Appendix R Slug Test Summary Report

William J. Ryan
Project Manager

nationalgrid

March 18, 2016

Mr. Henry Willems
New York State Department of Environmental Conservation
MGP Remedial Section, Division of Environmental Remediation
Bureau of Western Remedial Action, 11th Floor
625 Broadway
Albany, New York 12233-7017

Re: Slug Test Summary Letter
Greenpoint Energy Center Former Manufactured Gas Plant
287 Maspeth Avenue, Brooklyn, New York
Site No. 224052

Dear Mr. Willems:

National Grid is submitting this letter report to summarize the field activities, present the results, and provide an assessment of the findings regarding the recently conducted slug testing at the Greenpoint Energy Center site located in Brooklyn, New York. The purpose of the testing was to obtain estimates of hydraulic conductivity in the shallow and intermediate zone of the Upper Glacial aquifer. The primary areas of interest include the vicinity of the bulkhead fronting Newtown Creek and along Maspeth Avenue.

The slug test locations were selected to provide lateral and vertical coverage in the areas of interest described above (**Figure 1**). The bulkhead area along Newtown Creek and the Maspeth Avenue property boundaries are likely to be the focus of fate and transport assessment and remedial design.

Field activities were conducted in accordance with the scope of work, as described in the letter titled "Scope of Work and Cost Estimate for Slug Testing" dated November 19, 2015. The scope of work was based on GEI's slug test SOP GW-010 and ASTM Method D-4044. Field tests were conducted between December 10, 2015 and December 18, 2015.

Methodology

Slug testing was conducted utilizing both rising and falling head slug test techniques. Rising head tests were performed in wells screened across the water table, and in wells screened entirely below the water table. Falling head tests were only performed in wells screened completely below the water table.

In general, a minimum of two tests were performed per well. For wells screened below the water table, a minimum of two rising head and two falling head tests were performed. For wells screened across the water table, at least two rising head tests were performed. The exceptions included several wells with extremely slow recovery times. Only one test was performed at these wells due to the time required to complete the test and logistical constraints. Additional tests were performed if measurements did not produce an obvious linear or logarithmic recovery trend.

The slug test data was analyzed using either the Hvorslev (1951) type curve method or the Bouwer and Rice (1976, 1989) method. The Hvorslev analysis assumes that the well penetrates a confined aquifer, and the Bouwer and Rice method was used for wells screened across the water table. These results are described within **Table 1**.

Field Program Summary

Slug testing was conducted at a total of 14 monitoring wells. These wells were selected based on location, depth and field conditions. Both rising and falling head tests were conducted at nine of the 14 wells. The other five wells were screened across the groundwater interface; therefore, only falling head tests were performed.

Slug testing was performed by first adding (falling test) or removing (rising test) a known volume (slug) to or from the well, then observing and recording the subsequent rate of water level fall or rise within the well. The resulting data was then used to determine the hydraulic conductivity of the aquifer test zone using the appropriate analytical solution method. A slug bar of known volume was used to alter the water levels in the wells.

Manual measurements for water depth and elapsed time were recorded. These measurements were used to confirm low hydraulic conductivity values in wells screened through silt or clay layers. This information enabled the field team to adjust the log intervals on the transducers appropriately to better suit the recovery time for each individual well, while giving consideration to the memory capacity of the transducers.

The larger volume slug was utilized whenever possible to encourage greater displacement of water during each test. The smaller slug was used on wells that were too shallow to accommodate both the transducer and the full length of the larger slug.

Equipment used included:

- 5’x7/8” and 10’x1” solid polyvinyl chloride (PVC)
- Troll 700 pressure transducer and Rugged Reader
- Solinst 150’ depth to water indicator

Analytical software package:

- Super Slug version 3.2 (Starpoint Software)

Rising head tests were conducted as follows:

1. Slugs and other downhole equipment were decontaminated before and after each test.

2. Prior to conducting each slug test, the static water level in the well was measured to the nearest 0.01 foot.
3. The transducer parameters were set, the transducer was lowered into the well to below the lowest point that the slug was expected to reach, and the cable was secured at ground surface with tape or weight to keep the transducer at a constant depth.
4. Water levels were measured during the test with an electronic water level indicator and with pressure transducers attached to a data logger, thereby providing water level measurements by two independent devices.
5. A weighted slug of known volume was inserted gently into the well below the water table, but not touching the transducer. The water level was measured until the water level returned to static conditions.
6. The slug was then suddenly withdrawn from the well and the water level recovery was monitored at appropriate intervals until recovery was complete and stabilized. Groundwater elevation was recorded until the water level recovered to its original level, except as provided below.
7. Each well was allowed enough time to recover to within 20 percent of the original static water level relative to the initial test displacement (80 percent recovery).

Falling head tests were conducted as follows:

1. Prior to conducting each slug test, the static water level in the well was measured to the nearest 0.01 foot. Water levels were measured during the test with an electronic water level indicator and pressure transducer attached to a data logger, thereby providing water level measurements by two independent devices.
2. The transducer was lowered into the well to below the lowest point that the slug was expected to reach, the transducer parameters were set, and the cable was secured at ground surface with tape or weight to keep the transducer at a constant depth.
3. The transducer logging was initiated and the slug was inserted into the well to below the water table.
4. Once the slug was fully submerged below the water column, a stop watch was started and water level measurements were recorded.
5. The water level was measured with the electronic water level indicator until the water level returned to within 20 percent of static conditions, at which point logging was stopped and the slug and transducer were removed.

Results

The results of the slug testing are provided in tabular and graphical format in **Table 1** and **Attachment 1**, respectively. The average hydraulic conductivity value ranged from 0.0072 feet/ day to 175 feet/day with the highest value and lowest values identified in GPEC-MW-9 and GPEC-

MW328I, respectively. The high and low values are consistent with the lithology noted within the respective screen zones of these wells. No apparent spatial trends were identified.

If you have any questions or require additional information, please feel free to contact me at 516-545-2586 or by e-mail at william.ryan@nationalgrid.com.

Sincerely,

for

William J. Ryan
Project Manager

Enclosures

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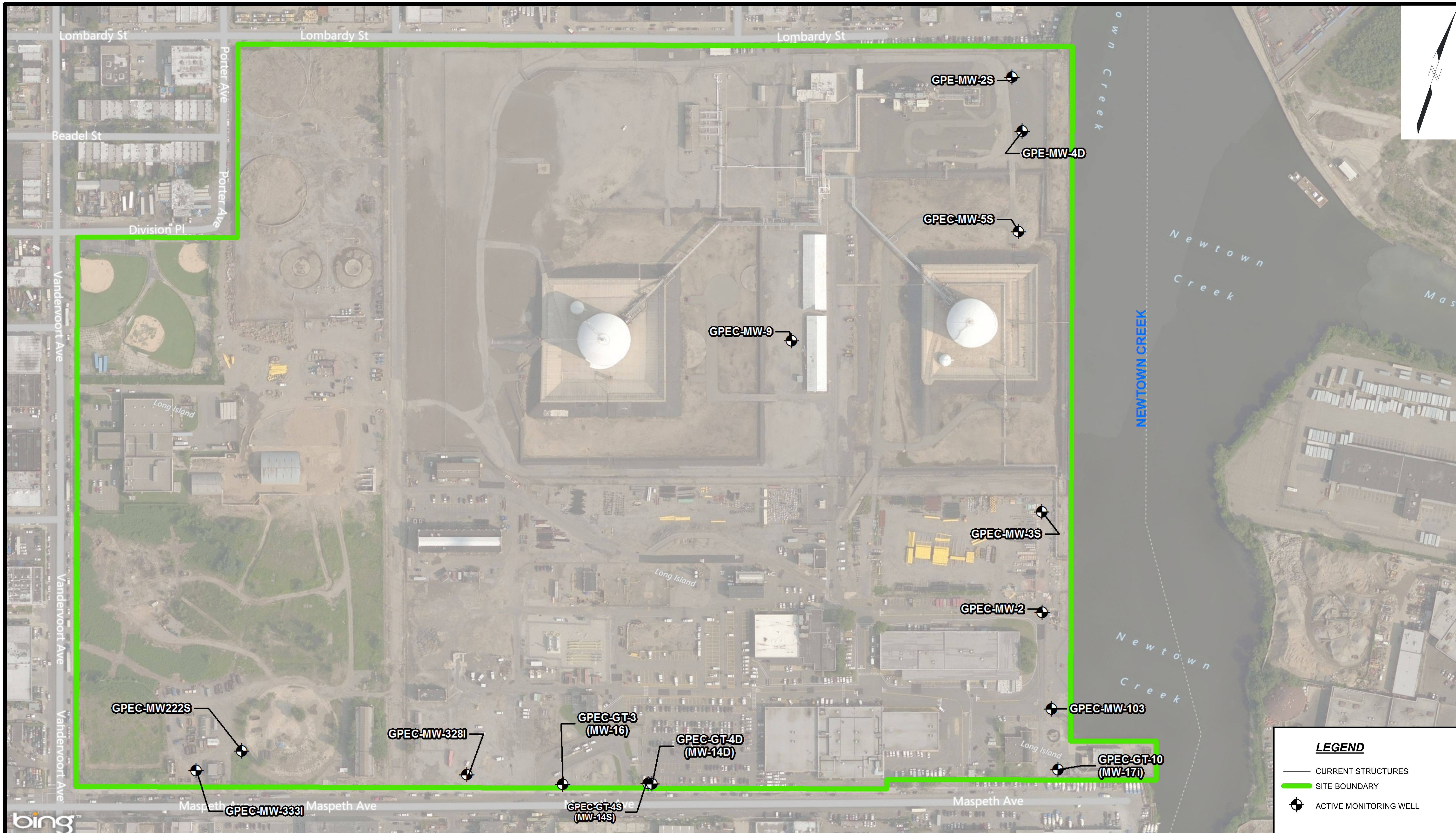
Figure



SOURCES:
1. FIGURE BASED ON PLAN TITLED "PROPOSED SOIL BORINGS/TEST PIT, MONITORING WELL AND SOIL GAS SAMPLE LOCATION SITE PLAN," BY PAULUS SOKOLOWSKI AND SARTOR ENGINEERING, PC DATED OCT 2004.
2. SURVEY OF EXISTING MONITORING WELLS CONDUCTED BY GEI ON 6-16-09.
3. AERIAL PHOTOGRAPH BING MAPS © 2014 MICROSOFT CORP.

0 250 500

SCALE, FEET

Phase II Remedial Investigation
Greenpoint Energy Center
Brooklyn, New York

nationalgrid

GEI Consultants

SLUG TEST LOCATIONS

Project 125180 | March 2016 | Fig. 1

J:\Projects\National_Grid\Greenpoint\Phase_2_RI\Slug Test Locations.mxd

Table

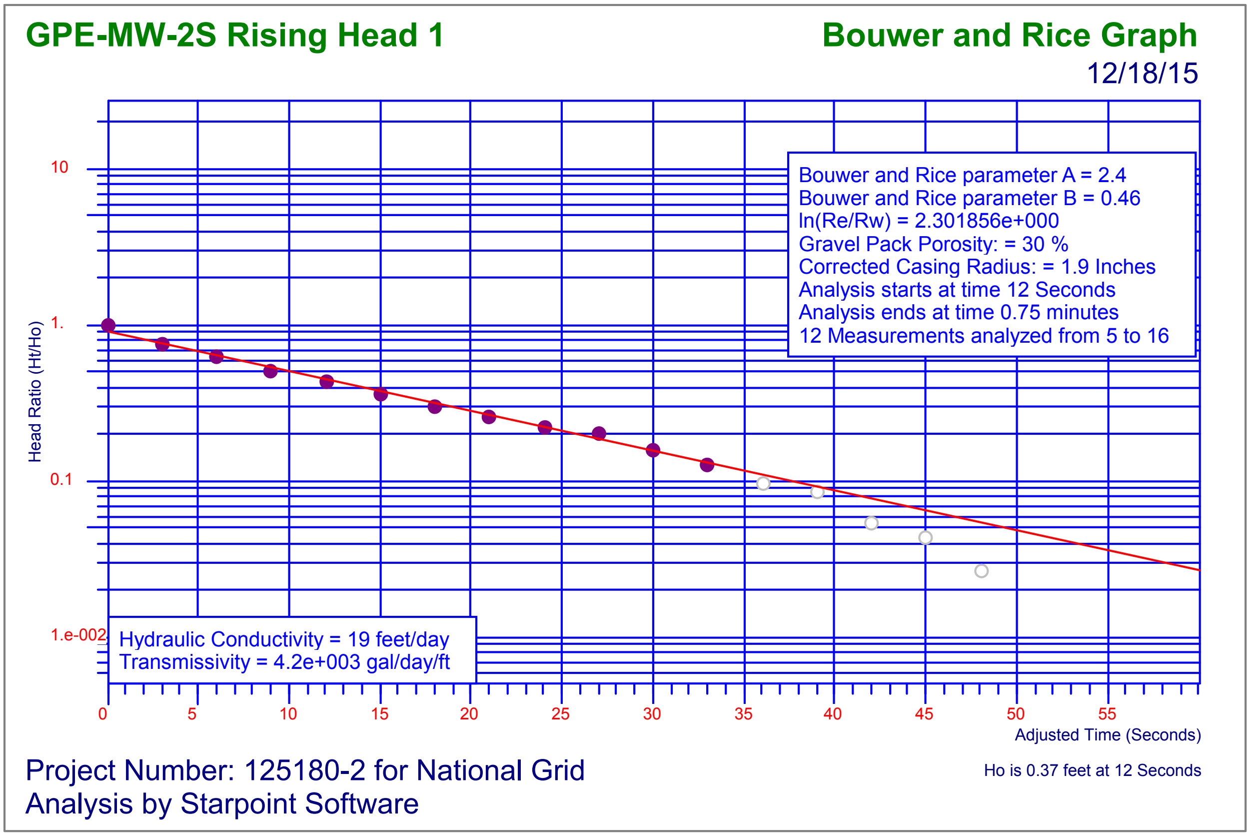
Table 1
Estimated Hydraulic Conductivity from Slug Tests
Greenpoint Former MGP Site, Brooklyn, New York

Well ID	Screen Depth (ft. bgs)	Screened Zone	Screened Formation	Depth to Water (ft.)	Depth to Well Bottom (ft.)	Estimated Hydraulic Conductivity				Average K_H
						Rising 1	Rising 2	Falling 1	Falling 2	
GPE-MW-2S	2 - 12	Shallow - Water Table	Sand/Silty Sand	4.17	11.95	19	27	NA	NA	23
GPE-MW-4D	30 - 40	Intermediate	Sand/Silty Sand	4.70	43.83	0.11	NT	0.17	0.17	0.15
GPEC-GT-3	2 - 17	Shallow - Water Table	Fill/Silt	7.35	22.36	0.024	NT	NA	NA	0.024
GPEC-GT-4S	3 - 18	Shallow - Water Table	Fill/Sand	7.45	19.40	5.1	6.9	NA	NA	6.0
GPEC-GT-4D	54 - 69	Intermediate	Sand	8.10	71.00	53	50	54	NT	52.3
GPEC-GT-10D	43 - 58	Intermediate	Sand	7.70	58.96	9	13	6.7	7.2	9.0
GPEC-MW-2	20 - 35	Shallow	Sand and Gravel	5.50	38.00	0.65	0.67	1.1	1	0.86
GPEC-MW-3S	25 - 40	Intermediate	Silt and Gravel	4.40	41.00	3.2	2.8	5.2	5.6	4.2
GPEC-MW-5S	28 - 38	Intermediate	Silty Sand	7.50	43.28	15	18	19	15	16.8
GPEC-MW-9	10 - 25	Shallow - Water Table	Sand and Gravel	14.43	26.32	230	120	NA	NA	175
GPEC-MW103	50 - 60	Intermediate	Sand and Gravel	6.55	59.00	25	24	25	33	26.8
GPEC-MW222S	2 - 12	Shallow - Water Table	Fill w/ Sand and Silt	5.47	12.34	7.8	7.7	NA	NA	7.8
GPEC-MW328I	30 - 40	Intermediate	Silt	10.35	37.90	7.50E-03	NT	6.90E-03	NT	7.20E-03
GPEC-MW-333I	30 - 40	Intermediate	Sand	12.12	37.61	2.2	4.6	7.5	6	5.1

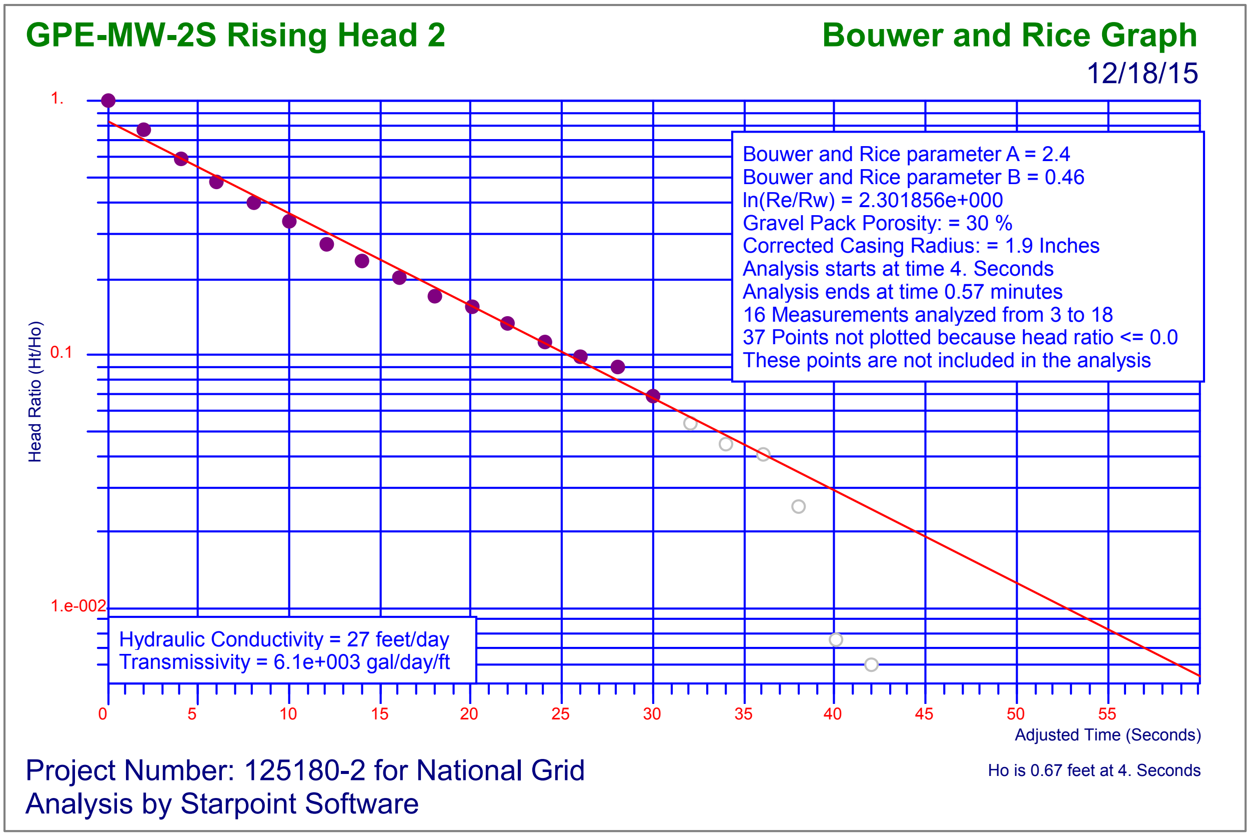
General Notes:

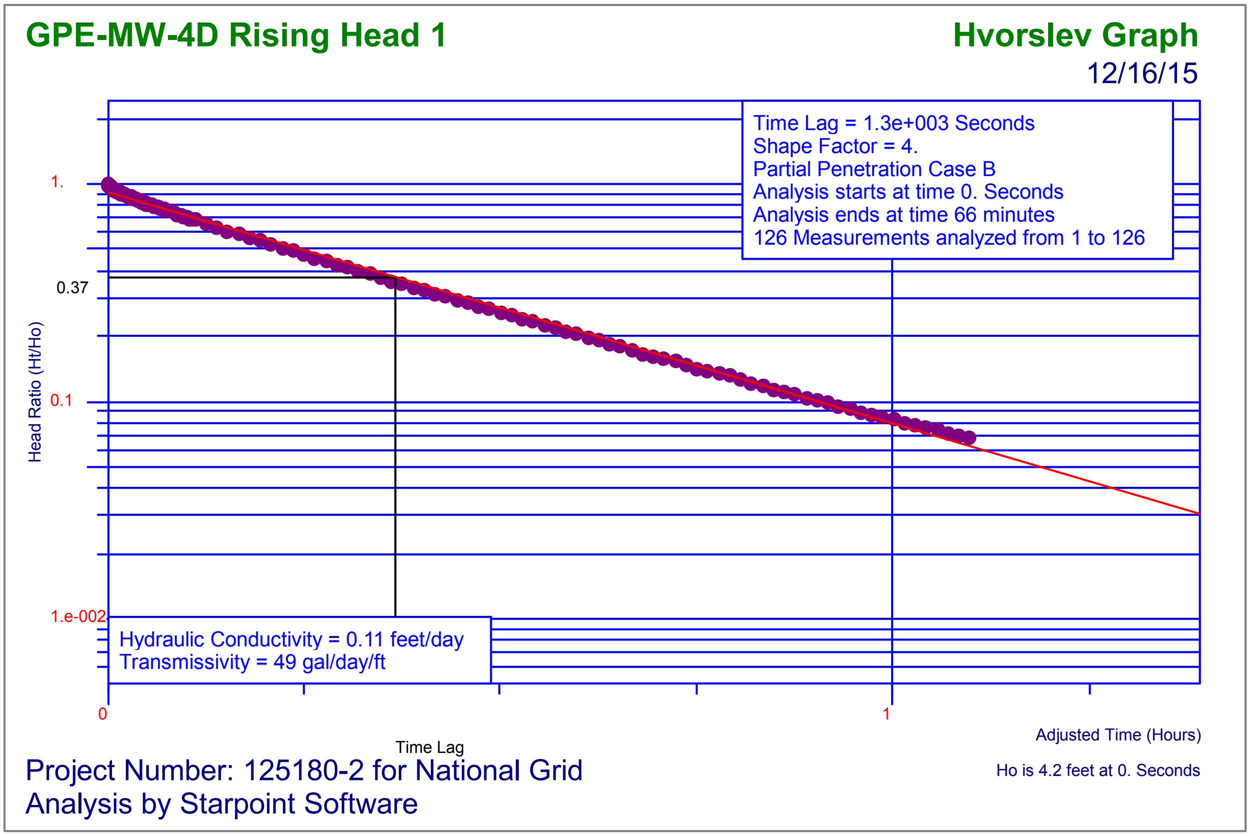
1. K_H = Hydraulic conductivity (horizontal) in units of feet per day.
2. ft. bgs = feet below ground surface.
3. NA = not applicable; falling head tests not performed on wells screened across water table.
4. Calculation method: Bouwer-Rice (wells screened across water table); Hvorslev (all others).
5. Depth to water measured from top of PVC riser.
6. GPE-MW-2S and GPEC-MW-3S: potential tidal effects apparent; later-time data not used in hydraulic conductivity estimate.
7. NT = indicated test not performed.

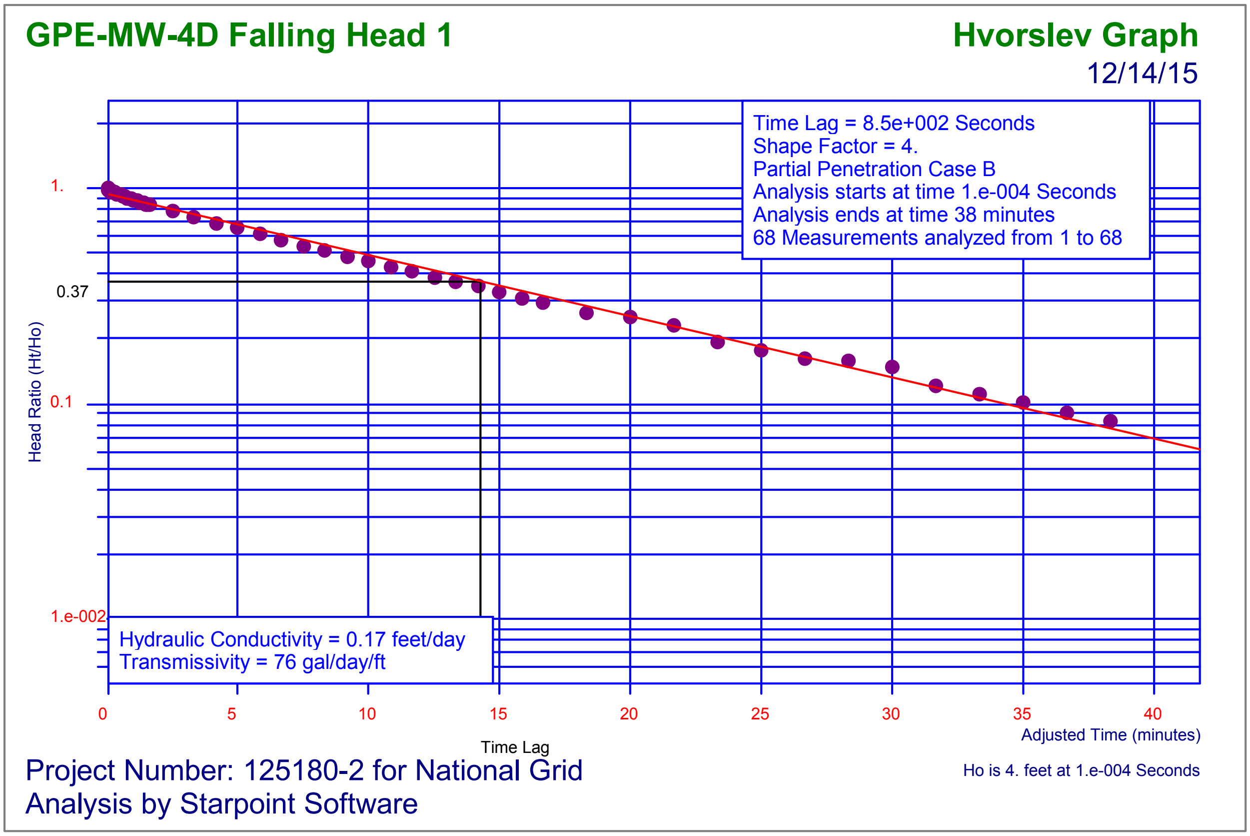
Attachment 1



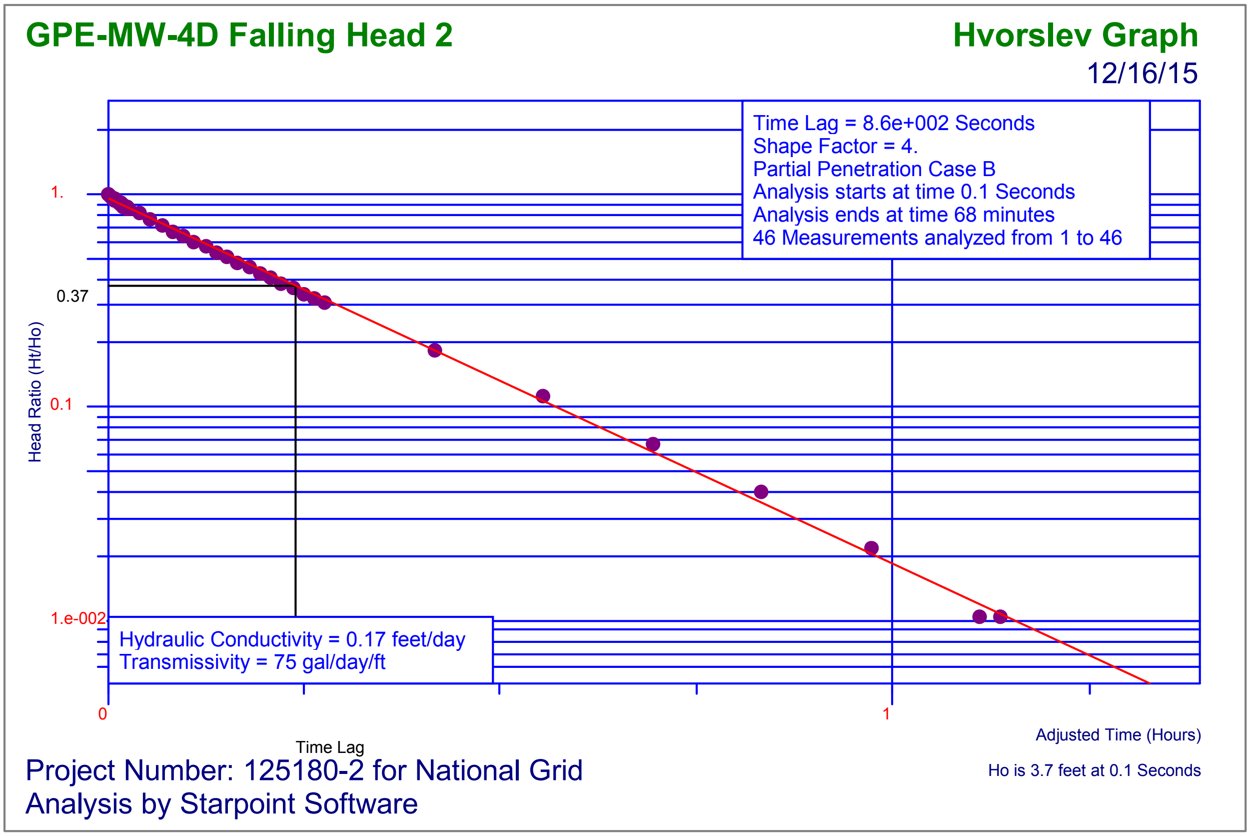
GPE-MW-2S Rising Head 1
Bouwer and Rice Graph
12/18/15
Bouwer and Rice parameter A = 2.4
Bouwer and Rice parameter B = 0.46
ln(Re/Rw) = 2.301856e+000
Gravel Pack Porosity: = 30 %
Corrected Casing Radius: = 1.9 Inches
Analysis starts at time 12 Seconds
Analysis ends at time 0.75 minutes
12 Measurements analyzed from 5 to 16
Hydraulic Conductivity = 19 feet/day
Transmissivity = 4.2e+003 gal/day/ft
Head Ratio (Ht/Ho)
10
1.
0.1
1.e-002
0
5
10
15
20
25
30
35
40
45
50
55
Adjusted Time (Seconds)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 0.37 feet at 12 Seconds


GPE-MW-2S Rising Head 2
Bouwer and Rice Graph
12/18/15
1.
0.1
1.e-002
Head Ratio (Ht/Ho)
Bouwer and Rice parameter A = 2.4
Bouwer and Rice parameter B = 0.46
ln(Re/Rw) = 2.301856e+000
Gravel Pack Porosity: = 30 %
Corrected Casing Radius: = 1.9 Inches
Analysis starts at time 4. Seconds
Analysis ends at time 0.57 minutes
16 Measurements analyzed from 3 to 18
37 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 27 feet/day
Transmissivity = 6.1e+003 gal/day/ft
0
5
10
15
20
25
30
35
40
45
50
55
Adjusted Time (Seconds)
Ho is 0.67 feet at 4. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

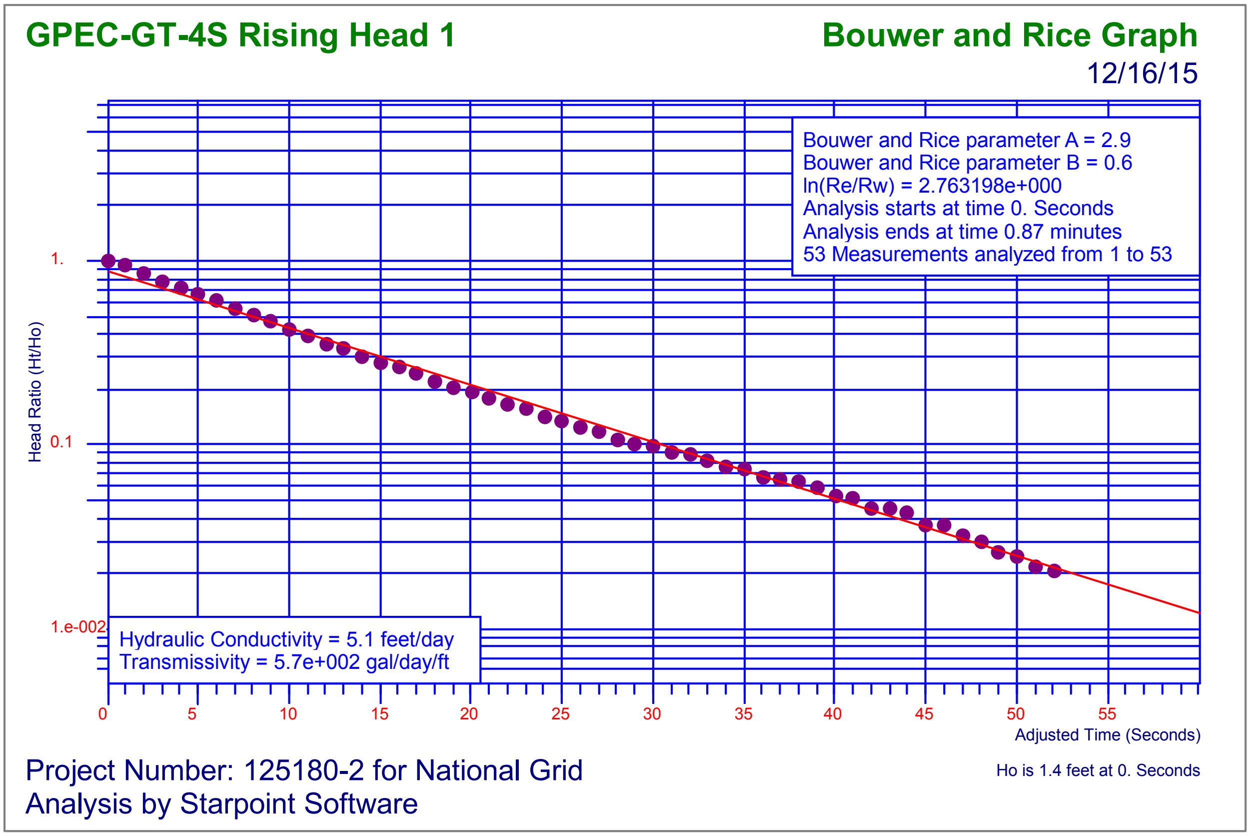

GPE-MW-4D Rising Head 1
Hvorslev Graph
12/16/15
Time Lag = 1.3e+003 Seconds
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 66 minutes
126 Measurements analyzed from 1 to 126
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
Hydraulic Conductivity = 0.11 feet/day
Transmissivity = 49 gal/day/ft
0
1
Time Lag
Adjusted Time (Hours)
Ho is 4.2 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software



GPE-MW-4D Falling Head 1
Hvorslev Graph
12/14/15
Time Lag = 8.5e+002 Seconds
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 1.e-004 Seconds
Analysis ends at time 38 minutes
68 Measurements analyzed from 1 to 68
1.
0.37
0.1
1.e-002
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 0.17 feet/day
Transmissivity = 76 gal/day/ft
0
5
10
15
20
25
30
35
40
Time Lag
Adjusted Time (minutes)
Ho is 4. feet at 1.e-004 Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software



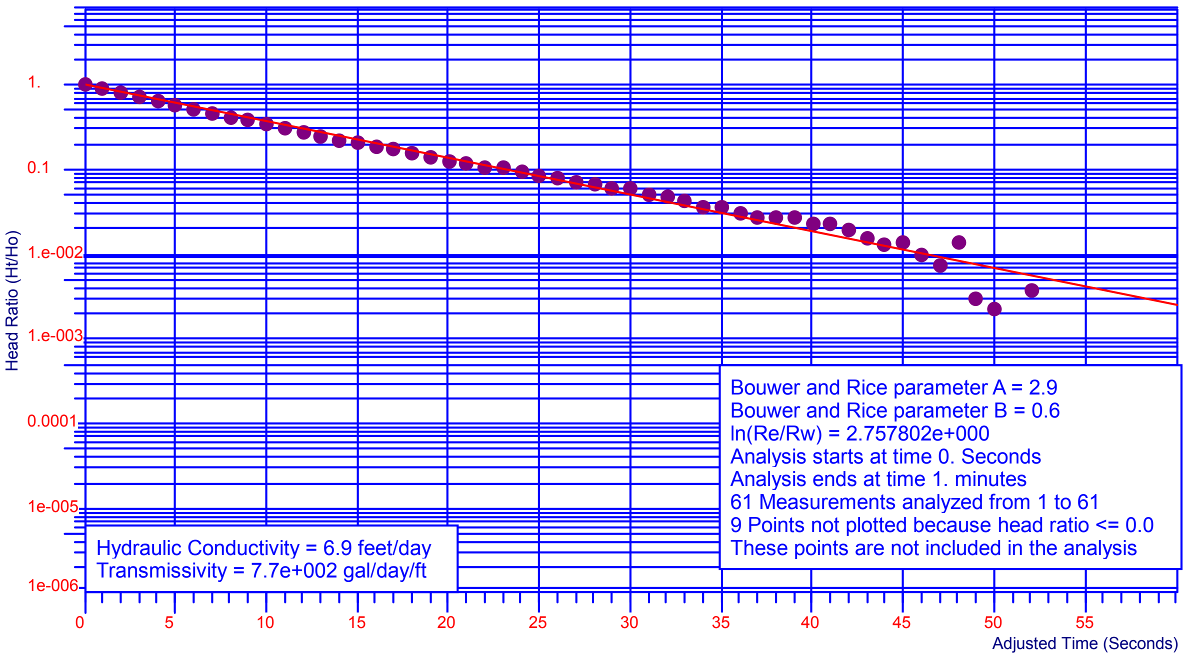
GPE-MW-4D Falling Head 2
Hvorslev Graph
12/16/15
Time Lag = 8.6e+002 Seconds
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0.1 Seconds
Analysis ends at time 68 minutes
46 Measurements analyzed from 1 to 46
1.
0.37
0.1
1.e-002
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 0.17 feet/day
Transmissivity = 75 gal/day/ft
0
1
Time Lag
Adjusted Time (Hours)
Ho is 3.7 feet at 0.1 Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-GT-4S Rising Head 1
Bouwer and Rice Graph
12/16/15
Bouwer and Rice parameter A = 2.9
Bouwer and Rice parameter B = 0.6
ln(Re/Rw) = 2.763198e+000
Analysis starts at time 0. Seconds
Analysis ends at time 0.87 minutes
53 Measurements analyzed from 1 to 53
Head Ratio (Ht/Ho)
1.
0.1
1.e-002
Hydraulic Conductivity = 5.1 feet/day
Transmissivity = 5.7e+002 gal/day/ft
0
5
10
15
20
25
30
35
40
45
50
55
Adjusted Time (Seconds)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 1.4 feet at 0. Seconds

