

**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 NAME: GEOPRO, INC.	PROJECT NUMBER: 02126306.0009
LOCATION:	DATE: 3/1/2012
SAMPLE ID: GEOPRO'S POWER TEC 88 W/ TG LITE BENTONITE(Thermal Grout Lite) - 21.80% POWER TEC - 10.90% DEIONIZED WATER - 67.30%	PANEL IDENTIFICATION: Lenexa Perm Board BURETTE AREA: 0.312 cm ² BURETTE INCREMENT LENGTH: 1.000 cm VOLUME PER INCREMENT: 0.312 cm ³

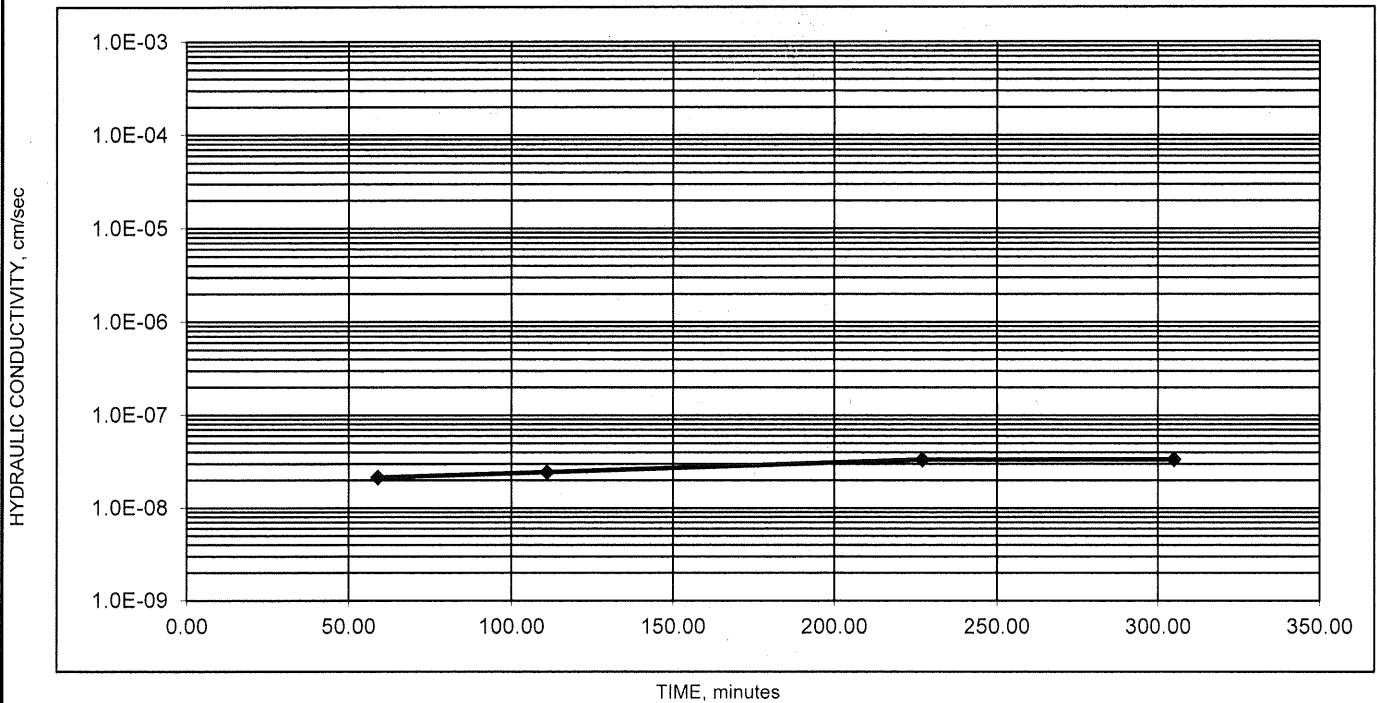
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	91.6		SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.422	6.15 cm	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.999	2.54 cm	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.72 cm ²	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST- URE, %	DENSITY:	75.9	PCF WET				
NA	DENSITY:	NA	PCF DRY				

