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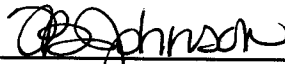


**Routine Calculations Report
In Support of Task 6 of AP-114**

**Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of
the Culebra Dolomite Member of the Rustler Formation near the WIPP
Site, May 2007, Revision 1**

**(AP-114: Analysis Plan for Evaluation and Recalibration of Culebra
Transmissivity Fields, Revision 1, ERMS 548162)**

WBS 1.4.2.3

Report Date: April 22, 2008

Author:	 _____ Patricia B. Johnson, 6712 Consulting Scientist	<u>4/30/08</u> Date
Technical Review:	 _____ Richard L. Beauheim, 6712 Sandia National Laboratories	<u>4/24/08</u> Date
QA Review:	 _____ Shelly Johnson, 6710 Carlsbad Programs Group	<u>4-30-08</u> Date

WIPP:1.4.2.3.TD:QA-L:REVERT:541153

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Title of Calculation:

Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007 in support of Task 6 of AP-114.

1. Planning Document:

AP-114 (ERMS 548162): Analysis Plan for Evaluation and Recalibration of Culebra Transmissivity Fields, Revision 1, Task 6, Calculation of Freshwater Heads and Compilation of Transient Heads to be Used in T-Field Calibration.

Note: A slight deviation from the task 6 specifications in AP-114 is more recent data (2007) were used to calculate freshwater heads in the Culebra than was specified in AP-114 (late 2004 or early 2005) so that more current head data could be used.

2. Description of Calculation Process:

A. The available freshwater head data for WIPP wells completed in the Culebra Dolomite Member of the Rustler Formation to be used in the MODFLOW model of the Culebra Dolomite at the WIPP for May 2007 were calculated in *2007_FreshH2OHead_Data_Rev1.xls* file created in Excel, on the *2007_FreshH2O Head Data* spreadsheet. The spreadsheet includes the supporting data and calculations utilized in the development of freshwater heads to create the 2007 Culebra potentiometric surface map. Attempts were made to use May 2007 water level elevation data for the potentiometric surface map; however, because of lack of data availability, other time periods were used when necessary. The *2007_FreshH2O Head Formula* spreadsheet includes the formulas contained in the data spreadsheet cells. The spreadsheet entries were verified by Shelly Johnsen, Organization 6710. Each column in the spreadsheet and its contents are described below:

- A – Well ID – Well name
- B – RTK - UTM NAD27 Y (m) – RTK survey UTM location coordinate
- C – RTK - UTM NAD27 X (m) – RTK survey UTM location coordinate
- D – RTK - Ground Surface Elevation NGVD29 (ft AMSL)
- E – RTK – Reference Casing Elevation NGVD29 (ft AMSL)
- F – Reference Casing Represents – Well reference point for depth to water measurements
- G – Depth of H2O Below TOC (ft) w TOC adjust – Depth to water measurement including any applicable top of casing adjustment
- H – Source of Water Level – Organization that collected the depth to water level measurement, and date noted when not May 2007
- I – Water-Level Elevation (ft AMSL) – (Formula = Column E - Column G)
- J – Water Level Elevation (m AMSL) – (Formula = Column I*.3048)
- K – Depth to Middle/Center of Culebra (ft) (ERMS 548032)
- L – Center of Culebra Elevation (ft AMSL) – monument/ground surface elevation minus the depth to Culebra (Column D – Column K)
- M – Head (ft) – water level elevation minus center of Culebra elevation (Column I – Column L)

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- N – Density (g/cm^3) (ERMS 548127) – density value used to calculate the freshwater head in grams per centimeter cubed
- O – Freshwater Head (ft AMSL) – head multiplied by the density value plus the center of Culebra elevation ((Column M*Column N)+Column L)
- P – Freshwater Head (m AMSL) – feet AMSL freshwater head converted to meters AMSL freshwater head (Column O*0.3048)

Following the spreadsheets are hydrographs of the water level data for each well from April 2001 through February 2008. The hydrographs illustrate that the water level data used to calculate the freshwater head equivalents are representative for each well.

Note:

- There were no water level data available in 2007 for WIPP-25 Culebra; therefore, the water level elevation was calculated using levelTroll pressure data. The following method was used to calculate the water level elevation at WIPP-25 on 5/9/2007 at 12:00, where the Troll depth was 355 feet BTOC:

$$\text{Feet of Water above Troll} = (\text{psi-baro psi}) * 2.3067$$

$$\text{Feet of Water above Troll} = (105.395 - 13.052) * 2.3067$$

$$\text{Feet of Water above Troll} = 213.008$$

$$\text{Depth to Water (BTOC)} = \text{depth of Troll} - \text{feet of water}$$

$$\text{Depth to Water (BTOC)} = 355 - 213.008$$

$$\text{Depth to Water (BTOC)} = 141.992 \text{ (rounded to 141.99)}$$

- B. A potentiometric surface map depicting the freshwater heads (ft AMSL) was prepared utilizing the data spreadsheet referenced in item A. The potentiometric surface map contours were developed using the software program Surfer, version 8.0. The parameters used in the Surfer program are as follows:

- Gridding method – Kriging
- Smoothing contours – High
- Contour interval – 5 meters

Notes:

- The potentiometric surface map is for illustration purposes only – it is not used for MODFLOW modeling.
- For contouring purposes, the freshwater head value used for SNL-6 and SNL-15 was 1000 m AMSL. The groundwater in these two wells has not fully recovered since the wells were drilled; therefore, the estimated freshwater head value of 1000 m AMSL was used to simulate anticipated future conditions. The estimated value caused a “bullseye” effect at SNL-15.

3. Identification/Listing of Input, Input sources, and Output:

- Excel spreadsheet including the data – 2007_FreshH2OHead_Data_Rev1.xls
 - Worksheet 1 – 2007 FreshH2O Head Data (printed copy attached and electronic copy provided on attached CD)

- Worksheet 2 – 2007 FreshH2O Head Formula (printed copy attached and electronic copy provided on attached CD)
- Excel spreadsheet including the water level data (April 2001 to February 2008) – Hydrographs.xls
 - Worksheet 1 – C-2737
 - Worksheet 2 – ERDA-9
 - Worksheet 3 – H-2b2
 - Worksheet 4 – H-3b2
 - Worksheet 5 – H-4b
 - Worksheet 6 – H-5b
 - Worksheet 7 – H-6b
 - Worksheet 8 – H-7b1
 - Worksheet 9 – H-9c
 - Worksheet 10 – H-10c
 - Worksheet 11 – H-11b4
 - Worksheet 12 – H-12
 - Worksheet 13 – H-15
 - Worksheet 14 – H-17
 - Worksheet 15 – H-19b0
 - Worksheet 16 – IMC-461
 - Worksheet 17 – SNL-1
 - Worksheet 18 – SNL-2
 - Worksheet 19 – SNL-3
 - Worksheet 20 – SNL-5
 - Worksheet 21 – SNL-6
 - Worksheet 22 – SNL-8
 - Worksheet 23 – SNL-9
 - Worksheet 24 – SNL-10
 - Worksheet 25 – SNL-12
 - Worksheet 26 – SNL-13
 - Worksheet 27 – SNL-14
 - Worksheet 28 – SNL-15
 - Worksheet 29 – SNL-16
 - Worksheet 30 – SNL-17
 - Worksheet 31 – SNL-18
 - Worksheet 32 – SNL-19
 - Worksheet 33 – USGS-4
 - Worksheet 34 – WIPP-11
 - Worksheet 35 – WIPP-13
 - Worksheet 36 – WIPP-19
 - Worksheet 37 – WIPP-25
 - Worksheet 38 – WIPP-30
 - Worksheet 39 – WQSP-1
 - Worksheet 40 – WQSP-2
 - Worksheet 41 – WQSP-3
 - Worksheet 42 – WQSP-4

- Worksheet 43 – WQSP-5
- Worksheet 44 – WQSP-6
- Contour map – 2007_FreshH20Head_plot_Rev1.srf (printed copy attached and electronic copy provided on attached CD)
- Supporting Surfer files – 2007_FreshH20Head_data_Rev1.grd (electronic copy provided on attached CD)

4. Data Qualification for Compliance Decision Analysis:

Data sources provided in Section 7.0, References

5. Software Used:

Microsoft Office Excel 2003 and Surfer 8.0 run on Dell Precision GX390, Intel Core 2 processor under Microsoft Windows XP Professional

6. Reviews:

Technical: Richard L. Beauheim, 6712

QA: Shelly Johnsen, 6710

7. References:

2007 Calculated Densities for Use in Deriving Equivalent Freshwater Heads of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007 (ERMS 548127).

Culebra Center Depths for Use in Calculating Equivalent Freshwater Heads of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007, Revision 1.0 (ERMS 548032).

SNL water level data from the following logbooks:

Long-Term Monitoring Notebook (LTM) 3 (ERMS 546179)

Long-Term Monitoring Notebook (LTM) 4 (ERMS 547753)

Long-Term Monitoring Notebook (LTM) 5 (ERMS 547072)

Long-Term Monitoring Notebook (LTM) 6 (ERMS 548068)

WIPP Site Well Testing (WSWT) 9 (ERMS 545596)

WIPP Site Well Testing (WSWT) 11 (ERMS 548076)

WRES Water Level Data submitted to SNL in monthly memoranda (package ERMS 546636)

WIPP Well Survey Data (package ERMS 547684).

8. List of Attachments:

Printout of Excel file 2007_FreshH20Head_Data_Rev1.xls:

- Worksheet 1 – 2007 FreshH20Head Data

- Worksheet 2 – 2007 FreshH20Head Formula

Printout of Excel file Hydrographs.xls:

- Worksheet 1 – C-2737
- Worksheet 2 – ERDA-9
- Worksheet 3 – H-2b2
- Worksheet 4 – H-3b2
- Worksheet 5 – H-4b
- Worksheet 6 – H-5b
- Worksheet 7 – H-6b
- Worksheet 8 – H-7b1
- Worksheet 9 – H-9c
- Worksheet 10 – H-10c
- Worksheet 11 – H-11b4
- Worksheet 12 – H-12
- Worksheet 13 – H-15
- Worksheet 14 – H-17
- Worksheet 15 – H-19b0
- Worksheet 16 – IMC-461
- Worksheet 17 – SNL-1
- Worksheet 18 – SNL-2
- Worksheet 19 – SNL-3
- Worksheet 20 – SNL-5
- Worksheet 21 – SNL-6
- Worksheet 22 – SNL-8
- Worksheet 23 – SNL-9
- Worksheet 24 – SNL-10
- Worksheet 25 – SNL-12
- Worksheet 26 – SNL-13
- Worksheet 27 – SNL-14
- Worksheet 28 – SNL-15
- Worksheet 29 – SNL-16
- Worksheet 30 – SNL-17
- Worksheet 31 – SNL-18
- Worksheet 32 – SNL-19
- Worksheet 33 – USGS-4
- Worksheet 34 – WIPP-11
- Worksheet 35 – WIPP-13
- Worksheet 36 – WIPP-19
- Worksheet 37 – WIPP-25
- Worksheet 38 – WIPP-30
- Worksheet 39 – WQSP-1
- Worksheet 40 – WQSP-2
- Worksheet 41 – WQSP-3
- Worksheet 42 – WQSP-4
- Worksheet 43 – WQSP-5
- Worksheet 44 – WQSP-6

Printout of 2007_FreshH2OHead_Plot_Rev1.srf (potentiometric surface – Surfer file)
CD including the Excel file, Surfer files, and documentation of calculation file

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2007 FreshH2O Head Data

A Well ID	B RTK - UTM NAD27 Y (m)	C RTK - UTM NAD27 X (m)	D RTK - Ground Surface Elevation NGVD29 (ft AMSL)	E RTK - Reference Casing Elevation NGVD29 (ft AMSL)	F Reference Casing Represents	G May 2007 Depth to Water Data				K Depth to Middle/ Center of Culebra (ft) (ERMS 548032)	L Center of Culebra Elevation (ft AMSL)	M Head (ft)	N Density (g/cm ³) (ERMS 548127)	O Freshwater Head (ft AMSL)	P Freshwater Head (m AMSL)
						Depth of H2O Below TOC (ft) w TOC adjust	Source of Water Level	Water-Level Elevation (ft AMSL)	Water-Level Elevation (m AMSL)						
C-2737	3581400.9	613598.0	3396.2	3400.8	Surface Casing	381.55	WRES	3019.21	920.26	686.5	2709.71	309.50	1.010	3022.41	921.23
ERDA-9	3581944.3	613696.1	3408.9	3410.2	Surface Casing	397.31	WRES	3012.86	918.32	715.9	2692.96	319.90	1.047	3027.94	922.92
H-2b2	3581639.7	612662.5	3376.8	3378.4	Inner Casing	332.64	WRES	3045.72	928.34	634.0	2742.82	302.90	1.014	3049.94	929.62
H-3b2	3580899.6	613693.6	3388.7	3389.9	Inner Casing	388.54	WRES	3001.37	914.82	686.5	2702.18	299.19	1.042	3014.05	918.68
H-4b	3578478.5	612376.0	3332.5	3333.6	Surface Casing	329.81	WRES	3003.77	915.55	503.0	2829.47	174.30	1.015	3006.35	916.34
H-5b	3584807.0	616866.0	3505.0	3506.8	Surface Casing	467.64	WRES	3039.14	926.33	908.5	2596.50	442.63	1.091	3079.33	938.58
H-6b	3584986.9	610598.6	3346.9	3347.7	Surface Casing	288.48	WRES	3059.21	932.45	615.5	2731.41	327.81	1.034	3070.24	935.81
H-7b1	3574646.4	608122.8	3162.3	3163.7	Surface Casing	163.35	WRES	3000.37	914.51	268.5	2893.80	106.57	1.002	3000.60	914.58
H-9c	3568237.2	613971.1	3405.5	3407.0	Surface Casing	412.63	WRES	2994.42	912.70	662.0	2743.54	250.88	1.001	2994.77	912.80
H-10c	3572444.3	622976.3	3687.5	3688.4	Surface Casing	663.97	WRES	3024.43	921.85	1371.2	2316.33	708.10	1.008	3030.18	923.60
H-11b4	3579123.5	615297.3	3409.2	3410.8	Inner Casing	423.93	WRES	2986.86	910.39	734.7	2674.57	312.29	1.070	3008.81	917.09
H-12	3575460.5	617022.0	3425.2	3427.3	Inner Casing	457.30	WRES	2970.03	905.26	836.4	2588.90	381.13	1.097	3007.00	916.53
H-15	3581855.2	615310.0	3479.8	3480.9	Surface Casing	482.25	WRES	2998.64	913.99	870.8	2609.02	389.63	1.053	3019.41	920.32
H-17	3577507.8	615717.0	3383.4	3385.2	Inner Casing	419.13	WRES	2966.11	904.07	718.6	2664.80	301.31	1.133	3006.04	916.24
H-19b0	3580715.8	614515.0	3416.6	3418.3	Inner Casing	426.11	WRES	2992.22	912.03	752.3	2664.36	327.86	1.068	3014.57	918.84
IMC-461	3582246.4	606182.6	3281.1	3283.6	Inner Casing	236.58	WRES	3047.03	928.74	374.0	2907.11	139.92	1.005	3047.75	928.95
SNL-1	3594299.0	613781.4	3510.0	3512.8	Inner Casing	428.84	WRES	3084.00	940.00	610.0	2899.97	184.03	1.033	3090.09	941.86
SNL-2	3586529.1	609113.1	3320.8	3323.1	Inner Casing	249.39	WRES	3073.67	936.86	468.5	2852.32	221.35	1.012	3076.28	937.65
SNL-3	3589046.9	616103.0	3487.9	3490.4	Inner Casing	415.19	WRES	3075.16	937.31	764.1	2723.83	351.33	1.023	3083.37	939.81
SNL-5	3587284.7	611970.2	3377.4	3380.0	Inner Casing	304.05	WRES	3075.93	937.54	646.4	2731.01	344.92	1.010	3079.38	938.59
SNL-6 ¹	3595390.0	621244.6	3643.1	3646.1	Inner Casing	936.43	WRES	2709.68	825.91	1335.3	2307.87	401.82	1.246	2808.38	856.00
SNL-8	3583783.3	618522.8	3552.0	3555.7	Inner Casing	527.51	WRES	3028.22	923.00	966.0	2586.03	442.18	1.103	3073.59	936.83
SNL-9	3582237.7	608704.8	3358.2	3361.0	Inner Casing	309.33	WRES	3051.63	930.14	564.4	2793.76	257.87	1.024	3057.89	932.05
SNL-10	3581764.8	611229.3	3374.1	3377.6	Inner Casing	324.43	WRES	3053.16	930.60	610.0	2764.13	289.03	1.011	3056.22	931.54
SNL-12	3572727.4	613223.4	3337.1	3339.5	Inner Casing	337.88	WRES	3001.57	914.88	568.5	2768.61	232.97	1.005	3002.74	915.24
SNL-13	3577599.8	610394.3	3291.1	3294.2	Inner Casing	284.90	WRES	3009.32	917.24	398.0	2893.06	116.26	1.027	3012.42	918.19
SNL-14	3577652.0	614989.7	3365.0	3368.4	Inner Casing	376.05	SNL - 11/07	2992.35	912.07	666.2	2698.90	293.46	1.048	3006.32	916.33
SNL-15 ¹	3580336.4	618353.2	3477.3	3479.9	Inner Casing	692.36	WRES	2787.57	849.65	920.2	2557.10	230.47	1.228	2840.05	865.65
SNL-16	3578999.7	605191.8	3131.7	3134.7	Inner Casing	121.50	WRES - 9/07	3013.16	918.41	205.0	2926.74	86.42	1.010	3014.06	918.68
SNL-17	3576016.1	609863.2	3235.5	3238.1	Inner Casing	230.98	WRES	3007.08	916.56	347.0	2888.50	118.58	1.006	3007.80	916.78
SNL-18	3591528.6	613605.8	3371.7	3375.4	Inner Casing	298.83	WRES	3076.61	937.75	547.5	2824.25	252.36	1.028	3083.55	939.87
SNL-19	3588947.4	607813.5	3219.1	3222.7	Inner Casing	147.23	WRES	3075.42	937.39	351.5	2867.57	207.85	1.003	3076.06	937.58
USGS-4 ^{2,4}	3569887.0	605841.0	3413.5	3415.9	Surface Casing	426.72	SNL - 4/07	2989.19	911.11	495.5	2917.98	71.21	1.000	2989.19	911.11
WIPP-11	3586474.0	613788.2	3425.5	3427.8	Surface Casing	360.54	WRES	3067.24	934.89	855.5	2569.99	497.24	1.038	3086.13	940.65
WIPP-13	3584241.7	612645.0	3404.8	3405.7	Surface Casing	342.00	WRES	3063.67	933.81	714.5	2690.35	373.32	1.053	3083.27	939.78
WIPP-19	3582773.5	613738.8	3432.4	3435.1	Inner Casing	388.60	WRES	3046.51	928.58	767.4	2664.96	381.55	1.044	3063.18	933.66
WIPP-25 ³	3584022.8	606385.7	3211.8	3214.2	Surface Casing	141.99	Troll - 5/9/07 12:00	3072.25	936.42	459.5	2752.32	320.16	1.011	3076.00	937.57
WIPP-30 ⁵	3589705.4	613716.5	3426.7	3429.2	Inner Casing	347.32	WRES	3081.91	939.37	642.0	2784.67	297.24	1.000	3081.91	939.37
WQSP-1 ⁶	3583430.3	612559.4	3416.1	3419.2	Surface Casing	356.95	WRES	3062.30	933.39	710.5	2705.55	356.75	1.0450	3078.35	938.28
WQSP-2 ⁶	3583972.2	613770.4	3460.8	3463.9	Surface Casing	396.38	WRES	3067.49	934.97	822.0	2638.85	428.64	1.0375	3083.56	939.87
WQSP-3 ⁶	3583506.8	614685.5	3477.5	3480.1	Surface Casing	464.25	WRES	3015.89	919.24	857.2	2620.27	395.62	1.1425	3072.27	936.43
WQSP-4 ⁶	3580762.8	614724.5	3430.4	3433.1	Surface Casing	443.35	WRES	2989.74	911.27	778.2	2652.19	337.55	1.0800	3016.74	919.50
WQSP-5 ⁶	3580353.6	613666.5	3381.7	3384.4	Surface Casing	378.98	WRES	3005.40	916.05	656.0	2725.67	279.73	1.0250	3012.39	918.18
WQSP-6 ⁶	3580737.9	612602.3	3361.6	3364.7	Surface Casing	343.73	WRES	3020.99	920.80	594.0	2767.61	253.38	1.0150	3024.79	921.96

Notes:

1. Heads are many years away from stabilizing; values of 1000m were used for modeling.
2. USGS-4 coordinates are from Gonzales (1989, SAND88-1065)
3. WIPP-25 water level calculated using psi, therefore H2O above Troll not corrected for density, H2O below Troll corrected for density
4. The calculated density for USGS-4 was 0.97; a value of 1.0 was used for freshwater head calculation
5. The calculated density for WIPP-30 was 0.994; a value of 1.0 was used for freshwater head calculation
6. The densities for WQSP-1 through WQSP-6 are averages of Round 22 (sample and duplicate) and Round 23 (sample and duplicate)

