

**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT: GEOPRO, INC.	TERRACON JOB #: 02096303.0001
SAMPLE GEOPRO'S THERMAL GROUT LITE 0.57	DATE: 2/16/2009
ID:	Durham Perm Cell
DESCR.: BENTONITE ("THERMAL GROUT LITE"): 22.65%	BURETTE Area 0.317 cm ²
SAND (SHORT MOUNTAIN GLASS): 22.65% DEIONIZED WATER: 54.71%	

INITIAL	
MOISTURE%	DENSITY
W & T, g	WET WT, g 99.8
D & T, g	DIA, in 2.424 6.16 cm
T, g	HT, in 0.998 2.54 cm
	AREA 29.77 cm ²
MOIST-URE, %	DENSITY: 82.6 PCF WET
	DENSITY: PCF DRY

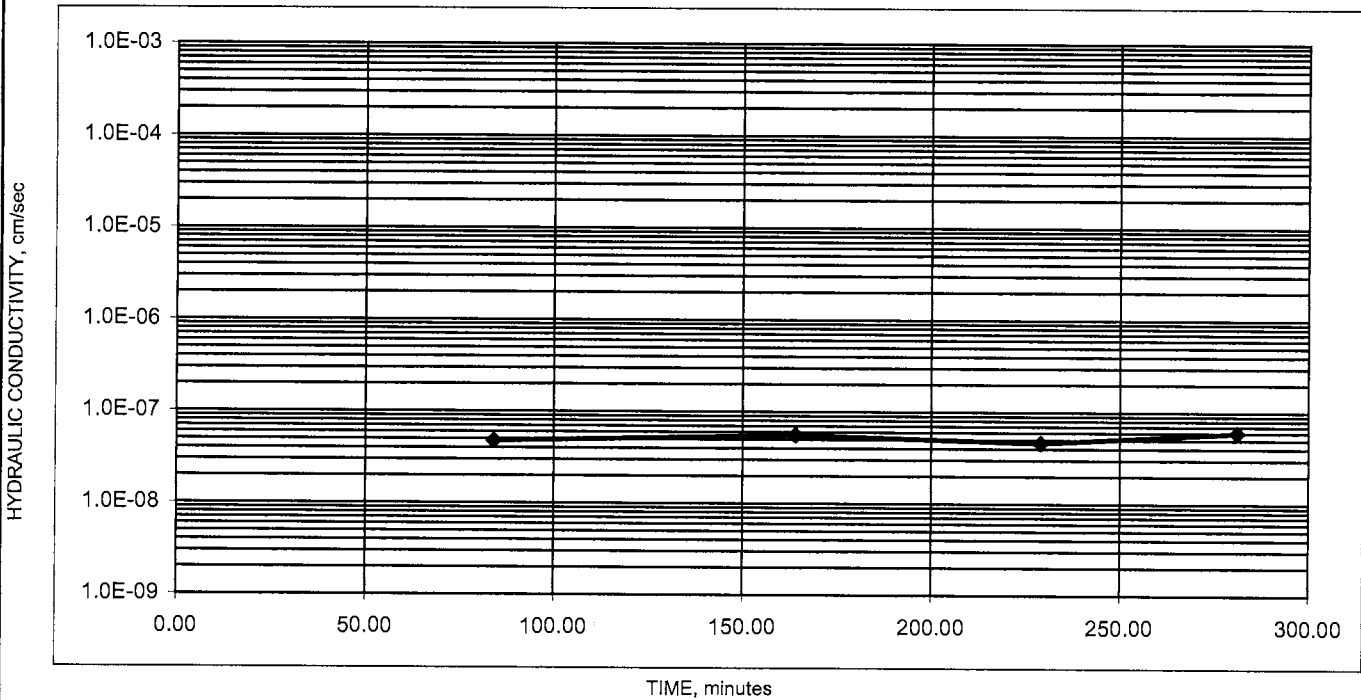
SPECIFIC GRAVITY: 2.70	REMOLDED?: YES
SPECIFIC GRAVITY: ASSUMED	PROCTOR, pcf: NA
POROSITY, %: NA	OPTIMUM, %: NA
SATURATION, %: NA	COMPACTION, %: NA
VOID RATIO: NA	OVER OPTIMUM, %: NA

SATURATION:	LATERAL PRESS.: 105.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi
TEST:	LATERAL PRESS.: 105.0 psi	UPPER: 100.0 psi LOWER: 100.0 psi
		BIAS PRESSURE (=LOWER-UPPER) 0.0 psi