GPEC-GT-4S Rising Head 2

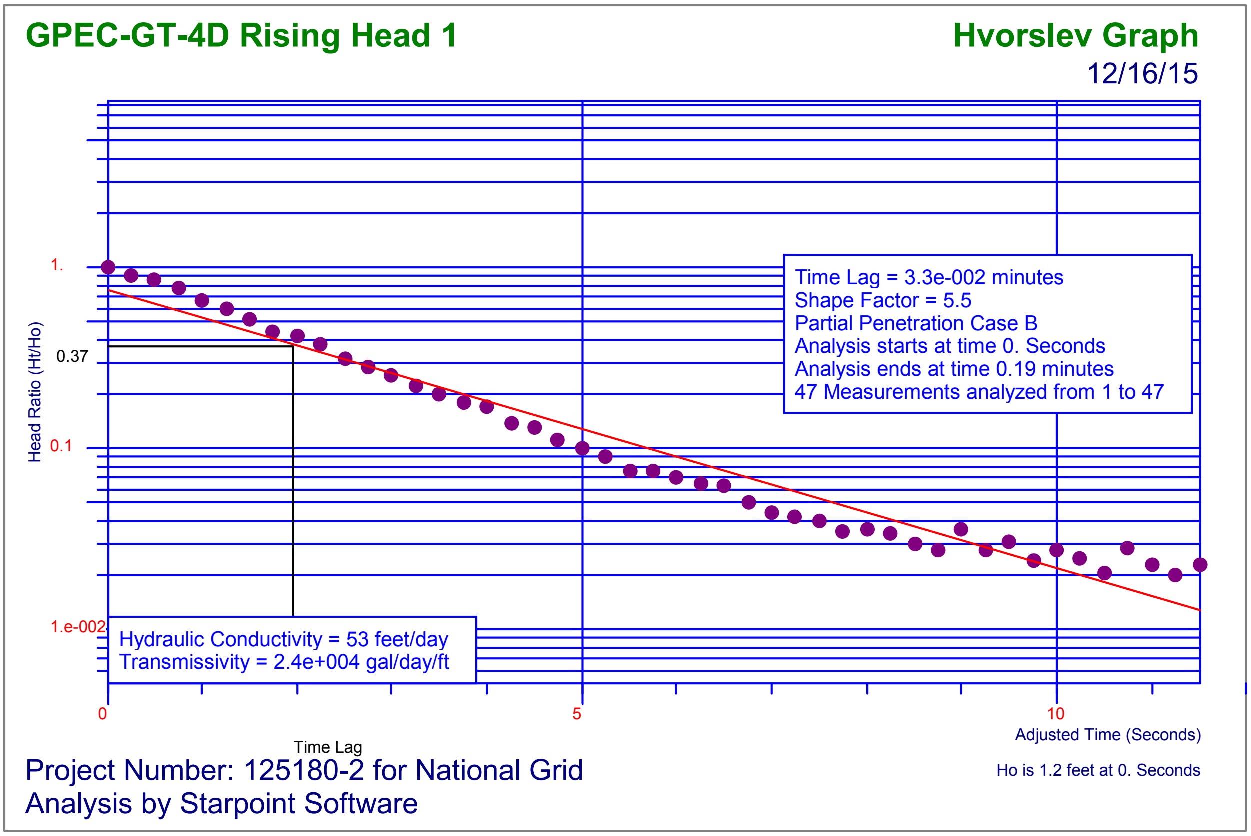
Bouwer and Rice Graph

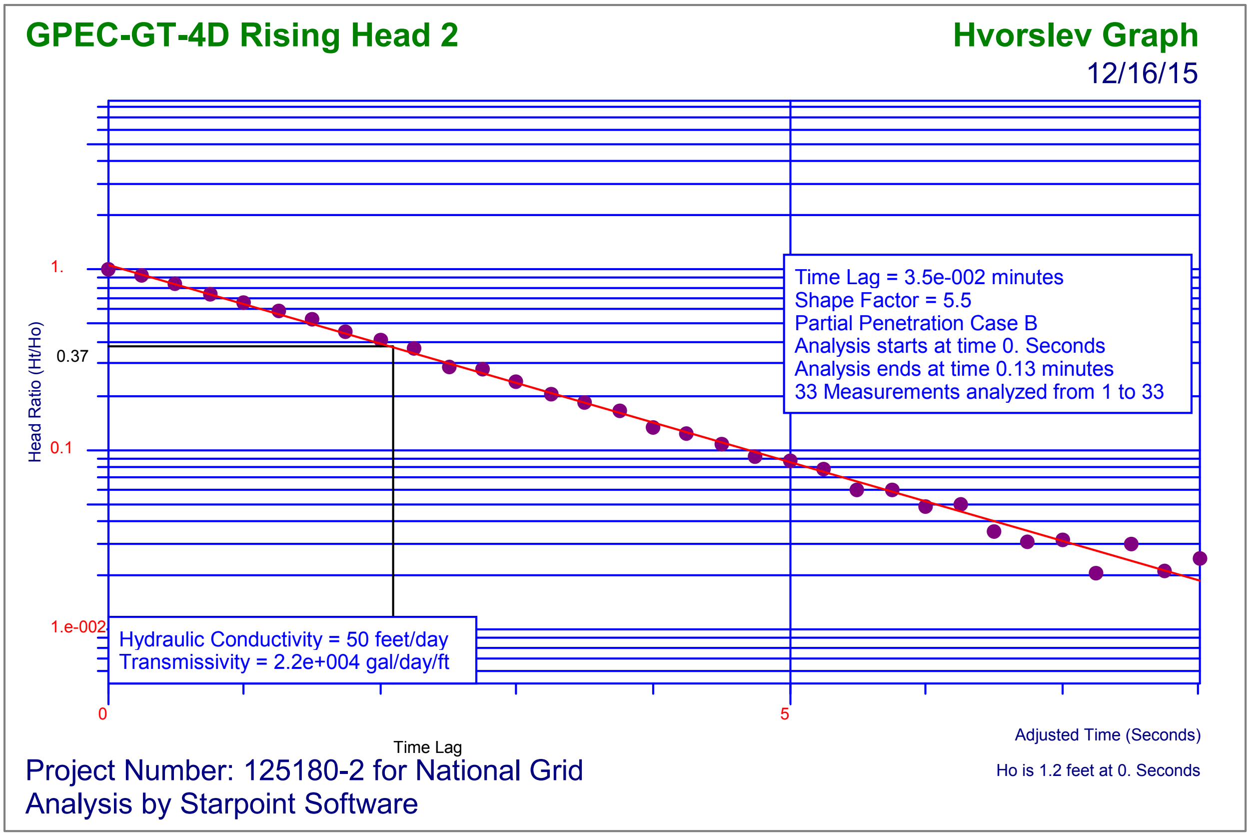
12/16/15



Ho is 1.3 feet at 0. Seconds

Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

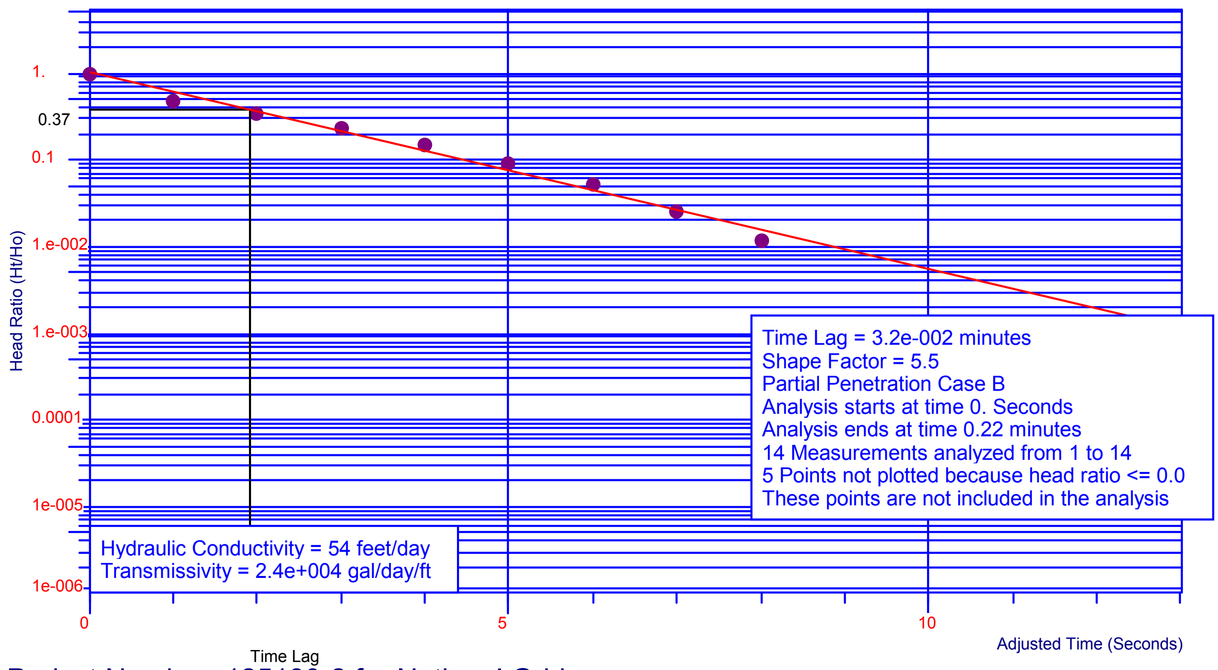

GPEC-GT-4D Rising Head 1
Hvorslev Graph
12/16/15
Time Lag = 3.3e-002 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 0.19 minutes
47 Measurements analyzed from 1 to 47
Hydraulic Conductivity = 53 feet/day
Transmissivity = 2.4e+004 gal/day/ft
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
0
5
10
Time Lag
Adjusted Time (Seconds)
Ho is 1.2 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-GT-4D Rising Head 2
Hvorslev Graph
12/16/15
1.
0.37
0.1
1.e-002
Head Ratio (Ht/Ho)
Time Lag = 3.5e-002 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 0.13 minutes
33 Measurements analyzed from 1 to 33
Hydraulic Conductivity = 50 feet/day
Transmissivity = 2.2e+004 gal/day/ft
0
5
Time Lag
Adjusted Time (Seconds)
Ho is 1.2 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

GPEC-GT-4D Falling Head 1

Hvorslev Graph

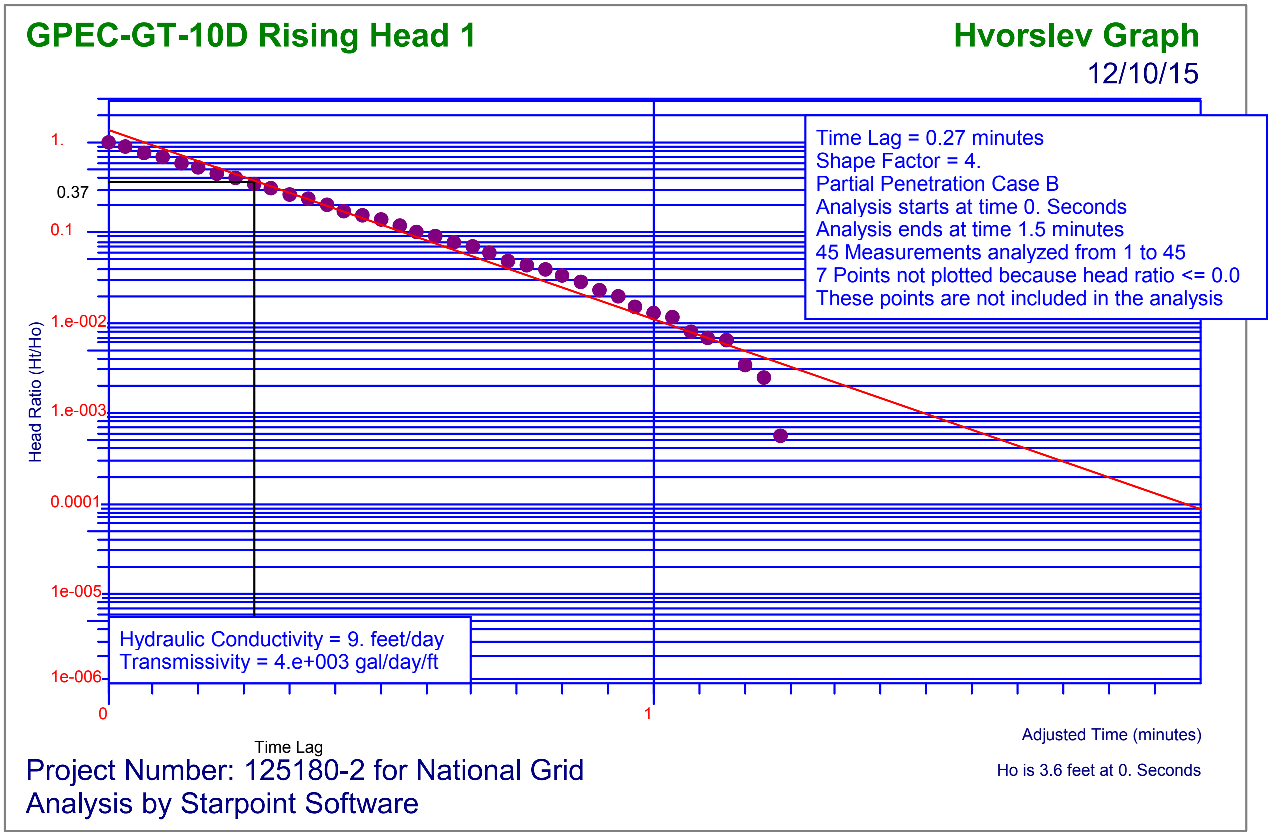
12/15/15

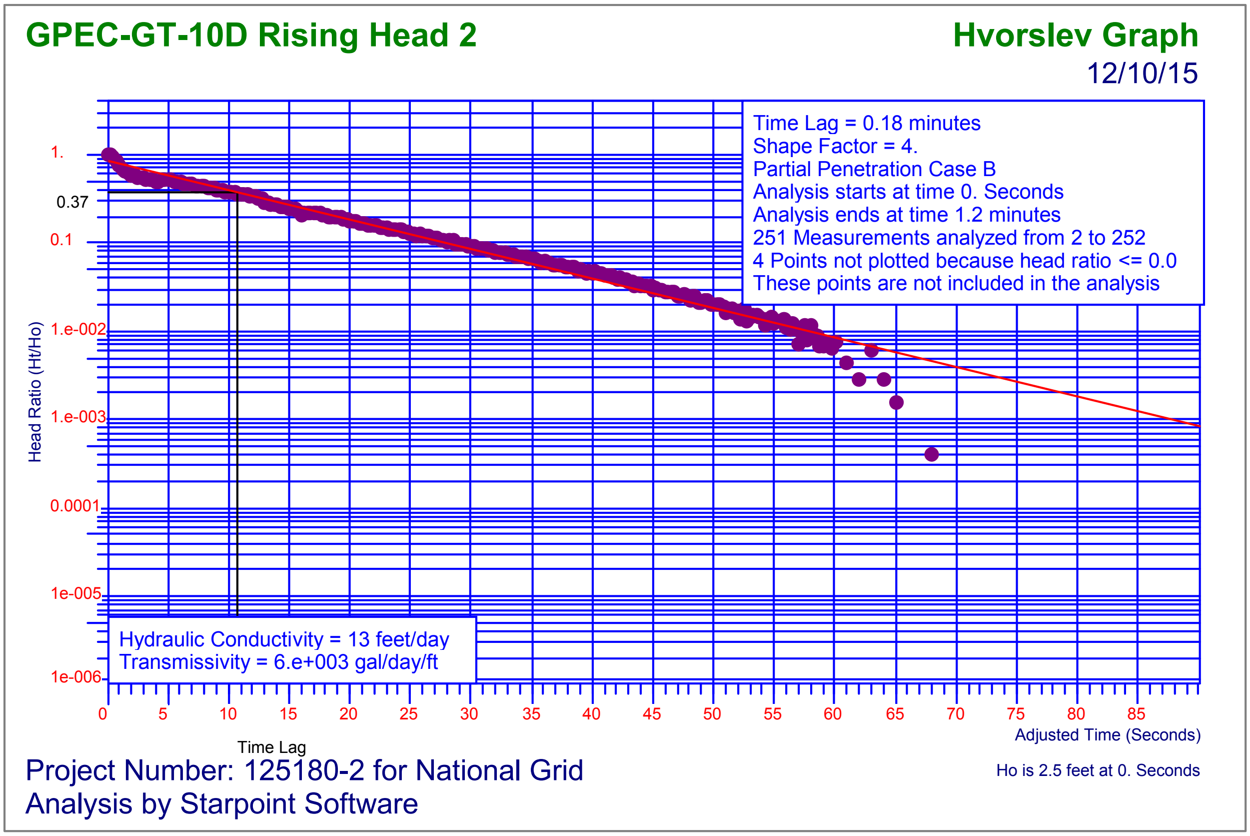


Ho is 1.9 feet at 0. Seconds

Project Number: 125180-2 for National Grid

Analysis by Starpoint Software


GPEC-GT-10D Rising Head 1
Hvorslev Graph
12/10/15
Time Lag = 0.27 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 1.5 minutes
45 Measurements analyzed from 1 to 45
7 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 9. feet/day
Transmissivity = 4.e+003 gal/day/ft
0
1
Time Lag
Adjusted Time (minutes)
Ho is 3.6 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

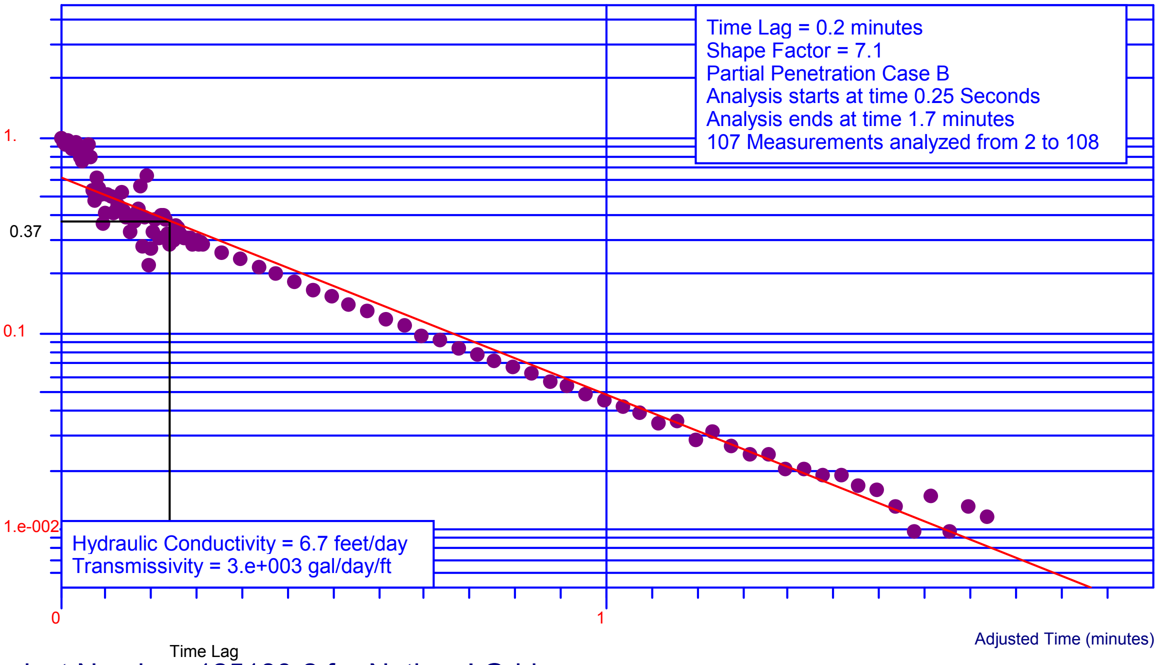


GPEC-GT-10D Rising Head 2
Hvorslev Graph
12/10/15
Time Lag = 0.18 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 1.2 minutes
251 Measurements analyzed from 2 to 252
4 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 13 feet/day
Transmissivity = 6.e+003 gal/day/ft
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Adjusted Time (Seconds)
Time Lag
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 2.5 feet at 0. Seconds

