

PACKER TEST FLOW RATE GRAPHS

Boring MP-202

Packer Test Intervals: *(below ground surface) (below top of casing)*

MP-202 Zone 1: **41.7** feet to **49.2** feet: **42.93** feet to **50.43** feet

MP-202 Zone 2: **153.0** feet to **160.5** feet: **154.23** feet to **160.5** feet

MP-202 Zone 3: **182.0** feet to **189.5** feet: **183.23** feet to **190.73** feet

Graphs of flow rate (gpm) vs time (minutes) have been created from Excel sheets containing data from field data sheets. For clarity, individual plots for each sequence within a tested interval are presented. Generally, plots are not provided if the field data sheets indicate no flow during a test sequence. ***Bechtel Field Instruction forms are provided. AMEC field data sheets are provided following the graphs for each zone. The AMEC field data sheets use top of casing as a field measurement reference. Assigned test interval depths below ground surface were converted to depths below top of casing by adding the casing height to the assigned test interval depths.*** Transducer data file names are listed on the last field data sheet of each test interval. Transducer data files are furnished as electronic files ***in a data supplement submittal.***

BECHTEL POWER CORPORATION
Project No. 25847
Clinch River CPA Project- Site Subsurface Investigation
FIELD INSTRUCTION FORM

Specification Section: 5.3.7.2

Packer Testing in MP 202

Field Instruction: The following are the three (3) depth zones in which packer testing will be conducted in borehole MP 202:

- 41.7. 50 49.2 QD. 7-19-13 (Due to Water Level) NY 7/19/13
- Zone 1: 40.0 to 47.5 feet below land surface. (Tolerance +/- 2 feet)
- Zone 2: 153.0 to 160.5 feet below land surface. (Tolerance +/- 2 feet) } QD 7-19-13
- Zone 3: 182.0 to 189.5 feet below land surface. (Tolerance +/- 2 feet) } COMPLETED 7-18-13

The desired pressure ranges that will be tested in each of the three zones are based on the calculation of the test pressures as provided in AMEC Project Procedure CRP-3 - Packer Pressure Testing in Boreholes, Attachment B (Bechtel Power InfoWorks 25847-601-V14-CY00-00018-006) or latest revision at time of testing. The test pressures will be determined just before the commencement of the tests by measuring the water level at the start of test.

Basis/Justification for Instruction:

The depths of the above zones were selected based on fracture zones identified from DRAFT geologic core logs, RQD analysis and from the acoustic televiewer logs. The bottom depth for packer testing is limited to approximately 250 feet due to the packer test assembly and maximum transducer cable length of approximately 285 feet. The justification of the pressure ranges that will be tested will be based on AMEC Project Procedure CRP-3 - Packer Pressure Testing in Boreholes, Attachment B (Bechtel Power InfoWorks 25847-601-V14-CY00-00018-006) or latest revision at time of testing.

Prepared By:	<u>Garnett D. De</u>	<u>[Signature]</u>	<u>7/10/13</u>
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	Name	Signature	Date
Approved By:	<u>Mark Reimnitz</u>	<u>[Signature]</u>	<u>7/10/13</u>
	Name	Signature	Date
(see Section 1.2 for further instructions)			
Received By AMEC	<u>S. Criscenzo</u>	<u>[Signature]</u>	<u>7/18/13</u>
Site Mgr or Proj Mgr:	Name	Signature	Date

Packer Test Worksheet

Clinch River SMR Project
AMEC Project No. 6468 13 1072

Test Date 7/19/2013
 Prepared By J. Goddard
 Checked By *Tm*

Boring Number	MP 202
Zone No.	1
Assigned Interval Top (ft-bgs)	41.70
Assigned Interval Bottom (ft-bgs)	49.20
Center of test interval (ft-bgs)	45.45
Height of Casing (ft ags)	1.23
Depth to water (ft below TOC)	39.49
Depth to Water (Ft- bgs)	38.26
Baro Pressure (psi)	14.41
A= Depth to Water Table (ft)	39.49

B=Surface Gage Height (ft)	1.63
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C= Height of water above center of test interval (ft)	7.19
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Static Water Pressure @ center of Interval (psi)	18
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Max Test Pressure (Po) (psi)	45
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1/3 Po (psi)	15
2/3 Po (psi)	30
1/2 Po (psi)	23

	Center Test Pressures (psi)	Inflation Pressure (psi)
Sequence A 1/3	33	83
Sequence B 2/3	48	98
Sequence C 1.0	63	113
Sequence D 1/2	41	91
Sequence E 1.0	63	113

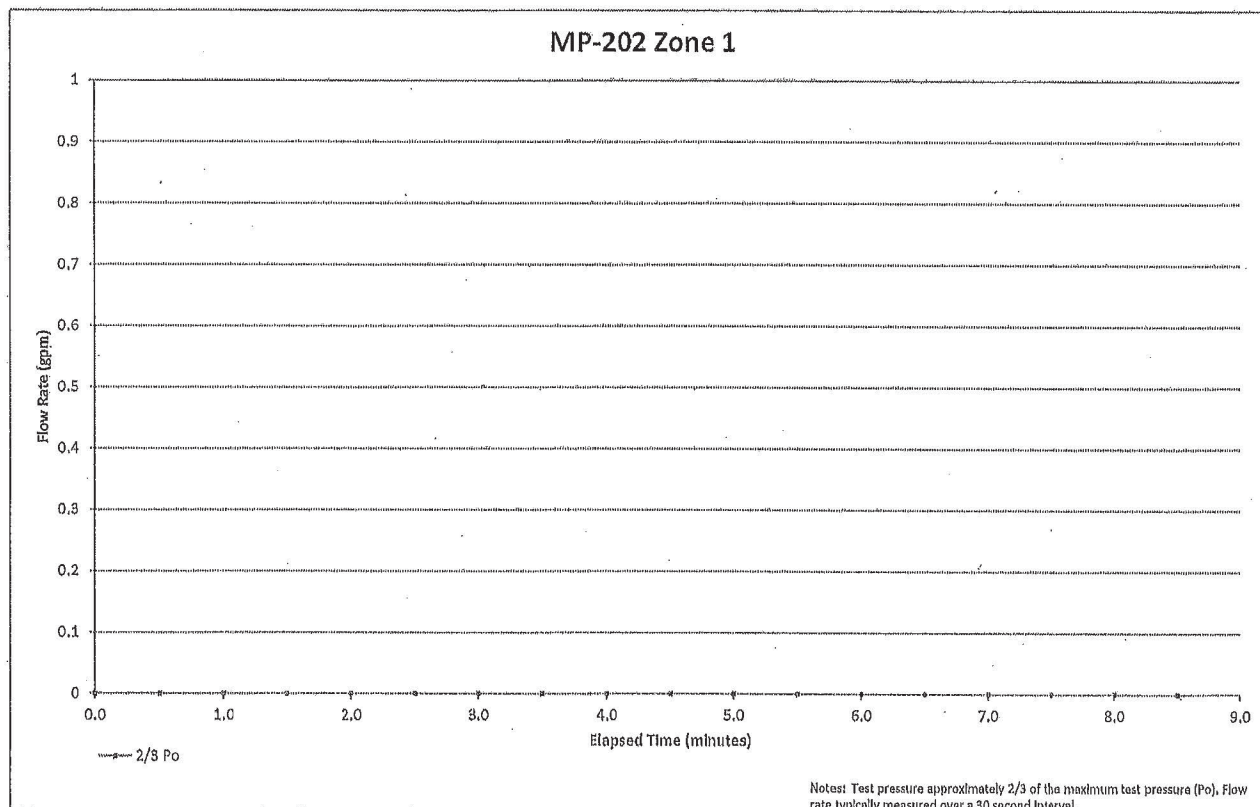
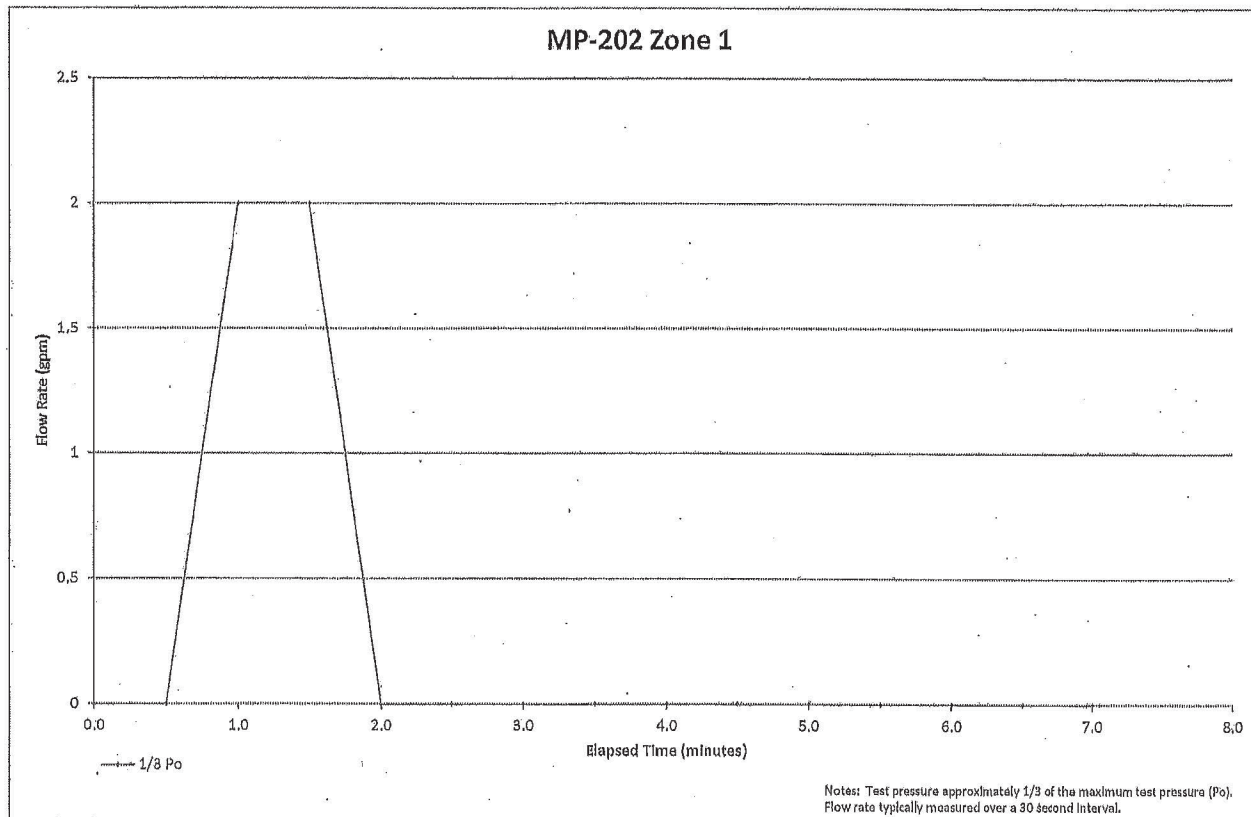
Pipe Check (Estimate Only for Field Guidance))

Length of Packer Assembly	13.29
Average Length of Pipe Section	21.12
Length of pipe to TOC	37.14
Number of Pipe Sections	1.76
length of stickup above TOC (ft)	5.10

Boring: MP-202
Zone: Z1 **41.7 feet to 49.2 feet below ground surface**
Transducer Location: Middle

Sequence A (1/3 Po)				Sequence B (2/3 Po)				Sequence C (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
9:29:00	0.0	18.92	0	9:38:30	0.0	37.66	0	9:49:00	0.0	49.27	0
9:29:30	0.5	18.91	0	9:39:00	0.5	38.07	0	9:49:30	0.5	49.12	0
9:30:00	1.0	18.90	2	9:39:30	1.0	39.07	0	9:50:00	1.0	55.00	0
9:30:30	1.5	37.07	2	9:40:00	1.5	39.14	0	9:50:30	1.5	61.00	0
9:31:00	2.0	37.68	0	9:40:30	2.0	40.32	0	9:51:00	2.0	55.33	0
9:31:30	2.5	37.77	0	9:41:00	2.5	42.72	0	9:51:30	2.5	59.44	0
9:32:00	3.0	37.88	0	9:41:30	3.0	43.11	0	9:52:00	3.0	60.46	0
9:32:30	3.5	37.94	0	9:42:00	3.5	45.54	0	9:52:30	3.5	60.09	0
9:33:00	4.0	37.89	0	9:42:30	4.0	45.48	0	9:53:00	4.0	61.03	0
9:33:30	4.5	37.86	0	9:43:00	4.5	46.92	0	9:53:30	4.5	62.23	0
9:34:00	5.0	37.88	0	9:43:30	5.0	47.31	0	9:54:00	5.0	62.27	0
9:34:30	5.5	37.85	0	9:44:00	5.5	49.15	0	9:54:30	5.5	63.84	0
9:35:00	6.0	37.84	0	9:44:30	6.0	49.21	0	9:55:00	6.0	64.07	0
9:35:30	6.5	37.80	0	9:45:00	6.5	49.20	0	9:55:30	6.5	63.81	0
9:36:00	7.0	37.79	0	9:45:30	7.0	49.37	0	9:56:00	7.0	63.99	0
				9:46:00	7.5	49.32	0	9:56:30	7.5	63.83	0
				9:46:30	8.0	49.03	0	9:57:00	8.0	63.94	0
				9:47:00	8.5	no reading	no reading				

Sequence D (1/2 Po)				Sequence E (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
9:59:00	0.0	63.71	0	10:27:00	0.0	42.55	0
9:59:30	0.5	55.00	0	10:27:30	0.5	42.55	0
10:00:00	1.0	54.76	0	10:28:00	1.0	43.20	0
10:00:30	1.5	54.82	0	10:28:30	1.5	43.31	0
10:01:00	2.0	53.33	0	10:29:00	2.0	50.87	0
10:01:30	2.5	50.59	0	10:29:30	2.5	50.96	0
10:02:00	3.0	49.22	0	10:30:00	3.0	55.83	0
10:02:30	3.5	48.06	0	10:30:30	3.5	58.97	0
10:03:00	4.0	47.96	0	10:31:00	4.0	60.33	0
10:03:30	4.5	44.06	0	10:31:30	4.5	60.41	0
10:04:00	5.0	44.05	0	10:32:00	5.0	66.24	0
10:04:30	5.5	44.03	0	10:32:30	5.5	66.58	0
10:05:00	6.0	44.12	0	10:33:00	6.0	68.54	0
10:05:30	6.5	44.01	0	10:33:30	6.5	64.22	0
10:06:00	7.0	43.99	0	10:34:00	7.0	64.21	0
10:06:30	7.5	43.97	0	10:34:30	7.5	64.13	0
10:07:00	8.0	43.93	0	10:35:00	8.0	64.07	0
				10:35:30	8.5	64.08	0



Prepared by/Date: KAL 1/4/14
 Checked by/Date: gcs 1/2/14

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 8468-13-1072

DATE: 7-19-13

Boring No. MP-202

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202Z1

Test length: 7.5

Test Section Depth (from Datum): From 41.23 To 48.73

Test Water Temp: 85°F Baro Pressure, psi: 14.41

(A) Depth to Water Table From Datum, Ft. 39.28

Down Hole Temp: 156.5°C (60.17)

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 45.45

(C) Distance Water Table to Center of Test Interval Ft. 10.94

Static water pressure at center = (C*62.4/144) + Baro = 18

MAXIMUM TEST PRESSURE, Po = [(A+B*1) + C*0.57] [Po = 45] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Po Values: 1/3 Po = 15; 2/3 Po = 30; 1/2 Po = 23 Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202Z1 Sequence No. A Planned Center Pressure: 33

Transducer Readings Before Packers Inflated: Top 14.37; Middle 16.95; Bottom: 20.77

Transducer Readings After Packers Inflated: Top 14.81; Middle 19.01; Bottom: 20.84

MP-202 Z1 SEQUENCE A

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
09:28:00	No READINGS					0	BEGIN INCREASE FLOW
09:29:00	18635	----	----	----	18.92	0	
09:29:30	18635	18635	0	0	18.91	0	7-19-13
09:30:00	18636	18636	1	2	18.90	0	
09:30:30	18636	18637	1	2	37.07	10	
09:31:00	18637	18637	0	0	37.68	10	
09:31:30	18637	18637	0	0	37.77	10	DECREASE FLOW
09:32:00	18637	18637	0	0	37.88	10	DECREASE FLOW
09:32:30	18637	18637	0	0	37.94	10	
09:33:00	18637	18637	0	0	37.89	10	DECREASE FLOW
09:33:30	18637	18637	0	0	37.86	10	
09:34:00	18637	18637	0	0	37.88	10	
09:34:30	18637	18637	0	0	37.85	10	
09:35:00	18637	18637	0	0	37.84	10	
09:35:30	18637	18637	0	0	37.80	10	
09:36:00	18637	18637	0	0	37.79	10	END
09:36:45							
09:37:15							

*From Preliminary Boring Layout Survey

** LOWERED INTERVAL 1.7' DUE TO WATER LEVEL (BGS 41.7 TO 50.2 FT) 7-19-13

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SR 12/13/17

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 0468-13-1072

DATE: 7-19-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202Z1

Test length: 7.5

Test Section Depth (from Datum): From 41.23 To 48.73

98. 7-19-13

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85 °F

Baro Pressure, psi: 14.41

98. 7-18-13

(B) Surface Gage Height Above Datum, Ft. 1.63

Down Hole

Depth to Center of Test Interval From Datum, Ft. 45.45

7-19-13

(C) Distance Water Table to Center of Test interval Ft. 10.94

Static water pressure at center = $(C \cdot 62.4/144) + \text{Baro} = 18$

MAXIMUM TEST PRESSURE, $P_o = [(A+B \cdot 1)] + C \cdot 0.67$ [$P_o = 45$] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 $P_o = 15$; 2/3 $P_o = 30$; 1/2 $P_o = 23$ Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202Z1 Sequence No. B Planned Center Pressure: 48

Transducer Readings Before Packers Inflated: Top 14.37; Middle 16.95; Bottom: 20.77

Transducer Readings After Packers Inflated: Top 14.81; Middle 19.01; Bottom: 20.84

