



THREE KINGS QUARRY

RESOURCE CONSENT 12977

ANNUAL DEWATERING MONITORING REPORT

May 2013

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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 2012 to 31 March 2013 and includes the precise level survey completed in May 2013.

Monitoring Summary

The monitoring of groundwater levels has been undertaken monthly for the year ending 31 March 2013. An additional monitoring round was undertaken in the last week of May 2012 and June 2012 for quarry and immediately surrounding boreholes to confirm that groundwater levels were greater than RL34m. With regard to the pneumatic piezometers, this monitoring is undertaken by a contractor and two monitoring rounds (September 2012 and January 2013) were missed. Procedures have been amended to ensure this monitoring is undertaken on monthly basis.

Groundwater levels within the quarry have been held above RL34m since the lowering of the groundwater table ceased in October 2002.

In the 12 months to 31 March 2013, a groundwater monitoring bore was lost to quarry development work in June 2012 (BH 1B located in the south-western corner of Three Kings Quarry), and 2 pneumatic piezometers reached the end of their operating life and are not responding to monitoring (piezometer 28B located in BH 28A on Hillsborough Road and 31B located within BH 31 on Shackleton Road).

No new groundwater monitoring bores were installed in the 12 month period ending 31 March 2013.

A survey of all precise level benchmarks was undertaken in March-April 2013. Final results were received 8 May 2013.

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).

Seven replacement marks were installed within the survey network, and differential settlement alarm values were continued to be recorded between marks within the general area of Mt Albert Road and Hillsborough Road. Two additional differential settlement alarm values were recorded to the north-west and south-west of Three Kings Quarry (on Duke Street and Smallfield Avenue respectively)

Groundwater levels and precise level survey results are attached to this report.

Groundwater Levels

Groundwater levels within the quarry continue to be maintained by pumping at between RL34m and RL35m. Groundwater levels in groundwater monitoring bores adjacent to and within Three Kings Quarry (especially BH6c, BH17, BH18A, BH19A and BH21 in the area surrounding Three Kings Quarry) continue to be drawn down by the dewatering of Three Kings Quarry.

Groundwater level monitoring elsewhere continues to record seasonal variations.

Groundwater level monitoring results (including graphs of monitoring results since December 1996) for the year ending 31 March 2013 are attached.

Precise Level Survey Results

A survey of all precise level benchmarks was undertaken in March-April 2013. Following receipt of the initial results, additional checks were undertaken over the northern third of the survey area where reasonably significant settlement was recorded. Final results were received 8 May 2013.

In summary, the precise level survey marks were generally within 5mm of the previous reading.

Settlements were recorded along the entire northern edge of the survey area, from Dominion Road in the west to The Drive in the east. Additional precise levelling surveying was undertaken to confirm these settlements following the initial results being received. The additional work generally confirmed the initial survey. These settlements continue outside the dewatering area of influence.

Three marks recorded settlements of 6mm – AP1619A on St Leonards Road, SS3306 on Mt Eden Road and RM3894 on Fulljames Avenue, all located to the north of Three Kings Quarry, and one mark recorded a rise of greater than 5mm – AP129A on Carr Road to the south of Three Kings Quarry.

With regard to AP1619A on St Leonards Road and SS3306 on Mt Eden Road, while all marks within this general area have recorded settlements since March 2011, groundwater levels in bores 24, 24A, 30 and 33 have been within levels recorded previously. The origin of the settlements recorded in AP1619A and SS3306 are unknown but are not considered to be a result of dewatering Three Kings Quarry. Graphs showing groundwater levels and precise level movements adjacent to these marks are attached to this report.

With regard to RM3894 on Fulljames Avenue, a settlement of 6mm was recorded. This settlement was not recorded in adjacent marks and groundwater levels in this general area have remained within seasonal variation. An inspection of RM3894 was undertaken. No obvious sign of damage or disturbance were observed. The reason for the settlement recorded in RM3894 is unclear. It may be a result of a natural (background) variation in the survey mark or a combination of a correction from previous levels compounded by the general settlement recorded over the northern third of the survey area. Differential settlements with adjacent marks are greater than 1 in 10,000.

With regard to AP129A on Carr Road to the south of Three Kings Quarry, a rise of 6mm was recorded. This rise is slightly greater than that recorded in surrounding marks and is most likely due to a correction in surface levels from those recorded in March 2012.

Seven replacement marks were installed:

- AP55A on Mt Eden Road (replaces AP55)
- AP3123A on Mt Eden Road (replaces SM3123)
- AP3124A on Mt Eden Road (replaces SM3124)
- AP3136A on Mt Eden Road (replaces SS3136)
- CN3137A on Mt Eden Road (replaces SS3137)
- AP71A on Marie Avenue (replaces AP71), and
- AP74A on Marie Avenue (replaces AP74).

All marks were lost due to footpath/kerb replacement works.

Differential Settlement

Differential settlement alarm values continue to be recorded between:

- AP92 and AP93, and AP92 and AP80 on Mt Albert Road,
- AP62A and AP88A at the intersection of Mt Albert and Hillsborough Road,
- AP110 and AP111 on Hillsborough Road, and
- OCP68 and AP114, AP69 and AP114, AP70 and AP117, and AP38 and AP117 on Budock Road.

In addition differential settlement alarm values were recorded between:

- AP115 and AP116 on Budock Road,
- OCP90B and SM6241 on Duke Street, and
- RM3901 and RM3902 on Smallfield Avenue

Marks	Location	Mar-12 Differential Settlement	Distance between Marks	Adjusted Difference in Levels between Marks
AP92 and AP93	Mt Albert Road	1 in 938	16.7m	17.78mm
AP92 and AP80	Mt Albert Road	1 in 994	17.7m	17.85mm
AP62A and AP88A	Mt Albert and Hillsborough	1 in 3397	24.1m	7.10mm
AP110 and AP111	Hillsborough Road	1 in 2698	17.7m	6.57mm
OCP68 and AP114	Budock Road	1 in 2221	23.0m	10.35mm
AP69 and AP114	Budock Road	1 in 3124	26.4m	8.33mm
AP70 and AP117	Budock Road	1 in 1743	21.5m	12.32mm
AP38 and AP117	Budock Road	1 in 1907	22.9m	11.99mm
AP115 and AP116	Budock Road	1 in 4819	20.2m	4.20mm
OCP90B and SM6241	Duke Street	1 in 4058	42.6m	10.50mm
RM3901 and RM3902	Smallfield Avenue	1 in 4896	82.6m	16.87mm

A trend analysis of each differential settlement alarm is attached to this report.

The actions required for Differential Settlement Alarms Values less than 1 in 5000 but greater than 1 in 2000 are to report these to the Auckland Council and Three Kings Quarry Manager,

and to install additional survey marks at 50 metre centres between existing survey marks.

Please note that the spacing between all marks with the exception of RM3901 and RM3902 is already less than 50 metres.

The differential settlement alarm between RM3901 and RM3902 is not considered to be the results of dewatering Three Kings Quarry. As reported in the April 2012 Annual Monitoring Report, recent settlements in RM3901 was considered to be partly due to a leaking water main.

The differential settlement between OCP90B and SM6241 on Duke Street has been just over 1 in 6000 since March 2008. The recent increase in the differential settlement has been a relative fall in OCP90B compared with SM6241. Trend analysis indicates this differential settlement between these two marks will remain at about 1 in 5000.

The actions required for Differential Settlement Alarm Values less than 1 in 2000 but greater than 1 in 1000 are to:

- Install additional survey marks at 25metre centres between existing marks,
- Report these settlements to the Three Kings Quarry Manager, affected property owners, South Epsom Planning, Three Kings United, Epsom Environmental Effects, and Mt Roskill and Eden-Albert Community Boards.
- Assess the potential impact of on-going settlements on building and services, and
- Undertake a review of the groundwater model and settlement predictions.

The Differential Settlement Alarms currently being recorded between AP38, AP70 and AP117 on Budock Road are not a result of dewatering Three Kings Quarry. AP38 and AP70 have recorded settlements consistent with other marks in this area, while AP117 has recorded an 11mm rise since it was installed in 2003.

There are visual signs of deterioration or disturbance to the footpath along Budock Road (all marks along Budock Road are survey nails in the footpath or driveways). There is a noticeable deterioration in the footpath at the location of AP117 (photographs attached).

A detailed analysis of precise level survey marks in the vicinity of AP38, AP70 and AP117 is presented in the following table. The locations of precise level survey marks are shown on the attached drawings. The adjusted change in level is undertaken to correct for any movement arising from the dewatering Three Kings Quarry prior to the precise level mark being installed.

