA-BHC	ND	UG/L	0.20	8080
GAMMA-BHC	ND	UG/L	0.20	8080
DELTA-BHC (LINDANE)	ND	UG/L	0.20	8080
CHLORDANE	ND	UG/L	0.20	8080
4,4'-DDD	ND	UG/L	0.20	8080
4,4'-DDE	ND	UG/L	0.20	8080
4,4'-DDT	ND	UG/L	0.20	8080
DIELDRIN	ND	UG/L	0.20	8080
ENDOSULFAN I	ND	UG/L	0.20	8080
ENDOSULFAN II	ND	UG/L	0.20	8080
ENDOSULFAN SULFATE	0.62	UG/L	0.20	8080
ENDRIN	ND	UG/L	0.20	8080

CONTINUED ON NEXT PAGE

WATER CONTROL LABORATORIES
A DIVISION OF COOPERATING MANAGEMENT INC.
HOPKINTON INDUSTRIAL PARK
136 SOUTH ST.
HOPKINTON, MA 01748
508-435-6824
Mass Cert No 313 * Conn Cert No PH-0515 * EPA ID No MA059

WCL ID: 91325730 | ACCOUNT: 000512 | CODE | PAGE: 1

SAMPLE IDENTIFICATION INFORMATION:

CHATHAM AIRPORT (MW-3)
GROUNDWATER STUDY

GENE SCHRAGER

REFERRED BY:

DUFRESNE-HENRY, INC.
239 LITTLETON RD.
SUITE 1A
WESTFORD, MA.

COLLECTED	RECEIVED	REPORTED
05/12/89 08:15	05/12/89	06/04/8

REPORT: FINAL REPORT

COMMENT:

TESTS	RESULTS	UNITS	DETECTION LIMIT	METHOD
*** GENERAL INFORMATION				
(COLLECTOR: DUFRESNE-HENRY)				
*** SAMPLE PREPARATION				
DIGESTION-METALS	5/12/89			
DIGESTION-HYDRIDES	5/12/89			
DIGESTION-MERCURY	5/15/89			
*** NUTRIENTS				
NITRATE	3.0	MG/L	0.5	353.3
*** TRACE METALS	WATER			
ARSENIC	0.218	MG/L	0.005	7061
BARIUM	0.92	MG/L	0.010	6010
CADMIUM	0.001	MG/L	0.001	7131
CHROMIUM, TOTAL	0.660	MG/L	0.001	7191
LEAD	0.235	MG/L	0.001	7421
MERCURY	<0.001	MG/L	0.001	7471
SELENIUM	0.006	MG/L	0.005	7741
SILVER	0.001	MG/L	0.001	7760
*** VOLATILE ORGANICS				
VOA ANALYSIS DATE:	5/24/89			
*** PESTICIDES	WATER			
PEST ANALYSIS DATE:	6/2/89			
PEST EXTRACTION DATE	5/19/89			
ALDRIN	ND	UG/L	0.20	8080
ALPHA-BHC	ND	UG/L	0.20	8080
BETA-BHC	ND	UG/L	0.20	8080
GAMMA-BHC	ND	UG/L	0.20	8080
DELTA-BHC (LINDANE)	ND	UG/L	0.20	8080
CHLORDANE	ND	UG/L	0.20	8080
4,4'-DDD	ND	UG/L	0.20	8080
4,4'-DDE	ND	UG/L	0.20	8080
4,4'-DDT	ND	UG/L	0.20	8080
DIELDRIN	ND	UG/L	0.20	8080
ENDOSULFAN I	ND	UG/L	0.20	8080
ENDOSULFAN II	ND	UG/L	0.20	8080
ENDOSULFAN SULFATE	0.88	UG/L	0.20	8080
ENDRIN	ND	UG/L	0.20	8080

CONTINUED ON NEXT PAGE

WATER CONTROL LABORATORIES
A DIVISION OF COOPERATING MANAGEMENT INC.
HOPKINTON INDUSTRIAL PARK
106 SOUTH ST.
HOPKINTON, MA 01748
508-435-6824
Mass. Cert. No. 313 * Conn. Cert. No. PH-0515 * EPA ID No. MA059

WCL ID #	ACCOUNT #	CODE	PAGE #
91325728	000512		1

SAMPLE IDENTIFICATION INFORMATION

CHATHAM AIRPORT (MW-2)
GROUNDWATER STUDY

REFERRED BY:

GENE SCHRAGER

DUFRESNE-HENRY, INC.
239 LITTLETON RD.
SUITE 1A
WESTFORD, MA.