Information Only

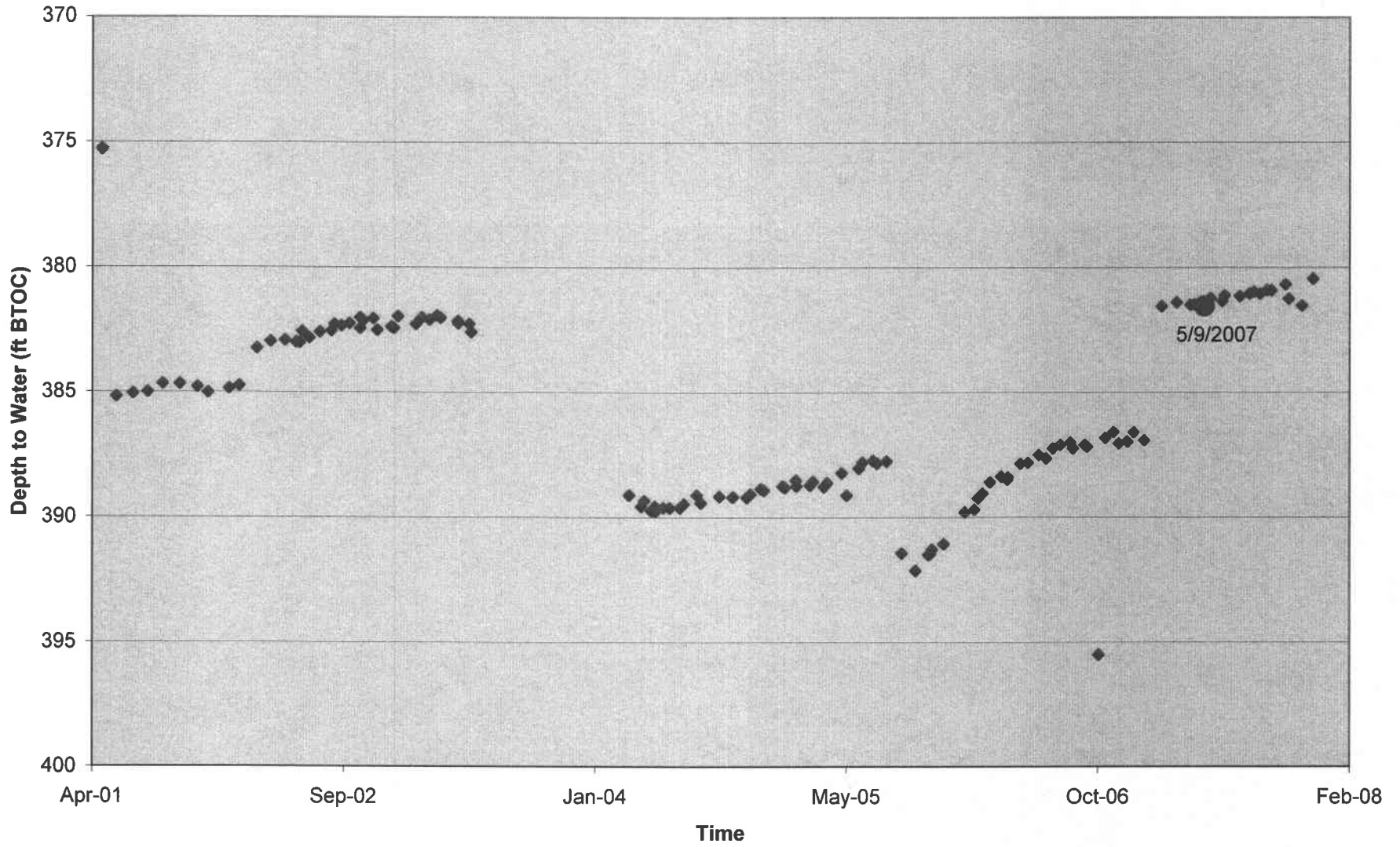
2007 FreshH2O Head Formula

A Well ID	B RTK - UTM NAD27 Y (m)	C RTK - UTM NAD27 X (m)	D RTK - Ground Surface Elevation NGVD29 (ft AMSL)	E RTK - Reference Casing Elevation NGVD29 (ft AMSL)	F Reference Casing Represents	G May 2007 Depth to Water Data				K Depth to Middle/ Center of Culebra (ft) (ERMS 548032)	L Center of Culebra Elevation (ft AMSL)	M Head (ft)	N Density (g/cm ³) (ERMS 548127)	O Freshwater Head (ft AMSL)	P Freshwater Head (m AMSL)
						Depth of H2O Below TOC (ft) w TOC adjust	Source of Water Level	Water-Level Elevation (ft AMSL)	Water-Level Elevation (m AMSL)						
C-2737	3581400.946	613598.024	3396.214	3400.764	Surface Casing	381.55	WRES	=E4-G4	=I4*0.3048	686.5	=D4-K4	=I4-L4	1.01032370894648	=(M4*N4)+L4	=O4*0.3048
ERDA-9	3581944.327	613696.117	3408.855	3410.167	Surface Casing	397.31	WRES	=E5-G5	=I5*0.3048	715.9	=D5-K5	=I5-L5	1.04715034025086	=(M5*N5)+L5	=O5*0.3048
H-2b2	3581639.689	612662.545	3376.824	3378.362783326	Inner Casing	332.64	WRES	=E6-G6	=I6*0.3048	634	=D6-K6	=I6-L6	1.01393932342182	=(M6*N6)+L6	=O6*0.3048
H-3b2	3580899.628	613693.599	3388.681	3389.9144758239	Inner Casing	388.54	WRES	=E7-G7	=I7*0.3048	686.5	=D7-K7	=I7-L7	1.0423684502679	=(M7*N7)+L7	=O7*0.3048
H-4b	3578478.454	612376.001	3332.474	3333.58	Surface Casing	329.81	WRES	=E8-G8	=I8*0.3048	503	=D8-K8	=I8-L8	1.01480625364005	=(M8*N8)+L8	=O8*0.3048
H-5b	3584807.018	616865.971	3505.003	3506.775	Surface Casing	467.64	WRES	=E9-G9	=I9*0.3048	908.5	=D9-K9	=I9-L9	1.09081606134476	=(M9*N9)+L9	=O9*0.3048
H-6b	3584986.9	610598.633	3346.906	3347.693	Surface Casing	288.48	WRES	=E10-G10	=I10*0.3048	615.5	=D10-K10	=I10-L10	1.03363269653144	=(M10*N10)+L10	=O10*0.3048
H-7b1	3574646.432	608122.842	3162.3	3163.718	Surface Casing	163.35	WRES	=E11-G11	=I11*0.3048	268.5	=D11-K11	=I11-L11	1.00213541450331	=(M11*N11)+L11	=O11*0.3048
H-9c	3568237.166	613971.126	3405.541	3407.047	Surface Casing	412.63	WRES	=E12-G12	=I12*0.3048	662	=D12-K12	=I12-L12	1.00139018209671	=(M12*N12)+L12	=O12*0.3048
H-10c	3572444.276	622976.305	3687.532	3688.402	Surface Casing	663.97	WRES	=E13-G13	=I13*0.3048	1371.2	=D13-K13	=I13-L13	1.00811813675813	=(M13*N13)+L13	=O13*0.3048
H-11b4	3579123.478	615297.262	3409.222	3410.7873383454	Inner Casing	423.93	WRES	=E14-G14	=I14*0.3048	734.65	=D14-K14	=I14-L14	1.07030972653042	=(M14*N14)+L14	=O14*0.3048
H-12	3575460.481	617021.991	3425.249	3427.3254699876	Inner Casing	457.3	WRES	=E15-G15	=I15*0.3048	836.35	=D15-K15	=I15-L15	1.09700563550649	=(M15*N15)+L15	=O15*0.3048
H-15	3581855.208	615310.008	3479.767	3480.892	Surface Casing	482.25	WRES	=E16-G16	=I16*0.3048	870.75	=D16-K16	=I16-L16	1.05330355214437	=(M16*N16)+L16	=O16*0.3048
H-17	3577507.764	615716.992	3383.402	3385.2423674869	Inner Casing	419.13	WRES	=E17-G17	=I17*0.3048	718.6	=D17-K17	=I17-L17	1.13252326624573	=(M17*N17)+L17	=O17*0.3048
H-19b0	3580715.82	614514.98	3416.614	3418.3297849878	Inner Casing	426.11	WRES	=E18-G18	=I18*0.3048	752.25	=D18-K18	=I18-L18	1.068171401485	=(M18*N18)+L18	=O18*0.3048
IMC-461	3582246.353	606182.613	3281.112	3283.6125758119	Inner Casing	236.58	WRES	=E19-G19	=I19*0.3048	374	=D19-K19	=I19-L19	1.00512170612952	=(M19*N19)+L19	=O19*0.3048
SNL-1	3594299.049	613781.437	3509.967	3512.8371241441	Inner Casing	428.84	WRES	=E20-G20	=I20*0.3048	610	=D20-K20	=I20-L20	1.03308869357414	=(M20*N20)+L20	=O20*0.3048
SNL-2	3586529.054	609113.097	3320.823	3323.0613158111	Inner Casing	249.39	WRES	=E21-G21	=I21*0.3048	468.5	=D21-K21	=I21-L21	1.0118	=(M21*N21)+L21	=O21*0.3048
SNL-3	3589046.909	616102.976	3487.933	3490.3508908121	Inner Casing	415.19	WRES	=E22-G22	=I22*0.3048	764.1	=D22-K22	=I22-L22	1.0233758999635	=(M22*N22)+L22	=O22*0.3048
SNL-5	3587284.734	611970.224	3377.359	3379.9771316422	Inner Casing	304.05	WRES	=E23-G23	=I23*0.3048	646.35	=D23-K23	=I23-L23	1.01	=(M23*N23)+L23	=O23*0.3048
SNL-6 ¹	3595389.988	621244.584	3643.116	3646.114283306	Inner Casing	936.43	WRES	=E24-G24	=I24*0.3048	1335.25	=D24-K24	=I24-L24	1.24563194170761	=(M24*N24)+L24	=O24*0.3048
SNL-8	3583783.348	618522.817	3552.034	3555.7282074741	Inner Casing	527.51	WRES	=E25-G25	=I25*0.3048	966	=D25-K25	=I25-L25	1.1026	=(M25*N25)+L25	=O25*0.3048
SNL-9	3582237.698	608704.77	3358.159	3360.9582016378	Inner Casing	309.33	WRES	=E26-G26	=I26*0.3048	564.4	=D26-K26	=I26-L26	1.0243	=(M26*N26)+L26	=O26*0.3048
SNL-10	3581764.844	611229.253	3374.127	3377.5851524747	Inner Casing	324.43	WRES	=E27-G27	=I27*0.3048	610	=D27-K27	=I27-L27	1.0106	=(M27*N27)+L27	=O27*0.3048
SNL-12	3572727.366	613223.418	3337.057	3339.4549116446	Inner Casing	337.88	WRES	=E28-G28	=I28*0.3048	568.45	=D28-K28	=I28-L28	1.005	=(M28*N28)+L28	=O28*0.3048
SNL-13	3577599.768	610394.291	3291.056	3294.2195433068	Inner Casing	284.9	WRES	=E29-G29	=I29*0.3048	398	=D29-K29	=I29-L29	1.0267	=(M29*N29)+L29	=O29*0.3048
SNL-14	3577651.971	614989.677	3365.049	3368.4048449726	Inner Casing	376.05	SNL - 11/07	=E30-G30	=I30*0.3048	666.15	=D30-K30	=I30-L30	1.0476	=(M30*N30)+L30	=O30*0.3048
SNL-15 ¹	3580336.378	618353.19	3477.25	3479.9340274797	Inner Casing	692.36	WRES	=E31-G31	=I31*0.3048	920.15	=D31-K31	=I31-L31	1.22768383580929	=(M31*N31)+L31	=O31*0.3048
SNL-16	3578999.704	605191.791	3131.742	3134.6589208045	Inner Casing	121.5	WRES - 9/07	=E32-G32	=I32*0.3048	205	=D32-K32	=I32-L32	1.0104	=(M32*N32)+L32	=O32*0.3048
SNL-17	3576016.07	609863.173	3235.499	3238.0614349698	Inner Casing	230.98	WRES	=E33-G33	=I33*0.3048	347	=D33-K33	=I33-L33	1.00606911413893	=(M33*N33)+L33	=O33*0.3048
SNL-18	3591528.616	613605.781	3371.749	3375.4430574721	Inner Casing	298.83	WRES	=E34-G34	=I34*0.3048	547.5	=D34-K34	=I34-L34	1.02750489464846	=(M34*N34)+L34	=O34*0.3048
SNL-19	3588947.363	607813.465	3219.072	3222.6539133064	Inner Casing	147.23	WRES	=E35-G35	=I35*0.3048	351.5	=D35-K35	=I35-L35	1.00304806603624	=(M35*N35)+L35	=O35*0.3048
USGS-4 ^{2,4}	3569887	605841	3413.4842519685	3415.91207349081	Surface Casing	426.72	SNL - 4/07	=E36-G36	=I36*0.3048	495.5	=D36-K36	=I36-L36	1	=(M36*N36)+L36	=O36*0.3048
WIPP-11	3586474.001	613788.155	3425.492	3427.776	Surface Casing	360.54	WRES	=E37-G37	=I37*0.3048	855.5	=D37-K37	=I37-L37	1.038007458099	=(M37*N37)+L37	=O37*0.3048
WIPP-13	3584241.7	612644.996	3404.849	3405.666	Surface Casing	342	WRES	=E38-G38	=I38*0.3048	714.5	=D38-K38	=I38-L38	1.0525	=(M38*N38)+L38	=O38*0.3048
WIPP-19	3582773.51	613738.77	3432.355	3435.1084183118	Inner Casing	388.6	WRES	=E39-G39	=I39*0.3048	767.4	=D39-K39	=I39-L39	1.0437050104413	=(M39*N39)+L39	=O39*0.3048
WIPP-25 ³	3584022.801	606385.697	3211.821	3214.239	Surface Casing	141.99	Troll - 5/9/07 12:00	=E40-G40	=I40*0.3048	459.5	=D40-K40	320.16	1.011	=(M40*N40)+L40	=O40*0.3048
WIPP-30 ⁵	3589705.437	613716.478	3426.673	3429.2286574801	Inner Casing	347.32	WRES	=E41-G41	=I41*0.3048	642	=D41-K41	=I41-L41	1	=(M41*N41)+L41	=O41*0.3048
WQSP-1 ⁶	3583430.263	612559.447	3416.053	3419.248	Surface Casing	356.95	WRES	=E42-G42	=I42*0.3048	710.5	=D42-K42	=I42-L42	=(1.05+1.04+1.04+1.05)/4	=(M42*N42)+L42	=O42*0.3048
WQSP-2 ⁶	3583972.186	613770.382	3460.846	3463.865	Surface Casing	396.38	WRES	=E43-G43	=I43*0.3048	822	=D43-K43	=I43-L43	=(1.03+1.03+1.04+1.05)/4	=(M43*N43)+L43	=O43*0.3048
WQSP-3 ⁶	3583506.813	614685.46	3477.47	3480.144	Surface Casing	464.25	WRES	=E44-G44	=I44*0.3048	857.2	=D44-K44	=I44-L44	=(1.15+1.14+1.14+1.14)/4	=(M44*N44)+L44	=O44*0.3048
WQSP-4 ⁶	3580762.78	614724.483	3430.393	3433.09	Surface Casing	443.35	WRES	=E45-G45	=I45*0.3048	778.2	=D45-K45	=I45-L45	=(1.09+1.09+1.07+1.07)/4	=(M45*N45)+L45	=O45*0.3048
WQSP-5 ⁶	3580353.565	613666.505	3381.666	3384.38	Surface Casing	378.98	WRES	=E46-G46	=I46*0.3048	656	=D46-K46	=I46-L46	=(1.03+1.02+1.03+1.02)/4	=(M46*N46)+L46	=O46*0.3048
WQSP-6 ⁶	3580737.907	612602.297	3361.607	3364.721	Surface Casing	343.73	WRES	=E47-G47	=I47*0.3048	594	=D47-K47	=I47-L47	=(1.01+1.02+1.02+1.01)/4	=(M47*N47)+L47	=O47*0.3048

- Notes:
1. Heads are many years away from stabilizing; values of 1000m were used for modeling.
 2. USGS-4 coordinates are from Gonzales (1989, SAND88-1065)
 3. WIPP-25 water level calculated using psi, therefore H2O above Troll not corrected for density, H2O below Troll corrected for density
 4. The calculated density for USGS-4 was 0.97; a value of 1.0 was used for freshwater head calculation
 5. The calculated density for WIPP-30 was 0.994; a value of 1.0 was used for freshwater head calculation
 6. The densities for WQSP-1 through WQSP-6 are averages of Round 22 (sample and duplicate) and Round 23 (sample and duplicate)

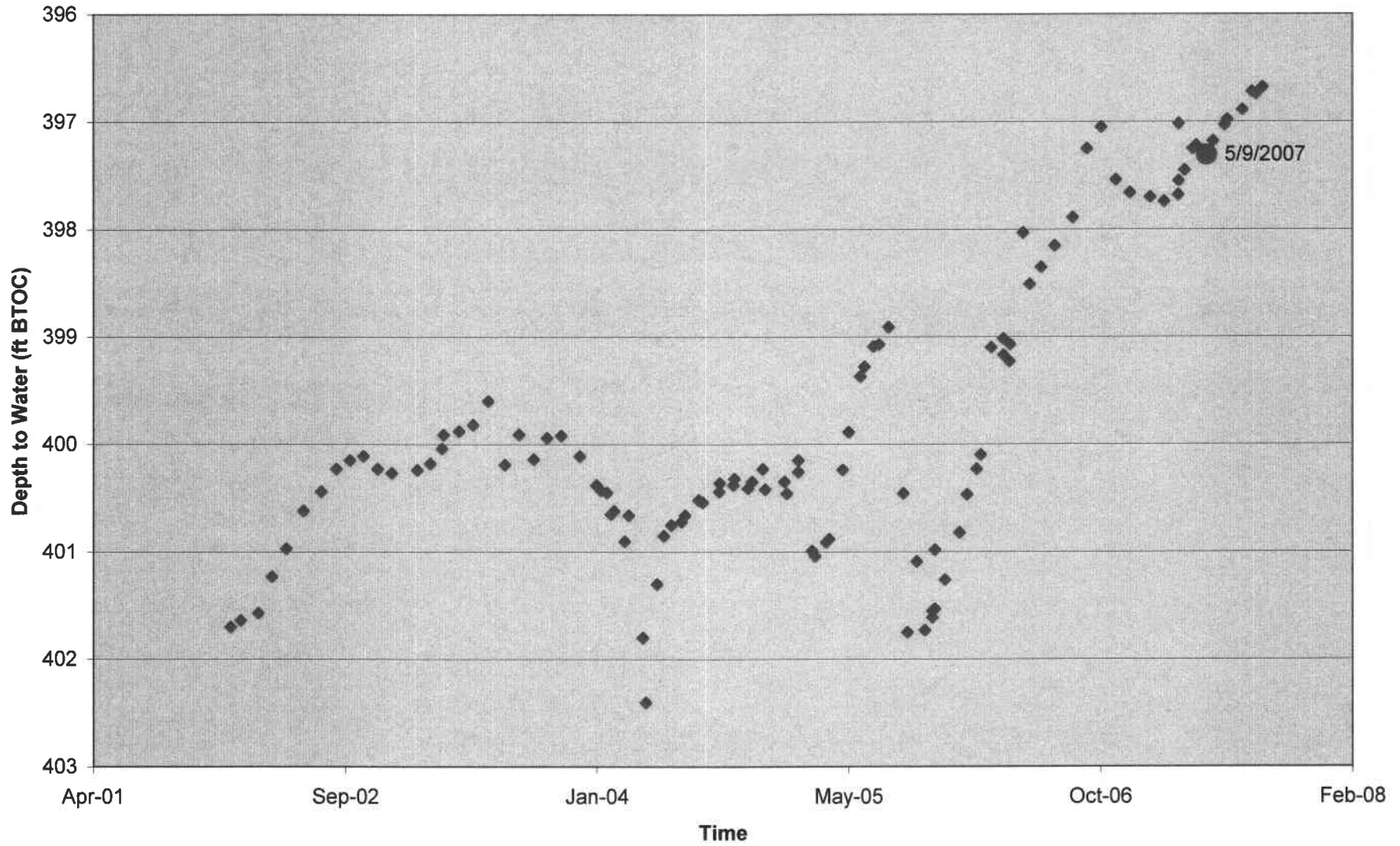
Information Only

C-2737



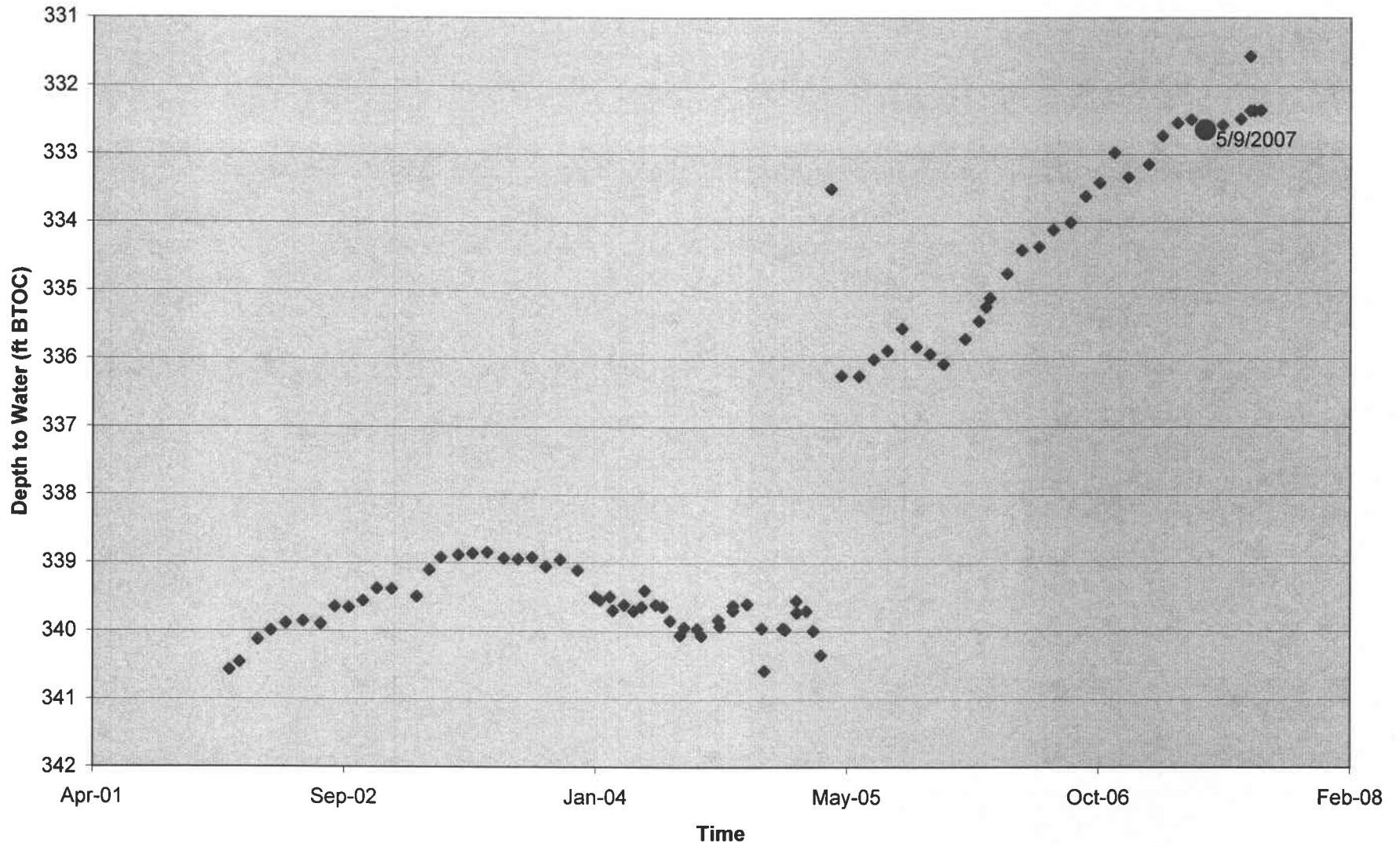
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ERDA-9



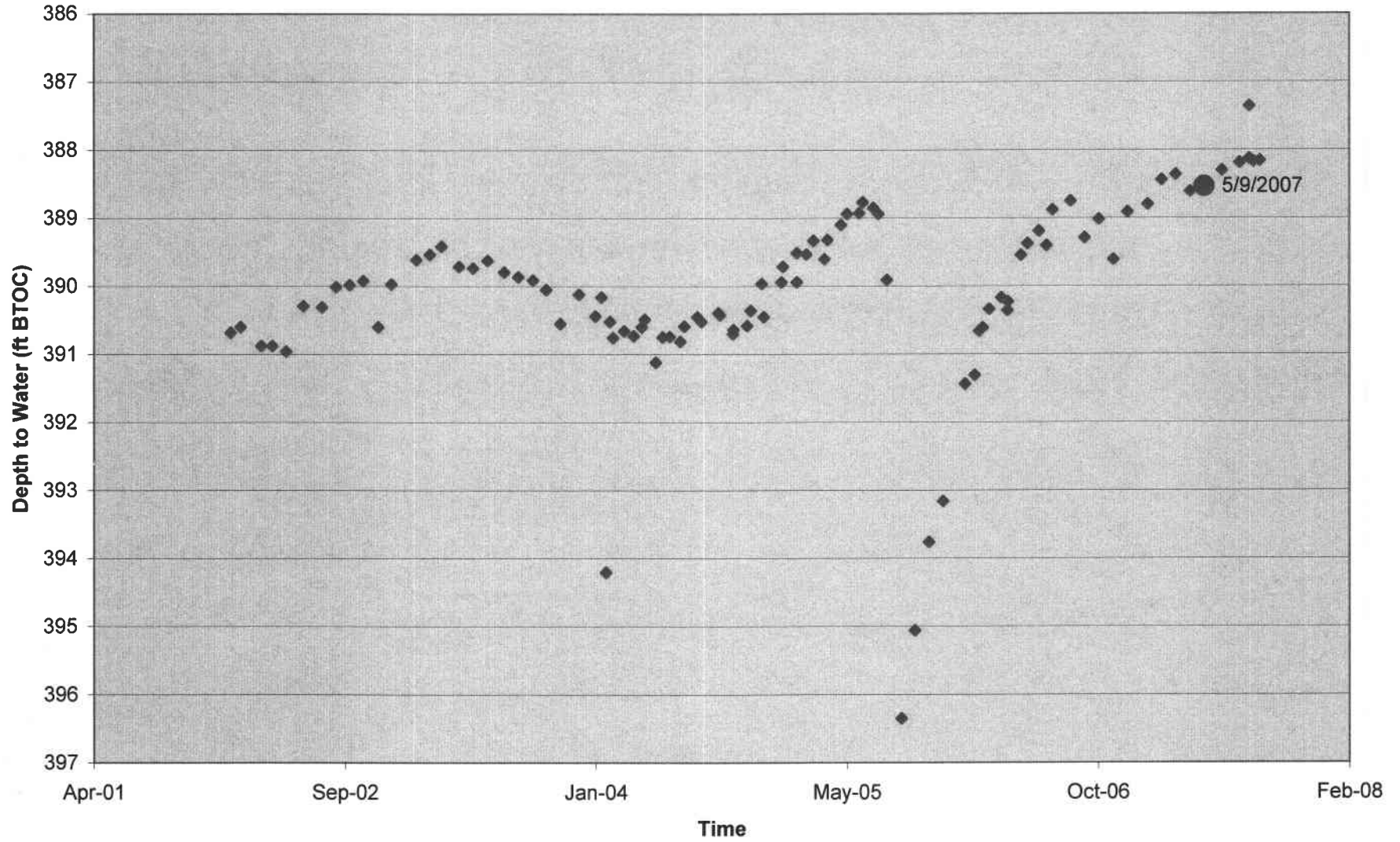
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H-2b2