MP-202 Z1 SEQUENCE B

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
09:38:30	18637	---	---	---	37.66	10	BEGIN INCREASE FLOW
09:39:00	18637	18637	0	0	38.07	10	INCREASE FLOW
09:39:30	18637	18637	0	0	39.07	12	
09:40:00	18637	18637	0	0	39.14	12	INCREASE FLOW
09:40:30	18637	18637	0	0	40.32	15	
09:41:00	18637	18637	0	0	42.72	15	INCREASE FLOW
09:41:30	18637	18637	0	0	43.11	17	
09:42:00	18637	18637	0	0	45.54	17	INCREASE FLOW
09:42:30	18637	18637	0	0	45.48	19	
09:43:00	18637	18637	0	0	46.92	19	INCREASE FLOW
09:43:30	18637	18637	0	0	47.31	20	
09:44:00	18637	18637	0	0	49.15	20	
09:44:30	18637	18637	0	0	49.21	20	
09:45:00	18637	18637	0	0	49.20	20	
09:45:30	18637	18637	0	0	49.37	20	
09:46:00	18637	18637	0	0	49.32	20	
09:46:30	18637	18637	0	0	49.03	20	END
09:47:00	No Reading			09:47:10	BOTTOM TRANS	20.81	

*** From Preliminary Boring Layout Survey
 ** Lowered Interval 1.7' DUE TO WATER LEVEL (BGS 41.7 TO 50.2 FT)
 Hy 7-19-13

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SP2 12/13/12

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-19-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft: 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202Z1

Test length: 7.5

Test Section Depth (from Datum): From 41.23 To 48.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.41

(B) Surface Gage Height Above Datum, Ft. 1.63

Down Hole Temp: 156.5°C (323.9°F)

Depth to Center of Test Interval From Datum, Ft.: 45.45

(C) Distance Water Table to Center of Test Interval Ft. 14.94

Static water pressure at center = (C*62.4/144) + Baro = 10

MAXIMUM TEST PRESSURE, Po = ((A+B*1) + C*0.57) [Po = 45] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Po Values: 1/3 Po = 15; 2/3 Po = 30; 1/2 Po = 23 Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202Z1 Sequence No. C Planned Center Pressure: 63

Transducer Readings Before Packers Inflated: Top 14.37; Middle 16.95; Bottom: 20.77

Transducer Readings After Packers Inflated: Top 14.81; Middle 19.01; Bottom: 20.84

MP-202 Z1 SEQUENCE C

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
09:49:00	18 637	---	---	---	49.27	20	BEGIN INCREASE FLOW
09:49:30	18 637	18 637	0	0	49.12	20	
09:50:00	18 637	18 637	0	0	55.61	25	
09:50:30	18 637	18 637	0	0	55.33	25	INCREASE FLOW
09:51:00	18 637	18 637	0	0	59.44	30	
09:51:30	18 637	18 637	0	0	60.46	30	
09:52:00	18 637	18 637	0	0	60.09	30	INCREASE FLOW
09:52:30	18 637	18 637	0	0	61.03	32	
09:53:00	18 637	18 637	0	0	62.23	32	
09:53:30	18 637	18 637	0	0	62.27	32	INCREASE FLOW
09:54:00	18 637	18 637	0	0	63.84	33	
09:54:30	18 637	18 637	0	0	64.07	33	
09:55:00	18 637	18 637	0	0	63.81	33	
09:55:30	18 637	18 637	0	0	63.99	33	
09:56:00	18 637	18 637	0	0	63.83	33	
09:56:30	18 637	18 637	0	0	63.94	33	END
09:57:00	NO READING			09:57:04	BOTTOM	TRANS = 20.81	
				09:57:34	TOP	TRANS = 14.85	

*From Preliminary Boring Layout Survey
** LOWERED INTERVAL 1.7' DUE TO WATER LEVEL (BGS 41.7 TO 50.2 FT)
By 7-19-13

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SJL 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 8468-13-1072

DATE: 7-19-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202Z1

Test length: 7.5

Test Section Depth (from Datum): From 41.23 To 48.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.41

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 45.45

(C) Distance Water Table to Center of Test Interval Ft. 1.17

Static water pressure at center = (C*62.4/144) + Baro = 18

MAXIMUM TEST PRESSURE, Po = [(A+B*1) + C*0.57] [Po = 45] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Po Values: 1/3 Po = 15; 2/3 Po = 30; 1/2 Po = 23 Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202Z1 Sequence No. D Planned Center Pressure: 41

Transducer Readings Before Packers Inflated: Top 14.37 Middle 16.95 Bottom: 20.77

Transducer Readings After Packers Inflated: Top 14.81 Middle 19.01 Bottom: 20.84

MP-202 Z1 SEQUENCE D

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
09:59:00	18 638	---	---	---	63.71	33	Begin
09:59:30	18 638	18 638	0	0	55.40	22	DECREASE FLOW
10:00:00	18 638	18 638	0	0	54.70	22	
10:00:30	18 638	18 638	0	0	54.82	22	DECREASE FLOW
10:01:00	18 638	18 638	0	0	53.33	17	
10:01:30	18 638	18 638	0	0	50.59	17	
10:02:00	18 638	18 638	0	0	49.22	14	
10:02:30	18 638	18 638	0	0	48.06	14	
10:03:00	18 638	18 638	0	0	47.96	14	
10:03:30	18 638	18 638	0	0	44.06	10	
10:04:00	18 638	18 638	0	0	44.05	10	
10:04:30	18 638	18 638	0	0	44.03	10	SHUT VALVE
10:05:00	18 638	18 638	0	0	44.12	10	DECREASE FLOW
10:05:30	18 638	18 638	0	0	44.01	10	
10:06:00	18 638	18 638	0	0	43.99	10	
10:06:30	18 638	18 638	0	0	43.97	10	
10:07:00	18 638	18 638	0	0	43.93	10	END
				10:07:36	BOTTOM TRANS = 20.81		
				10:08:10	TOP TRANS = 14.86		

*From Preliminary Boring Layout Survey
 ** LOWERED INTERVAL 1.7' DUE TO WATER LEVEL (BGS 41.7 TO 50.2 FT)
 Hy 7-19-13

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by 52 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-19-13

Boring No. MP-202 Borehole Diameter, in.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202Z1

Test length: 7.5

Test Section Depth (from Datum): From 41.23 To 48.73

98. 7-19-13

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85 °F Baro Pressure, psi: 14.41

98. 7-18-13

(B) Surface Gage Height Above Datum, Ft. 1.63

Down Hole Depth to Center of Test Interval From Datum, Ft. 45.45

7-19-13

(C) Distance Water Table to Center of Test Interval Ft. 44.94

Static water pressure at center = (C*62.4/144) + Baro = 10

MAXIMUM TEST PRESSURE, Po = ((A+B*1) + C*0.57) [Po = 45] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Po Values: 1/3 Po = 15; 2/3 Po = 30; 1/2 Po = 23 Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202Z1 Sequence No. E Planned Center Pressure: 63

Transducer Readings Before Packers Inflated: Top 14.37; Middle 16.95; Bottom: 20.77

Transducer Readings After Packers Inflated: Top 14.81; Middle 19.01; Bottom: 20.84

MP-202 Z1 SEQUENCE E

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
10: 27:00	18638	----	----	----	42.55	10	BEGIN INCREASE FLOW
10: 27:30	18638	18638	0	0	42.55	10	
10: 28:00	18638	18638	0	0	43.20	10	INCREASE FLOW
10: 28:30	18638	18638	0	0	43.31	20	
10: 29:00	18638	18638	0	0	50.87	20	INCREASE FLOW
10: 29:30	18638	18638	0	0	50.96	25	
10: 30:00	18638	18638	0	0	55.83	25	INCREASE FLOW
10: 30:30	18638	18638	0	0	58.97	30	
10: 31:00	18638	18638	0	0	60.33	30	INCREASE FLOW
10: 31:30	18638	18638	0	0	60.41	35	
10: 32:00	18638	18638	0	0	66.24	35	
10: 32:30	18638	18638	0	0	66.58	35	DECREASE FLOW
10: 33:00	18638	18638	0	0	68.54	40	
10: 33:30	18638	18638	0	0	64.22	32	
10: 34:00	18638	18638	0	0	64.21	32	
10: 34:30	18638	18638	0	0	64.13	32	
10: 35:00	18638	18638	0	0	64.07	32	
10: 35:30	18638	18638	0	0	64.08	32	END

** From Preliminary Boring Layout Survey

LOWERED INTERVAL 1.7' DUE TO WATER LEVEL (BGS 41.7 TO 50.2 FT)

Hy 7-19-13

10: 36:10 BOTTOM TRANS = 20.83

10: 36:41 TOP TRANS = 14.86

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SR 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

Page 2

BORING: MP-202 Z1

DATE: 7-19-13

DATA COLLECTED BY: Tom McGill / Jim Goddard

SHUT-IN TEST PRESSURE: N/A psi

This sheet applies
to all Zme 1 Tests
SR 12/13/13

TIME, minute	SURFACE GAGE PRESSURE, psi	CENTER TRANSDUCER PRESSURE, psi
	<u>Not Used</u>	

SR 7-19-13

EQUIPMENT USED

Transducers: Mini Trol Serial Numbers: 335896 (6-12-13) 315381 (6-20-13)
241486 (6-19-13) 142142 (6-20-13)

Surface Pressure Gage: MW-4 & MW-5 BACK FLOW MW-3 (6-11-13)
NITROGEN MW-1 & MW-2 (6-11-13)

Barometric Probe: 241486 (121315 (6-12-13)) THERMOMETER: LT28 (5-1-13)
SR 7-19-13

Flow Meter: 8824788

Stop Watch: L286 (6-10-13)

Date of Calibration: IN PARENTHESES

Calibration due: POST TESTING

MP-202	Z1	(B)	2013-07-19	10.44.40	WISL
MP-202	Z1	(B)	2013-07-19	10.44.40	EXCEL
MP-202	Z1	(T)	2013-07-19	10.38.36	WISL
MP-202	Z1	(T)	2013-07-19	10.38.36	EXCEL
MP-202	Z1	(M)	2013-07-19	10.40.27	WISL
MP-202	Z1	(M)	2013-07-19	10.40.27	EXCEL
MP-202	Z1	(L)	2013-07-19	10.43.03	WISL
MP-202	Z1	(L)	2013-07-19	10.43.03	EXCEL

VERY LITTLE DROP IN TEST WATER TANK QUANTITY

Packer Test Worksheet

Clinch River SMR Project
AMEC Project No. 6468 13 1072

Test Date 7/18/2013
 Prepared By J. Goddard
 Checked By TM

Boring Number	MP 202
Zone No.	2
Assigned Interval Top (ft-bgs)	153.00
Assigned Interval Bottom (ft-bgs)	160.50
Center of test interval (ft-bgs)	156.75
Height of Casing (ft ags)	1.23
Depth to water (ft below TOC)	39.28
Depth to Water (Ft- bgs)	38.05
Baro Pressure (psi)	14.44
A= Depth to Water Table (ft)	39.28

B=Surface Gage Height (ft)	1.63
----------------------------	------

C= Height of water above center of test interval (ft)	118.70'
---	---------

Static Water Pressure @ center of Interval (psi)	66
--	----

Max Test Pressure (Po) (psi)	109
------------------------------	-----

1/3 Po (psi)	36
2/3 Po (psi)	73
1/2 Po (psi)	55

	Center Test Pressures (psi)	Inflation Pressure (psi)
Sequence A 1/3	102	152
Sequence B 2/3	139	189
Sequence C 1.0	175	225
Sequence D 1/2	121	171
Sequence E 1.0	175	225

Pipe Check (Estimate Only for Field Guidance))

Length of Packer Assembly	13.29
Average Length of Pipe Section	21.12
Length of pipe to TOC	148.44
Number of Pipe Sections	7.03
length of stickup above TOC (ft)	20.52

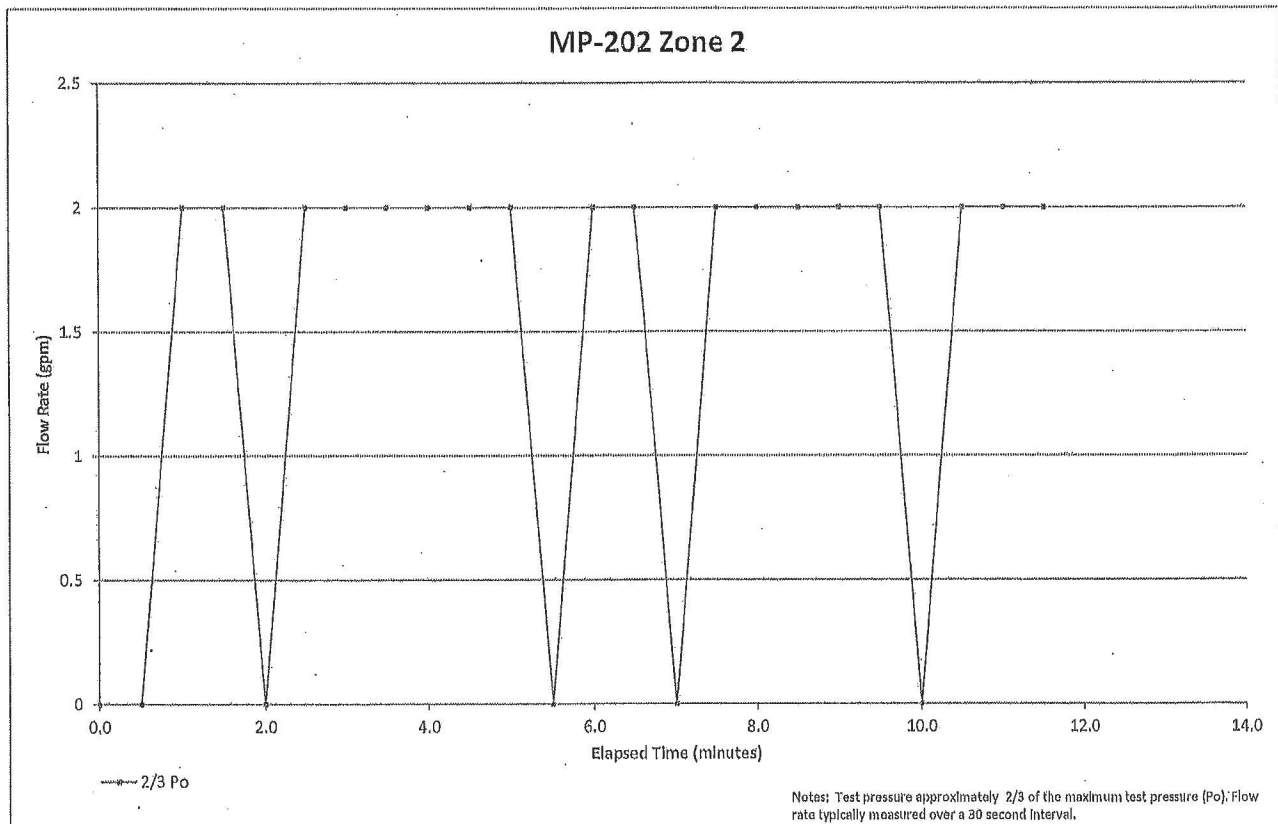
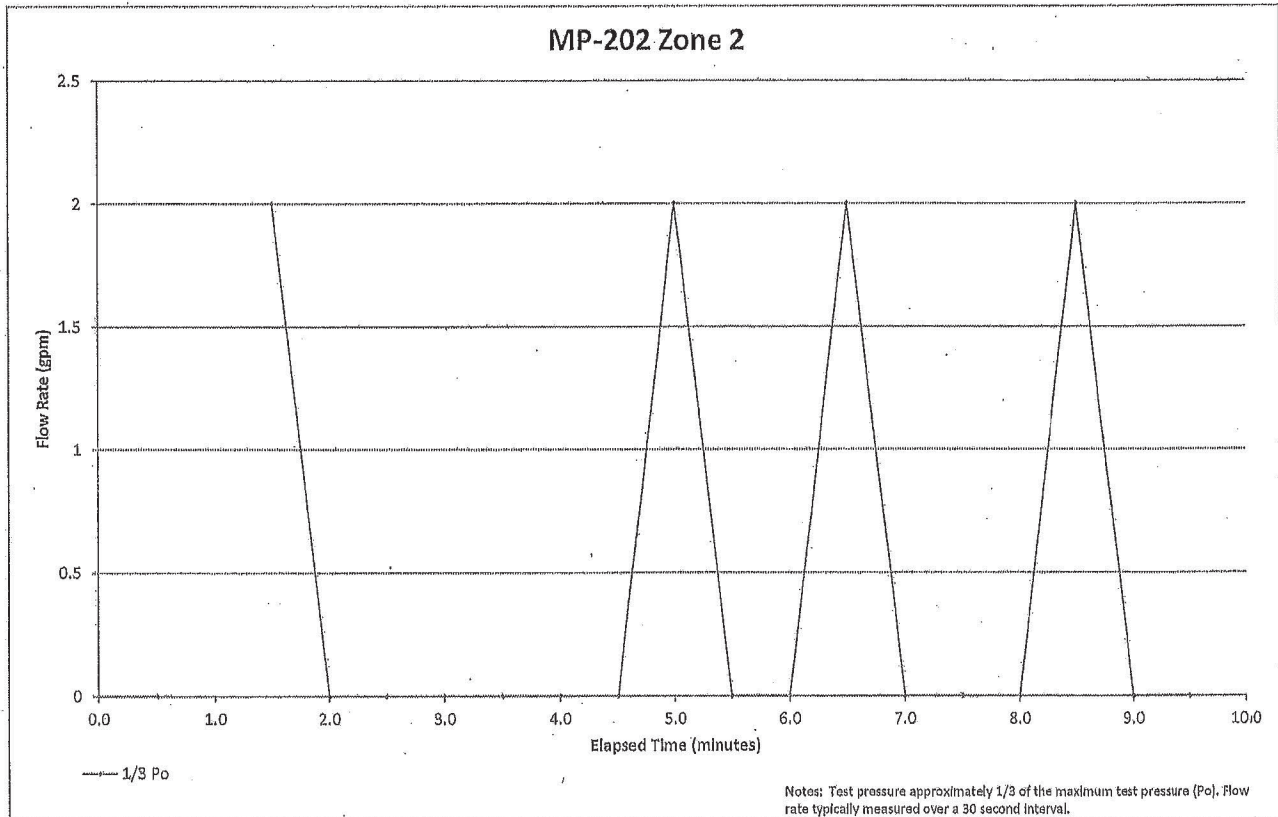
Boring: MP-202