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
DURING TEST:	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 ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP. C	TEMP. CORR.:
8.7	40.3	0.00	31.6									
8.8	40.2	59.00	31.4	0.006349	2.14E-08	0.03	0.03	1.00	12.4	24	24.6	0.897
8.9	40.1	111.00	31.2	0.006390	2.44E-08	0.03	0.03	1.00	12.3	13	24.7	0.895
9.2	39.8	227.00	30.6	0.019418	3.34E-08	0.09	0.09	1.00	12.1	18	24.6	0.897
9.4	39.6	305.00	30.2	0.013158	3.36E-08	0.06	0.06	1.00	11.9	19	24.6	0.897

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 2.8E-08 cm/sec**

MAXIMUM HYDRAULIC GRADIENT	1.0E-03 TO 1.0E-07	1.0E-04 TO 1.0E-07	2	0.75<	30	% < 25 AT
			5	RATIO	MAX	> 1.0E-8
			10	<1.25	HYDRAULIC	OR
			20		GRADIENT	% < 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 TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GEOPRO, INC.	PROJECT NUMBER: 02126306.0010
LOCATION:	DATE: 3/1/2012
SAMPLE ID: GEOPRO'S POWER TEC 100 W/ TG LITE BENTONITE(Thermal Grout Lite) - 23.10% POWER TEC - 11.55% DEIONIZED WATER - 65.35%	PANEL IDENTIFICATION: Lenexa Perm Board BURETTE AREA: 0.312 cm ² BURETTE INCREMENT LENGTH: 1.000 cm VOLUME PER INCREMENT: 0.312 cm ³

INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	91.9		SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.425	6.16 cm	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.997	2.53 cm	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA	29.80 cm ²		VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST- URE, %	DENSITY:	76.0	PCF WET				
NA	DENSITY:	NA	PCF DRY				

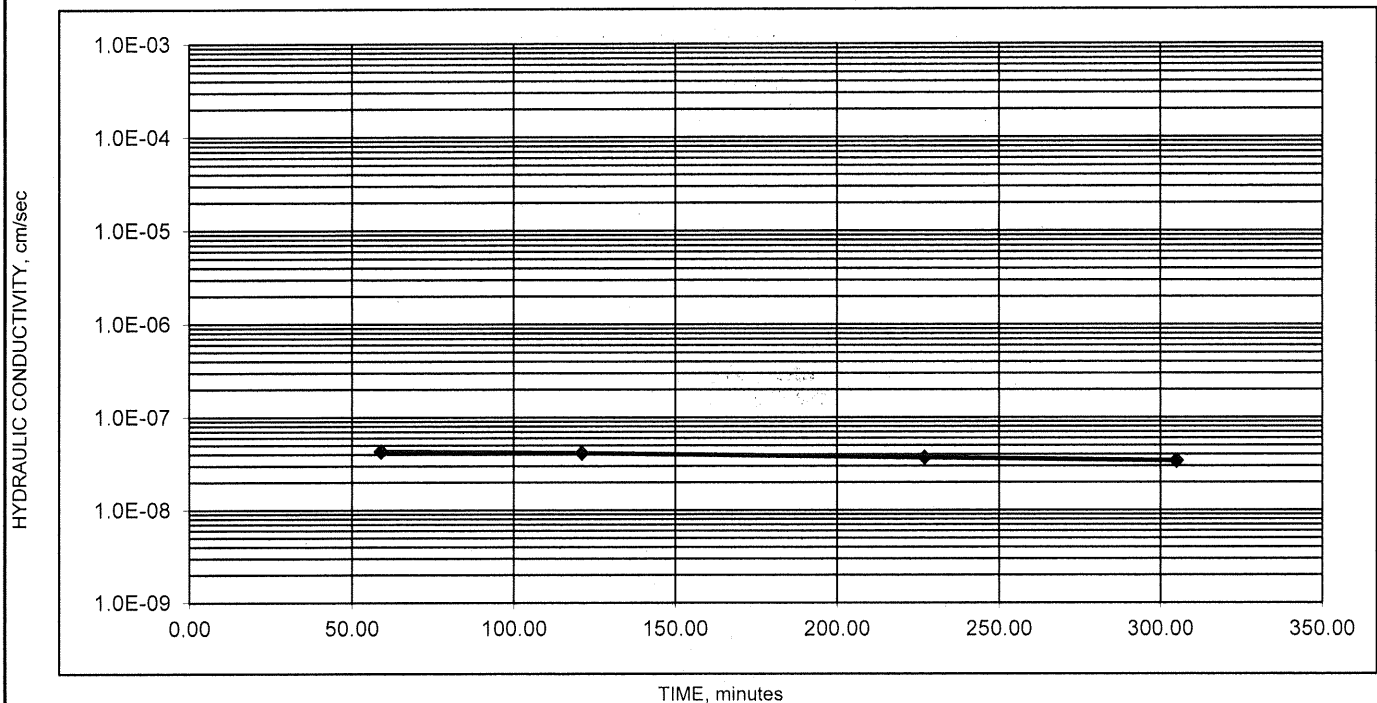
SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi
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DURING TEST:	LATERAL PRESS.: 104.0 psi	H2: 100.0 psi	H1: 100.0 psi
	BIAS PRESSURE (=H1-H2) 0.0 psi		