Upper cm ³	Lower cm ³	ELAPSED	DELTA	Ln H1/H2	HYD CON k, cm/sec	OUT	IN	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
		TIME, min	H cm			FLOW cm ³	FLOW cm ³					
10.5	64.0	0.00	53.5									
11.0	63.4	84.00	52.4	0.020775	4.76E-08	0.5	0.6	0.83	20.7	9	26.1	0.855
11.6	62.8	164.00	51.2	0.023167	5.56E-08	0.6	0.6	1.00	20.2	6	26.2	0.853
12.0	62.4	229.00	50.4	0.015748	4.63E-08	0.4	0.4	1.00	19.9	11	26.3	0.850
12.4	62.0	281.00	49.6	0.016000	5.99E-08	0.4	0.4	1.00	19.6	14	25.7	0.865

HYDRAULIC CONDUCTIVITY (k) = **AVERAGE 5.2E-08 cm/sec**

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	1.0E-05 TO 1.0E-06	10	<1.25	HYD	OR
	1.0E-06 TO 1.0E-07	20		GRAD	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8



**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
 USING A FLEXIBLE WALL PERMEAMETER
 ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
 FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT: GEOPRO, INC.

TERRACON JOB #: 02096303.0002
 DATE: 2/16/2009

SAMPLE GEOPRO'S THERMAL GROUT LITE 0.88

ID:

DESCR.: BENTONITE ("THERMAL GROUT LITE"): 12.63%
 SAND (SHORT MOUNTAIN GLASS): 50.53% DEIONIZED WATER: 36.83%

Durham Perm Cell
 BURETTE Area 0.317 cm²

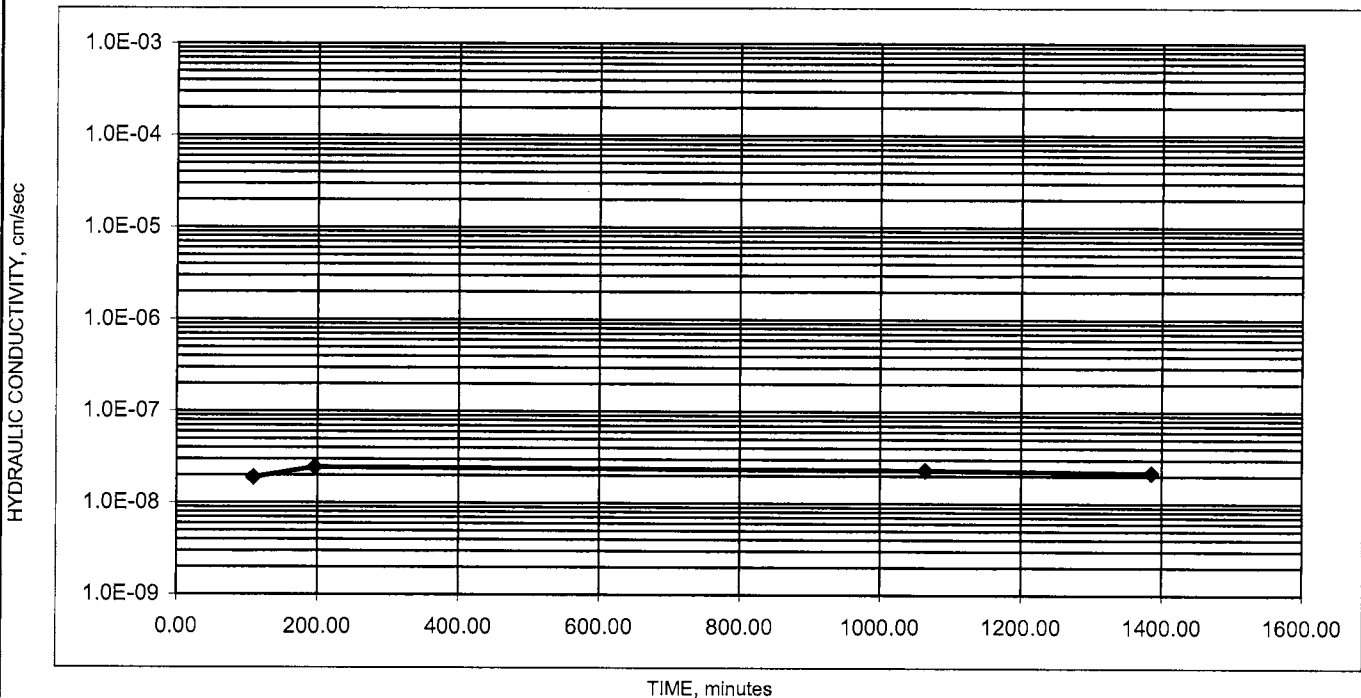
MOISTURE%		INITIAL DENSITY			SPECIFIC GRAVITY:		REMOVED?:	
W & T, g	WET WT, g	123.1			2.70	YES		
D & T, g	DIA, in	2.425	6.16	cm	SPECIFIC GRAVITY: ASSUMED	PROCTOR, pcf:	NA	
T, g	HT, in	0.998	2.54	cm	POROSITY, %:	OPTIMUM, %:	NA	
	AREA		29.79	cm ²	SATURATION, %:	COMPACTION, %:	NA	
MOIST-URE, %	DENSITY:	101.7	PCF WET		VOID RATIO:	OVER OPTIMUM, %:	NA	
	DENSITY:		PCF DRY					