Zone: 2 **153.0 feet to 160.5 feet below ground surface**

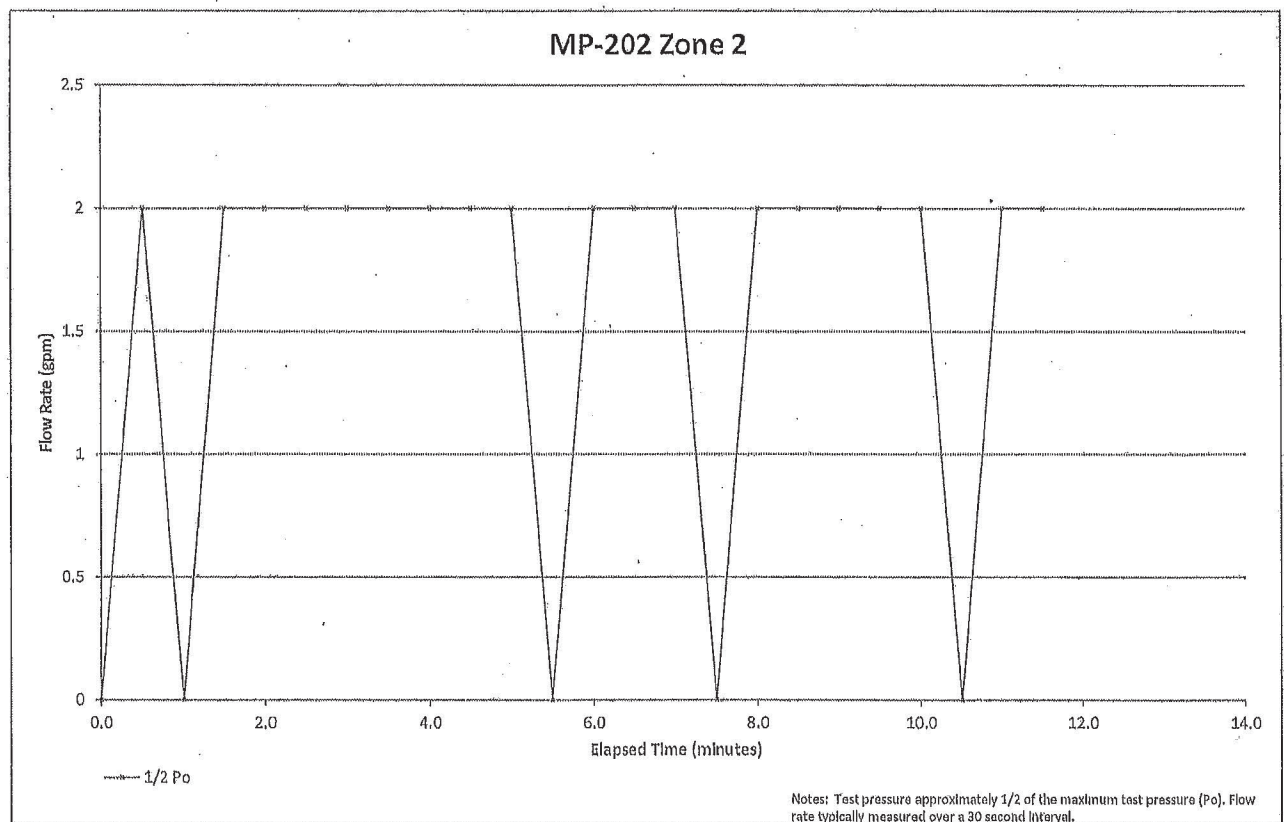
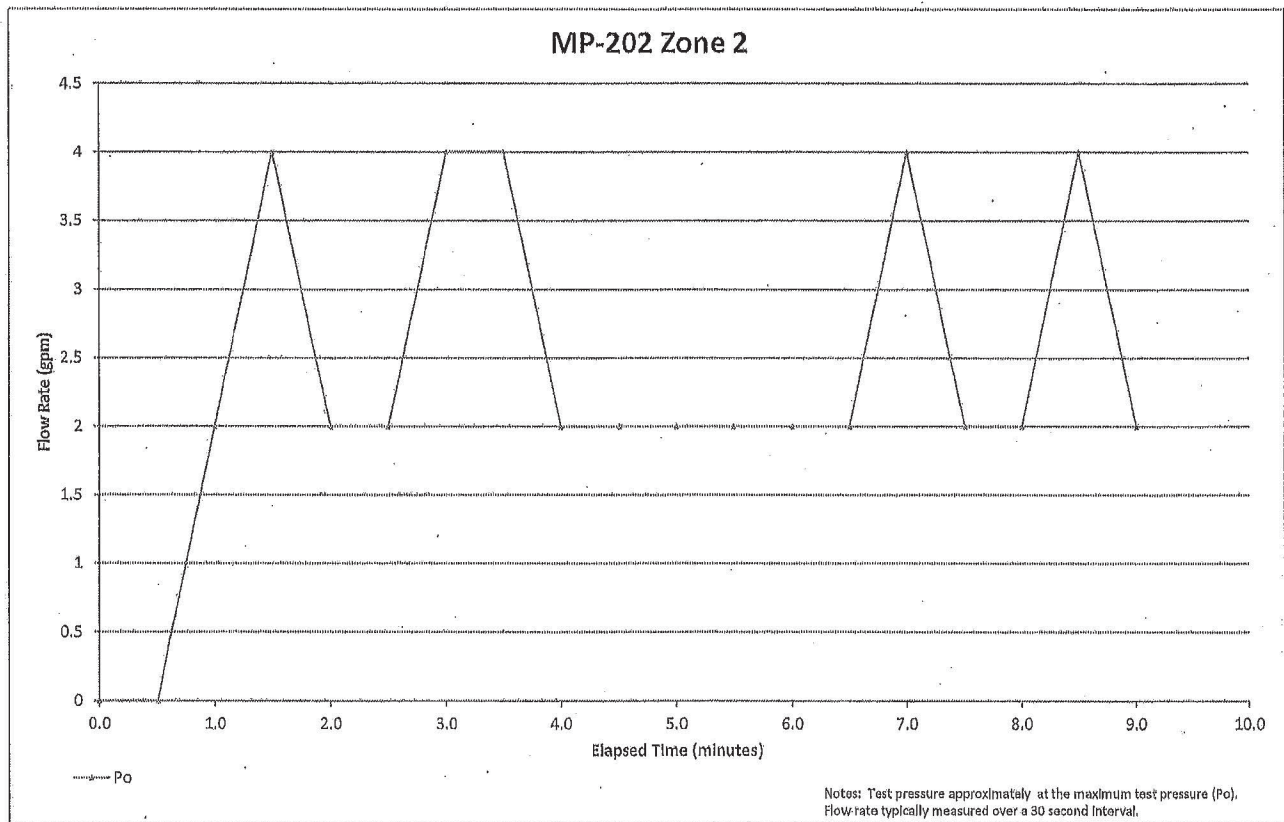
Transducer Location: Middle

Sequence A (1/3 Po)				Sequence B (2/3 Po)				Sequence C (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
14:46:30	0.0	65.17	0	14:59:00	0.0	103.39	0	15:13:30	0.0	140.59	0
14:47:00	0.5	69.70	0	14:59:30	0.5	110.49	0	15:14:00	0.5	140.65	0
14:47:30	1.0	no reading		15:00:00	1.0	113.96	2	15:14:30	1.0	151.86	2
14:48:00	1.5	78.26	2	15:00:30	1.5	114.40	2	15:15:00	1.5	160.92	4
14:48:30	2.0	91.32	0	15:01:00	2.0	131.25	0	15:15:30	2.0	161.51	2
14:49:00	2.5	91.80	0	15:01:30	2.5	131.31	2	15:16:00	2.5	174.03	2
14:49:30	3.0	91.83	0	15:02:00	3.0	134.77	2	15:16:30	3.0	173.38	4
14:50:00	3.5	92.38	0	15:02:30	3.5	136.01	2	15:17:00	3.5	173.25	4
14:50:30	4.0	94.81	0	15:03:00	4.0	135.95	2	15:17:30	4.0	172.75	2
14:51:00	4.5	98.61	0	15:03:30	4.5	136.08	2	15:18:00	4.5	174.52	2
14:51:30	5.0	100.48	2	15:04:00	5.0	136.61	2	15:18:30	5.0	175.23	2
14:52:00	5.5	100.57	0	15:04:30	5.5	136.62	0	15:19:00	5.5	174.55	2
14:52:30	6.0	101.18	0	15:05:00	6.0	136.21	2	15:19:30	6.0	174.84	2
14:53:00	6.5	103.16	2	15:05:30	6.5	136.36	2	15:20:01	6.5	175.75	2
14:53:30	7.0	103.36	0	15:06:00	7.0	139.35	0	15:20:30	7.0	174.05	4
14:54:00	7.5	103.38	0	15:06:30	7.5	137.52	2	15:21:00	7.5	174.86	2
14:54:30	8.0	103.48	0	15:07:00	8.0	137.33	2	15:21:30	8.0	174.91	2
14:55:00	8.5	103.36	2	15:07:30	8.5	137.10	2	15:22:01	8.5	174.62	4
14:55:30	9.0	103.33	0	15:08:00	9.0	140.11	2	15:22:30	9.0	175.34	2
14:56:00	9.5	103.39	0	15:08:30	9.5	140.53	2				
				15:09:00	10.0	140.61	0				
				15:09:30	10.5	140.58	2				
				15:10:00	11.0	140.70	2				
				15:10:30	11.5	140.82	2				

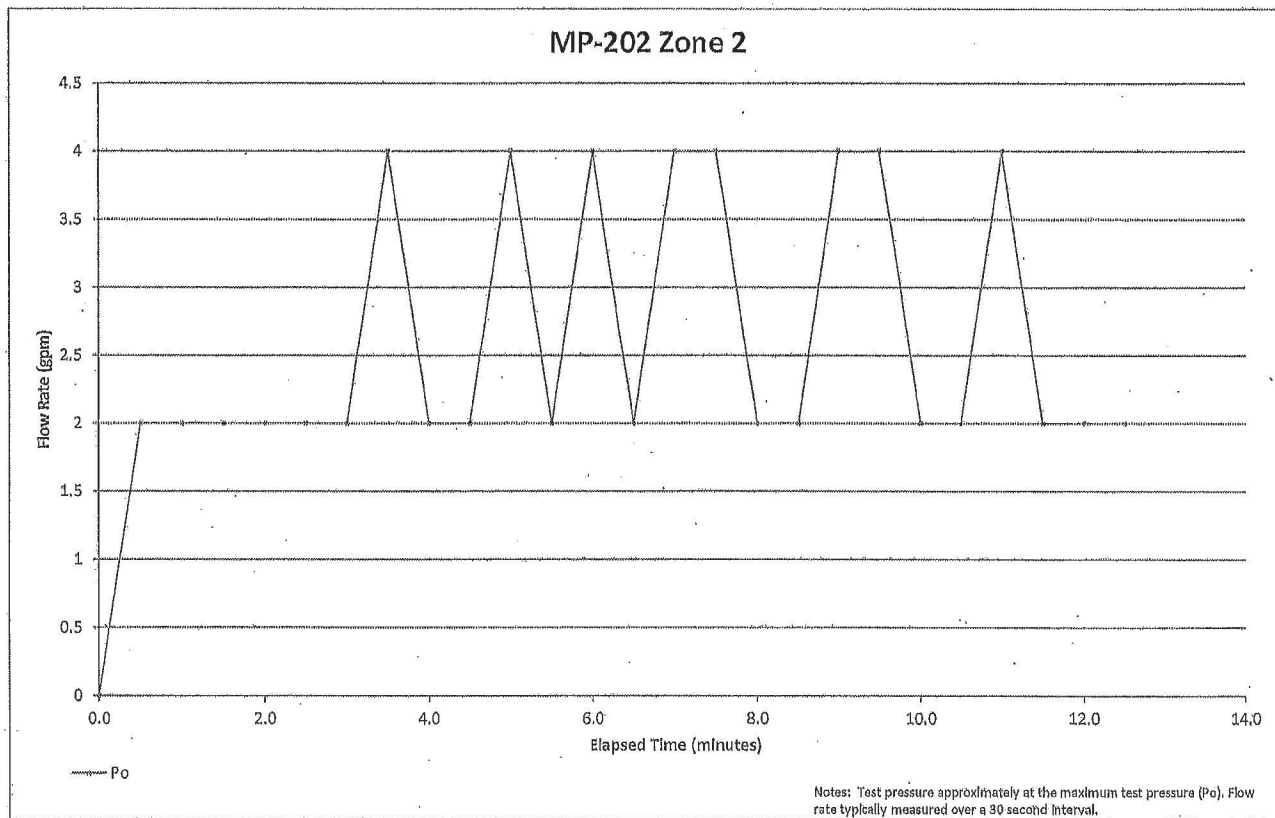
Sequence D (1/2 Po)				Sequence E (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
15:25:30	0.0	176.00	0	15:40:00	0.0	122.56	0
15:26:00	0.5	174.51	2	15:40:30	0.5	122.45	2
15:26:30	1.0	158.48	0	15:41:00	1.0	133.04	2
15:27:00	1.5	158.96	2	15:41:30	1.5	141.87	2
15:27:30	2.0	144.58	2	15:42:00	2.0	143.01	2
15:28:00	2.5	144.59	2	15:42:30	2.5	147.72	2
15:28:30	3.0	134.63	2	15:43:00	3.0	153.91	2
15:29:00	3.5	134.95	2	15:43:30	3.5	163.00	4
15:29:30	4.0	133.87	2	15:44:00	4.0	164.66	2
15:30:00	4.5	128.69	2	15:44:30	4.5	173.71	2
15:30:30	5.0	128.66	2	15:45:00	5.0	173.57	4
15:31:00	5.5	124.78	0	15:45:30	5.5	174.34	2
15:31:30	6.0	124.11	2	15:46:00	6.0	177.28	4
15:32:00	6.5	123.64	2	15:46:30	6.5	176.28	2
15:32:30	7.0	123.62	2	15:47:00	7.0	178.59	4
15:33:00	7.5	123.72	0	15:47:30	7.5	177.85	4
15:33:30	8.0	122.22	2	15:48:00	8.0	177.71	2
15:34:00	8.5	122.31	2	15:48:30	8.5	173.02	2
15:34:30	9.0	121.97	2	15:49:00	9.0	174.94	4
15:35:00	9.5	122.46	2	15:49:30	9.5	174.07	4
15:35:30	10.0	122.01	2	15:50:00	10.0	173.86	2
15:36:00	10.5	121.96	0	15:50:30	10.5	174.47	2
15:36:30	11.0	121.87	2	15:51:00	11.0	173.53	4
15:37:00	11.5	122.33	2	15:51:30	11.5	174.01	2
				15:52:00	12.0	173.64	2
				15:52:30	12.5	171.98	2



Prepared by/Date: ICR 1/4/14
 Checked by/Date: 90.3 1/12/14



Prepared by/Date: KAL 1/4/14
 Checked by/Date: JOS 1/2/14



Prepared by/Date: rcr 1/4/14
Checked by/Date: gcr 1/2/14

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z 2 Test length: 7.5 Test Section Depth (from Datum): From 154.23 To 161.73

(A) Depth to Water Table From Datum, Ft. 39.23

Test Water Temp: 85°F Baro Pressure, psi: 14.44

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 157.98 156.98 92. 7-18-13

(C) Distance Water Table to Center of Test Interval Ft. 118.70 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} =$ 66

MAXIMUM TEST PRESSURE, $P_o = ([A+B \cdot 1] + C \cdot 0.57)$ $[P_o = 109]$ Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

P_o Values: 1/3 $P_o =$ 36; 2/3 $P_o =$ 73; 1/2 $P_o =$ 55 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z 2 Sequence No. A Planned Center Pressure: 102

Transducer Readings Before Packers Inflated: Top 19.12; Middle 65.07; Bottom: 68.89

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z 2 SEQUENCE A

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
14: 44:30	18509	---	---	---	65.17	0	BEGIN INCREASE FLOW
14: 47:00	18509	18 509	0	0	69.70	0	
14: 48:00	No	READING					
14: 48:30	18509	18 510	1	2	78.26	16	
14: 48:30	18510	18 510	0	0	91.32	16	
14: 49:00	18510	18 510	0	0	91.80	16	
14: 49:30	18510	18 510	0	0	91.83	16	INCREASE FLOW
14: 50:00	18 510	18 510	0	0	92.38	20	
14: 50:30	18510	18 510	0	0	94.81	20	INCREASE FLOW
14: 51:00	18510	18 510	0	0	98.61	25	
14: 51:30	18510	18 511	1	2	100.48	25	
14: 52:00	18511	18 511	0	0	100.57	25	INCREASE FLOW
14: 52:30	18511	18 511	0	0	101.18	26	
14: 53:00	18511	18 512	1	2	103.16	26	
14: 53:30	18512	18 512	0	0	103.36	26	
14: 54:00	18512	18 512	0	0	103.38	26	
14: 54:30	18512	18 512	0	0	103.48	26	
14: 55:00	18512	18 513	1	2	103.36	26	

*From Preliminary Boring Layout Survey

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Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7 *

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z 2

Test length: 7.5

Test Section Depth (from Datum): From 154.23 To 161.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.44

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 157.98

811.7 - 13

(C) Distance Water Table to Center of Test Interval Ft. 118.70

Static water pressure at center = (C*62.4/144) + Baro = 66

MAXIMUM TEST PRESSURE, Po = ((A+B*1) + C*0.57) [Po = 109] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Sequence ID: A B C D E

Po Values: 1/3 Po = 36; 2/3 Po = 73; 1/2 Po = 55 Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202 Z 2 Sequence No. B Planned Center Pressure: 139

Transducer Readings Before Packers Inflated: Top 19.12; Middle 65.07; Bottom: 68.89