GPEC-GT-10D Falling Head 1

Hvorslev Graph

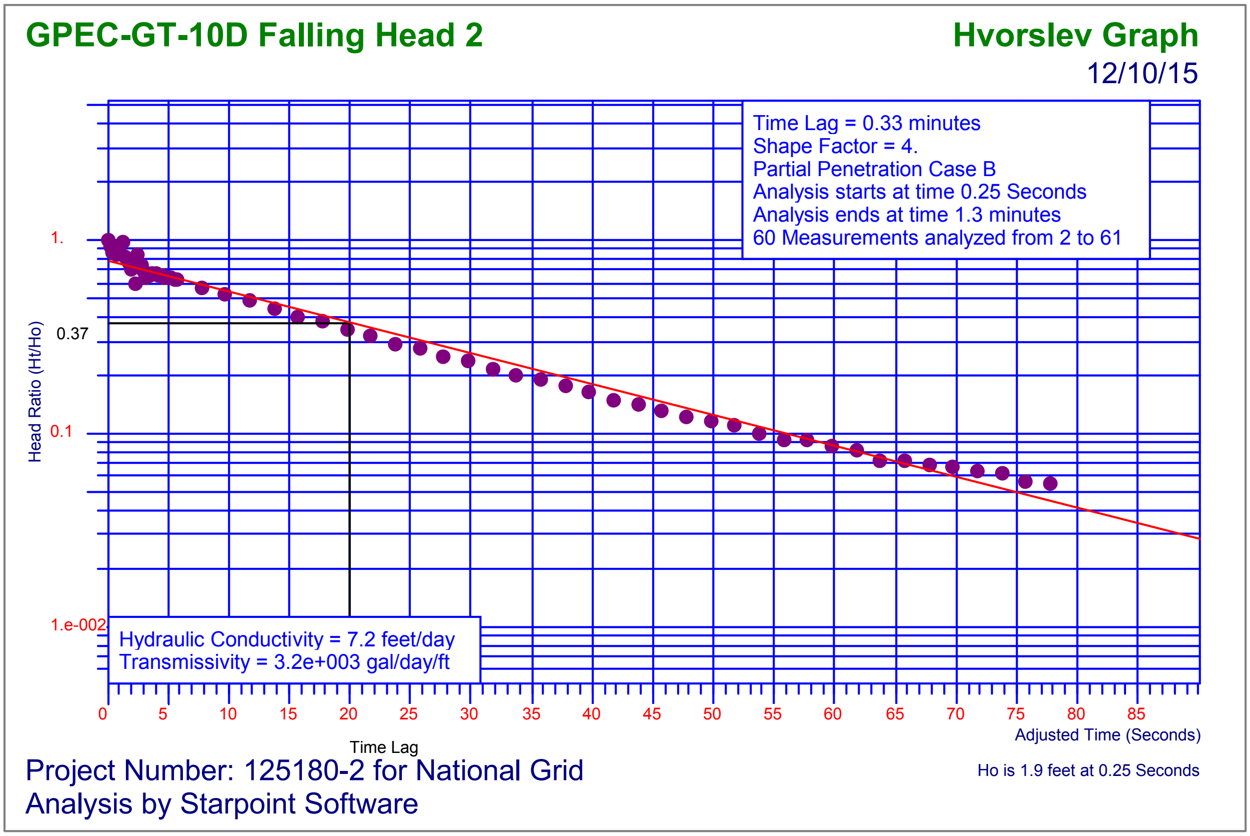
12/10/15



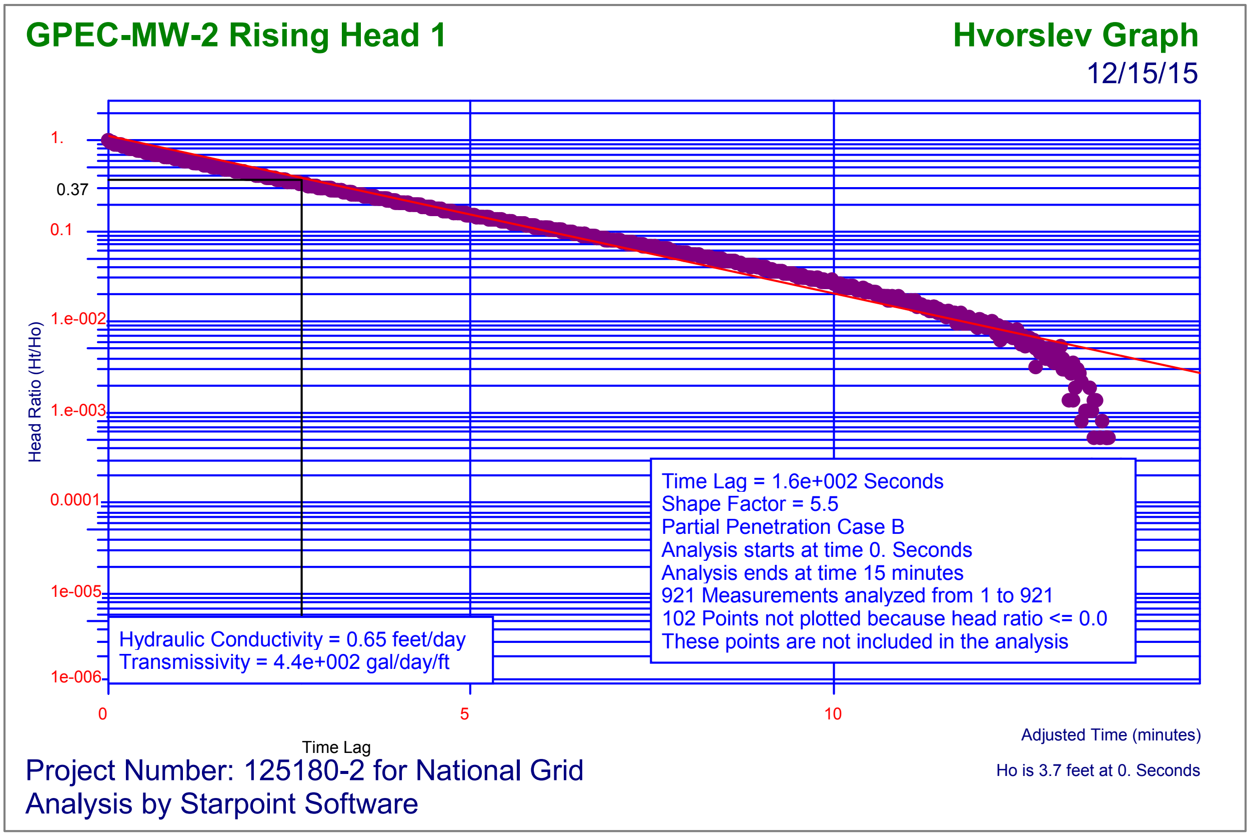
Ho is 2.1 feet at 0.25 Seconds

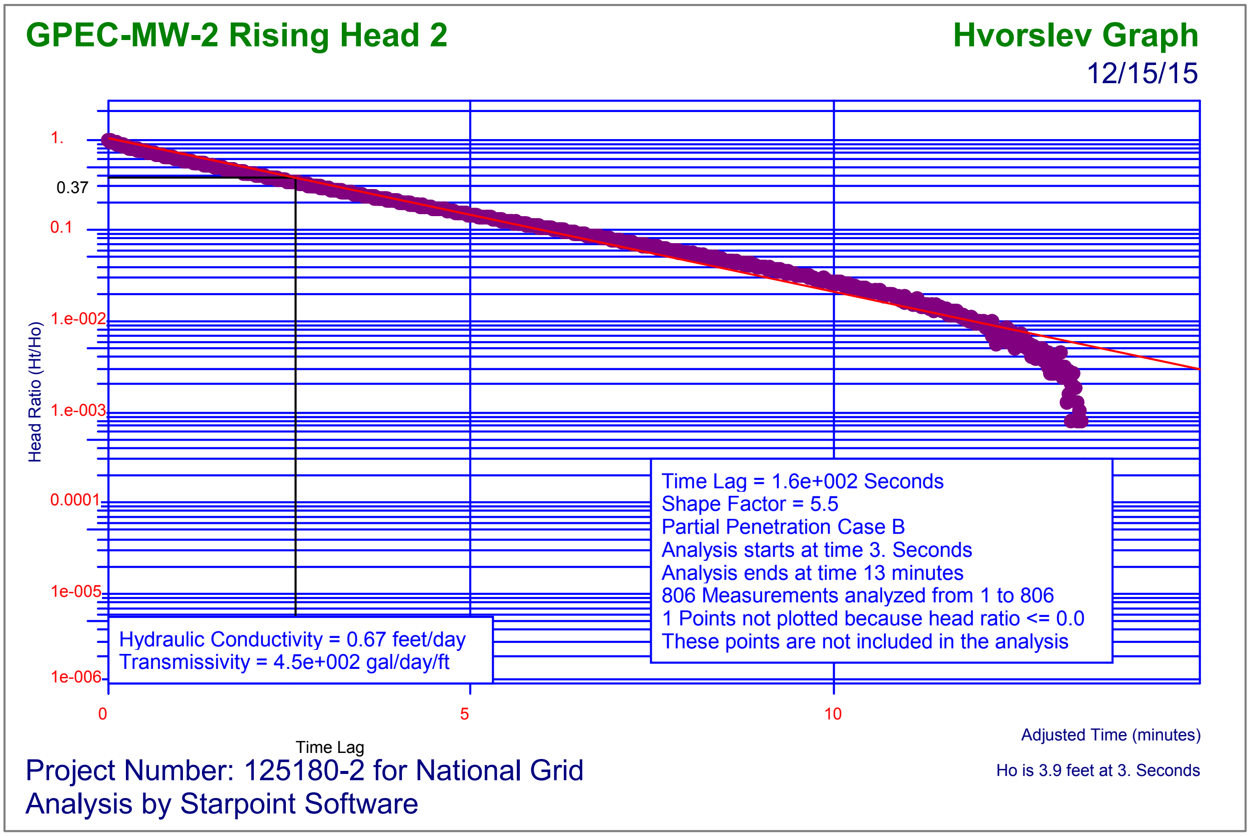
Project Number: 125180-2 for National Grid

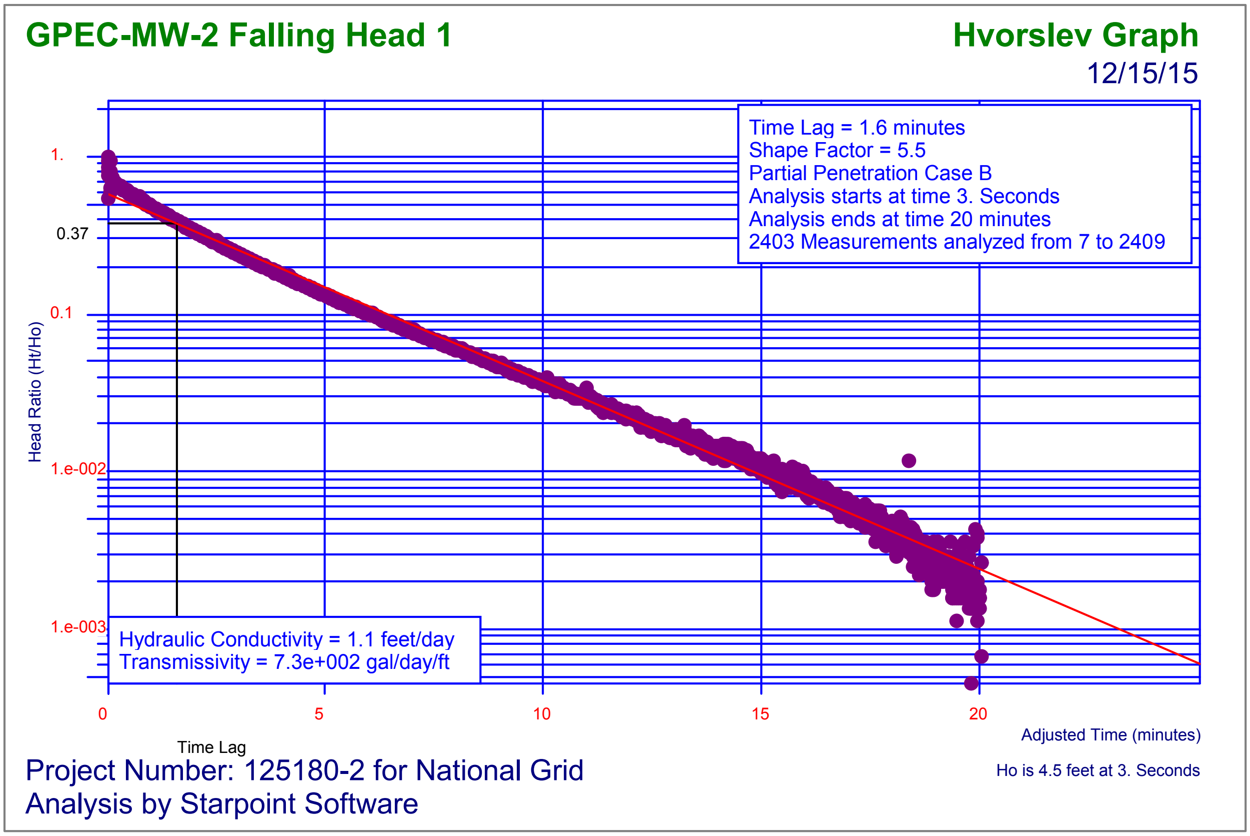
Analysis by Starpoint Software

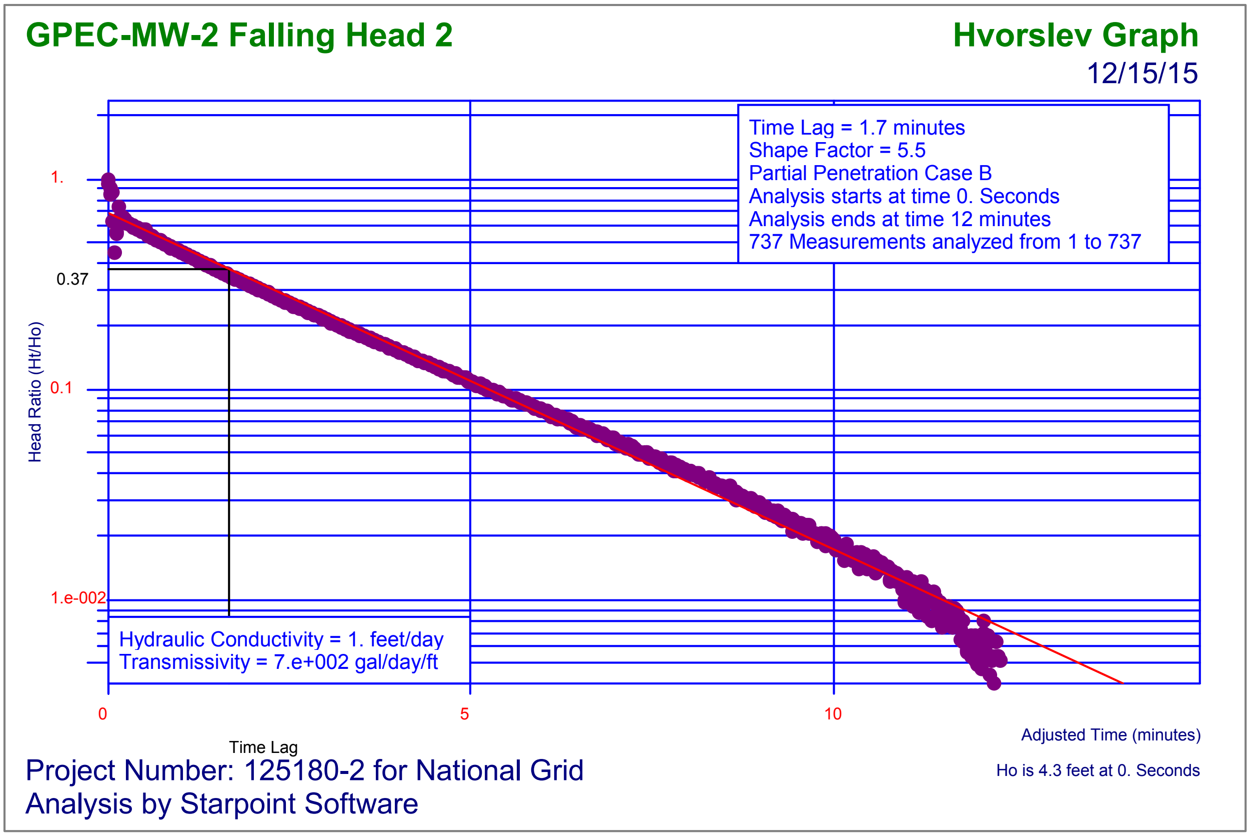


GPEC-GT-10D Falling Head 2
Hvorslev Graph
12/10/15
Time Lag = 0.33 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0.25 Seconds
Analysis ends at time 1.3 minutes
60 Measurements analyzed from 2 to 61
1.
0.37
0.1
1.e-002
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 7.2 feet/day
Transmissivity = 3.2e+003 gal/day/ft
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
Adjusted Time (Seconds)
Time Lag
Project Number: 125180-2 for National Grid
Ho is 1.9 feet at 0.25 Seconds
Analysis by Starpoint Software


GPEC-MW-2 Rising Head 1
Hvorslev Graph
12/15/15
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Head Ratio (Ht/Ho)
Time Lag = 1.6e+002 Seconds
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 15 minutes
921 Measurements analyzed from 1 to 921
102 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 0.65 feet/day
Transmissivity = 4.4e+002 gal/day/ft
0
5
10
Adjusted Time (minutes)
Time Lag
Ho is 3.7 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