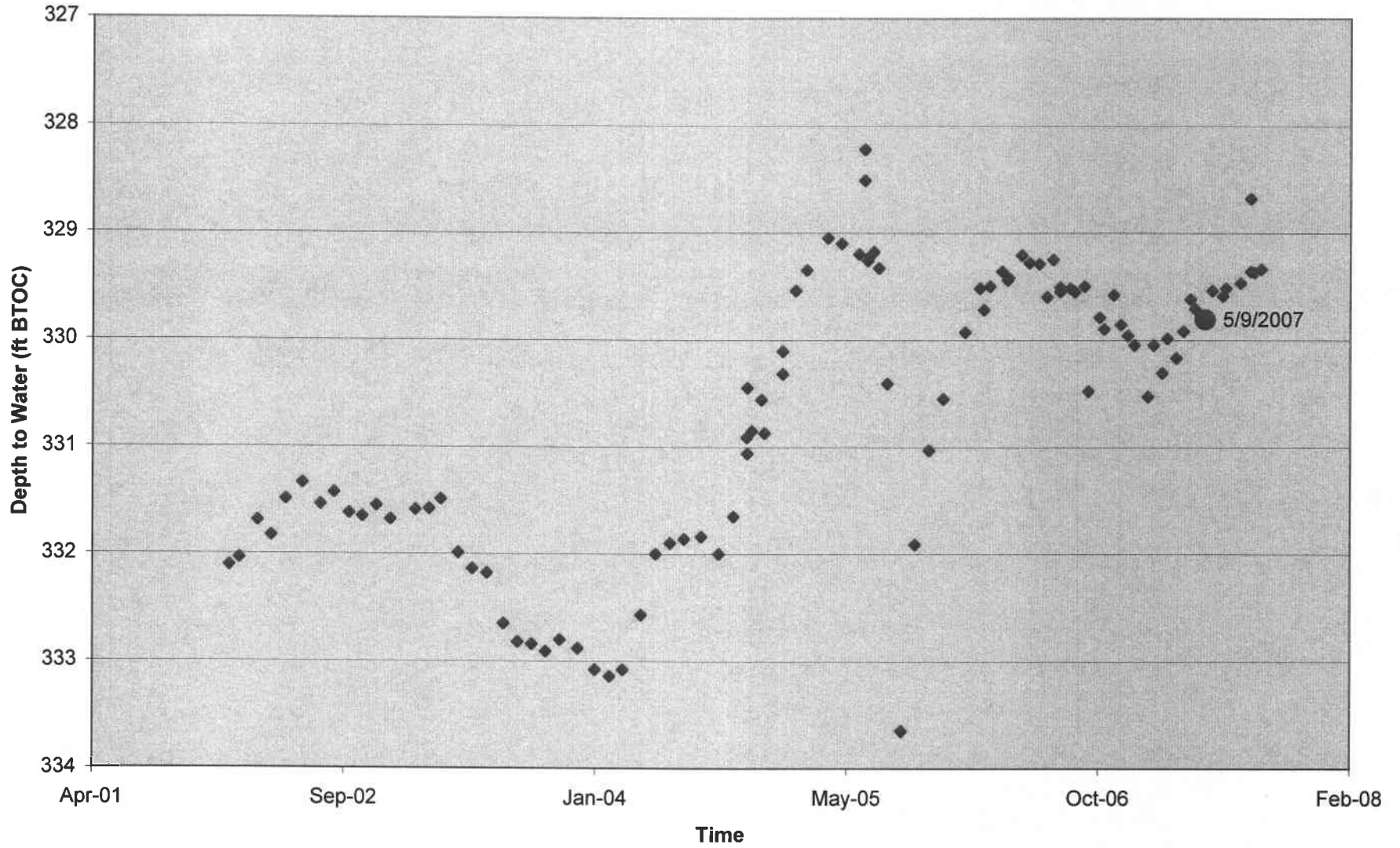
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H-3b2



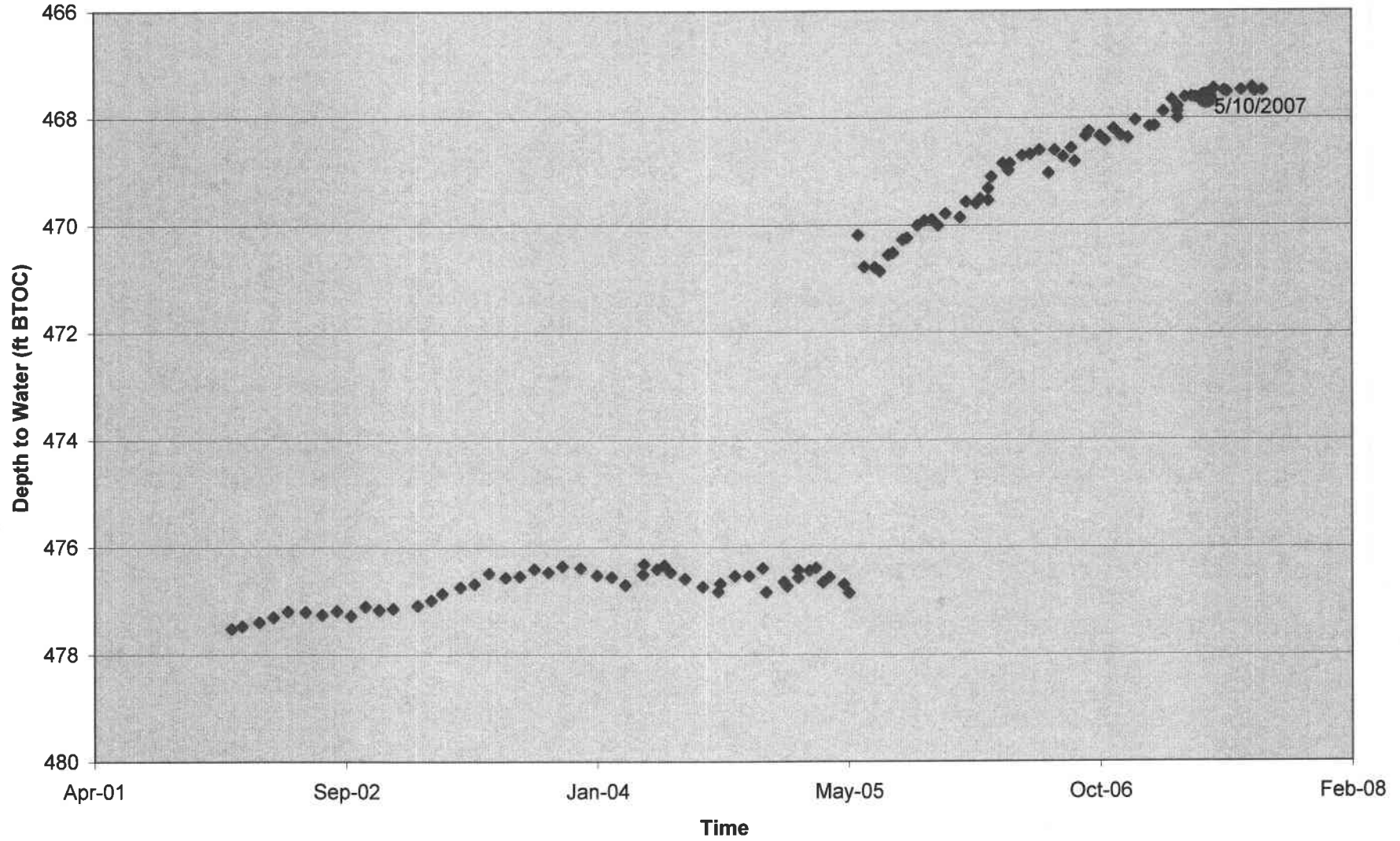
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H-4b



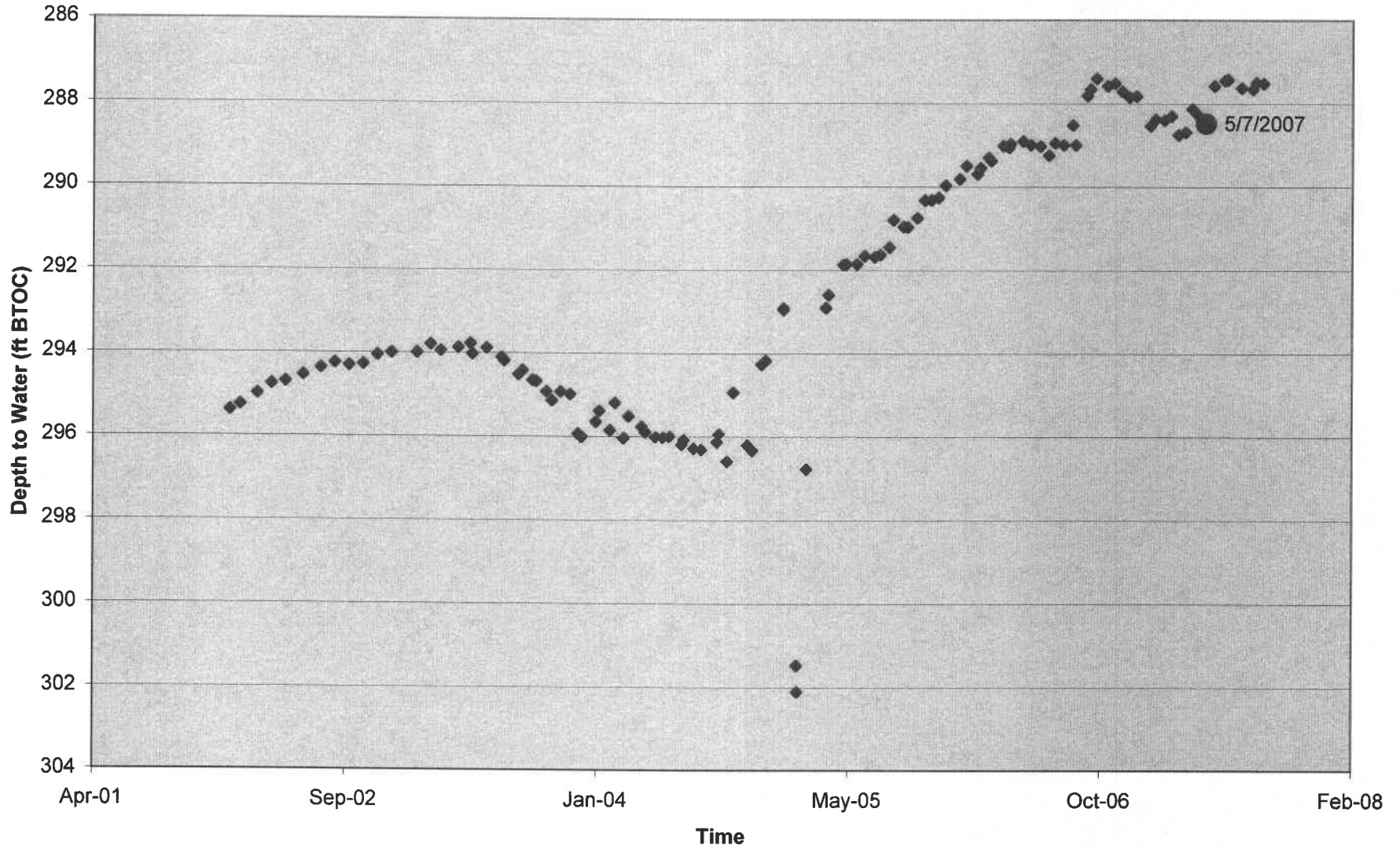
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H-5b



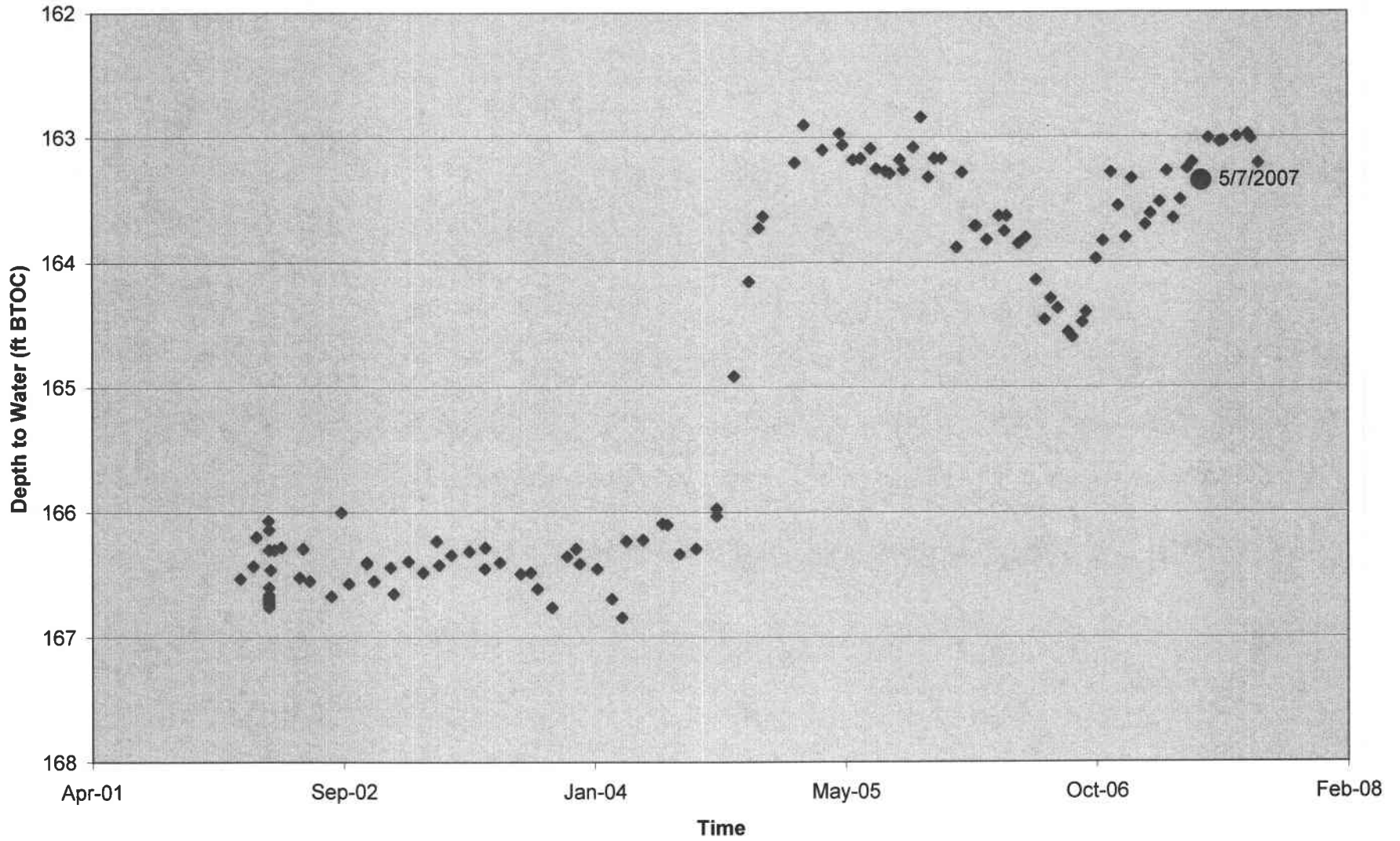
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H-6b



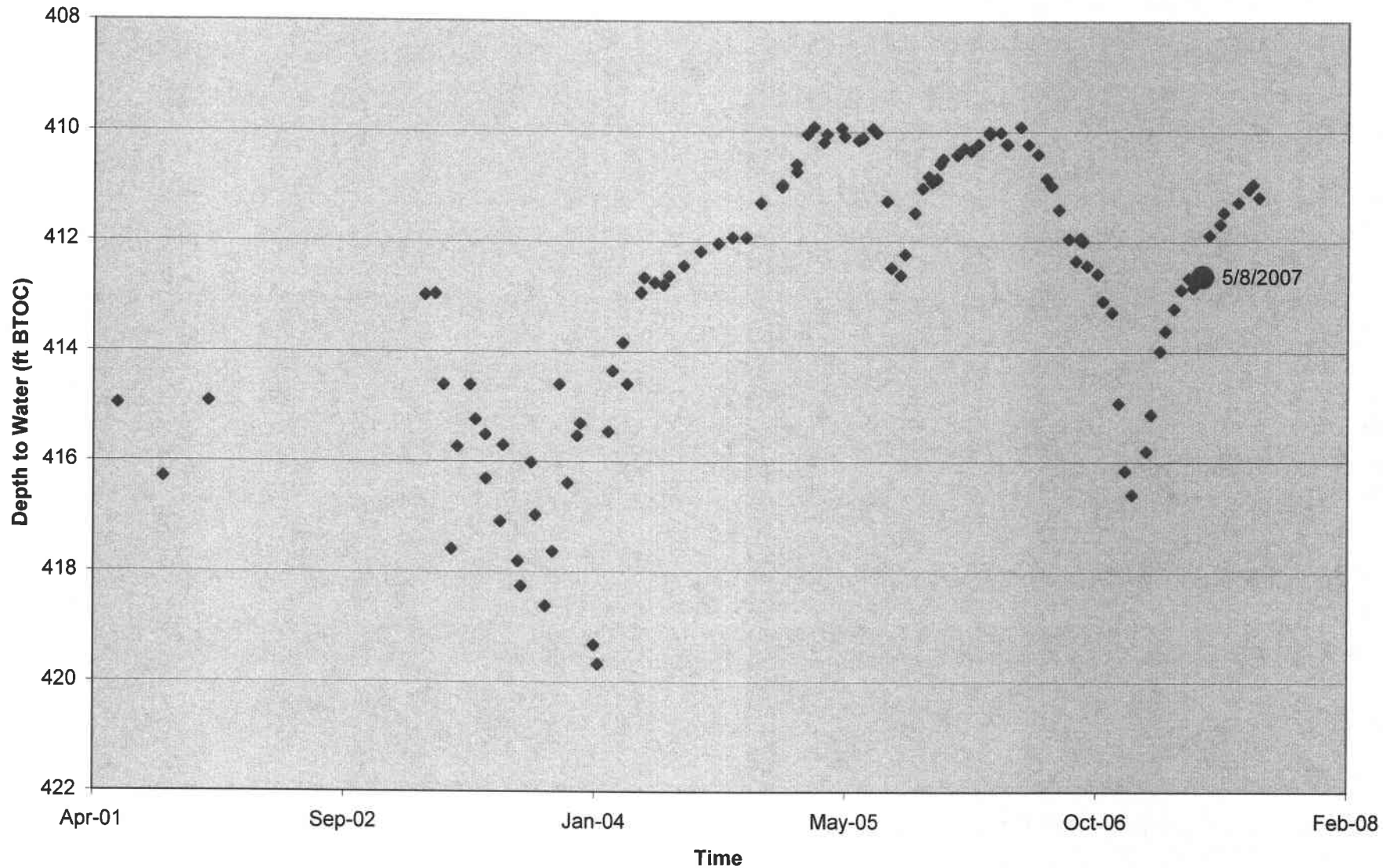
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H-7b1



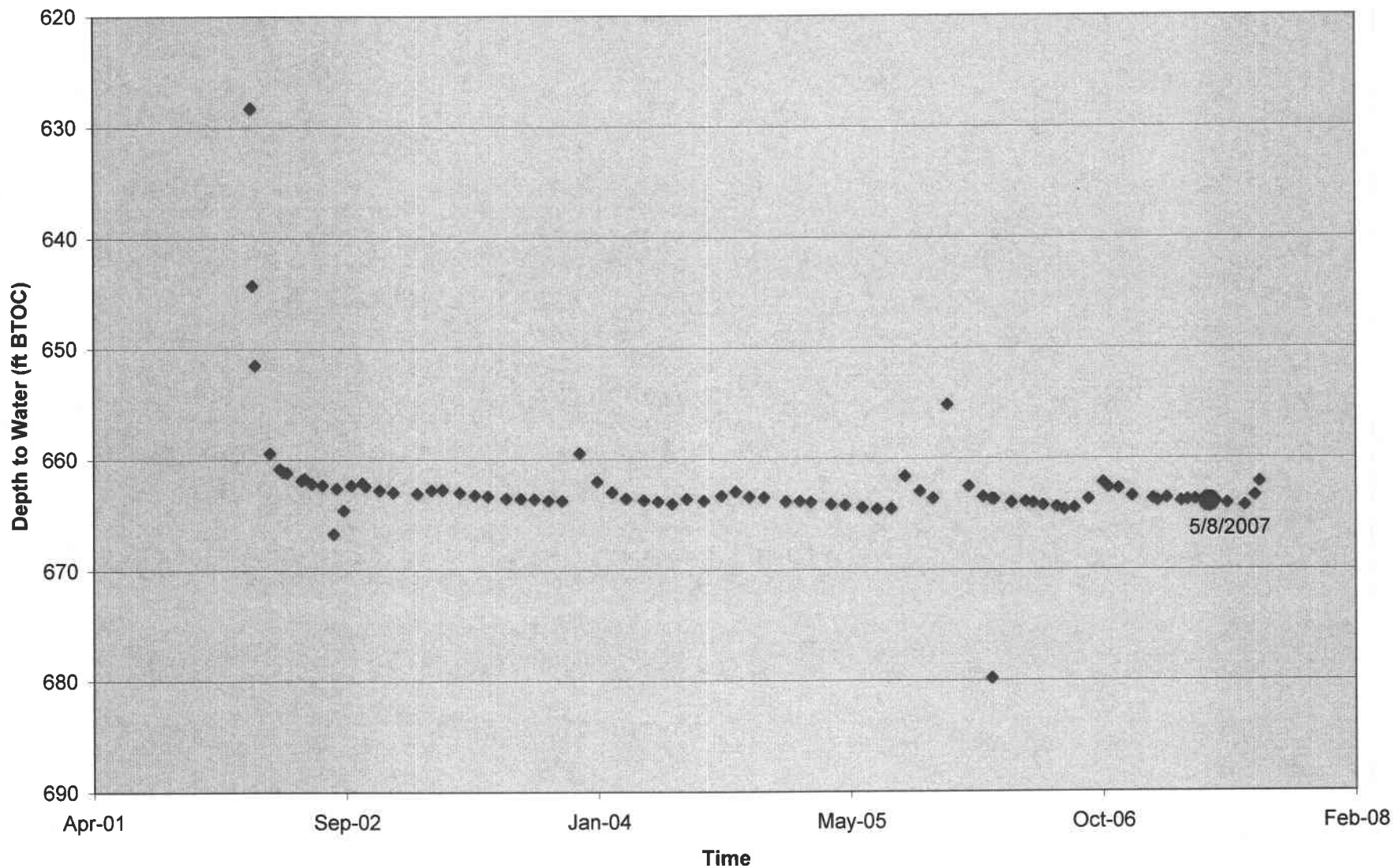
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H-9c



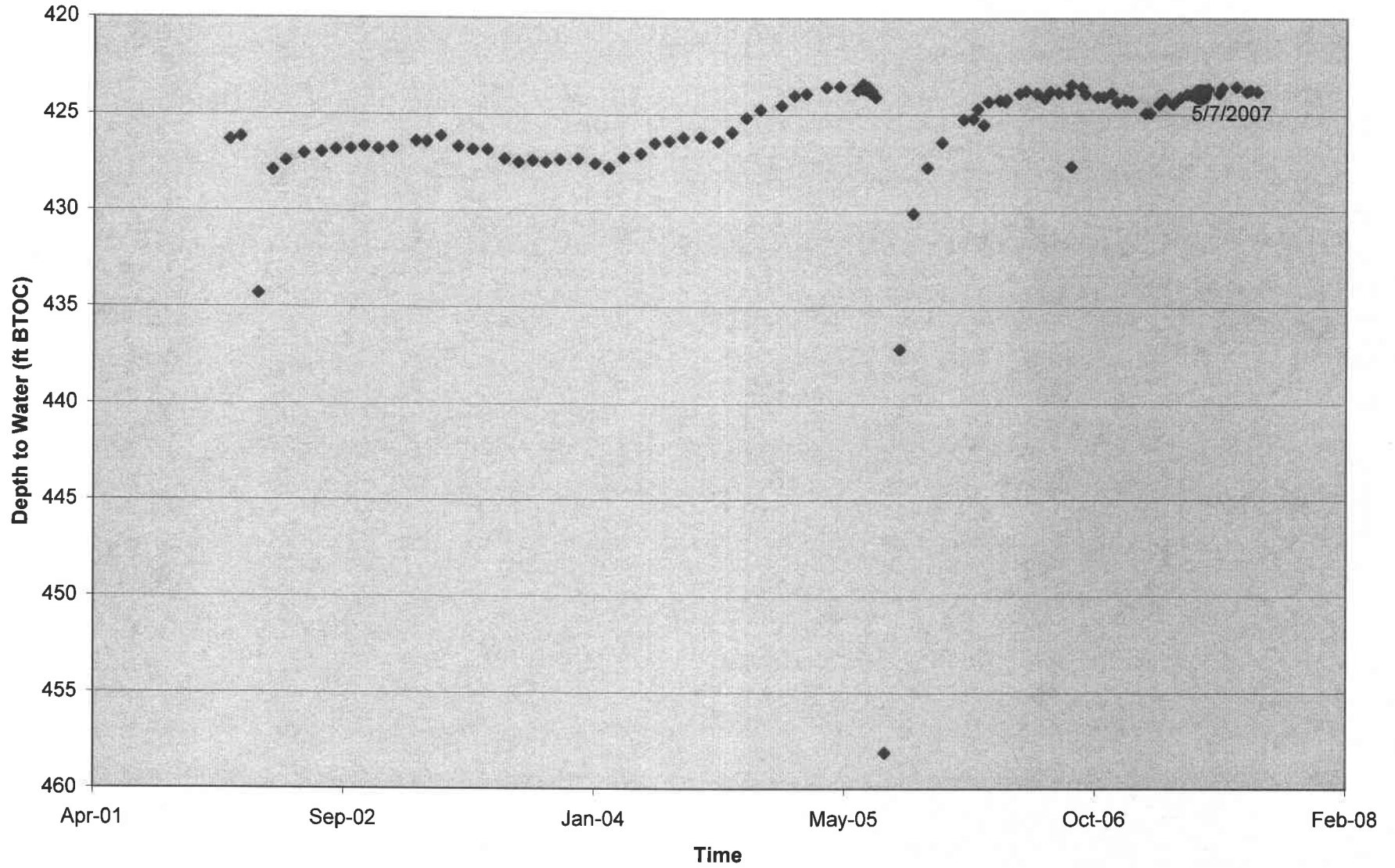
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H-10c