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z 2 SEQUENCE B

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
14:59:00	18515	----	----	----	103.39	26	BEGIN INCREASE FLOW
14:59:30	18515	18515	0	0	110.49	36	
15:00:00	18515	18516	1	2	113.96	35	INCREASE FLOW
15:00:30	18516	18517	1	2	114.40	51	
15:01:00	18517	18517	0	0	131.25	51	
15:01:30	18517	18518	1	2	131.31	51	INCREASE FLOW
15:02:00	18518	18519	1	2	134.77	57	
15:02:30	18519	18520	1	2	136.01	57	
15:03:00	18520	18521	1	2	135.95	57	
15:03:30	18521	18522	1	2	136.08	57	
15:04:00	18522	18523	1	2	136.61	57	
15:04:30	18523	18523	0	0	136.62	57	
15:05:00	18523	18524	1	2	136.21	57	INCREASE FLOW
15:05:30	18524	18525	1	2	136.36	57	
15:06:00	18525	18525	0	0	139.35	59	
15:06:30	18525	18526	1	2	137.52	59	
15:07:00	18526	18527	1	2	137.33	59	INCREASE FLOW
15:07:30	18527	18528	1	2	137.10	59	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by 512 12/13/13

Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7 *

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 8468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z 2 Test length: 7.5 Test Section Depth (from Datum): From 154.23 To 161.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.44

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 157.98

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(C) Distance Water Table to Center of Test Interval Ft. 118.70 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} =$ 66

MAXIMUM TEST PRESSURE, $P_o = [(A+B \cdot 1) + C \cdot 0.57]$ [$P_o =$ 109] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

P_o Values: 1/3 $P_o =$ 36; 2/3 $P_o =$ 73; 1/2 $P_o =$ 55 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z 2 Sequence No. C Planned Center Pressure: 175

Transducer Readings Before Packers Inflated: Top 19.12; Middle 65.07; Bottom: 68.89

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z 2 SEQUENCE C

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
15:13:30	18538	----	----	----	140.59	61	BEGIN INCREASE FLOW
15:14:00	18538	18538	0	0	140.65	71	
15:14:30	18538	18539	1	2	151.86	70	INCREASE FLOW
15:15:00	18539	18541	2	4	160.92	80	
15:15:30	18541	18542	1	2	161.51	80	INCREASE FLOW
15:16:00	18542	18543	1	2	174.03	91	
15:16:30	18543	18545	2	4	173.38	91	
15:17:00	18545	18547	2	4	173.25	91	
15:17:30	18547	18548	1	2	172.75	94	
15:18:00	18548	18549	1	2	174.52	94	
15:18:30	18549	18550	1	2	175.23	94	
15:19:00	18550	18551	1	2	174.55	94	
15:19:30	18551	18552	1	2	174.84	94	
15:20:00	18552	18553	1	2	175.75	94	
15:20:30	18553	18555	2	4	174.05	94	
15:21:00	18555	18556	1	2	174.86	94	
15:21:30	18556	18557	1	2	174.91	94	
15:22:00	18557	18559	2	4	174.62	94	

*From Preliminary Boring Layout Survey

Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7 *

Test Section Depth (from Datum): From 154.23 To 161.73

Depth to Center of Test Interval From Datum, Ft: 106.98

Po Values: $1/3 P_o = 36$; $2/3 P_o = 73$; $1/2 P_o = 55$ Sequence ID: A B C D E
Add Appropriate Po value to static pressure at center of test interval

Transducer Readings After Packers Inflated: Top: 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z 2 SEQUENCE C (CONT'D)

[illegible]

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by 52 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 0468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z 2 Test length: 7.5 Test Section Depth (from Datum): From 154.23 To 161.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.44

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 157.98

(C) Distance Water Table to Center of Test Interval Ft. 118.70 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} =$ 66

MAXIMUM TEST PRESSURE, $P_o = ([A+B \cdot 1] + C \cdot 0.57)$ [$P_o =$ 109] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 $P_o =$ 36; 2/3 $P_o =$ 73; 1/2 $P_o =$ 55 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z 2 Sequence No. D Planned Center Pressure: 121

Transducer Readings Before Packers Inflated: Top 19.12; Middle 65.07; Bottom: 68.89

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z 2 SEQUENCE D

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
151 25:30	18569	----	----	----	176.04	94	BEG DECREASE FLOW
151 26:00	18569	570	1	2	174.51	75	
151 26:30	18570	570	0	0	158.48	76	
151 27:00	18570	571	1	2	158.96	76	DECREASE FLOW
151 27:30	18571	572	1	2	144.58	61	
151 28:00	18572	573	1	2	144.59	61	DECREASE FLOW
151 28:30	18573	574	1	2	134.63	51	
151 29:00	18574	575	1	2	134.95	51	DECREASE FLOW
151 29:30	18575	576	1	2	133.87	45	
151 30:00	18576	577	1	2	128.69	45	DECREASE FLOW
151 30:30	18577	578	1	2	128.66	45	
151 31:00	18578	578	0	0	124.78	41	DECREASE FLOW
151 31:30	18578	579	1	2	124.11	40	
151 32:00	18579	580	1	2	123.64	40	
151 32:30	18580	581	1	2	123.62	40	
151 33:00	18581	581	0	0	123.73	40	DECREASE FLOW
151 33:30	18581	582	1	2	122.22	39	
151 34:00	18582	583	1	2	122.31	39	

*From Preliminary Boring Layout Survey

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202 Borehole Diameter, in.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z2 Test length: 7.5 Test Section Depth (from Datum): From 154.23 To 161.73

(A) Depth to Water Table From Datum, Ft. 39.28

Test Water Temp: 85°F Baro Pressure, psi: 14.44

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 157.98 156.98 95. 7-18-13

(C) Distance Water Table to Center of Test Interval Ft. 118.70 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} =$ 66

MAXIMUM TEST PRESSURE, $P_o = ((A+B \cdot 1) + C \cdot 0.57)$ $[P_o =$ 109 $]$ Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

P_o Values: 1/3 $P_o =$ 36; 2/3 $P_o =$ 73; 1/2 $P_o =$ 55 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z2 Sequence No. E Planned Center Pressure: 175

Transducer Readings Before Packers Inflated: Top 19.12; Middle 65.07; Bottom: 68.89

Transducer Readings After Packers Inflated: Top 19.77; Middle 66.21; Bottom: 68.28

MP-202 Z2 SEQUENCE E

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
15:40:00	18592	----	----	----	122.50	39	BEGIN INCREASE FLOW
15:40:30	18592	18 593	1	2	122.45	50	
15:41:00	18593	18 594	1	2	133.04	50	INCREASE FLOW
15:41:30	18594	18 595	1	2	141.87	60	
15:42:00	18595	18 596	1	2	143.01	60	INCREASE FLOW
15:42:30	18596	18 597	1	2	147.72	70	
15:43:00	18597	18 598	1	2	153.91	70	95. 7-18-13 INCREASE FLOW
15:43:30	18598	18 600	2	4	163.00	80	INCREASE FLOW
15:44:00	18600	18 601	1	2	164.66	90	
15:44:30	18601	18 602	1	2	173.71	90	
15:45:00	18602	18 604	2	4	173.57	90	INCREASE FLOW
15:45:30	18604	18 605	1	2	174.34	93	
15:46:00	18605	18 607	2	4	177.28	94	
15:46:30	18607	18 608	1	2	176.28	94	
15:47:00	18608	18 610	2	4	178.59	94	
15:47:30	18610	18 612	2	4	177.85	94	DECREASE FLOW
15:48:00	18612	18 613	1	2	177.71	91	
15:48:30	18613	18 614	1	2	173.02	90	
15:49:00	18614	18 616	2	4	174.97	90	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by 502 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

Page 2

This sheet applies
to all Zmc 2 tests
SSZ 12/13/13.

BORING: MP-202

DATE: 7-18-13

DATA COLLECTED BY: TOM MCGILL / JIM GODDARD

SHUT-IN TEST PRESSURE: N/A psi
SSZ 12/13/13

TIME, minute	SURFACE GAGE PRESSURE, psi	CENTER TRANSDUCER PRESSURE, psi
	Not used	

SSZ 7-18-13

EQUIPMENT USED

Transducers: Mini Trol Serial Numbers: 335896/R24844 (6/12/13), 142142/R20367 (6/20/13), 315381/R24039 (6/20/13)

Surface Pressure Gage: MW-4 (6/11/13), MW-5 (6/11/13), MW-3 BACKFLOW (6/11/13)

Barometric Probe: 121315/R22669 (6/12/13)

THERMOMETER LT28 (5/1/13)

Flow Meter: 8824788 (6/10/13)

Stop Watch: L286/2786

Date of Calibration: IN PARENTHESIS

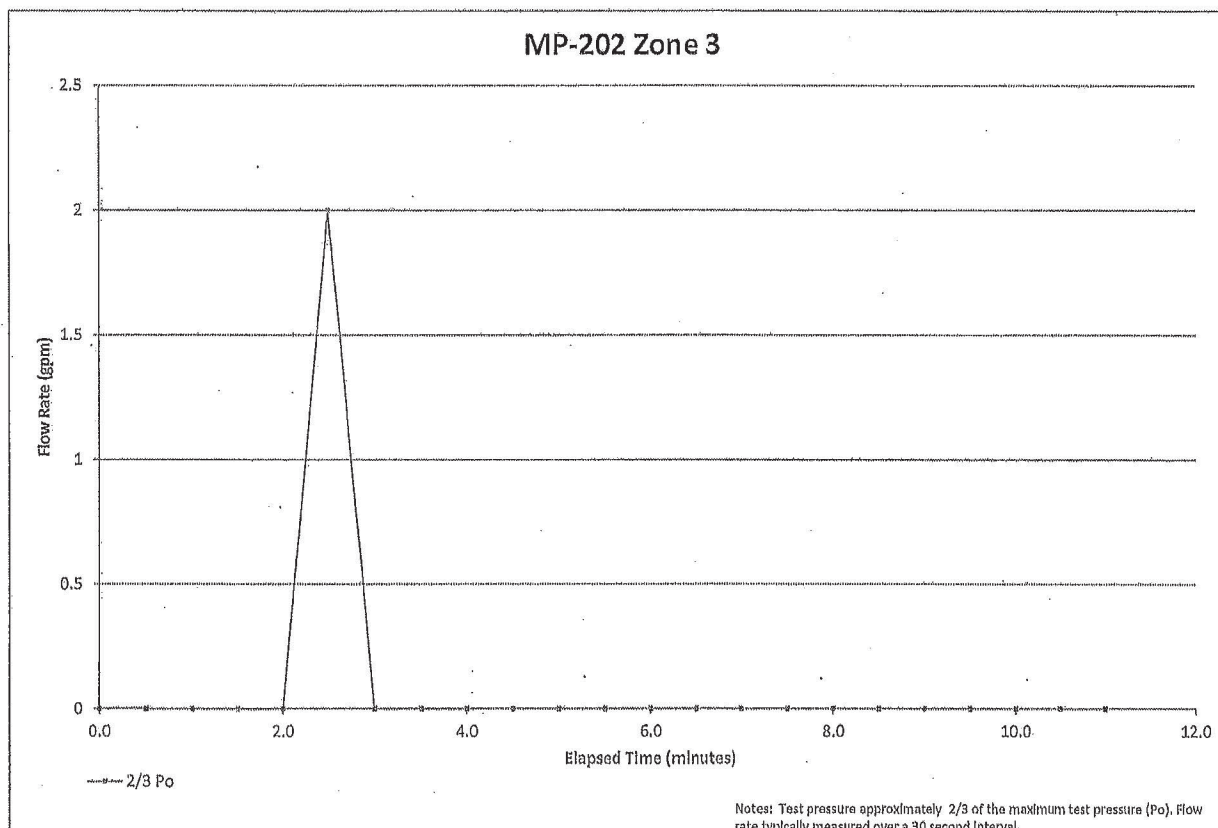
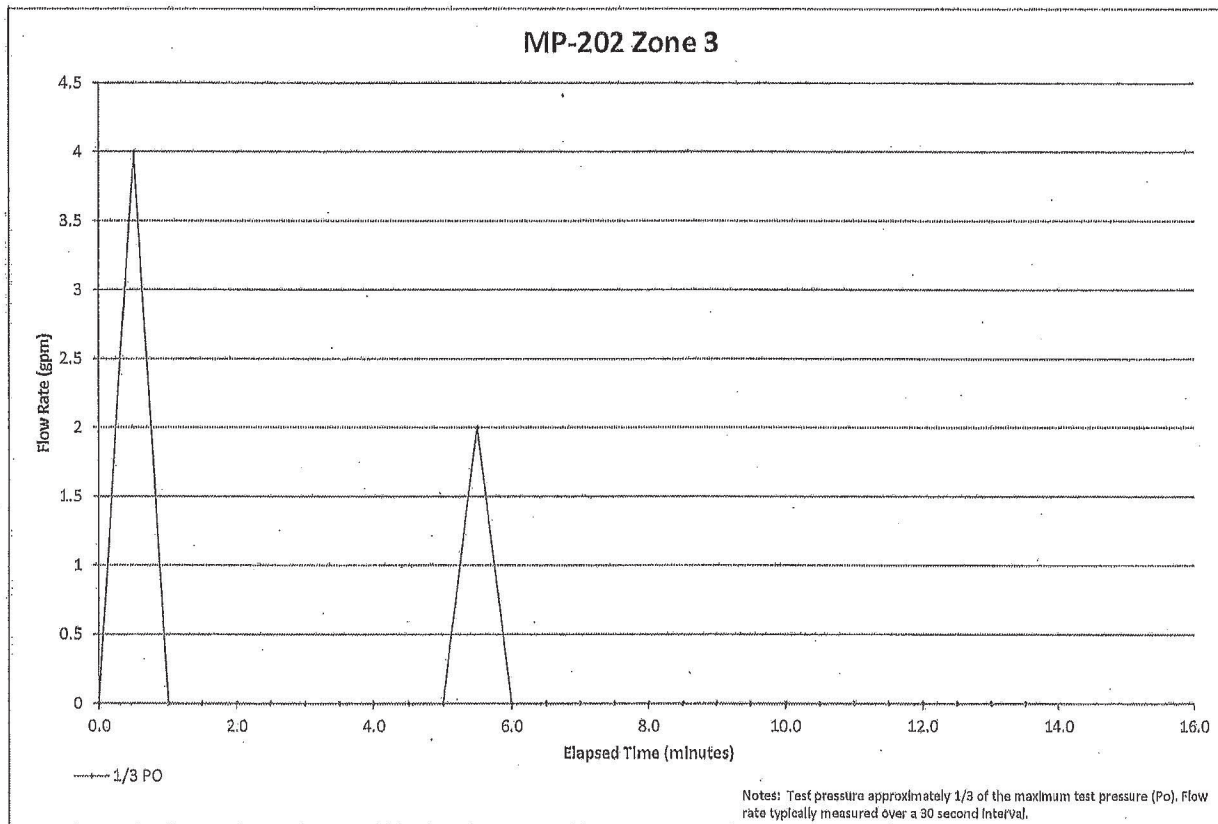
Calibration due: POST TESTING

MP-202	Z2	(B)	2013-07-18	16.00, 12	W/S	SSZ 7-18-13
MP-202	Z2	(B)	2013-07-18	13.24	EXCEL	
MP-202	Z2	(T)	2013-07-18	16.00, 12	W/S	
MP-202	Z2	(T)	2013-07-18	15.54.39	EXCEL	
MP-202	Z2	(M)	2013-07-18	15.54.39	W/S	
MP-202	Z2	(M)	2013-07-18	15.58.28	EXCEL	
MP-202	Z2	(L)	2013-07-18	15.58.28	W/S	
MP-202	Z2	(L)	2013-07-18	15.56.48	EXCEL	

