CDM

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Memorandum

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Cc: *Pat Evans, Ph.D., CDM*
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Date: *September 6, 2006*

Subject: *Summary of Slug Test Analysis for C-Sand Aquifer Unit*
Remediation of Volatile Organic Compounds
Former C-6 Facility, Los Angeles, California

Camp Dresser & McKee Inc. (CDM) has prepared this memorandum presenting the procedures and results of the slug tests conducted on select C-Sand screened monitoring wells at the former C-6 Facility (site). The objective of the slug tests was to estimate the aquifer characteristics of the C-Sand aquifer.

The slug tests were completed in Wells IRZCMW0002, MWC009, MWC015, MWC017 and MWC022 (Figure 1). Based on the previous investigation data at the site, the C-sand aquifer is composed of predominantly coarse grained strata from approximately 96 to 145 feet below ground surface (ft bgs).

1.0 Selection of Wells

An initial slug test was performed by Tait Environmental Management (Tait) under direct contract with Boeing Realty Corporation during the quarterly groundwater monitoring event in June 2006. Based on CDM's recommendation, the C-sand well sampled and slug tested was IRZCMW0002. The purpose of testing this well was to determine its potential for use as an observation well during any proposed aquifer performance tests (APTs). The value of hydraulic conductivity (K) for the C-sand aquifer obtained from this well (discussed below in

Section 3), was two orders of magnitude lower than the estimated K value of 145 feet per day (ft/day) for the C-Sand aquifer in the site vicinity (CH2MHill, 2004). As a result, CDM recommended conducting additional slug tests at the site to confirm these results and obtain better information regarding the probable range of hydraulic conductivity in the C-Sand aquifer.

The wells recommended by CDM for additional slug testing consisted of MWC009, MWC011, MWC015, and MWC017 selected to obtain an estimate of the range of K values in the C-sand aquifer across the site. The slug tests were conducted on August 2, 2006 by Tait. Initially, MWC011 in Lot 8 was selected to perform a slug test since the well is screened in the "window" where the confining aquitard unit (Middle Bellflower Mud) between the lower Bellflower and the C-Sand aquifer was noted to be absent (Rubicon Crossections, August 2006). Due to access issues at this well and the first alternate well MWC006, Tait, with concurrence from CDM, performed the slug test in the second alternate location, well MWC022, which was approximately 200 feet east of MWC006. This well was projected to be screened in the same zone as MWC011 and MWC006.

2.0 Slug Test Procedures

Slug tests were performed in well IRZCMW0002 on June 19, 2006; and in wells MWC009, MWC015, MWC017 and MWC022 on August 2, 2006 by Tait. In general, the slug tests were performed in accordance with the CDM Standard Operating Procedures (SOPs) for slug testing which were provided to Tait prior to initiating each of the test events. Water levels were recorded using a downhole data logger (Solnist Troll Model F30/M10). An electronic water-level indicator was used to measure the static water level prior to the start of the slug test. Manual water-level measurements were also collected during the test at regular intervals. The field notes complied by Tait during the slug test is presented in Appendix A.

Each test was initiated by quickly lowering the slug into the water column (falling-head test). The falling head test was then simulated after the well recovered to static conditions. The water level in the well was monitored until static conditions were achieved; thereafter a second test was initiated by rapidly lifting the slug to a point above the static water level (rising-head test). Upon completion of the test, the data from the transducer was downloaded to a computer and reduced into spreadsheet format. Analysis of the water level response with time permits the estimation of K for the area immediately adjacent to the screened portion of the well.

3.0 Test Analysis and Results

The Bouwer and Rice solution, developed by Bouwer and Rice (1976) and modified by Bouwer (1989) was used to analysis the slug test data. The Bouwer and Rice solution was

developed for use with fully or partially penetrating wells screened in unconfined aquifers; however, the solution is also appropriate for confined or stratified aquifers. Computations were done using commercial software that implements the Bouwer and Rice method.

Well characteristics required for slug test analysis and the range of calculated values of K are presented in Table 1. The estimated K values for the C-Sand aquifer unit range from 4.1 ft/day to 13.4 ft/day for the test conducted in August 2006. The semi-log plots of water level change versus time for the slug tests performed are presented in Appendix B along with other related data.

4.0 Conclusions

Based on the data presented in this memorandum, the following conclusions can be made:

- This estimated K value of 0.13 ft/day in IRZCMW002 is anomalously low and is not believed to be representative of the C-Sand aquifer. This could be attributed to the fact that this is an amendment well or was in the general area where electron donor (molasses) injections were conducted previously, which could have resulted in clogging of the screen and surrounding soil. Since slug tests values are representative only of the saturated soils in the immediate vicinity of the screen, K-values are likely underestimated. This well is not suitable for use as an observation well during any APTs.

- Based on the second round of slug tests, the values of K in the C-Sand aquifer are estimated to range from 4.1 to 13.4 ft/day. These values are similar to the B-Sand aquifer unit and an order of magnitude lower than the estimated K value of 145 feet per day (ft/day) for the C-Sand aquifer in the site vicinity (CH2MHill, 2004).

5.0 Limitations

The influence of a slug test extends only a short distance into the soils surrounding a well screen, and the area tested is relatively small compared with that influenced by a pumping test. Therefore, aquifer parameters determined by slug testing are representative only of the saturated soils in the immediate vicinity of the screen and may be affected by the well construction.

References

CH2MHill. 2004. *Initial Calibration and Data Gap Analysis Report, Dual Site Groundwater Operable Unit Remedial Design, Montrose Chemical and Del Amo Superfund Site*. October 2004.

Attachments

Table 1 - C-Sand Slug Test Summary (June and August 2006)
Figure 1 – Well Location Map
Appendix A – Slug Test Analysis Data Sheets
Appendix B – Tait Field Data Sheets

Table 1
C-Sand Slug Test Summary (June and August 2006)
Former C-6 Facility, Boeing Reality Corporation, Long Beach, California

Monitoring Well Designation (Unit)	Date Tested	Slug Test Type	Well Casing Radius r_c (feet)	Borehole Radius r_w (feet)	Saturated Screen Interval L_e (feet)	Depth to Screen Bottom (feet)	Interpreted Aquifer Thickness [1] (feet)	Static Water Level Depth (feet)	Estimated Hydraulic Conductivity K (feet/day)	Estimated Hydraulic Conductivity (Average) K (feet/day)
IRZCMW0002	6/19/2006	Falling Head Test	0.17	0.42	25	121	30	65.00	0.14	**0.13**
		Rising Head Test							0.13	
MWC009	8/2/2006	Falling Head Test	0.17	0.42	20	121	40	62.55	7.63	**7.66**
		Rising Head Test							7.70	
MWC015	8/2/2006	Falling Head Test	0.17	0.42	25	125	30	60.51	10.83	**10.77**
		Rising Head Test							10.71	
MWC017	8/2/2006	Falling Head Test	0.17	0.42	25	125	40	64.75	13.41	**13.39**
		Rising Head Test							13.38	
MWC022	8/2/2006	Falling Head Test	0.17	0.42	20	117	45	59.33	4.38	**4.10**
		Rising Head Test							3.84	

Notes:

c	Depth to aquifer bottom assumed to be equivalent to the depth to the bottom of the screened portion of the well.
R_e	Effective radial distance over which Y is dissipated.
Y	Head change induced within the well.
*	The screen was not fully saturated for this test, so only the rising head test was used with an adjusted saturated interval.
cm/sec	Centimeters per second.
1	Estimated from crossections produced by Rubicon, August 2006

References:

1) Bouwer, H. and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, v. 12, pp. 423-428.

2) Bouwer, H., 1989. The Bouwer and Rice Slug Test - An Update. Ground Water, v. 12, No. 3, pp. 304 - 309.

190th Street
MWB020
PARCEL A
MWC007
MWB007
MWC006
MWB006
WCC_03S
MWC022[2]
MWB027
WCC_04S
MWC011
MWC023
WCC_05S
WCC_06S
WCC_07S
TMW_08
MWC004
MWB028
MWB003
TMW_07
WCC_12S
WCC_09S
Knox Street
Normandie Avenue
DAC-P1
PARCEL B
MWB013
MWC009[2]
MWG001
TMW_04
MWB012
MW0005
IRZMW002A/B
IRZMW003A/B
IRZMW001A/B
TMW_15
PARCEL C
MWC021
TMW_10
MWG003
MWC015[2]
BL-03
MWC016
TMW_06
IRZMW005
IRZB0081
IRZCMW001
IRZMW004
IRZB0095
CMW026
IRZCMW003
XMW_19
MWG002
IRZCMW002[1]
MWG004
MWB014
TMW_11
TMW_14
MWB019
MWC017[2]
CMW001
Francisco Street
XMW-09
CMW002
PARCEL D

NOTES:
1. Slug Tested Wells (June 19, 2006 by Tait)
2. Slug Tested Wells (August 2, 2006 by Tait)

0 250 500
Feet

Legend

- Parcel Boundary
- Property Boundary
- B-Sand Monitoring Well
- C-Sand Monitoring Well
- Gage Monitoring Well
- Montrose Monitoring Well (B-Sand)
- B-Sand IRZ Bioremediation Monitoring Well
- C-Sand IRZ Bioremediation Monitoring Well

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Figure 1
Boeing Realty Corporation
Former C-6 Facility
Well Location Map

Appendix A
Slug Test Analysis Data Sheets

CDM

IRZCMW002

I FIELD EQUIPMENT

- Solinst F30/M10 = 13.007 psi rating
  = 30.05 ft of water

- Slug
  $l = 5.4'$
  $\phi = 3''$ o.d
  $\therefore$ Volume of slug $= \pi r^2 h = (3.14)(0.125\,ft)^2 \times (5.4\,ft) = 0.26\,ft^3$

- Theoretical $H_0 = \dfrac{0.26}{0.65 \cdots (\text{for } 4''\phi)} = \boxed{0.41\ ft}$

II ANALYSIS

- Bower & Rice method ..... Bouwer H, 1989

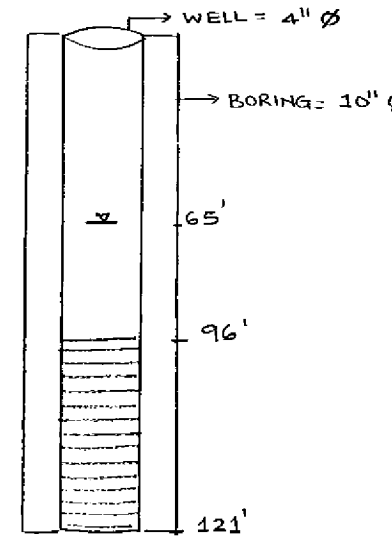
- Formula: $K = \left[\dfrac{r_c^2 \ln(R_e/r_w)}{2L}\right]\left(\dfrac{1}{t}\right) \ln\left(\dfrac{Y_0}{Y_t}\right)$

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(H/r_w)} + \frac{A+B\ln[(D-H)/r_w]}{L/r_w}\right]^{-1}$$

- Well information
  r_c = casing radius = $4''/2 = (0.33\,ft) \div 2 = 0.17\,ft$
  $r_w = (10''/2) = 0.42'$