<i>Precise Level Mark</i>	<i>Change in Level since First Survey (mm)</i>	<i>Adjusted Change in Level (mm)</i>	<i>Precise Level Marks</i>	<i>Differential Settlement</i>	
				Spacing (metres)	Differential Settlement
AP 38	-5.20	-5.20			
AP 117	+11.13	-6.79	AP38-AP117	22.9	1 in 1907
AP 70	-3.07	-5.53	AP117-AP70	21.5	1 in 1743
AP 116	-1.37	-7.55	AP70-AP116	18.7	1 in 9278
AP 115	-4.33	-11.74	AP116-AP115	20.2	1 in 4819
AP 69	-5.33	-11.75	AP115-AP69	22.0	1 in 2199826
AP 114	+6.77	-3.42	AP69-AP114	26.4	1 in 3164
OCP 68	-4.30	-13.77	AP114-OCP68	23.0	1 in 2221
AP 113	-1.33	-14.22	OCP68-AP113	21.2	1 in 47693
AP 112	-3.50	-18.23	AP113-AP112	25.7	1 in 6407
AP 67	-7.70	-21.41	AP112-AP67	17.6	1 in 5537

The results show that the change in level of AP117 (as is AP114 and to a lesser extent AP116 and AP113) is anomalous and not consistent with the settlement arising from the dewatering of Three Kings Quarry. Its relative rise in level is not considered to be a result of dewatering Three Kings Quarry.

The actions required for Differential Settlement Alarm Values less than 1 in 1000 are to:

- Cease taking groundwater from Three Kings Quarry,
- Report these settlements to the Three Kings Quarry Manager, the Auckland Council, affected property owners, South Epsom Planning, Three Kings United, Epsom Environmental Effects, and Mt Roskill and Eden-Albert Community Boards.
- Assess the potential impact of on-going settlements on affected structures, and
- Assess and repair any damage in accordance with condition 21B of the consent to dewater Three Kings Quarry.

The Differential Settlement Alarms currently being recorded between AP80, AP92 and AP93 on Mt Albert Road adjacent to the St Andrews Reserve are not a result of dewatering Three Kings Quarry (as reported and agreed previously). AP80 and AP93 have recorded settlements consistent with other marks in this area while AP92 has risen 9mm since it was installed in 2003.

There are signs of deterioration or disturbance to the footpath at the location of AP92. There is a noticeable upward bowing in the concrete footpath compared with the kerb (photographs attached).

A detailed analysis of precise level survey marks in the vicinity of AP80, AP92 and AP93 is presented in the following table. The locations of precise level survey marks are shown on the attached drawings. The adjusted change in level is undertaken to correct for any movement arising from the dewatering Three Kings Quarry prior to the precise level mark being installed.

<i>Precise Level Mark</i>	<i>Change in Level since First Survey (mm)</i>	<i>Adjusted Change in Level (mm)</i>	<i>Precise Level Marks</i>	<i>Differential Settlement</i>	
				Spacing (metres)	Differential Settlement
RM 6813	-26.83	-26.83			
AP 97	-7.7	-26.36	RM6813-AP97	25.0	1 in 52772
AP 96	-7.3	-26.35	AP97-AP96	25.5	1 in 2551789
AP 8B	-16.1	-27.53	AP96-AP8B	25.0	1 in 21186
AP 79	-9.2	-22.13			
AP 94	-7.37	-25.00	AP79-AP94	21.8	1 in 7601
AP 8B	-16.1	-27.53	AP94-AP8B	23.2	1 in 9148
AP 93	-8.03	-26.63	AP8B-AP93	23.7	1 in 26436
AP 92	+9.17	-8.85	AP93-AP92	16.7	1 in 938
AP 80	-12.63	-26.70	AP92-AP80	17.7	1 in 994
AP 91	-8.73	-26.55	AP80-AP91	20.9	1 in 139580
AP90	-9.5	-27.75	AP91-AP90	21.8	1 in 18222
RM 7647	-26.67	-26.67	AP90-RM7647	21.0	1 in 19341

The results show that the change in level of AP92 is anomalous and not consistent with the change in levels in the surrounding precise level survey marks. Its relative rise in level is not considered to be a result of dewatering Three Kings Quarry.

These differential settlement alarm values are being carefully tracked and any further assessments will be undertaken as required by the Monitoring and Contingency Plan for Dewatering Three Kings Quarry.

Stage Control Levels

A review of the Stage Control Levels has been undertaken (Table 1, Section 7.0 of the Monitoring and Contingency Plan). Intermediate triggers have been recorded for total settlement in Settlement Zones I, II, IIB, III, IV and V.

Section 7.1 of the Monitoring and Contingency Plan requires that if a Stage Control Trigger is recorded, dewatering (lowering of the groundwater table) is to cease. Section 7.2 requires a review of groundwater levels and precise level survey data, and section 7.3 requires that the results of this review be forwarded to the Auckland Council prior to dewatering recommencing.

Graphs showing the adjusted total settlements exceeding the Intermediate Trigger (any pre-existing settlement has been added to marks installed after dewatering commenced) of precise level marks in each Settlement Zone are attached together with the drawing showing the Settlement Zones.

In summary, the Immediate Trigger for Zone 1 for quarry groundwater drawdown at RL30m is 10mm, 20mm for Zone II, 45mm for Zone IIA, 15mm for Zone IIB, 10mm for Zones III and IV, 25mm for Zone IIIA and 5mm for Zone V. There are no precise level marks in Zone IIIB.

These triggers have been exceeded as summarised in the following table.

Settlement Zone	Intermediate Trigger (mm)	Current Maximum Total Settlement (mm)
Zone 1	10	18
Zone II	20	30 (33)
Zone IIA	45	29
Zone IIB	15	17
Zone III	10	15
Zone IIIA	25	16
Zone IIIB	20	-
Zone IV	10	11
Zone V	5	7

Please note in Zone II, two precise level marks (RM3901 and RM3895) are currently recording 33mm of movement however this movement is not considered to be solely a result of dewatering Three Kings Quarry. The movement of RM3895 is considered to be a result of the removal an adjacent large tree at some time in the past, and the recent movement in RM3901 is considered to be partly due to a leaking water main.

Although further dewatering is not being proposed, a review of groundwater levels and survey data has been undertaken.

Groundwater levels have stabilised since dewatering (lowering of the groundwater table) ceased in October 2002. Groundwater levels have generally only varied due to season fluctuations since dewatering ceased with some rebound of groundwater levels following the reduced pumped rates being measured in isolated piezometers (bores 23, 26, 28a, 29, 30 and 33).

Precise level marks levels have stabilised since dewatering ceased with cessation of settlement of precise level survey marks (no settlement as a result of dewatering greater than 5mm in any continuous 12 month period) having been recorded since September 2005.

In summary, the primary consolidation associated with dewatering ceased mid-2004. Precise level survey marks in Areas I, II, IIA and IIIA are recording some secondary consolidation but at a much reduced rate compared with the primary consolidation (3 to 4mm per year primary consolidation compared with 0.6 to 0.9mm per year secondary consolidation).

The Intermediate Stage Control Triggers are shown on the attached graphs with the location of the triggering points shown on the attached plan. The location of the triggering points are scattered but are generally grouped to the northwest and southeast of Three Kings Quarry.

Differential settlement triggers associated with these Intermediate Stage Control Triggers have only been recorded between OCP90B and SM6241 on Duke Street (1 in 4058), and between RM3901 and RM3902 on Smallfield Avenue (1 in 4896).

With regard to section 7.2 of the Monitoring and Contingency Plan, ground settlements are not greater than 10mm per year; there are no differential settlement (as a result of the dewatering) greater than 1 in 2000; and there is no settlement greater than 100mm for points established prior to 30 September 2002, or greater than 75mm for points established after 30 September 2002.

There is no proposal to recommence dewatering. As required by section 7.3 of the Monitoring and Contingency Plan, should dewatering be recommenced, the results of a review undertaken prior to dewatering recommencing will be forwarded to the Auckland Council.

Seasonal Variation Calculations

As required by Section 6.7 of the Monitoring and Contingency Plan, seasonal variation calculations were defined for bores 37, 38, 39 and 40 in the 2007 Annual Report. 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

Seasonal variation triggers are the greater of the 0.2 metres below the bottom level of the natural groundwater level range (99% confidence level), or the bottom 99.9% probability limit calculated from the first two years of data.

Table 3: Seasonal Variation Triggers

	BH37	BH38	BH39	BH40
Deep Piezometers	RL53.40m	RL53.60m	RL54.62m	RL61.03m
Shallow Piezometers	RL53.36m	RL53.13m	RL56.30m	RL63.11m

The groundwater levels in BH40a and BH40b have been in excess of seasonal variation trigger since early 2008. BH40 is the southern most of the Three Kings Quarry groundwater monitoring bores located on Hillsborough Road just to the north of the SH20.

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 approximately 0.85metres from an average level of approximately RL61.65m (to March 2007) to an average level for the year ending 31 March 2013 of approximately RL60.80m.

