

**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. - 2016 Laboratory Testing	PROJECT NUMBER: 02156304.0013
SAMPLE ID: GeoPro's TG Lite 45	DATE: 8/10/2016
BENTONITE - 30.00%	PANEL IDENTIFICATION: Lenexa Perm Board
DEIONIZED WATER - 70.00%	BURETTE AREA: 0.312 cm ²
	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm ³

Sample tested after a 24 hour curing period.

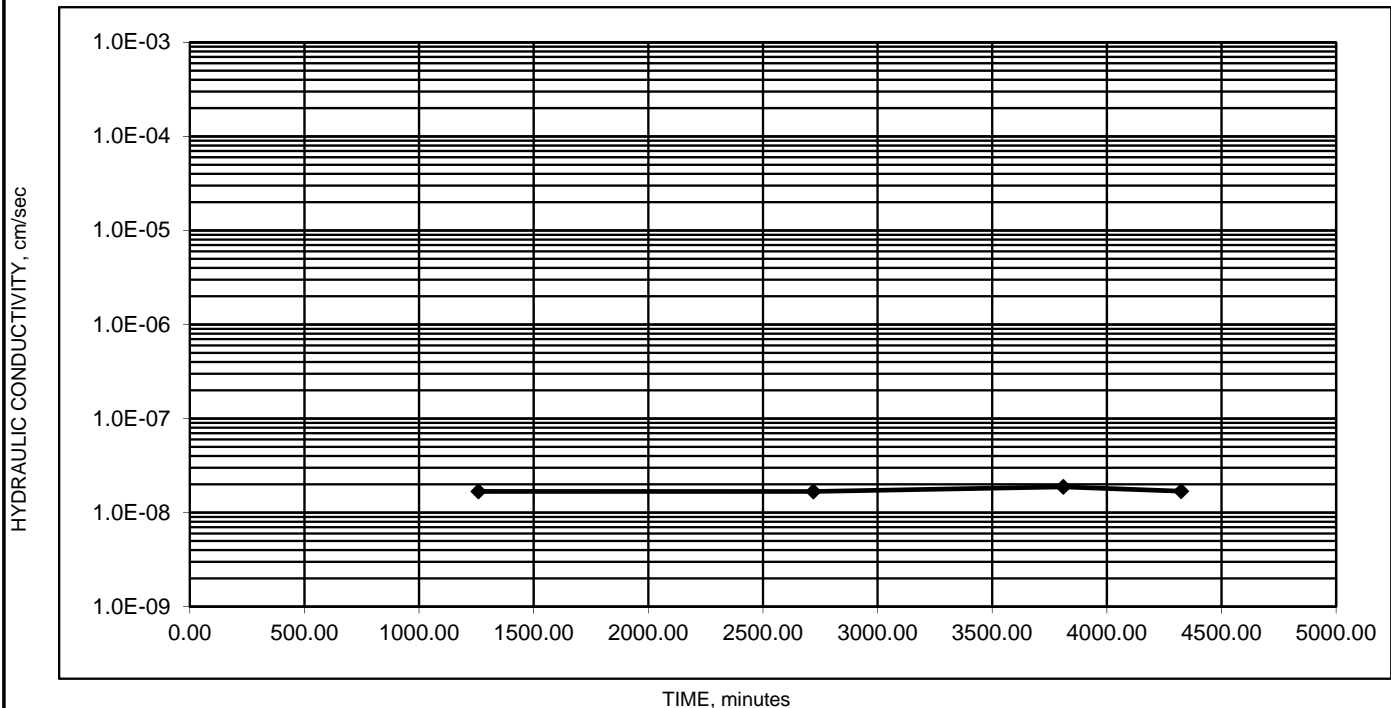
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	90.9		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.421	6.15	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.999	2.54	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.70	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	75.3	PCF WET				
	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.:
8.9	65.5	0.00	56.6									
12.0	63.0	1259.00	51.0	0.104183	1.68E-08	0.97	0.78	1.24	20.1	3	23.8	0.914
15.2	60.4	2720.00	45.2	0.120729	1.68E-08	1.00	0.81	1.23	17.8	3	23.8	0.914
17.5	58.5	3810.00	41.0	0.097525	1.88E-08	0.72	0.59	1.21	16.2	8	22.4	0.944
18.4	57.7	4324.00	39.3	0.042348	1.69E-08	0.28	0.25	1.13	15.5	2	23.4	0.923