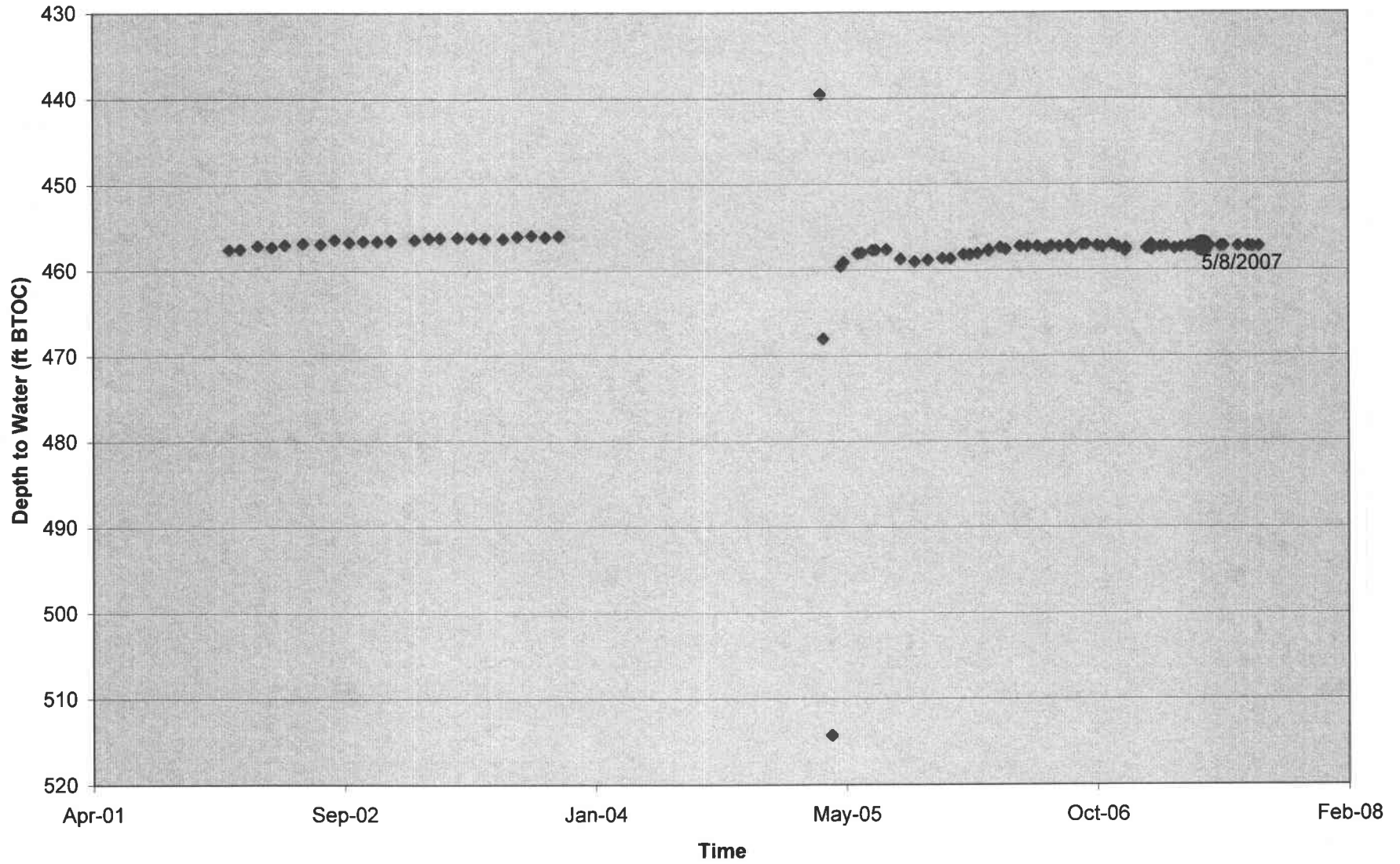
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H-11b4



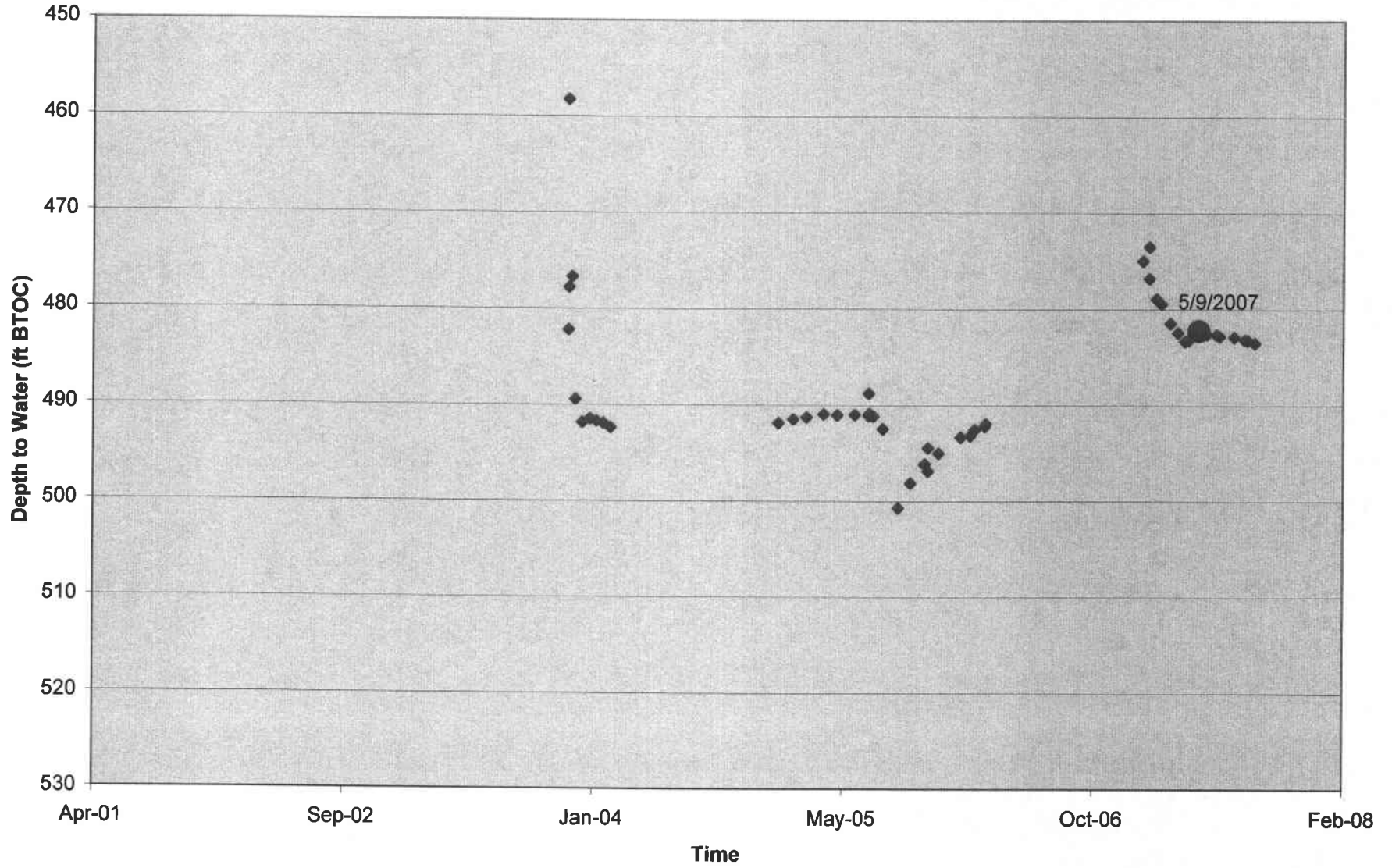
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H-12



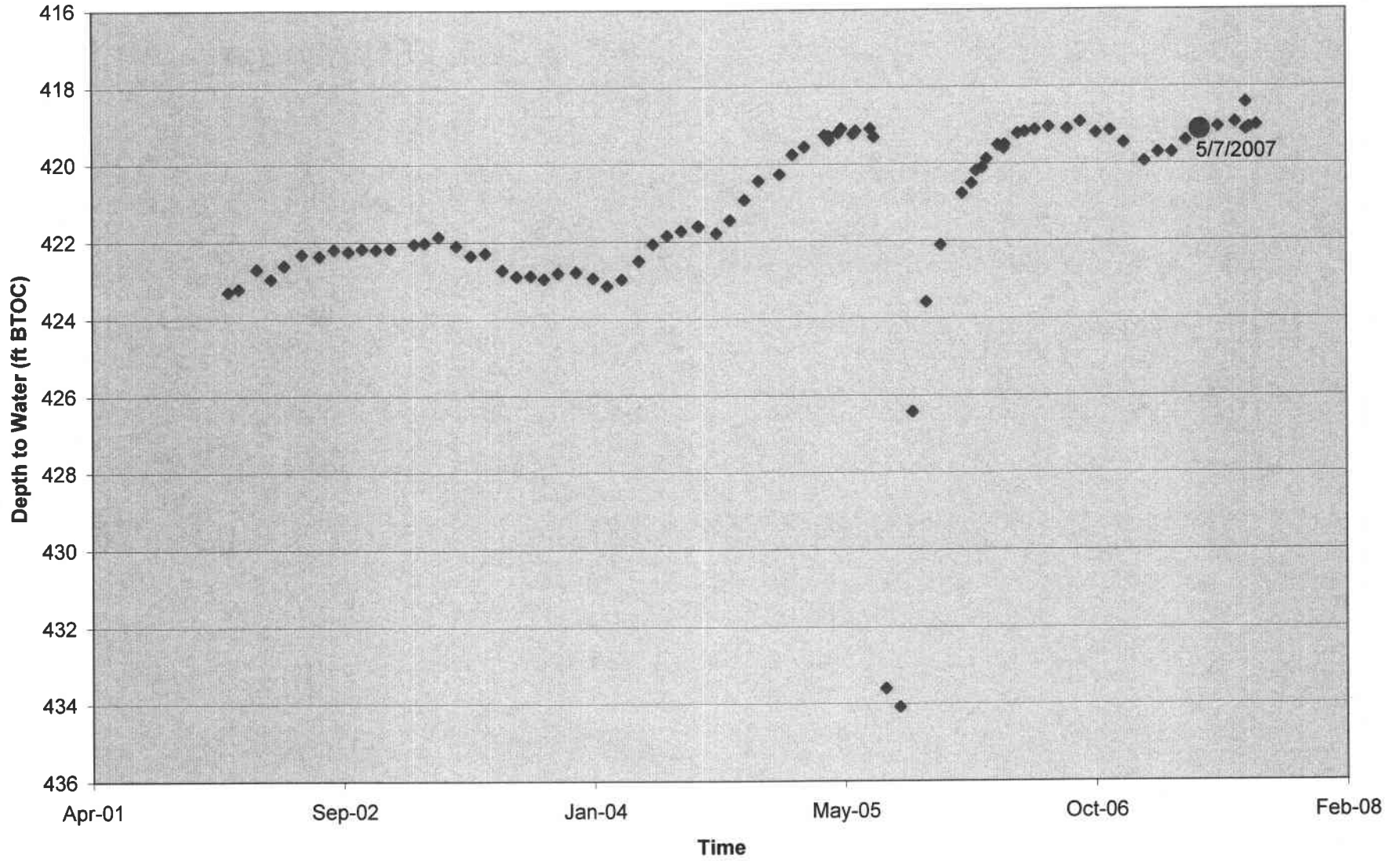
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H-15



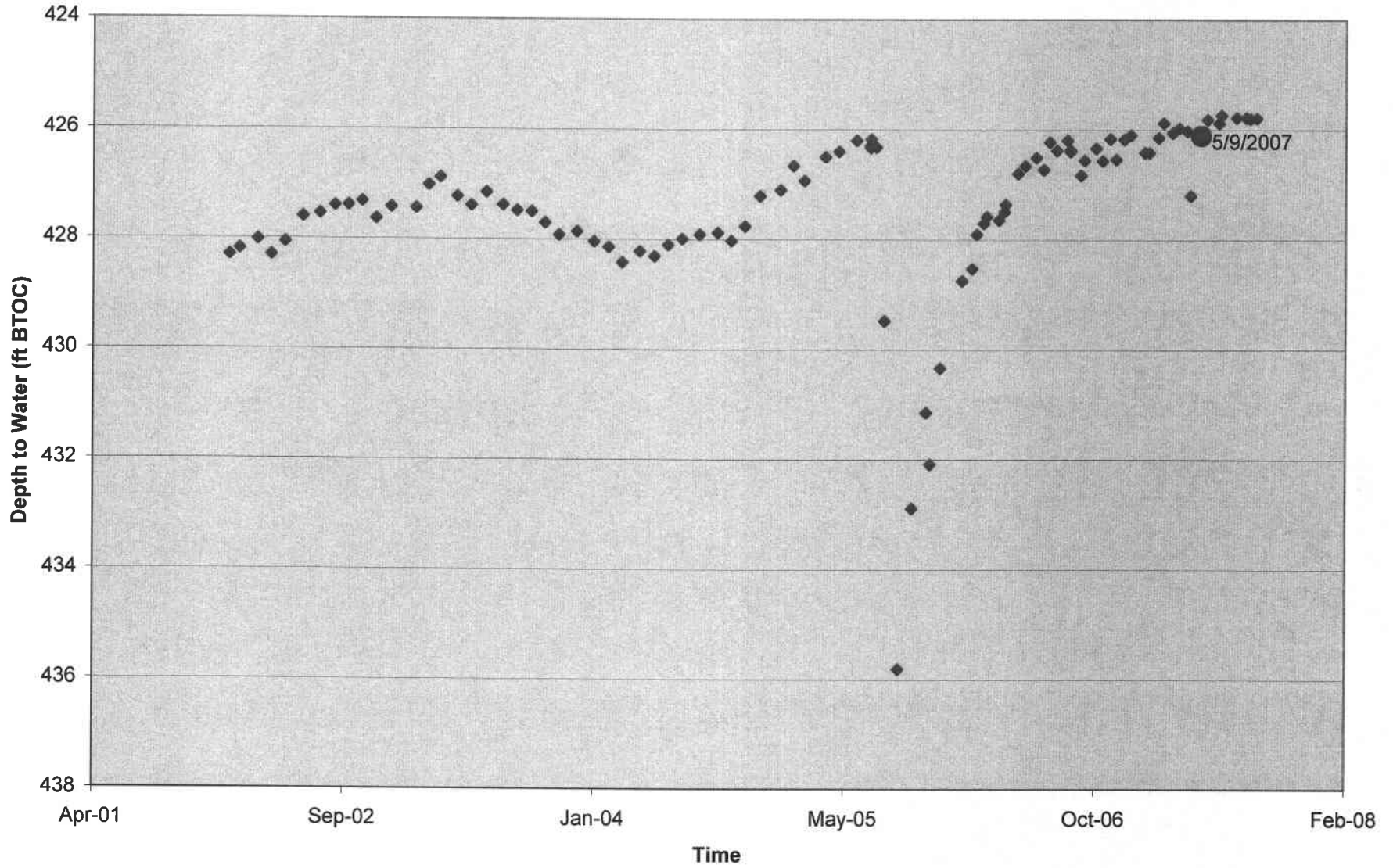
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H-17



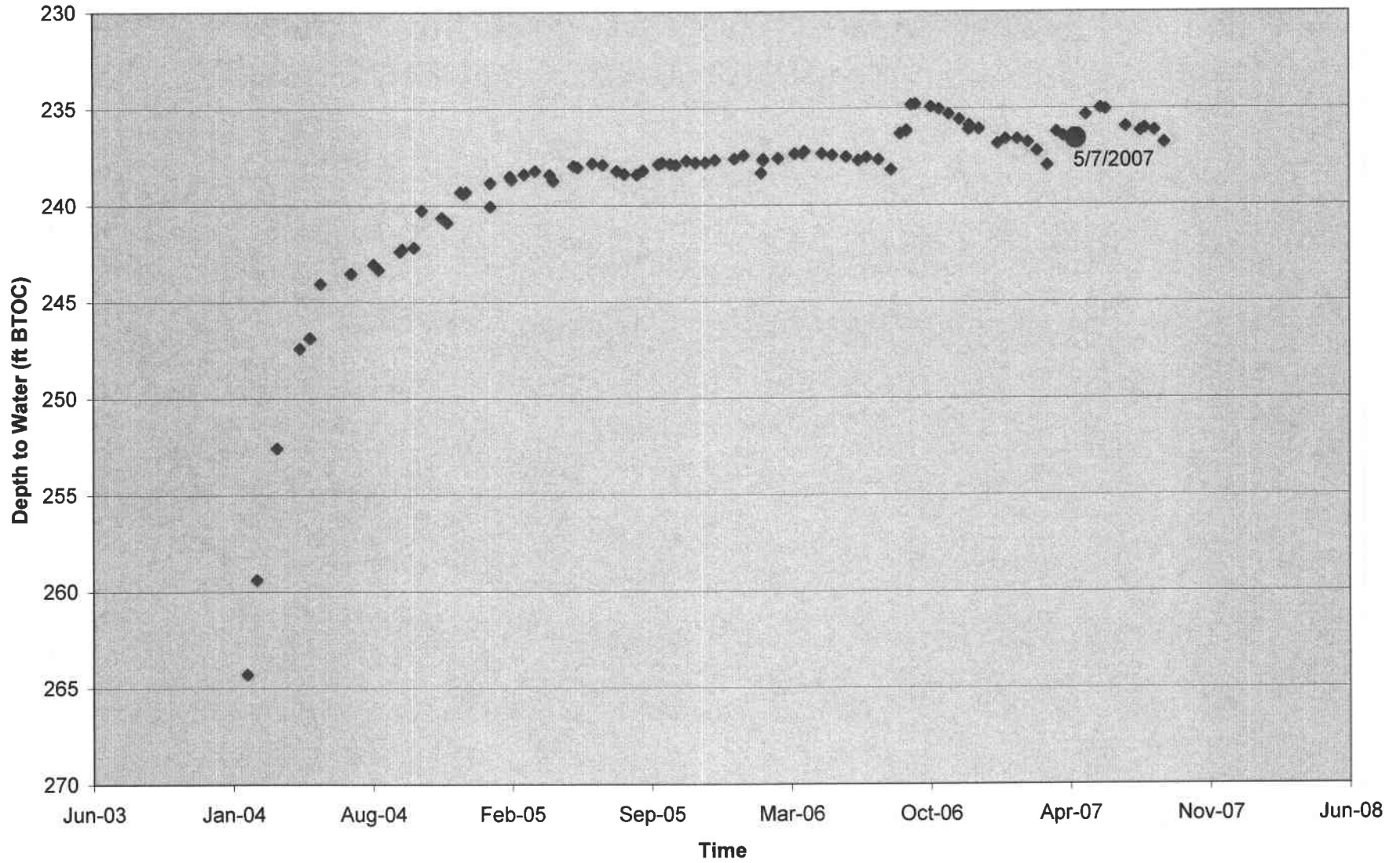
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H-19b0



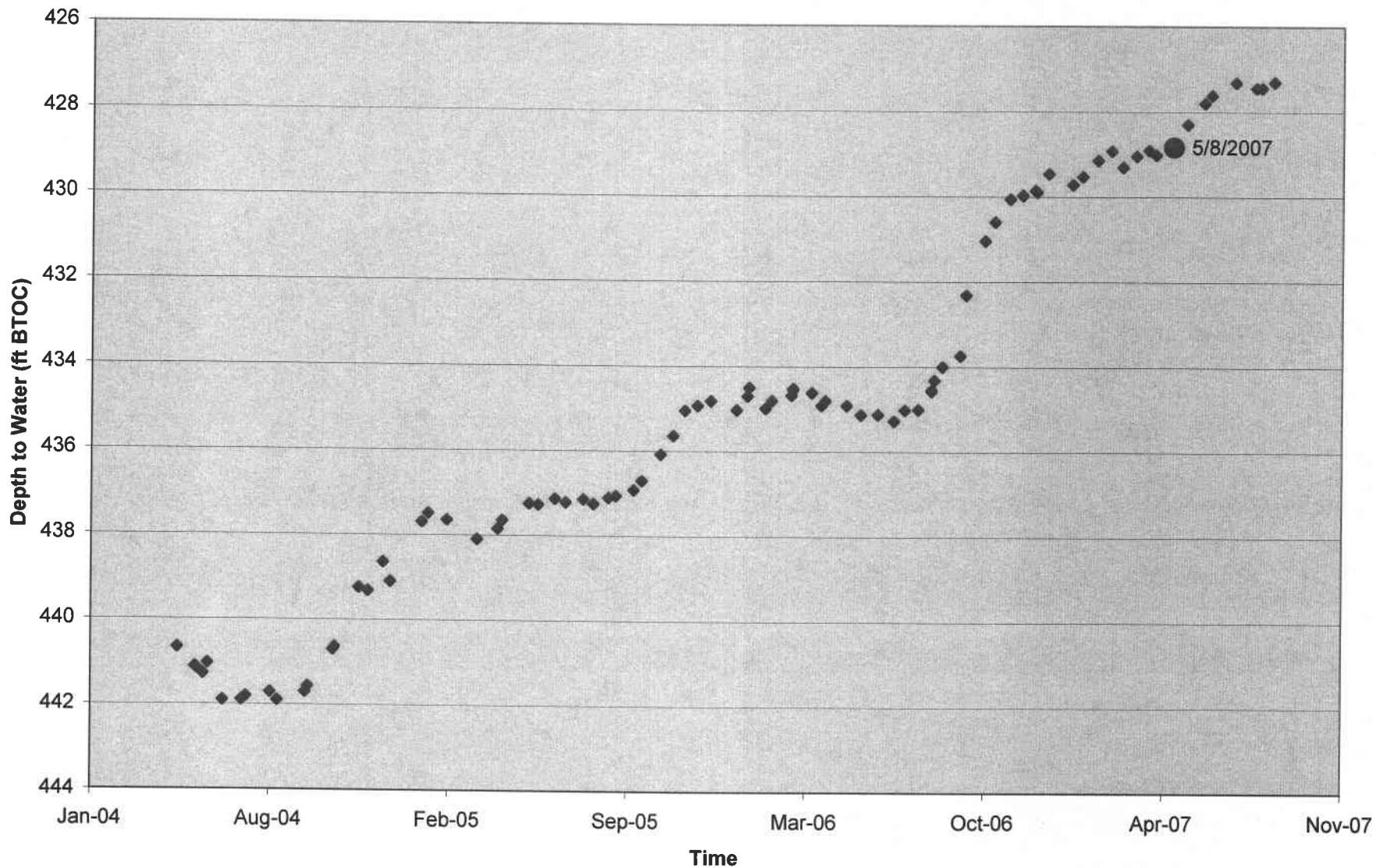
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IMC-461



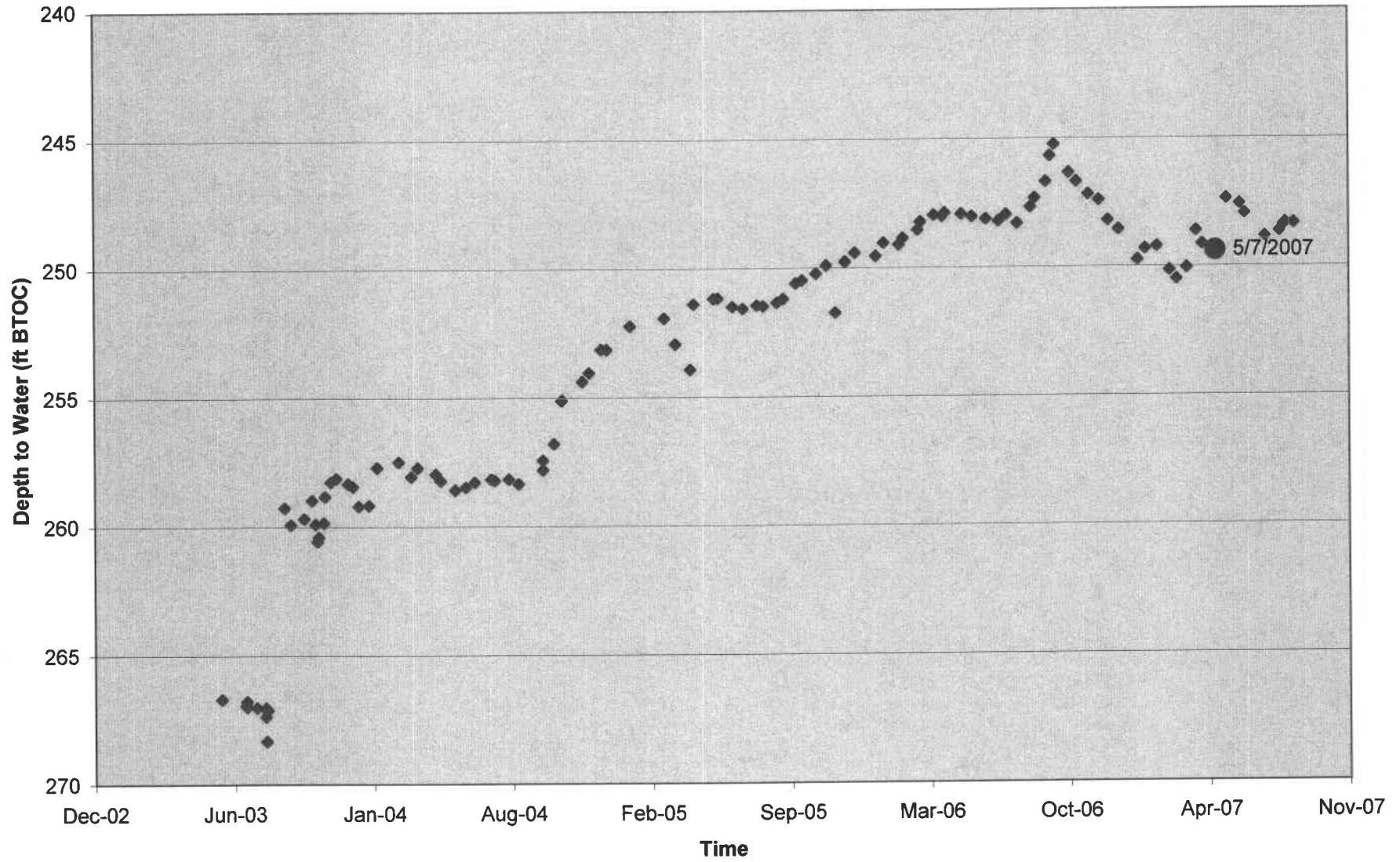
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SNL-1



