



UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
ATOMIC SAFETY AND LICENSING BOARD

In the Matter of  
  
CROW BUTTE RESOURCES, INC.  
  
(Marsland Expansion Area)

Docket No. 40-8943-MLA-2  
  
ASLBP No. 13-926-01-MLA-BD01

Hearing Exhibit

Exhibit Number:

Exhibit Title:

Analysis of K results				
Formation	Geomean of K (cm/sec)	STD	Coeff of Variation	# of Samples
Arikaree	1.4E-04	9.3E-04	6.69	10
Brule	8.9E-05	6.1E-05	0.69	13
Upper Chadron	5.1E-05	8.2E-06	0.16	3
Middle Chadron	2.2E-05	8.3E-06	0.37	2
Upper + Middle Chadron	3.7E-05	1.7E-05	0.47	5
Basal Sandstone	7.5E-05	N/A	N/A	1
Pierre	2.5E-06	1.3E-06	0.54	7

Note:

While values have been calculated for the Pierre Shale using Kozeny-Carman, those values are not valid due to high levels of clay present and have not been included in the application.

Porosity	0.438	
Kozeny-Carman Coeff	4.8 Range 4.5 to 5.1	
Shape Factor	6.5 Range 6 to 8.4	Rounded 6.1 - 6.6

$$\text{Intrinsic Permeability} = \frac{\text{Porosity}^3}{\left( \text{K-C coefficient} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^2 \right)}$$

$$\text{Hydraulic Conductivity (K)} = \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

Hydraulic Conductivity K (cm/sec)		3.5E-03		Anikaree		Anikaree		Brule		Brule		Pierre Shale		Anikaree		Anikaree		Brule		Brule		Upper Chadron		Pierre Shale	
		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35	
		M-533C Run 1, Sample 1		M-533C Run 1, Sample 2		M-533C Run 3, Sample 1		M-533C Run 3, Sample 2		M-533C Run 5, Sample 1		M-1635C Run 1, Sample 1		M-1635C Run 1, Sample 2		M-1635C Run 2, Sample 1		M-1635C Run 2, Sample 2		M-1635C Run 3, Sample 1		M-1635C Run 6, Sample 1			
Sieves Size/Number	Sieve Size (mm)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	
		6.35107	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		4.75683	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		3.36359	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		2.00000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
Medium Sand		1.18921	3.42	2.110	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.84090	2.47	2.389	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.70711	1.42	1.810	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.59460	2.07	3.137	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.50000	3.50	6.307	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.42045	5.55	11.892	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
Fine Sand		0.35355	6.39	16.280	0.00	0.007	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.29730	11.20	33.927	0.11	0.333	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	
		0.25000	10.90	39.258	0.41	1.477	0.00	0.002	0.00	0.001	0.00	0.000	0.00	0.005	0.00	0.004	0.00	0.000	0.00	0.001	0.00	0.001	0.00	0.000	
		0.21022	10.80	46.250	0.83	3.555	0.03	0.111	0.02	0.094	0.00	0.000	0.08	0.343	0.09	0.377	0.00	0.018	0.03	0.124	0.00	0.000	0.00	0.000	
		0.17678	9.65	49.136	1.24	6.315	0																		

Analysis of K results				
Formation	Geomean of K (cm/sec)	STD	# of Samples	
Arikaree	1.4E-04	9.27E-04	10	
Brule	9.2E-05	6.15E-05	12	
Upper Chadron	4.8E-05	7.85E-06	2	
Basal Sandstone	--	--	--	
Pierre Shale	2.1E-06	1.14E-06	2	