The groundwater level in BH40b (shallower piezometer) has also fallen 0.85m from an average level of approximately RL63.6m (to March 2007) to an average level for the year ending 31 March 2013 of approximately RL62.75m.

The groundwater levels in BH40a and BH40b are currently recording seasonal variation (refer attached graphs).

Up until March 2008, Transits groundwater monitoring bores adjacent to the "Hillsborough Road cut" SH20 works recorded a similar or greater amount of change 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 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).

As reported previously, 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 and reviewed as the results are received. A review of groundwater levels and precise level survey marks has been undertaken as required by Section 7.2 of the Monitoring and Contingency Plan.

Surface Levels

as required by Section 7.2 of the Monitoring and Contingency Plan.

Surface Levels

The results of precise level surfaces are checked and reviewed when the results are received, with the results forwarded to the Auckland Council and Three Kings United Inc.

A review of precise level survey data was undertaken by Tonkin and Taylor in 2005. This report reviewed settlement data to the March 2005 survey and included the findings of the Pattle Delamore 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 is 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 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. 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.

A review of the precise level data has been undertaken as required by Section 7.2 of the Monitoring and Contingency Plan – exceedance of an Intermediate Settlement Trigger. The review concluded that settlements are not in excess of 10mm per year; that the differential settlement between any two monitoring points caused by the exercise of the consent to dewater Three Kings Quarry is not greater than 1 in 2000; and total settlement is not greater than 100mm (or 75mm for precise level survey marks installed after 30 September 2002).

There is currently no proposal to further dewater Three Kings Quarry.

REMEDIAL ACTION

No remedial action was required or undertaken for the period ending mid-May 2013.

Groundwater Level Monitoring Results and Graphs

(Groundwater Monitoring Bore Location Plan)

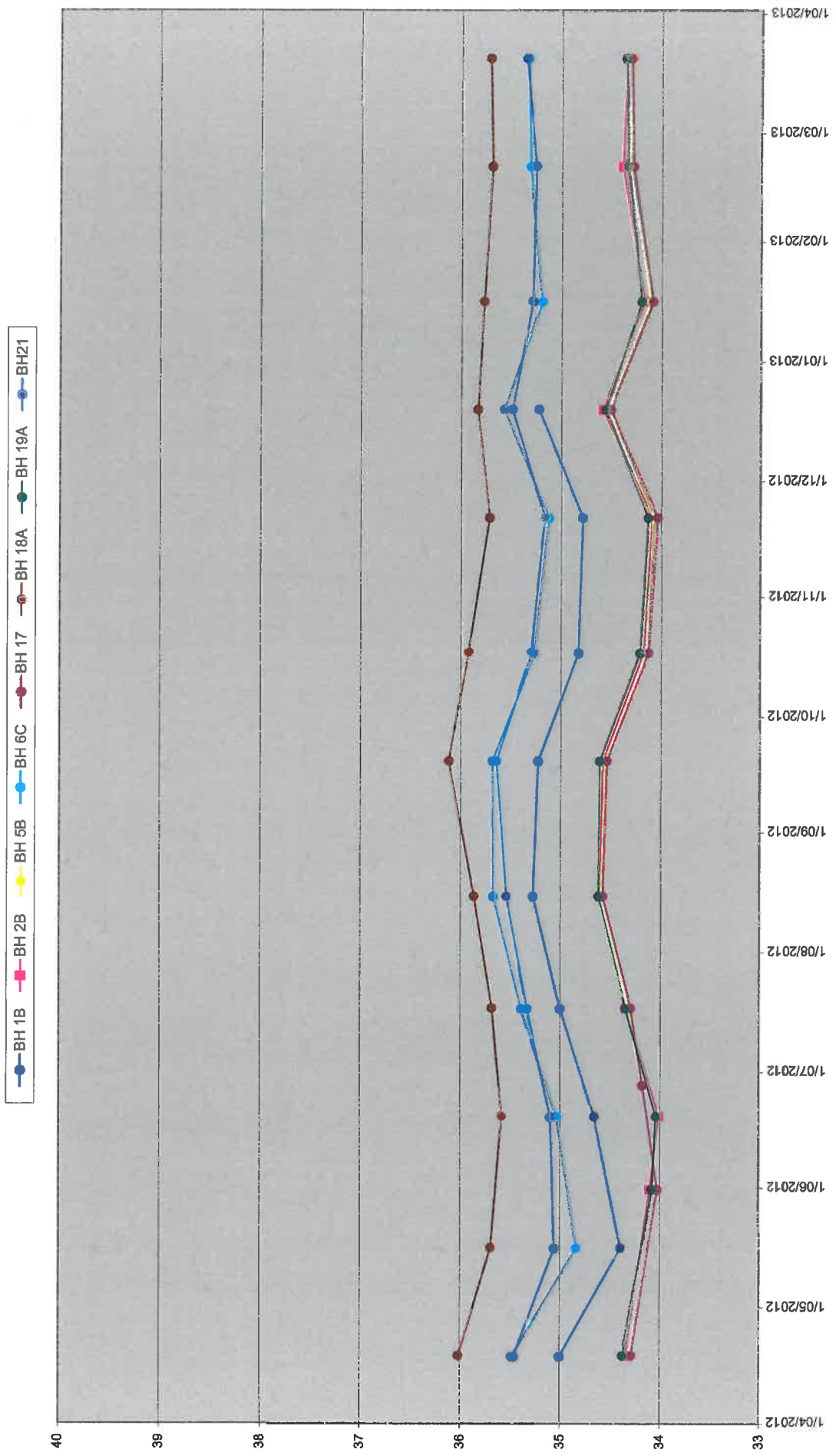
THREE KINGS GROUNDWATER LEVEL RECORD SHEET

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-12	35.01	34.35	34.30	45.66	40.15	35.48	40.15	51.00	72.68	72.43	51.05	67.09	57.74	66.35	51.56	34.29	36.02	45.68	34.37	38.60
16-May-12	34.40			45.61	39.92	34.84	40.06	50.92	72.67	72.46	50.84	67.09	56.05	66.33	51.37		35.70	46.53		38.67
31-May-12		34.11	34.03													34.03				
19-Jun-12	34.66	34.02		45.32	39.91	35.04	40.01	50.91	72.67	72.44	50.78	67.08	55.85	66.34	51.24		35.59	46.47	34.04	38.71
27-Jun-12			34.18													34.18				
17-Jul-12	35.01	34.35	34.32	45.25	40.10	35.40	40.34	50.90	72.67	72.45	50.88	67.15	57.84	66.41	51.28	34.30	35.69	46.44	34.35	38.82
15-Aug-12	35.28	34.61	34.60	46.02	40.32	35.68	41.07	51.26	72.67	72.45	51.31	67.19	59.12	66.38	51.70	34.58	35.87	46.62	34.62	39.06
19-Sep-12	35.23	34.58	34.56	46.82	40.54	35.69	40.55	51.34	72.68	72.43	51.37	67.15	58.70	66.36	51.88	34.54	36.12	46.81	34.61	39.13
17-Oct-12	34.83	34.18	34.15	46.50	40.24	35.27	40.08	51.16	72.67	72.43	51.20	67.11	58.73	66.35	51.74	34.13	35.93	46.83	34.21	38.77
21-Nov-12	34.79	34.10	34.09	45.95	40.05	35.13	39.98	50.93	72.66	72.40	50.94	66.94	56.70	66.34	51.46	34.04	35.72	45.63	34.13	38.85
19-Dec-12	35.23	34.59	34.53	45.57	40.17	35.57	39.92	50.92	72.66	72.45	50.79	66.94	56.22	66.34	51.29	34.51	35.84	46.55	34.56	38.86
16-Jan-13		34.18	34.11	45.27	39.96	35.20	39.69	50.92	72.67	72.42	50.64	66.90	55.91	66.32	51.12	34.09	35.78	46.28	34.20	38.85
20-Feb-13		34.40	34.32	44.92	39.87	35.32	39.57	50.92	72.66	72.43	50.46	66.98	55.48	66.31	50.90	34.29	35.70	46.15	34.34	38.84
20-Mar-13		34.36	34.30	44.68	39.87	35.34	39.52	50.91	72.66	72.35	50.30	66.98	55.28	66.31	50.75	34.31	35.72	45.73	34.36	39.03

