



WINSTONE
AGGREGATES

THREE KINGS QUARRY
RESOURCE CONSENT 12977
ANNUAL MONITORING REPORT

April 2008.

Where noted diagrams have been removed from this document and have been posted on individual web-links as identified

ANNUAL THREE KING QUARRY MONITORING REPORT

Introduction

The following report is made with regard to Section 9 of the Monitoring and Contingency Plan for Dewatering Three Kings Quarry dated September 2005.

This report contains a compilation of all monitoring data and documents any settlement alarm level events, reviews and remedial action undertaken for the period of 1 April 2007 to 31 March 2008.

Monitoring Summary

The monitoring of groundwater levels has been undertaken monthly for the year ending March 31 2008. Groundwater levels within the quarry have been held above RL34m since the lowering of the groundwater table ceased in October 2002.

BH5B was used as the quarry reference bore from March 2006 to October 2007. Monitoring of the quarry reference bore BH2A was recommenced in November 2007 when access to this bore was restored.

No new groundwater monitoring bores were installed in the 12 month period ending 31 March 2008.

The monitoring of precise level survey marks has continued with a survey of all survey benchmarks undertaken in March/April 2008.

Precise level surveys are currently being undertaken at 12 month intervals as dewatering has not been undertaken for more than 2 years, and there has been a cessation of settlement (as defined in the permit to dewater Three Kings Quarry).

Replacement marks were installed for AP47, AP48, AP49A, AP50A and AP51A (all on Landscape Road), and AP126 (Carr Road). All these marks were destroyed in the previous 12 months during footpath upgrading.

Precise Level Survey Results

All marks with the exception of four were within 5mm of the March 07 survey. Benchmark RM 3887 was -6mm of its previous reading, SS 7702B was +6mm of its previous reading and SS 3313 and SS 7701B were +7mm of their previous readings. All these benchmarks were within 5mm of levels recorded in the March 06 survey.

Differential settlement alarm values were recorded between AP92 and AP93, and AP92 and AP80 on Mt Albert Road, AP110 and AP111 on Hillsborough Road, and between OCP68 and AP114 on Budock Road. These differential settlement alarms are detailed on the following table.

Marks	Location	Mar-07 Differential Settlement	Mar-08 Differential Settlement	Distance between Marks	Adjusted Difference in Levels between Marks
AP92 and AP93	Mt Albert Road	1 in 4660	1 in 3642	16.7m	4.6mm
AP92 and AP80	Mt Albert Road	1 in 5815	1 in 4379	17.7m	4.1mm
AP110 and AP111	Hillsbrough Road	1 in 2827	1 in 2827	17.7m	6.3mm
OCP68 and AP114	Budock Road	1 in 3308	1 in 3308	23.0m	7.0mm

Settlement alarm values were recorded between AP92 and AP93, AP110 and AP111, and OCP68 and AP114 following the March 2007 survey.

Settlement alarm values were also recorded between AP110 and AP111, and OCP68 and AP114 in the March 2006 survey. The differential settlements at that time were 1 in 4150 and 1 in 4645 respectively. A differential settlement of 1 in 3363 was recorded between AP110 and AP111 in the June 2005 survey.

The settlement alarm events were reported to the Quarry Manager and the Auckland Regional Council. No further action was required as the spacing between these marks are already less than 50 metres.

Seasonal Variation Calculations

As required by Section 6.7 of the Monitoring and Contingency Plan, seasonal variation calculations have been defined for bores 37, 38, 39 and 40. The calculated seasonal variation for the deep and shallow piezometers respectively in bores 37, 38, 39 and 40 are as follows:

Table 1: Deep Piezometers

	BH37a	BH38a	BH39a	BH40a
99% Confidence Limits	RL54.17m RL53.60m	RL54.73m RL53.80m	RL55.31m RL54.82m	RL62.07m RL61.23m
99.9% Confidence Limits	RL54.25m RL53.53m	RL54.85m RL53.67m	RL55.37m RL54.76m	RL62.19m RL61.12m

Table 2: Shallow Piezometers

	BH37b	BH38b	BH39b	BH40b
99% Confidence Limits	RL54.03m RL53.56m	RL53.80m RL53.33m	RL57.42m RL56.50m	RL63.86m RL63.31m
99.9% Confidence Limits	RL54.09m RL53.50m	RL53.87m RL53.26m	RL57.55m RL56.38m	RL63.94m RL63.23m

The groundwater levels in BH40a and BH40b have been in excess of seasonal variation (99% confidence limits) since December 2007. BH40 is the southern most of the Three Kings Quarry

groundwater monitoring bores located on Hillsborough Road immediately adjacent to the SH20 works.

Three Kings groundwater monitoring bores located closer to the Three Kings Quarry (boreholes 36 and 39) have not recorded any movement of groundwater levels beyond normal seasonal variations.

The groundwater level in BH40a (deep piezometer) has fallen 0.95metres from an average level of approximately RL61.65m (to March 2007) to RL60.71m recorded in March 2008. The groundwater level in BH40b (shallower piezometer) has fallen 0.65m from an average level of RL63.6m (to March 2007) to RL62.96m recorded in March 2008.

Over this same period, Transits groundwater monitoring bores adjacent to the "Hillsborough Road cut" SH20 works have fallen similar or greater amounts although the monitoring record is not complete as the Three Kings Quarry groundwater monitoring record. Transits BH15 on the crest of the Hillsborough Road cut has recorded a fall in groundwater level of 1.9m since December 2006 (from RL64.44m to RL62.53m).

The Transit monitoring bores do not extend to the same depth as the Three Kings Quarry groundwater monitoring bores but all bores are located in East Coast Bays Formation (Waitemata).

Although the monitoring results are not conclusive (with the deeper groundwater level in BH40a being drawn down more than the shallower groundwater level – BH40b), as the groundwater monitoring bores closer to the Three Kings Quarry (bores 36 and 39) are not being drawn down, it is considered unlikely that the falling groundwater levels being recorded in BH40a and BH40b are the result of dewatering Three Kings Quarry.