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H, cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP. C	TEMP. CORR.:
7.3	38.8	0.00	31.5									
7.5	38.6	59.00	31.1	0.012780	4.30E-08	0.06	0.06	1.00	12.3	11	24.6	0.897
7.7	38.4	121.00	30.7	0.012945	4.14E-08	0.06	0.06	1.00	12.1	6	24.7	0.895
8.0	38.1	227.00	30.1	0.019737	3.70E-08	0.09	0.09	1.00	11.9	5	24.6	0.897
8.2	37.9	305.00	29.7	0.013378	3.40E-08	0.06	0.06	1.00	11.7	12	24.6	0.897

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 3.9E-08 cm/sec**

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



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FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GEOPRO, INC.	PROJECT NUMBER: 02126306.0011
LOCATION:	DATE: 3/1/2012
SAMPLE ID: GEOPRO'S POWER TEC 120 W/ TG SELECT	PANEL IDENTIFICATION: Lenexa Perm Board
BENTONITE(Thermal Grout Select) - 25.00%	BURETTE AREA: 0.312 cm ²
POWER TEC - 12.50%	BURETTE INCREMENT LENGTH: 1.000 cm
DEIONIZED WATER - 62.50%	VOLUME PER INCREMENT: 0.312 cm ³

INITIAL					ADDITIONAL DATA			
MOISTURE%	DENSITY				SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	98.9			SPECIFIC GRAVITY: ASSUMED		PROCTOR, pcf:	NA
D & T, g	DIA, in	2.415	6.13	cm	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	1.000	2.54	cm	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA	29.55		cm ²	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	82.3	PCF WET					
NA	DENSITY:	NA	PCF DRY					

SATURATION:	LATERAL PRESS.: 104.0 psi	BACK PRESSURE (=UPPER=LOWER): 100.0 psi	
DURING TEST:	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 ³	IN FLOW cm ³	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP. C	TEMP. CORR.:
9.5	65.5	0.00	56.0									
9.8	65.2	61.00	55.4	0.010772	3.51E-08	0.09	0.09	1.00	21.8	1	25.0	0.889
10.4	64.6	174.00	54.2	0.021899	3.85E-08	0.19	0.19	1.00	21.3	10	25.0	0.889
10.6	64.4	225.00	53.8	0.007407	2.89E-08	0.06	0.06	1.00	21.2	17	25.0	0.889
11.0	64.0	305.00	53.0	0.014982	3.72E-08	0.12	0.12	1.00	20.9	6	25.1	0.887

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 3.5E-08 cm/sec**

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