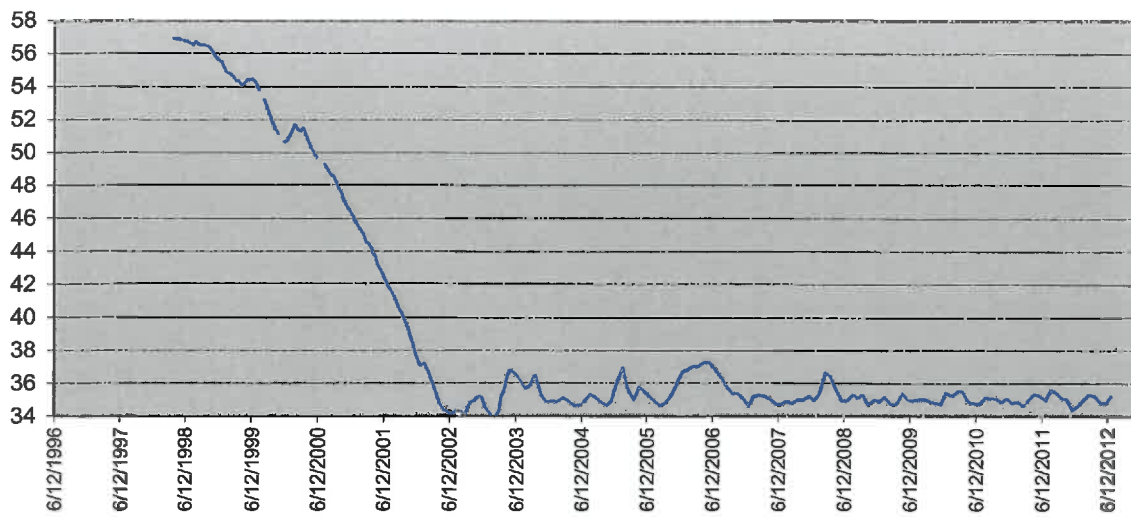
Date	BH 20	BH 20A	BH 21	BH 22	BH 22a	BH 23	BH 23a	BH 24	BH 24a	BH 25	BH 25a	BH 25b1	BH 25b2	BH 26	BH 26a	BH 27	BH 28a	BH 28b	BH 29	BH 30
18-Apr-12	55.12	51.31	35.46	41.19	64.71	51.72	51.26	56.30	60.56	37.26	48.65	48.14	51.69	59.43	54.25	49.59	51.63	53.48	58.63	55.44
16-May-12	55.18	50.92	35.06	41.19	64.43	51.79	51.25	56.34	60.54	37.18	48.96	48.70	51.36	59.43	54.30	49.59	51.65	53.72	58.68	55.36
31-May-12																				
19-Jun-12	55.20	50.80	35.10	41.19	64.35	51.75	51.18	56.26	60.53	37.02	48.88	48.69	51.46	59.43	54.31	49.60	51.55	53.94	58.61	55.32
27-Jun-12																				
17-Jul-12	55.25	51.11	35.34	41.19	64.49	51.71	51.18	56.23	60.55	37.07	49.01	48.79	51.53	59.43	54.34	49.59	51.62		58.65	55.39
15-Aug-12	55.48	52.01	35.55	41.19	65.15	51.77	51.41	56.37	60.37	37.24	49.46	49.25	56.09	59.44	54.47	49.60	51.86		58.83	55.80
19-Sep-12	55.63	52.12	35.65	41.18	65.14	51.82	51.56	56.50	60.37	37.35	49.71			59.44	54.42	49.60			58.86	
17-Oct-12	55.59	51.73	35.30	41.18	64.90	51.83	51.51	56.47	60.37	37.24	49.54	49.35	54.49	59.44	54.34	49.60	51.83		58.80	55.63
19-Sep-12	55.43	51.19	35.17	41.19	64.55	51.81	51.35	56.37	60.37	37.12	47.89	49.96	57.20	59.42	55.28	49.60	51.67		58.72	55.48
17-Oct-12	55.15	50.78	35.49	41.19	64.35	51.77	51.22	56.28	60.36	37.13	47.37	47.18	56.09	59.40	54.25	49.60	51.64		58.65	55.30
16-Jan-13	54.86	50.46	35.29	41.19	64.17	51.71	51.08	56.17	60.36	37.16	45.44			59.34	54.18	49.58			58.60	
20-Feb-13	54.38	50.11	35.26	41.18	63.95	51.60	50.90	55.87	60.34	37.01	44.70	46.20	53.77	59.31	54.13	49.57	51.47		58.46	55.00
20-Mar-13	54.20	49.89	35.36	41.17	63.81	51.57	50.81	55.89	60.31	37.08	45.49	47.16	54.32	59.34	54.11	49.47	51.48		58.43	54.90

Date	BH31a	BH31b	BH32	BH33	BH34	BH35a	BH35b	BH36a	BH36b	BH37a	BH37b	BH38a	BH38b	BH39a	BH39b	BH40a	BH40b
18-Apr-12	49.03	50.35		59.33	49.31	48.85	55.40	59.05	59.11	54.07	53.88	54.40	53.64	54.83	57.21	60.79	62.87
16-May-12	49.06	50.27		59.27	49.35	48.76	55.51	59.03	59.11	53.86	53.78	54.27	53.51	54.71	57.22	60.64	62.76
31-May-12																	
19-Jun-12	48.97	50.25		59.15	49.29	48.62	55.38	59.01	59.07	53.93	53.84	54.33	53.63	54.82	57.27	60.74	62.83
27-Jun-12																	
17-Jul-12	48.95			59.04	49.48	48.57	55.32	59.04	59.09	54.01	53.91	54.36	53.67	54.88	57.23	60.78	62.93
15-Aug-12	49.15			58.94	49.92	48.59	55.52	59.23	59.29	53.99	53.90	54.34	53.71	54.80	57.32	60.73	62.84
19-Sep-12				58.95	50.05	48.57	55.59	59.23	59.30	54.06	53.93	54.42	53.76	54.83	57.34	60.84	62.93
17-Oct-12	49.15			58.82	49.86	48.58	55.56	59.12	59.18	54.03	53.89	54.41	53.66	54.77	57.30	60.87	62.89
21-Nov-12	49.13			58.73	49.21	48.54	55.46	59.03	59.07	54.01	53.88	54.45	53.61	54.80	57.24	60.84	62.82
19-Dec-12	48.99			58.62	48.61	48.55	55.37	58.97	59.02	53.97	53.83	54.47	53.57	54.77	57.19	60.78	62.77
16-Jan-13				58.48	47.96	48.43	55.27	58.89	58.95	53.91	53.75	54.31	53.63	54.72	57.14	60.69	62.68
20-Feb-13	48.73			58.35	47.41	48.33	55.09	58.78	58.86	53.90	53.75	54.26	53.48	54.73	57.05	60.57	62.65
20-Mar-13	48.70			58.22	47.37	48.32	55.02	58.74	58.83	53.86	53.70	54.23	53.46	54.66	57.03	60.56	62.56

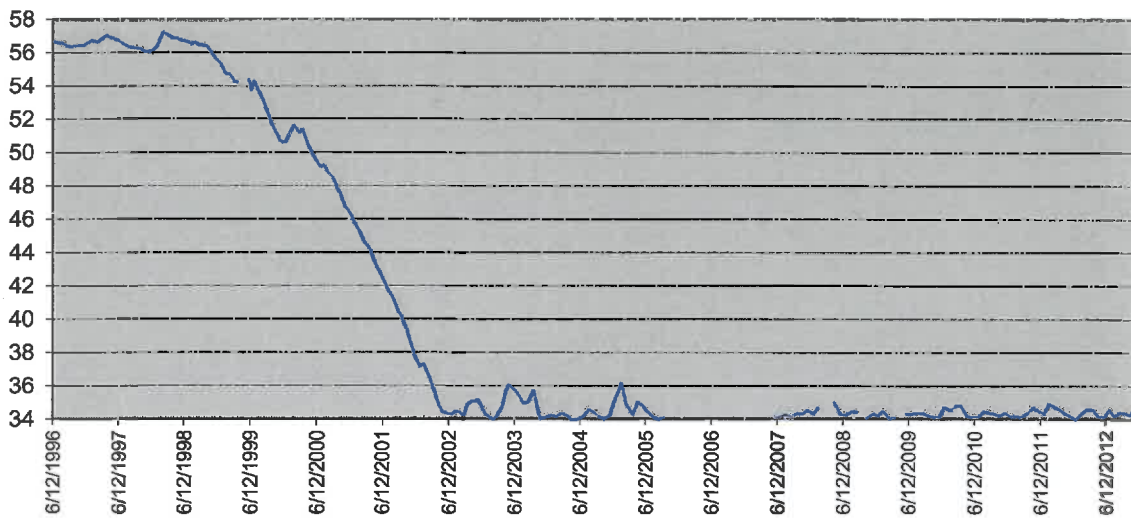
Groundwater Levels - Boreholes within or immediately adjacent to Three Kings Quarry