REVIEWS

Groundwater

The results of the groundwater level monitoring are checked as the results are received. No reviews of groundwater levels were undertaken in the year ending March 31 2008.

Surface Levels

The results of precise level surfaces are checked as the results are received. The results of each precise level survey are forwarded to the Auckland Regional Council within 10 working days of the completion of each precise level survey.

A review of precise level survey data was undertaken by Tonkin and Taylor in April 2005 (letter report entitled Three Kings Quarry Dewatering Settlement Review Data to April 2005 dated 16 June 2005). This report reviewed settlement data to the March 2005 survey and included the findings of the Pattle Delemore annual groundwater report dated January 2005.

The Tonkin and Taylor report concluded that while surface settlement monitoring indicates that surface settlement is typically on-going about the quarry, it was at a much reduced rate.

The on-going settlement close to the quarry was concluded to be the result of secondary consolidation induced by changes in groundwater pressure associated with past quarry dewatering. At increased distances from the quarry, Tonkin and Taylor concluded that it is

possible that the ongoing surface settlement includes some delayed consolidation as a result primarily of consolidation of soil strata not currently monitored by piezometers. In addition Tonkin and Taylor concluded that any groundwater drawdown effects at distance from the quarry are small and surface settlement data at the fringe of drawdown are within expected settlement tolerances.

A further review of the precise level survey information was undertaken in August 2005 to determine if cessation of settlement had occurred (letter report dated 29 August 2005). It was found that cessation of settlement (as defined by the consent to dewater Three Kings Quarry) had occurred and this was reported more fully to the Auckland Regional Council in September 2005. As such, and because more than two years has elapsed since dewatering has been undertaken, precise level surveys are now required to be undertaken at 12 month intervals.

No further reviews of surface levels were undertaken in the year ending March 31 2008.

REMEDIAL ACTION

No remedial action was required or undertaken for the 12 month period ending 31 March 2008.

THREE KINGS GROUNDWATER LEVEL RECORD SHEET

Date	BH 1B	BH 2B	BH 5B	BH 6A	BH 6B	BH 6C	BH 7	BH 10a	BH 10b	BH 11b	BH 12a	BH 12b	BH 13a	BH 13c	BH 16	BH 17	BH 18A	BH 18B	BH 19A	BH 19B
18-Apr-07	35.40		34.68	44.51	40.00	35.76	39.86	50.82	72.65	71.99	50.5	66.89	55.15	66.28	50.81	34.59	36.22	45.28	34.68	38.45
16-May-07	35.13		34.39	44.42	39.86	35.56	39.77	50.82	72.65	72.01	50.47	66.9	54.94	66.27	50.8	34.35	36.08	45.15	34.47	38.51
20-Jun-07	34.65	34.04	34.05	44.24	39.59	35.06	39.58	50.80	72.65	72.04	50.78	66.88	54.71	65.93	50.71	34.09	35.81	44.94	34.01	38.39
18-Jul-07	35.21		34.55	44.45	40.01	35.65	40.69	50.94	72.71	72.03	50.78	67.18	54.73	66.36	51.01	34.53	35.9	44.94	34.59	38.58
15-Aug-07	35.30		34.64	45.19	40.23	35.92	40.69	50.99	72.70	72.01	51.12	67.11	63.12	66.37	51.41	34.63	36.07	44.89	34.69	38.65
19-Sep-07	35.21		34.54	46.06	40.29	35.76	40.17	51.01	72.70	72.02	51.12	67.11	63.12	66.37	51.54	34.54	36.19	45.87	34.63	38.51
17-Oct-07	35.05		34.39	46.02	40.25	35.62	40.34	50.97	72.70	72.09	51.06	67.15	64.54	66.36	51.44	34.38	36.07	45.92	34.45	38.51
21-Nov-07	34.72	34.06	34.05	45.93	40.00	35.29	40.08	50.96	72.70	72.15	51.03	67.11	63.48	66.37	51.29	34.04	35.87	46.18	34.15	38.61
19-Dec-07	34.74	34.10	34.07	45.74	39.96	35.27	39.92	50.95	72.69	72.49	50.88	66.94	56.57	66.35	51.29	34.11	35.78	46.08	34.15	38.54
16-Jan-08	34.91	34.27	34.23	45.48	39.95	35.40	39.78	50.95	72.69	72.47	50.73	66.88	55.88	66.34	51.15	34.22	35.83	45.81	34.3	38.67
20-Feb-08	34.80	34.15	34.12	45.12	39.78	35.27	39.68	50.94	72.69	72.41	50.51	66.86	55.62	66.33	50.93	34.11	35.73	45.72	34.2	38.55
19-Mar-08	35.01	34.36	34.34	44.87	39.85	35.48	39.70	50.93	72.69	72.40	50.43	66.86	55.43	66.33	50.81	34.32	35.84	45.68	34.36	38.56