COLLECTED	RECEIVED	REPORTED
05/12/89 11:00	05/12/89	05/31/89

REPORT: FINAL REPORT

COMMENT:

TESTS	RESULTS	UNITS	DETECTION LIMIT	METHOD #
*** GENERAL INFORMATION				
(COLLECTOR: DUFRESNE-HENRY)				
*** SAMPLE PREPARATION				
DIGESTION-METALS	5/12/89			
DIGESTION-HYDRIDES	5/12/89			
DIGESTION-MERCURY	5/15/89			
*** NUTRIENTS				
NITRATE	<0.5	MG/L	0.5	353.3
*** TRACE METALS	WATER			
ARSENIC	0.233	MG/L	0.005	7061
BARIUM	0.72	MG/L	0.010	6010
CADMIUM	0.001	MG/L	0.001	7131
CHROMIUM, TOTAL	0.480	MG/L	0.001	7191
LEAD	0.126	MG/L	0.001	7421
MERCURY	0.001	MG/L	0.001	7471
SELENIUM	0.007	MG/L	0.005	7741
SILVER	0.002	MG/L	0.001	7760
*** PESTICIDES	WATER			
PEST ANALYSIS DATE:	5/26/89			
PEST EXTRACTION DATE	5/19/89			
ALDRIN	ND	UG/L	0.20	8080
ALPHA-BHC	ND	UG/L	0.20	8080
BETA-BHC	ND	UG/L	0.20	8080
GAMMA-BHC	ND	UG/L	0.20	8080
DELTA-BHC (LINDANE)	ND	UG/L	0.20	8080
CHLORDANE	ND	UG/L	0.20	8080
4,4'-DDD	ND	UG/L	0.20	8080
4,4'-DDE	ND	UG/L	0.20	8080
4,4'-DDT	ND	UG/L	0.20	8080
DIELDRIN	ND	UG/L	0.20	8080
ENDOSULFAN I	ND	UG/L	0.20	8080
ENDOSULFAN II	ND	UG/L	0.20	8080
ENDOSULFAN SULFATE	0.90	UG/L	0.20	8080
ENDRIN	ND	UG/L	0.20	8080
ENDRIN ALDEHYDE	ND	UG/L	0.20	8080
HEPTACHLOR	ND	UG/L	0.20	8080
HEPTACHLOR EPOXIDE	ND	UG/L	0.20	8080

CONTINUED ON NEXT PAGE

Gervais

CHATHAM AIRPORT
Chatham, Mass.

Date Drilled: April 18, 1989 and April 19, 1989

M-1

0 -55' Sand Gravel
55 -60' Gray Clay
60 -70' Sand Gravel
Static: 57'
69' Deep

M-2

0 -50' Sand Gravel
50 -55' Gray Clay
60 -75' Sand Gravel
Static: 57'
74' Deep

M-3

0 -55' Sand Gravel
55 -60' Gray Clay
60 -70' Sand Gravel
Static: 56'
71' Deep

M-4

0 -50' Sand Gravel
50 -60' Gray Clay
60 -75' Sand Gravel
Static: 58'
74' Deep

M-5

0 -45' Sand Gravel
45 -55' Gray Clay
55 -75' Sand Gravel
Static: 49'
74' Deep

DRILLING CONTRACTORS • WATER SYSTEMS
RFD 1098A • VINEYARD HAVEN, MA 02568 • 693-4999

3.3 GROUNDWATER QUALITY

Groundwater samples were collected from monitoring wells, MW-1 - MW-5 on May 12 and July 20, 1989. The chemical results for these two rounds of sampling have been summarized on Tables 3 and 4 and compiled in Appendix D. There were no available historic water quality data for the Airport to compare with the results of the aforementioned two rounds of sampling.

The pH varied between 5.96 and 6.70 for both rounds with an arithmetic mean of 6.32. In general, the slightly acidic pH's are consistent with groundwater conditions in the Cape Cod and other New England aquifers. Specific conductance ranged between 80-250 microohms/cm with an arithmetic mean of 161 microohms/cm. Specific conductance is a measure of the dissolved minerals in the groundwater. The sampling results indicate a low dissolved mineral content.

The concentration of nitrate varied from 0.5 to 3.0 ppm. The highest concentrations of nitrate, 2.0 ppm and 3.0 ppm, were detected in monitoring well MW-3. This well is located downgradient from the Airport subsurface sewage disposal system (see Appendix A in back pocket). These results are below the EPA primary drinking water limit of 10 ppm.

The concentration of chloride varied from 12 to 65 ppm with an arithmetic mean of 29 ppm. These results are below the EPA secondary drinking water limit of 250 ppm.

The concentrations of several of the heavy metals from "unfiltered" groundwater samples for the first round of sampling exceeded the EPA Safe Drinking Water Standards. These concentrations were high because the samples were not filtered prior to analysis and as such, both suspended solids (metals in suspension) and metals in solution were determined. For Round #2, the

heavy metal concentrations on "filtered" groundwater samples were all below the EPA maximum contaminant levels. Therefore, we consider the second round results and not the first to be representative of the true groundwater quality for heavy metals.

For Round #1, no VOC's (EPA Method 524) or EDB (EPA Method 504) were detected in the monitoring wells except chloroform in monitoring wells MW-4 and MW-5. The levels of chloroform were 0.7 and 0.5 ppm, respectively. We believe that these low levels of chloroform occur naturally in groundwater in proximity to a marine environment. No VOC's or EDB were detected in Round #2.

Neither herbicides nor acid, base, neutral compounds were detected in either round of sampling.

The pesticide endosulfane sulfate was detected in Round #1 in monitoring wells MW-2, MW-3, and MW-5 at concentrations of 0.90, 0.88, and 0.62 ppb, respectively. The source of the endosulfane sulfate is uncertain, but may have originated at the Cape Cod Mosquito Control property. No pesticides were detected in Round #2.