  $H = (121-65) = 56\,ft$
  $L = (121-96) = 25\,ft$
  $D = (125-65) = 60\,ft$

IRZCMW002



(A) • Match point : FALLING HEAD
  $y_0 = 1.9\,ft$
  $y_t = 0.4\,ft$

  $t = 30$ minutes
  $A+B = (3.3 + 0.5)$

( ) SOLUTION FOR FALLING HEAD

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(56/0.42)} + \frac{3.3+0.5\ln[(60-56)/0.42]}{25/0.42}\right]^{-1}$$

$$= \left[\frac{1.1}{4.89} + \frac{4.42}{59.52}\right]^{-1} = 0.29^{-1} = \boxed{3.45}$$

$$\therefore\ k = \left[\frac{(0.17\ ft)^2\ (3.45)}{2\ (25)}\right] \times \frac{1}{30\ min} \times \ln\left(\frac{1.9\ ft}{0.4\ ft}\right)$$

$$= 1.03 \times 10^{-4}\ ft/min$$

$$= \boxed{0.15\ ft/day}$$

(B) RISING HEAD

- MATCH POINT : Rising head
  $y_0 = 2.2\ ft$
  $y_t = 1.8\ ft$
  $t = 5$ minutes
  $A+B = (3.3 + 0.5)$

- Solution

$$\ln \frac{R_e}{r_w} = \left[\frac{1.1}{\ln(56/0.42)} + \frac{3.3 + 0.5 \ln[(60-56)/0.42]}{(25/0.42)}\right]^{-1}$$

$$= \boxed{3.45}$$

$$\therefore\ k = \left[\frac{(0.17\ ft^2)\ (3.45)}{2\ (25)}\right] \times \frac{1}{5\ minutes} \times \ln\left(\frac{2.2\ ft}{1.8\ ft}\right)$$

$$= 8.0 \times 10^{-5}\ ft/min$$

$$= \boxed{0.12\ ft/day}$$

III SUMMARY

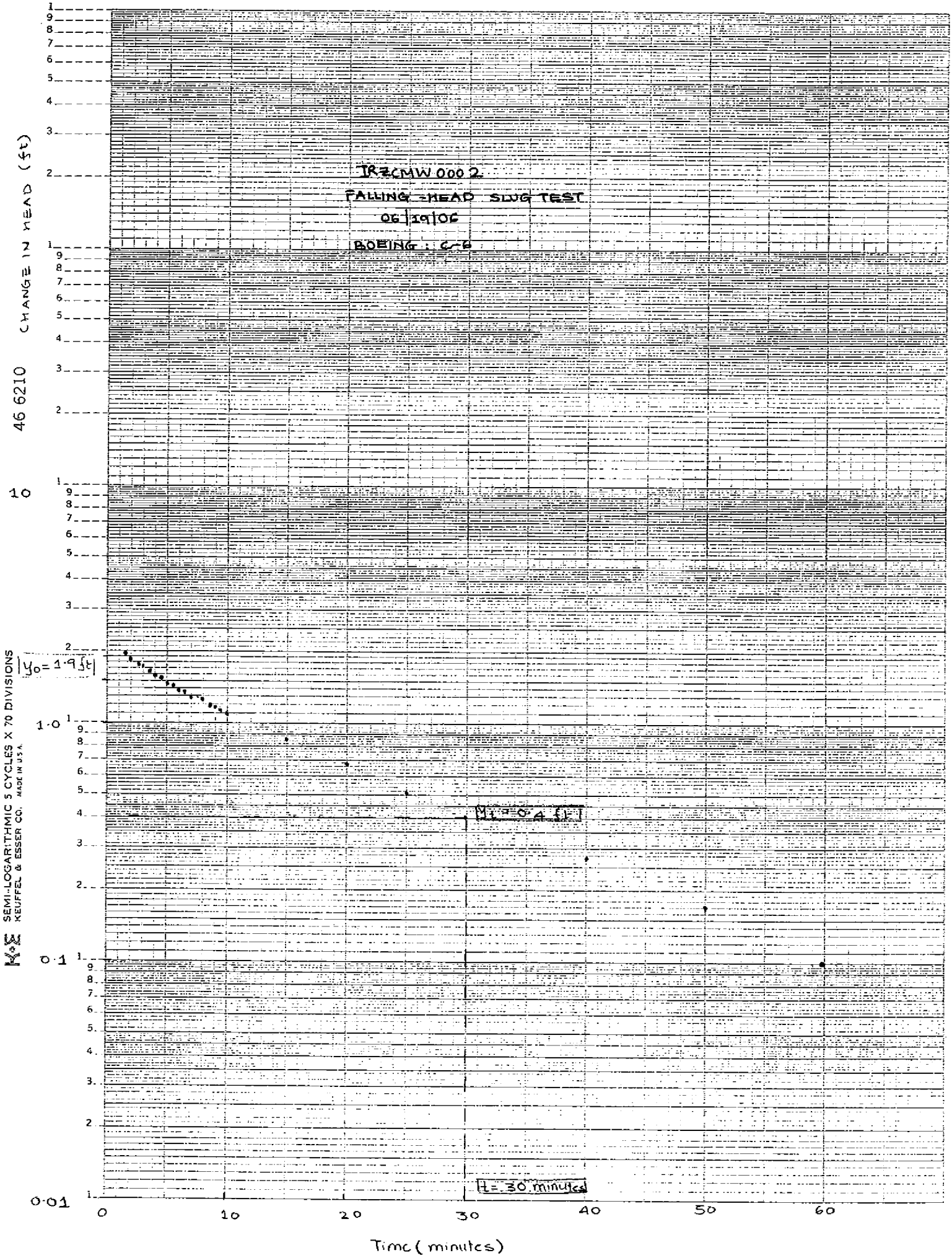
TEST	FALLING	RISING	GEOMEAN
MANUAL	0.15 ft/day	0.12 ft/day	0.13 ft/day
TRANSDUCER	0.14 ft/day	0.13 ft/day	0.13 ft/day

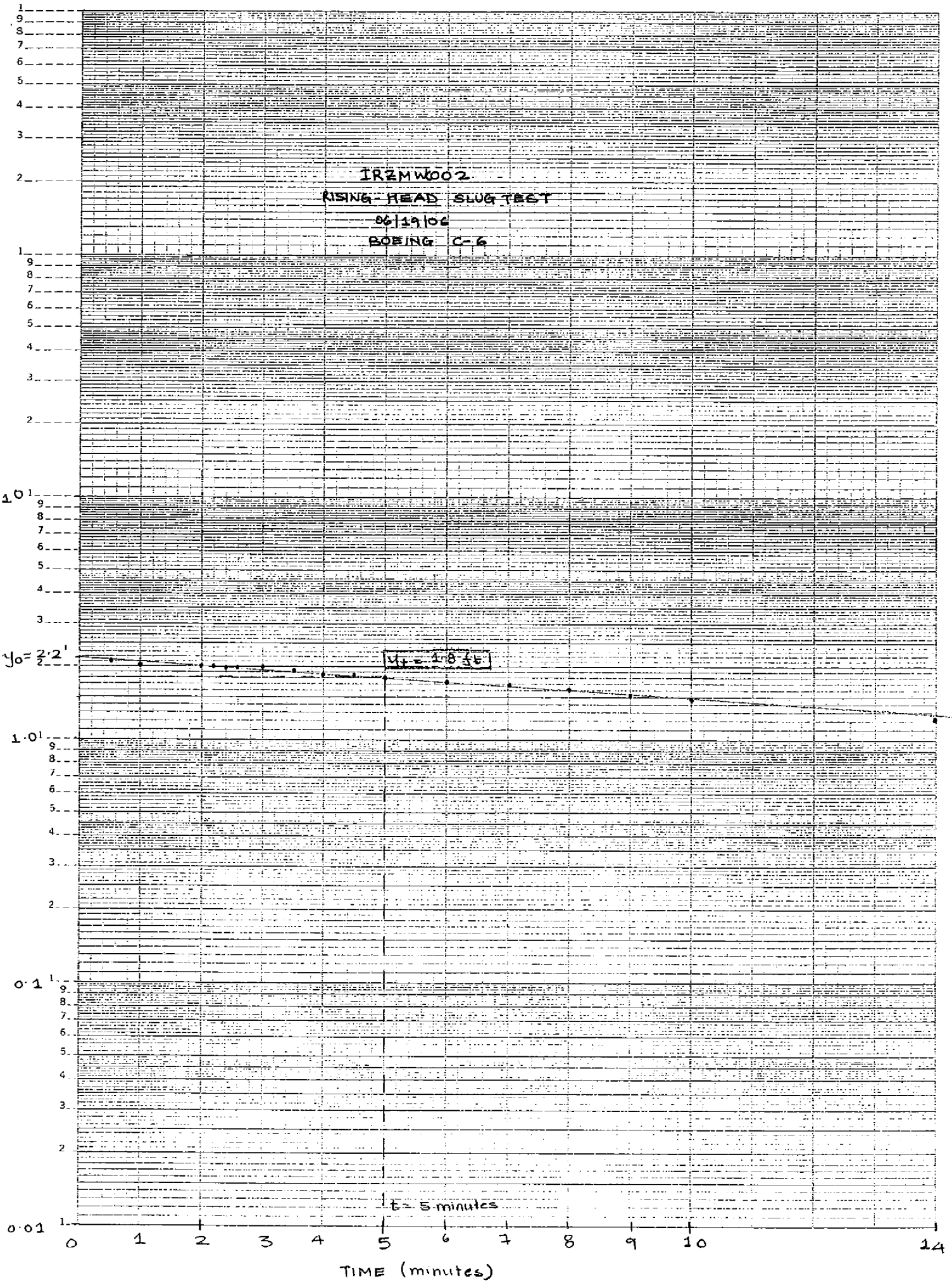
IV CONCLUSION

$$K = 0.13 \frac{ft}{day} = 4.51E-05 \frac{cm}{sec}$$

∴ Value of K indicate material screened = silt to silty sand .... Freeze & Cherry, 1979

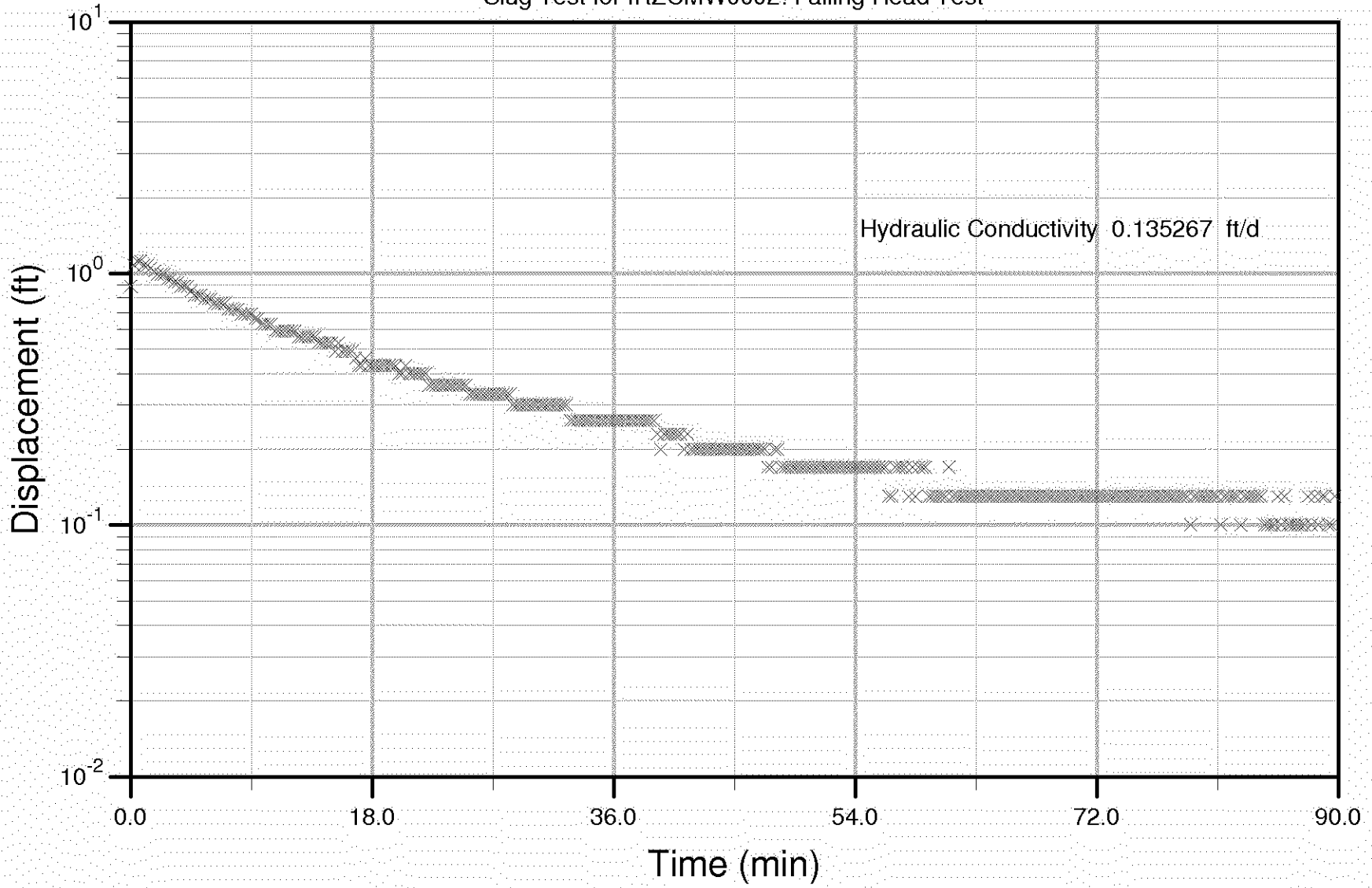
∴ ROI is small due to permeability of material.