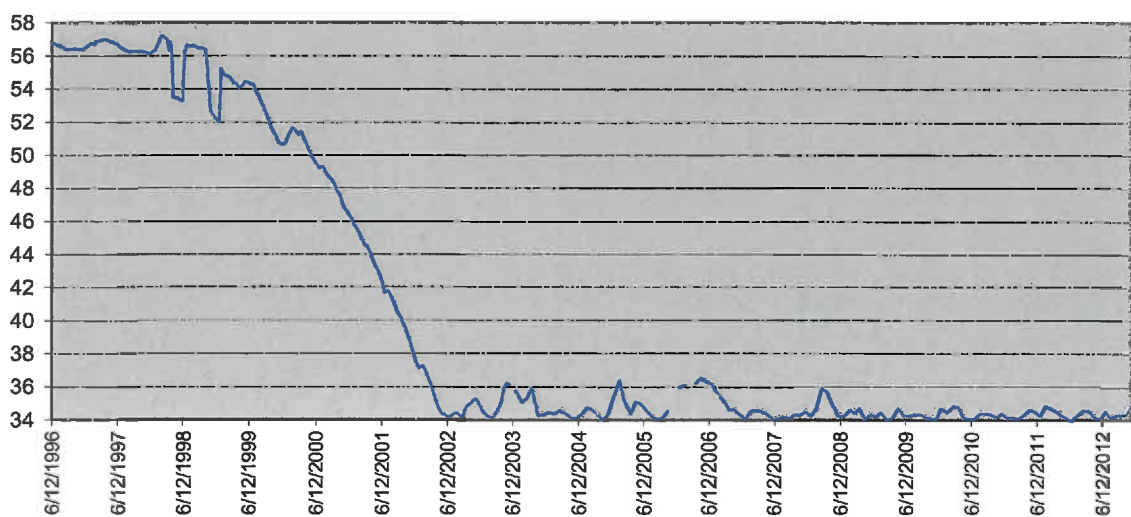
Borehole 1B

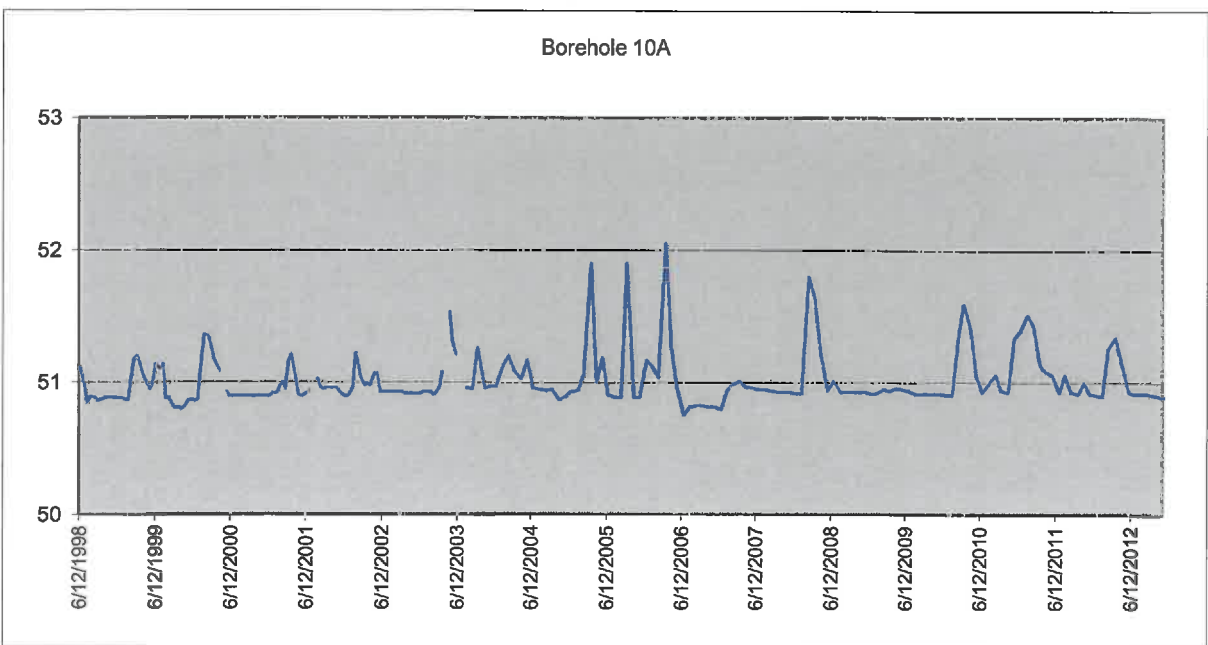
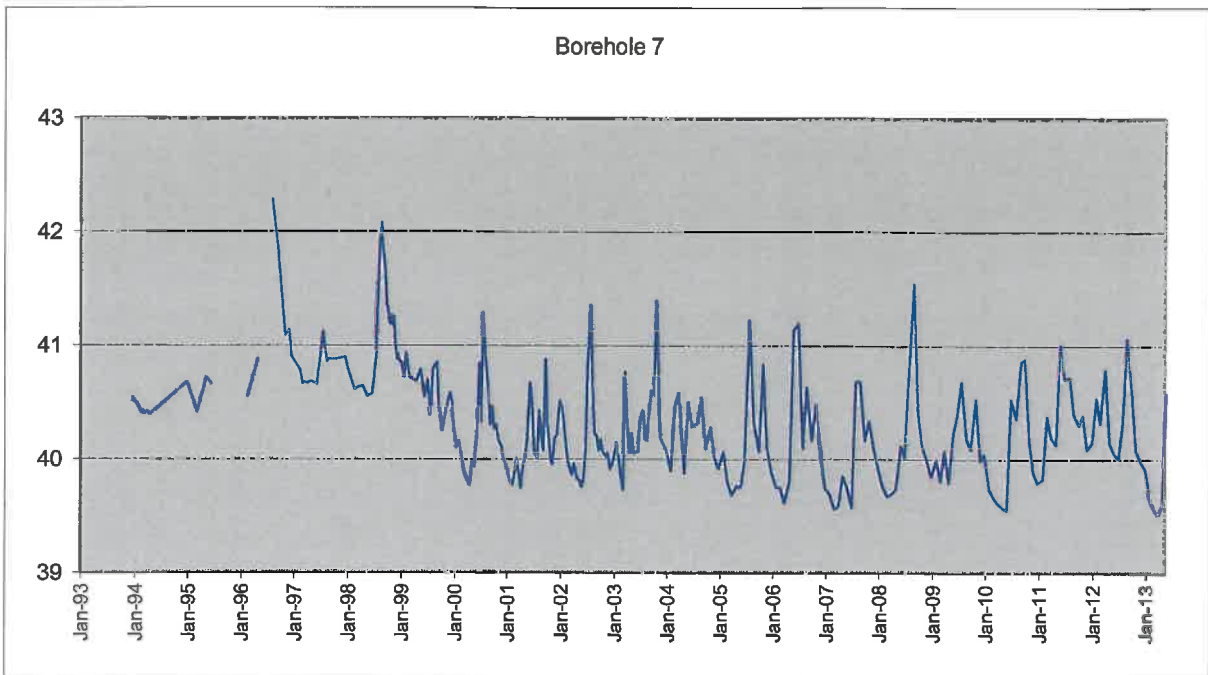
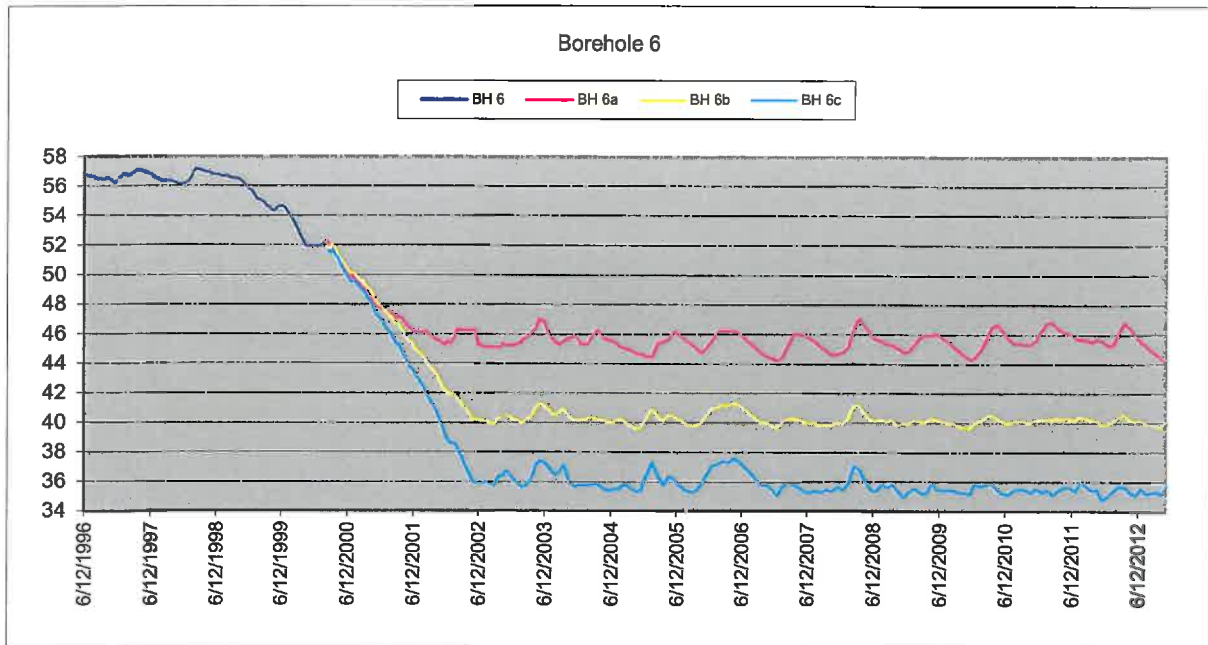