Date	BH 20	BH 20A	BH 21	BH 22	BH 22a	BH 23	BH 23a	BH 24	BH 24a	BH 25	BH 25a	BH 25b1	BH 25b2	BH 26	BH 26a	BH 27	BH 28a	BH 28b	BH 29	BH 30
18-Apr-07	54.62	50.37	36.23	41.17	64.38	51.45	51.13	55.69	62.76	37.57	48.50	48.01	50.89	59.04	54.25	49.5	50.98	52.32	57.73	54.84
16-May-07	54.69	50.37	35.77	41.17	64.33	51.37	51.11	55.71	62.59	37.42	48.62	48.20	50.86	59.04	54.23	49.58	50.91	52.27	57.7	54.87
20-Jun-07	54.71	50.20	35.08	41.18	64.15	51.30	51.08	55.70	62.45	37.15	48.61	48.64	51.37	59	54.19	49.59	51.04	52.39	57.65	54.92
18-Jul-07	54.91	50.89	35.61	41.32	64.68	51.39	51.12	55.82	62.36	37.31	48.91	49.38	51.72	59.06	54.39	49.6	51.26	52.99	57.8	55.18
15-Aug-07	55.07	51.52	36.11	41.32	65.10	51.40	51.11	55.91	62.29	37.35	49.36	49.22	52.1	59.08	54.38	49.59	51.08	53.22	57.87	55.23
19-Sep-07	55.24	51.51	36.10	41.32	64.99	51.48	51.12	56.05	62.22	37.46	49.57	49.22	50.6	59.1	54.32	49.59	50.96	52.64	57.95	55.2
17-Oct-07	55.33	51.48	36.52	41.32	64.97	51.55	51.12	56.11	62.17	37.39	49.49	48.83	50.71	59.09	54.36	49.59	50.88	52.42	57.92	55.17
21-Nov-07	55.24	51.36	36.10	41.32	64.84	51.51	51.14	56.05	62.11	37.21	47.85	49.12	51.95	59.12	54.3	49.59	51.18	52.71	57.92	55.15
19-Dec-07	55.12	51.06	36.04	41.31	64.62	51.54	51.13	55.99	62.06	37.09	48.41	48.53	52	59.33	54.3	49.59	51.25	52.87	57.91	55.16
16-Jan-08	54.93	50.75	36.41	41.31	64.44	51.50	51.13	55.86	62.00	37.09	45.93	48.71	51.65	59.13	54.23	49.59	51.32	52.76	57.84	55.03
20-Feb-08	54.44	50.29	36.38	41.30	64.13	51.38	51.10	55.78	61.93	37.00	46.69	49.08	52.07	59.04	54.13	49.57	50.97	52.54	57.72	55.15
19-Mar-08	54.44	50.19	36.54	41.30	64.04	51.39	51.08	55.73	61.88	37.06	46.49	46.53	50.67	59.04	54.13	49.56	50.82	52.21	57.7	54.69

Date	BH 31a	BH 31b	BH 32	BH 33	BH 34	BH 35a	BH 35b	BH 36a	BH 36b	BH 37a	BH 37b	BH 38a	BH 38b	BH 39a	BH 39b	BH 40a	BH 40b
18-Apr-07	48.75	50.08	54.06	56.82	48.97	49.57	54.91	58.59	58.80	54.09	53.91	54.41	53.67	55	57.09	61.38	63.46
16-May-07	48.64	50.01	54.03	56.91	49.07	49.41	54.90	58.56	58.79	54.05	53.89	54.39	53.61	55.02	57.07	61.26	63.41
20-Jun-07	48.91	50.17	53.88	56.84	48.98	49.43	54.92	58.50	58.77	53.96	53.82	54.36	53.53	54.96	57.06	61.23	63.46
18-Jul-07	49.07	50.31	54.48	57.43	49.52	49.49	55.03	58.68	58.95	54.05	53.96	54.47	53.69	55.12	57.16	61.34	63.42
15-Aug-07	48.79	50.19	54.85	57.76	49.86	49.40	55.12	58.77	59.04	54.11	54.04	54.56	53.79	55.08	57.23	61.35	63.57
19-Sep-07	48.89	50.24	54.73	58.01	49.98	49.44	55.28	58.77	59.06	54.05	53.95	54.5	53.71	55.08	57.22	61.37	63.45
17-Oct-07	48.85	50.28	54.72	58.36	49.96	49.42	55.29	58.81	59.05	54.04	53.96	54.46	53.71	55.17	57.26	61.35	63.42
21-Nov-07	49.05	50.25	54.57	58.52	49.38	49.35	55.23	58.71	58.97	54.05	53.92	54.47	53.73	55.13	57.18	61.23	63.45
19-Dec-07	49.07	50.32	54.36	58.49	49.23	49.36	55.25	58.57	58.94	53.96	53.89	54.43	54.4	55.03	57.13	61.09	63.27
16-Jan-08	49.04	50.41	54.18	58.51	48.11	49.28	55.11	58.51	58.86	53.98	53.87	54.37	53.63	55.04	57.18	61.02	63.2
20-Feb-08	48.84	50.25	54.04	58.32	48.08	49.17	54.93	58.35	58.73	53.91	53.75	54.37	53.64	55.02	57.03	60.79	63.12
19-Mar-08	46.55	49.91	54.04	58.47	48.16	49.13	54.87	58.40	58.72	53.87	53.67	54.37	53.51	54.88	57.02	60.71	62.96

Diagram removed – see link
“Groundwater Levels – Annual Report April 2008”
on previous web page

Diagram removed – see link
“Borehole Location Plan at 10-03-05”
on previous web page