IRZCMW 0002
FALLING-HEAD SLUG TEST
06/19/06
BOEING : C-6
CHANGE IN HEAD (ft)
46 6210
10
1.0
0.1
0.01
$y_0 = 1.9$ ft
$M_1 = 0.4$ ft
t = 30 minutes
0
10
20
30
40
50
60
Time (minutes)
K&E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.


IRZMW002
RISING-HEAD SLUG TEST
06/19/06
BOEING C-6
$y_0 = 2.2'$
$y_t = 1.8$ ft
t = 5 minutes
TIME (minutes)
0
1
2
3
4
5
6
7
8
9
10
14
0.01
0.1
1.0
10
46 6210
K&E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

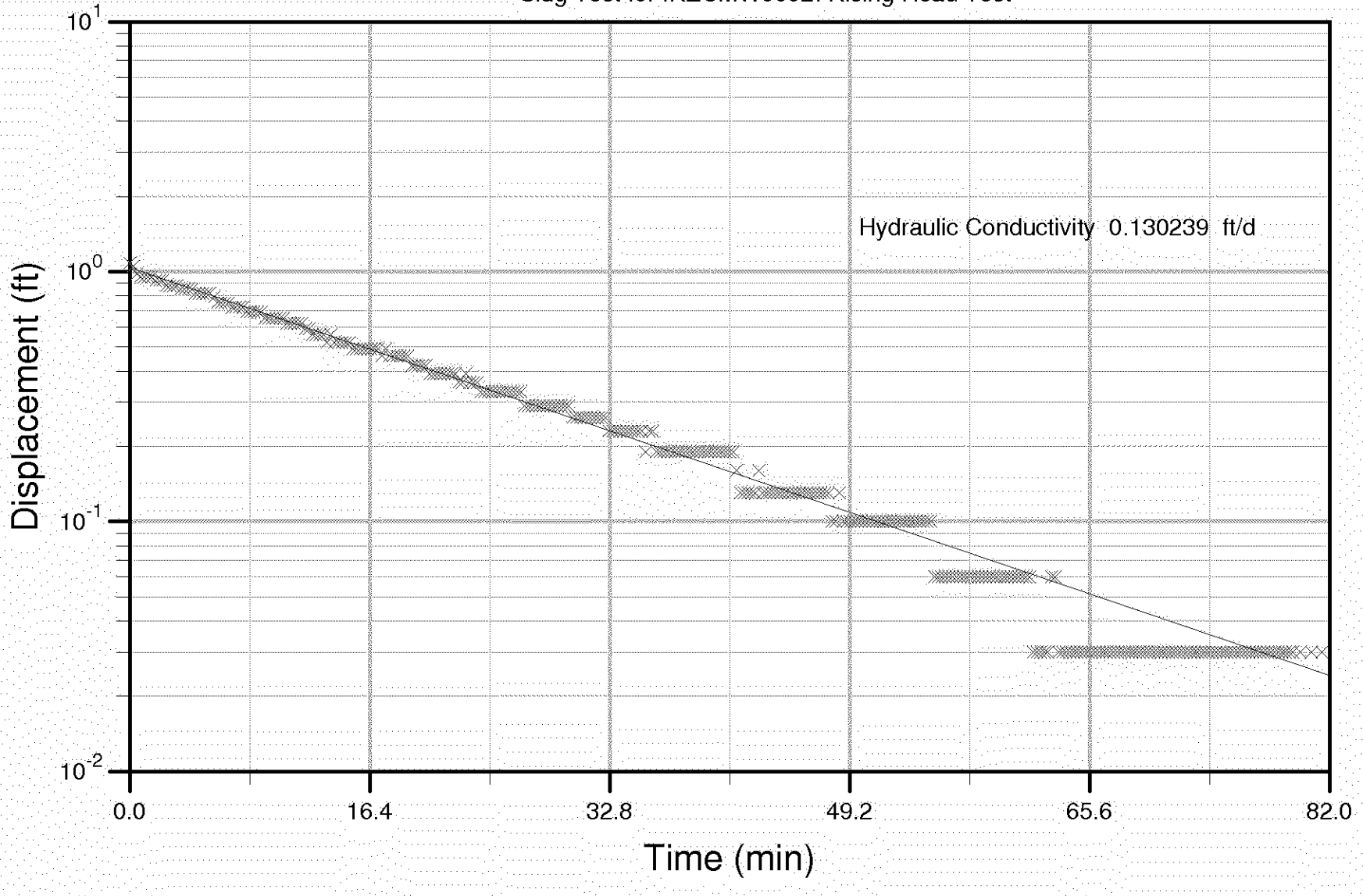
Bouwer & Rice

Slug Test for IRZCMW0002: Falling Head Test



Bouwer & Rice

Slug Test for IRZCMW0002: Rising Head Test



I FIELD EQUIPMENT

- Solinst F15/M5

  = 15 psi rating = 34.65 ft of water

- slug

  $l = 5.22'$

  $\phi = 3''$ (o.d)

  ∴ volume of slug $= \pi r^2 h = 3.14 \times (0.125)^2 \times 5.22 = 0.26\ ft^3$

- Theorehical $H_o = \frac{0.26}{0.65}$ (for 4"ϕ) $= \boxed{0.41\ ft}$

II WELL INFORMATION

1) MWC009

   $\phi = 4''$

   borehole diameter = 10"

   TD = 119.53'

   screen = 101 to 121 = 20 ft

   Σ = 62.55 (8/2/6 @ 745) ··· static

2) MWC015

   $\phi = 4''$

   borehole diameter = 10"

   T.D = 120.26' (Teit's field notes) = 128' (boeing portal)

   screen = 100 to 125 = 25'

   Σ = 60.51 (8/2/06 @ 0932) ···· static

3) MWC017

   $\phi = 4''$

   borehole diameter = 10"

   T.D = 124.82 (Teit's field notes) = 128' (boeing portal)

   screen = 100 - 125 = 25'

   Σ = 64.75 (8/2/06 @ 1200) ···· static

4) MWC022

   $\phi = 4''$

   borehole diameter = 10"

   T.D = 115.80 (Teit's field notes) = 120 (boeing portal)

   screen = 97 - 117 = 20'

   Σ = 59.33 (8/2/6 @ 1453)

III. ANALYSIS

- gravel pack porosity = 0.3
- Aquifer thickness
  - MWC017 ≅ 40'
  - MWC022 ≅ 45'
  - MWC009 = 40'
  - MWC015 ≅ 30'
- Bouwer & Rice 1989 for confined systems

  & Cooper, Bredehoeft and Papadopulus, 1967 for confined aquifer

IV. RESULTS FOR K (ft/day)

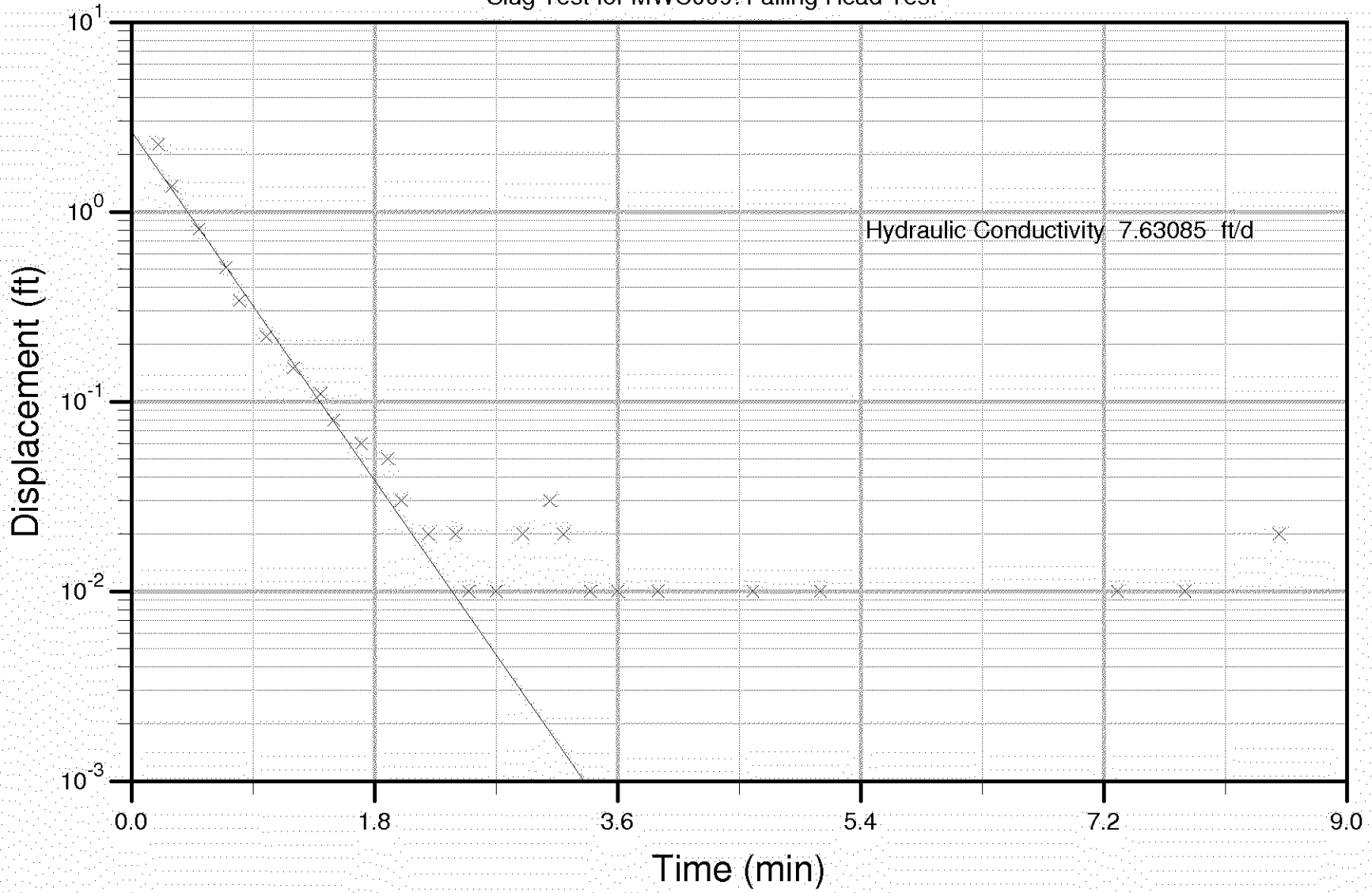
	MWC009	MWC015	MWC017	MWC022
FALLING HEAD	7.63 [1] 12.82 [2]	10.83 [1] 18.99 [2]	13.41 [1] 27.12 [2]	4.38 [1] 7.13 [2]
RISING HEAD	7.70 [1] 12.63 [2]	10.71 [1] 10.14 [2]	13.34 [1] 28.81 [2]	3.84 [1] 7.18 [2]
GEOMEAN [3]	9.88	12.22	19.34	5.42

Notes: Units are in ft/day for hydraulic conductivity (K)

1. Results from Bouwer & Rice analysis
2. Results from Cooper analysis. For cooper analysis $K = \frac{\text{Transmissivity}}{\text{thickness}}$ $\frac{(ft^2/day)}{(ft)}$
3. K (ft/day) is average geomean values from falling & rising tests using Bouwer & Cooper solutions.