Borehole 2B

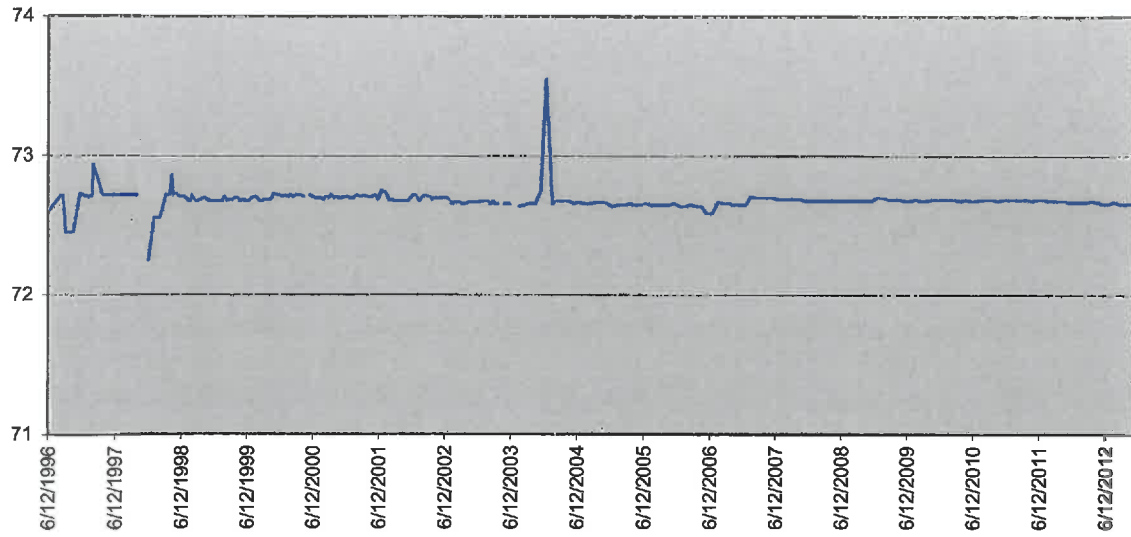


Borehole 5B

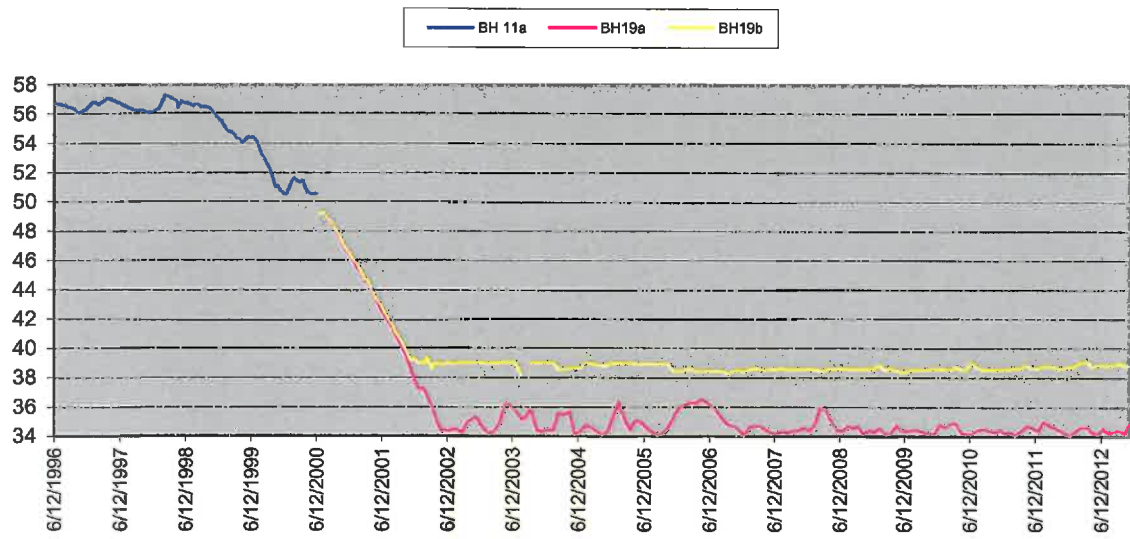




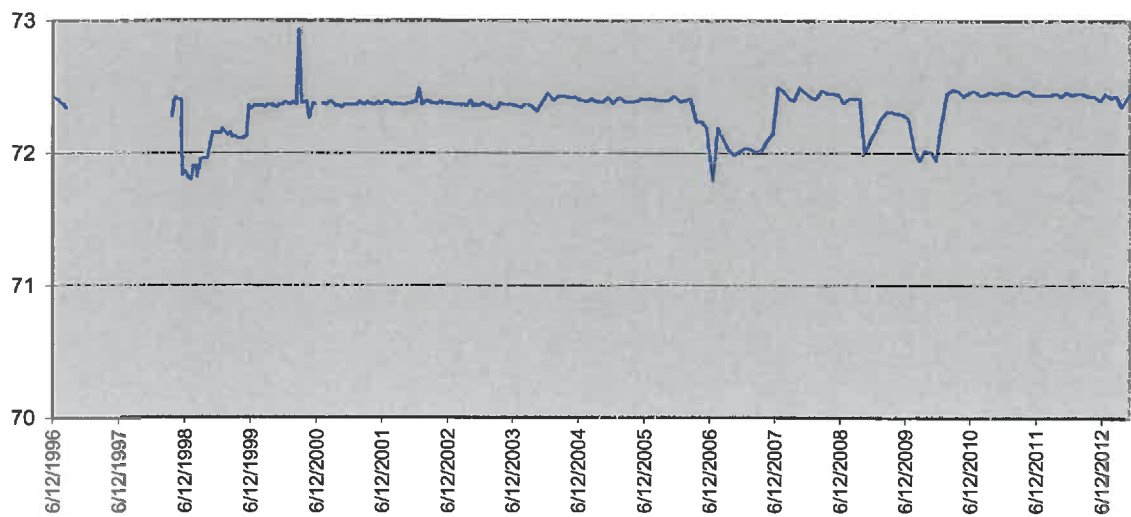
Borehole 10B



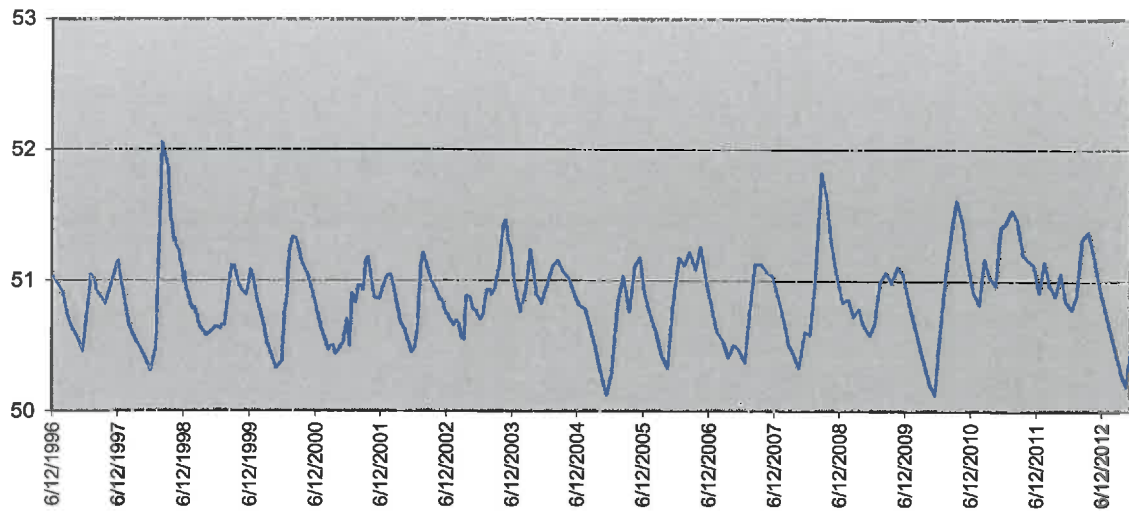
Borehole 11a, 19a and 19b