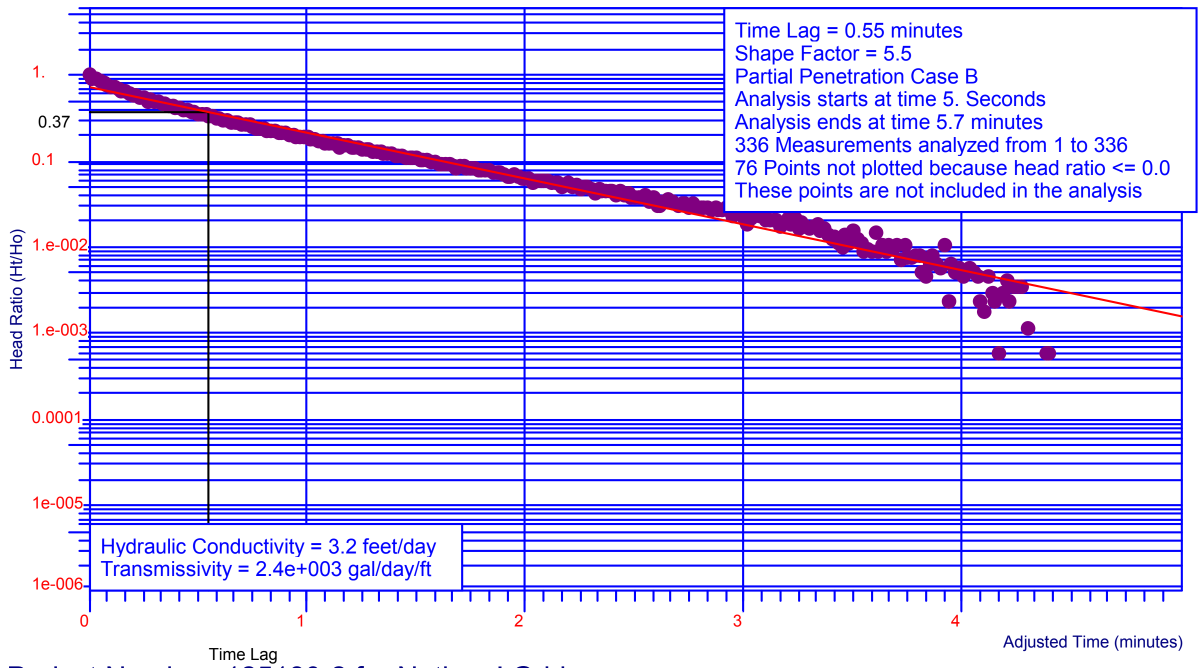

GPEC-MW-2 Rising Head 2
Hvorslev Graph
12/15/15
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Head Ratio (Ht/Ho)
0
5
10
Time Lag
Adjusted Time (minutes)
Ho is 3.9 feet at 3. Seconds
Time Lag = 1.6e+002 Seconds
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 3. Seconds
Analysis ends at time 13 minutes
806 Measurements analyzed from 1 to 806
1 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 0.67 feet/day
Transmissivity = 4.5e+002 gal/day/ft
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-MW-2 Falling Head 1
Hvorslev Graph
12/15/15
Time Lag = 1.6 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 3. Seconds
Analysis ends at time 20 minutes
2403 Measurements analyzed from 7 to 2409
1.
0.37
0.1
1.e-002
1.e-003
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 1.1 feet/day
Transmissivity = 7.3e+002 gal/day/ft
0
5
10
15
20
Adjusted Time (minutes)
Time Lag
Ho is 4.5 feet at 3. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-MW-2 Falling Head 2
Hvorslev Graph
12/15/15
Time Lag = 1.7 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 12 minutes
737 Measurements analyzed from 1 to 737
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
Hydraulic Conductivity = 1. feet/day
Transmissivity = 7.e+002 gal/day/ft
0
5
10
Adjusted Time (minutes)
Time Lag
Ho is 4.3 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

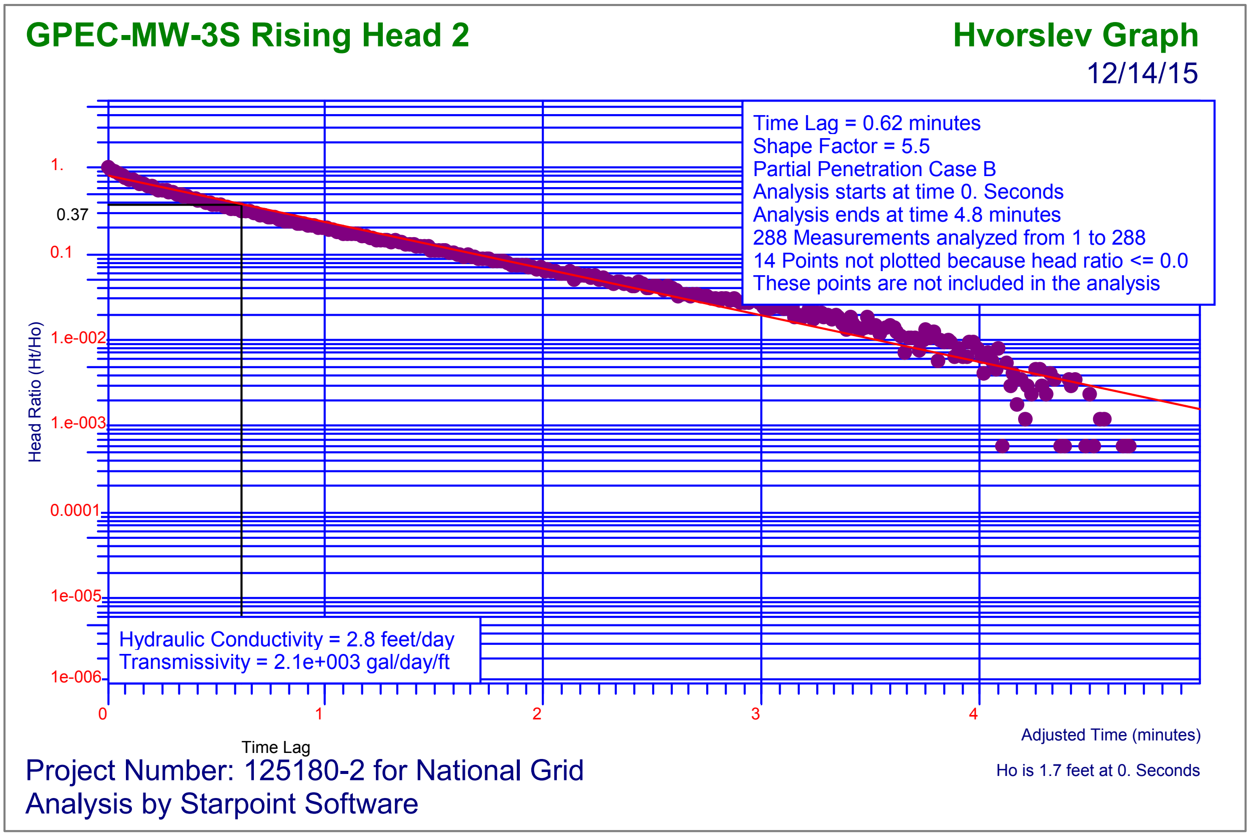
GPEC-MW-3S Rising Head 1 **Hvorslev Graph**

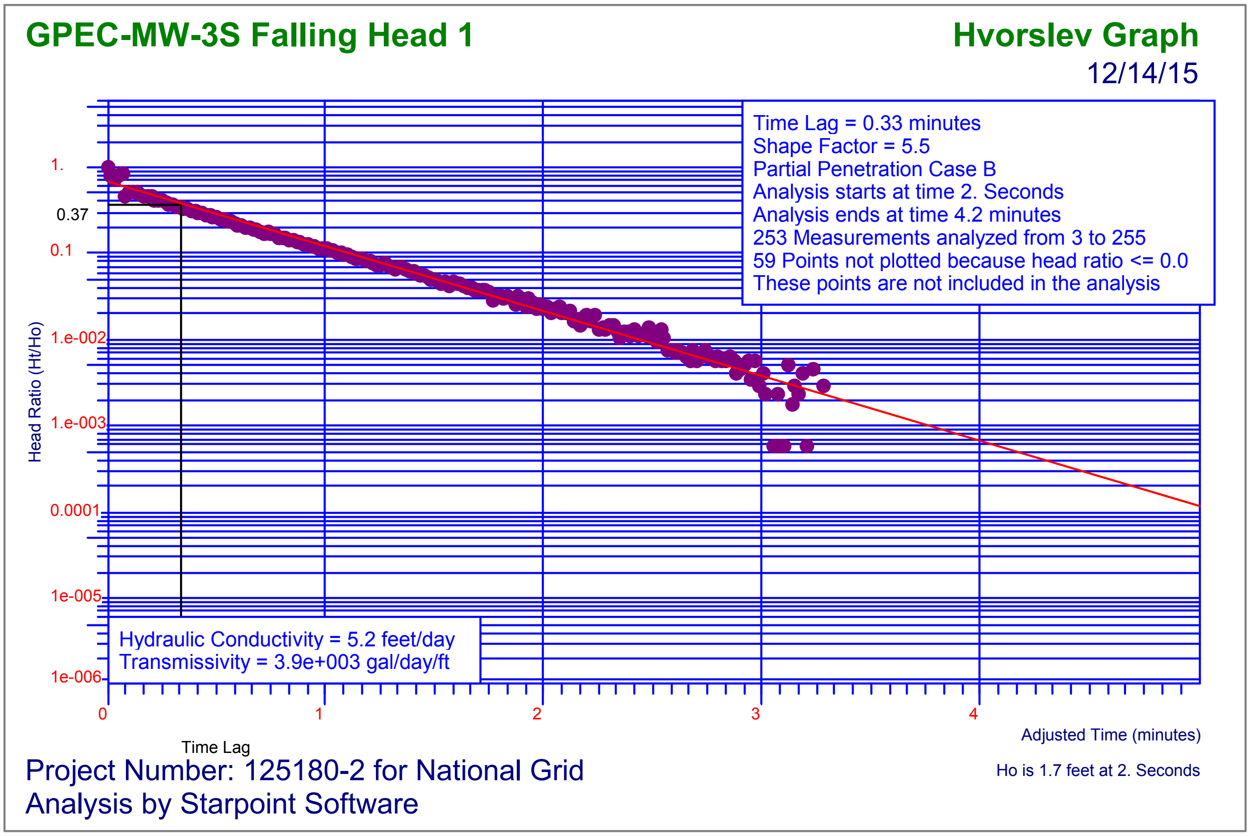
12/14/15

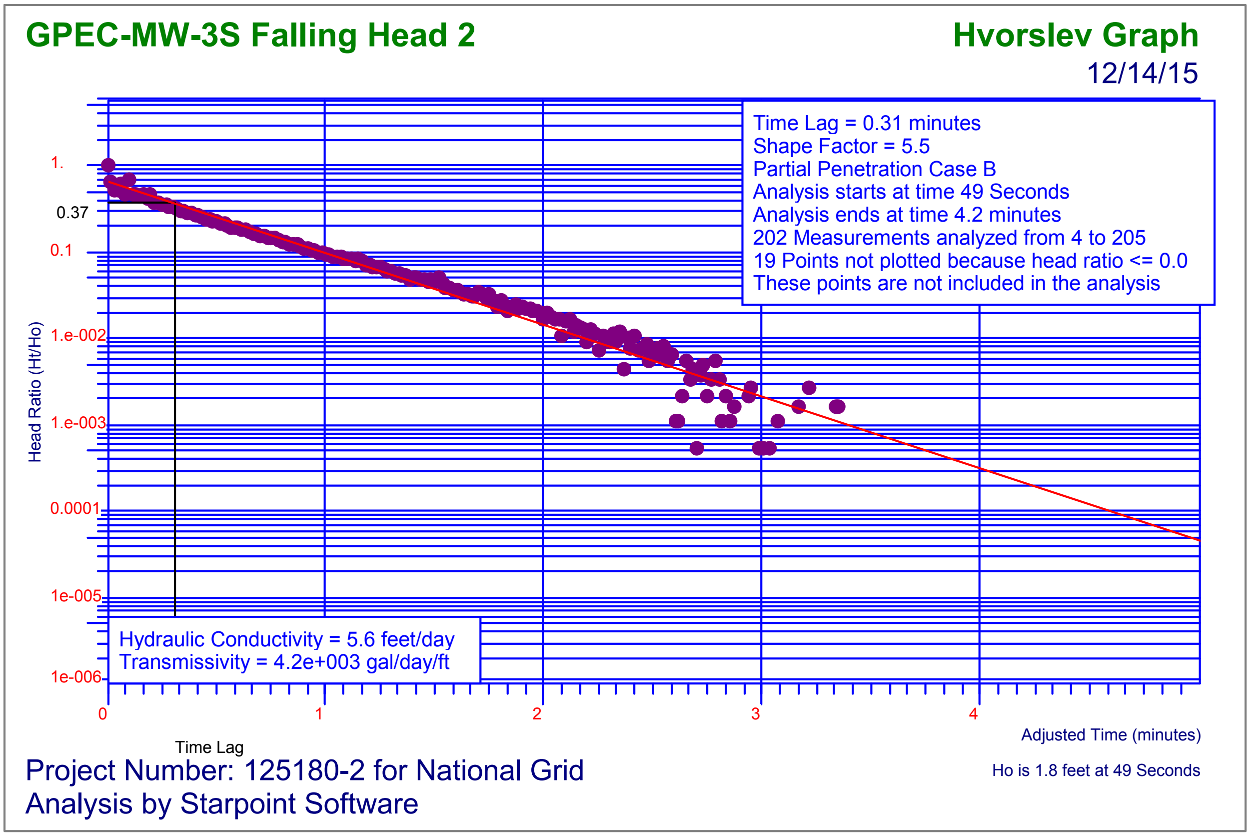


Project Number: 125180-2 for National Grid

Analysis by Starpoint Software


GPEC-MW-3S Rising Head 2
Hvorslev Graph
12/14/15
Time Lag = 0.62 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 4.8 minutes
288 Measurements analyzed from 1 to 288
14 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 2.8 feet/day
Transmissivity = 2.1e+003 gal/day/ft
0
1
2
3
4
Time Lag
Adjusted Time (minutes)
Ho is 1.7 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-MW-3S Falling Head 1
Hvorslev Graph
12/14/15
Time Lag = 0.33 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 2. Seconds
Analysis ends at time 4.2 minutes
253 Measurements analyzed from 3 to 255
59 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 5.2 feet/day
Transmissivity = 3.9e+003 gal/day/ft
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
1
2
3
4
Time Lag
Adjusted Time (minutes)
Ho is 1.7 feet at 2. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

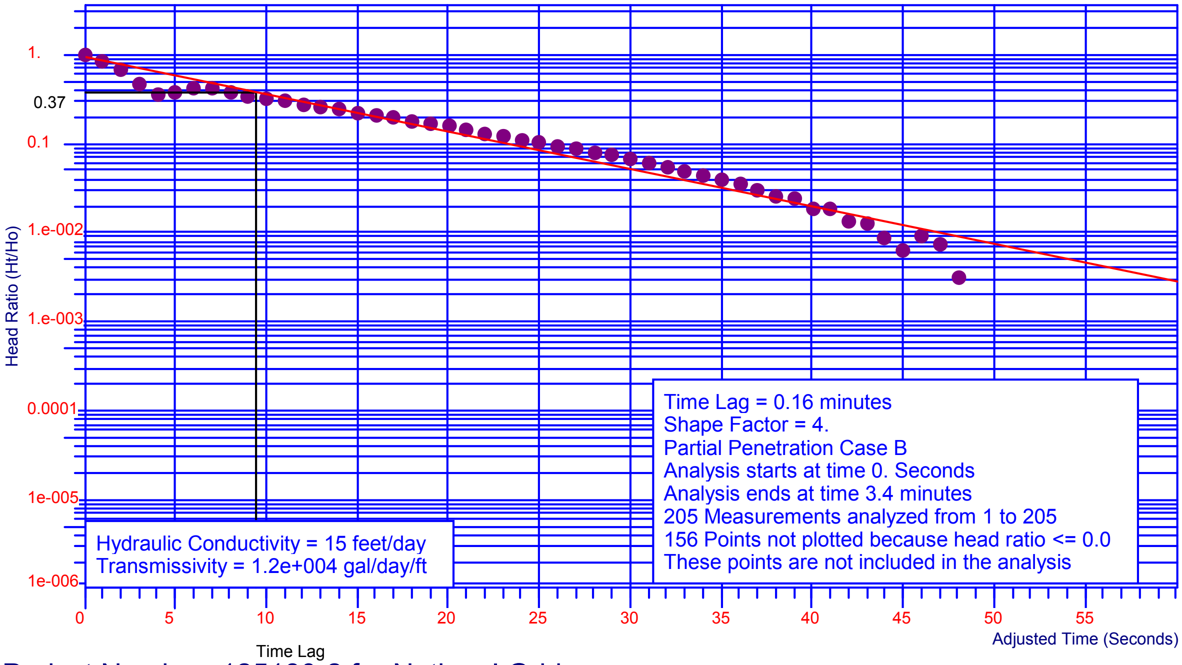


GPEC-MW-3S Falling Head 2
Hvorslev Graph
12/14/15
Time Lag = 0.31 minutes
Shape Factor = 5.5
Partial Penetration Case B
Analysis starts at time 49 Seconds
Analysis ends at time 4.2 minutes
202 Measurements analyzed from 4 to 205
19 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Hydraulic Conductivity = 5.6 feet/day
Transmissivity = 4.2e+003 gal/day/ft
0
1
2
3
4
Time Lag
Adjusted Time (minutes)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 1.8 feet at 49 Seconds

