

**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 DISTILLED WATER WITH 35 g/liter OCEAN SALT**

PROJECT NAME: GEOPRO, INC.	PROJECT NUMBER: 02156304.0006
SAMPLE ID: GeoPro's Thermal Grout with Type II Portland Cement 40 Thermal Grout w/ Type II Portland (CG Plus) - 25.00% DEIONIZED WATER - 75.00%	DATE: 9/18/2015
Sample tested after a 28 day curing period within a salt water bath.	PANEL IDENTIFICATION: Lenexa Perm Board BURETTE AREA: 0.312 cm <sup>2</sup> BURETTE INCREMENT LENGTH: 1.000 cm VOLUME PER INCREMENT: 0.312 cm <sup>3</sup>

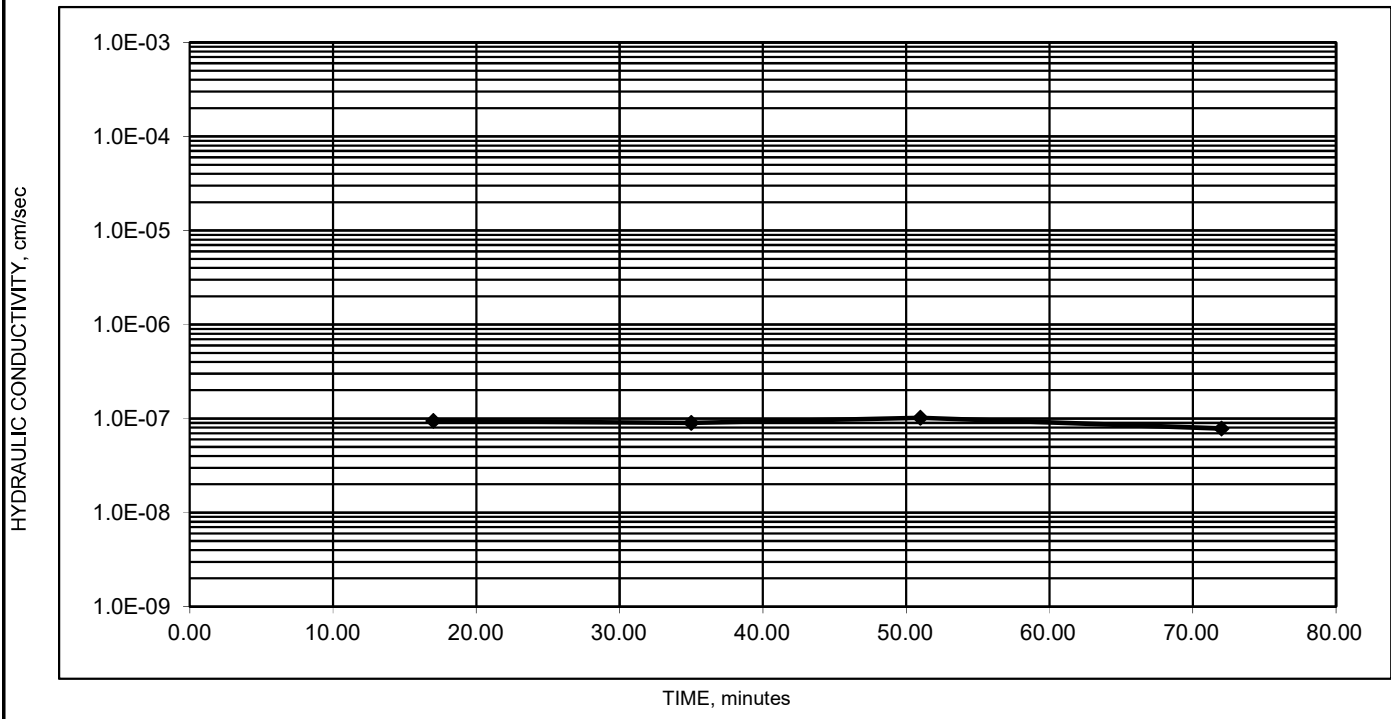
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	88.7		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.424	6.16	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	1.003	2.55	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.77	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	73.0	PCF WET				
NA	DENSITY:	NA	PCF DRY				

<b>SATURATION:</b>	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
<b>DURING TEST:</b>	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
		BIAS PRESSURE (=H1-H2) 0.0 psi	

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm <sup>3</sup>	IN FLOW cm <sup>3</sup>	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
11.8	63.1	0.00	51.3									
12.0	62.9	17.00	50.9	0.007828	9.44E-08	0.06	0.06	1.00	20.0	4	23.5	0.920
12.2	62.7	35.00	50.5	0.007890	8.98E-08	0.06	0.06	1.00	19.8	1	23.5	0.920
12.4	62.5	51.00	50.1	0.007952	1.02E-07	0.06	0.06	1.00	19.7	12	23.4	0.923
12.6	62.3	72.00	49.7	0.008016	7.82E-08	0.06	0.06	1.00	19.5	14	23.5	0.920

HYDRAULIC CONDUCTIVITY (k<sub>20</sub>) = **AVERAGE 9.1E-08 cm/sec**

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



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ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL  
FLUID: DEAIRED DISTILLED WATER WITH 35 g/liter OCEAN SALT**

PROJECT NAME: GEOPRO, INC.	PROJECT NUMBER: 02156304.0026
SAMPLE ID: GeoPro's Thermal Grout with Type II Portland Cement 120 Thermal Grout w/ Type II Portland (CG Plus) - 22.80% PowerTEC - 9.90% DEIONIZED WATER - 67.27% Sample tested after a 28 day curing period within a salt water bath.	DATE: 6/8/2017
	PANEL IDENTIFICATION: Lenexa Perm Board
	BURETTE AREA: 0.312 cm <sup>2</sup>
	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm <sup>3</sup>

INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	92.6		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.418	6.14	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.994	2.52	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.63	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	77.3	PCF WET				
NA	DENSITY:	NA	PCF DRY				

<b>SATURATION:</b>	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
<b>DURING TEST:</b>	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
		BIAS PRESSURE (=H1-H2) 0.0 psi	

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm <sup>3</sup>	IN FLOW cm <sup>3</sup>	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
11.0	63.4	0.00	52.4									
11.8	62.7	57.00	50.9	0.029044	1.04E-07	0.25	0.22	1.14	20.2	6	23.3	0.925
12.5	61.9	127.00	49.4	0.029912	8.76E-08	0.22	0.25	0.87	19.6	11	23.3	0.925
13.8	60.8	226.00	47.0	0.049803	1.03E-07	0.41	0.34	1.18	18.6	5	23.2	0.927
22.2	52.8	1125.00	30.6	0.429148	9.83E-08	2.62	2.50	1.05	12.1	0	23.1	0.929

HYDRAULIC CONDUCTIVITY (k<sub>20</sub>) = **AVERAGE 9.8E-08 cm/sec**

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