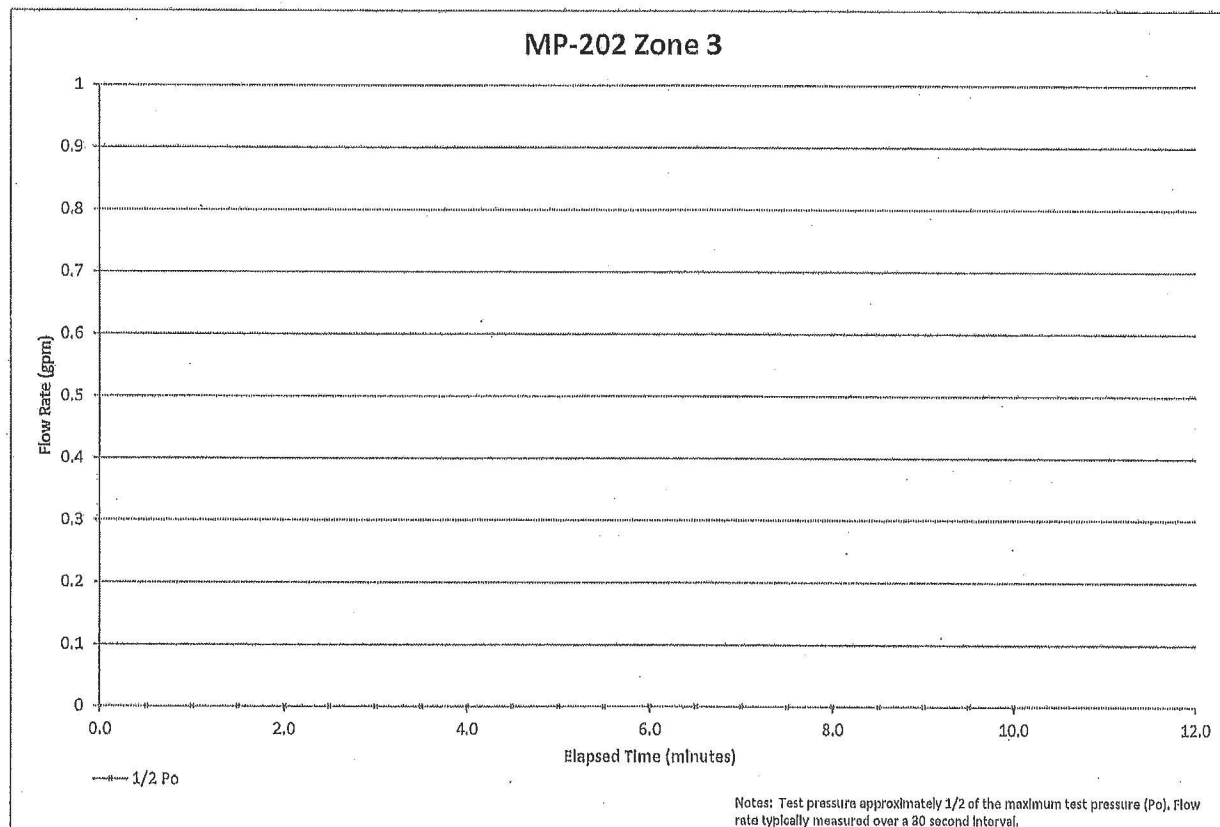
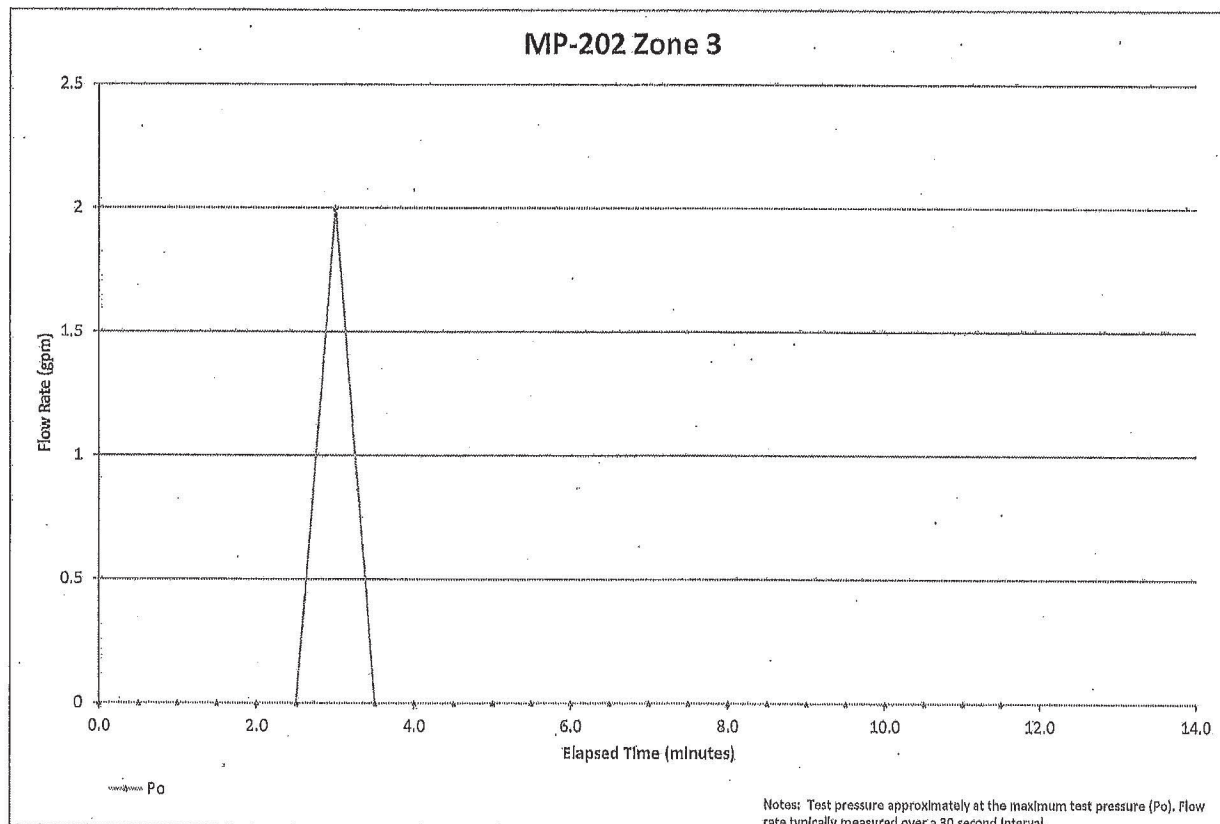
Boring: MP-202
Zone: Z3 182.0 feet to 189.5 feet below ground surface
Transducer Location: Middle

Sequence A (1/3 Po)				Sequence B (2/3 Po)				Sequence C (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
12:11:30	0.0	79.51	0	12:27:30	0.0	119.98	0	12:41:30	0.0	160.04	0
12:12:00	0.5	79.50	4	12:28:00	0.5	120.18	0	12:42:00	0.5	160.02	0
12:12:30	1.0	108.48	0	12:28:30	1.0	126.33	0	12:42:30	1.0	177.77	0
12:13:00	1.5	108.36	0	12:29:00	1.5	131.65	0	12:43:00	1.5	177.13	0
12:13:30	2.0	108.22	0	12:29:30	2.0	132.15	0	12:43:30	2.0	177.77	0
12:14:00	2.5	111.59	0	12:30:00	2.5	136.58	2	12:44:00	2.5	188.97	0
12:14:30	3.0	114.54	0	12:30:30	3.0	136.77	0	12:44:30	3.0	189.22	2
12:15:00	3.5	114.28	0	12:31:00	3.5	141.44	0	12:45:00	3.5	195.68	0
12:15:30	4.0	116.98	0	12:31:30	4.0	141.61	0	12:45:30	4.0	195.99	0
12:16:00	4.5	116.94	0	12:32:00	4.5	148.04	0	12:46:00	4.5	203.34	0
12:16:30	5.0	119.49	0	12:32:30	5.0	152.63	0	12:46:30	5.0	205.04	0
12:17:00	5.5	119.36	2	12:33:00	5.5	154.60	0	12:47:00	5.5	201.42	0
12:17:30	6.0	119.41	0	12:33:30	6.0	154.23	0	12:47:30	6.0	201.02	0
12:18:00	6.5	119.67	0	12:34:00	6.5	156.74	0	12:48:00	6.5	206.55	0
12:18:30	7.0	119.80	0	12:34:30	7.0	157.00	0	12:48:30	7.0	206.42	0
12:19:00	7.5	123.81	0	12:35:00	7.5	160.61	0	12:49:00	7.5	206.18	0
12:19:30	8.0	123.67	0	12:35:30	8.0	160.91	0	12:49:30	8.0	206.48	0
12:20:00	8.5	123.84	0	12:36:00	8.5	160.60	0	12:50:00	8.5	205.88	0
12:20:30	9.0	120.27	0	12:36:30	9.0	160.87	0	12:50:30	9.0	205.85	0
12:21:00	9.5	120.10	0	12:37:00	9.5	160.61	0	12:51:00	9.5	206.54	0
12:21:30	10.0	120.41	0	12:37:30	10.0	160.71	0	12:51:30	10.0	206.70	0
12:22:00	10.5	120.00	0	12:38:00	10.5	160.56	0	12:52:00	10.5	206.61	0
12:22:30	11.0	119.93	0	12:38:30	11.0	160.56	0	12:52:30	11.0	206.15	0
12:23:00	11.5	120.17	0					12:53:00	11.5	206.26	0
12:23:30	12.0	119.82	0								
12:24:00	12.5	119.98	0								
12:24:30	13.0	119.98	0								
12:25:00	13.5	119.92	0								

Sequence D (1/2 Po)				Sequence E (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
12:55:30	0.0	206.72	0	13:09:00	0.0	140.16	0
12:56:00	0.5	206.14	0	13:09:30	0.5	148.23	0
12:56:30	1.0	175.07	0	13:10:00	1.0	151.33	0
12:57:00	1.5	174.65	0	13:10:30	1.5	158.57	0
12:57:30	2.0	169.51	0	13:11:00	2.0	169.97	0
12:58:00	2.5	169.17	0	13:11:30	2.5	175.21	0
12:58:30	3.0	165.01	0	13:12:00	3.0	185.08	0
12:59:00	3.5	159.25	0	13:12:30	3.5	197.60	0
12:59:30	4.0	158.96	0	13:13:00	4.0	198.18	0
13:00:00	4.5	154.70	0	13:13:30	4.5	197.77	0
13:00:30	5.0	154.61	0	13:14:00	5.0	201.71	0
13:01:00	5.5	149.32	0	13:14:30	5.5	201.72	0
13:01:30	6.0	149.28	0	13:15:00	6.0	202.52	0
13:02:00	6.5	145.84	0	13:15:30	6.5	204.40	0
13:02:30	7.0	145.73	0	13:16:00	7.0	203.62	0
13:03:00	7.5	141.96	0	13:16:30	7.5	203.62	0
13:03:30	8.0	141.16	0	13:17:00	8.0	203.99	0
13:04:00	8.5	141.16	0	13:17:30	8.5	203.31	0
13:04:30	9.0	140.95	0				
13:05:00	9.5	140.96	0				
13:05:30	10.0	140.71	0				
13:06:00	10.5	no reading	0				



Prepared by/Date: KRL 1/4/14
 Checked by/Date: JAS 4/1/14



Prepared by/Date: KAL 1/4/14
 Checked by/Date: [Signature] 1/12/14

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

(A) Depth to Water Table From Datum, Ft. 38.63

Test Water Temp: 76°F Baro Pressure, psi: 14.45

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \cdot 82.4 / 144) + \text{Baro} =$ 79

MAXIMUM TEST PRESSURE, $P_o = ([A+B \cdot 1] + C \cdot 0.57)$ [$P_o =$ 125] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Sequence ID: A B C D E

P_o Values: 1/3 $P_o =$ 42; 2/3 $P_o =$ 83; 1/2 $P_o =$ 63 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z3 Sequence No. A Planned Center Pressure: 121

Transducer Readings Before Packers Inflated: Top 20.24; Middle 77.69; Bottom: 81.49

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

MP-202 Z3 SEQUENCE A

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
11:11:30	18504	----	----	----	79.51	0	BEGIN INCREASE FLOW
12:12:00	18504	18506	2	4	79.50	20	
12:12:30	18506	18506	0	0	108.43	19	9:18-13
12:13:00	18506	18506	0	0	108.36	19	
12:13:30	18506	18506	0	0	108.22	19	INCREASE FLOW
12:14:00	18506	18506	0	0	111.59	25	
12:14:30	18506	18506	0	0	114.54	25	INCREASE FLOW
12:15:00	18506	18506	0	0	114.28	26	
12:15:30	18506	18506	0	0	116.98	26	INCREASE FLOW
12:16:00	18506	18506	0	0	116.94	30	
12:16:30	18506	18506	0	0	119.49	30	
12:17:00	18506	18507	1	2	119.36	30	
12:17:30	18507	18507	0	0	119.41	30	
12:18:00	18507	18507	0	0	119.67	30	INCREASE FLOW
12:18:30	18507	18507	0	0	119.80	30	
12:19:00	18507	18507	0	0	123.81	32	
12:19:30	18507	18507	0	0	123.67	32	DECREASE FLOW
12:20:00	18507	18507	0	0	123.84	30	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SD 12/13/13

Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

MP-202 E3 SEQUENCE A (CONT'D)

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
12:20:30	18 507	18 507	0	0	120.27	30	
12:21:00	18 507	18 507	0	0	120.10	30	
12:21:30	18 507	18 507	0	0	120.41	30	
12:22:00	18 507	18 507	0	0	120.00	30	
12:22:30	18 507	18 507	0	0	119.93	30	
12:23:00	18 507	18 507	0	0	120.17	30	
12:23:30	18 507	18 507	0	0	119.82	30	
12:24:00	18 507	18 507	0	0	119.98	30	
12:24:30	18 507	18 507	0	0	119.98	30	
12:25:00	18 507	18 507	0	0	119.92	30	END
				12:25:30	Bottom	TRANS	80.03
				12:26:00	Top	TRANS	20.51

*From Preliminary Boring Layout Survey

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 8488-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, in.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z 3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

(A) Depth to Water Table From Datum, Ft. 38.63

Test Water Temp: 76°F Baro Pressure, psi: 14.45

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} =$ 79

MAXIMUM TEST PRESSURE, $P_o = ([A+B \cdot 1] + C \cdot 0.57)$ [$P_o =$ 125] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Sequence ID: A B C D E

P_o Values: 1/3 $P_o =$ 42; 2/3 $P_o =$ 83; 1/2 $P_o =$ 63 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z 3 Sequence No. B Planned Center Pressure: 162

Transducer Readings Before Packers Inflated: Top 20.24; Middle 77.69; Bottom: 81.49

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

MP-202 Z 3 SEQUENCE B

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
12:27:30	18507	---	---	---	119.98	30	BEGIN INCREASE FLOW
12:28:00	18507	18507	0	0	120.18	35	INCREASE FLOW
12:28:30	18507	18507	0	0	126.33	40	
12:29:00	18507	18507	0	0	131.65	40	INCREASE FLOW
12:29:30	18507	18507	0	0	132.15	45	
12:30:00	18507	18508	1	2	136.58	45	INCREASE FLOW
12:30:30	18508	18508	0	0	136.77	50	
12:31:00	18508	18508	0	0	141.44	50	INCREASE FLOW
12:31:30	18508	18508	0	0	141.61	56	
12:32:00	18508	18508	0	0	148.04	56	INCREASE FLOW
12:32:30	18508	18508	0	0	152.63	60	
12:33:00	18508	18508	0	0	152.60	60	INCREASE FLOW
12:33:30	18508	18508	0	0	154.23	65	
12:34:00	18508	18508	0	0	156.74	65	INCREASE FLOW
12:34:30	18508	18508	0	0	157.00	69	
12:35:00	18508	18508	0	0	160.61	69	
12:35:30	18508	18508	0	0	160.91	69	
12:36:00	18508	18508	0	0	160.60	69	

*From Preliminary Boring Layout Survey

Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7 *

Elev. Top of Casing, Ft. (Grnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-242 z 3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

Test Water Temp: 76°F Baro Pressure, psi: 14.45

Depth to Center of Test Interval From Datum, Ft: 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} = \underline{79}$

MAXIMUM TEST PRESSURE, $P_o = ([A+B*1] + C*0.57)$ [$P_o = 125$] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 Po = 42; 2/3 Po = 83; 1/2 Po = 63 Sequence ID: A B C D E
Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-202²³ Sequence No. B Planned Center Pressure: 162

Transducer Readings Before Packers Inflated: Top 20.24; Middle 77.69; Bottom: 81.49

Transducer Readings After Packers Inflated: Top 24.53; Middle 79.69; Bottom: 84.16

MP-202 Z3 SEQUENCE B (CONT'D)

[illegible]

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SDZ 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Grd Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Grd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

(A) Depth to Water Table From Datum, Ft. 38.63

Test Water Temp: 76°F Baro Pressure, psi: 14.45

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \cdot 62.4/144) + \text{Baro} =$ 79

MAXIMUM TEST PRESSURE, $P_o = [(A+B \cdot 1) + C \cdot 0.57]$ $[P_o = \underline{125}]$ Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

P_o Values: 1/3 $P_o = \underline{42}$; 2/3 $P_o = \underline{83}$; 1/2 $P_o = \underline{63}$ Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z3 Sequence No. C Planned Center Pressure: 204

Transducer Readings Before Packers Inflated: Top 20.24; Middle 77.69; Bottom: 81.49

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

MP-202 Z3 SEQUENCE C

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
12:41:30	18509	----	----	----	160.04	69	BEGIN INCREASE FLOW
12:42:00	18509	18509	0	0	160.02	85	
12:42:30	18509	18509	0	0	177.77	85	
12:43:00	18509	18509	0	0	177.13	85	INCREASE FLOW
12:43:30	18509	18509	0	0	177.77	95	
12:44:00	18509	18509	0	0	188.97	95	INCREASE FLOW
12:44:30	18509	18510	1	2	189.22	102	
12:45:00	18510	18510	0	0	195.68	102	INCREASE FLOW
12:45:30	18510	18510	0	0	195.99	102	
12:46:00	18510	18510	0	0	203.34	111	
12:46:30	18510	18510	0	0	205.04	107	
12:47:00	18510	18510	0	0	201.42	107	INCREASE FLOW
12:47:30	18510	18510	0	0	201.02	112	
12:48:00	18510	18510	0	0	206.55	112	
12:48:30	18510	18510	0	0	206.42	112	
12:49:00	18510	18510	0	0	206.18	112	
12:49:30	18510	18510	0	0	206.49	112	
12:50:00	18510	18510	0	0	205.88	112	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by STC 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 8468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

End Elev, Ft. 811.7

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (End Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

(A) Depth to Water Table From Datum, Ft. 38.63

Test Water Temp: 76°F Baro Pressure, psi: 14.45

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro}$ = 79

MAXIMUM TEST PRESSURE, $P_o = \frac{[A+B \cdot 1] + C \cdot 0.57}{[P_o = 125]}$ Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 P_o = 42; 2/3 P_o = 83; 1/2 P_o = 63 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z3 Sequence No. D Planned Center Pressure: 142

Transducer Readings Before Packers Inflated: Top 20.24 Middle 77.69 Bottom: 81.49

Transducer Readings After Packers Inflated: Top 20.53 Middle 79.69 Bottom: 80.16

MP-202 Z3 SEQUENCE D

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
12:55:30	18510	----	----	----	206.72	112	BEGIN DECREASE FLOW
12:56:00	18510	18510	0	0	206.14	80	
12:56:30	18510	18510	0	0	175.07	80	DECREASE FLOW
12:57:00	18510	18510	0	0	174.65	75	
12:57:30	18510	18510	0	0	169.51	75	DECREASE FLOW
12:58:00	18510	18510	0	0	169.17	70	
12:58:30	18510	18510	0	0	165.01	70	DECREASE FLOW
12:59:00	18510	18510	0	0	159.25	65	DECREASE FLOW
12:59:30	18510	18510	0	0	158.96	60	
13:00:00	18510	18510	0	0	154.70	60	
13:00:30	18510	18510	0	0	154.61	60	DECREASE FLOW
13:01:00	18510	18510	0	0	149.32	54	
13:01:30	18510	18510	0	0	149.28	54	DECREASE FLOW
13:02:00	18510	18510	0	0	145.84	50	
13:02:30	18510	18510	0	0	145.73	50	DECREASE FLOW
13:03:00	18510	18510	0	0	141.96	45	
13:03:30	18510	18510	0	0	141.16	45	
13:04:00	18510	18510	0	0	141.16	45	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SL 12/13/13