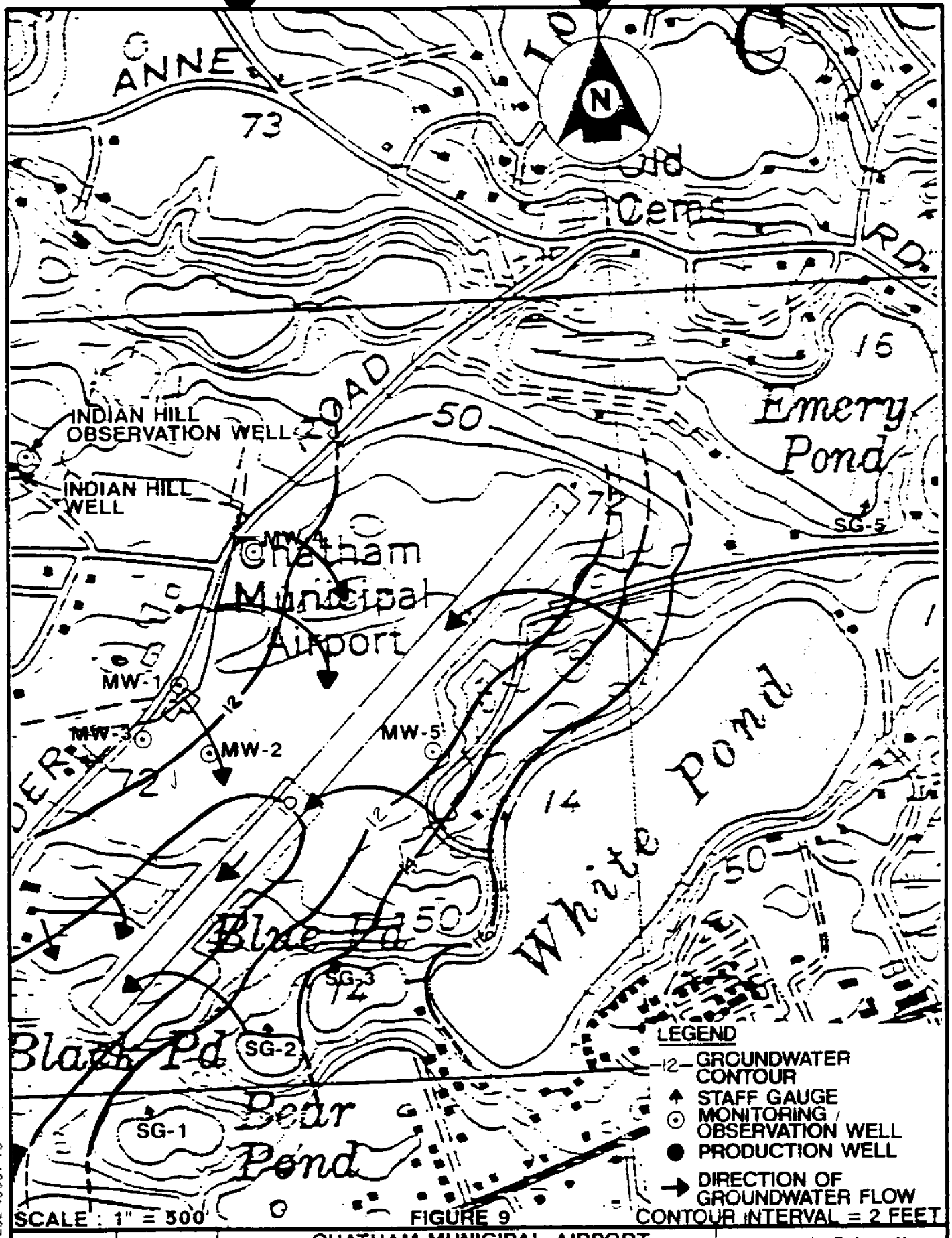


FIGURE 9

Client No.	817050
Proj. Mgr.	DFE
Date	6/9/89

CHATHAM MUNICIPAL AIRPORT
GROUNDWATER CONTOUR MAP
CHATHAM MASSACHUSETTS

Dufresne-Henry Inc.

A

BRUNING 44 232 45337-13

TABLE 1

MONITORING WELL DATA

Well Identification	Well Depth (feet)	Length of Screen (feet)	Elevation of Well (feet) Top of PVC Casing	Screen El. (MSL)
MW-1	69	10	69.46	0 to 10'
MW-2	74	10	61.96	-14 to -4
MW-3	71	15	67.23	-4 to 11'
MW-4	74	15	68.78	-6 to 9'
MW-5	74	10	64.71	-10 to 0

RATIONALE FOR 7X SCREEN LENGTHS & LOCATIONS?

The construction of a typical monitoring well is shown on Figure 5.

Water level information was taken at the five monitoring wells, Indian Hill Well, Indian Hill observation well, and the five ponds. All water level observation locations were surveyed with respect to the National Geodetic Vertical Datum (N.G.V.D.) (Appendix C).

The locations of the five monitoring wells were selected in order to characterize the site hydrogeology and groundwater quality conditions according to the following criteria: provide sufficient upgradient water level and groundwater quality information; provide sufficient downgradient water level and groundwater quality information; and locate and identify potential sources of contamination. Only the five monitoring wells were sampled and analyzed as part of the Groundwater Management Plan. Groundwater level measurements were taken at the other locations (see above) to supplement on-site data for groundwater flow conditions.

