Geotechnical Report

Appendix D

Groundwater Monitoring Results

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:
Piezometer SP-04-28
Ground Elevation (m) 234.02

I.D.	Top of Piezo Elev (m)	Inlet Type	Depth to Tip (m)	Sand Backfill Top (m)	Sand Backfill Bottom (m)	Middle of sand pack Elevation (m)
SP-04-28	234.94	casagrande	4.6	2.1	4.6	230.67

Date	Time	Standpipe (till) Reading (m)	Standpipe (till) Ground Water Elev. (m)
December 16, 2004		3.14	231.80
December 23, 2004		3.12	231.82
January 6, 2005		3.10	231.84
January 26, 2005		2.91	232.03
February 4, 2005		2.96	231.98

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Piezometer VW-04-29A
Location:
Depth of VW: 10.0 m
Ground Elev.: 234.07 m
Tip Elevation: 224.07 m
Baseline Reading (Atm, taken prior to installation with VW to be installed):
Date 10-Dec-04
Reading (R_0) 8920.3
Temp.°C (T_0) 25.1

This sheet is based on the formulas:

Pressure = $AR^2 + BR + C$

$P_{corrected} = P + P_T - P_B = P + (T_1 - T_0)xK - (S_1 - S_0)$

Installed VW Piezometer:
Information from VW Calibration Report:
Supplier: Geokon
Serial No.: 04-14194
Polynomial Gage Factors (metric):

A	B	C *	* Factory Value
7.59E-08	-0.1001	888.11	

Thermal Factor (-0.1209 kPa/°C
Calculated C: 886.88 kPa, Based on P=0, Using R_0

Barometric VW Piezometer:
Original Calibration Information:
Supplier:
Serial No.: 25976
Date: 18-Feb-94
R_0 = 8941.6 F^2x10^-3
T_0 = 15.0 C
G = 0.016184 psi/digit
C = -0.021039 psi/C rise
Pressure: 29.15 in. of Hg
98.71 kPa

Date	Installed Piezometer Reading R_1 (F^2x10^-3)	Installed Piezometer Temperature T_1 (°C)	Barometric Piezometer Reading R_1 (F^2x10^-3)	Barometric Piezometer Temperature T_1 (°C)	Barometric S_1 $P+P_T+S_0$ (kPa)	Barometric Correction P_B (kPa)	Installed $P+P_T$ (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed $P_{corrected}$ $P+P_T-P_B$ (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
Baseline Reading (Atm, taken prior to installation, with VW to be installed):														
10-Dec-04	8920.3	25.1	8935.7	-6.3	102.46		0.00							Prior to Installation
Readings after installation:														
10-Dec-04	8130.0	7.3	8935.7	-6.3	102.46	0.00	80.24	8.18	1.82	80.24	8.18	232.25	1.82	Water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	8467.3	6.8	8930.5	-12.3	103.91	1.45	46.96	4.79	5.21	45.51	4.64	228.71	5.36	
23-Dec-04	8452.0	6.7	8928.1	-17.1	104.88	2.41	48.48	4.94	5.06	46.07	4.70	228.77	5.30	
6-Jan-05	8496.7	6.7	8944.3	-20.9	103.62	1.16	44.07	4.49	5.51	42.91	4.38	228.45	5.62	
26-Jan-05	8462.5	6.7	8906.7	-12.6	106.61	4.15	47.45	4.84	5.16	43.30	4.41	228.48	5.59	
4-Feb-05	8473.6	6.7	8891.9	-0.1	106.45	3.99	46.35	4.73	5.27	42.36	4.32	228.39	5.68	

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Piezometer: VW-04-29B
Location:
Depth of VW: 6.7 m
Ground Elev.: 234.07 m
Tip Elevation: 227.37 m
Baseline Reading (Atm, taken prior to installation with VW to be installed):
Date 13-Dec-04
Reading (R_0) 8747.6
Temp.°C (T_0) 20.5

This sheet is based on the formulas:

Pressure = $AR^2 + BR + C$

$P_{corrected} = P + P_T - P_B = P + (T_1 - T_0)xK - (S_1 - S_0)$

Installed VW Piezometer:
Information from VW Calibration Report:
Supplier: Geokon
Serial No.: 04-13873
Polynomial Gage Factors (metric):

A	B	C *	* Factory Value
-8.33E-08	-0.1092	963.27	

Thermal Factor (-0.0073 kPa/°C
Calculated C: 961.61 kPa, Based on P=0, Using R_0

Barometric VW Piezometer:
Original Calibration Information:
Supplier:
Serial No.: 25976
Date: 18-Feb-94
R_0 = 8941.6 F^2x10^-3
T_0 = 15.0 C
G = 0.016184 psi/digit
C = -0.021039 psi/C rise
Pressure: 29.15 in. of Hg
98.71 kPa