Porosity	0.438
Kozeny-Carman Coeff	4.8
Shape Factor	6.5

	Porosity	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
		M-1912C Run 1, Sample 1	M-1912C Run 2, Sample 1	M-1912C Run 3, Sample 1	M-1912C Run 3, Sample 2	M-1912C Run 4, Sample 1	M-1912C Run 4, Sample 2	M-1912C Run 4, Sample 2R2	M-1956C Run 1, Sample 1	M-1956C Run 3, Sample 1	M-1956C Run 4, Sample 1	M-1956C Run 4, Sample 2			
Sieves Size/Number	Sieve Size (mm)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)	Retained (%)			
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
		0.82	0.506	0.74	0.457	0.02	0.013	0.00	0.000	0.00	0.000	0.00			
		0.69	0.668	2.75	2.661	0.35	0.339	0.00	0.000	0.00	0.000	0.00			
		0.32	0.408	0.96	1.224	0.41	0.523	0.00	0.000	0.00	0.000	0.00			
		0.35	0.531	0.89	1.350	0.78	1.183	0.00	0.000	0.00	0.000	0.00			
		0.56	1.010	1.17	2.109	1.28	2.307	0.00	0.000	0.00	0.000	0.00			
		0.42045	1.11	2.381	1.33	2.851	1.58	3.387	0.00	0.000	0.00	0.00			
		0.35355	1.76	4.488	0.98	2.498	1.38	3.517	0.00	0.000	0.00	0.00			
		0.29733	4.49	13.615	3.34	1.89	5.727	0.00	0.000	0.00	0.000	0.00			
		0.25000	6.17	22.245	1.17	4.216	1.77	0.033	0.823	2.955	14.79	53.294			
		0.21022	8.16	34.937	2.13	9.126	2.28	0.901	0.00	0.000	0.00	0.00			
		0.17678	9.53	48.523	3.87	19.714	3.12	15.892	1.09	5.558	0.00	0.00			
		0.14865	10.31	62.421	6.15	37.250	4.20	25.436	2.62	15.884	0.00	0.00			
		0.12500	10.51	75.660	8.05	57.974	5.30	38.165	4.42	31.861	0.00	0.00			
		0.10511	10.00	85.591	9.01	77.152	6.58	56.337	6.73	57.596	0.00	0.00			
		0.08839	8.75	89.034	8.83	89.901	8.00	81.441	9.53	97.015	0.00	0.00			
		0.07433	6.87	83.211	7.73	93.576	9.15	110.753	12.01	145.401	0.00	0.00			
		0.06250	4.77	68.695	6.16	88.664	9.44	135.859	13.01	187.288	0.00	0.00			
		0.05256	2.95	50.514	4.63	79.238	8.62	147.505	11.91	203.843	0.00	0.00			
		0.04419	1.73	35.222	3.46	70.406	7.06	143.643	9.35	190.230	0.00	0.00			
		0.03716	1.11	26.871	2.74	66.293	5.39	130.392	6.59	159.345	0.00	0.00			
		0.03125	0.83	23.890	2.34	67.315	4.08	117.356	4.53	130.435	0.00	0.00			
		0.02503	0.92	32.108	2.67	93.133	3.90	136.021	4.03	140.701	0.00	0.00			
		0.02005	0.88	38.331	2.44	106.222	2.85	124.056	2.87	125.057	0.00	0.00			
		0.01563	0.97	53.325	2.50	137.361	2.36	129.653	2.36	129.788	0.22	12.085			
		0.01105	1.28	93.899	3.19	233.885	2.31	169.345	2.30	168.787	5.93	434.660			
		0.00781	1.09	113.043	2.85	295.408	1.58	163.750	1.59	164.958	8.65	739.608			
		0.0050													

Sand (%)  
Silt (%)  
Clay (%)

3

Porosity	0.438
Kozeny-Carman Coeff	4.8
Shape Factor	6.5

Effective Grain Size (cm)	0.006494829
Intrinsic Permeability (cm2)	5.5E-08
Rho (g/cm3)	1.03
Viscosity (dyne-sec/cm2)	0.016
Gravitational Const (cm/sec2)	980
Hydraulic Conductivity K (cm/sec)	3.5E-03