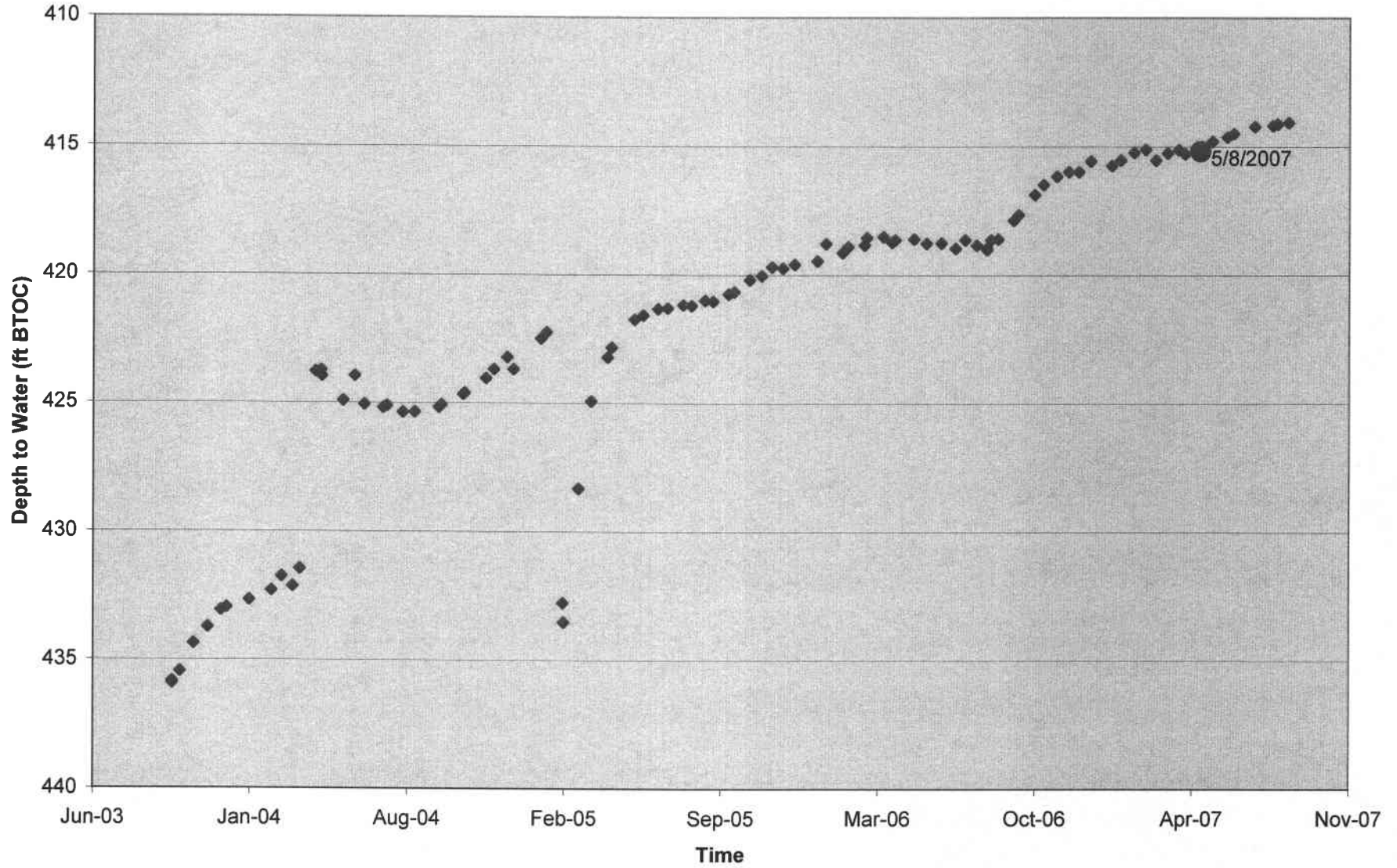
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SNL-2



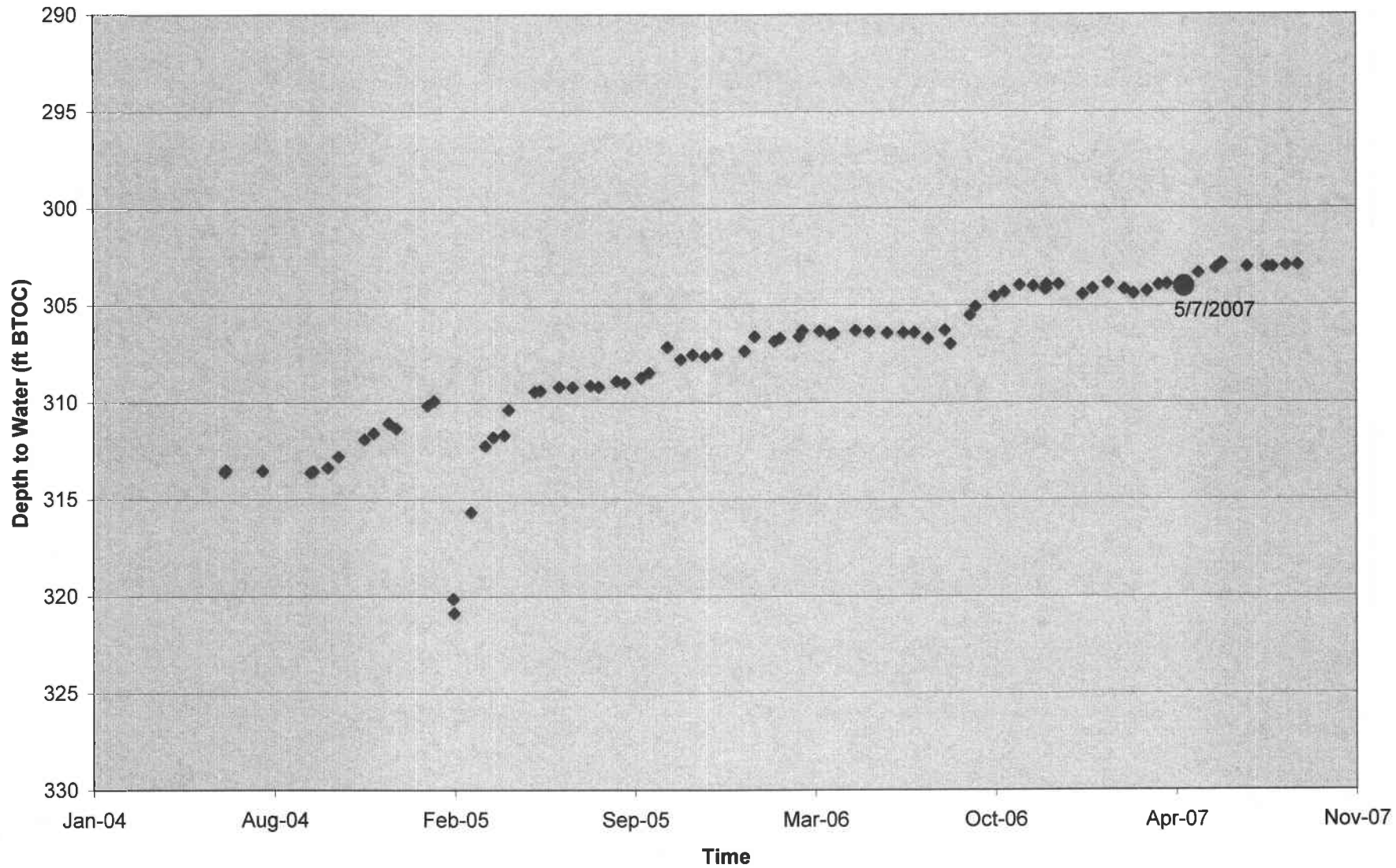
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SNL-3



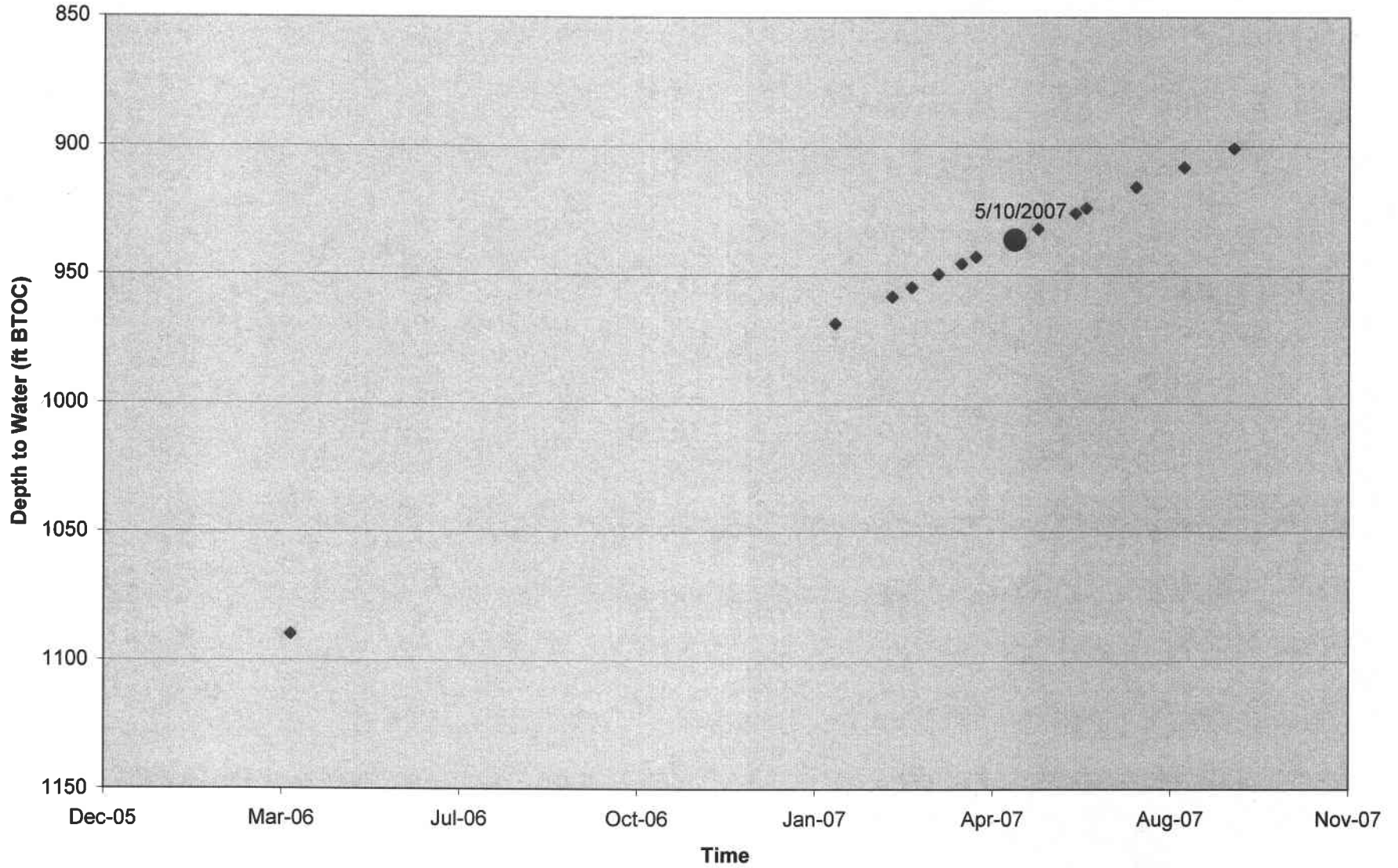
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SNL-5



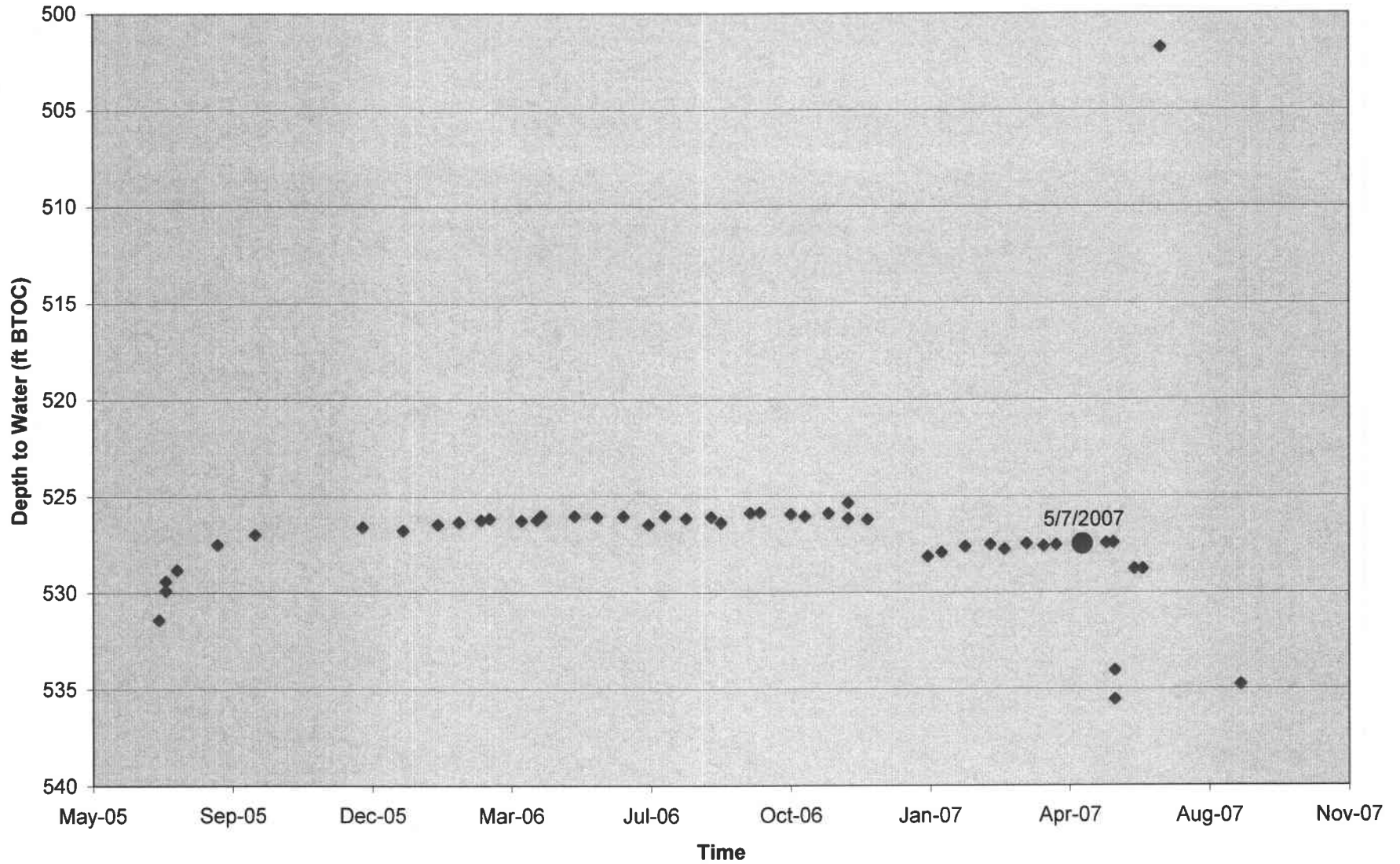
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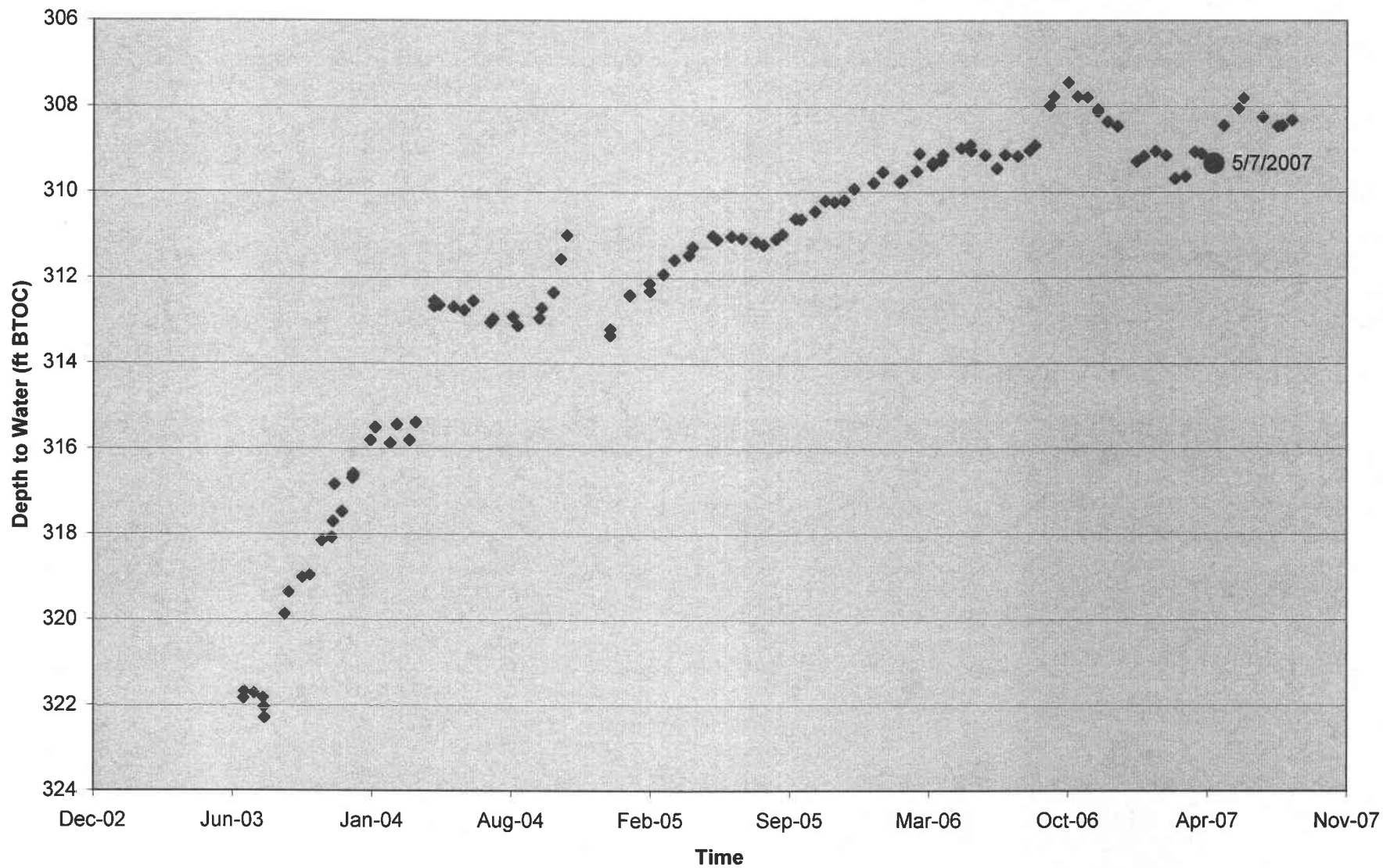
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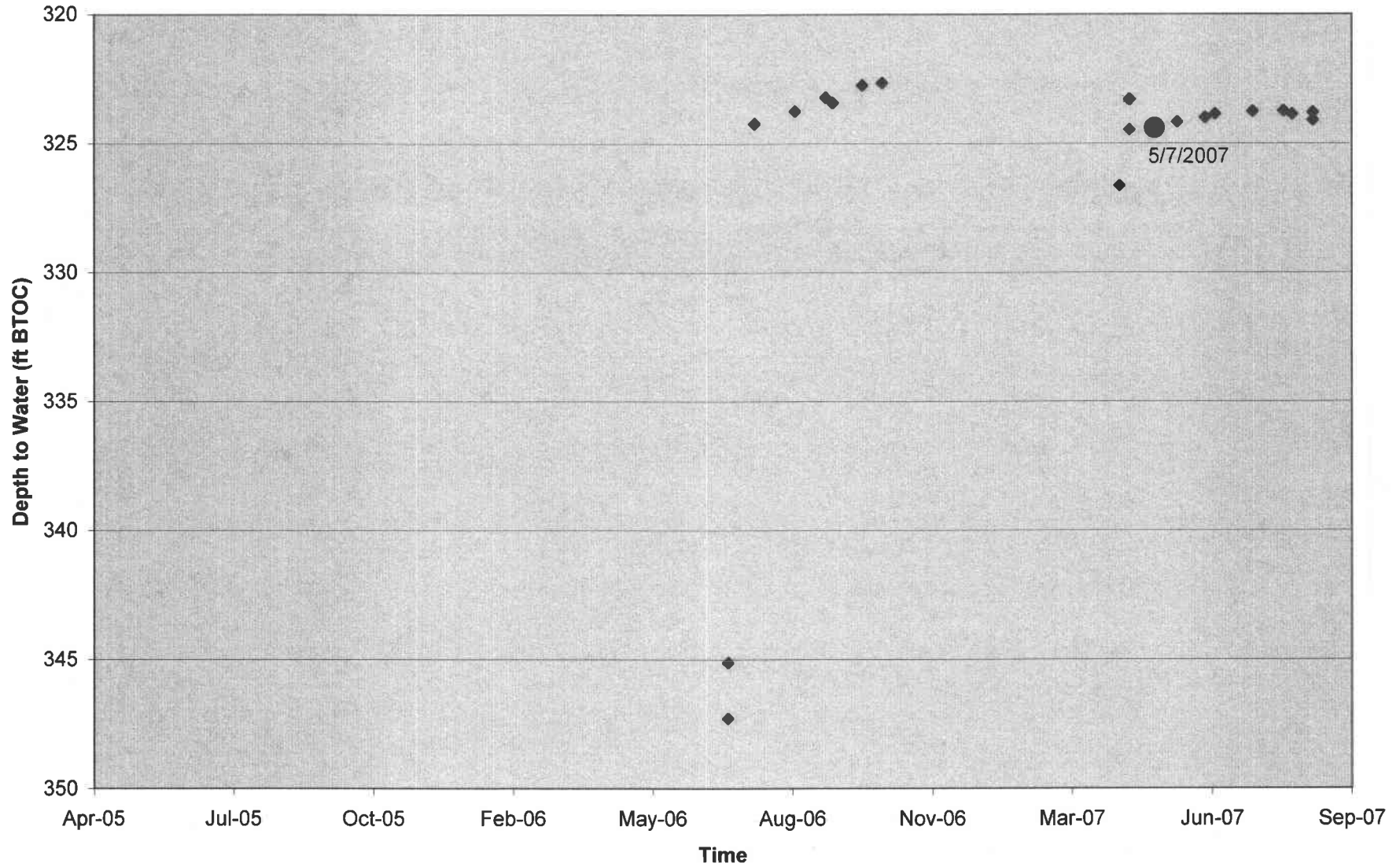
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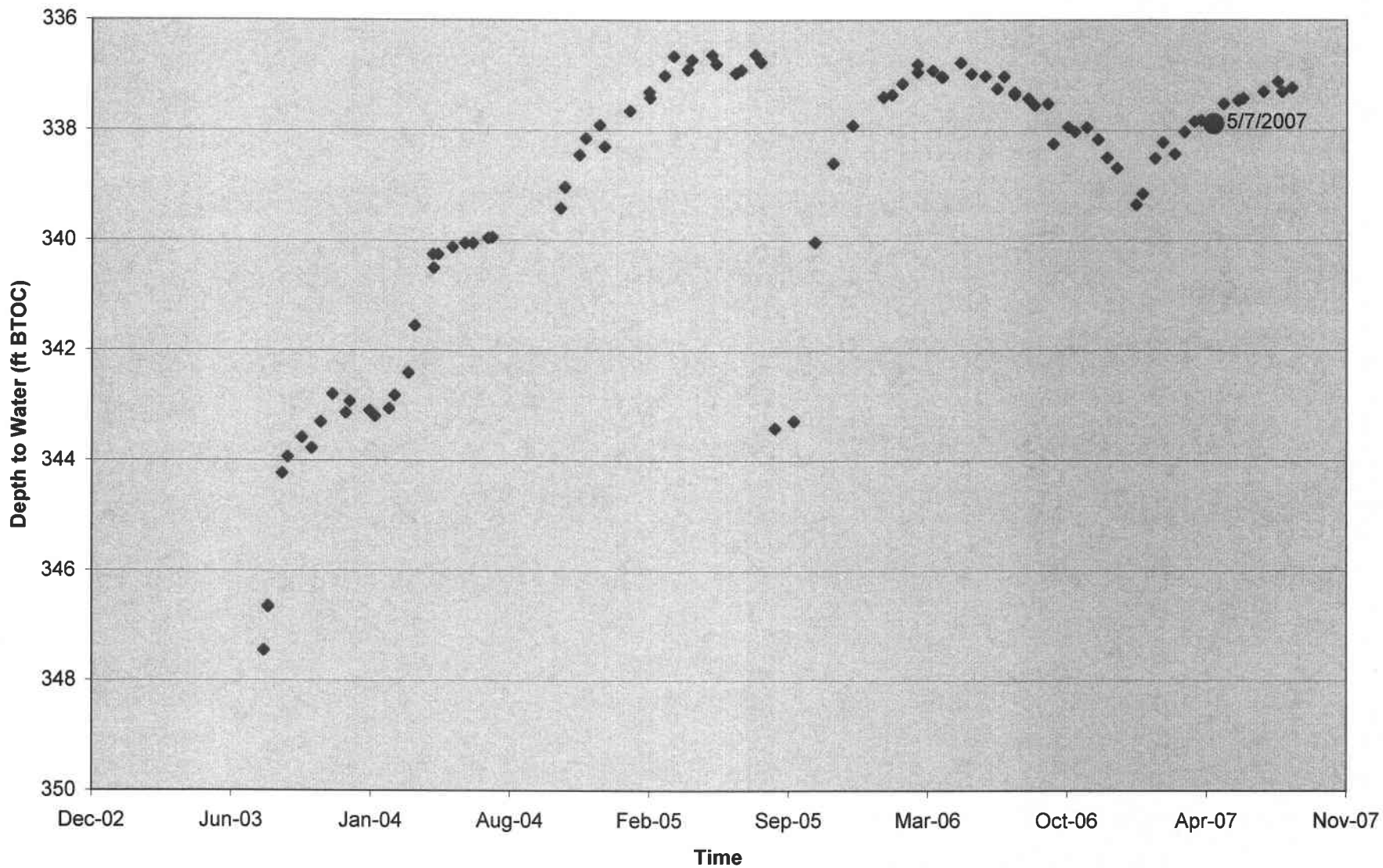
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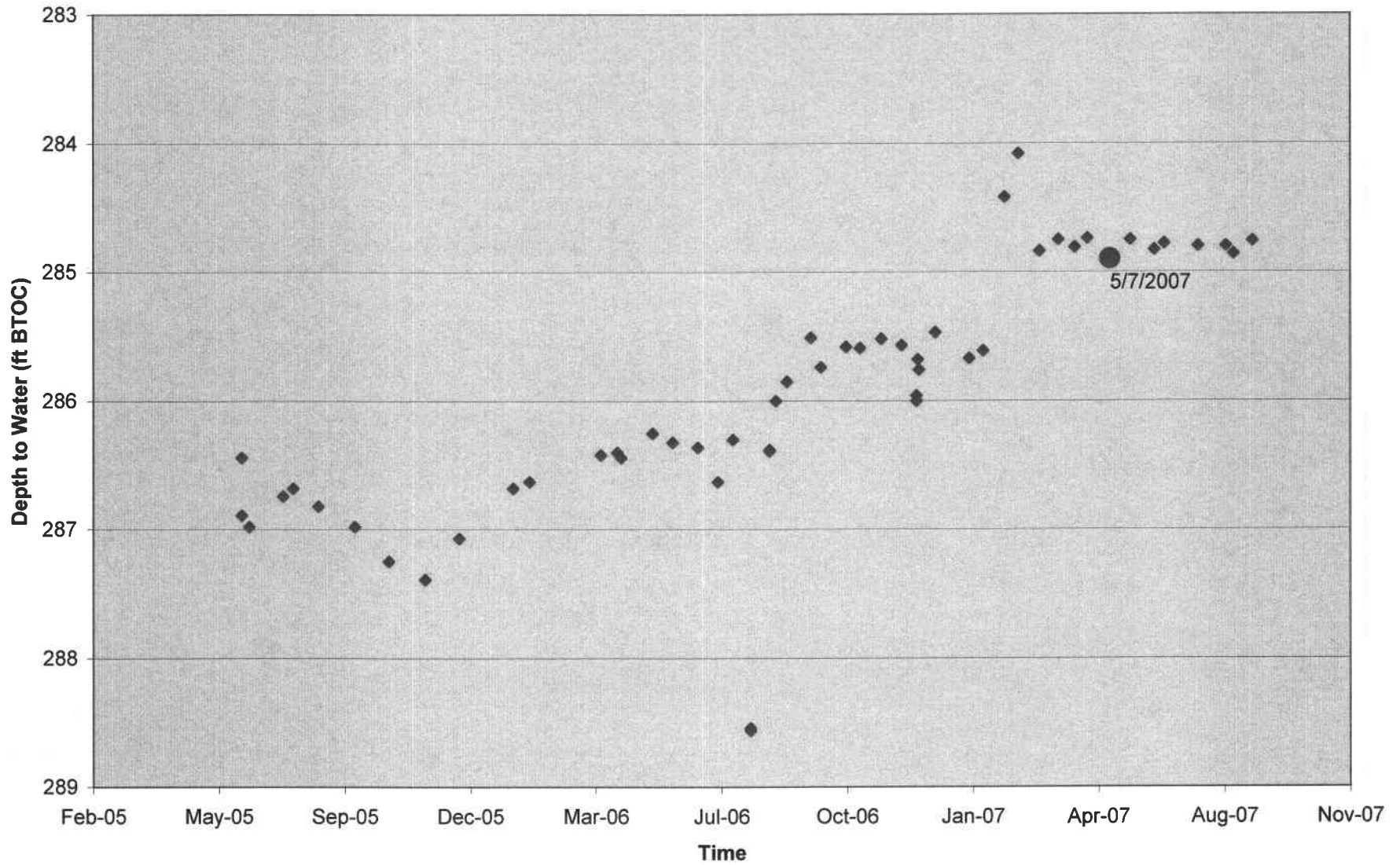
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SNL-12