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 1.7E-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 TAP WATER WITH 0.005 N CaSO4**

PROJECT NAME: GeoPro, Inc. - 2016 Laboratory Testing	PROJECT NUMBER: 02156304.0014
SAMPLE ID: GeoPro's TG Select 45	DATE: 8/10/2016
BENTONITE - 30.00%	PANEL IDENTIFICATION: Lenexa Perm Board
DEIONIZED WATER - 70.00%	BURETTE AREA: 0.312 cm ²
	BURETTE INCREMENT LENGTH: 1.000 cm
	VOLUME PER INCREMENT: 0.312 cm ³

Sample tested after a 24 hour curing period.

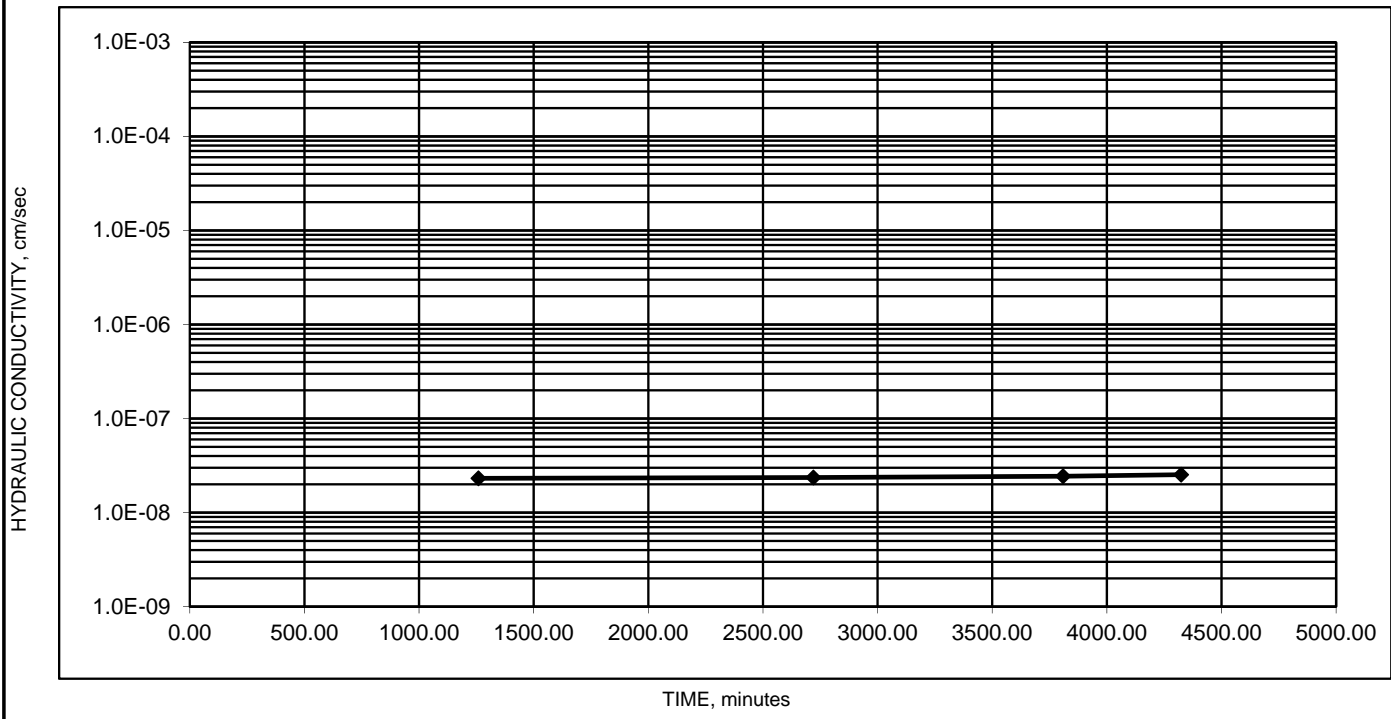
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	92.1		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.421	6.15	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	1.004	2.55	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.70	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	75.9	PCF WET				
	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.:
9.7	65.2	0.00	55.5									
13.3	61.4	1259.00	48.1	0.143101	2.32E-08	1.12	1.19	0.95	18.9	4	23.9	0.912
17.0	57.6	2720.00	40.6	0.169514	2.36E-08	1.16	1.19	0.97	15.9	2	23.9	0.912
19.5	55.3	3809.00	35.8	0.125820	2.44E-08	0.78	0.72	1.09	14.0	1	22.4	0.944
20.6	54.2	4324.00	33.6	0.063422	2.53E-08	0.34	0.34	1.00	13.2	5	23.5	0.920