Hydraulic Conductivity K (cm/sec)		3.5E-03		Brule		Brule		Pierre Shale		Anikaree		Anikaree		Brule		Brule		Upper Chadron		Pierre Shale	
		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35		0.35	
		Porosity		M-1956C Run 5, Sample 1		M-1956C Run 5, Sample 2		M-1956C Run 6, Sample 1		M-2169C Run 1, Sample 1		M-2169C Run 2, Sample 3		M-2169C Run 3, Sample 1		M-2169C Run 4, Sample 1		M-2169C Run 5, Sample 1		M-2169C Run 7, Sample 1	
Sieves Size/Number		Sieve Size (mm)		Retained (%)		Retained (%)		Retained (%)		Retained (%)		Retained (%)		Retained (%)		Retained (%)		Retained (%)		Retained (%)	
		6.35107		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
		4.75683		0.00		0.000		0.00		0.000		0.00		0.000		0.00		0.000		0.00	
		3.36359		0.00		0.000		0.00		0.000		0.00		0.000		0.00		0.000		0.00	
		2.00000		0.00		0.000		0.00		0.000		0.00		0.000		0.00		0.000		0.00	
Medium Sand		1.18921		0.00		0.000		0.30		0.185		0.00		0.000		0.00		0.000		0.00	
		0.84090		0.00		0.000		0.96		0.929		0.00		0.000		0.00		0.000		0.00	
		0.70711		0.00		0.000		0.36		0.459		0.00		0.000		0.15		0.191		0.00	
		0.59460		0.00		0.000		0.50		0.758		0.00		0.000		0.00		0.425		0.00	
		0.50000		0.00		0.000		0.75		1.352		0.00		0.000		0.33		0.595		0.00	
		0.42045		0.00		0.000		0.89		1.908		0.00		0.000		0.24		0.514		0.00	
Fine Sand		0.35355		0.00		0.000		0.81		2.064		0.00		0.000		0.18		0.459		0.00	
		0.29730		0.00		0.000		1.32		4.000		0.00		0.000		0.40		1.212		0.00	
		0.25000		0.00		0.006		1.42		5.116		0.00		0.003		0.69		2.486		0.00	
		0.21022		0.07		0.283		1.86		7.968		0.00		0.32		1.371		0.731		0.00	
		0.17678		0.48		2.445		2.47		12.582		0.00		0.85		4.330		0.73		0.00	
		0.14865		1.31		7.933		3.17		19.199		0.00		1.60		9.690		2.55		0.00	
		0.12500		1.85		13.320		3.67		26.428		0.00		2.43		17.499		35.840		0.00	
		0.10511		2.13		18.234		4.09		35.019		0.00		3.54		30.310		65.890		0.00	
		0.08839		2.72		27.686		4.65		47.339		0.00		5.07		51.615		102.761		0.00	
		0.07433		3.98		48.168		5.35		64.759		0.00		6.71		81.221		11.09		0.00	
Silt		0.06250		5.62		80.872		5.98		86.066		0.00		7.79		112.116		10.19		0.00	
		0.05256		6.92		118.399		6.34		108.493		0.00		7.92		135.531		8.29		0.00	
		0.04419		7.52		152.983		6.40		130.219		0.00		7.37		129.735		8.74		0.00	
		0.03716		7.36		178.027		6.10		147.573		0.00		6.51		157.492		5.02		0.00	
		0.03125		6.89		198.157		5.62		161.657		0.00		5.65		162.520		4.11		0.00	
		0.02503		7.90		275.494		6.38		222.523		0.02		0.663		6.07		211.711		0.02	
		0.02005		6.75		293.780		5.50		239.414		1.49		64.894		4.94		215.038		0.02	
		0.01563		6.26		343.867		5.15		282.938		4.74		260.551		4.56		250.525		0.06	
		0.01105		7.04		516.033		5.57		408.346		6.64		487.048		5.32		390.020		0.06	
		0.00781		5.65		585.488		4.05		419.752		9.84		1019.345		4.59		475.721		0.06	
		0.00500		5.73		874.224		3.55		541.707		16.41		2503.863		5.01		764.497		0.06	
Clay		0.00125		8.3		2437.972		4.08		1182.172		36.32		19567.555		8.01		2348.189		0.08	
		0.00098		3.76		2530.975		1.76		1184.898		17.51		11787.899		3.87		2605.438		0.14	
		0.00049		1.56		2098.715		0.87		1170.621		6.51		8764.120		1.61		2166.330		0.09	
		0.00038		0.14		316.435		0.08		185.369		0.52		1176.136		0.14		316.486		0.08	
						11119.503				6706.814				36632.474				10657.807			
						0.0090		Deff (mm)		0.0149		Deff (mm)		0.0027		Deff (mm)		0.0094		Deff (mm)	
						K (cm/sec)		2.6E-05		K (cm/sec)		7.0E-05		K (cm/sec)		2.4E-06		K (cm/sec)		2.8E-05	
						K (ft/day)		0.07		K (ft/day)		0.01		K (ft/day)		0.08		K (ft/day)		0.13	
						K (m/day)		0.02		K (m/day)		0.06		K (m/day)		0.02		K (m/day)		0.05	
						D10 (mm)		0.0090		D10 (mm)		0.0149		D10 (mm)		0.0027		D10 (mm)		0.0121	
						K Hazen (cm/sec)		8.09E-05		K Hazen (cm/sec)		2.22E-04		K Hazen (cm/sec)		7.45E-06		K Hazen (cm/sec)		8.80E-05	
						K (ft/day)		0.23		K (ft/day)		0.63		K (ft/day)		0.25		K (ft/day)		0.57	
						K Hazen (cm/sec)		4.17E-05		K Hazen (cm/sec)		1.15E-04		K Hazen (cm/sec)		3.84E-06		K Hazen (cm/sec)		4.54E-05	
						K (ft/day)		0.12		K (ft/day)		0.33		K (ft/day)		0.01		K (ft/day)		0.13	