BRUNING 44-232 45337-13

Client No.	817050
Proj. Mgr.	DFE.
Date	OCT. 89

CHATHAM MUNICIPAL AIRPORT
GEOLOGIC PROFILE (A-A')
SEE FIGURE 4 FOR LOCATION OF PROFILE
CHATHAM MASSACHUSETTS

Dufresne-Henry Inc.

A

FIGURE 8

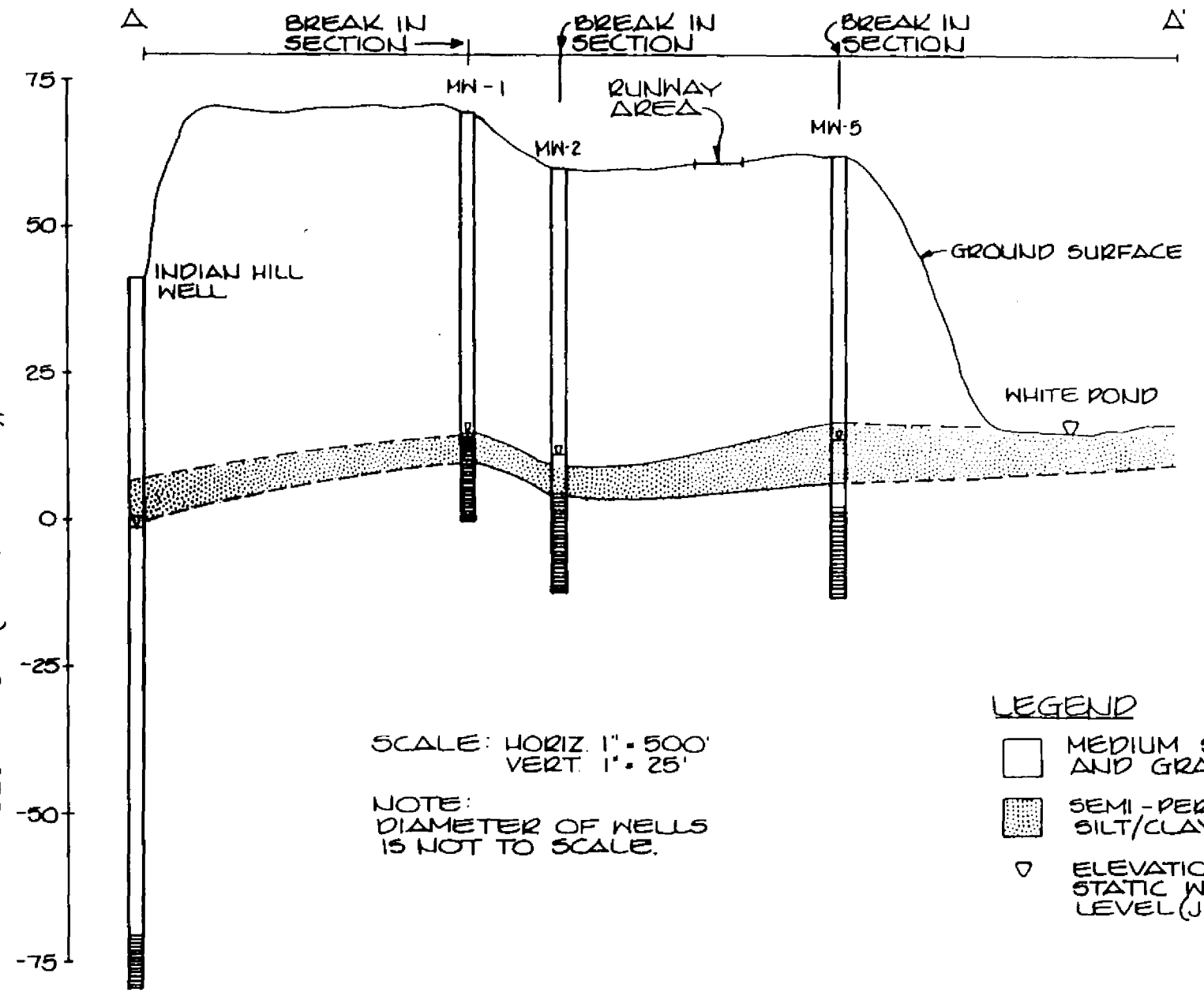
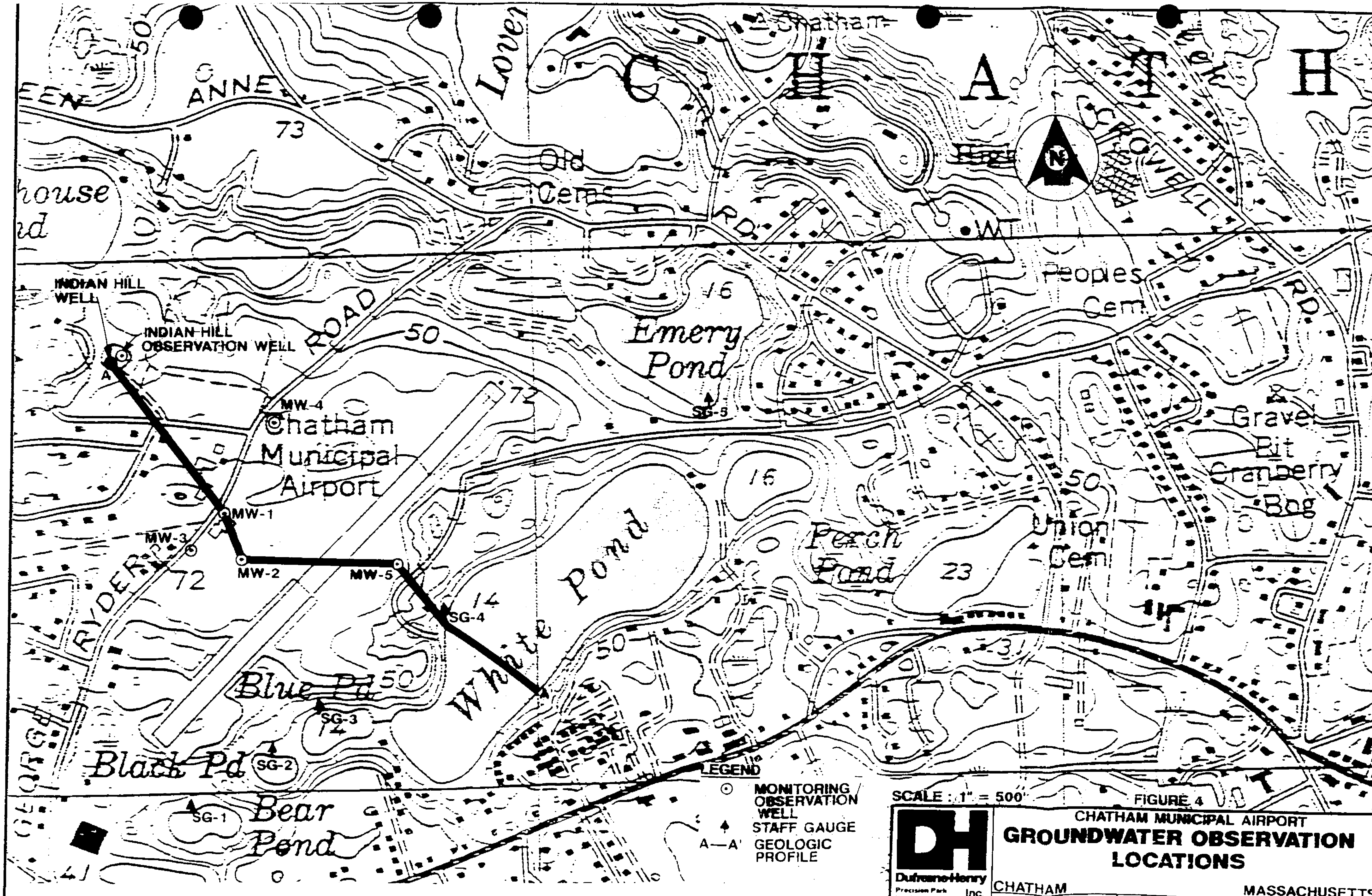