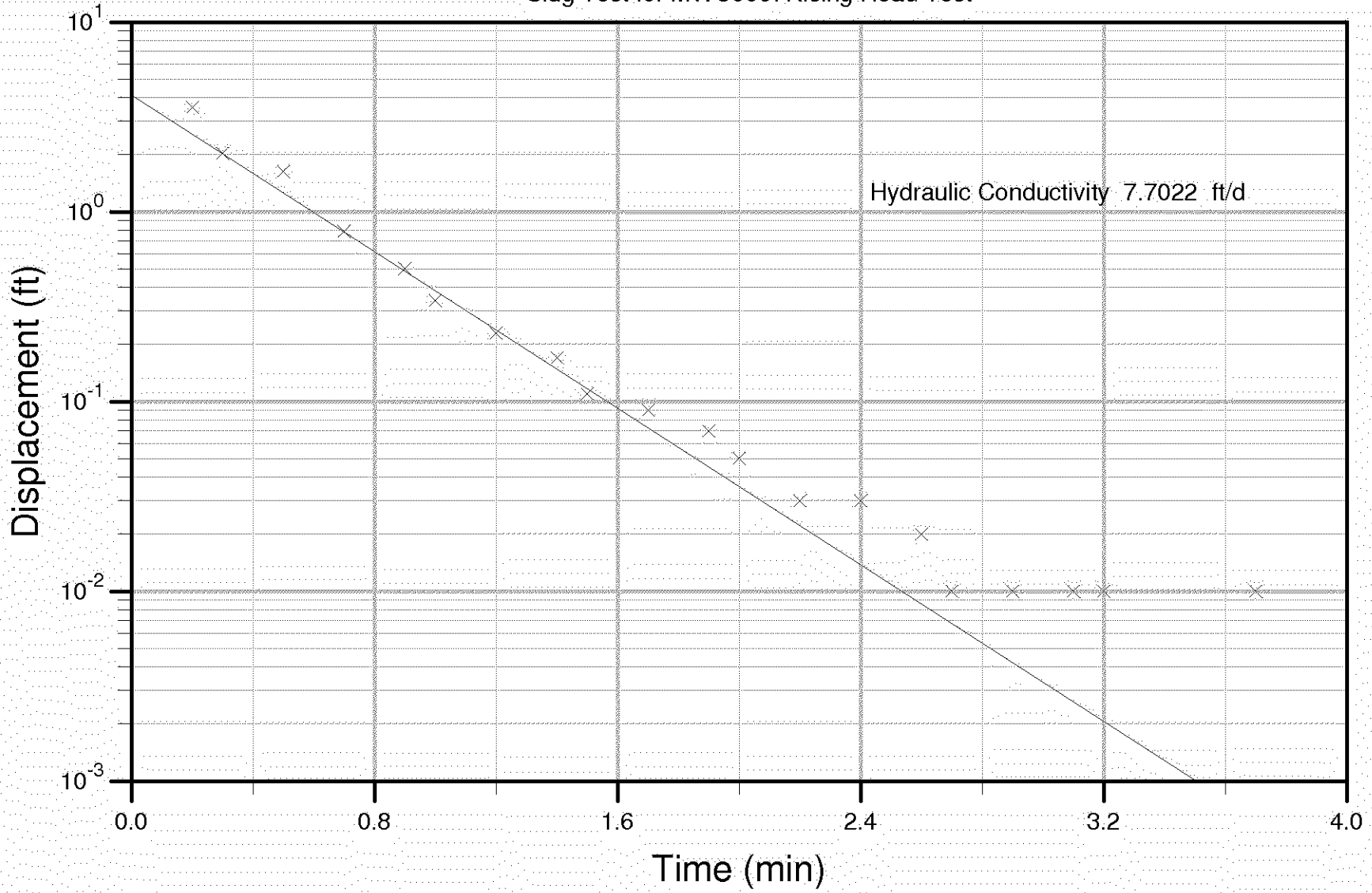
Bouwer & Rice

Slug Test for MWC009: Falling Head Test



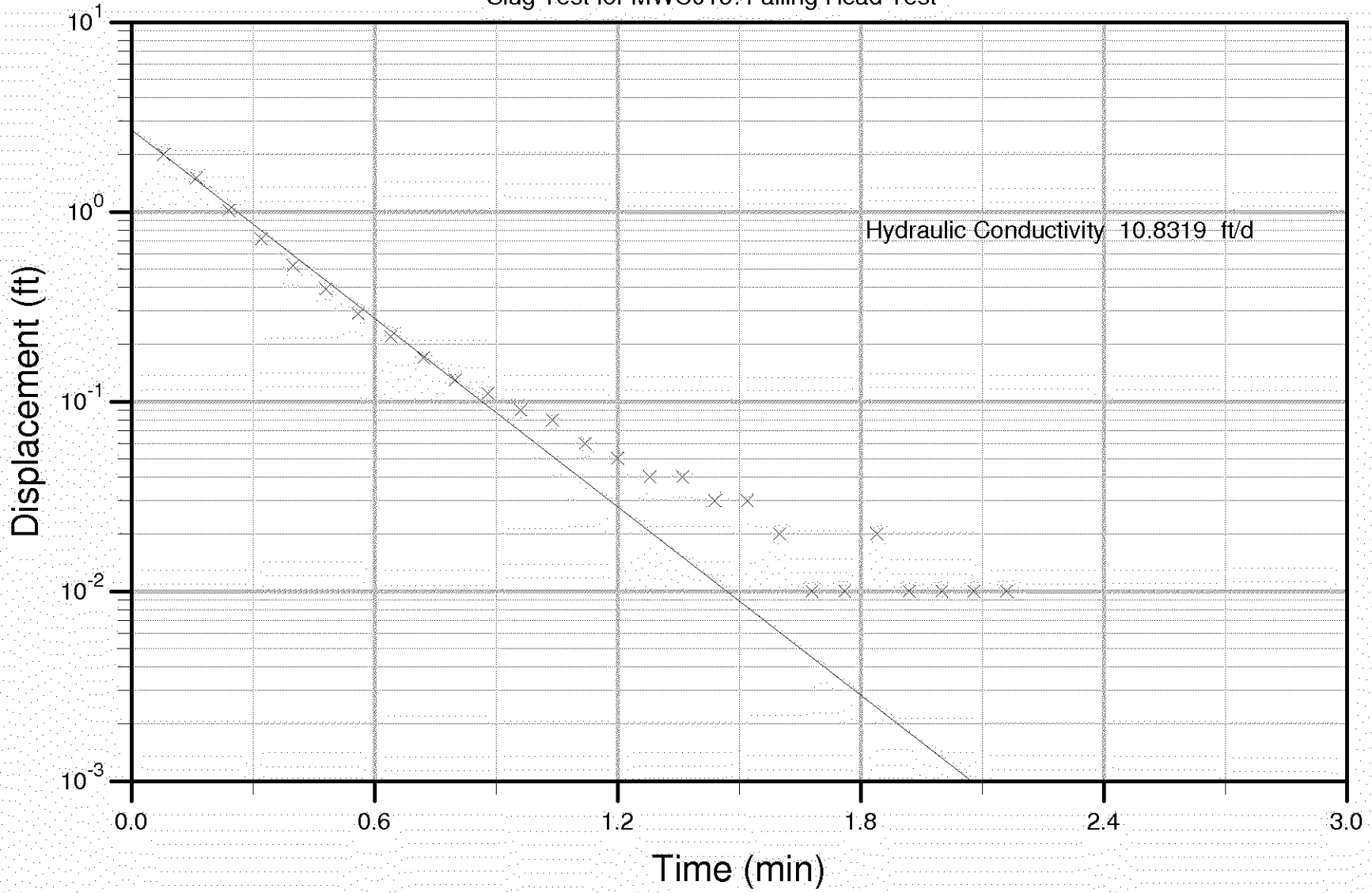
Bouwer & Rice

Slug Test for MWC009: Rising Head Test



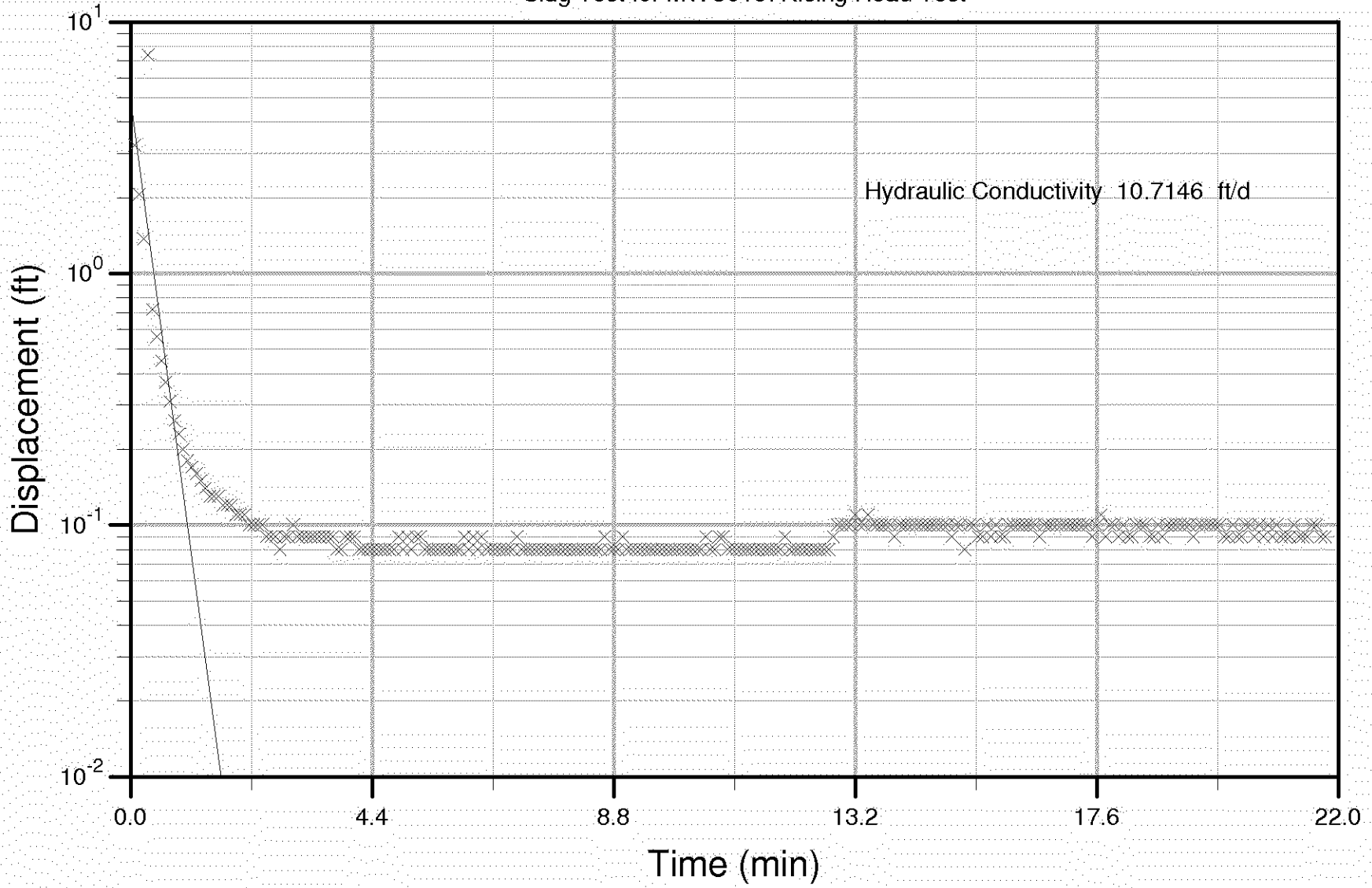
Bouwer & Rice

Slug Test for MWC015: Falling Head Test



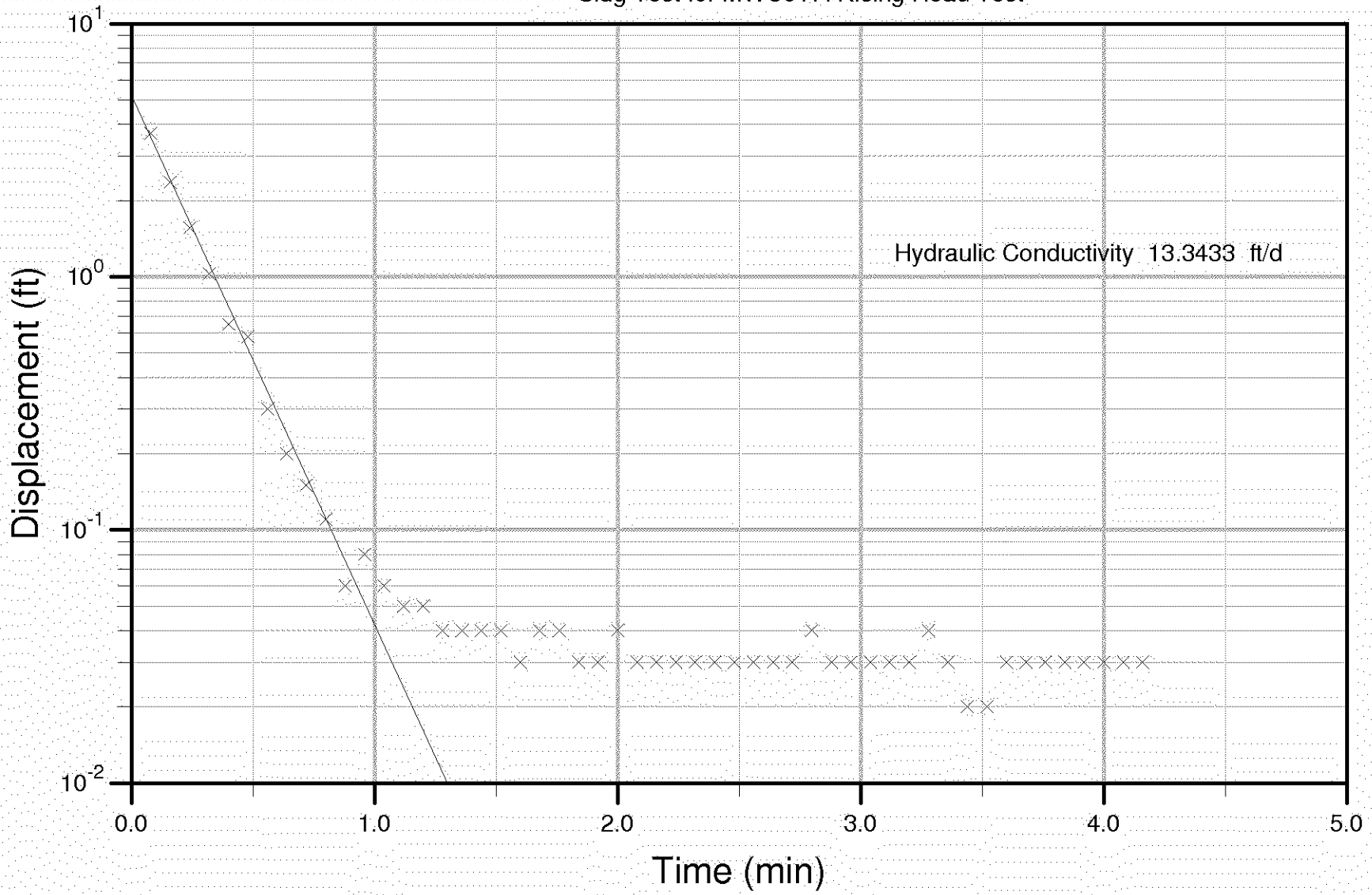
Bouwer & Rice

Slug Test for MWC015: Rising Head Test



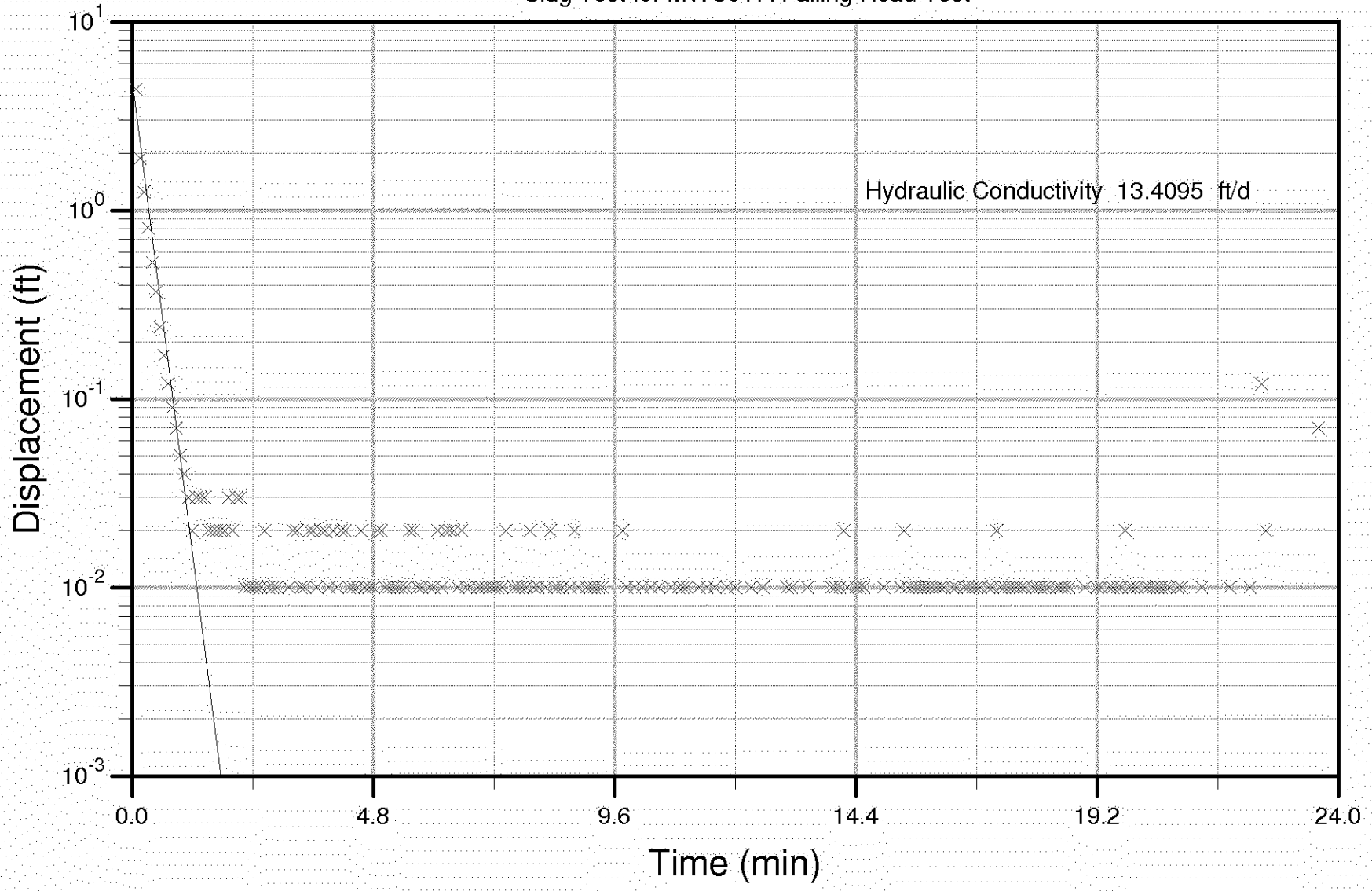
Bouwer & Rice

Slug Test for MWC017: Rising Head Test



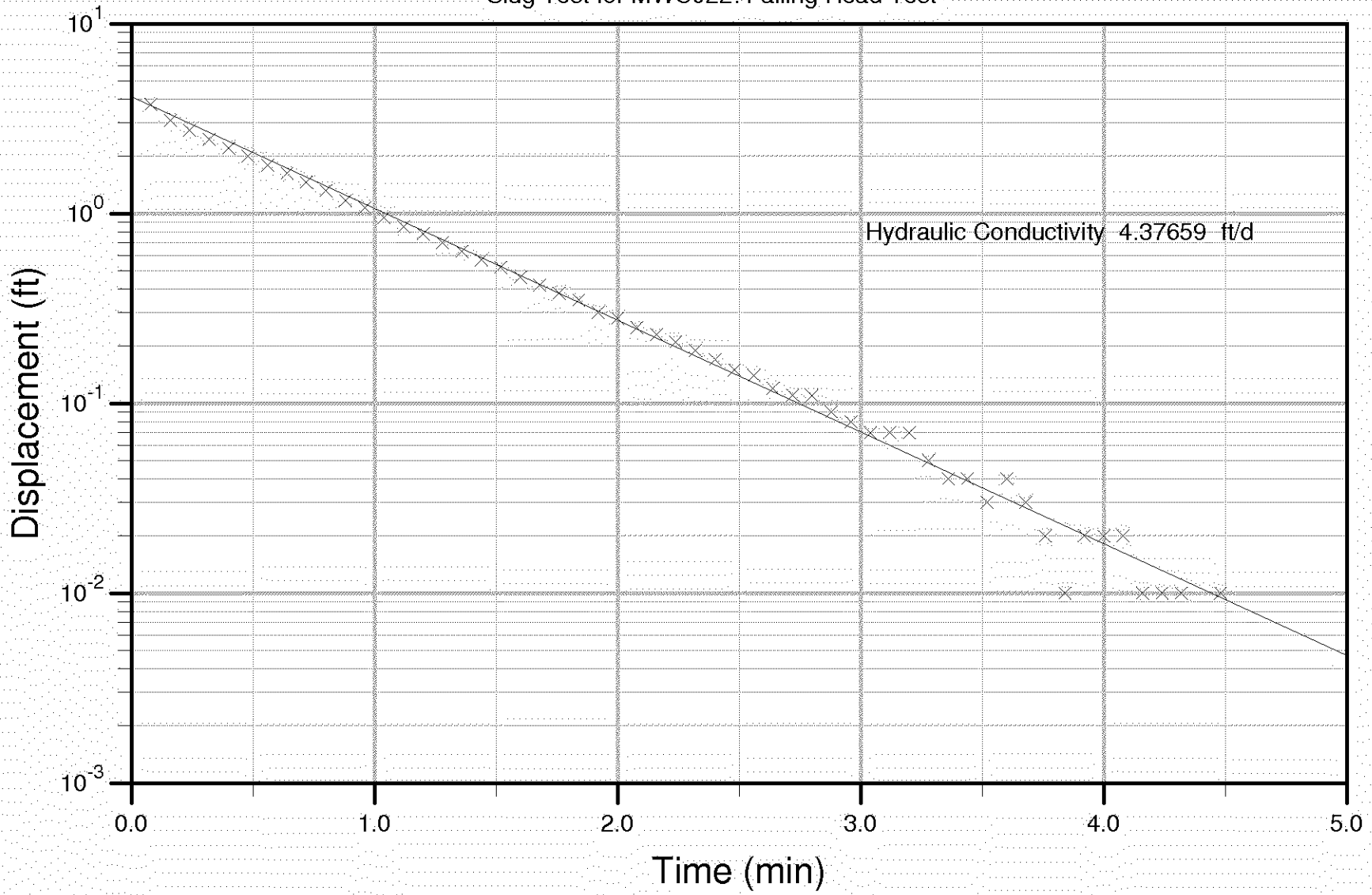
Bouwer & Rice

Slug Test for MWC017: Falling Head Test



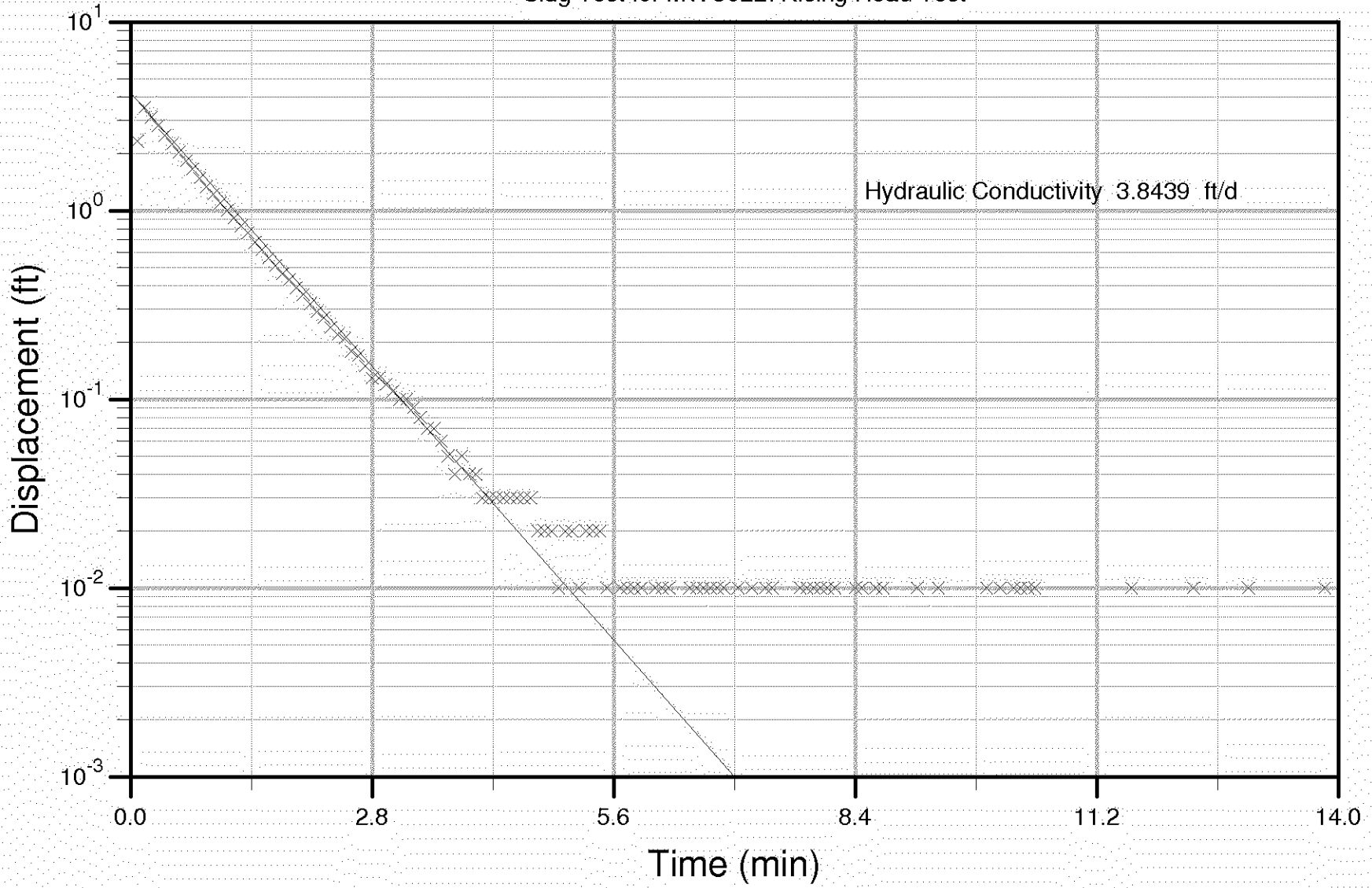
Bouwer & Rice

Slug Test for MWC022: Falling Head Test



Bouwer & Rice

Slug Test for MWC022: Rising Head Test



Appendix B
Tait Field Data Sheets

CDM

eing Former Torrance C-6 Facility

Torrance, California

Well Number IRZCMW0002
SLUG TEST WELL

Test Date(s): 06/19/06

Page 1 **of** _____

Slug Test Well Casing Diameter: 4" inches ID
Slug Test Well Borehole Diameter 10" inches
Slug Test Well Screen Interval (feet bMP): 96 to 121
Slug Test Well Total Depth (feet bMP): 121
Measuring Point (MP) Description: TOR (pre-marked pts
MP distance (above/below) survey point: —
Top of slug depth (feet below MP) 70'
Slug Volume _____(CF); Slug Length 5.4" (feet); Slug Diameter 3" in. OD

Data logger Serial # 06234
Data logger type: Solinst F30/M10
Data Logger depth (bMP): 75'
Pre-determined minimum drawdown depth (feet bMP): _____
Bottom of Slug Depth 75.4

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes bailing comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
6/19	9:15	Static Water Level (Pre-emplacement reading)	65.07	0	@10:40 Dropped slug, but had to pull out, because it was not completely submerged.