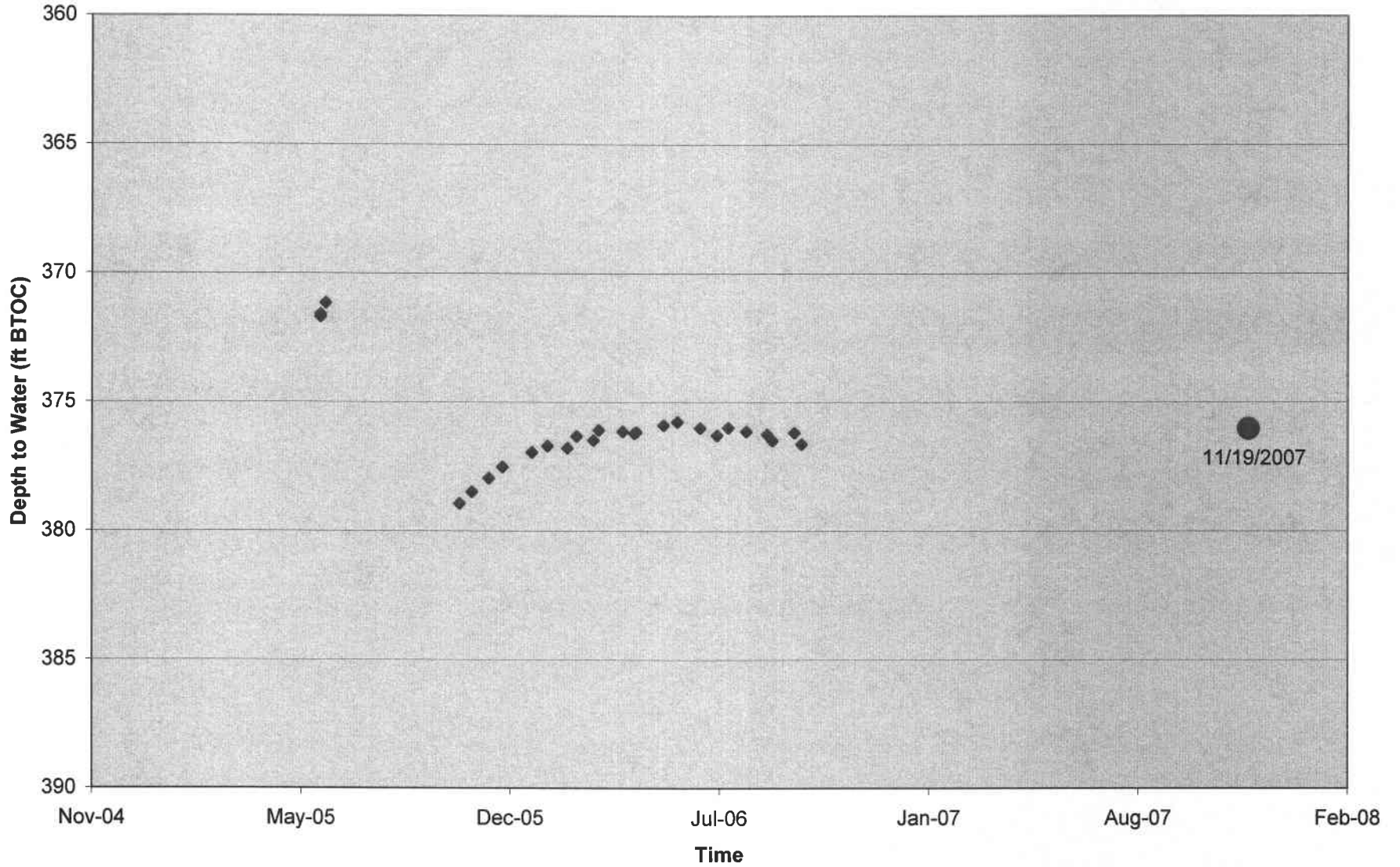
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SNL-13



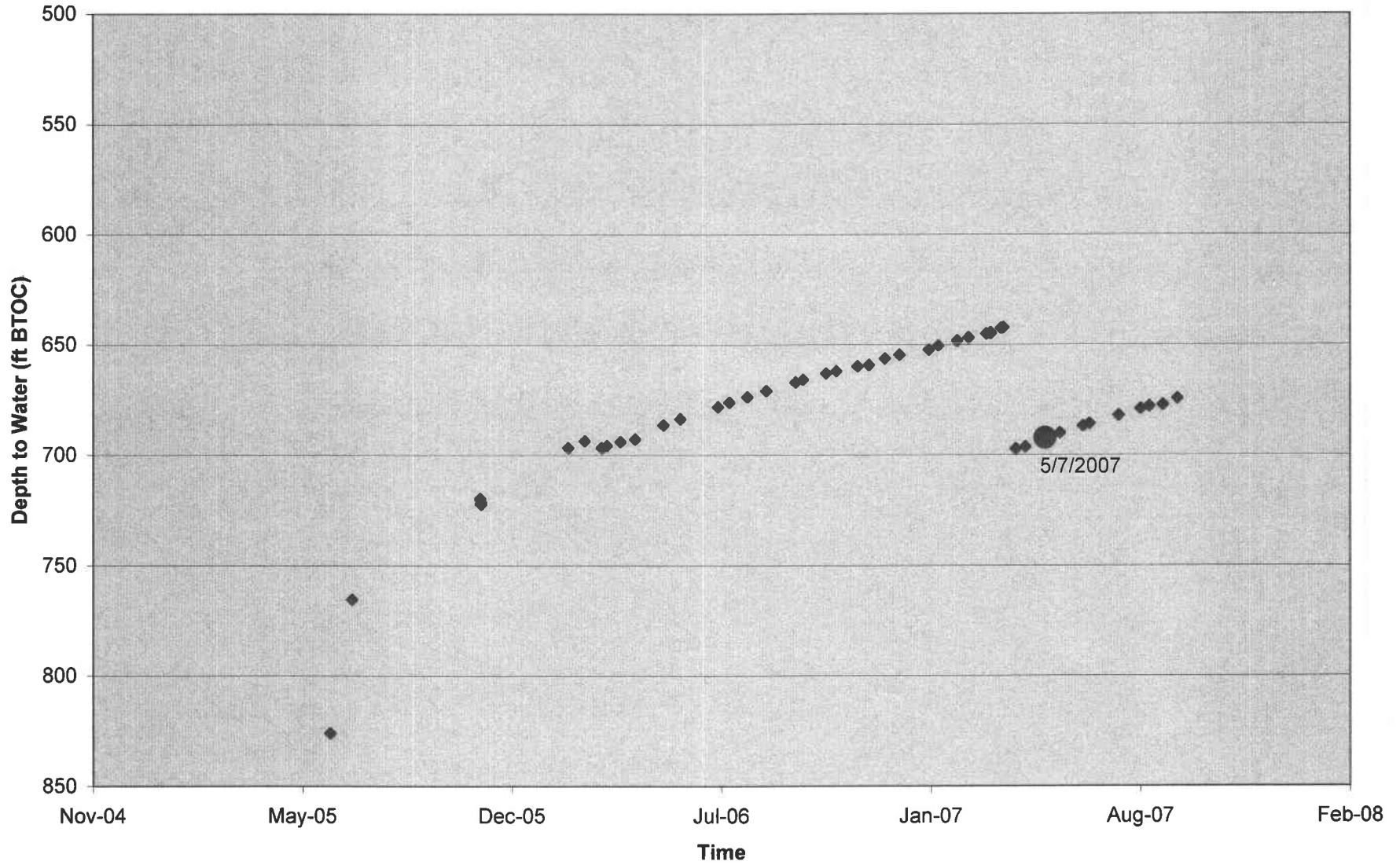
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SNL-14



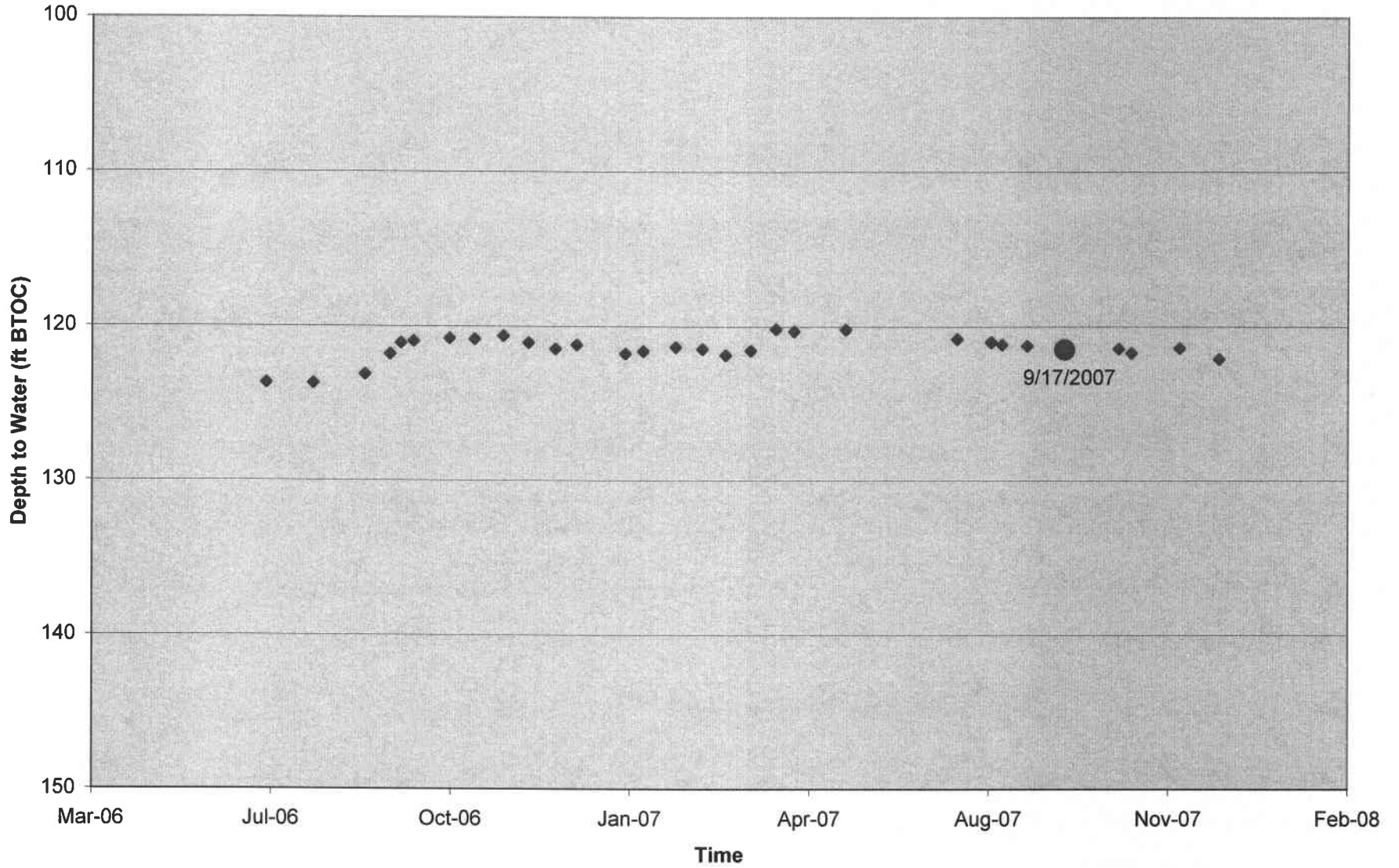
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SNL-15



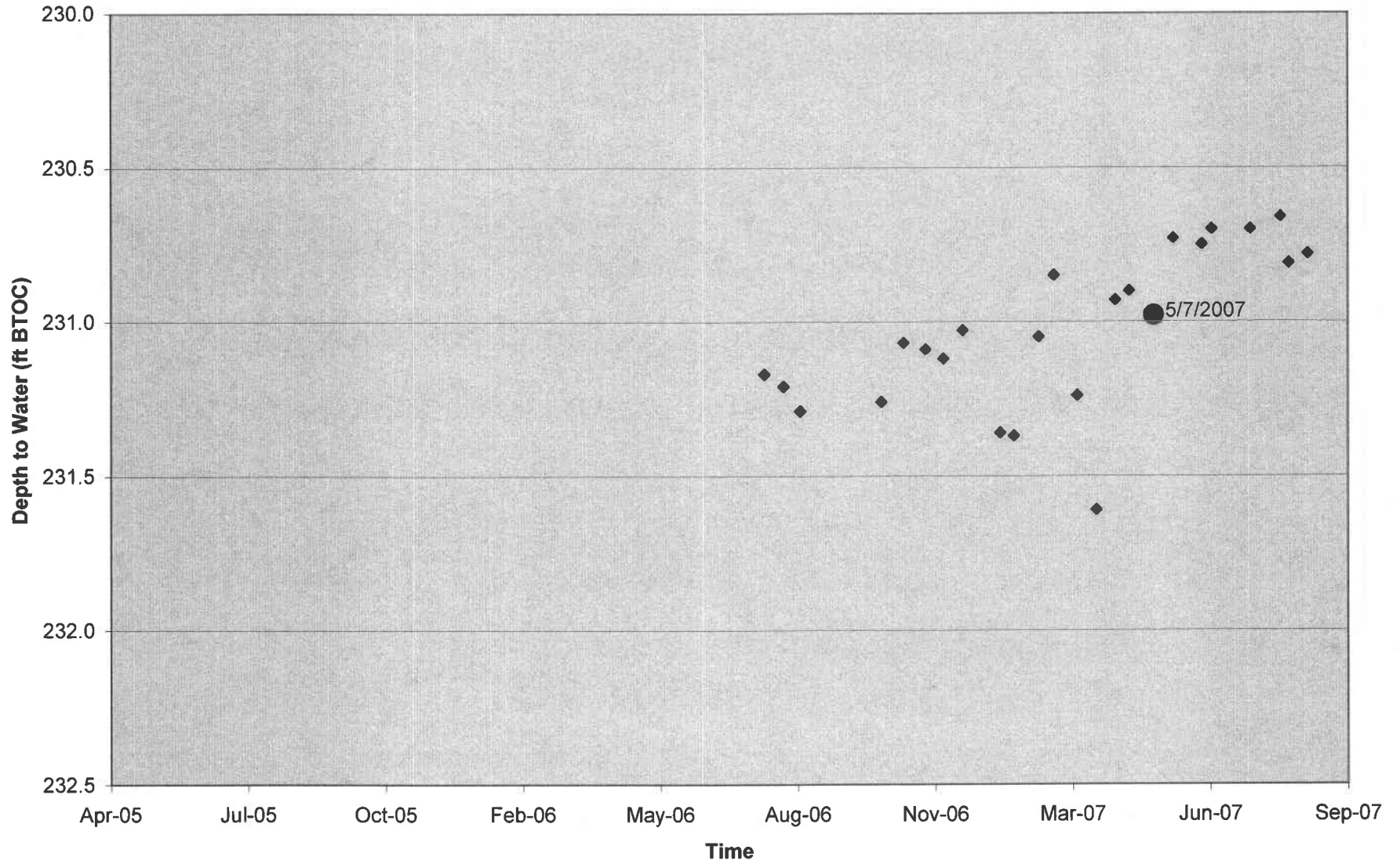
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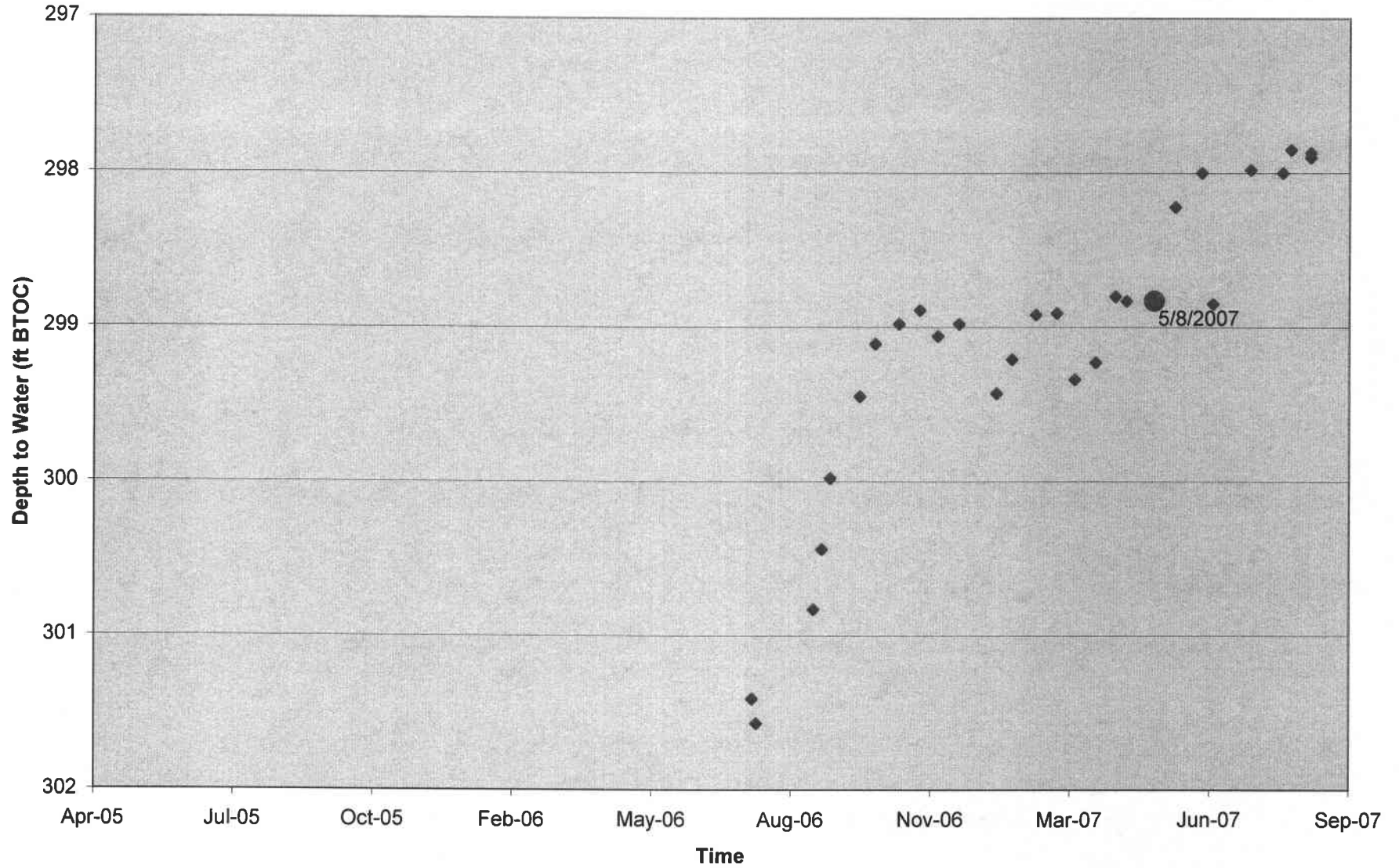
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SNL-17