Analysis of K results		
Formation	Geomean of K (cm/sec)	
Arikaree		1.4E-04
Brule		9.2E-05
Upper Chadron		4.8E-05
Basal Sandstone	--	
Pierre Shale		2.1E-06

Rounded 6.1 - 6.6  
Medium angular 7.4 - 7.5  
Very Angular 7.7 - 8.4

Effective Grain Size (cm)	0.001308166
Intrinsic Permeability (cm2)	2.2E-09
Rho (g/cm3)	1.03
Viscosity (dyne-sec/cm2)	0.016
Gravitational Const (cm/sec2)	980
Hydraulic Conductivity K (cm/sec)	1.4E-04

Analysis by Aaron Kempf			
			Avg K
Upper Chadron	5.4E-05	5.9E-05	5.6E-05
Middle Chadron	1.7E-05	2.9E-05	2.3E-05

0.438  
4.8 Range 4.5 to 5.1  
6.5 Range 6 to 8.4      Rounded 6.1 - 6.6  
Medium angular 7.4 - 7.5  
Very Angular 7.7 - 8.4

$$\text{Intrinsic Permeability} = \frac{\text{Porosity}^3}{\left( \text{K-Coefficient} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^3 \right)}$$

$$\text{Hydraulic Conductivity (K)} = \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

Analysis of K results			
Formation	Geomean of K (cm/sec)	STD	# of Samples
Arikaree	1.4E-04	9.3E-04	10



Effective Grain Size (cm)	0.00152912
Intrinsic Permeability (cm <sup>2</sup> )	3.1E-09
Rho (g/cm <sup>3</sup> )	1.03
Viscosity (dyne-sec/cm <sup>2</sup> )	0.016
Gravitational Const (cm/sec <sup>2</sup> )	980
Hydraulic Conductivity K (cm/sec)	1.9E-04

Analysis of K results	
Formation	Geomean of K (cm/sec)
Brule	8.9E-05



Porosity 0.438  
Kozeny-Carman Coeff 4.8 Range 4.5 to 5.1  
Shape Factor 6.5 Range 6 to 8.4 Rounded 6.1 - 6.6  
Medium angular 7.4 - 7.5  
Very Angular 7.7 - 8.4

Effective Grain Size (cm) 0.001164539  
Intrinsic Permeability (cm2) 1.8E-09  
Rho (g/cm3) 1.03  
Viscosity (dyne-sec/cm2) 0.016  
Gravitational Const (cm/sec2) 980  
Hydraulic Conductivity K (cm/sec) 1.1E-04

Intrinsic Permeability

$$= \frac{\text{Porosity}^3}{\left( \frac{K-C}{\text{coefficient}} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^2 \right)}$$