Page 1 of 2

DATE: 7-18-13

Gnd Elev, Ft: 811.7 *

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-18-13

Boring No. MP-202

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 460

Gnd Elev, Ft. 811.7 *

Casing Height above ground, Ft. 1.23

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 812.93 = Datum

TEST ID: MP-202 Z3 Test length: 7.5 Test Section Depth (from Datum): From 183.23 To 190.73

(A) Depth to Water Table From Datum, Ft. 38.63

Test Water Temp: 76°F Baro Pressure, psi: 14.45

(B) Surface Gage Height Above Datum, Ft. 1.63

Depth to Center of Test Interval From Datum, Ft. 186.98

(C) Distance Water Table to Center of Test Interval Ft. 148.35 Static water pressure at center = $(C \times 0.4/144) + \text{Baro} =$ 79

MAXIMUM TEST PRESSURE, $P_o = [(A+B \times 1) + C \times 0.57]$ [$P_o =$ 125] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Sequence ID: A B C D E

P_o Values: 1/3 $P_o =$ 42; 2/3 $P_o =$ 83; 1/2 $P_o =$ 63 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-202 Z3 Sequence No. E Planned Center Pressure: 204

Transducer Readings Before Packers Inflated: Top 20.24; Middle 77.69; Bottom: 81.49

Transducer Readings After Packers Inflated: Top 20.53; Middle 79.69; Bottom: 80.16

MP-202 Z3 SEQUENCE E

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
13:09:00	18510	---	---	---	140.16	45	BEGIN INCREASE FLOW
13:09:30	18510	18510	0	0	148.23	55	INCREASE FLOW
13:10:00	18510	18510	0	0	151.33	65	INCREASE FLOW
13:10:30	18510	18510	0	0	158.57	76	INCREASE FLOW
13:11:00	18510	18510	0	0	169.97	81	
13:11:30	18510	18510	0	0	175.21	81	INCREASE FLOW
13:12:00	18510	18510	0	0	185.05	91	INCREASE FLOW
13:12:30	18510	18510	0	0	195.60	104	
13:13:00	18510	18510	0	0	198.18	104	INCREASE FLOW
13:13:30	18510	18510	0	0	197.77	108	
13:14:00	18510	18510	0	0	201.71	108	
13:14:30	18510	18510	0	0	201.72	108	INCREASE FLOW
13:15:00	18510	18510	0	0	202.52	110	
13:15:30	18510	18510	0	0	204.40	110	
13:16:00	18510	18510	0	0	203.62	110	
13:16:30	18510	18510	0	0	203.62	110	
13:17:00	18510	18510	0	0	203.99	110	
13:17:30	18510	18510	0	0	203.31	110	END

*From Preliminary Boring Layout Survey

13:18:10 BOTTOM TRANS = 80.11
13:18:40 TOP TRANS = 20.52

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

Page 2

BORING: MP-202DATE: 7-18-13DATA COLLECTED BY: TOM MCGILL / JIM GODDARDSHUT-IN TEST PRESSURE: N/A psi5/2 12/17/13

This sheet
applies to all
Zone 3 tests
5/2 12/13/13

TIME, minute	SURFACE GAGE PRESSURE, psi	CENTER TRANSDUCER PRESSURE, psi
	<i>Not Used</i>	

5/2 7-18-13

EQUIPMENT USED

Transducers: Mini Trol Serial Numbers: 335896/R24844, 142142/R20367, 315381/R24039;Surface Pressure Gage: MW-4, MW-5, MW-3 BACKFLOWBarometric Probe: 121315/R22669THERMOMETER LT28Flow Meter: 8824788

VERY LITTLE WATER USED

Stop Watch: L286/2786Date of Calibration: IN PARENTHESISCalibration due: POST TESTING

FILES:

BORING	ZONE	DATE	TIME	WELL	FILE
MP-202	Z3	(B)	2013-07-18	13,24,02	WSL
MP-202	Z3	(B)	2013-07-18	13,24,02	EXCEL
MP-202	Z3	(T)	2013-07-18	13,24,34	WSL
MP-202	Z3	(T)	2013-07-18	13,24,34	EXCEL
MP-202	Z3	(M)	2013-07-18	13,22,00	WSL
MP-202	Z3	(M)	2013-07-18	13,22,00	EXCEL
MP-202	Z3	(L)	2013-07-18	13,23,07	WSL
MP-202	Z3	(L)	2013-07-18	13,23,07	EXCEL

PACKER TEST FLOW RATE GRAPHS

Boring MP-401

Packer Test Intervals: *(below ground surface) (below top of casing)*

MP-401 Zone 1: **10.0** feet to **17.5** feet **Not Tested**

MP-401 Zone 2: **28.0** feet to **35.5** feet: **29.75** feet to **37.25** feet

MP-401 Zone 3: **77.0** feet to **84.5** feet: **78.75** feet to **86.25** feet

MP-401 Zone 4: **237.0** feet to **244.5** feet: **238.75** feet to **246.25** feet

Graphs of flow rate (gpm) vs time (minutes) have been created from Excel sheets containing data from field data sheets. For clarity, individual plots for each sequence within a tested interval are presented. Generally, plots are not provided if the field data sheets indicate no flow during a test sequence. ***Bechtel Field Instruction forms are provided. AMEC field data sheets are provided following the graphs for each zone. The AMEC field data sheets use top of casing as a field measurement reference. Assigned test interval depths below ground surface were converted to depths below top of casing by adding the casing height to the assigned test interval depths.*** Transducer data file names are listed on the last field data sheet of each test interval. Transducer data files are furnished as electronic files ***in a data supplement submittal.***

BECHTEL POWER CORPORATION
Project No. 25847
Clinch River CPA Project- Site Subsurface Investigation
FIELD INSTRUCTION FORM

Specification Section: 5.3.7.2

Packer Testing in MP 401

Field Instruction: The following are the four (4) depth zones in which packer testing will be conducted in borehole MP 401:

- Zone 1: 10.0 to 17.5 feet below land surface. (Tolerance +/- 0.5 feet)
 Zone 2: 28.0 to 35.5 feet below land surface. (Tolerance +/- 0.5 feet)
 Zone 3: 77.0 to 84.5 feet below land surface. (Tolerance +/- 0.5 feet)
 Zone 4: 237.0 to 244.5 feet below land surface. (Tolerance +/- 0.5 feet)

WATER LEVEL IS
 BELOW TOP PACKER. ZONE
 1 IS TERMINATED.
 48 7/20/13
 COMPLETED 7-19-13

The desired pressure ranges that will be tested in each of the four zones are based on the calculation of the test pressures as provided in AMEC Project Procedure CRP-3 – Packer Pressure Testing in Boreholes, Attachment B (Bechtel Power InfoWorks 25847-601-V14-CY00-00018-006) or latest revision at time of testing. The test pressures will be determined just before the commencement of the tests by measuring the water level at the start of test.

Basis/Justification for Instruction:

The depths of the above zones were selected based on fracture zones identified from DRAFT geologic core logs, RQD analysis and from the acoustic televiewer logs. The bottom depth for packer testing is limited to approximately 250 feet due to the packer test assembly and maximum transducer cable length of approximately 285 feet. The justification of the pressure ranges that will be tested will be based on AMEC Project Procedure CRP-3 – Packer Pressure Testing in Boreholes, Attachment B (Bechtel Power InfoWorks 25847-601-V14-CY00-00018-006) or latest revision at time of testing.

Prepared By:	<u>HILLOL GUHA</u>	<u>[Signature]</u>	<u>7/17/13</u>
	Name	Signature	Date
Reviewed By:	<u>GERALD MSLANE</u>	<u>[Signature]</u>	<u>7/17/13</u>
	Name	Signature	Date
Approved By:	<u>Mark Reimnitz</u>	<u>[Signature]</u>	<u>7/17/13</u>
	Name	Signature	Date
(see Section 1.2 for further instructions)			
Received By AMEC	<u>Stephen Criscenzo</u>	Digitally signed by stephen.criscenzo@amec.com Date: 2013.07.19 11:35:28 -04'00'	
Site Mgr or Proj Mgr:	Name	Signature	Date

Packer Test Worksheet

Clinch River SMR Project
AMEC Project No. 6468 13 1072

Test Date 7/20/2013
Prepared By J. Goddard
Checked By TM

Boring Number	MP 401
Zone No.	2
Assigned Interval Top (ft-bgs)	28.00
Assigned Interval Bottom (ft-bgs)	35.50
Center of test interval (ft-bgs)	31.75
Height of Casing (ft ags)	1.75
Depth to water (ft below TOC)	12.15
Depth to Water (Ft- bgs)	10.40
Baro Pressure (psi)	14.37
A= Depth to Water Table (ft)	12.15

B=Surface Gage Height (ft)	1.50
----------------------------	------

C= Height of water above center of test interval (ft)	21.35
---	-------

Static Water Pressure @ center of Interval (psi)	24
--	----

Max Test Pressure (Po) (psi)	26
------------------------------	----

1/3 Po (psi)	9
2/3 Po (psi)	17
1/2 Po (psi)	13

	Center Test Pressures (psi)	Inflation Pressure (psi)
Sequence A 1/3	33	83
Sequence B 2/3	41	91
Sequence C 1.0	50	100
Sequence D 1/2	37	87
Sequence E 1.0	50	100

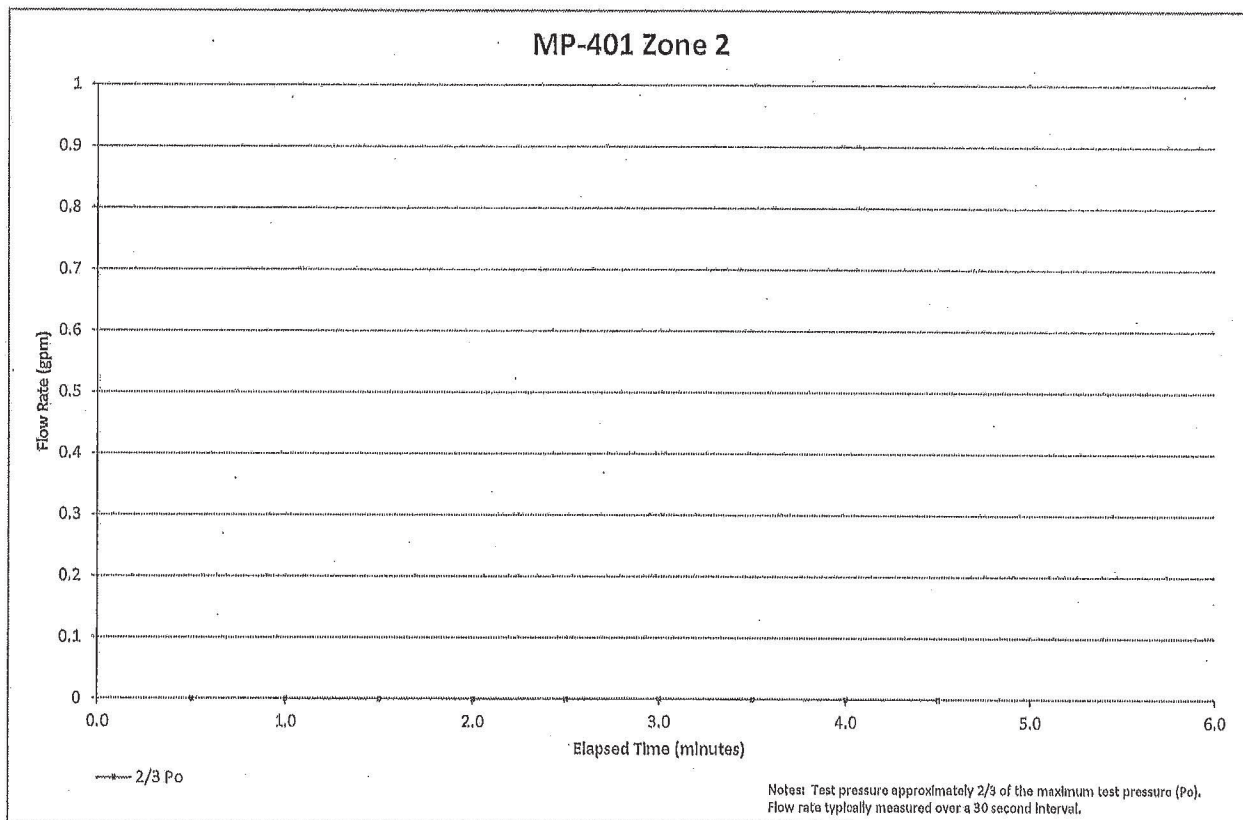
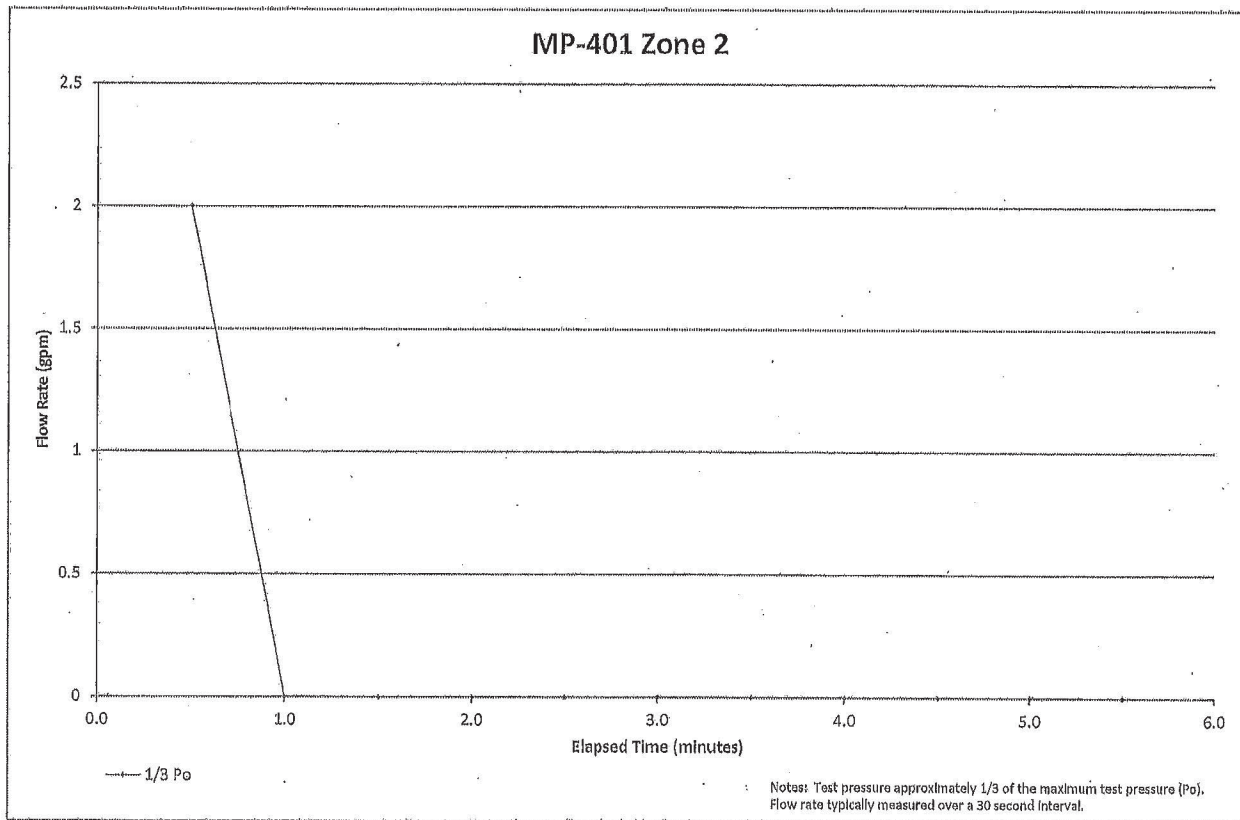
Pipe Check (Estimate Only for Field Guidance))

Length of Packer Assembly	13.29
Average Length of Pipe Section	21.12
Length of pipe to TOC	23.96
Number of Pipe Sections	1.13
length of stickup above TOC (ft)	18.28