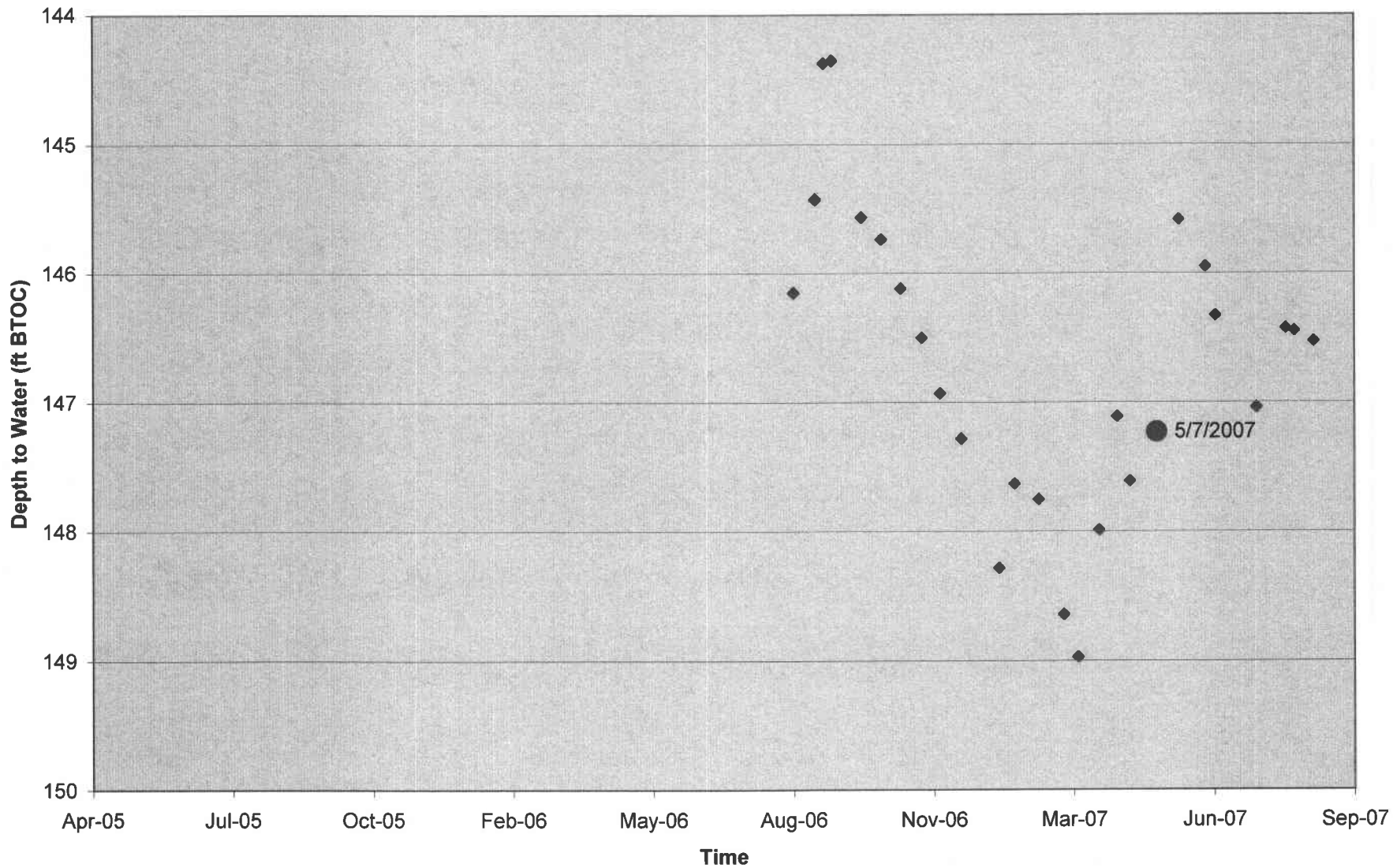
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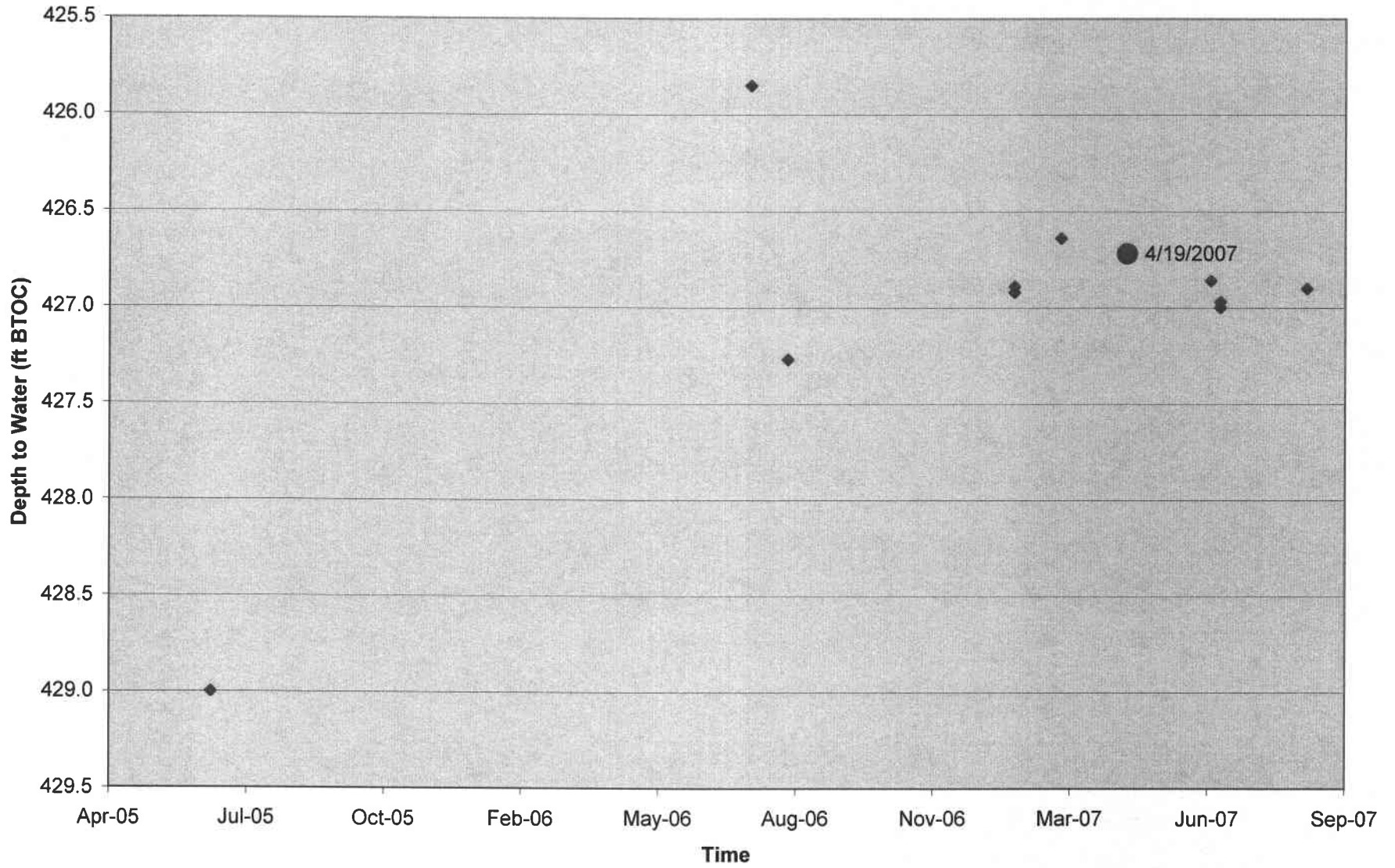
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SNL-19



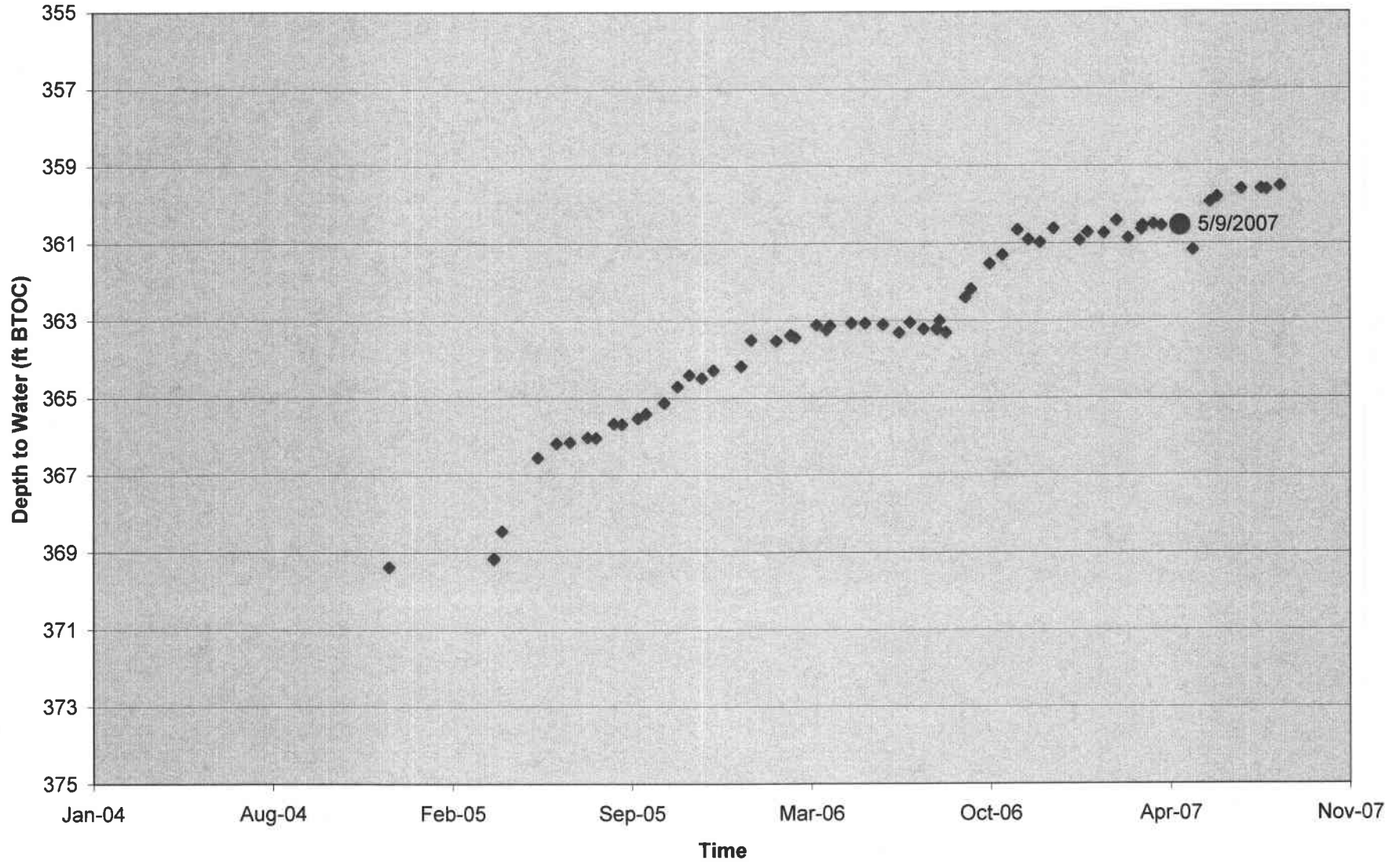
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USGS-4



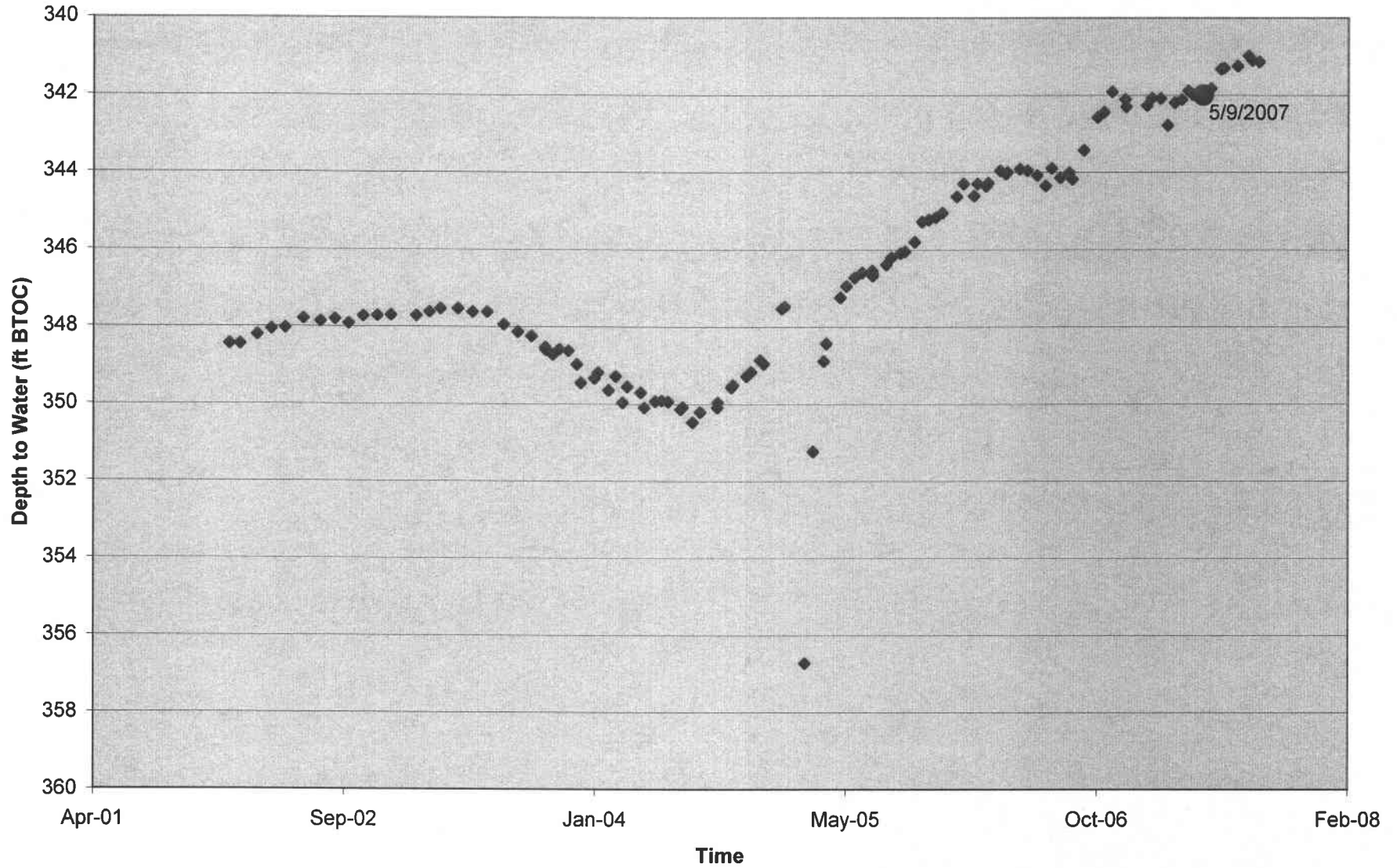
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WIPP-11



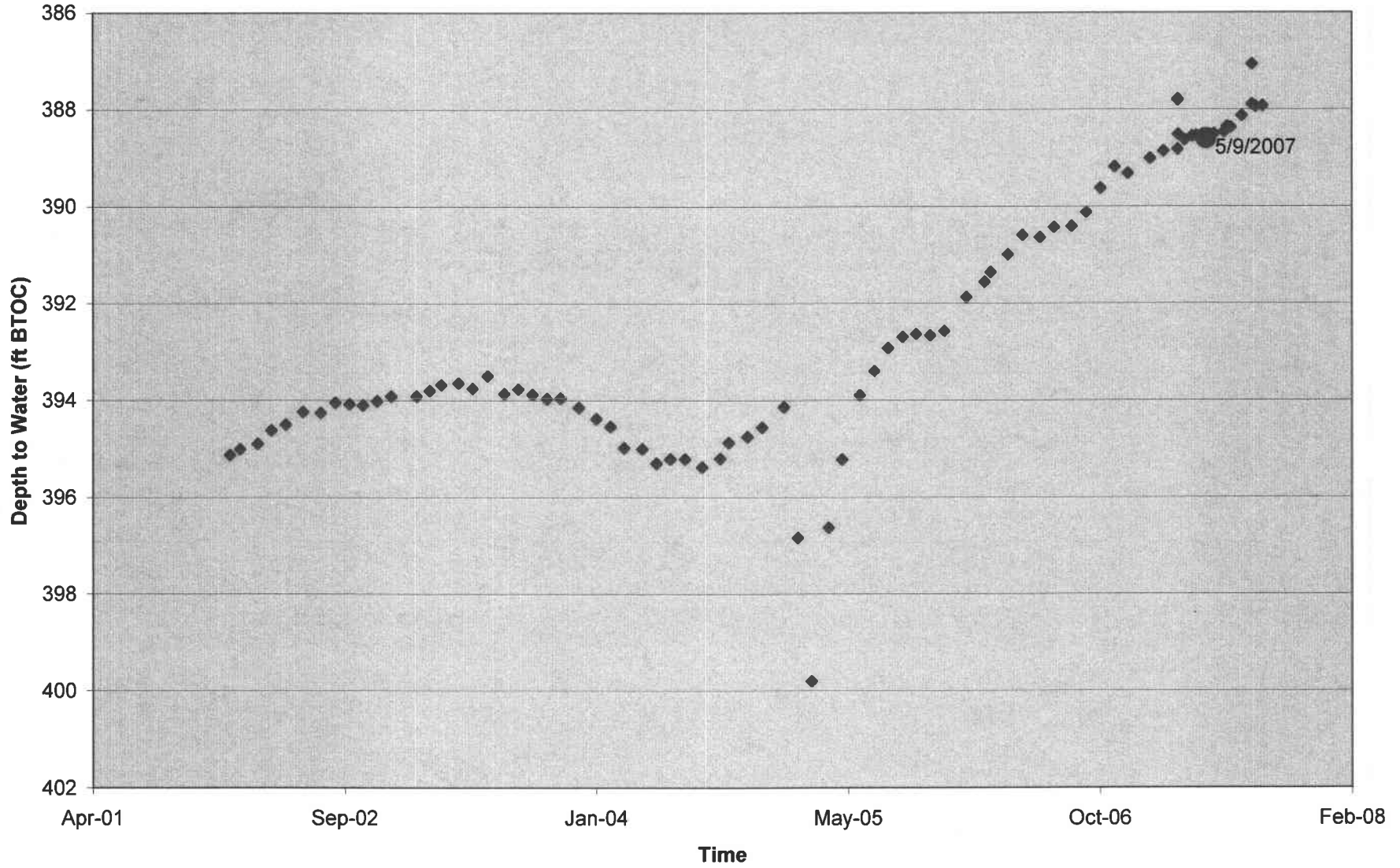
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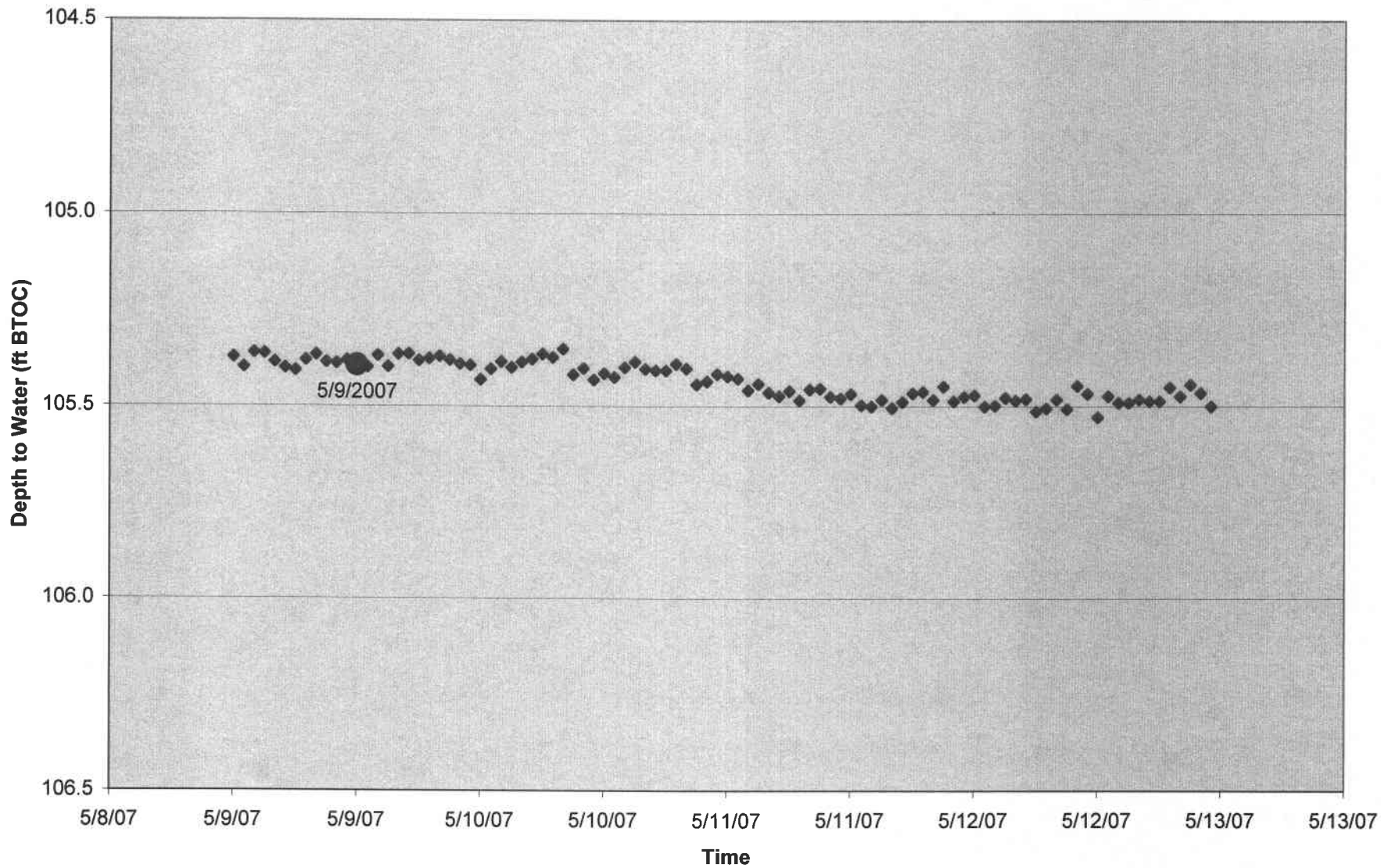
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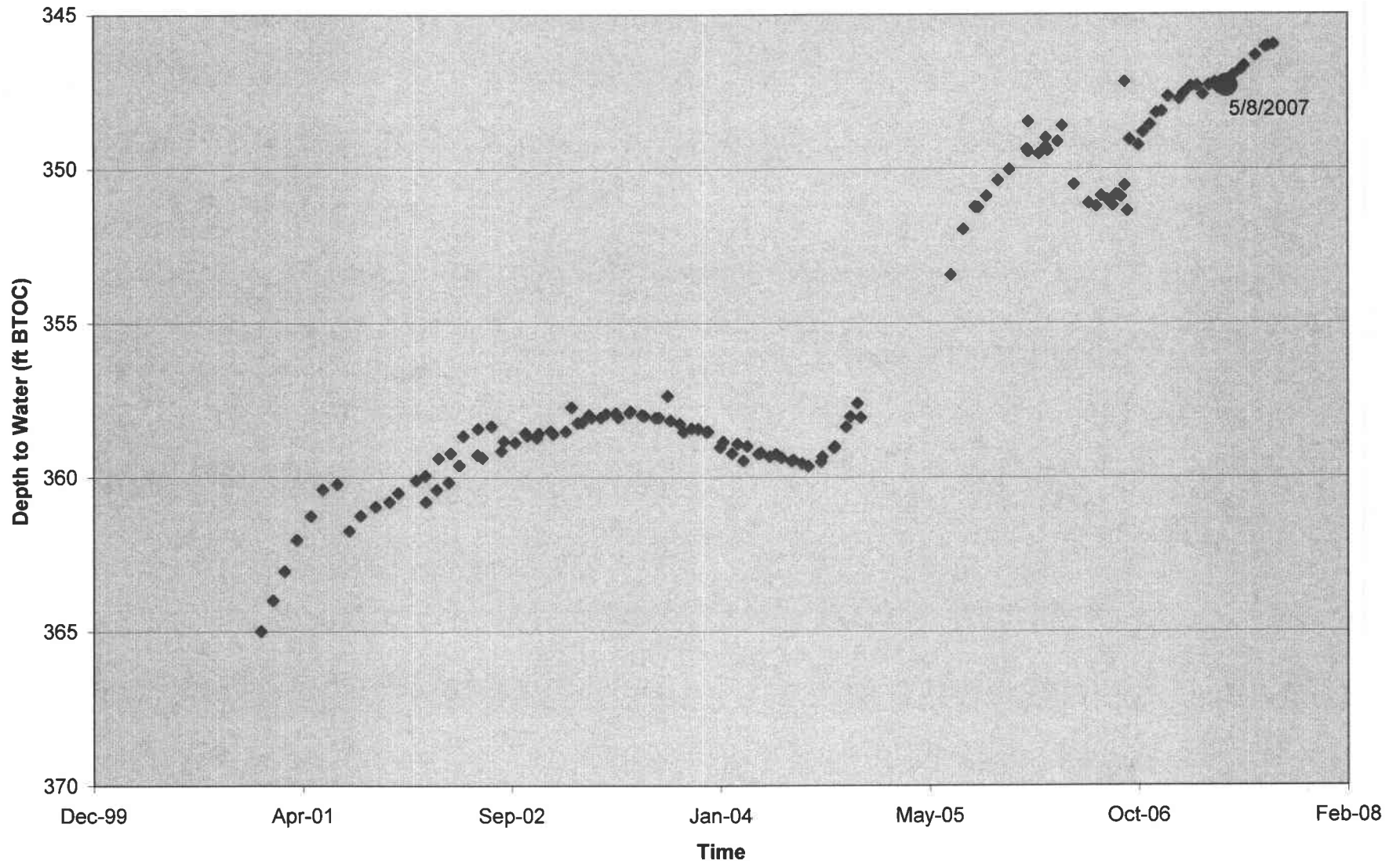
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WIPP-25 (Troll Data - calculated water level)