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 2.4E-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	OR
	1.0E-06 TO 1.0E-07	20		GRADIENT	% < 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 NAME: GeoPro, Inc. - 2016 Laboratory Testing	PROJECT NUMBER: 02156304.0016
SAMPLE ID: GeoPro's TG Lite / PTECx 107	DATE: 8/10/2016
BENTONITE - 23.80%	PANEL IDENTIFICATION: Lenexa Perm Board
PowerTECx - 4.76%	BURETTE AREA: 0.312 cm ²
DEIONIZED WATER - 70.36%	BURETTE INCREMENT LENGTH: 1.000 cm
Sample tested after a 24 hour curing period.	VOLUME PER INCREMENT: 0.312 cm ³

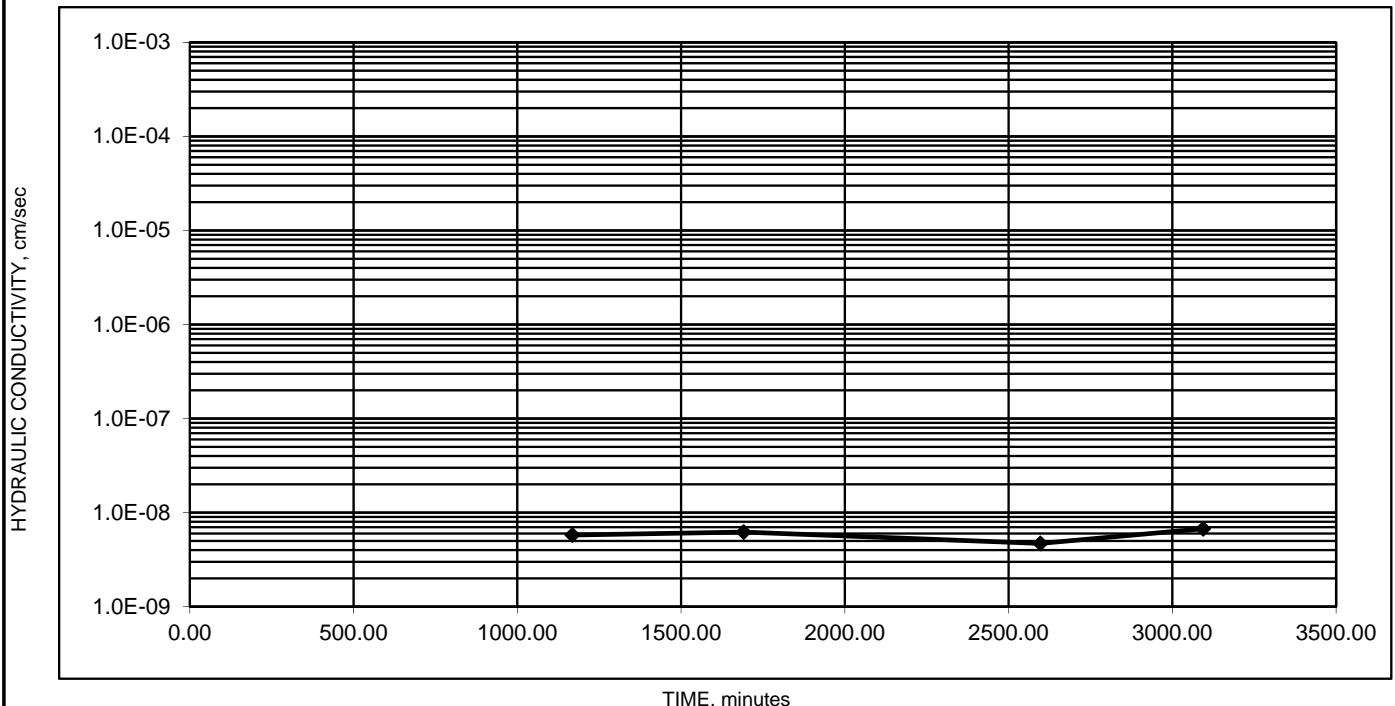
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	91.6		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.426	6.16	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.998	2.53	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA	29.82	cm ²	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	75.6	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.:
10.1	67.1	0.00	57.0									
10.9	66.1	1168.00	55.2	0.032088	5.78E-09	0.25	0.31	0.80	21.8	1	22.1	0.951
11.3	65.6	1691.00	54.3	0.016439	6.21E-09	0.12	0.16	0.80	21.4	6	24.8	0.893
11.8	65.0	2597.00	53.2	0.020466	4.71E-09	0.16	0.19	0.83	21.0	20	22.5	0.942
12.2	64.5	3094.00	52.3	0.017062	6.74E-09	0.12	0.16	0.80	20.6	15	25.1	0.887