	10:30	Post-emplacement Water Level Reading	65.07		
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
6/19	10:40				see notes above letting levels restabalize
6/19	11:10	0:00	65.17	approximate	
	11:10.5	1:30	63.1		
	11:12	2:00	63.22		
		2:45	63.32		
	11:13	3:00	63.35		
		3:30	63.42		
	11:14	4:00	63.48		
		4:30	63.52		
	11:15	5:00	63.59		
		5:30	63.64		
	11:16	6:00	63.70		
		6:30	63.73		
	11:17	7:00	63.78		

Page 2 **of** _____

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes bailing comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
		7:30	63.80		
	11:18	8:00	63.82		

Explanation-
bMP = below measuring point

eing Former Torrance C-6 Facility

Torrance, California

Well Number _____
SLUG TEST WELL

Test Date(s): _____

		8:30	63.88		
6/19	11:19	9:00	63.90		
		9:30	63.93		
	11:20	10:00	63.96		
	11:25	15:00	64.22		
	11:30	20:00	64.40		
	11:35	25:00	64.56		
	11:40	30:00	64.66		
	11:50	40:00	64.80		
	12:00	50:00	64.90		
	12:10	60:00	64.97		
	12:25	75:00	65.00		
	12:40	90:00	65.06		
		SLUG	OUT		
	12:40				
		1:30		67.18	
		1:45		67.14	
	12:42	2:00		67.10	
		2:15		67.08	
		2:30		67.05	
		2:45		67.05	
	12:43	300		67.04	
		3:30	67.00	67.00	
	12:44	4:00	66.95	66.95	
		4:30	66.92	66.92	
12:45		5:00	66.87	66.87	
12:46		6:00	66.80	66.80	
12:47		7:00	66.75	66.75	
12:48		8:00			
12:49		9:00	66.68	66.68	
12:50		10:00	66.60	66.60	
12:55		15:00	66.55	66.55	

next page

Explanation-
bMP = below measuring point

eing Former Torrance C-6 Facility

Torrance, California

Well Number IRZCMW 0002
SLUG TEST WELL

Test Date(s): 06/19/06

	Time	Elapsed time	Depth		
	12:55	15:00	66.29	66.29	
	13:00	20:00	66.14	66.14	
	13:05	25:00	65.95	65.95	
	13:10	30:00	65.80	65.80	
	13:20	40:00	65.58	65.58	
	13:30	50:00	65.44	65.44	
	13:40	60:00	65.36	65.36	