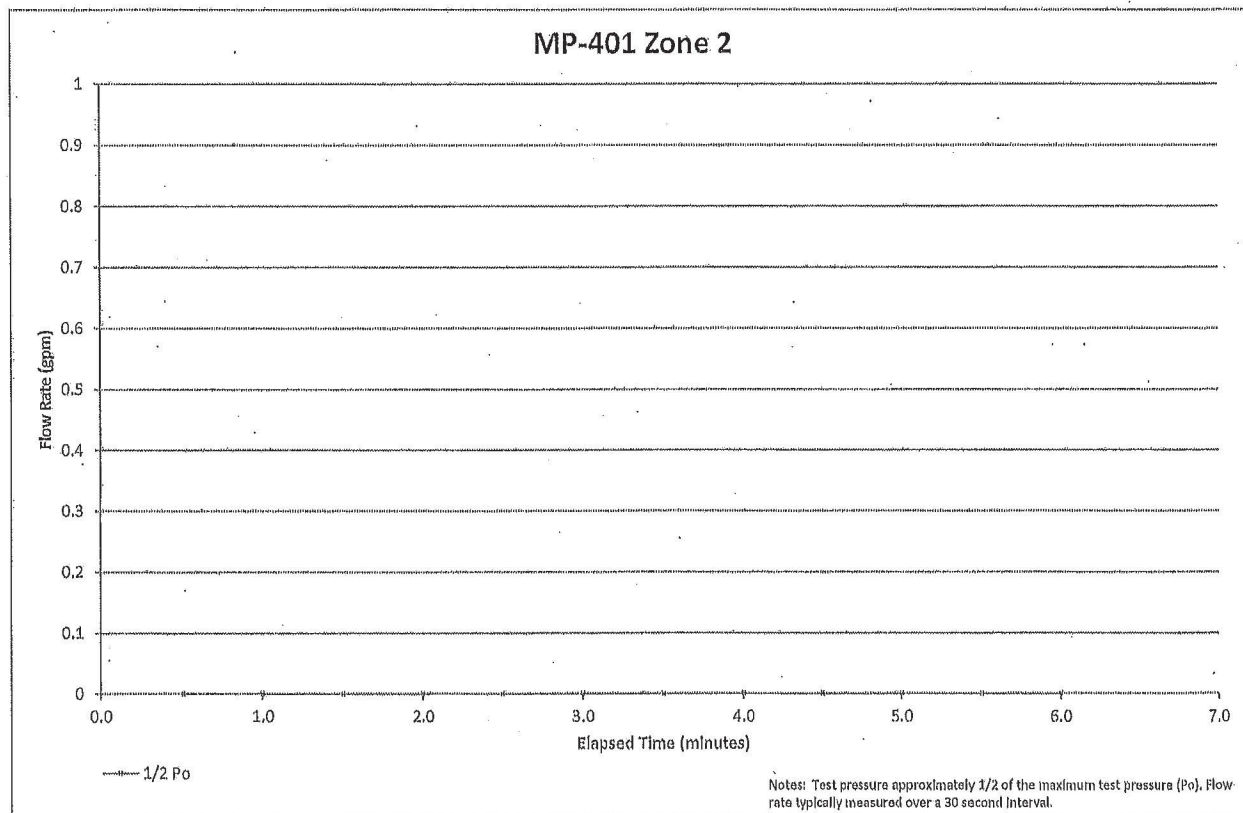
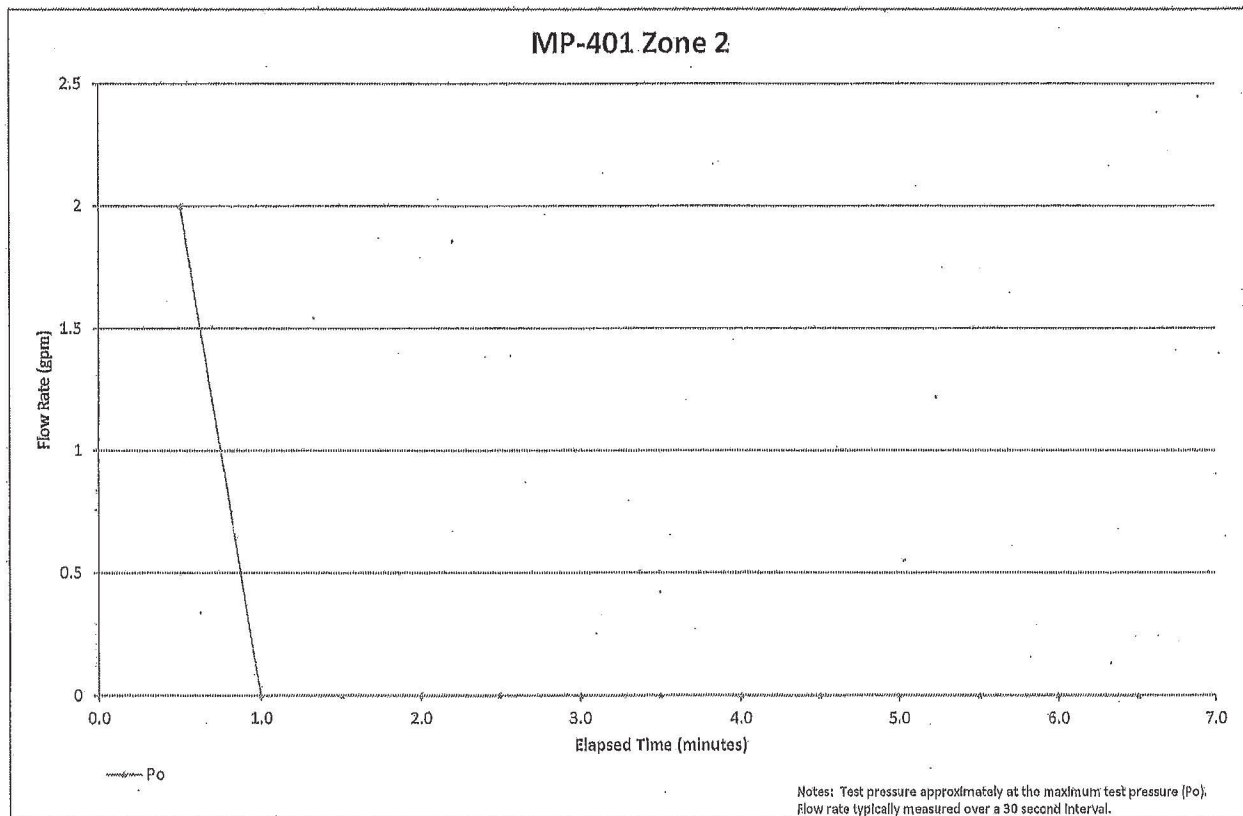
Boring: MP-401
Zone: 2 28.0 feet to 35.5 feet below ground surface
Transducer Location: Middle

Sequence A (1/3 Po)				Sequence B (2/3 Po)				Sequence C (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
10:31:30	0.0	24.85		10:40:00	0.0	37.42		10:48:00	0.0	41.38	
10:32:00	0.5	24.83	2	10:40:30	0.5	38.67	0	10:48:30	0.5	47.84	2
10:32:30	1.0	36.10	0	10:41:00	1.0	38.56	0	10:49:00	1.0	45.72	0
10:33:00	1.5	36.81	0	10:41:30	1.5	38.92	0	10:49:30	1.5	46.05	0
10:33:30	2.0	36.91	0	10:42:00	2.0	41.29	0	10:50:00	2.0	48.60	0
10:34:00	2.5	37.01	0	10:42:30	2.5	41.27	0	10:50:30	2.5	48.80	0
10:34:30	3.0	37.24	0	10:43:00	3.0	41.34	0	10:51:00	3.0	48.89	0
10:35:00	3.5	36.93	0	10:43:30	3.5	41.39	0	10:51:30	3.5	49.03	0
10:35:30	4.0	36.92	0	10:44:00	4.0	41.25	0	10:52:00	4.0	51.29	0
10:36:00	4.5	36.93	0	10:44:30	4.5	41.56	0	10:52:30	4.5	51.33	0
10:36:30	5.0	36.89	0	10:45:00	5.0	no reading		10:53:00	5.0	51.32	0
10:37:00	5.5	37.00	0					10:53:30	5.5	51.50	0
								10:54:00	6.0	51.17	0
								10:54:30	6.5	51.38	0

Sequence D (1/2 Po)				Sequence E (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
10:57:30	0.0	51.25		11:06:30	0.0	39.47	
10:58:00	0.5	48.30	0	11:07:00	0.5	44.51	0
10:58:30	1.0	46.75	0	11:07:30	1.0	44.39	0
10:59:00	1.5	46.65	0	11:08:00	1.5	44.52	0
10:59:30	2.0	42.03	0	11:08:30	2.0	46.56	0
11:00:00	2.5	42.07	0	11:09:00	2.5	46.51	0
11:00:30	3.0	42.04	0	11:09:30	3.0	47.64	0
11:01:00	3.5	39.82	0	11:10:00	3.5	48.32	0
11:01:30	4.0	39.69	0	11:10:30	4.0	48.20	0
11:02:00	4.5	39.68	0	11:11:00	4.5	48.63	0
11:02:30	5.0	39.72	0	11:11:30	5.0	49.24	0
11:03:00	5.5	39.59	0	11:12:00	5.5	49.21	0
11:03:30	6.0	39.54	0	11:12:30	6.0	49.19	0
11:04:00	6.5	no reading		11:13:00	6.5	49.23	0
				11:13:30	7.0	49.12	0
				11:14:00	7.5	no reading	



Prepared by/Date: KDL 1/4/14
 Checked by/Date: JO 3/12/14



Prepared by/Date: KW 1/4/14
 Checked by/Date: JO 1/2/14

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-20-13

Boring No. MP-401

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 420

Gnd Elev, Ft. 825.7*

Casing Height above ground, Ft. 1.75

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 ZR Test length: 7.5 Test Section Depth (from Datum): From 29.75 To 37.25

(A) Depth to Water Table From Datum, Ft. 12.15

Test Water Temp: 81°F Baro Pressure, psi: 14.37

(B) Surface Gage Height Above Datum, Ft. 1.50

Well Water Temp: 61°F (16.22°C)
Depth to Center of Test Interval From Datum, Ft. 33.50

(C) Distance Water Table to Center of Test Interval Ft. 21.35 Static water pressure at center = $(C \cdot 62.4 / 144) + \text{Baro} = 2.4$

MAXIMUM TEST PRESSURE, $P_o = [(A+B) \cdot 1] + C \cdot 0.57$ [$P_o = 26$] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 $P_o = 9$; 2/3 $P_o = 17$; 1/2 $P_o = 13$ Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-401 ZR Sequence No. A Planned Center Pressure: 33

Transducer Readings Before Packers Inflated: Top 17.36; Middle 22.99; Bottom: 26.81

Transducer Readings After Packers Inflated: Top 18.32; Middle 25.08; Bottom: 23.52

MP-401 ZR SEQUENCE A

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	** Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
10:31:30	18763	----	----	----	24.85	0	BEGIN INCREASE FLOW
10:32:00	18763	18764	1 0	0.2	24.83	5	7-20-13
10:32:30	18764	18764	0	0	36.10	8	
10:33:00	18764	18764	0	0	36.81	9	
10:33:30	18764	18764	0	0	36.91	9	
10:34:00	18764	18764	0	0	37.01	9	
10:34:30	18764	18764	0	0	37.24	9	
10:35:00	18764	18764	0	0	36.93	9	
10:35:30	18764	18764	0	0	36.92	9	
10:36:00	18764	18764	0	0	36.93	9	
10:36:30	18764	18764	0	0	36.89	9	
10:37:00	18764	18764	0	0	37.00	9	
				10:37:15	BOTTOM	TRANS =	22.74
				10:38:30	TOP	TRANS =	18.35
**	COULD NOT REDUCE TRANSDUCER READING						
							7-20-13

*From Preliminary Boring Layout Survey.

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by STZ 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-20-13

Boring No. MP-401

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 420

Grd Elev, Ft. 825.7*

Casing Height above ground, Ft. 1.75

Elev. Top of Casing, Ft. (Grid Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 ZR Test length: 7.5 Test Section Depth (from Datum): From 29.75 To 37.25

(A) Depth to Water Table From Datum, Ft. 12.15

Test Water Temp: 81°F Baro Pressure, psi: 14.37

(B) Surface Gage Height Above Datum, Ft. 1.50

Well Water Temp: 61°F (16.22°C)
Depth to Center of Test Interval From Datum, Ft. 33.50

(C) Distance Water Table to Center of Test Interval Ft. 21.35 Static water pressure at center = (C*62.4/144) + Baro = 24

MAXIMUM TEST PRESSURE, Po = [(A+B*1) + C*0.57] [Po = 26] Test Pressure sequence = 1/3 Po, 2/3 Po, Po, 1/2 Po, Po

Po Values: 1/3 Po = 9; 2/3 Po = 17; 1/2 Po = 13 Sequence ID: A B C D E
Add Appropriate Po value to static pressure at center of test interval

TEST NO. MP-401 ZR Sequence No. B Planned Center Pressure: 41

Transducer Readings Before Packers Inflated: Top 17.36; Middle 22.99; Bottom: 26.81

Transducer Readings After Packers Inflated: Top 18.32; Middle 25.08; Bottom: 23.52

MP-401 ZR SEQUENCE B

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
10:40:00	18764	----	----	----	37.42	9	BEGIN INCREASE FLOW
10:40:30	18764	18764	0	0	38.67	11	
10:41:00	18764	18764	0	0	38.56	10	INCREASE FLOW
10:41:30	18764	18764	0	0	38.92	12	
10:42:00	18764	18764	0	0	41.29	12	
10:42:30	18764	18764	0	0	41.27	12	
10:43:00	18764	18764	0	0	41.34	13	
10:43:30	18764	18764	0	0	41.39	13	
10:44:00	18764	18764	0	0	41.25	13	
10:44:30	18764	18764	0	0	41.50	13	END
45	No Reading						
				10:45:20	Bottom	TRANS = 22.48	
				10:45:50	Top	TRANS = 18.35	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SR 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-20-13

Boring No. MP-401

Borehole Diameter, in.: 3.8

Total Boring Depth, Ft. 420

Gnd Elev, Ft. 825.7*

Casing Height above ground, Ft. 1.75

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 ZR Test length: 7.5 Test Section Depth (from Datum): From 29.75 To 37.25

(A) Depth to Water Table From Datum, Ft. 12.15

Test Water Temp: 81°F Baro Pressure, psi: 14.37

Well Water Temp: 61°F (16.22°C)

(B) Surface Gage Height Above Datum, Ft. 1.50

Depth to Center of Test Interval From Datum, Ft. 33.50

(C) Distance Water Table to Center of Test Interval Ft. 21.35 Static water pressure at center = (0*82.4/144) + Baro = 24

MAXIMUM TEST PRESSURE, $P_o = [(A+B*1) + C*0.57]$ [$P_o = 26$] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Po Values: 1/3 $P_o = 9$; 2/3 $P_o = 17$; 1/2 $P_o = 13$ Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-401 ZR Sequence No. C Planned Center Pressure: 50

Transducer Readings Before Packers Inflated: Top 17.36 Middle 22.99 Bottom: 26.81

Transducer Readings After Packers Inflated: Top 18.32 Middle 25.08 Bottom: 23.52

MP-401 ZR SEQUENCE C

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
10:48:00	18764	----	----	----	41.38	13	BEGIN INCREASE FLOW
10:48:30	18764	18765	1	2	47.84	17	
10:49:00	18765	18765	0	0	45.72	17	
10:49:30	18765	18765	0	0	46.05	17	INCREASE FLOW
10:50:00	18765	18765	0	0	48.60	20	
10:50:30	18765	18765	0	0	48.80	20	
10:51:00	18765	18765	0	0	48.89	20	INCREASE FLOW
10:51:30	18765	18765	0	0	49.03	22	
10:52:00	18765	18765	0	0	51.29	22	
10:52:30	18765	18765	0	0	51.33	22	
10:53:00	18765	18765	0	0	51.32	22	
10:53:30	18765	18765	0	0	51.50	22	
10:54:00	18765	18765	0	0	51.17	22	
10:54:30	18765	18765	0	0	51.38	22	END
55	No Reading						
				10:55:15	BOTTOM TRANS	22.30	
				10:55:50	TOP TRANS	18.35	

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SR 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-24-13

Boring No. MP-401

Borehole Diameter, In.: 3.8 Total Boring Depth, Ft. 420

Gnd Elev, Ft: 825.7*

Casing Height above ground, Ft. 1.75

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 ZR Test length: 7.5 Test Section Depth (from Datum): From 29.75 To 37.25

(A) Depth to Water Table From Datum, Ft. 12.15

Test Water Temp: 81°F Baro Pressure, psi: 14.37

(B) Surface Gage Height Above Datum, Ft. 1.50

Well Water Temp: 61°F (16.22°C)
Depth to Center of Test Interval From Datum, Ft. 33.50

(C) Distance Water Table to Center of Test Interval Ft. 21.35 Static water pressure at center = $(C*62.4/144) + \text{Baro} =$ 24

MAXIMUM TEST PRESSURE, $P_o = [(A+B*1) + C*0.57]$ $[P_o =$ 26 $]$ Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

P_o Values: 1/3 $P_o =$ 9 ; 2/3 $P_o =$ 17 ; 1/2 $P_o =$ 13 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-401 ZR Sequence No. D Planned Center Pressure: 37

Transducer Readings Before Packers Inflated: Top 17.36 ; Middle 22.99 ; Bottom: 26.81

Transducer Readings After Packers Inflated: Top 18.32 ; Middle 25.08 ; Bottom: 23.52

MP-401 ZR SEQUENCE D

Time, Minutes	FLOWMETER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
10:57:30	18765	----	----	----	51.25	22	BEGIN DECREASE FLOW
10:58:00	18765	18765	0	0	48.30	18	
10:58:30	18765	18765	0	0	46.75	17	
10:59:00	18765	18765	0	0	46.65	17	DECREASE FLOW
10:59:30	18765	18765	0	0	42.03	12	
11:00:00	18765	18765	0	0	42.07	12	
11:00:30	18765	18765	0	0	42.04	12	DECREASE
11:01:00	18765	18765	0	0	39.82	9	
11:01:30	18765	18765	0	0	39.69	9	
11:02:00	18765	18765	0	0	39.68	9	
11:02:30	18765	18765	0	0	39.72	9	
11:03:00	18765	18765	0	0	39.59	9	
11:03:30	18765	18765	0	0	39.54	9	END
11:04:00	No Reading						
				11:04:10	BOTTOM TRANS =		22.20
				11:04:40	TOP TRANS =		18.36

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SJZ 12/13/17

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-13

Boring No. MP-401

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 42.0

Gnd Elev, Ft: 825.7*

Casing Height above ground, Ft. 1.75

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 ZR Test length: 7.5 Test Section Depth (from Datum): From 29.75 To 37.25

(A) Depth to Water Table From Datum, Ft. 12.15

Test Water Temp: 81°F Baro Pressure, psi: 14.37

Well Water Temp: 61°F (16.22°C)

(B) Surface Gage Height Above Datum, Ft. 1.50

Depth to Center of Test Interval From Datum, Ft. 33.50

(C) Distance Water Table to Center of Test Interval Ft. 21.35 Static water pressure at center = (C*62.4/144) + Baro = 24

MAXIMUM TEST PRESSURE, $P_o = ([A+B*1] + C*0.57)$ [$P_o = 26$] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Sequence ID: A B C D E
Po Values: 1/3 $P_o = 9$; 2/3 $P_o = 17$; 1/2 $P_o = 13$ Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-401 ZR Sequence No. E Planned Center Pressure: 50

Transducer Readings Before Packers Inflated: Top 17.36; Middle 22.99; Bottom: 26.81

Transducer Readings After Packers Inflated: Top 18.32; Middle 25.08; Bottom: 23.52