Table 2. Ground Water Elevation Data

LOCATION	ELEVATION TOP OF PVC CASING OR STAKE (feet)	WATER LEVEL MEASUREMENTS (feet) DEPTH OF WATER TOP OF WELL			ELEVATION OF GROUND WATER, USGS DATUM (feet)		
		MAY 15, 1989	JUNE 9, 1989	JULY 20, 1989	MAY 15, 1989	JUNE 9, 1989	JULY 20, 1989
MW-1	69.46	55.57	54.83	54.46	13.89	14.63	15.00
MW-2	61.96	50.53	50.24	50.27	11.43	11.72	11.69
MW-3	67.23	54.67	54.87	54.81	12.56	12.36	12.42
MW-4	68.78	55.09	57.89	58.10	13.69	10.89	10.68
MW-5	64.71	54.08	53.88	50.23	10.63	10.83	14.48
INDIAN HILL	42.40	34.48	42.07	35.20	7.92	0.33	-0.72
INDIAN OBS-A	44.14	33.55	34.37	35.36	10.59	9.77	8.78
BEARSE P SG-1	14.40				13.06	13.31	13.47
BLACK P SG-2	15.21				14.01	14.10	14.32
BLUE P SG-3	16.65				15.56	15.62	15.72
WHITE P SG-4	16.87				15.56	16.07	15.72
EMERY P SG-5	18.56				17.12	17.92	16.89

BRUNING 45337-3



LEGEND

- ⊙ MONITORING / OBSERVATION WELL
- ▲ STAFF GAUGE
- A—A' GEOLOGIC PROFILE

SCALE : 1" = 500'

