

April 23, 2009

CPNPP HYDRO Package

NRC Needs List: HYD-02

Subject: CPNPP Unit 3 and 4 Hydraulic Conductivity Summary Table



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WELL/BORING ID	DIAMETER	TEST	SCREEN	MATERIAL	K (cm/sec)
MW-1207a	2"	Slug Test	12.3-17.3	Undifferentiated fill material	3.15E-05
MW-1207b	2"	Slug Test	28.5-48.5	Shallow Bedrock	6.29E-06
MW-1215a	2"	Slug Test	30.4-55.4	Undifferentiated fill material	5.00E-04
MW-1215b	2"	Slug Test	14.3-19.3	Shallow Bedrock	2.93E-05
MW-1217b	2"	Slug Test	23.0-43.0	Shallow Bedrock	1.37E-05
MW-1219a	2"	Slug Test	27.8-47.8	Undifferentiated fill material	6.03E-06

WELL/BORING ID	DIAMETER	TEST	SCREEN	MATERIAL	K (cm/sec)
RW-1 (Pumping)	4"	Step Test	31.8-61.8	Undifferentiated fill material	2.60E-03
RW-1 (Recovery)	4"	Step Test	31.8-61.8	Undifferentiated fill material	3.40E-03

WELL/BORING ID	DIAMETER	TEST	SCREEN	MATERIAL	K (cm/sec)
RW-1 (Pumping)	4"	Pump Test (72 Hr)	31.8-61.8	Undifferentiated fill material	1.70E-03
RW-1 (Recovery)	4"	Pump Test (72 Hr)	31.8-61.8	Undifferentiated fill material	3.50E-03

WELL/BORING ID	BOREHOLE SIZE	TEST	PACKER MID-DEPTH	MATERIAL	METHOD 1	METHOD 2
					K (cm/sec)	K (cm/sec)
B-1016	HQ	Packer Test	152	Bedrock	3.95E-08	1.403E-08
B-1016	HQ	Packer Test	135	Bedrock	1.37E-08	5.482E-09
B-1016	HQ	Packer Test	110	Bedrock	1.06E-08	4.984E-09
B-1016	HQ	Packer Test	91	Bedrock	9.47E-09	4.829E-09
B-1016	HQ	Packer Test	69	Bedrock	4.03E-08	2.479E-08
B-1016	HQ	Packer Test	45	Bedrock	0.00E+00	0.00E+00
B-1016	HQ	Packer Test	30	Bedrock	0.00E+00	0.00E+00
B-1019	HQ	Packer Test	175	Bedrock	4.75E-09	1.298E-09
B-1019	HQ	Packer Test	133	Bedrock	4.56E-08	1.885E-08
B-1019	HQ	Packer Test	110	Bedrock	7.00E-09	3.304E-09
B-1019	HQ	Packer Test	95	Bedrock	1.00E-08	4.721E-09
B-1019	HQ	Packer Test	67	Bedrock	2.51E-08	1.509E-08
B-1019	HQ	Packer Test	57	Bedrock	0.00E+00	0.00E+00
B-1019	HQ	Packer Test	27	Bedrock	0.00E+00	0.00E+00
B-1021	HQ	Packer Test	130	Bedrock	4.18E-09	1.744E-09
B-1021	HQ	Packer Test	101	Bedrock	1.86E-08	9.445E-09
B-1021	HQ	Packer Test	90	Bedrock	2.51E-08	1.331E-08
B-1021	HQ	Packer Test	65	Bedrock	0.00E+00	0.00E+00
B-1021	HQ	Packer Test	49	Bedrock	0.00E+00	0.00E+00
B-1021	HQ	Packer Test	24	Bedrock	0.00E+00	0.00E+00
B-2015	HQ	Packer Test	165	Bedrock	2.08E-08	7.307E-09
B-2015	HQ	Packer Test	133	Bedrock	2.78E-08	1.066E-08
B-2015	HQ	Packer Test	110	Bedrock	3.83E-08	1.735E-08
B-2015	HQ	Packer Test	95	Bedrock	2.24E-08	1.141E-08
B-2015	HQ	Packer Test	70	Bedrock	8.89E-09	5.635E-09
B-2015	HQ	Packer Test	58	Bedrock	1.30E-09	9.567E-10
B-2015	HQ	Packer Test	20	Bedrock	1.35E-08	1.164E-08
B-2018	HQ	Packer Test	154	Bedrock	3.05E-09	1.041E-09
B-2018	HQ	Packer Test	123	Bedrock	0.00E+00	0.00E+00
B-2018	HQ	Packer Test	110	Bedrock	2.18E-08	9.948E-09
B-2018	HQ	Packer Test	96	Bedrock	0.00E+00	0.00E+00
B-2018	HQ	Packer Test	63	Bedrock	5.93E-09	3.727E-09
B-2018	HQ	Packer Test	56	Bedrock	0.00E+00	0.00E+00
B-2018	HQ	Packer Test	24	Bedrock	2.19E-08	1.914E-08
B-2020	HQ	Packer Test	131.5	Bedrock	1.06E-08	4.120E-09
B-2020	HQ	Packer Test	116	Bedrock	7.89E-09	3.592E-09
B-2020	HQ	Packer Test	91	Bedrock	1.03E-08	5.284E-09
B-2020	HQ	Packer Test	72	Bedrock	6.38E-07	4.000E-07
B-2020	HQ	Packer Test	47	Bedrock	6.19E-08	5.411E-08
B-2020	HQ	Packer Test	37	Bedrock	8.31E-08	8.340E-08

Method 1: In this method, Lugeon water test procedure was used. The permeability is calculated in Lugeon units and then converted to cm/s. Permeability in Lugeon is namely, the water taken in each test in liter per minute per meter (l/min/m) at a pressure of 10 bars (or about 150 psi). The following equation was used for reducing the data into permeability in terms of Lugeon and cm/s:

$$K_{lu} = Q \text{ (gal/min)} \times 10 \text{ (bars)} / P \text{ (bars)} \times l \text{ (m)}$$

Where:

- K_{lu} = Coefficient of permeability, Lugeon (lu)
- Q = Steady flow into well, gal/min
- P = Test pressure, bars
- l = Length of test section, m

$$K = K_{lu} \times (1 \times 10^{-5})$$

Where:

- K = Coefficient of permeability, cm/s

Method 2: In this method, the procedure recommended by U.S. Department of the Interior, Bureau of Reclamation (Engineering Geology Field Manual, Ref. 2, chapter 17) for unsaturated consolidated rock was utilized. The following equation was used for reducing the data:

$$K = Q / (C_u \times r \times H)$$

Where:

- K = Coefficient of permeability, ft/s
- Q = Steady flow into well, ft³/s
- C_u = Conductivity coefficient for unsaturated materials [C_u is obtained from Figure 17.7 (Ref. 2) based on values of H/r and l/H]
- r = radius of test hole, ft
- H = Effective head (h₁ + h₂ - L), ft [h₁ represents the distance between the gage and the bottom packer, h₂ is the applied pressure at the gage, and L is the head loss in the pipe]
- l = Length of test section, ft

Sources: TXUT-001-PR-003 Field Packer Test Results; TXUT-001-PR-008 Groundwater Aquifer Test Results