	13:55	75:00	65.21	65.21	
	14:10	90:00	65.17	65.17	

Explanation-
bMP = below measuring point

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number MWC 009
SLUG TEST TYPE: Slug in / Slug out
Test Date(s): 8-2-06
Page 1 of 1

Slug Test Well Casing Diameter: 4 inches ID
Slug Test Well Borehole Diameter 10 inches
Slug Test Well Screen Interval (feet bMP): 101 to 121
Slug Test Well Total Depth (feet bMP): 119.53
Measuring Point (MP) Description: TOC N-side
MP distance (above/below) survey point: 0
Top of slug depth (feet below MP) 63.50
Slug Volume 0.32 (CF); Slug Length 62 5/8 in (feet); Slug Diameter 3 3/8" in. OD
CSV File Directory/Name
Levelogger File directory/name:

Data logger Serial # 40249
Data logger type: Solinst LT F15/M5
Data Logger depth (bMP): ~ 73'
Obs Well(s): MW
Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2/06		Static Water Level (Pre-test-01)	62.55	0	TD 119.53
		Static Water Level (Pre-test-02)	62.55		
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			Start test @ 8:41.00
	8:42.		62.35		
	8.42.09		62.40		
MW	~~8.42~~	8.42.29	62.47		
	8:42.50		62.50		
	8:43.0		62.52		
	8.44.00		62.54		
	8.44.47		62.55		

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number ~~MW-C-015~~
SLUG TEST TYPE: Slug in / Slug out
Test Date(s): 8-2-06
Page 1 of 1

Slug Test Well Casing Diameter: 4 inches ID
Slug Test Well Borehole Diameter: 10 inches
Slug Test Well Screen Interval (feet bMP): 100 to 125
Slug Test Well Total Depth (feet bMP): 120.26
Measuring Point (MP) Description: North side TOC
MP distance (above/below) survey point: 0
Top of slug depth (feet below MP) 62.45
Slug Volume 0.32 (CF); Slug Length 62 5/8 (feet); Slug Diameter 3 3/8 in. OD
CSV File Directory/Name
Levelogger File directory/name:

Data logger Serial #: 40249
Data logger type: Solinst LT F15/M5
Data Logger depth (bMP): ≈ 70 ft.
Obs Well(s): None
Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2/06	0932	Static Water Level (Pre-test-01)	60.51	0	TD 120.26
	0940	Static Water Level (Pre-test-02)	60.51		removed hoses
		Pre-removal Water Level Reading 1	~~60.51~~		
		Pre-removal Water Level Reading 2	~~60.51~~		
	10:04.00				start 10:04.00
	05.30				
	05.00		60.40		
	06.30		60.47		
	06.0		60.50		
	06.30		60.51		
	07.00		60.51		
	10:07.30		60.51		top of slug 62.45 to TOC

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number MWC 015
SLUG TEST TYPE: Slug in / Slug out

Test Date(s): _____

Page 1 of _____

Slug Test Well Casing Diameter: 4 inches ID

Slug Test Well Borehole Diameter: 10 inches

Slug Test Well Screen Interval (feet bMP): 100 to 125

Slug Test Well Total Depth (feet bMP): 120.26

Measuring Point (MP) Description: North Side TOC

MP distance (above/below) survey point: 0

Top of slug depth (feet below MP) 62.45

Slug Volume 0.32 (CF); Slug Length 10 5/8 in (feet); Slug Diameter 3 3/8 in. OD

CSV File Directory/Name

Levelogger File directory/name:

Data logger Serial #: 40249

Data logger type: Solinst LT F15/M5

Data Logger depth (bMP): ~70 ft

Obs Well(s): None

Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2/06	10:14:00	Static Water Level (Pre-test-01)	60.51	0	
		Static Water Level (Pre-test-02)			
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
	10:20:00				Slug out
	10:21:00		60.70		
	10:21:10		60.86		
			~~60.65~~		
	10:21:50		60.65		
	10:22:00		60.58		
	10:22:10		60.56		
	10:22:20		60.55		
	10:22:30		60.55		
	10:22:40		60.54		
	10:22:50		60.54		
	10:23:00		60.54		
	10:23:30		60.535		
	10:24:30		60.53		

Site: MW C015 Page 2 of 2

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2	10:25:30		60.53		
	10:26:30		60.52		
	10:27:30		60.52		
	10:37:00		60.51		

Object Information

MWC015

Object Name	MWC015
Object Type	Groundwater Monitoring Well
Geological Unit	C-Sand
Date Completed	5/17/2004
Object Status	Active
Location Description	Surveyed by Tait and Associates
Sub Area/Zone	
Top Of Casing Z	51.51
Groundwater Elevation	-9.45
Survey Date	5/19/2005
Depth To Top Of Screen	100
Depth To Bottom Of Screen	125
Total Depth/Height	128
# Samples Collected	Water - 6 Soil - 0
Last Sample Date	Water - Mar 16 2006 11:15AM Soil -
Analysis Groups	VOC
Latest PCE, TCE, cis-DCE in Water	40.00 U, 1300.00, 40.00 U
Max PCE, TCE, cis-DCE in Water	50.00 U, 1700.00, 50.00 U
Max PCE, TCE, cis-DCE in Soil	
VOCs Detected in Water	1,1-Dichloroethene, cis-1,2-Dichloroethene, Tetrahydrofuran (THF)
VOCs Detected in Soil	

SLUG TEST FIELD FORM MWC017 Slug in

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number
SLUG TEST TYPE: Slug In / Slug out
Test date(s): 8/2/06

Page 1 of 1

Slug Test Well Casing Diameter: 4 inches ID

Slug Test Well Borehole Diameter: 10 inches

Slug Test Well Screen Interval (feet bMP): 100 to 125

Slug Test Well Total Depth (feet bMP): 124.82

Measuring Point (MP) Description: TOC

MP distance (above/below) survey point: 0

Top of slug depth (feet below MP) 65.80 5/8

Slug Volume 0.32 (CF); Slug Length 62 (feet); Slug Diameter 3 3/8 in. OD

CSV File Directory/Name

Levelogger File directory/name:

Data logger Serial #: 40249

Data logger type: Solinst LTF15/m5

Data Logger depth (bMP): ~75.00 ft

Obs Well(s): MWB019

Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/02/06	1200	Static Water Level (Pre-test-01)	64.75	0	
	1245	Static Water Level (Pre-test-02)	64.75		
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
	13:10.30		64.60		
	13:10.40		64.66		
	13:10.50		64.67		
	13:11:00		64.672		
	13:11.10		64.673		
	13:12.30		64.735		
	13:12.40		64.740		
	13:12.50		64.745		
	13:13.00		64.750		

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number MWC 017
SLUG TEST TYPE: Slug in / Slug out

Test Date(s): 8-2-06

Page 1 of 1

Slug Test Well Casing Diameter: 4 inches ID

Slug Test Well Borehole Diameter: 10 inches

Slug Test Well Screen Interval (feet bMP): 100 to 125

Slug Test Well Total Depth (feet bMP): 124.82

Measuring Point (MP) Description: TOC

MP distance (above/below) survey point: 0

Top of slug depth (feet below MP) 65.80

Slug Volume 0.32 (CF); Slug Length 62.5/8 ~~(feet)~~ inch; Slug Diameter 3 3/8 in. OD

CSV File Directory/Name

Levelogger File directory/name:

Data logger Serial # 40249

Data logger type: Solinst LT F15/M5

Data Logger depth (bMP): ≈ 75.00 ft

Obs Well(s): MWB 019

Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2/06	1332	Static Water Level (Pre-test-01)	64.75	0	
	1334	Static Water Level (Pre-test-02)	64.75		
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
					Slug out 1335.00
	1335.45		64.78		
	1336.00		64.78		
	1336.30		64.75		
	1336.45		64.73		
	1337.00		64.73		
	1338.00		64.73		
	1338.30		64.73		

Leadoggre Serial No: 05799 L P 15/M5

Set @ 72 ft bTOC MWB019 Obs well

Site: Page 1 of 1

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
	12:30		64.62		
	13:01 ~~101.00~~		64.620		
	1309.00 ~~1311.09.00~~		64.615		Slug in 1310.00
	1311.00 ~~1311.11.00~~		64.62		
	1313.00		64.62		
	1315.00		64.62		
					Slug out
					Set Transducer
					approximately 8 ft below
					water level @
					72 ft ~~bgs~~ below TOC

Object Information

MWC017

Object Name	MWC017
Object Type	Groundwater Monitoring Well
Geological Unit	C-Sand
Date Completed	5/17/2004
Object Status	Active
Location Description	Surveyed by Tait and Associates
Sub Area/Zone	
Top Of Casing Z	55.16
Groundwater Elevation	-10.2
Survey Date	5/19/2005
Depth To Top Of Screen	100
Depth To Bottom Of Screen	125
Total Depth/Height	128
# Samples Collected	Water - 7 Soil - 0
Last Sample Date	Water - Mar 14 2006 12:10PM Soil -
Analysis Groups	Alkalinity, Anions, Metals, TOC, Unspecified, VOC
Latest PCE, TCE, cis-DCE in Water	0.62 J, 100.00, 39.00
Max PCE, TCE, cis-DCE in Water	25.00 U, 1300.00, 46.00
Max PCE, TCE, cis-DCE in Soil	
VOCs Detected in Water	1,1-Dichloroethane, 1,2-Dichloroethane, Chlorobenzene, cis-1,2-Dichloroethene, Tetrachloroethene, trans-1,2-Dichloroethene
VOCs Detected in Soil	

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number MWC 022
SLUG TEST TYPE: Slug in / Slug out
Test Date(s): 8-2-06
Page 1 of 2

Slug Test Well Casing Diameter: 4 inches ID
Slug Test Well Borehole Diameter 10 inches
Slug Test Well Screen Interval (feet bMP): 97 to 117
Slug Test Well Total Depth (feet bMP): 115.80
Measuring Point (MP) Description: N. side of TOC
MP distance (above/below) survey point: 0
Top of slug depth (feet below MP) 61.36
Slug Volume 0.32 (CF); Slug Length 62 5/8 (feet); Slug Diameter 3 3/8 in. OD
CSV File Directory/Name
Levelogger File directory/name:

Data logger Serial # 40249
Data logger type: Solinst LT F15/M5
Data Logger depth (bMP): 75.00 ft
Obs Well(s): None
Pre-determined minimum drawdown depth (feet bMP): NA

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2	1453	Static Water Level (Pre-test-01)	59.33	0	TD 115.80
		Static Water Level (Pre-test-02)			
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
	1520		58.51		Slug in test
	1521.30		58.71		
	1521.45		58.91		
	1522.0		59.0		
	1522.10		59.05		
	1522.15		59.10		
	1522.30		59.15		
	1522.45		59.20		
	1523.10		59.25		
	1524.00		59.29		
	1524.15		59.30		
	1524.50		59.31		
	1526.00		59.31		
	1527.00		59.32		

Site: MW C 022 Page 2 of 2

DATE	TIME (h:min:sec)	~~ELAPSED~~ TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/7/06		1528.0	59.32		
		1529.0	59.32		
		1530.0	59.325		
		1531.0	59.325		top of slug 61.36' TOC
		1540	59.325		

SLUG TEST FIELD FORM

Site Info:
BRC Former C-6 Facility
Torrance, CA

Well Number MWC 022
SLUG TEST TYPE: Slug in / Slug out

Test Date(s): 8-2-06

Page 1 of 2

Slug Test Well Casing Diameter: 4 inches ID

Slug Test Well Borehole Diameter: 10 inches

Slug Test Well Screen Interval (feet bMP): 97 to 117

Slug Test Well Total Depth (feet bMP): 115.80

Measuring Point (MP) Description:

MP distance (above/below) survey point: N side of TOC

Top of slug depth (feet below MP) 61.86 0

Slug Volume 0.32 (CF); Slug Length 62 5/8 (feet); Slug Diameter 3 3/8 in. OD

Data logger Serial #: 40249

Data logger type: Solinst LT F15/M5

Data Logger depth (bMP): 75.00 ft

Obs Well(s): NA

Pre-determined minimum drawdown depth (feet bMP): NA

CSV File Directory/Name

Levelogger File directory/name:

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
8/2	1540	Static Water Level (Pre-test-01)	59.325	0	
		Static Water Level (Pre-test-02)			
		Pre-removal Water Level Reading 1			
		Pre-removal Water Level Reading 2			
					Slug out test
	1542.0		—		1542.0
	1542.45		60.60		
	1543.0		60.40		
	1543.10		60.20		
	1543.20		60		
	1543.30		59.90		
	1543.40		59.80		
	1543.50		59.75		
	1543.55		59.70		
	1544.00		59.65		
	1544.10		59.6		
	1544.26		59.55		
	1544.30		59.5		

Site: MWC 022 Page 2 of 2

DATE	TIME (h:min:sec)	ELAPSED TIME (min)	DEPTH TO WATER (feet below MP)	DRAWDOWN (feet)	COMMENTS (includes comments before slug emplacement, water level stabilization after slug emplacement, observations, etc.)
6/8/06		1544.45	59.45		
		1545.00	59.40		
		1546.00	59.35		
		1548.40	59.33		
		1550.20	59.32		

Object Information

MWC022

Object Name	MWC022
Object Type	Groundwater Monitoring Well
Geological Unit	C-Sand
Date Completed	6/7/2005
Object Status	
Location Description	
Sub Area/Zone	
Top Of Casing Z	51.6
Groundwater Elevation	-8.72
Survey Date	6/13/2005
Depth To Top Of Screen	97
Depth To Bottom Of Screen	117
Total Depth/Height	120
# Samples Collected	Water - 4 Soil - 0
Last Sample Date	Water - Mar 13 2006 10:10AM Soil -
Analysis Groups	VOC
Latest PCE, TCE, cis-DCE in Water	1.00 U, 47.00, 5.40
Max PCE, TCE, cis-DCE in Water	10.00 U, 120.00, 7.60
Max PCE, TCE, cis-DCE in Soil	
VOCs Detected in Water	1,1-Dichloroethane, cis-1,2-Dichloroethene, Toluene, trans-1,2-Dichloroethene
VOCs Detected in Soil	

Tait Environmental Management, Inc.