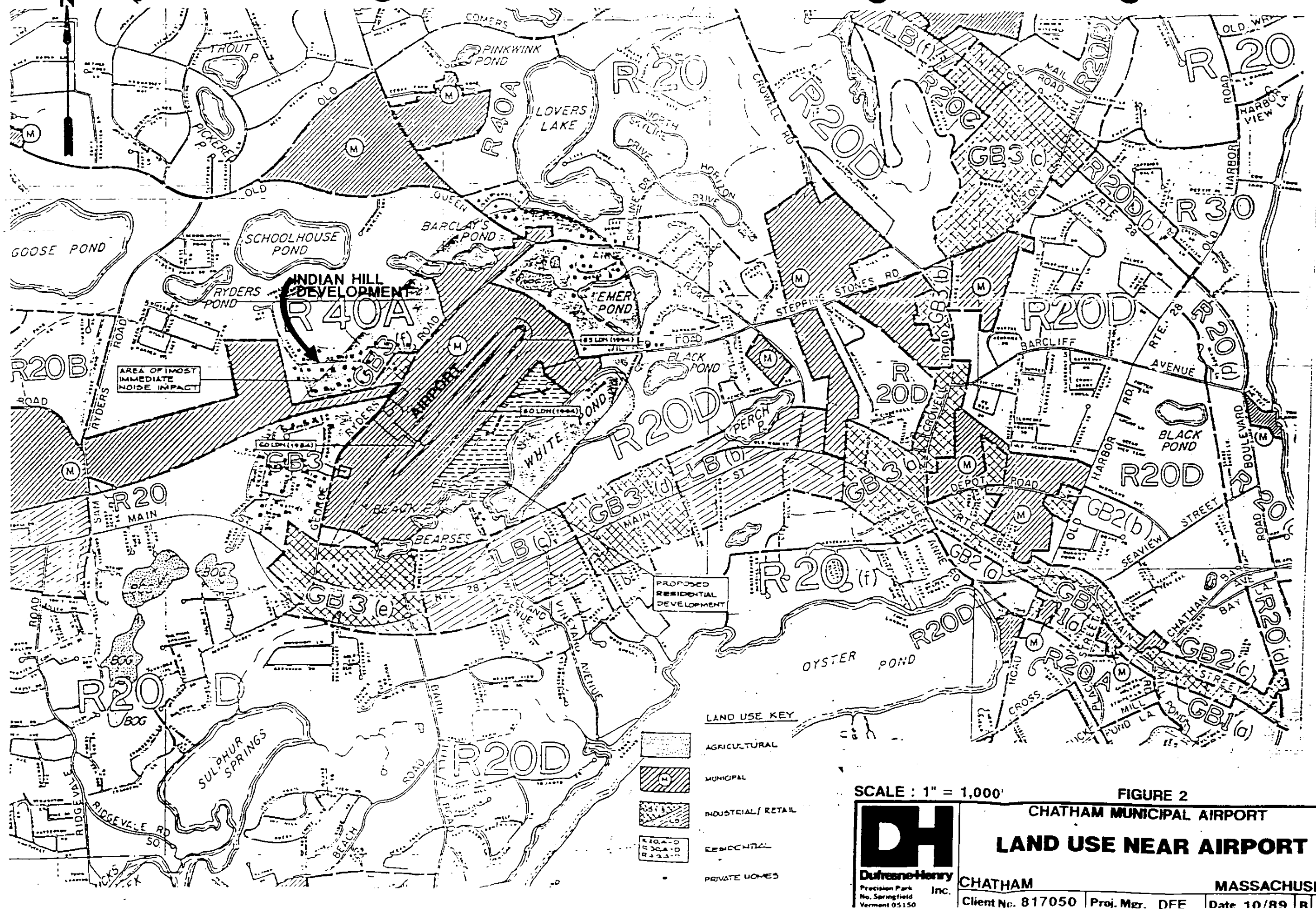
FIGURE 4

CHATHAM MUNICIPAL AIRPORT

GROUNDWATER OBSERVATION LOCATIONS

DH Dufresne-Henry Inc. Precision Park No. Springfield Vermont 05150

CHATHAM		MASSACHUSETTS	
Client No. 817050	Proj. Mgr. DFE	Date OCT 89	B



SCALE : 1" = 1,000'