SATURATION:	LATERAL PRESS.:	105.0	psi	BACK PRESSURE (=UPPER=LOWER):	100.0	psi
TEST:	LATERAL PRESS.:	105.0	psi	UPPER:	100.0	psi
				LOWER:	100.0	psi
				BIAS PRESSURE (=LOWER-UPPER)	0.0	psi

Upper cm ³	Lower cm ³	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
9.0	64.8	0.00	55.8									
9.3	64.5	109.00	55.2	0.010811	1.90E-08	0.3	0.3	1.00	21.8	14	26.3	0.850
9.6	64.2	196.00	54.6	0.010929	2.44E-08	0.3	0.3	1.00	21.5	11	25.7	0.865
12.3	61.7	1064.00	49.4	0.100083	2.30E-08	2.7	2.5	1.08	19.5	4	24.8	0.887
13.2	60.9	1385.00	47.7	0.035019	2.16E-08	0.9	0.8	1.12	18.8	2	25.0	0.882

HYDRAULIC CONDUCTIVITY (k) = **AVERAGE 2.2E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-05	1.0E-04 TO 1.0E-06	1.0E-05 TO 1.0E-07	less than 1.0E-07	2	5	10	20	30	0.75<	30	% < 25 AT	> 1.0E-8	OR	% < 50 AT	< 1.0E-8
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**MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAERED TAP WATER WITH 0.005 N CaSO4**

PROJECT: GEOPRO, INC.	TERRACON JOB #: 02096303.0005
SAMPLE GEOPRO'S THERMAL GROUT LITE 1.00	DATE: 2/19/2009
ID:	Durham Perm Cell
DESCR.: BENTONITE ("THERMAL GROUT LITE"): 11.01%	BURETTE Area 0.317 cm ²
SAND (SHORT MOUNTAIN GLASS): 55.05% DEIONIZED WATER: 33.94%	

MOISTURE%		DENSITY		SPECIFIC GRAVITY:		REMOVED?:	
W & T, g	WET WT, g	126.7		2.70	YES		
D & T, g	DIA, in	2.419	6.14	ASSUMED	PROCTOR, pcf:	NA	
T, g	HT, in	0.992	2.52	NA	OPTIMUM, %:	NA	
	AREA		29.65	NA	COMPACTION, %:	NA	
			cm ²	NA	OVER OPTIMUM, %:	NA	
MOIST-URE, %	DENSITY:	105.9	PCF WET	VOID RATIO:	NA		
	DENSITY:		PCF DRY				

SATURATION:	LATERAL PRESS.:	105.0	psi	BACK PRESSURE (=UPPER=LOWER):	100.0	psi
TEST:	LATERAL PRESS.:	105.0	psi	UPPER:	100.0	psi
				LOWER:	100.0	psi
				BIAS PRESSURE (=LOWER-UPPER)	0.0	psi

Upper cm ³	Lower cm ³	ELAPSED TIME min	DELTA H cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
8.1	65.1	0.00	57.0									
8.4	64.8	98.00	56.4	0.010582	2.14E-08	0.3	0.3	1.00	22.4	7	25.0	0.882
8.8	64.4	218.00	55.6	0.014286	2.36E-08	0.4	0.4	1.00	22.1	18	25.0	0.882
9.0	64.2	303.00	55.2	0.007220	1.67E-08	0.2	0.2	1.00	21.9	16	25.2	0.877
9.2	64.0	381.00	54.8	0.007273	1.83E-08	0.2	0.2	1.00	21.7	8	25.3	0.875

HYDRAULIC CONDUCTIVITY (k) = **AVERAGE 2.0E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-04	2	0.75 <	30	% < 25 AT
	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
	1.0E-05 TO 1.0E-06	10	<1.25	HYD	OR
	1.0E-06 TO 1.0E-07	20		GRAD	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8