Hydraulic Conductivity (K)

$$= \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

		Upper Chadron		Upper Chadron		Upper Chadron	
		0.35		0.35		0.35	
		M-1635C Run 3, Sample 1		M-1454c Run 1		M-1624c Run 1	
Sieves Size/Number	Sieve Size (mm)	Retained (%)		Retained (%)		Retained (%)	
	6.35107	0.00		0.00		0.00	
	4.75683	0.00	0.000	0.00	0.000	0.00	0.000
	3.36359	0.00	0.000	0.00	0.000	0.00	0.000
	2.00000	0.00	0.000	0.00	0.000	0.00	0.000
Medium Sand	1.18921	0.00	0.000	3.58	2.211	0.81	0.500
	0.84090	0.17	0.164	11.00	10.646	2.66	2.573
	0.70711	0.40	0.510	3.31	4.223	0.89	1.135
	0.59460	0.56	0.849	2.42	3.671	0.81	1.228
	0.50000	0.77	1.388	2.14	3.860	1.05	1.892
	0.42045	0.93	1.993	1.85	3.967	1.28	2.743
Fine Sand	0.35355	0.79	2.013	1.22	3.111	1.16	2.956
	0.29730	1.07	3.243	1.34	4.062	1.72	5.211
	0.25000	1.05	3.783	1.13	4.073	1.76	6.340
	0.21022	1.53	6.555	1.36	5.829	2.25	9.636
	0.17678	2.36	12.021	1.63	8.306	2.84	14.462
	0.14865	3.19	19.320	1.89	11.451	3.32	20.102
	0.12500	3.54	25.492	2.06	14.841	3.52	25.341
	0.10511	3.66	31.338	2.23	19.102	3.69	31.586
#200	0.08839	4.02	40.926	2.62	26.684	4.10	41.728
	0.07433	4.75	57.498	3.31	40.083	4.77	57.723
Silt	0.06250	5.53	79.591	4.09	58.889	5.44	78.273
	0.05256	5.99	102.505	4.59	78.579	5.83	99.738
	0.04419	6.12	124.524	4.73	96.280	5.87	119.403
	0.03716	5.98	144.672	4.54	109.879	5.54	133.989
	0.03125	5.68	163.386	4.23	121.725	5.02	144.359
	0.02503	6.54	228.108	4.87	169.928	5.58	194.567
	0.02005	5.53	240.725	4.23	184.208	4.69	204.100
	0.01563	5.10	280.197	3.98	218.751	4.33	237.824
	0.01105	5.70	417.885	4.53	332.241	4.81	352.534
	0.00781	4.47	463.291	3.67	380.528	3.79	392.699
	0.00500	4.37	666.848	3.77	575.520	3.77	575.123
Clay	0.00195	6.15	1789.526	5.78	1682.536	5.38	1565.017
	0.00098	2.77	1864.904	2.69	1811.769	2.34	1574.950
	0.00049	1.18	1587.771	1.08	1453.795	0.93	1251.016
	0.00038	0.10	226.065	0.09	203.540	0.08	178.539
			8587.092	Sum(fi/(dli^0.404*	7644.287		7327.286
		Deff (mm)	0.0116	Deff (mm)	0.0131	Deff (mm)	0.0136
		K (cm/sec)	4.3E-05	K (cm/sec)	5.4E-05	K (cm/sec)	5.9E-05
		K (ft/day)	0.12	K (ft/day)	0.15	K (ft/day)	0.17
		K (m/day)	0.04	K (m/day)	0.05	K (m/day)	0.05
		D10 (mm)	0.0116	D10 (mm)	0.0131	D10 (mm)	0.0136
		K Hazen (cm/sec)	1.36E-04	K Hazen (cm/sec)	1.71E-04	K Hazen (cm/sec)	1.86E-04
		K (ft/day)	0.38	K (ft/day)	0.49	K (ft/day)	0.53
		K Hazen (cm/sec)	7.00E-05	K Hazen (cm/sec)	8.83E-05	K Hazen (cm/sec)	9.61E-05
		K (ft/day)	0.20	K (ft/day)	0.25	K (ft/day)	0.27