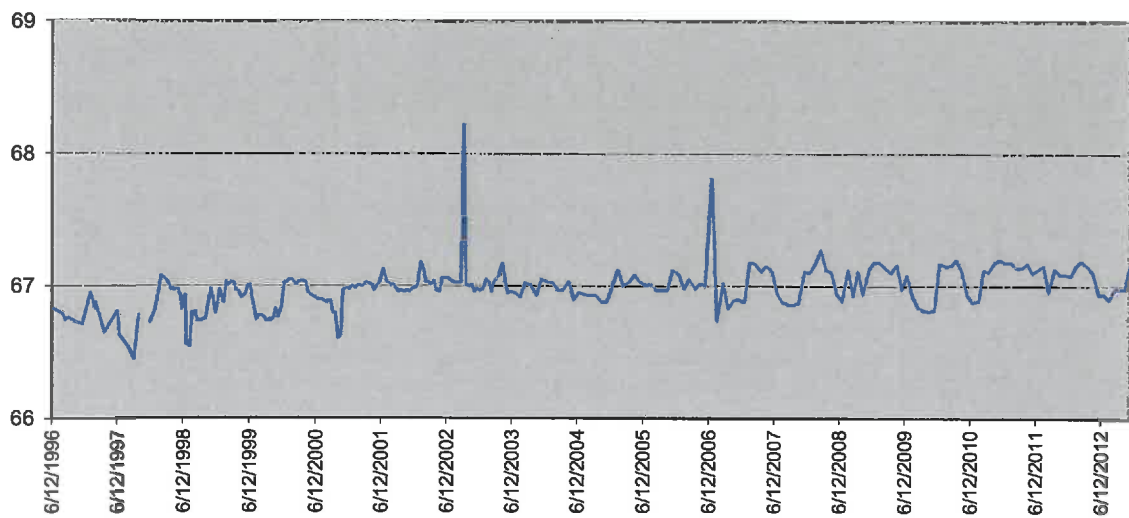
Borehole 11b



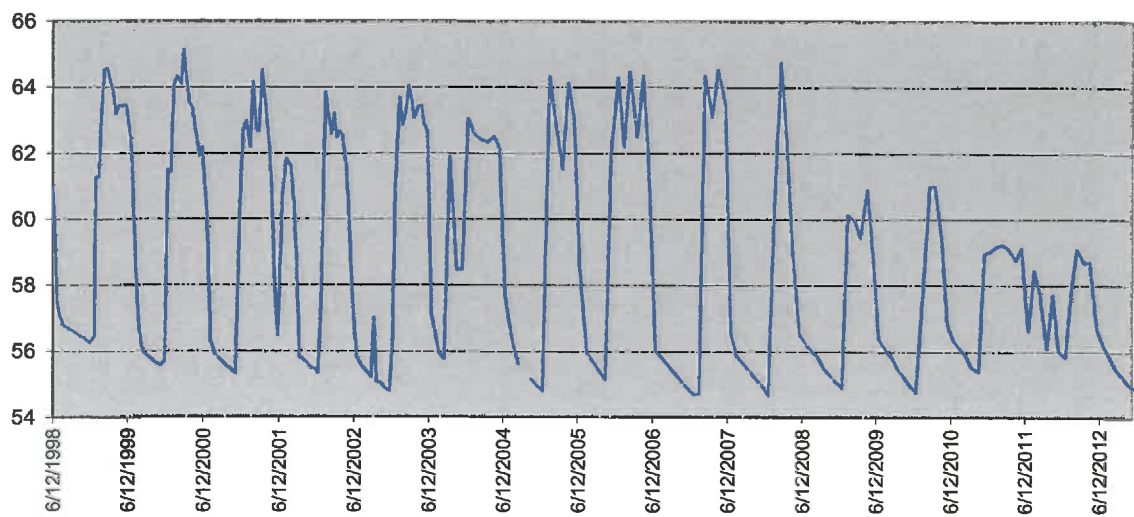
Borehole 12A

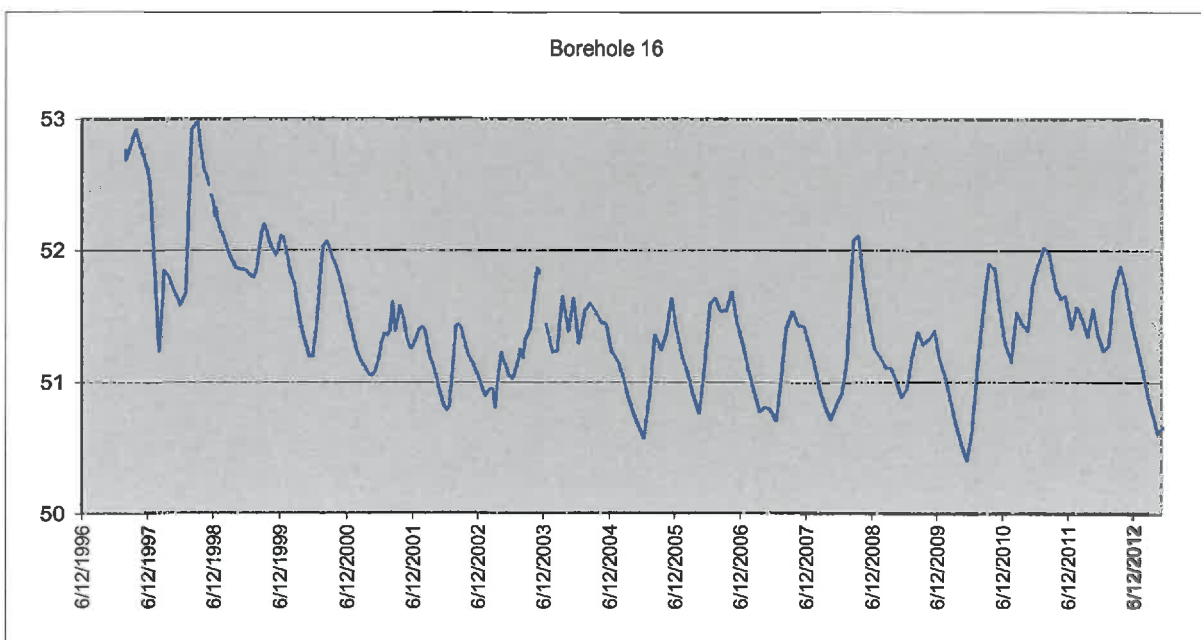
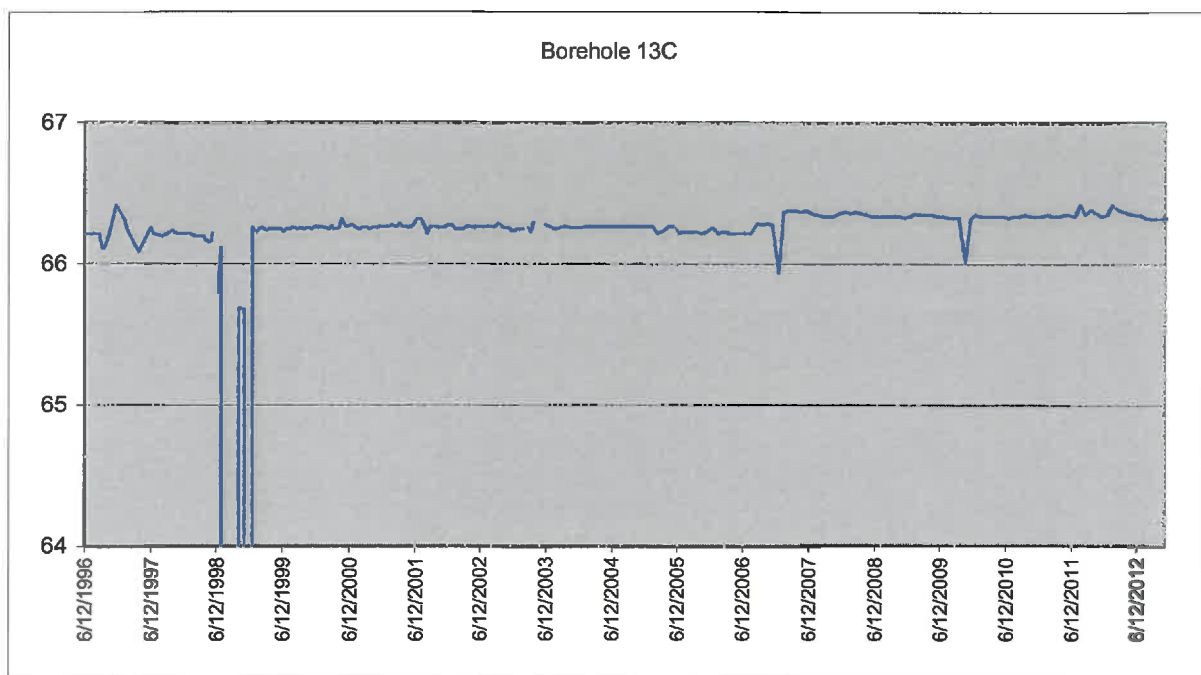
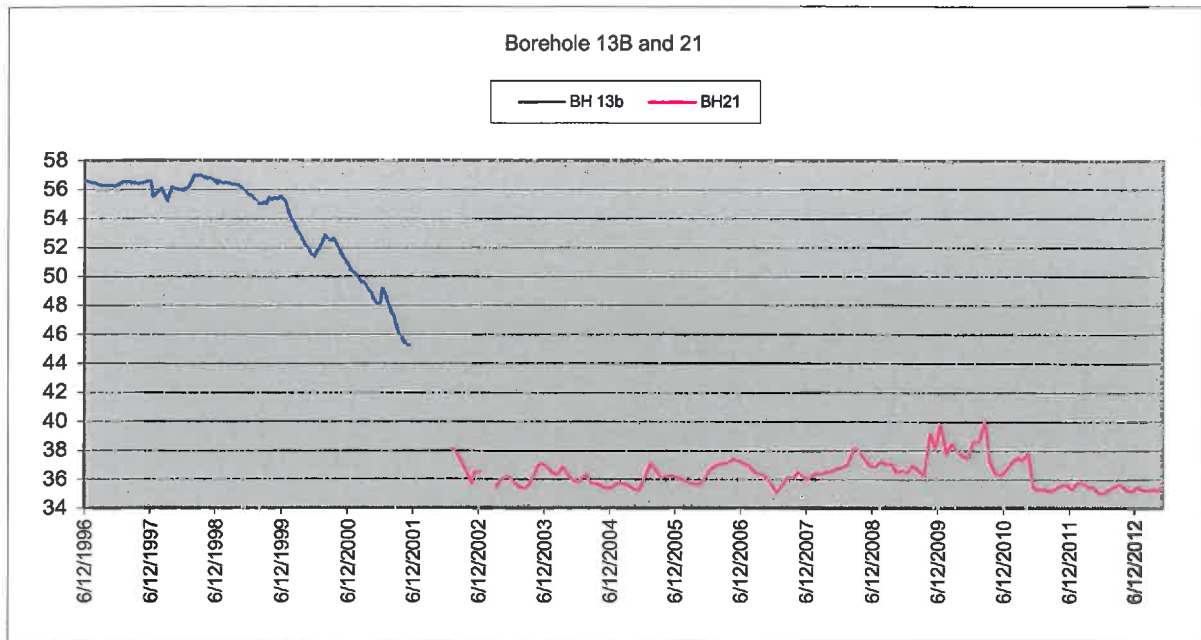