THREE KINGS SURVEY RECORD

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)	
		mN	mE		Mar-07	Mar-08	Mar-07	Mar-08
SS 3136	Mt Eden Rd	697910.68	299385.73	63.047	63.030	63.030	-17	-17
SS 3137	Mt Eden Rd	698072.60	299427.08	63.343	63.338	63.339	-5	-4
M 212A	Mt Albert Rd	696504.39	299153.17	86.127	86.111	86.112	-16	-15
SM 4163	Mt Albert Rd	696843.03	298513.03	74.142	74.141	74.142	-1	0
SM 4164	Mt Albert Rd	696728.57	298688.37	75.851	75.844	75.845	-7	-6
SM 4165	Mt Albert Rd	696625.11	298783.31	83.632	83.623	83.624	-9	-8
SM 3882	Parau St	697063.26	298555.52	63.302	63.301	63.300	-1	-2
RM 3898	McCullough Ave	697067.11	298760.28	76.078	76.065	76.065	-13	-13
RM 3899	McCullough Ave	696900.99	298813.23	77.811	77.801	77.802	-10	-9
RM 3900	McCullough Ave	696713.60	298916.53	76.657	76.642	76.643	-15	-14
RM 3901	Smallfield Ave	696669.58	298986.57	78.931	78.915	78.914	-16	-17
RM 3902	Smallfield Ave	696747.40	299014.21	80.177	80.165	80.165	-12	-12
RM 3903	Smallfield Ave	696834.73	298965.09	82.524	82.515	82.516	-9	-8
RM 3904	Smallfield Ave	696939.98	298912.45	82.708	82.699	82.699	-9	-9
RM 3907	Fyvie Ave	697063.27	299054.59	80.321	80.315	80.316	-6	-5
RM 3910	Scout Ave	696974.91	298672.88	83.414	83.404	83.405	-10	-9
RM 3925	Bremner Ave	696727.72	298541.52	65.423	65.426	65.425	3	2
RM 3926	Bremner Ave	696630.47	298448.99	59.088	59.092	59.092	4	4
RM 3933	Milliken Rd	696725.14	298412.65	71.049	71.054	71.055	5	6
RM 3934	Milliken Rd	696742.66	298472.30	66.303	66.307	66.307	4	4
RM 3935	Simmonds Ave	696876.97	298725.70	91.755	91.745	91.746	-10	-9
RM 3936	Simmonds Ave	696788.84	298756.78	90.869	90.856	90.857	-13	-12
RM 7440	Hayr Rd	696258.10	299279.70	84.033	84.025	84.026	-8	-7
RM 7457	Mt Albert Rd	696575.40	298967.90	85.707	85.691	85.692	-16	-15
AP 1	Plaza, Mt Albert Rd	696589.80	299127.20	81.269	81.250	81.251	-19	-18
AP 2	Plaza, Mt Albert Rd	696706.40	299158.20	76.290	76.274	76.275	-16	-15
AP 2A	Plaza, Mt Albert Rd	696679.30	299152.50	77.582	77.568	77.570	-14	-12
AP 3	Plaza, Mt Albert Rd	696693.00	299259.10	77.367	77.355	77.355	-12	-12
AP 4	Plaza, Mt Albert Rd	696564.80	299244.90	83.366	83.347	83.347	-19	-19
AP 13	Barrister Ave	696796.00	299064.30	79.867	79.861	79.860	-6	-7
AP 20	Grahame Breed Dr	696723.10	299358.50	76.792	76.784	76.784	-8	-8
SM 3123	Mt Eden Rd	697750.13	299344.75	75.676	75.658	75.658	-18	-18
SM 3124	Landscape Rd	697715.79	299327.99	77.724	77.705	77.705	-19	-19
SM 3125	Landscape Rd	697810.23	298959.44	69.440	69.429	69.429	-11	-11
SM 3126	Landscape Rd	697873.04	298716.42	63.015	63	63.009	-6	-6
SS 3127	Landscape Rd	697911.99	298565.74	59.724	59.722	59.721	-2	-3
SS 3132	Waitomo St	697987.80	298590.90	61.689	61.687	61.687	-2	-2
SM 3883	Parau St	697156.95	298581.04	64.371	64.368	64.367	-3	-4
RM 3884	Parau St	697301.96	298629.21	62.539	62.537	62.535	-2	-4
SM 3885	Duke St	697474.42	298680.34	61.857	61.850	61.848	-7	-9
RM 3886	Fearon Ave	697329.55	298529.49	55.236	55.237	55.235	1	-1
RM 3887	Fearon Ave	697221.32	298498.22	51.548	51.545	51.539	-3	-9
OCP 3888	Parau St	697732.59	298744.43	62.513	62.505	62.504	-8	-9
RM 3889	Duke St	697452.34	298785.50	69.233	69.214	69.213	-19	-20
RM 3891	Duke St	697515.89	299039.80	77.575	77.560	77.561	-15	-14
RM 3892	Duke St	697529.22	299086.26	78.012	77.998	77.998	-14	-14
RM 3893	Duke St	697610.67	299248.07	79.146	79.125	79.125	-21	-21
RM 3894	Fulljames Ave	697586.82	298923.43	72.082	72.063	72.064	-19	-18
RM 3895	Hamon Ave	697620.41	298829.46	65.188	65.174	65.170	-14	-18
RM 3896	McCullough Ave	697345.49	298887.04	69.820	69.801	69.800	-19	-20
RM 3897	McCullough Ave	697170.56	298776.56	75.084	75.070	75.070	-14	-14
RM 3905	Fyvie Ave	697080.60	298923.97	75.813	75.806	75.807	-7	-6
RM 3906	Fyvie Ave	697134.57	298836.07	77.447	77.436	77.436	-11	-11
RM 3908	Fyvie Ave	697093.64	299129.18	82.069	82.065	82.067	-4	-2
RM 3909	Scout Ave	697136.38	298680.63	80.056	80.047	80.048	-9	-8
RM 3911	Dally Tce	697387.46	298991.05	88.894	88.881	88.882	-13	-12
RM 3912	Fearon Ave	697399.31	298512.83	51.652	51.655	51.653	3	1
RM 3913	Fearon Ave	697445.84	298362.01	49.238	49.246	49.244	8	6
RM 3921	Duncumb St	697530.84	298402.67	50.034	50.039	50.037	5	3
RM 3923	Connelly Ave	697465.89	299086.33	74.293	74.279	74.278	-14	-15
RM 3924	Connelly Ave	697424.55	299131.88	73.034	73.021	73.021	-13	-13
SM 4354	Mt Eden Rd	697606.00	299322.20	80.155	80.132	80.132	-23	-23
SM 6241	Duke St	697468.58	298893.36	70.012	69.989	69.988	-23	-24
OCP 90B	Duke St	697480.39	298934.30	71.805	71.787	71.788	-18	-17
AP 10	Roskill Way	697458.10	299308.70	82.673	82.661	82.661	-12	-12
AP 14	Churches Ave	697318.10	298969.20	91.334	91.322	91.324	-12	-10
AP 15	Dally Terrace	697357.20	299055.90	90.821	90.811	90.813	-10	-8
AP 17C	Hunters Park Dr	697293.89	299402.87	74.602	74.596	74.596	-6	-6
AP 29A	Duke St	697501.58	298517.84	49.542	49.543	49.538	2	-4
M 220	Mt Eden Rd	697232.61	299557.19	81.700	81.666	81.666	-34	-34
M 221	Mt Eden Rd	697359.09	299539.94	83.449	83.435	83.435	-14	-14
SS 1555	Selwyn Rd	697413.60	300062.90	99.584	99.582	99.584	-2	0