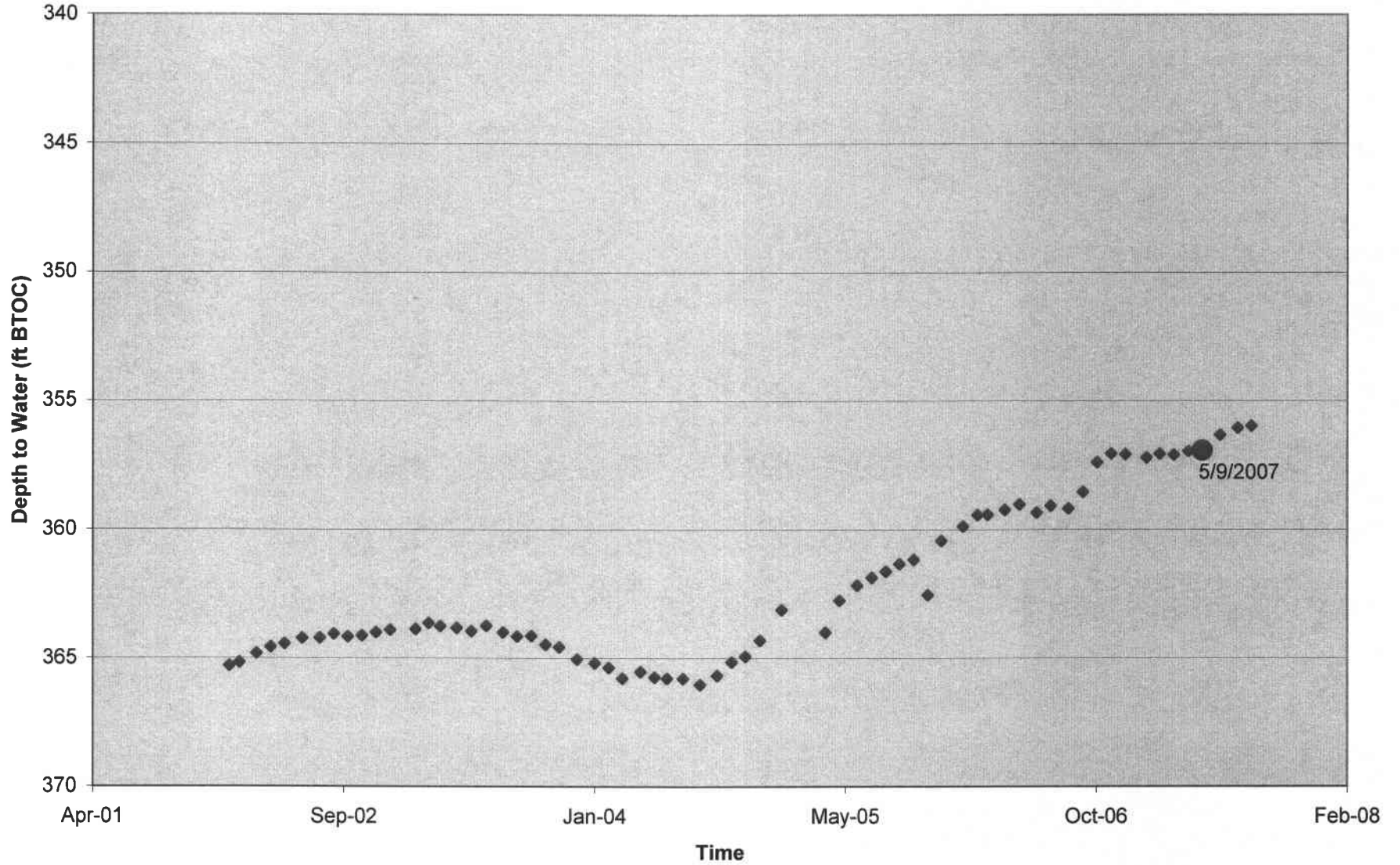
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WIPP-30



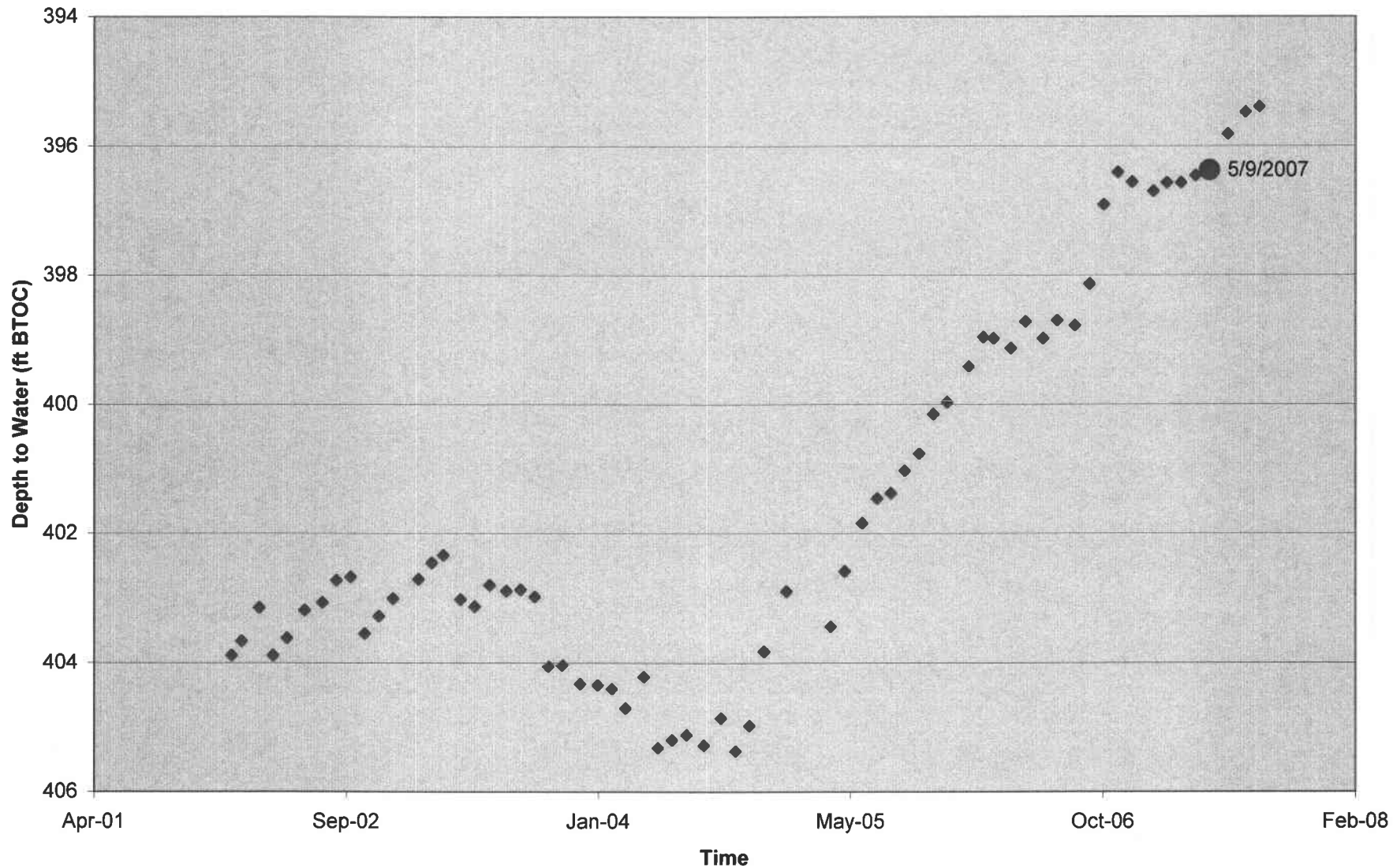
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WQSP-1

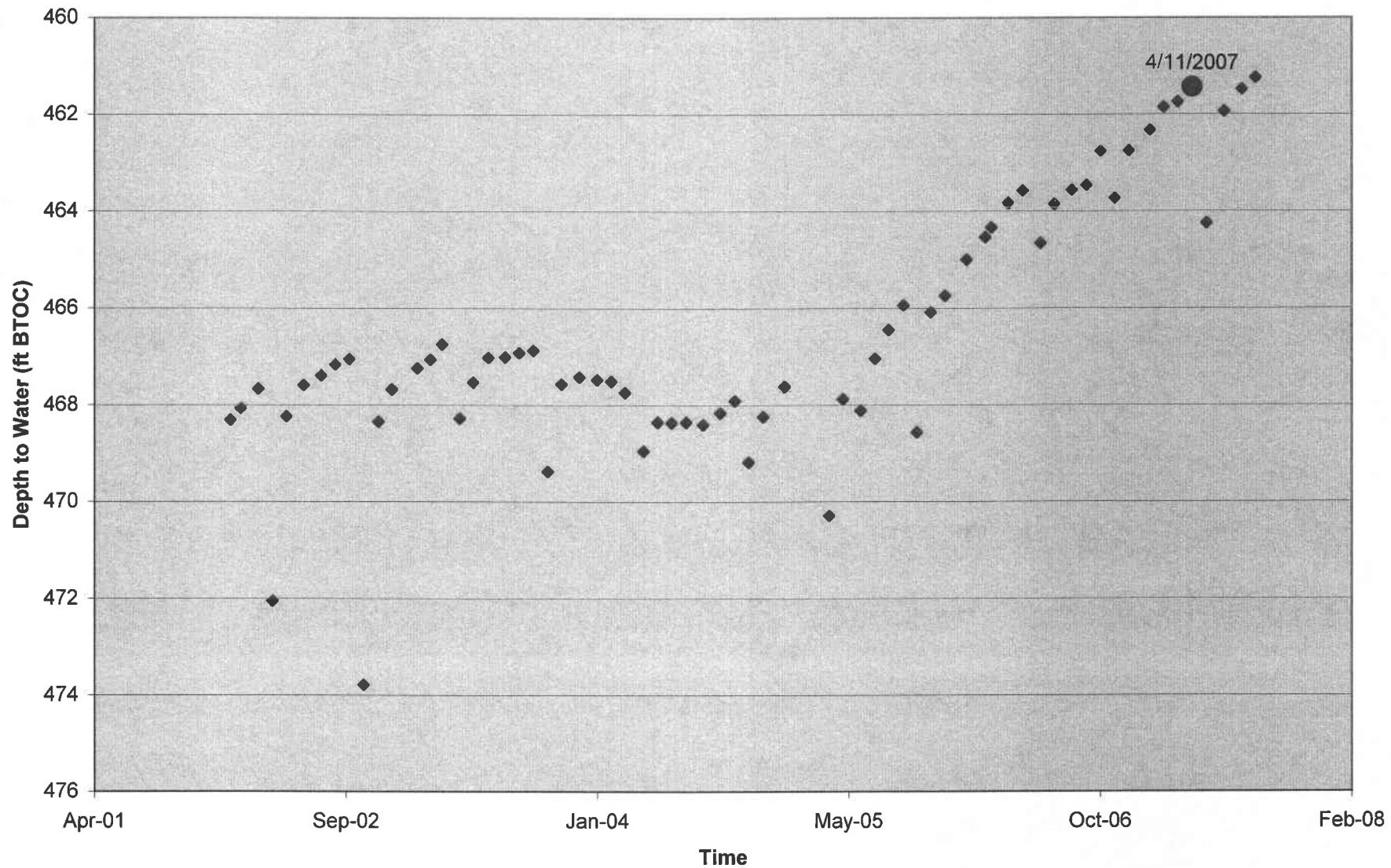


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WQSP-2

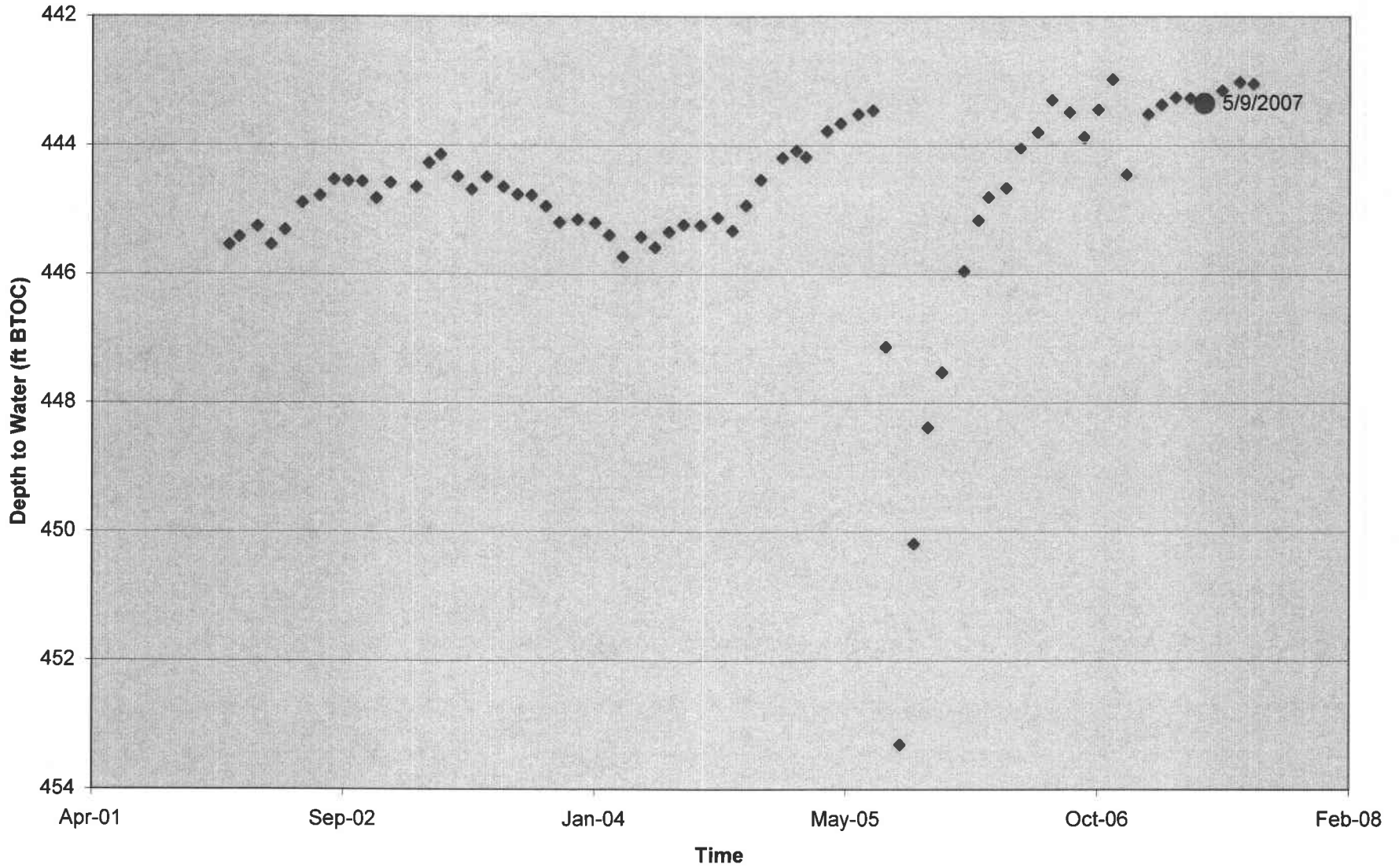


WQSP-3



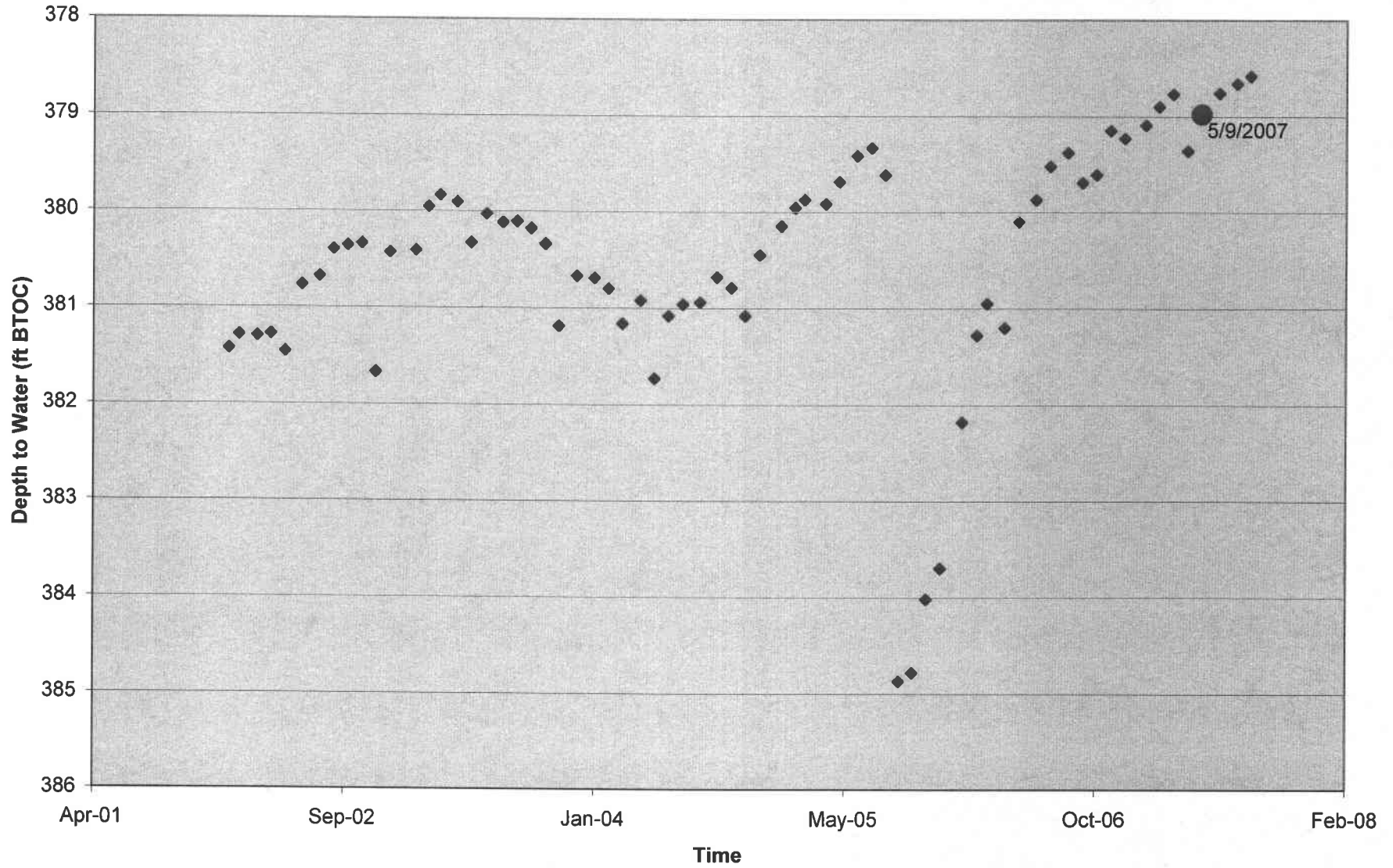
Information Only

WQSP-4



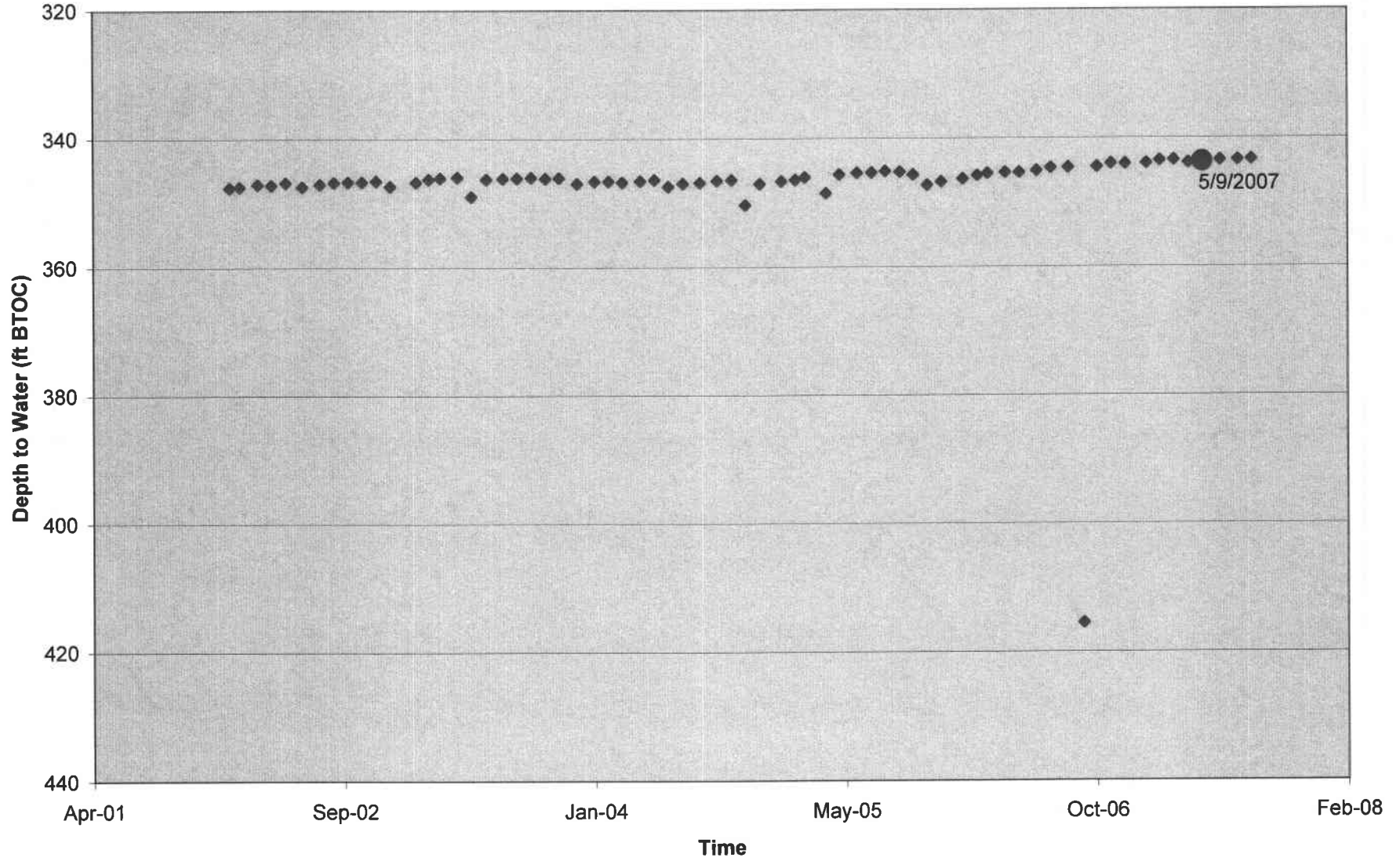
Information Only

WQSP-5

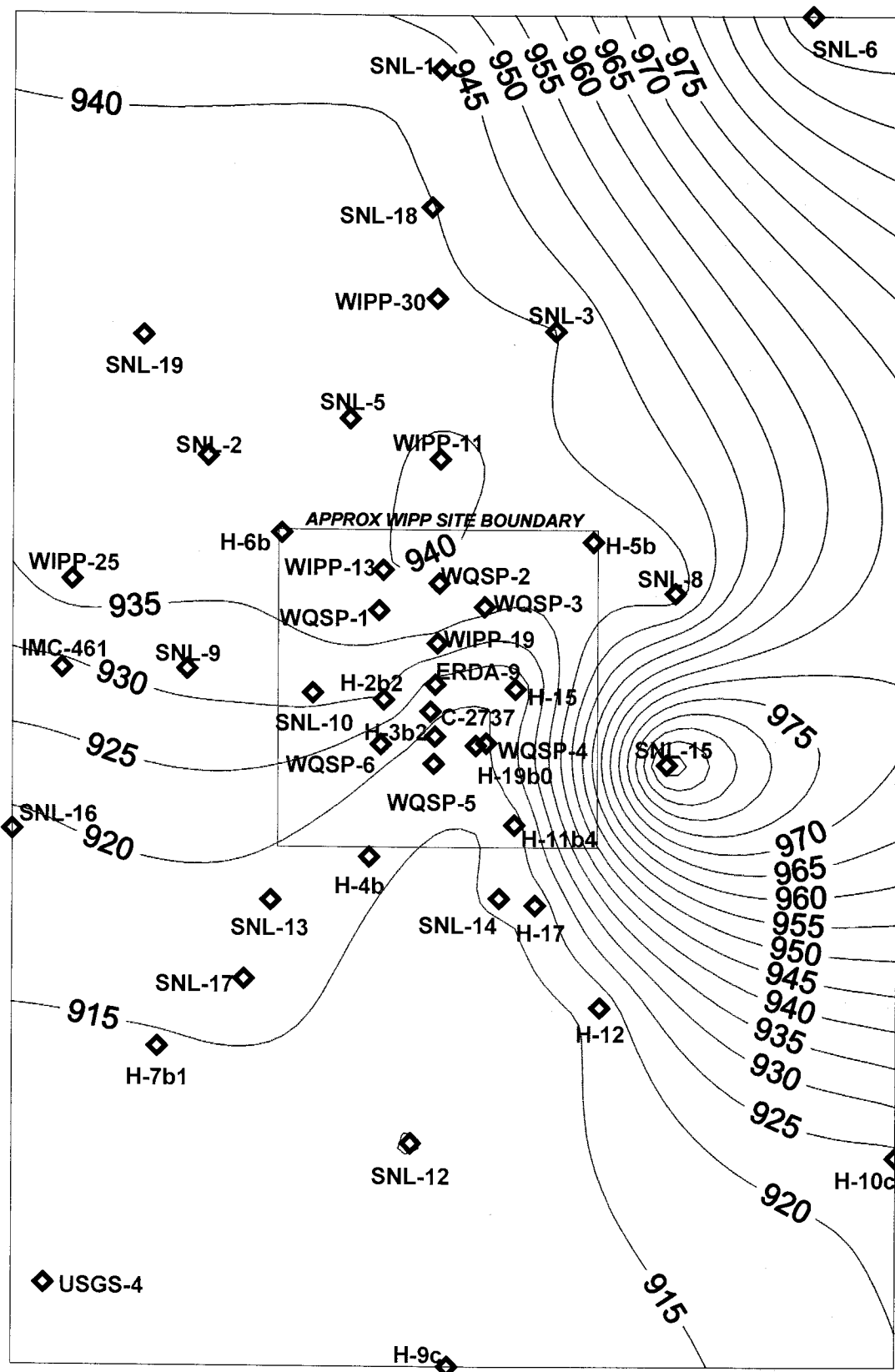


Information Only

WQSP-6



Information Only



Potentiometric Surface, Adjusted to Equivalent Freshwater Heads, of the Culebra Dolomite Member of the Rustler Formation near the WIPP Site, May 2007, Revision 1



Note: Contour elevations are in meters above mean sea level

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