Sand (%)	28.79	43.11	36.62
Silt (%)	61.01	47.25	54.65
Clay (%)	10.20	9.64	8.73

Analysis of K results			
Formation	Geomean of K (cm/sec)	STD	# of Samples
Upper Chadron	5.1E-05	8.2E-06	3

$$\text{Intrinsic Permeability} = \frac{\text{Porosity}^3}{\left( \text{K-C coefficient} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^3 \right)}$$

$$\text{Hydraulic Conductivity (K)} = \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

Hydraulic Conductivity K (cm/sec)		4.6E-05	Middle Chadron		Middle Chadron	
	Porosity		0.35		0.35	
			M-1451c Run 2		M-1624c Run 2	
Sieves Size/Number	Sieve Size (mm)	Retained (%)			Retained (%)	
	6.35107	0.00			0.00	
	4.75683	0.00	0.000		0.00	0.000
	3.36359	0.00	0.000		0.00	0.000
	2.00000	0.00	0.000		0.00	0.000
Medium Sand	1.18921	0.00	0.000		2.23	1.377
	0.84090	1.24	1.200		8.51	8.234
	0.70711	2.40	3.061		4.07	5.191
	0.59460	1.92	2.911		4.04	6.126
	0.50000	1.42	2.560		3.97	7.158
	0.42045	1.60	3.430		3.55	7.611
Fine Sand	0.35355	1.64	4.180		2.54	6.474
	0.29730	2.63	7.970		3.04	9.214
	0.25000	2.46	8.864		2.40	8.649
	0.21022	2.67	11.439		2.31	9.898
	0.17678	2.82	14.365		2.24	11.412
	0.14865	2.77	16.777		2.14	12.963
	0.12500	2.49	17.931		1.98	14.260
	0.10511	2.26	19.351		1.83	15.671
#200	0.08839	2.26	23.008		1.79	18.226
	0.07433	2.41	29.172		1.85	22.397
Silt	0.06250	2.55	36.701		1.93	27.781
	0.05256	2.63	45.007		2.00	34.230
	0.04419	2.80	56.972		2.13	43.345
	0.03716	3.04	73.546		2.28	55.167
	0.03125	3.28	94.350		2.43	69.908
	0.02503	4.40	153.467		3.22	112.324
	0.02005	4.43	192.841		3.24	141.058
	0.01563	4.61	253.276		3.39	186.273
	0.01105	5.86	429.615		4.36	319.687
	0.00781	5.69	589.737		4.35	450.912
	0.00500	7.07	1078.859		5.63	859.231
Clay	0.00195	13.10	3811.835		10.80	3142.990
	0.00098	5.63	3790.401		4.44	2989.622
	0.00049	1.79	2408.567		1.22	1641.807
	0.00038	0.13	293.884		0.08	174.092
			13475.274		Sum(fi/(dli^0.404*	10413.286
		Deff (mm)	0.0074		Deff (mm)	0.0096
		K (cm/sec)	1.7E-05		K (cm/sec)	2.9E-05
		K (ft/day)	0.05 K (ft/day)			0.08
		K (m/day)	0.02 K (m/day)			0.03
		D10 (mm)	0.0074		D10 (mm)	0.0096
		K Hazen (cm/sec)	5.51E-05		K Hazen (cm/sec)	9.22E-05
		K (ft/day)	0.16 K (ft/day)			0.26
		K Hazen (cm/sec)	2.84E-05		K Hazen (cm/sec)	4.76E-05
		K (ft/day)	0.08 K (ft/day)			0.13

Analysis of K results			
Formation	Geomean of K (cm/sec)	STD	# of Samples
Middle Chadron	2.2E-05	8.29E-06	2

Porosity 0.438  
Kozeny-Carman Coeff 4.8  
Shape Factor 6.5

Effective Grain Size (cm) 0.000232359  
Intrinsic Permeability (cm2) 7.1E-11  
Rho (g/cm3) 1.03  
Viscosity (dyne-sec/cm2) 0.016  
Gravitational Const (cm/sec2) 980  
Hydraulic Conductivity K (cm/sec) 4.5E-06

$$\text{Intrinsic Permeability} = \frac{\text{Porosity}^3}{\left( \frac{K-C}{\text{coefficient}} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^2 \right)}$$

$$\text{Hydraulic Conductivity (K)} = \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