Date	Installed Piezometer Reading R_1 (F^2x10^-3)	Installed Piezometer Temperature T_1 (°C)	Barometric Piezometer Reading R_1 (F^2x10^-3)	Barometric Piezometer Temperature T_1 (°C)	Barometric S_1 $P+P_T+S_0$ (kPa)	Barometric Correction P_B (kPa)	Installed $P+P_T$ (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed $P_{corrected}$ $P+P_T-P_B$ (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
Baseline Reading (Atm, taken prior to installation, with VW to be installed):														
13-Dec-04	8747.6	20.5	8935.7	-6.3	102.46		0.00							Prior to Installation
Readings after installation:														
13-Dec-04	8265.7	8.2	8935.7	-6.3	102.46	0.00	53.40	5.44	1.26	53.40	5.44	232.81	1.26	Water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	8434.8	7.1	8930.5	-12.3	103.91	1.45	34.70	3.54	3.16	33.25	3.39	230.76	3.31	
23-Dec-04	8425.3	7.1	8928.1	-17.1	104.88	2.41	35.75	3.65	3.05	33.34	3.40	230.77	3.30	
6-Jan-05	8469.0	7.2	8944.3	-20.9	103.62	1.16	30.92	3.15	3.55	29.76	3.03	230.40	3.67	
26-Jan-05	8437.8	7.3	8906.7	-12.6	106.61	4.15	34.37	3.50	3.20	30.22	3.08	230.45	3.62	

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:
Piezometer SP-04-30A Till
Ground Elevation (m) 234.25

I.D.	Top of Piezo Elev	Inlet Type	Depth to	Sand Backfill		Mid Tip Elevation	Tip
	(m)	casagrande	Tip (m)	Top (m)	Bottom (m)	(m)	
SP-04-30A (Till) Till	235.17		13.1	13.1	12.4	221.50 Till	221.15

Date	Time	Standpipe (till) Reading (m)	Ground Water Elev. (m)
December 16, 2004		6.97	228.20
December 23, 2004		6.93	228.24
January 6, 2005		6.89	228.28
January 26, 2005		6.84	228.33
February 4, 2005		6.86	228.31

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Piezometer VW-04-30B
Location:
Depth of VW: 8.4 m
Ground Elev.: 234.16 m
Tip Elevation: 225.76 m
Baseline Reading (Atm, taken prior to installation with VW to be installed):
Date 10-Dec-04
Reading (R_0) 8616.8
Temp.°C (T_0) 22.8

This sheet is based on the formulas:

Pressure = $AR^2 + BR + C$

$P_{corrected} = P + P_T - P_B = P + (T_1 - T_0)xK - (S_1 - S_0)$

Installed VW Piezometer:
Information from VW Calibration Report:
Supplier: Geokon
Serial No.: 04-13874
Polynomial Gage Factors (metric):

A	B	C *	* Factory Value
-2.48E-07	-0.1163	1022.69	

Thermal Factor (-0.0253 kPa/°C
Calculated C: 1020.56 kPa, Based on P=0, Using R_0

Barometric VW Piezometer:
Original Calibration Information:
Supplier:
Serial No.: 25976
Date: 18-Feb-94
R_0 = 8941.6 F^2x10^-3
T_0 = 15.0 C
G = 0.016184 psi/digit
C = -0.021039 psi/C rise
Pressure: 29.15 in. of Hg
98.71 kPa

Date	Installed Piezometer Reading R_1 (F^2x10^-3)	Installed Piezometer Temperature T_1 (°C)	Barometric Piezometer Reading R_1 (F^2x10^-3)	Barometric Piezometer Temperature T_1 (°C)	Barometric S_1 $P+P_T+S_0$ (kPa)	Barometric Correction P_B (kPa)	Installed $P+P_T$ (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed $P_{corrected}$ $P+P_T-P_B$ (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
Baseline Reading (Atm, taken prior to installation, with VW to be installed):														
10-Dec-04	8616.8	22.8	8935.7	-6.3	102.46		0.00							Prior to Installation
Readings after installation:														
10-Dec-04	8624.7	3.2	8935.7	-6.3	102.46	0.00	-0.46	-0.05	8.45	-0.46	-0.05	225.71	8.45	Water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	8549.2	6.9	8930.5	-12.3	103.91	1.45	8.55	0.87	7.53	7.10	0.72	226.48	7.68	
23-Dec-04	8462.4	6.8	8928.1	-17.1	104.88	2.41	19.02	1.94	6.46	16.60	1.69	227.45	6.71	
6-Jan-05	8375.3	6.8	8944.3	-20.9	103.62	1.16	29.51	3.01	5.39	28.35	2.89	228.65	5.51	
26-Jan-05	8170.2	7.0	8906.7	-12.6	106.61	4.15	54.20	5.53	2.87	50.05	5.10	230.86	3.30	

Project:	**Kenaston Underpass**
UMA Job No.:	**4231-040-09**
Piezometer	**VW-04-30C**
Location:	
Depth of VW:	4.5 m
Ground Elev.:	234.16 m
Tip Elevation:	229.66 m
Baseline Readings:	
Date	4-Dec-93
Reading (R_0)	9735
Temp. (T_0)	0.0
Bar. (S_0)	100.1

This sheet is based on the formula:

$$P_{corrected} = ((R_0-R_1)xG) + ((T_1-T_0)xK) - (S_1-S_0)$$

$$P_{corrected} = P + P_T - P_B$$

Installed VW Piezometer:
Information from VW Calibration Report:

Supplier:		
Serial No.:	24459	
Linear Gage Factor (G) =	0.00274	psi/digit
Thermal Factor (K)=	-0.00274	psi/°C

Barometric VW Piezometer:
Original Calibration Information:

Supplier:		
Serial No.:	25976	
Date:	18-Feb-94	
R_0 =	8941.6	F^2x10^-3
T_0 =	15.0	C
G =	0.016184	psi/digit
C =	-0.021039	psi/C rise
Pressure:	29.15	in. of Hg
	98.71	kPa

Date	Installed Piezometer Reading R_1 (F^2x10^-3)	Installed Piezometer Temperature T_1 (°C)	Barometric Piezometer Reading R_1 (F^2x10^-3)	Barometric Piezometer Temperature T_1 (°C)	Barometric S_0 (kPa)	Barometric Correction P_B (kPa)	Installed $P+P_T$ (kPa)	Uncorrected Ground Water above tip (m)	Uncorrected Depth Below Ground (m)	Installed $P_{corrected}$ $P+P_T-P_B$ (kPa)	Height of Ground Water above tip (m)	Ground Water Elevation (m)	Depth Below Ground (m)	Comments:
Baseline Reading (Atm. taken prior to installation, with VW to be installed):														
9-Dec-04	9611.9	10.0	8939.1	-7.5	102.26									Prior to Installation
Readings after installation:														
9-Dec-04	9635.7	7.8	8939.1	-7.5	102.26	0.00	-0.41	-0.04	4.54	-0.41	-0.04	229.62	4.54	No water in hole during installation, reading taken after piezometer backfilled.
16-Dec-04	9521.5	8.1	8930.5	-12.3	103.91	1.66	1.74	0.18	4.32	0.09	0.01	229.67	4.49	
23-Dec-04	8578.6	8.1	8928.1	-17.1	104.88	2.62	19.56	1.99	2.51	16.94	1.73	231.39	2.77	
6-Jan-05	8595.4	8.0	8944.3	-20.9	103.62	1.36	19.24	1.96	2.54	17.88	1.82	231.48	2.68	
26-Jan-05	8200.4	7.8	8906.7	-12.6	106.61	4.36	26.71	2.72	1.78	22.35	2.28	231.94	2.22	

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:
Piezometer SP-04-31
Ground Elevation (m) 233.37

I.D.	Top of Piezo Elev (m)	Inlet Type casagrande	Depth to Tip (m)	Sand Backfill Top (m)	Sand Backfill Bottom (m)	Tip Elevation (m)
SP-04-31	234.28	0 0 mm	4.6	59	64	228.77

Date	Time	Standpipe (till) Reading (m)	Standpipe (till) Ground Water Elev. (m)
December 16, 2004		5.35	228.93
December 23, 2004		5.71	228.57
January 6, 2005		4.05	230.23
January 26, 2005		3.11	231.17
February 4, 2005		2.93	231.35

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:
Piezometer SP-04-34
Ground Elevation (m) 233.85

I.D.	Top of Piezo Elev (m)	Inlet Type casagrande	Depth to Tip (m)	Sand Backfill Top (m)	Sand Backfill Bottom (m)	Tip Elevation (m)
SP-04-34	234.76		4.6	59	64	229.25

Date	Time	Standpipe (till) Reading (m)	Standpipe (till) Ground Water Elev. (m)
December 16, 2004		3.98	230.78
December 23, 2004		3.21	231.55
January 6, 2005		2.90	231.86
January 26, 2005		2.60	232.16
February 4, 2005		2.60	232.16

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:

Piezometer	**PN-04-35**		
Ground Elevation (m)	233.51		
I.D.	**Gnd Elev** (m)	**Tip Depth** (m)	**Tip Elevation** (m)
PN-04-35		9.2	224.31

Date	Time	Pnuematic Reading (psi)	Pnuematic Ground Water Elev. (m)
January 26, 2005		8.70	230.43

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:
Piezometer: SP-04-36
Ground Elevation (m) 233.04

I.D.	Top of Piezo Elev	Inlet Type	Depth to	Sand Backfill		Tip Elevation
	(m)	casagrande	Tip (m)	Top (m)	Bottom (m)	(m)
SP-04-36	233.95		4.6	59	64	228.44

Date	Time	Standpipe (till)	
		Reading (m)	Ground Water Elev. (m)
January 6, 2005		2.99	230.96
January 26, 2005		3.06	230.89

Project: Kenaston Underpass
UMA Job No.: 4231-040-09

Location:

Piezometer I.D.	Ground Elevation (m)	Top of Piezo Elev (m)	Inlet Type	Depth to Tip (m)	Sand Backfill Top (m)	Sand Backfill Bottom (m)	Tip Elevation (m)
SP-04-42 (Bedrock)	234.29	235.59	casagrande	26.5	59	64	207.79

Date	Time	Standpipe (bedrock) Reading (m)	Standpipe (bedrock) Ground Water Elev. (m)
December 16, 2004		10.48	224.73
January 26, 2005		10.48	225.11
February 4, 2005		10.55	225.04