GPEC-MW-5S Rising Head 1

Hvorslev Graph

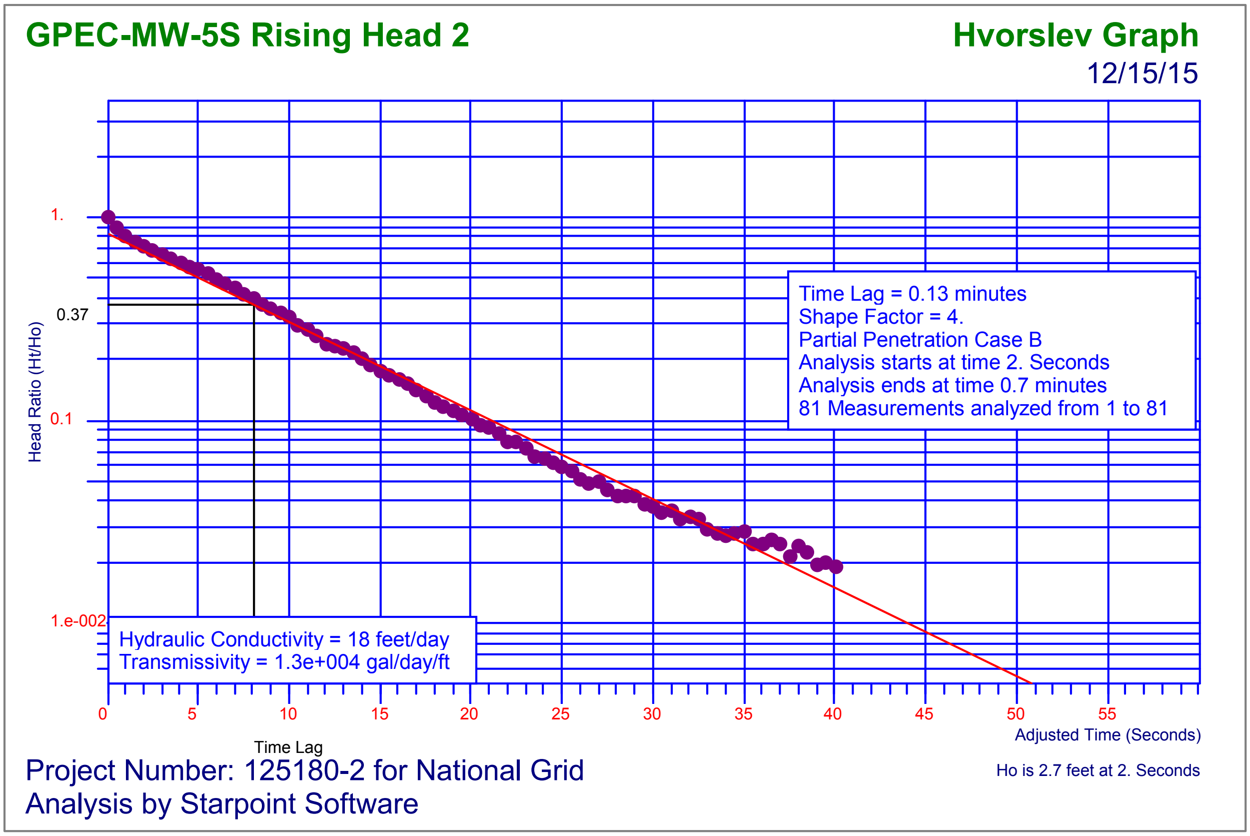
12/15/15



Ho is 2.8 feet at 0. Seconds

Project Number: 125180-2 for National Grid

Analysis by Starpoint Software

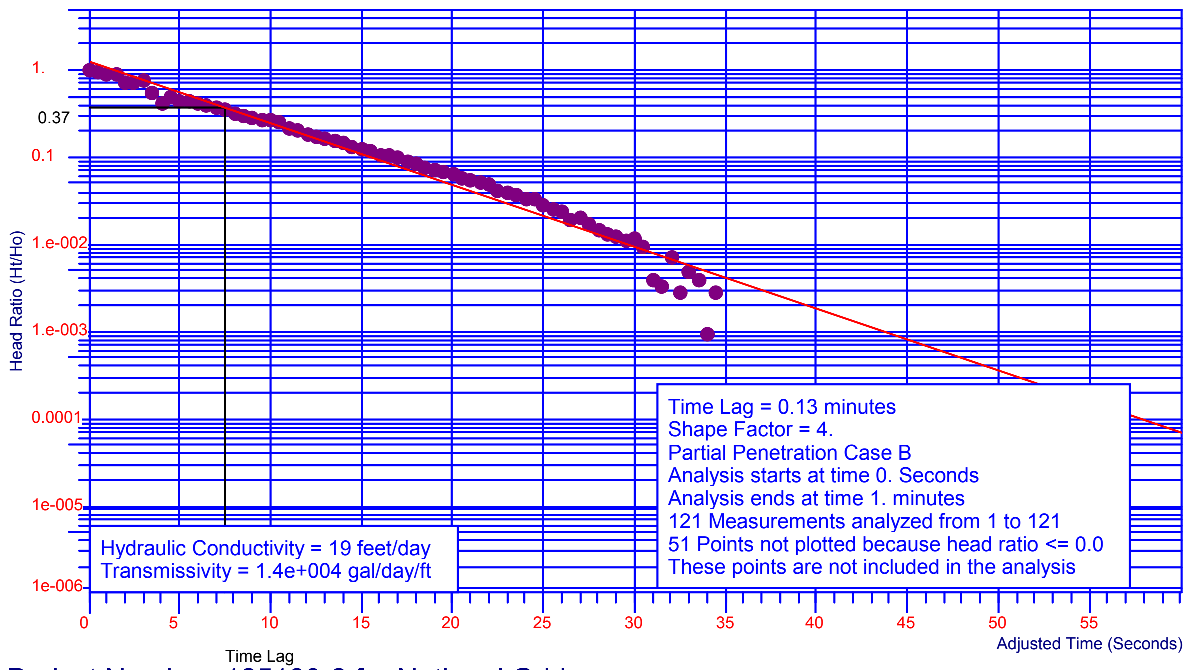


GPEC-MW-5S Rising Head 2
Hvorslev Graph
12/15/15
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
Time Lag = 0.13 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 2. Seconds
Analysis ends at time 0.7 minutes
81 Measurements analyzed from 1 to 81
Hydraulic Conductivity = 18 feet/day
Transmissivity = 1.3e+004 gal/day/ft
0
5
10
15
20
25
30
35
40
45
50
55
Adjusted Time (Seconds)
Time Lag
Project Number: 125180-2 for National Grid
Ho is 2.7 feet at 2. Seconds
Analysis by Starpoint Software

GPEC-MW-5S Falling Head 1

Hvorslev Graph

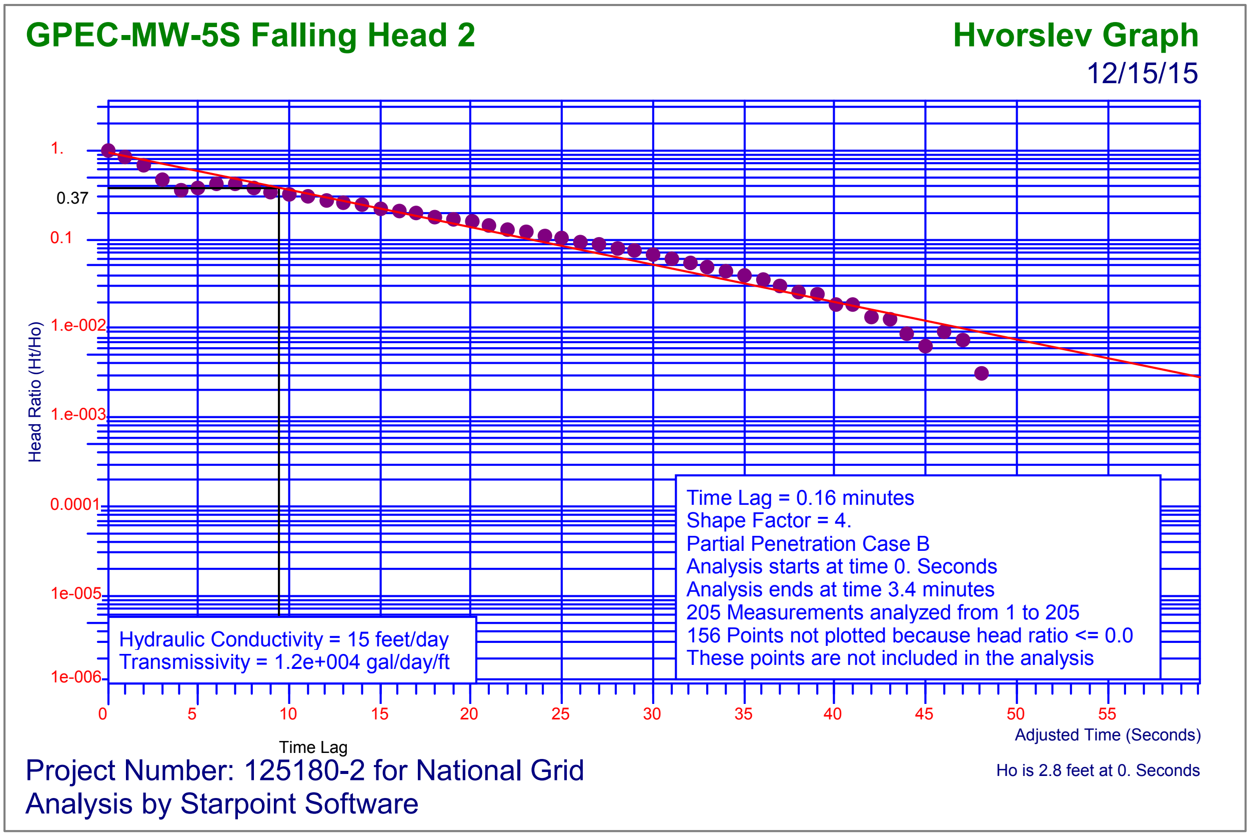
12/15/15



Ho is 2.1 feet at 0. Seconds

Project Number: 125180-2 for National Grid

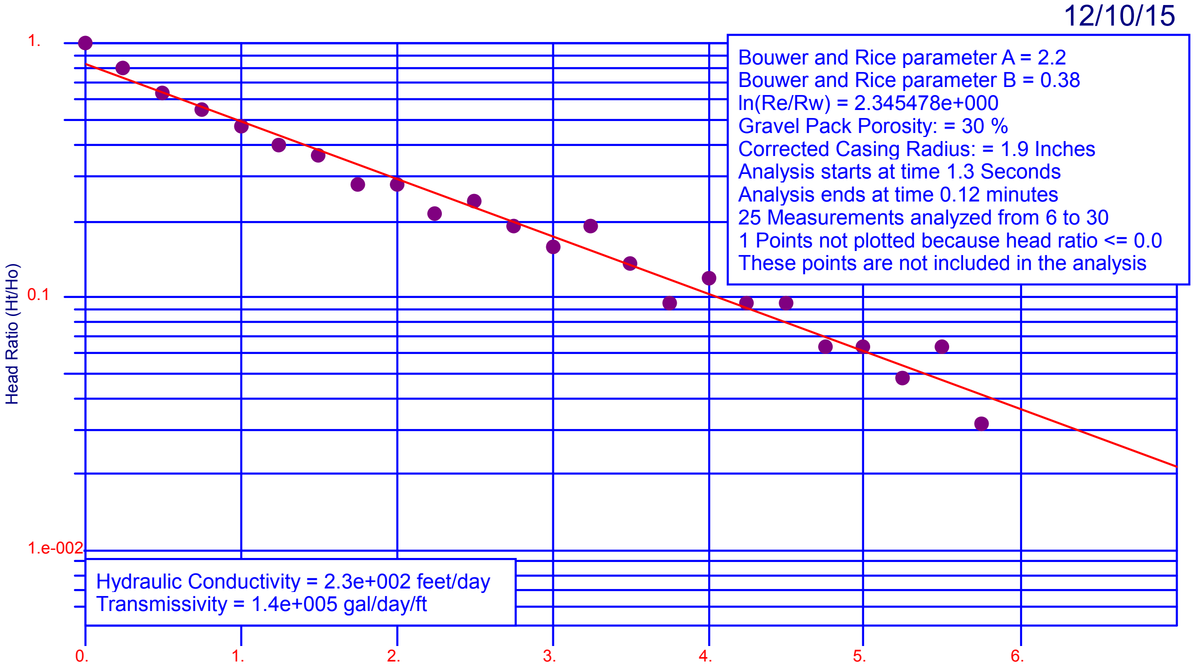
Analysis by Starpoint Software


GPEC-MW-5S Falling Head 2
Hvorslev Graph
12/15/15
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
5
10
15
20
25
30
35
40
45
50
55
Adjusted Time (Seconds)
Time Lag
Time Lag = 0.16 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 3.4 minutes
205 Measurements analyzed from 1 to 205
156 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 15 feet/day
Transmissivity = 1.2e+004 gal/day/ft
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 2.8 feet at 0. Seconds

MW-9 Rising Head 1

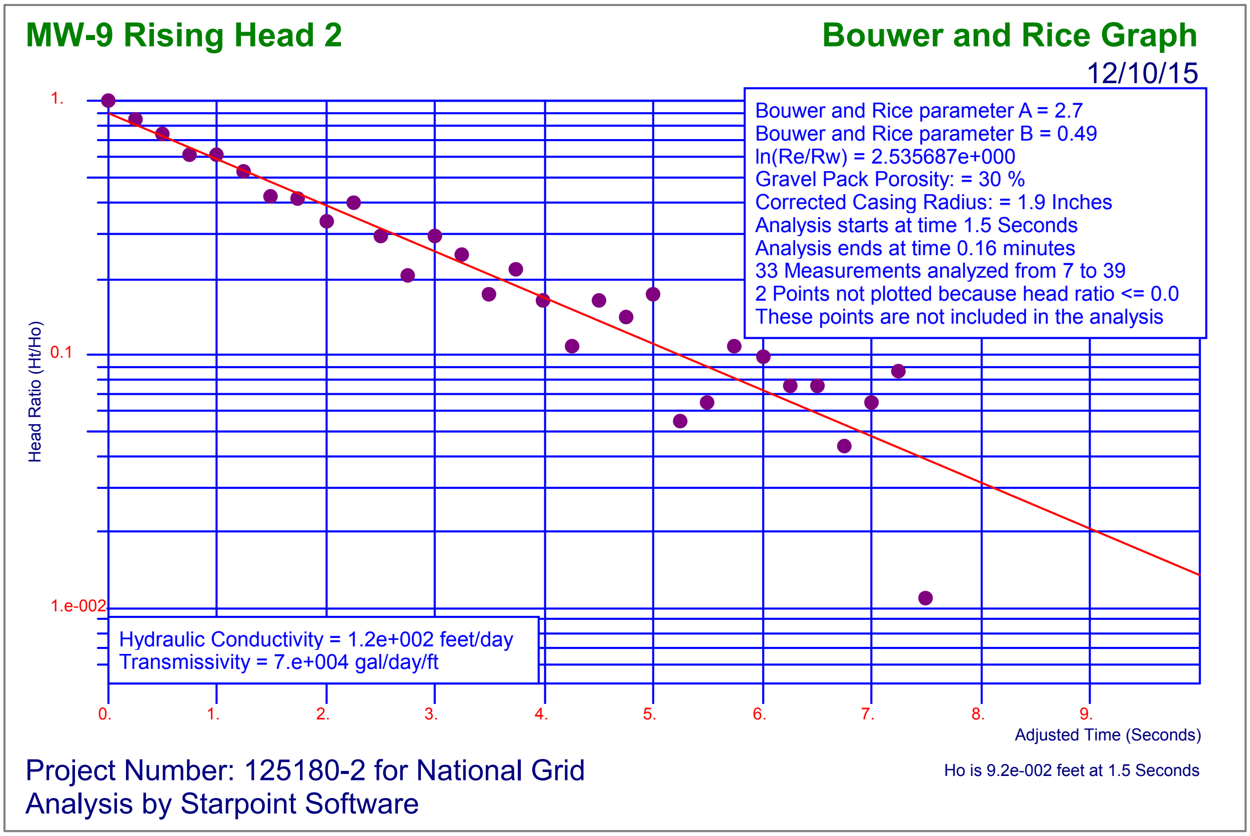
Bouwer and Rice Graph

12/10/15

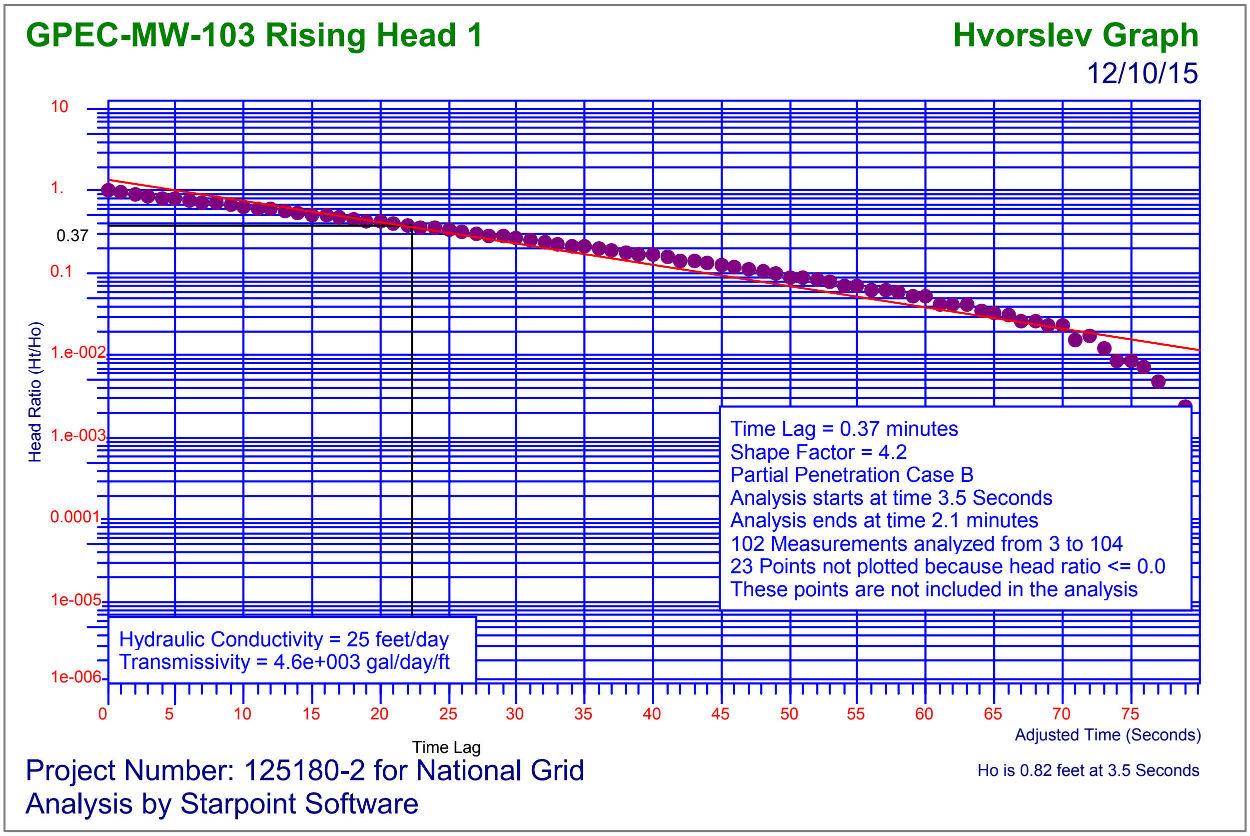


Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

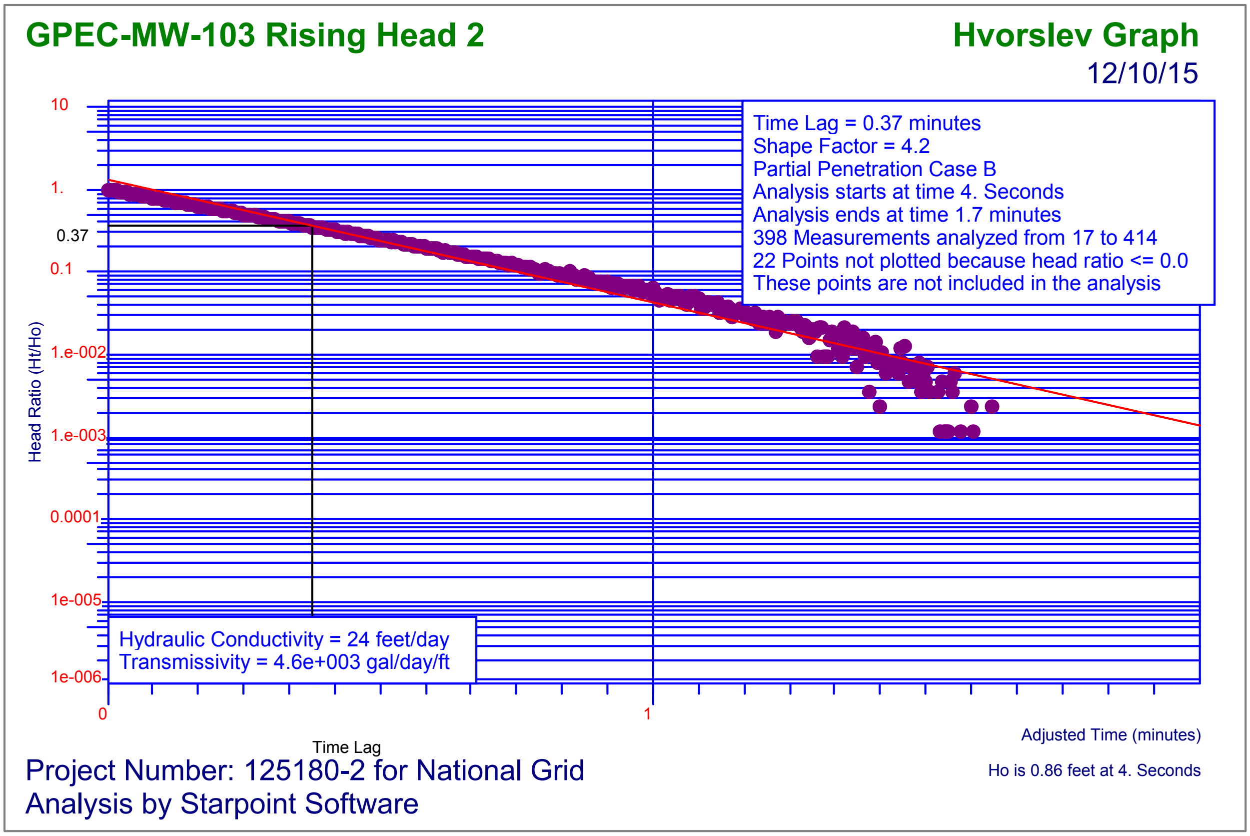
Ho is 0.13 feet at 1.3 Seconds



MW-9 Rising Head 2
Bouwer and Rice Graph
12/10/15
Bouwer and Rice parameter A = 2.7
Bouwer and Rice parameter B = 0.49
ln(Re/Rw) = 2.535687e+000
Gravel Pack Porosity: = 30 %
Corrected Casing Radius: = 1.9 Inches
Analysis starts at time 1.5 Seconds
Analysis ends at time 0.16 minutes
33 Measurements analyzed from 7 to 39
2 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
1.
0.1
1.e-002
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 1.2e+002 feet/day
Transmissivity = 7.e+004 gal/day/ft
0.
1.
2.
3.
4.
5.
6.
7.
8.
9.
Adjusted Time (Seconds)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 9.2e-002 feet at 1.5 Seconds