FIGURE 2

CHATHAM MUNICIPAL AIRPORT

LAND USE NEAR AIRPORT

CHATHAM MASSACHUSETTS

Client No. 817050	Proj. Mgr. DEE	Date 10/89	R

Dufresne-Henry Inc.
Precision Park
No. Springfield
Vermont 05150

45337-3

BRUNING

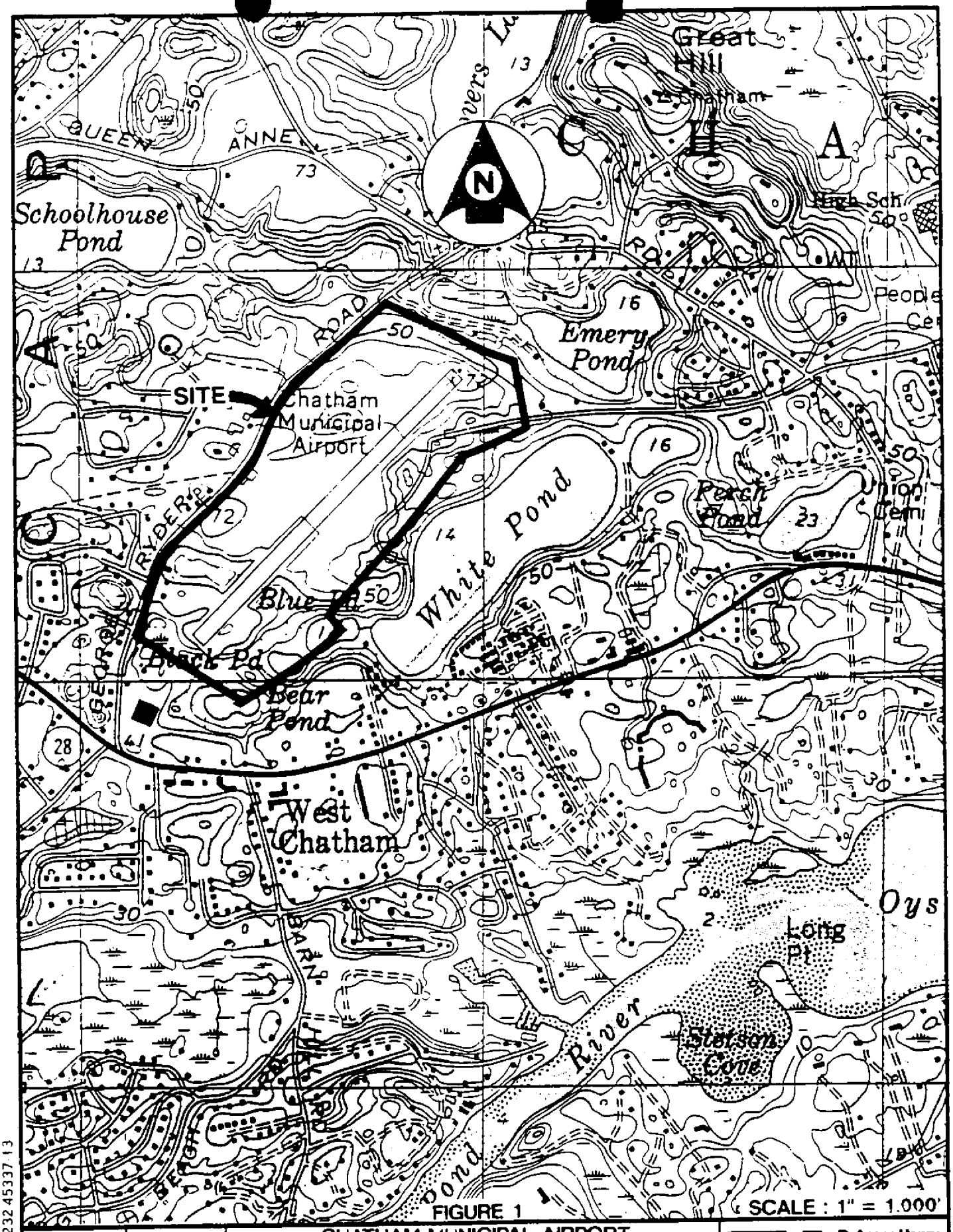


FIGURE 1

SCALE : 1" = 1,000'

Client No.	817050	CHATHAM MUNICIPAL AIRPORT	Dufresne-Henry Inc.
Proj. Mgr.	DFE	**LOCATION MAP**	
Date	NOV89	CHATHAM MASSACHUSETTS	A

BRUNING 44 232 45337 13

50' VEGETATION BUFFER

10 UNIT T-HANGARS 30' x 300'

RESERVED FOR FUTURE T-HANGARS

8 UNIT T-HANGARS 40' x 280'

AUTO PARKING (67,500 SF - ULT.)

TERMINAL BUILDING & MAINT. HANGAR

NEW UNDERGROUND FUEL FARM

2 - 10" ROTATING BEACON

EXISTING FUEL AREA (2 PUMPS) TO BE RELOCATED

GEORGE RYDER ROAD

8 A/C

16 A/C

15 A/C

14 A/C

29 A/C

37 A/C

21 A/C

22 A/C

46 A/C

38 A/C

A.I.P. 3-25-0015-04
T-HFP APRON TIE DOWN
T/85 (185' x 500')
44 AIRCRAFT

TURF TIE-DOWNS

EXISTING EARTH BERM

(ULT) BUILDING RESTRICTION LINE & AIRCRAFT PARKING LIMIT

(EXIST.) BUILDING RESTRICTION LINE & AIRCRAFT PARKING LIMIT

3,000' x 100' (EXIST. & ULT.)

ARP

BEARING : N 42° 55' 35" E (TRUE)

24

BUILDING RESTRICTION LINE & AIRCRAFT PARKING LIMIT (EXIST.)

8' WIND CONE

SEAPLANE EASEMENT TO WHITE POND

LEGEND		
EXISTING	PROPOSED	
		PROPERTY LINE
		B.R.L. & A.P.L.
		ELEVATION CONTOURS
		BUILDINGS (ON AIRPORT)
		FENCE
		AUTO PAVEMENT
		AIRCRAFT PAVEMENT
		WOODED AREA
		EARTH BERM

0 100 200 300

SCALE IN FEET
1" = 100'

APPENDIX B

MASTER PLAN UPDATE

TERMINAL AREA PLAN

CHATHAM, MASSACHUSETTS

Dufresne-Henry Inc.
321 Washington Ave
Pittsfield

Client No.	300121
Proj. Manager	M.J. DELUCA
Proj. Designer	J.W. McGRATH
Drawn By	C.W. MILLS
Checked By	J.W. McGRATH
Scale	1" = 100'
Approved	

Sheet 3 of 6

ING 44 132 45337 3

Gervais

CHATHAM AIRPORT
Chatham, Mass.