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)	
		mN	mE		Mar-07	Mar-08	Mar-07	Mar-08
SS 1556	Selwyn Rd	697425.87	300012.81	102.373	102.370	102.372	-3	-1
SS 1617	St Andrews Rd	697887.68	299983.32	81.442	81.443	81.443	1	1
SS 1618	St Leonards Rd	697906.03	299884.48	78.478	78.475	78.474	-3	-4
SS 1619	St Leonards Rd	697935.70	299724.63	66.617	66.614	66.613	-3	-4
SS 1623	St Andrews Rd	697461.10	299874.96	107.522	107.515	107.518	-7	-4
SS 3306	Mt Eden Rd	697993.20	299406.80	60.565	60.555	60.555	-10	-10
SS 3307	St Leonards Rd	697985.83	299454.69	59.661	59.653	59.653	-8	-8
SS 3308	St Leonards Rd	697952.15	299635.99	63.275	63.271	63.270	-4	-5
SS 3311	Rahiri Rd	697752.00	299610.94	95.306	95.292	95.294	-14	-12
SS 3312	Rahiri Rd	697733.64	299682.97	95.929	95.917	95.918	-12	-11
SS 3313	Landscape Rd	697648.30	299592.51	112.633	112.615	112.622	-18	-11
SS 3315	Rewa Rd	697613.41	299396.64	80.938	80.916	80.916	-22	-22
SS 3316	Rewa Rd	697579.48	299529.80	98.902	98.883	98.885	-19	-17
RM 6807	St Andrews Rd	697216.70	299808.10	102.487	102.473	102.476	-14	-11
RM 6812	St Andrews Rd	697370.60	299846.60	108.907	108.894	108.897	-13	-10
SM 6826	Buckley Rd	697157.90	300077.50	74.710	74.708	74.707	-2	-3
RM 6827	Buckley Rd	697345.96	300128.04	83.332	83.334	83.333	2	1
SM 6828	Buckley Rd	697383.80	300177.40	87.952	87.954	87.953	2	1
SS 7701B	Landscape Rd	697619.71	299657.05	115.509	115.506	115.513	-3	4
SS 7702B	Landscape Rd	697602.26	299725.78	110.538	110.535	110.541	-3	3
RM 7703	Landscape Rd	697589.21	299808.37	100.149	100.135	100.137	-14	-12
SM 7704	St Andrews Rd	697556.90	299894.50	97.816	97.810	97.812	-6	-4
RM 7705	St Andrews Rd	697703.31	299921.80	88.086	88.085	88.084	-1	-2
AP 9	St Andrews Rd	697103.90	299782.20	92.802	92.784	92.785	-18	-17
AP 11	Mt Eden Rd	697168.40	299548.70	80.191	80.183	80.184	-8	-7
AP 16	Queens Way	697156.20	299676.20	83.646	83.631	83.633	-15	-13
AP 18B	Mt Eden Rd	697509.31	299384.27	81.641	81.641	81.641	0	0
M 205	Mt Albert Rd	696471.16	300138.54	59.305	59.305	59.304	0	-1
AP 206A	Mt Albert Rd	696527.29	299919.36	59.997	59.998	59.996		-1
M 210	Mt Albert Rd	696536.06	299441.55	83.050	83.032	83.032	-18	-18
SM 1979	Hillsborough Rd	696308.02	299637.25	61.241	61.217	61.214	-24	-27
BP 1977B	Hillsborough Rd	696141.75	299609.93	71.993	71.988	71.983	-5	-10
SM 6809	St Andrews Rd	697001.27	299757.44	81.800	81.781	81.781	-19	-19
SM 6810	St Andrews Rd	696925.56	299720.86	76.956	76.940	76.939	-16	-17
RM 6811	St Andrews Rd	696849.02	299715.44	76.526	76.509	76.506	-17	-20
RM 6813	St Andrews Rd	696631.95	299652.97	80.905	80.882	80.882	-23	-23
RM 6816	Rowan Rd	696721.88	299845.69	78.908	78.889	78.888	-19	-20
SM 6817	Rowan Rd	696808.83	299876.79	80.995	80.981	80.980	-14	-15
RM 6818	Rowan Rd	696826.70	299791.25	81.966	81.949	81.948	-17	-18
RM 6819	Buckley Rd	696678.00	299942.25	65.620	65.610	65.608	-10	-12
SM 6820	Buckley Rd	696808.11	299988.79	71.955	71.949	71.948	-6	-7
SM 6821	Buckley Rd	696938.51	300004.30	71.114	71.110	71.109	-4	-5
SM 6822	Gorrie Ave	696973.90	299863.23	81.874	81.859	81.859	-15	-15
SM 6823	Buckley Rd	697012.43	300021.72	70.593	70.588	70.587	-5	-6
RM 6824	Buckley Rd	697044.38	300030.36	71.084	71.081	71.080	-3	-4
RM 6825	Quentin Ave	697092.90	299916.80	81.386	81.375	81.374	-11	-12
SM 6835	Torrance St	696969.98	300185.70	70.784	70.786	70.785	2	1
SM 6836	Torrance St	696930.33	300343.26	65.955	65.957	65.957	2	2
RM 6838	Fernleigh Ave	696773.28	300065.80	70.304	70.299	70.299	-5	-5
SM 6839	Fernleigh Ave	696748.10	300163.47	67.487	67.487	67.486	0	-1
SM 6840	Fernleigh Ave	696714.69	300296.02	63.278	63.279	63.278	1	0
SM 6841	Peet Ave	696626.68	300131.57	65.698	65.697	65.695	-1	-3
AP 6843A	Kings Way	696958.45	299642.05	75.223	75.223	75.222		-1
RM 7647	Mt Albert Rd	696565.00	299755.10	67.601	67.579	67.577	-22	-24
ORM.I	Weaver Street	696836.50	300316.20	63.578	63.580	63.580	2	2
AP 5	Mt Eden Rd	696757.00	299500.90	75.746	75.736	75.736	-10	-10
AP 6	Queens Way	696746.90	299590.60	75.306	75.289	75.289	-17	-17
AP 7A	St Andrews Rd	696778.94	299702.10	76.820	76.821	76.819	1	-1
AP 8B	Mt Albert Rd	696559.06	299633.48	75.740	75.728	75.727	-12	-13
AP 12	Warren Ave	696409.10	299402.20	94.357	94.341	94.342	-16	-15
OAP 19	St Andrews Rd	696725.00	299676.40	77.508	77.486	77.485	-22	-23
AP 21A	Mt Eden Rd	696997.90	299534.34	77.288	77.288	77.287	0	-1
AP 22	Queens Way	697069.30	299667.60	78.352	78.342	78.342	-10	-10
AP 23	Queens Way	696858.57	299609.62	74.402	74.393	74.392	-10	-10
AP 30	Mt Eden Rd	696966.19	299525.13	77.329	77.320	77.321	-9	-8
AP 31	Mt Eden Rd	696934.22	299521.42	76.857	76.853	76.854	-4	-3
AP 32	Mt Eden Rd	696902.63	299517.81	76.203	76.194	76.194	-9	-9
AP 33	Mt Eden Rd	696855.06	299512.27	75.121	75.113	75.113	-8	-8
AP 34	Mt Eden Rd	696807.28	299506.75	74.937	74.926	74.925	-11	-12
SM 5387	Erson Ave	696146.21	300815.94	56.747	56.749	56.748	2	1
SM 5386	Symonds St	696104.12	300983.29	55.184	55.187	55.185	3	1
M 638	Manukau Rd	696081.51	301109.25	54.690	54.692	54.691	2	1
CA 55	Manukau Rd	696605.90	300894.30	65.141	65.141	65.141	0	0
CA 53	Akarana Ave	696935.90	298292.10	70.594	70.594	70.594	0	0