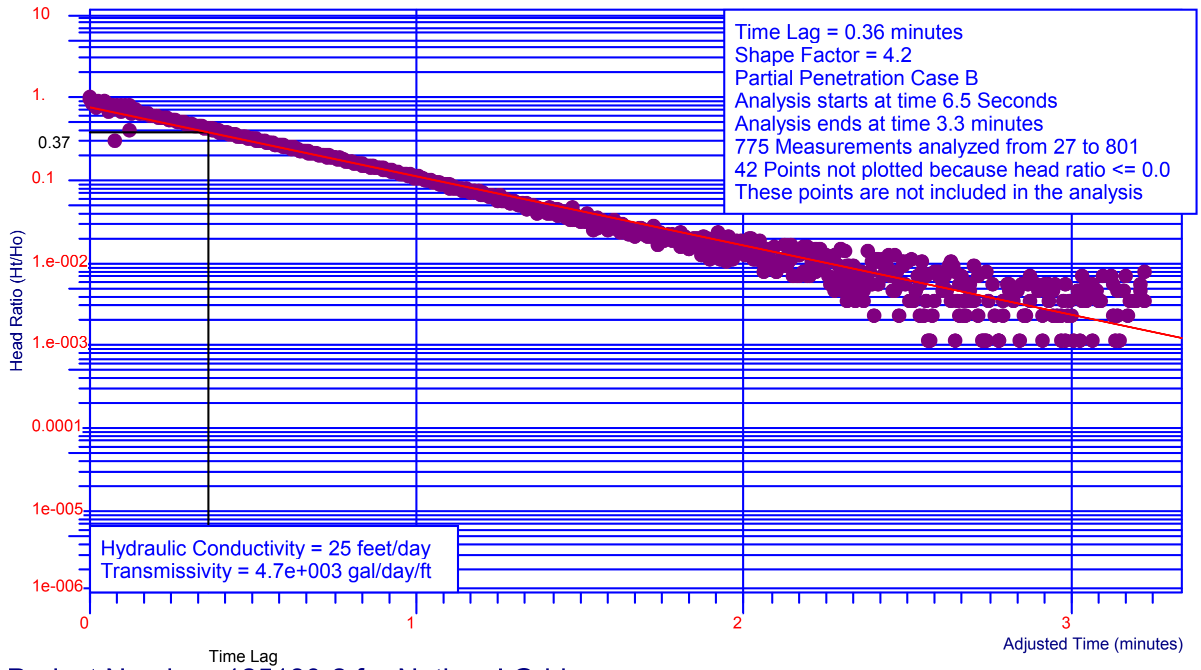
GPEC-MW-103 Rising Head 1
Hvorslev Graph
12/10/15
Head Ratio (Ht/Ho)
10
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
Time Lag
Adjusted Time (Seconds)
Time Lag = 0.37 minutes
Shape Factor = 4.2
Partial Penetration Case B
Analysis starts at time 3.5 Seconds
Analysis ends at time 2.1 minutes
102 Measurements analyzed from 3 to 104
23 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 25 feet/day
Transmissivity = 4.6e+003 gal/day/ft
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 0.82 feet at 3.5 Seconds


GPEC-MW-103 Rising Head 2
Hvorslev Graph
12/10/15
Time Lag = 0.37 minutes
Shape Factor = 4.2
Partial Penetration Case B
Analysis starts at time 4. Seconds
Analysis ends at time 1.7 minutes
398 Measurements analyzed from 17 to 414
22 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 24 feet/day
Transmissivity = 4.6e+003 gal/day/ft
Head Ratio (Ht/Ho)
10
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
1
Time Lag
Adjusted Time (minutes)
Ho is 0.86 feet at 4. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

GPEC-MW-103 Falling Head 1

Hvorslev Graph

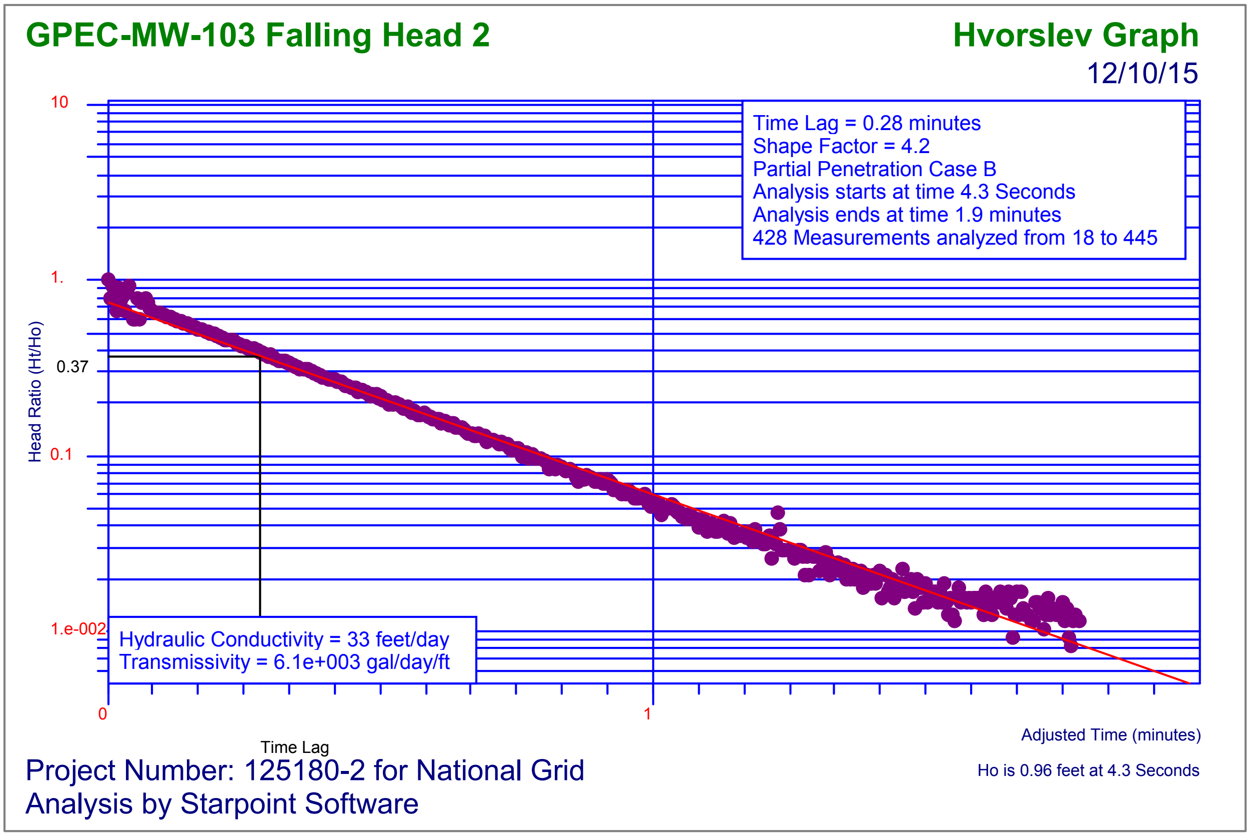
12/10/15

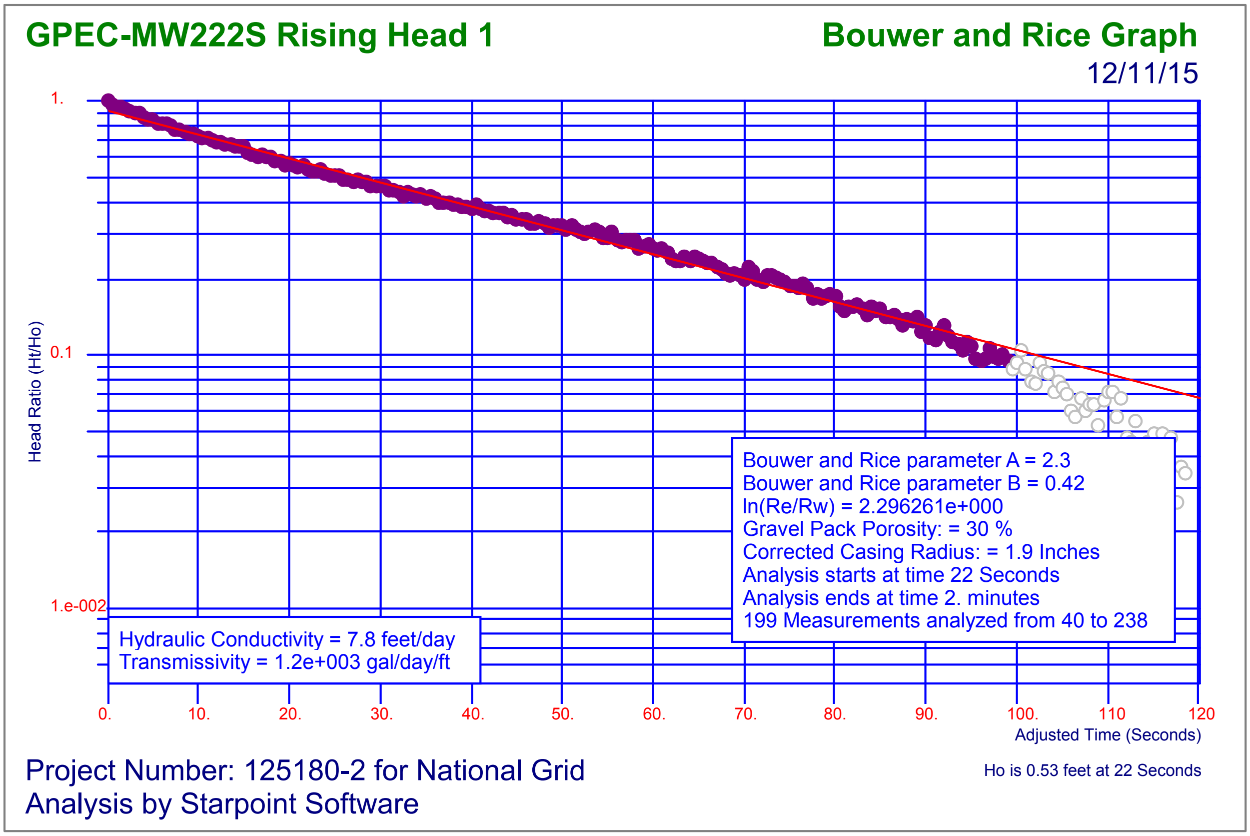


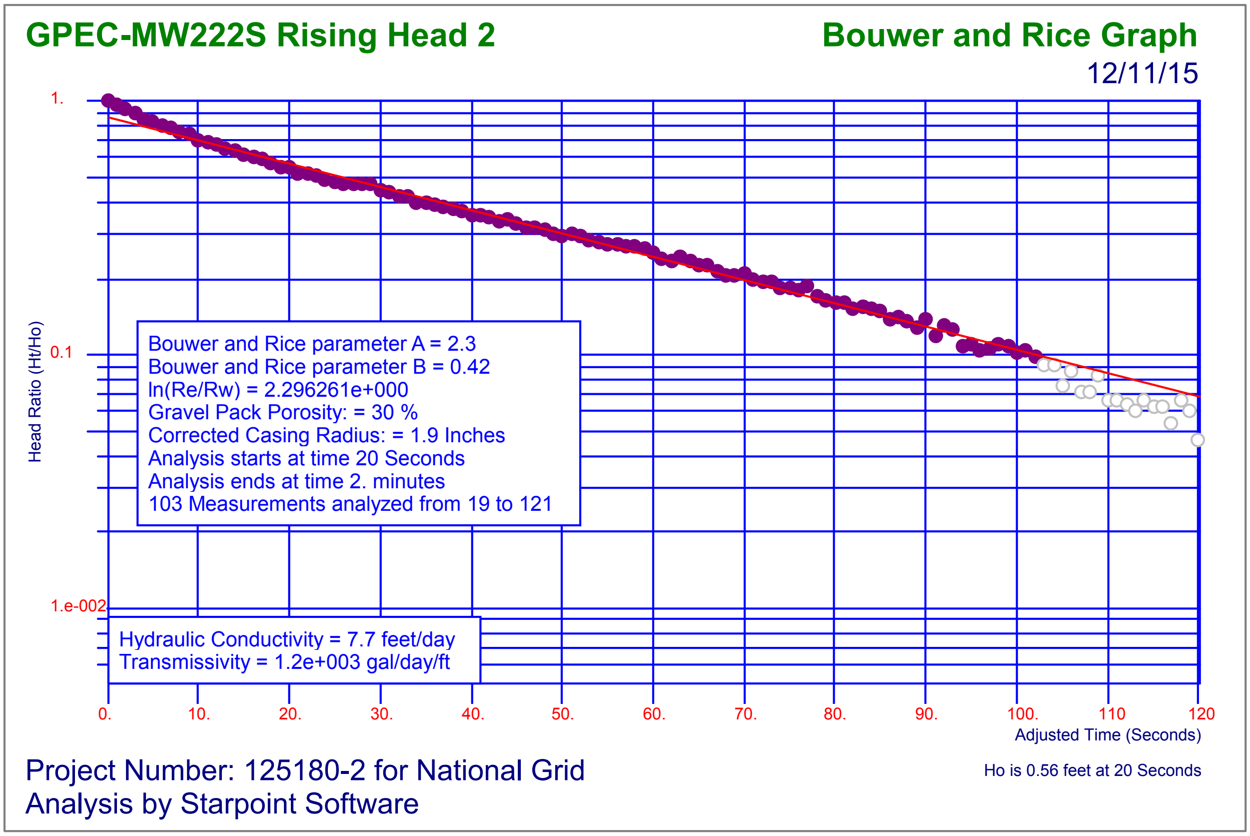
Project Number: 125180-2 for National Grid

Analysis by Starpoint Software

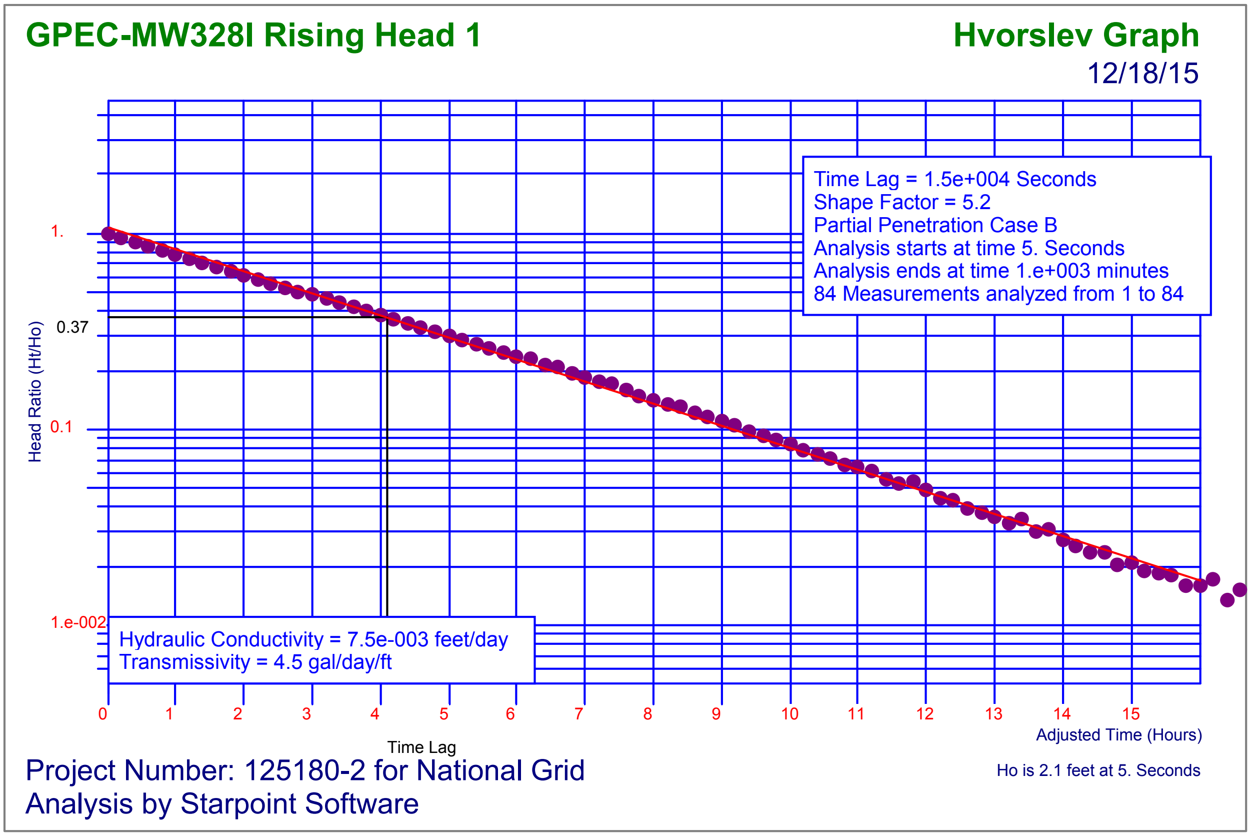
Ho is 0.88 feet at 6.5 Seconds

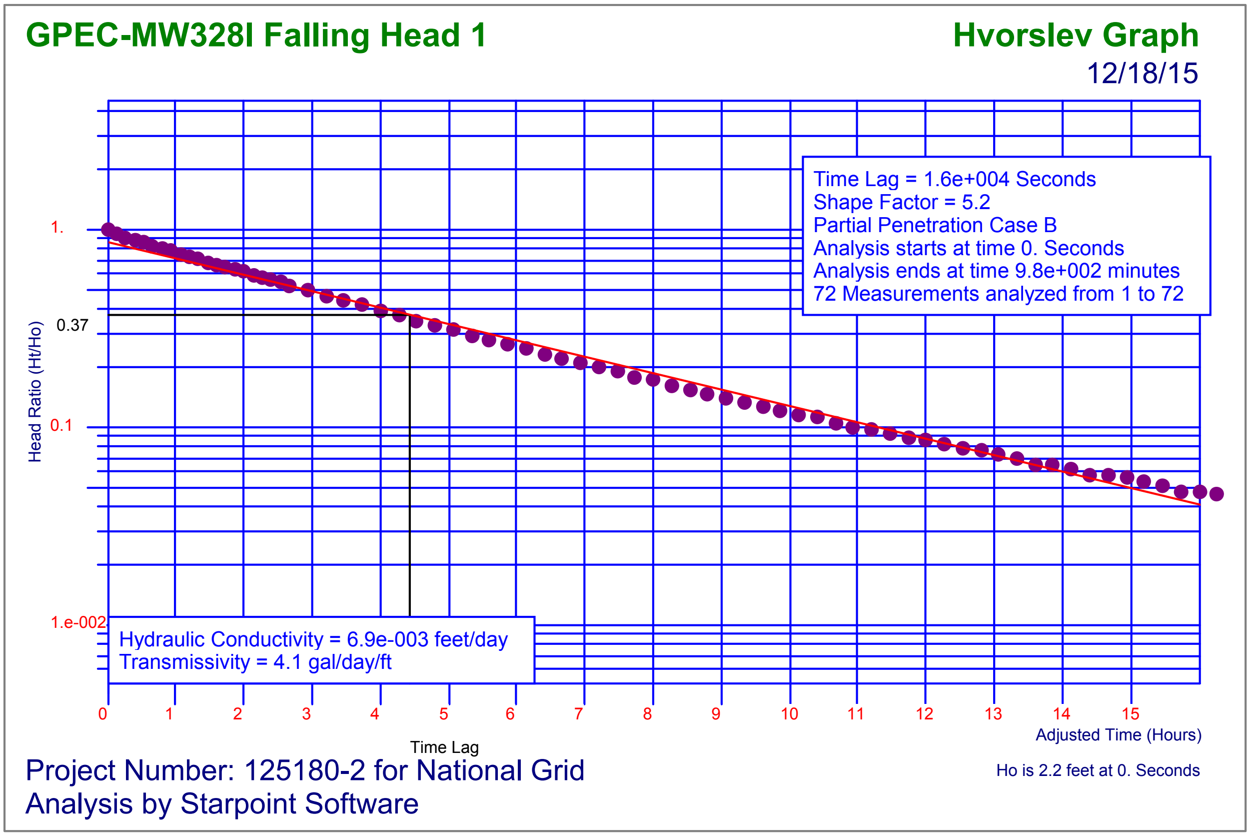

GPEC-MW-103 Falling Head 2
Hvorslev Graph
12/10/15
Time Lag = 0.28 minutes
Shape Factor = 4.2
Partial Penetration Case B
Analysis starts at time 4.3 Seconds
Analysis ends at time 1.9 minutes
428 Measurements analyzed from 18 to 445
10
1.
0.37
0.1
1.e-002
Head Ratio (Ht/Ho)
Hydraulic Conductivity = 33 feet/day
Transmissivity = 6.1e+003 gal/day/ft
0
1
Time Lag
Adjusted Time (minutes)
Ho is 0.96 feet at 4.3 Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