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 5.9E-09 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



**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. - 2016 Laboratory Testing	PROJECT NUMBER: 02156304.0017
SAMPLE ID: GeoPro's TG Lite / PTECx 120	DATE: 8/10/2016
BENTONITE - 25.30%	PANEL IDENTIFICATION: Lenexa Perm Board
PowerTECx - 5.06%	BURETTE AREA: 0.312 cm ²
DEIONIZED WATER - 69.64%	BURETTE INCREMENT LENGTH: 1.000 cm
Sample tested after a 24 hour curing period.	VOLUME PER INCREMENT: 0.312 cm ³

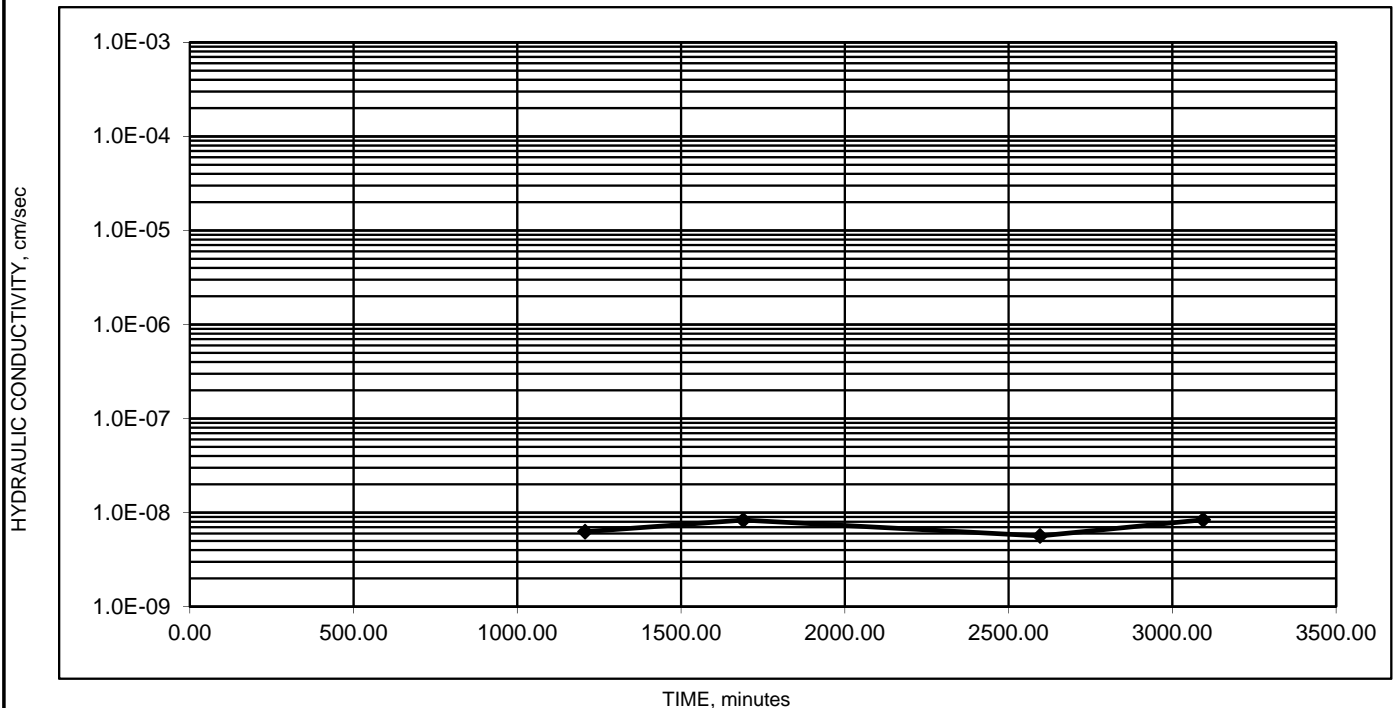
INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	90.7		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.421	6.15	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	1.000	2.54	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA		29.70	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	75.1	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.:
10.6	67.4	0.00	56.8									
11.5	66.3	1207.00	54.8	0.035846	6.27E-09	0.28	0.34	0.82	21.6	12	22.2	0.949
12.0	65.7	1690.00	53.7	0.020277	8.33E-09	0.16	0.19	0.83	21.1	16	24.9	0.891
12.6	65.0	2596.00	52.4	0.024506	5.66E-09	0.19	0.22	0.86	20.6	21	22.6	0.940
13.1	64.4	3094.00	51.3	0.021216	8.39E-09	0.16	0.19	0.83	20.2	17	25.2	0.885

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 7.2E-09 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