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)	
		mN	mE		Mar-07	Mar-08	Mar-07	Mar-08
M 216	Mt Albert Rd	696903.54	298347.91	72.658	72.658	72.658	0	0
SS 1977	Hillsborough Rd	696020.20	299595.82	74.453	74.451	74.448	-2	-5
RM 3927	Bremner Ave	696633.32	298338.77	62.651	62.651	62.652	0	1
RM 3928	Bremner Ave	696727.76	298195.81	56.144	56.146	56.146	2	2
AP 139	Bremner Ave	696788.02	298157.42	56.225	56.225	56.224	0	-1
RM 3931	Milliken Ave	696817.47	298257.51	62.500	62.501	62.501	1	1
RM 3932	Milliken Ave	696733.95	298363.24	71.719	71.718	71.720	-1	1
SS 3004	Dominion Rd	698058.80	298223.46	51.812	51.811	51.810	-1	-2
SS 3131	Shackleton Rd	698110.53	298631.80	59.419	59.417	59.417	-2	-2
SS 3133	Shackleton Rd	698071.30	298770.71	59.554	59.551	59.550	-3	-4
SS 3134	Shackleton Rd	698021.66	298946.50	61.479	61.473	61.473	-6	-6
SS 3135	Shackleton Rd	697966.25	299165.81	61.684	61.680	61.680	-4	-4
SS 3151	Mt Eden Rd	698285.87	299497.70	67.987	67.985	67.987	-2	0
SS 1905	St Andrews Rd	698147.73	300049.39	88.810	88.807	88.807	-3	-3
RM 7707	St Andrews Rd	697973.66	299990.96	81.206	81.204	81.203	-2	-3
SS 1558	Empire Rd	697813.79	300111.39	92.169	92.167	92.166	-2	-3
SS 1559	Empire Rd	697800.00	300165.50	96.024	96.022	96.022	-2	-2
SS 1549	The Drive	697753.34	300348.67	85.871	85.870	85.870	-1	-1
SS 1550	The Drive	697589.88	300306.71	84.432	84.433	84.432	1	0
RM 6830	The Drive	697538.21	300294.84	81.638	81.638	81.637	0	-1
SS 1551	The Drive	697492.54	300281.71	77.481	77.480	77.478	-1	-3
RM 6829	Selwyn Rd	697363.05	300258.05	79.864	79.861	79.858	-3	-6
RM 6832	Selwyn Rd	697337.40	300403.57	80.190	80.189	80.189	-1	-1
SM 5912	Pah Rd	697278.09	300666.24	74.285	74.285	74.284	0	-1
AP 35	Mt Albert Rd	696402.12	300407.23	54.190	54.194	54.193	4	3
AP 37	Hillsborough Rd	696407.39	299705.88	59.335	59.327	59.324	-8	-11
AP 38	Budock Rd	696246.76	299834.65	69.274	69.269	69.268	-4	-5
AP 39	Hillsborough Bowling	696383.07	299856.28	56.297	56.295	56.292	-2	-5
AP 40	Hillsborough Bowling	696445.91	299895.62	55.757	55.754	55.752	-3	-5
IS 41	Hillsborough Bowling	696403.82	299804.75	56.336	56.333	56.330	-3	-6
AP 42	Dornwell Rd	696378.41	299015.87	76.373	76.365	76.364	-8	-9
AP 43	Dornwell Rd	696260.57	298956.76	66.002	65.995	65.994	-7	-8
AP 44	Dornwell Rd	696110.00	298858.85	58.493	58.487	58.486	-6	-7
AP 45	Frost Rd	696471.85	298726.92	64.920	64.912	64.912	-8	-8
AP 54	Frost Rd	696264.66	298577.84	57.855	57.845	57.844	-10	-11
AP 46	Dominion Rd	697995.61	298226.64	50.443	50.442	50.441	-1	-2
AP 47	DESTROYED	697950.56	298343.52	52.522	52.522		0	Refer AP 47A
AP 47A	Landscape Rd	697951.78	298343.10	52.564		52.564		
AP 48	DESTROYED	697921.33	298458.57	56.819	56.817		-2	Refer AP 48A
AP 48A	Landscape Rd	697937.88	298463.58	57.064		57.064		
AP 49A	DESTROYED	697784.60	299050.46	70.323	70.318		-5	Refer AP 49B
AP 49B	Landscape Rd	697788.49	299044.88	70.341		70.341		
AP 50A	DESTROYED	697765.09	299133.24	71.653	71.652		-1	Refer AP 50B
AP 50B	Landscape Rd	697766.32	299132.16	71.660		71.660		
AP 51A	DESTROYED	697744.94	299214.66	74.053	74.048		-5	Refer AP 51B
AP 51B	Landscape Rd	697745.03	299214.61	74.121		74.121		
AP 55	Mt Eden Rd	698209.04	299461.78	68.263	68.260	68.263	-3	0
AP 56	Mt Albert Rd	696314.42	300774.76	58.409	58.411	58.410	2	1
AP 60	Rowan Rd	696681.05	299826.31	76.276	76.268	76.268	-8	-8
AP 61	Rowan Rd	696616.53	299797.11	71.310	71.303	71.301	-7	-9
AP 62	Mt Albert Rd	696530.18	299814.00	63.068	63.063	63.060	-5	-8
AP 63A	Mt Albert Rd	696520.06	299875.15	61.370	61.371	61.369		-1
AP 64	Hillsborough Rd	696478.45	299774.30	60.579	60.575	60.572	-4	-7
AP 65	Hillsborough Rd	696446.58	299735.84	59.546	59.540	59.537	-6	-9
OAP 66	Hillsborough Rd	696359.44	299672.76	59.987	59.984	59.980	-3	-7
AP 67	Hillsborough Rd	696248.43	299622.21	63.871	63.867	63.864	-4	-7
OCP 68	Budock Rd	696235.97	299684.44	66.304	66.300	66.299	-4	-5
AP 69	Budock Rd	696249.57	299731.19	65.977	65.974	65.972	-3	-5
AP 70	Budock Rd	696244.13	299790.39	71.208	71.205	71.204	-3	-4
OAP 71	Hillsborough Rd	696195.17	299615.83	67.651	67.650	67.646	-1	-5
AP 72	Hillsborough Rd	696072.41	299594.01	74.077	74.076	74.072	-1	-5
AP 73	Marie Ave	696238.34	299544.47	70.874	70.869	70.867	-5	-7
AP 74	Marie Ave	696260.93	299489.18	80.330	80.325	80.323	-5	-7
AP 75	Marie Ave	696280.07	299452.86	86.876	86.871	86.872	-5	-4
AP 77	Mt Albert Rd	696539.58	299487.18	82.751	82.744	82.743	-7	-8
AP 78	Mt Albert Rd	696559.36	299551.48	81.022	81.015	81.014	-7	-8
AP 79	Mt Albert Rd	696558.48	299588.52	78.663	78.656	78.656	-7	-7
AP 80	Mt Albert Rd	696561.89	299691.52	71.414	71.407	71.405	-7	-9
AP 81A	Mt Albert Rd	696501.72	300015.21	58.551	58.552	58.550		-1
AP 82A	Mt Albert Rd	696507.72	299991.38	58.575	58.576	58.574		-1
AP 83	Mt Albert Rd	696514.36	299966.95	58.863	58.863	58.861	0	-2
AP 84	Mt Albert Rd	696520.40	299943.25	59.350	59.349	59.347	-1	-3
AP 85	Mt Albert Rd	696516.23	299894.40	60.619	60.617	60.615	-2	-4
AP 86	Mt Albert Rd	696524.80	299855.75	62.051	62.050	62.047	-1	-4