Rerun

		Basal Sandstone/Pierre Shale		Basal Sandstone/Pierre Shale	
Porosity		0.35		0.35	
		M-1912C Run 4, Sample 2		M-1912C Run 4, Sample 2R2	
Sieves Size/Number	Sieve Size (mm)	Retained (%)		Retained (%)	
	6.35107	0.00		0.00	
	4.75683	0.00	0.000	0.00	0.000
	3.36359	0.00	0.000	0.00	0.000
	2.00000	0.00	0.000	0.00	0.000
Medium Sand	1.18921	0.00	0.000	25.71	15.870
	0.84090	0.00	0.000	25.10	24.283
	0.70711	0.00	0.000	9.82	12.523
	0.59460	0.00	0.000	6.77	10.265
	0.50000	0.00	0.000	4.24	7.644
	0.42045	0.00	0.000	2.66	5.702
Fine Sand	0.35355	0.00	0.000	1.46	3.721
	0.29730	0.00	0.000	1.33	4.030
	0.25000	0.00	0.000	0.82	2.955
	0.21022	0.00	0.000	0.70	2.999
	0.17678	0.00	0.000	0.59	3.005
	0.14865	0.00	0.000	0.48	2.907
	0.12500	0.00	0.000	0.40	2.881
	0.10511	0.00	0.000	0.37	3.168
#200	0.08839	0.00	0.000	0.35	3.563
	0.07433	0.00	0.000	0.33	3.995
Silt	0.06250	0.00	0.000	0.31	4.462
	0.05256	0.00	0.000	0.30	5.134
	0.04419	0.00	0.000	0.30	6.104
	0.03716	0.00	0.000	0.31	7.500
	0.03125	0.00	0.000	0.33	9.492
	0.02503	0.00	0.000	0.48	16.742
	0.02005	0.10	4.177	0.56	24.377
	0.01563	2.33	127.940	0.63	34.613
	0.01105	5.79	424.246	0.94	68.914
	0.00781	7.14	739.608	1.36	140.957
	0.00500	12.59	1921.642	2.38	363.180
Clay	0.00195	39.38	11458.186	6.53	1900.098
	0.00098	23.99	16148.973	3.35	2255.390
	0.00049	8.14	10946.796	1.02	1372.480
	0.00038	0.56	1265.254	0.07	158.245
			43036.821		6477.198
		Deff (mm)	0.0023	Deff (mm)	0.0154
		K (cm/sec)	1.7E-06	K (cm/sec)	7.5E-05
		K (ft/day)	0.00	K (ft/day)	0.21
		K (m/day)	0.00	K (m/day)	0.07
		D10 (mm)	0.0023	D10 (mm)	0.0154
		K Hazen (cm/sec)	5.40E-06	K Hazen (cm/sec)	2.38E-04
		K (ft/day)	0.02	K (ft/day)	0.68
		K Hazen (cm/sec)	2.79E-06	K Hazen (cm/sec)	1.23E-04
		K (ft/day)	0.01	K (ft/day)	0.35
	Sand (%)	0.00		81.13	
	Silt (%)	27.94		7.90	
	Clay (%)	72.06		10.97	

Analysis of K results			
Formation	Geomean of K (cm/sec)	STD	# of Samples
Basal Sandstone	7.5E-05	N/A	1

$$\text{Intrinsic Permeability} = \frac{\text{Porosity}^3}{\left( \text{K}_{\text{C-C}} \text{coefficient} \times \left( \frac{\text{Shape Factor}}{\text{Effective Grain Size}} \right)^2 \times (1 - \text{Porosity})^2 \right)}$$

$$\text{Hydraulic Conductivity (K)} = \frac{\text{Intrinsic Permeability} \times \text{Density} \times \text{Gravity}}{\text{Viscosity}}$$

Effective Grain Size (cm)	0.000242738
Intrinsic Permeability (cm2)	7.7E-11
Rho (g/cm3)	1.03
Viscosity (dyne-sec/cm2)	0.016
Gravitational Const (cm/sec2)	980
Hydraulic Conductivity K (cm/sec)	4.9E-06

Analysis of K results			
Formation	Geomean of K (cm/sec)	STD	# of Samples
Pierre Shale	2.5E-06	1.32E-06	7