MP-401 ZR SEQUENCE E

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
11:06:30	18765	----	----	----	39.47	9	BEGIN INCREASE FLOW
11:07:00	18765	18765	0	0	44.51	14	
11:07:30	18765	18765	0	0	44.39	14	INCREASE FLOW
11:08:00	18765	18765	0	0	44.52	14	
11:08:30	18765	18765	0	0	46.56	16	
11:09:00	18765	18765	0	0	46.51	16	INCREASE FLOW
11:09:30	18765	18765	0	0	47.64	19	
11:10:00	18765	18765	0	0	48.32	19	
11:10:30	18765	18765	0	0	48.20	19	INCREASE FLOW
11:11:00	18765	18765	0	0	48.63	20	
11:11:30	18765	18765	0	0	49.24	20	
11:12:00	18765	18765	0	0	49.21	20	
11:12:30	18765	18765	0	0	49.19	20	
11:13:00	18765	18765	0	0	49.23	20	
11:13:30	18765	18765	0	0	49.12	20	END
11:14:00	No READING						
				11:14:10	BOTTOM	TRANS	22:11
				11:14:40	TOP	TRANS	18:36

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SR 12/13/13

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

Page 2

BORING: MP-401DATE: 7-19-13 QJL 7-20-13DATA COLLECTED BY: TOM MCGILL / JIM GODDARDSHUT-IN TEST PRESSURE: N/A psiSR 12/13/13

This sheet applies
to all Zone 2 tests
SR 12/13/13

TIME, minute	SURFACE GAGE PRESSURE, psi	CENTER TRANSDUCER PRESSURE, psi
<div style="position: relative; height: 100px;"> <div style="position: absolute; top: 0; left: 0; right: 0; bottom: 0; border: 1px solid black; transform: rotate(45deg); transform-origin: center;"></div> <div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); font-size: 2em;"> NOT USED </div> </div>		

QJL 7-19-13

EQUIPMENT USED

Transducers: Mini Trol Serial Numbers: 335896 (6-12-13)1421421414(6-20-13)Surface Pressure Gage: MW-3, MW-4, MW-5 (6-11-13)

Nitrogen

MW-1, MW-2(6-11-13)Barometric Probe: 121315 (6-12-13)Flow Meter: 8824788 (FIELD 7-8-13)THERMOMETER LT28(5-1-13)Stop Watch: L286 (6-10-13)Date of Calibration: IN PARENTHESISCalibration due: POST TESTING

FILES:

MP-401	Z2	(B)	2013-07-20	11.21.27	WSL
MP-401	Z2	(B)	2013-07-20	11.21.27	EXCEL
MP-401	Z2	(T)	2013-07-20	11.20.23	WSL
MP-401	Z2	(T)	2013-07-20	11.20.23	EXCEL
MP-401	Z2	(M)	2013-07-20	11.16.24	WSL
MP-401	Z2	(M)	2013-07-20	11.16.24	EXCEL
MP-401	Z2	(L)	2013-07-20	11.18.07	WSL
MP-401	Z2	(L)	2013-07-20	11.18.07	EXCEL

Packer Test Worksheet

Clinch River SMR Project
AMEC Project No. 6468 13 1072

Test Date 7/20/2013
 Prepared By J. Goddard
 Checked By *TJA*

Boring Number	MP 401
Zone No.	3
Assigned Interval Top (ft-bgs)	77.00
Assigned Interval Bottom (ft-bgs)	84.50
Center of test interval (ft-bgs)	80.75
Height of Casing (ft ags)	1.75
Depth to water (ft below TOC)	9.51
Depth to Water (Ft- bgs)	7.76
Baro Pressure (psi)	14.36
A= Depth to Water Table (ft)	9.51

B=Surface Gage Height (ft)	1.50
----------------------------	------

C= Height of water above center of test interval (ft)	72.99
---	-------

Static Water Pressure @ center of Interval (psi)	46
--	----

Max Test Pressure (Po) (psi)	53
------------------------------	----

1/3 Po (psi)	18
2/3 Po (psi)	35
1/2 Po (psi)	27

	Center Test Pressures (psi)	Inflation Pressure (psi)
Sequence A 1/3	64	114
Sequence B 2/3	81	131
Sequence C 1.0	99	149
Sequence D 1/2	73	123
Sequence E 1.0	99	149

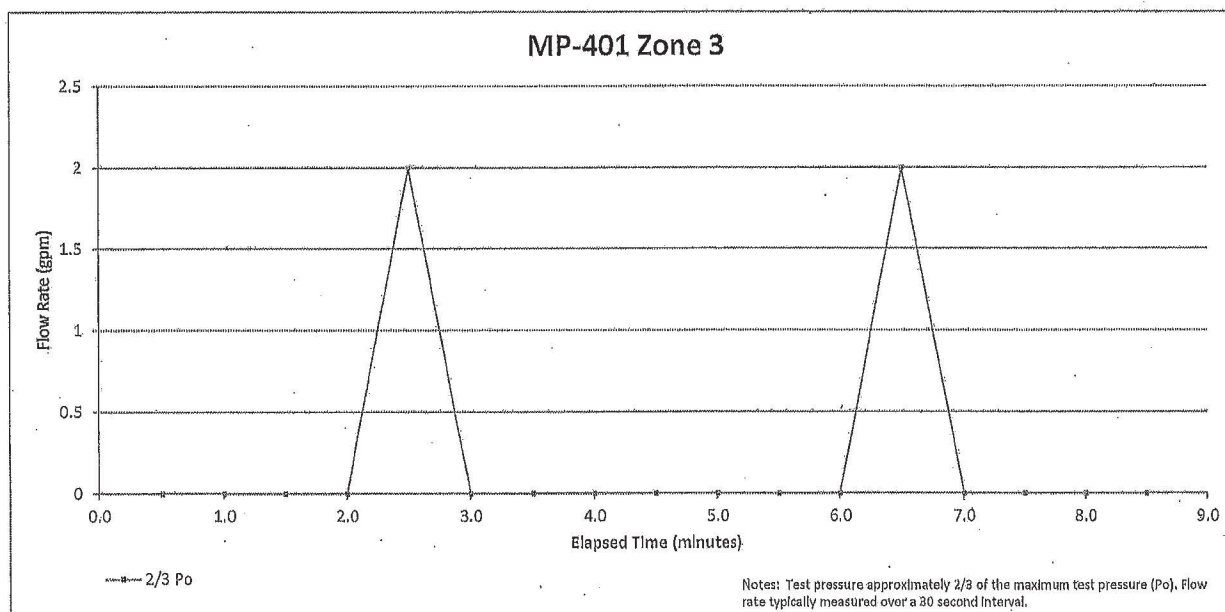
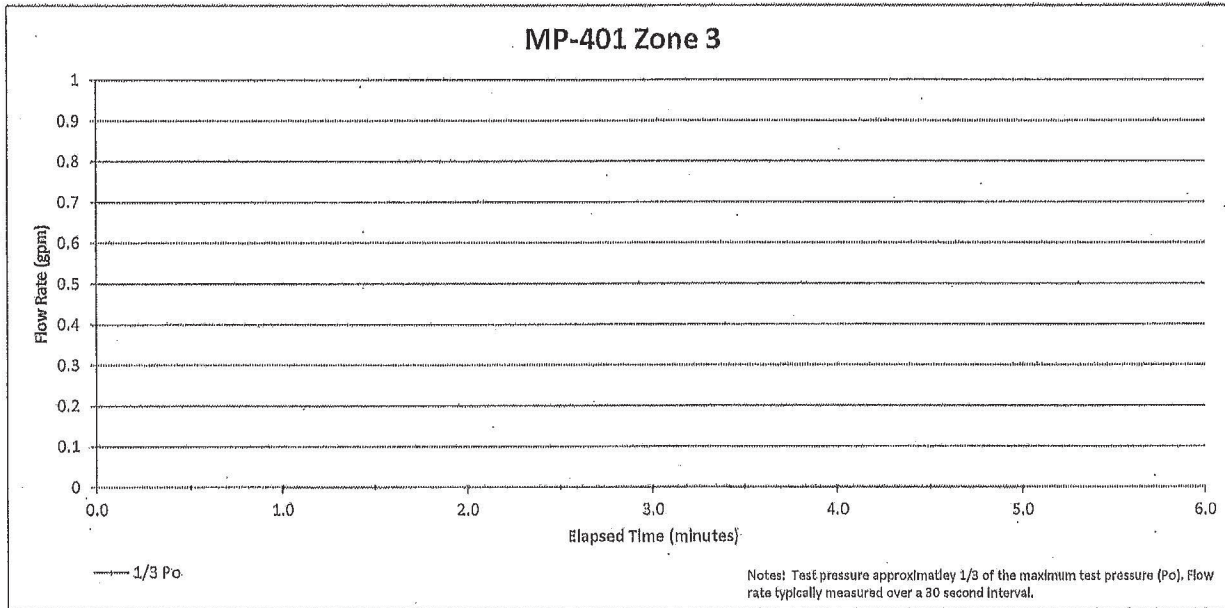
Pipe Check (Estimate Only for Field Guidance))

Length of Packer Assembly	13.29
Average Length of Pipe Section	21.12
Length of pipe to TOC	72.96
Number of Pipe Sections	3.45
length of stickup above TOC (ft)	11.52

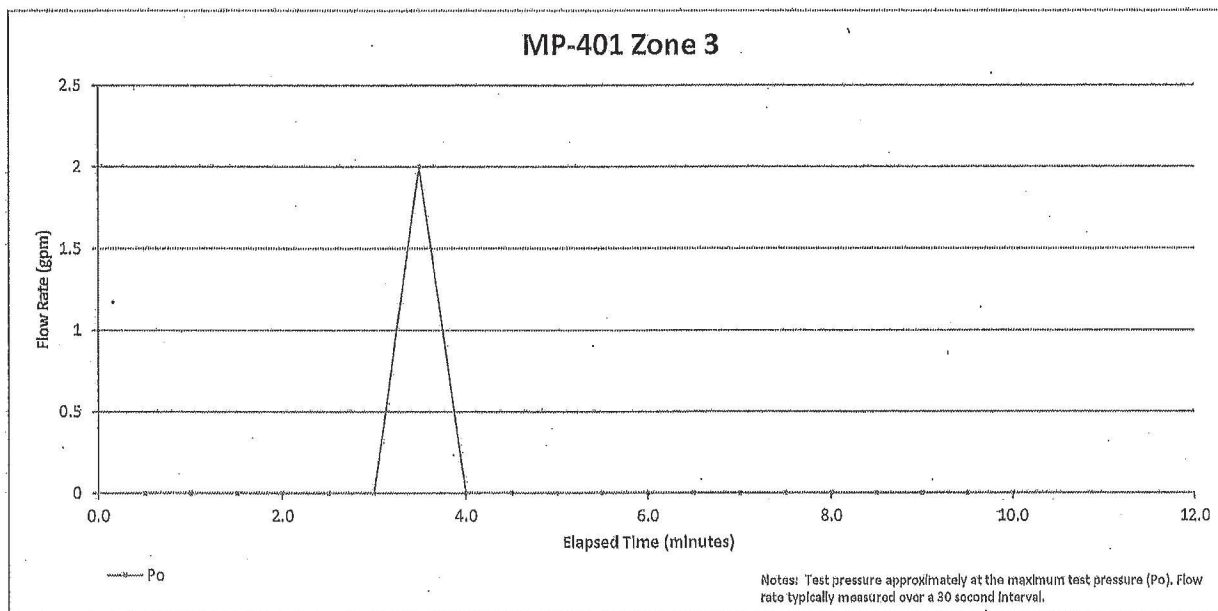
Boring: MP-401
Zone: Z3 77.0 feet to 84.5 feet below ground surface
Transducer Location: Middle

Sequence A (1/3 Po)				Sequence B (2/3 Po)				Sequence C (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
8:20:30	0.0	48.55		8:28:30	0.0	65.63		8:41:30	0.0	80.42	
8:21:00	0.5	49.88	0	8:29:00	0.5	72.42	0	8:42:00	0.5	83.33	0
8:21:30	1.0	65.18	0	8:29:30	1.0	73.78	0	8:42:30	1.0	89.44	0
8:22:00	1.5	65.03	0	8:30:00	1.5	74.49	0	8:43:00	1.5	89.15	0
8:22:30	2.0	65.41	0	8:30:30	2.0	78.68	0	8:43:30	2.0	89.11	0
8:23:00	2.5	65.15	0	8:31:00	2.5	78.52	2	8:44:00	2.5	95.26	0
8:23:30	3.0	65.18	0	8:31:30	3.0	78.80	0	8:44:30	3.0	96.41	0
8:24:00	3.5	65.48	0	8:32:00	3.5	84.03	0	8:45:00	3.5	96.68	0
8:24:30	4.0	65.53	0	8:32:30	4.0	84.06	0	8:45:30	4.0	98.97	0
8:25:00	4.5	65.28	0	8:33:00	4.5	84.04	0	8:46:00	4.5	98.64	0
8:25:30	5.0	65.57	0	8:33:30	5.0	81.14	0	8:46:30	5.0	98.64	0
				8:34:00	5.5	80.96	0	8:47:00	5.5	98.34	0
				8:34:30	6.0	81.11	0	8:47:30	6.0	98.71	0
				8:35:00	6.5	80.80	2	8:48:00	6.5	98.54	0
				8:35:30	7.0	80.62	0	8:48:30	7.0	98.54	0
				8:36:00	7.5	80.77	0				
				8:36:30	8.0	80.62	0				
				8:37:00	8.5	80.55	0				

Sequence D (1/2 Po)				Sequence E (Po)			
Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)	Time	Elapsed Time (minutes)	Pressure (psi)	Flow Rate (gpm)
8:51:30	0.0	97.91		9:03:00	0.0	74.39	
8:52:00	0.5	87.03	0	9:03:30	0.5	83.68	0
8:52:30	1.0	84.19	0	9:04:00	1.0	84.56	0
8:53:00	1.5	no reading		9:04:30	1.5	84.98	0
8:53:30	2.0	84.27	0	9:05:00	2.0	93.28	0
8:54:00	2.5	83.99	0	9:05:30	2.5	91.77	0
8:54:30	3.0	78.42	0	9:06:00	3.0	94.02	0
8:55:00	3.5	78.42	0	9:06:30	3.5	97.10	-2
8:55:30	4.0	78.23	0	9:07:00	4.0	97.04	0
8:56:00	4.5	74.85	0	9:07:30	4.5	95.42	0
8:56:30	5.0	75.08	0	9:08:00	5.0	98.67	0
8:57:00	5.5	75.05	0	9:08:30	5.5	99.09	0
8:57:30	6.0	74.87	0	9:09:00	6.0	99.15	0
8:58:00	6.5	74.86	0	9:09:30	6.5	99.24	0
8:58:30	7.0	75.01	0	9:10:00	7.0	99.00	0
8:59:00	7.5	74.77	0	9:10:30	7.5	98.61	0
8:59:30	8.0	74.60	0	9:11:00	8.0	98.65	0
9:00:00	8.5	75.06	0	9:11:30	8.5	98.66	0
				9:12:00	9.0	98.64	0
				9:12:30	9.5	98.90	0
				9:13:00	10.0	98.91	0



Prepared by/Date: KLR 1/4/14
 Checked by/Date: MS 1/12/14



Prepared by/Date: XAL 1/4/14
Checked by/Date: JDS 1/12/14

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET
AMEC ENVIRONMENTAL & INFRASTRUCTURE, INC.

Page 1 of 2

PROJECT NAME: Clinch River SMR Project

JOB NO. 6468-13-1072

DATE: 7-20-13

Boring No. MP-401

Borehole Diameter, In.: 3.8

Total Boring Depth, Ft. 42.0

Gnd Elev, Ft: 825.7*

Casing Height above ground, Ft: 1.75

Elev. Top of Casing, Ft. (Gnd Elev + Casing Height): 827.45 = Datum

TEST ID: MP-401 Z3 Test length: 7.5 Test Section Depth (from Datum): From 78.75 To 86.25 (Total ± 0.5)

(A) Depth to Water Table From Datum, Ft: 9.51

Test Water Temp: 80°F Baro Pressure, psi: 14.36

Well Water Temp: 74.4°C (55°F)

15.19°C

(B) Surface Gage Height Above Datum, Ft: 1.50

Depth to Center of Test Interval From Datum, Ft: 82.50

QJ, 7-20-13

(C) Distance Water Table to Center of Test Interval Ft: 72.99 Static water pressure at center = $(C*62.4/144) + \text{Baro} =$ 46

MAXIMUM TEST PRESSURE, $P_o = ((A+B*1) + C*0.57)$ [$P_o =$ 53] Test Pressure sequence = 1/3 P_o , 2/3 P_o , P_o , 1/2 P_o , P_o

Sequence ID: A B C D E

P_o Values: 1/3 $P_o =$ 18; 2/3 $P_o =$ 35; 1/2 $P_o =$ 27 Add Appropriate P_o value to static pressure at center of test interval

TEST NO. MP-401 Z3 Sequence No. A Planned Center Pressure: 64

Transducer Readings Before Packers Inflated: Top 19.74; Middle 45.31; Bottom: 49.11

Transducer Readings After Packers Inflated: Top 19.80; Middle 48.59; Bottom: 44.48

MP-401 Z3 SEQUENCE A

Time, Minutes	FLOW METER READING, Gallons			FLOW, gpm	Middle Transducer Reading, psi	Surface Gage Pressure, psi	REMARKS
	Initial	Final	Difference				
08:20:30	18764	---	---	---	48.55	0	BEGIN INCREASE FLOW
08:21:00	18764	18764	0	0	49.88	15	
08:21:30	18764	18764	0	0	65.18	15	
08:22:00	18764	18764	0	0	65.03	15	DECREASE FLOW
08:22:30	18764	18764	0	0	65.41	15	
08:23:00	18764	18764	0	0	65.15	15	
08:23:30	18764	18764	0	0	65.18	15	QJ, 7-20-13
08:24:00	18764	18764	0	0	65.48	15	
08:24:30	18764	18764	0	0	65.53	15	
08:25:00	18764	18764	0	0	65.28	15	
08:25:30	18764	18764	0	0	65.57	15	END
				08:26:24	BOTTOM	TRANS	44.13
				27:00			
				08:26:27	TOP	TRANS	19.80

*From Preliminary Boring Layout Survey

Form Approved for Use on Clinch River SMR Project - J. A. Tice, Technical Lead

Form Rev 0 - Reviewed by SSC 12/13/13