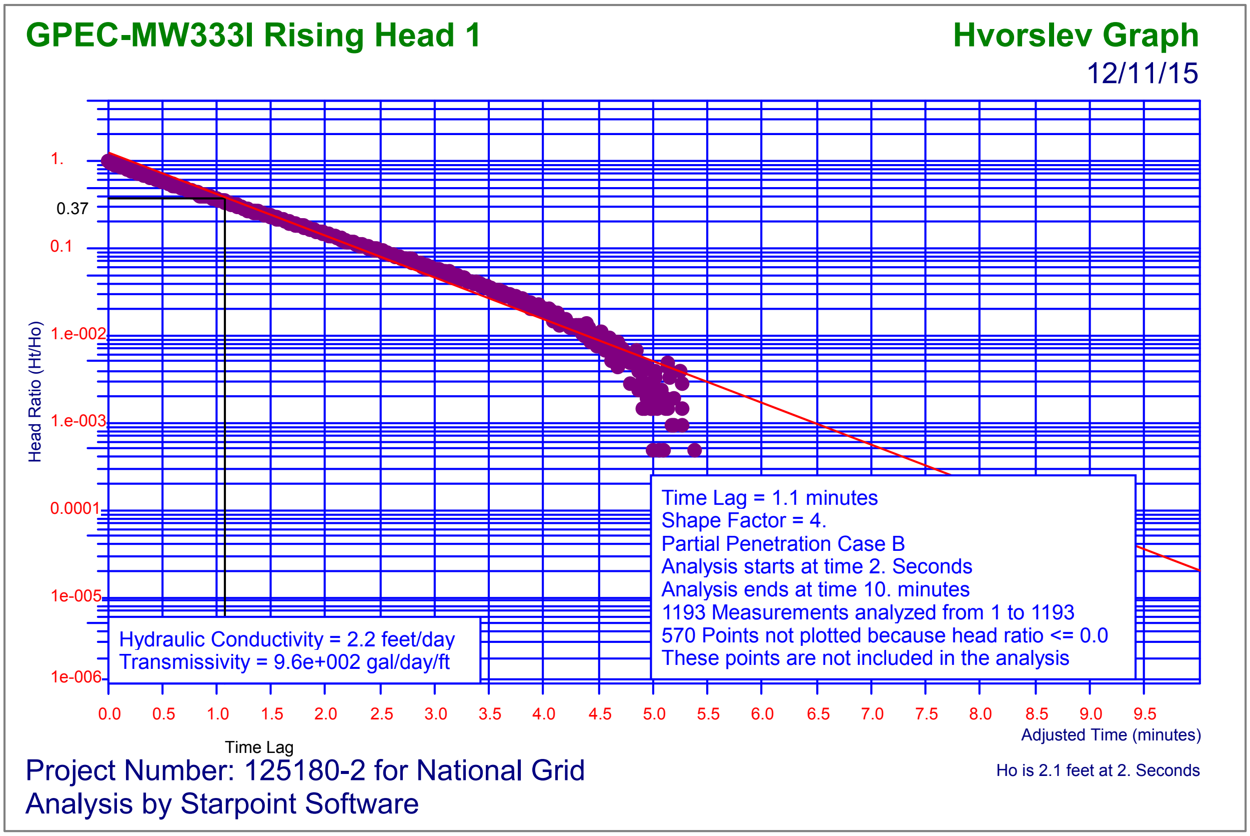

GPEC-MW222S Rising Head 1
Bouwer and Rice Graph
12/11/15
1.
0.1
1.e-002
Head Ratio (Ht/Ho)
0.
10.
20.
30.
40.
50.
60.
70.
80.
90.
100.
110
120
Adjusted Time (Seconds)
Hydraulic Conductivity = 7.8 feet/day
Transmissivity = 1.2e+003 gal/day/ft
Bouwer and Rice parameter A = 2.3
Bouwer and Rice parameter B = 0.42
ln(Re/Rw) = 2.296261e+000
Gravel Pack Porosity: = 30 %
Corrected Casing Radius: = 1.9 Inches
Analysis starts at time 22 Seconds
Analysis ends at time 2. minutes
199 Measurements analyzed from 40 to 238
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 0.53 feet at 22 Seconds

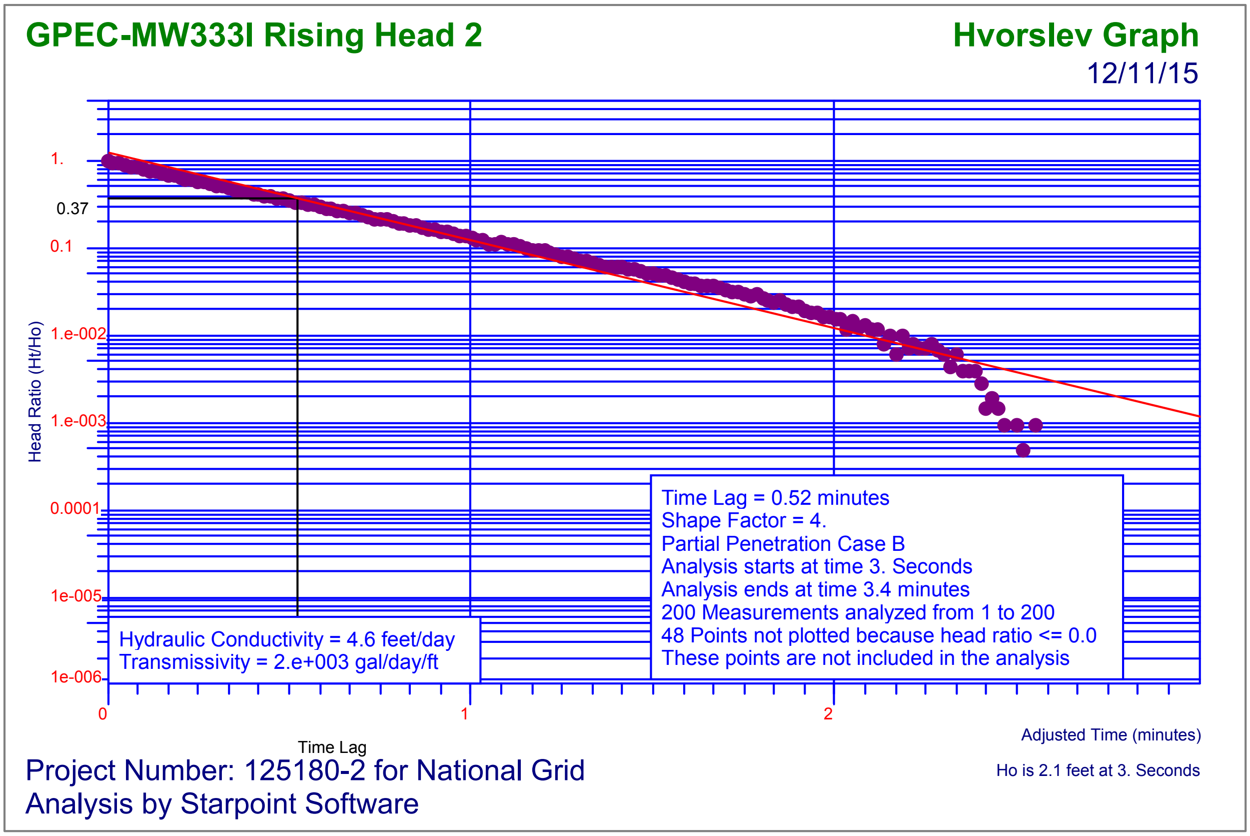


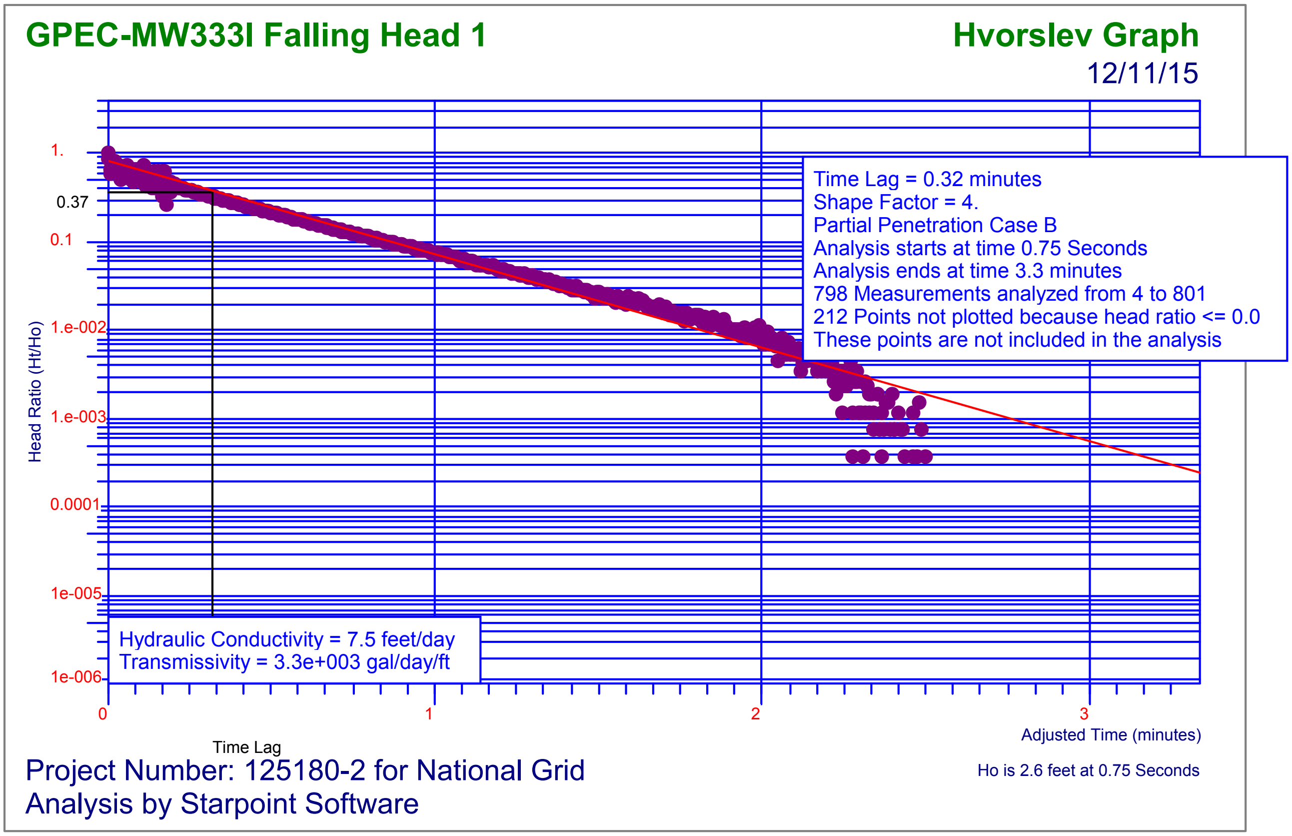
GPEC-MW222S Rising Head 2
Bouwer and Rice Graph
12/11/15
1.
0.1
1.e-002
Head Ratio (Ht/Ho)
Bouwer and Rice parameter A = 2.3
Bouwer and Rice parameter B = 0.42
ln(Re/Rw) = 2.296261e+000
Gravel Pack Porosity: = 30 %
Corrected Casing Radius: = 1.9 Inches
Analysis starts at time 20 Seconds
Analysis ends at time 2. minutes
103 Measurements analyzed from 19 to 121
Hydraulic Conductivity = 7.7 feet/day
Transmissivity = 1.2e+003 gal/day/ft
0. 10. 20. 30. 40. 50. 60. 70. 80. 90. 100. 110 120
Adjusted Time (Seconds)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 0.56 feet at 20 Seconds


GPEC-MW328I Rising Head 1
Hvorslev Graph
12/18/15
Time Lag = 1.5e+004 Seconds
Shape Factor = 5.2
Partial Penetration Case B
Analysis starts at time 5. Seconds
Analysis ends at time 1.e+003 minutes
84 Measurements analyzed from 1 to 84
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
Hydraulic Conductivity = 7.5e-003 feet/day
Transmissivity = 4.5 gal/day/ft
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Time Lag
Adjusted Time (Hours)
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 2.1 feet at 5. Seconds


GPEC-MW328I Falling Head 1
Hvorslev Graph
12/18/15
Time Lag = 1.6e+004 Seconds
Shape Factor = 5.2
Partial Penetration Case B
Analysis starts at time 0. Seconds
Analysis ends at time 9.8e+002 minutes
72 Measurements analyzed from 1 to 72
Hydraulic Conductivity = 6.9e-003 feet/day
Transmissivity = 4.1 gal/day/ft
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Time Lag
Adjusted Time (Hours)
Ho is 2.2 feet at 0. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software


GPEC-MW333I Rising Head 1
Hvorslev Graph
12/11/15
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5
Adjusted Time (minutes)
Time Lag
Hydraulic Conductivity = 2.2 feet/day
Transmissivity = 9.6e+002 gal/day/ft
Time Lag = 1.1 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 2. Seconds
Analysis ends at time 10. minutes
1193 Measurements analyzed from 1 to 1193
570 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software
Ho is 2.1 feet at 2. Seconds

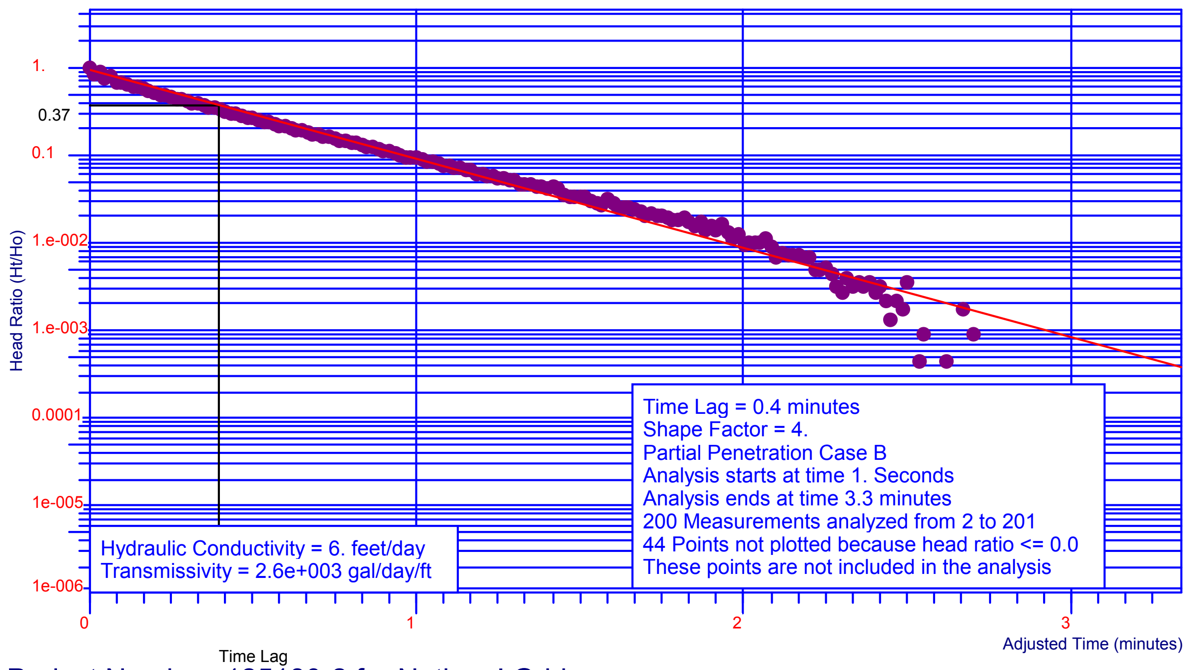

GPEC-MW333I Rising Head 2
Hvorslev Graph
12/11/15
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
Head Ratio (Ht/Ho)
0
1
2
Time Lag
Adjusted Time (minutes)
Time Lag = 0.52 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 3. Seconds
Analysis ends at time 3.4 minutes
200 Measurements analyzed from 1 to 200
48 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 4.6 feet/day
Transmissivity = 2.e+003 gal/day/ft
Ho is 2.1 feet at 3. Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software



GPEC-MW333I Falling Head 1
Hvorslev Graph
12/11/15
Time Lag = 0.32 minutes
Shape Factor = 4.
Partial Penetration Case B
Analysis starts at time 0.75 Seconds
Analysis ends at time 3.3 minutes
798 Measurements analyzed from 4 to 801
212 Points not plotted because head ratio <= 0.0
These points are not included in the analysis
Hydraulic Conductivity = 7.5 feet/day
Transmissivity = 3.3e+003 gal/day/ft
Head Ratio (Ht/Ho)
1.
0.37
0.1
1.e-002
1.e-003
0.0001
1e-005
1e-006
0
1
2
3
Time Lag
Adjusted Time (minutes)
Ho is 2.6 feet at 0.75 Seconds
Project Number: 125180-2 for National Grid
Analysis by Starpoint Software

GPEC-MW333I Falling Head 2 **Hvorslev Graph**

12/11/15



Project Number: 125180-2 for National Grid

Ho is 2.2 feet at 1. Seconds

Analysis by Starpoint Software