Date Drilled: April 18, 1989 and April 19, 1989

M-1

0 -55' Sand Gravel
55 -60' Gray Clay
60 -70' Sand Gravel
Static: 57'
69' Deep

M-2

0 -50' Sand Gravel
50 -55' Gray Clay
60 -75' Sand Gravel
Static: 57'
74' Deep

M-3

0 -55' Sand Gravel
55 -60' Gray Clay
60 -70' Sand Gravel
Static: 56'
71' Deep

M-4

0 -50' Sand Gravel
50 -60' Gray Clay
60 -75' Sand Gravel
Static: 58'
74' Deep

M-5

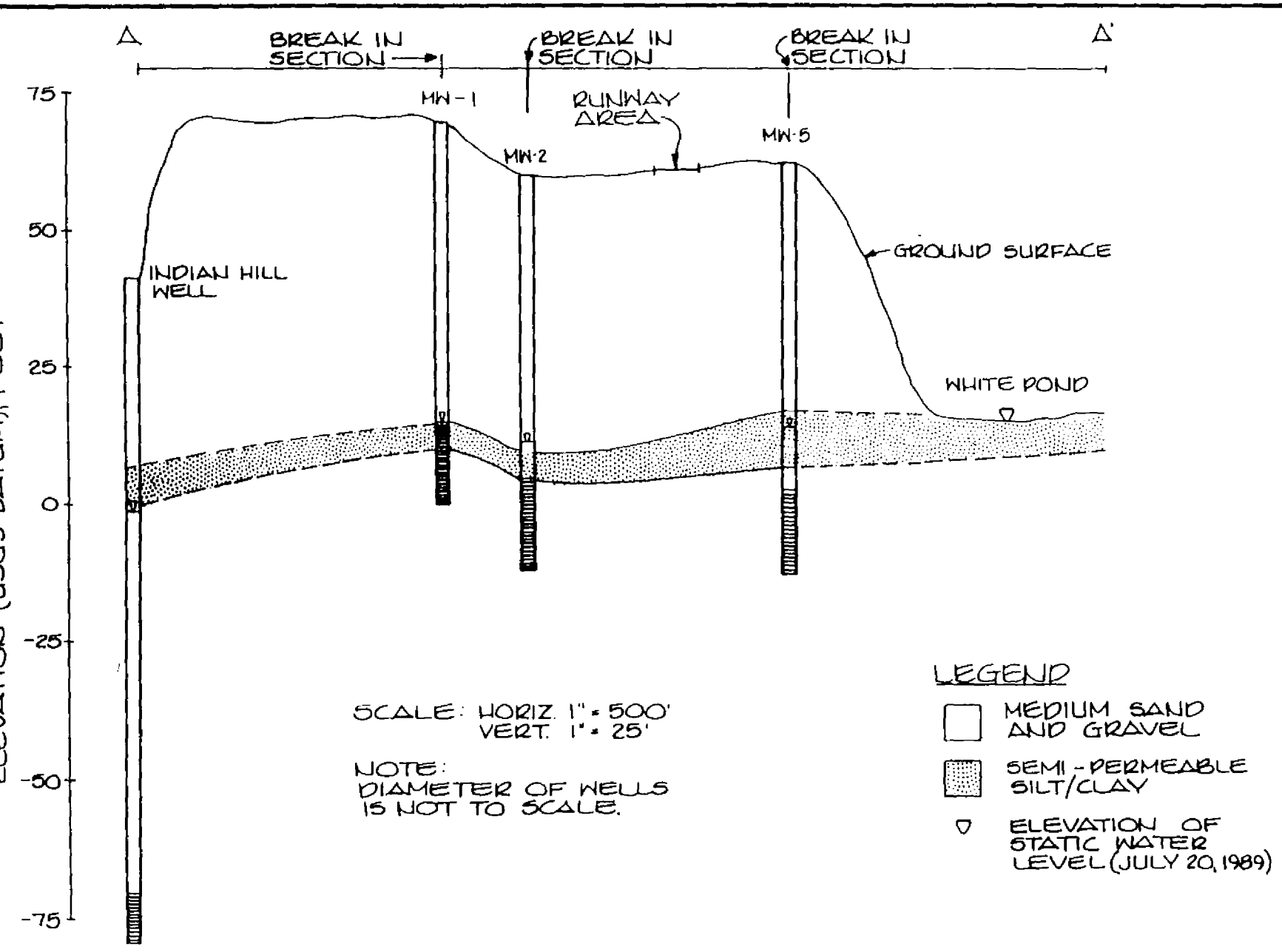
0 -45' Sand Gravel
45 -55' Gray Clay
55 -75' Sand Gravel
Static: 49'
74' Deep

DRILLING CONTRACTORS • WATER SYSTEMS
RFD 1098A • VINEYARD HAVEN, MA 02568 • 693-4999

Client No.	817050
Proj. Mgr.	D.F.E.
Date	OCT. 89

CHATHAM MUNICIPAL AIRPORT
GEOLOGIC PROFILE (A-A')
SEE FIGURE 4 FOR LOCATION OF PROFILE
CHATHAM MASSACHUSETTS

FIGURE 8



Dufresne-Henry

A