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)	
		mN	mE		Mar-07	Mar-08	Mar-07	Mar-08
AP 87	Mt Albert Rd	696530.55	299833.50	62.733	62.731	62.729	-2	-4
AP 88	Mt Albert Rd	696541.65	299788.51	64.828	64.824	64.821	-4	-7
AP 89	Mt Albert Rd	696560.86	299777.80	65.939	65.935	65.932	-4	-7
AP 90	Mt Albert Rd	696562.93	299734.25	68.687	68.684	68.681	-3	-6
AP 91	Mt Albert Rd	696562.43	299712.45	70.075	70.072	70.070	-3	-5
AP 92	Mt Albert Rd	696560.50	299673.84	72.613	72.613	72.612	0	-1
AP 93	Mt Albert Rd	696559.89	299657.17	73.864	73.861	73.859	-3	-5
AP 94	Mt Albert Rd	696558.57	299610.31	77.101	77.097	77.096	-4	-5
AP 95	Mt Albert Rd	696559.21	299569.96	79.957	79.952	79.951	-5	-6
AP 96	St Andrews Rd	696582.87	299641.10	77.897	77.893	77.892	-4	-5
AP 97	St Andrews Rd	696607.72	299646.90	80.321	80.317	80.316	-4	-5
AP 98	Rowan Rd	696588.07	299763.68	68.501	68.498	68.497	-3	-4
AP 99	Rowan Rd	696594.23	299786.13	69.478	69.475	69.474	-3	-4
AP 100	Hillsborough Rd	696521.99	299784.89	62.966	62.963	62.960	-3	-6
AP 101	Hillsborough Rd	696494.72	299786.95	61.359	61.356	61.352	-3	-7
AP 102	Hillsborough Rd	696457.24	299761.13	60.006	60.003	60.000	-3	-6
AP 103	Hillsborough Rd	696427.81	299719.78	59.404	59.400	59.397	-4	-7
AP 104A	Hillsborough Rd	696385.14	299690.23	59.554	59.553	59.550	-1	-4
AP 105	Hillsborough Rd	696373.80	299682.70	59.711	59.709	59.706	-2	-5
AP 106	Hillsborough Rd	696341.88	299660.52	60.458	60.457	60.454	-1	-4
AP 107	Hillsborough Rd	696324.59	299648.55	60.881	60.880	60.876	-1	-5
AP 108	Hillsborough Rd	696290.76	299628.82	62.060	62.059	62.055	-1	-5
AP 109	Hillsborough Rd	696270.02	299627.79	62.806	62.805	62.802	-1	-4
AP 110	Hillsborough Rd	696230.60	299619.62	64.997	64.992	64.989	-5	-8
AP 111	Hillsborough Rd	696213.05	299617.07	66.322	66.321	66.318	-1	-4
AP 112	Budock Rd	696247.78	299636.80	63.699	63.698	63.695	-1	-4
AP 113	Budock Rd	696235.55	299662.37	65.546	65.546	65.544	0	-2
AP 114	Budock Rd	696238.48	299707.28	65.879	65.883	65.882	4	3
AP 115	Budock Rd	696251.17	299753.13	67.579	67.577	67.576	-2	-3
AP 116	Budock Rd	696251.91	299773.34	69.485	69.484	69.483	-1	-2
AP 117	Budock Rd	696245.16	299811.84	70.833	70.834	70.832	1	-1
OAP 118	Mt Albert Rd	696509.17	299918.39	59.895	59.891	59.890	-4	-5
AP 119A	Haughey Ave	696164.45	299223.61	72.896	72.897	72.895		-1
AP 120	Haughey Ave	696109.88	299304.27	67.450	67.449	67.447	-1	-3
AP 121	Haughey Ave	696056.80	299385.05	66.666	66.665	66.662	-1	-4
AP 122	Haughey Ave	696006.86	299462.68	66.032	66.031	66.028	-1	-4
AP 123	Haughey Ave	695958.87	299555.50	73.227	73.224	73.220	-3	-7
OAP 125	Hillsborough Rd	695847.40	299535.51	69.958	69.957	69.953	-1	-5
SS 1976	Hillsborough Rd	695759.40	299503.94	71.137	71.132	71.129	-5	-8
AP 126	DESTROYED	695885.73	299463.44	65.133	65.129		-4	Refer AP 126A
AP 126A	Carr Rd	695885.14	299465.27	65.244		65.244		
OAP 127	Carr Rd	695905.57	299370.85	61.441	61.441	61.438	0	-3
RM 7441	Carr Rd	695901.87	299261.38	58.499	58.498	58.496	-1	-3
AP 129A	Carr Rd	695938.31	299190.92	58.155	58.156	58.154		-1
OAP 130	Dornwell Rd	696185.75	298907.65	60.670	60.669	60.668	-1	-2
OAP 131	Hayr Rd	696067.40	299157.71	63.120	63.120	63.119	0	-1
OCP 41B	Carr/Hayr Rds	695981.19	299080.36	58.362	58.360	58.357	-2	-5
AP 132	Carr Rd	696043.81	298963.55	58.403	58.403	58.401	0	-2
AP 133	Carr Rd	696128.84	298776.82	58.156	58.156	58.155	0	-1
AP 134	Carr Rd	696177.86	298685.47	58.033	58.033	58.032	0	-1
AP 135	Frost Rd	696157.94	298506.10	57.399	57.400	57.399	1	0
AP 136	Frost Rd	696363.44	298640.34	59.265	59.263	59.263	-2	-2