**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. - 2016 Laboratory Testing	PROJECT NUMBER: 02156304.0019
SAMPLE ID: GeoPro's TG Select / PTECx 140	DATE: 8/10/2016
BENTONITE - 22.80%	PANEL IDENTIFICATION: Lenexa Perm Board
PowerTECx - 6.84%	BURETTE AREA: 0.312 cm ²
DEIONIZED WATER - 70.36%	BURETTE INCREMENT LENGTH: 1.000 cm
Sample tested after a 24 hour curing period.	VOLUME PER INCREMENT: 0.312 cm ³

INITIAL				ADDITIONAL DATA			
MOISTURE%	DENSITY			SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	YES
W & T, g	WET WT, g	91.8		SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
D & T, g	DIA, in	2.424	6.16	POROSITY, %:	NA	OPTIMUM, %:	NA
T, g	HT, in	0.996	2.53	SATURATION, %:	NA	COMPACTION, %:	NA
	AREA	29.77	cm ²	VOID RATIO:	NA	OVER OPTIMUM, %:	NA
MOIST-URE, %	DENSITY:	76.1	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.:
8.6	66.8	0.00	58.2									
9.0	66.3	411.00	57.3	0.015585	7.86E-09	0.12	0.16	0.80	22.7	17	22.7	0.938
9.7	65.5	1341.00	55.8	0.026527	5.91E-09	0.22	0.25	0.88	22.1	12	22.7	0.938
10.1	65.0	1880.00	54.9	0.016261	5.97E-09	0.12	0.16	0.80	21.7	11	24.7	0.895
10.9	64.1	2791.00	53.2	0.031455	7.16E-09	0.25	0.28	0.89	21.0	6	22.7	0.938

HYDRAULIC CONDUCTIVITY (k₂₀) = **AVERAGE 6.7E-09 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