Engineering • Environmental • Compliance

DAILY FIELD REPORT

Project Name: BRC-C6 SLUGTEST	**Project #:** EM27270	**Date:** 8-2-06
Personnel: MP/KL/NJB	**Sub Contractors:** NONE	

Task: PERFORM SLUGTEST IN 4 WELLS.

Time Arrived at Site: 6:30 A.	**Time Left Site:** 5:30 PM	**Total Hours at Site:** 11:00
Odometer (Start): —	**Odometer (End):** —	**Total Miles:** —

Equipment List:

- ☑ Solinst Water Level Meter Serial #: 35566, 29484, 29625
- ☑ Solinst Water/~~Product Level Interface Meter~~ Serial #: _____
- ☐ Horiba U-22 Water Quality Meter Serial #: _____
- ☐ PID/FID Type: _____ Serial #: _____
- ☐ Submbersible Pump Type: _____ Serial #: _____
- ☐ Generator Type: _____ Serial #: _____
- ☑ Company Truck License #: _____
- ☑ Other(s): SLUG, LEVELLOGERS (3 used)

Desription of Work Performed: (Summarize all field activities in a chronological sequence. Include tailgate health and safety meeting, personnel/visitors at site, calibration times and methods.)

Arrive on site @ 6:30 Kevin was onsite
Pearl from CDM SHOWED UP AT 6:45 Neal Arrival 7:00
Had HSP Meeting. Discussed work scope
HSP, HOSP. etc.

Client Signature (if applicable): _____ **Date:** _____

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Page 1 of __

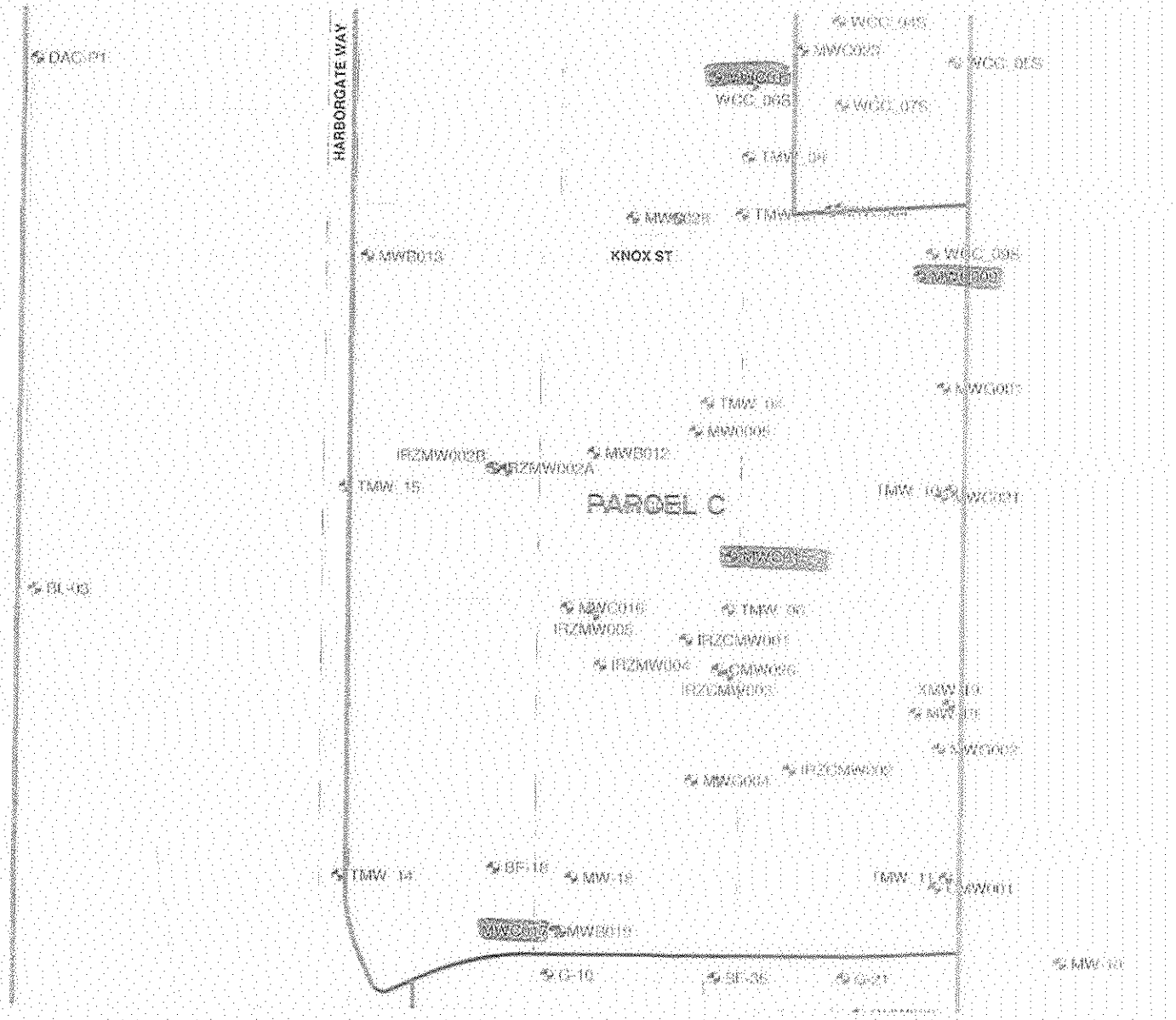
Calibrate Tapes (WL1.)
29484 Solinst 30.05 Steel tape 30.00
35566 " 30.02 " " 30.00
29625 " 30.09 " " 30.00

Start with the 1st on MWC009
MWC011 had a trailer parked over could not be reached.
0755 MWC009 WL 62.55, TD 119.53 (Sol# 29484)
0841 Started slug in test MWC009
0850 Started slug out test MWC009
0900 Pearl w/ CDM left the site
1004 Started slug in test MWC015
1020 Started slug out test MWC015
1040 Calibrated watched used for timing with computer setting transducers. The watch was 0.30 seconds faster.
1120 Neal off to Home Depot
1200 Monitored MWC017, obs. MWB019
1330 Jeremy Squire w/ ~~[illegible]~~ onsite. Signed H&S Plan
1335 Started slug out test MWC017
14:00 Completed " " " " "
14:01 Checked MWC011 was not blocked anymore opened the box will way 2" Moved to MWC006 checked that it was also 2". Called Pavi left a message ~~[illegible]~~ on computer for a suitable well in the area found MWC022 being 4".
14:53 Changed MWC022, Setup and performed slug in and slug out tests. Downloaded transducers after the test
17:30 Depart site.

BRC Former C-6 Facility and Surrounding Geography

Environmental Objects
- GW Monitoring Well

Basemap
- Parcel Text
- Road Text
- Parcel Lines
- C6 Base Map Features
- Lots
- Road

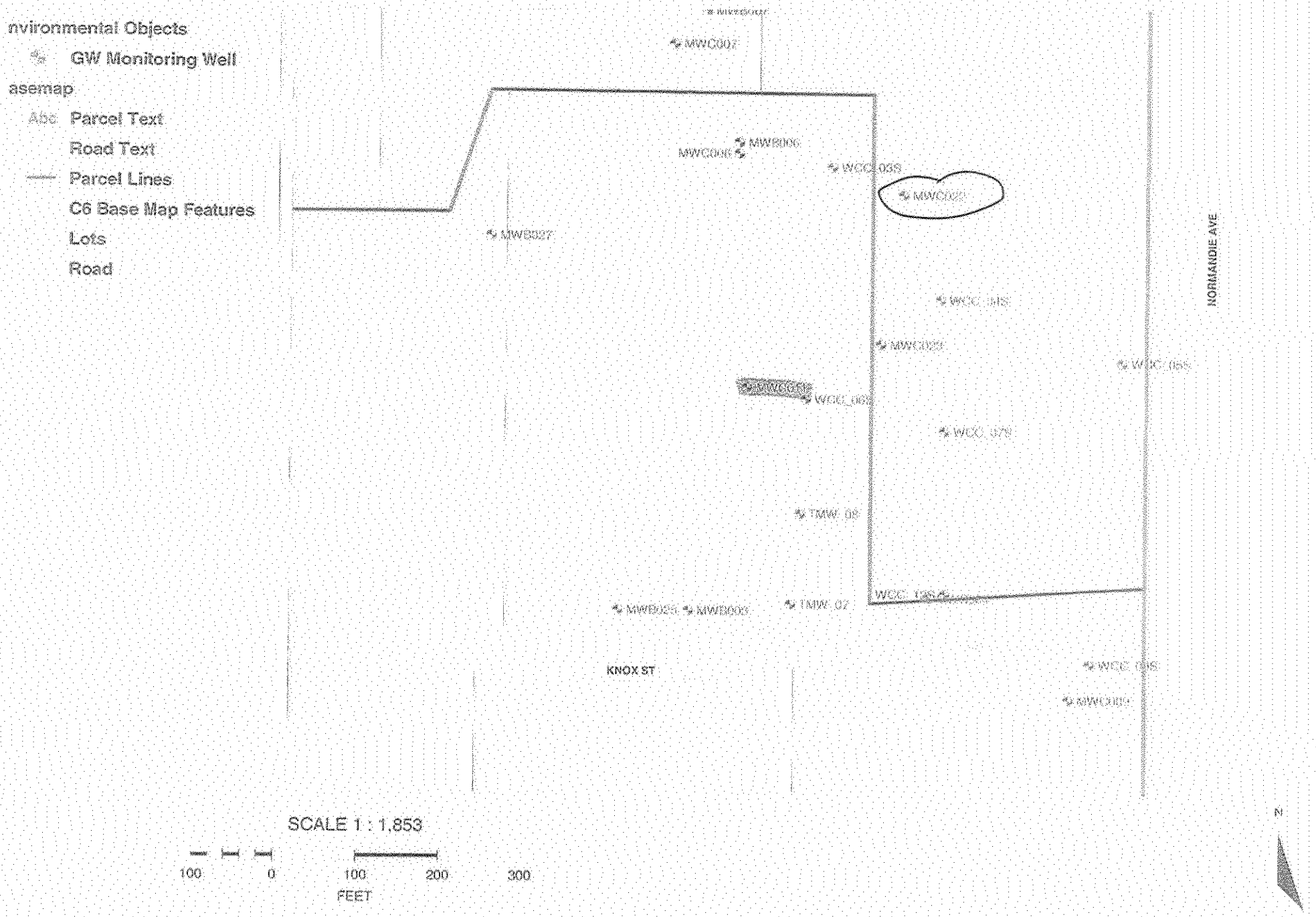


SCALE 1 : 3,707

200 0 200 400 600

FEET

BRC Former C-6 Facility and Surrounding Geography



s://bpn.boeing.com/bedms/GIS/219_PRV.mwf

Monday, July 31, 2006 10:58 AM

BOE-C6-0051060