Diagrams removed – see link
“Survey Monitoring Points – Sheets 1 & 2”
on previous web page

Transit ARC Consent 26046 Groundwater Level Monitoring

Piezometer No. Ground Level RL (m) Installed Depth (m) Base of Screen RL (m)	BH 60		BH 68		BH 70		BH 71	
	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)
	55.09 11.37		69.05 18.3 50.75	69.05 5.9	77.29 23.35 53.94	77.29 10	75.33 17	75.33
			Deep	Shallow	Deep	Shallow	Deep	Shallow
Date	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)	Water Depth (m)	Water Lvl RL (m)
4/10/2005	3.335	65.715	1.96	67.09	8.05	69.24	7.78	67.55
2/11/2005	3.4	65.65	2.05	67	7.93	69.36	7.9	67.43
7/12/2005	3.43	65.62	2.09	66.96	7.8	69.49	7.95	67.38
1/01/2006								
1/02/2006					7.61	69.68	8.03	67.3
2/03/2006					7.4	69.89	7.96	67.37
1/04/2006								
4/05/2006					7.35	69.94	7.6	67.73
1/06/2006					7.4	69.89	7.35	67.98
3/07/2006	3.21	65.84	2.5	66.55	7.45	69.84	7.02	68.31
31/08/2006	3.32	65.73	2.7	66.35	7.51	69.78	8.8	68.53
1/09/2006								
5/10/2006	3.12	65.93	2.32	66.73	7.63	69.66		
1/11/2006								
1/12/2006	3.35	65.7	2.62	66.43	7.74	69.55		
12/01/2007	3.56	65.49	2.75	66.3	7.96	69.33		
8/02/2007	3.79	65.26	3	66.05	8.13	69.16	13.11	62.22
6/03/2007	4.05	65	3.32	65.73	8.33	68.96	13.33	62
17/04/2007	4.34	64.71	3.5	65.55	8.62	68.67	13.15	62.18
8/05/2007	4.4	64.65	3.61	65.44	8.84	68.45	13.24	62.09
13/06/2007	4.53	64.52	3.74	65.31	9.14	68.15	13.26	62.07
17/07/2007	4.45	64.6			9.26	68.03	13.175	62.155
16/08/2007					9.24	68.05		
7/09/2007					9.27	68.02		
2/10/2007	6.285	48.805			9.37	67.92		
13/11/2007	6.25	48.84			9.34	67.95		
11/12/2007			3.18	65.87	9.44	67.85		
16/01/2008			3.27	65.78	9.56	67.73		
12/02/2008	7.43	47.66	3.47	65.58	9.67	67.62		
25/03/2008	8.14	46.95	3.64	65.41	10.57	66.72	13.31	62.02
			4.55	64.5				

Diagrams removed – see link
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