Borehole 12B

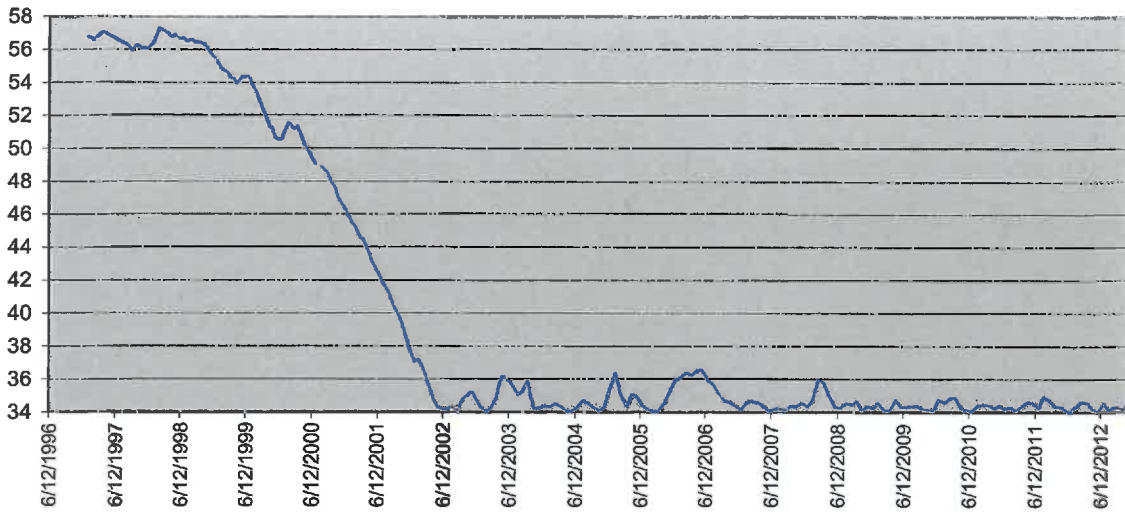


Borehole 13A

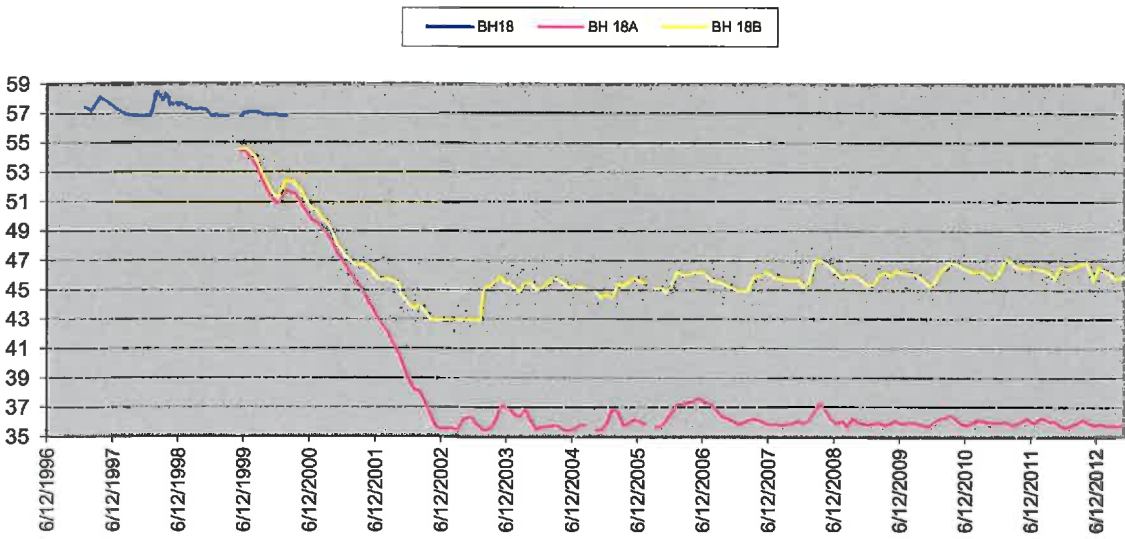




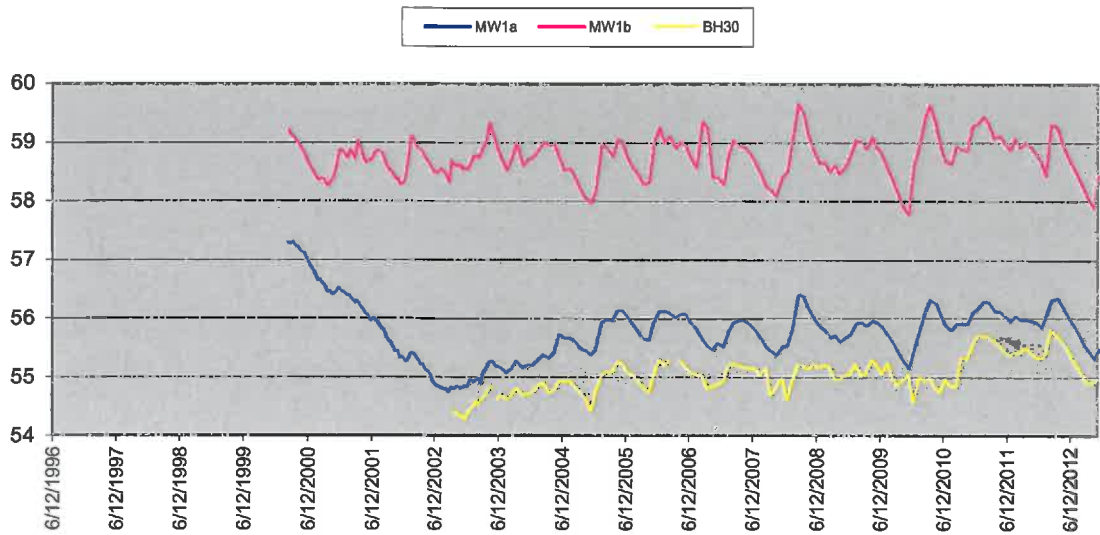
Borehole 17

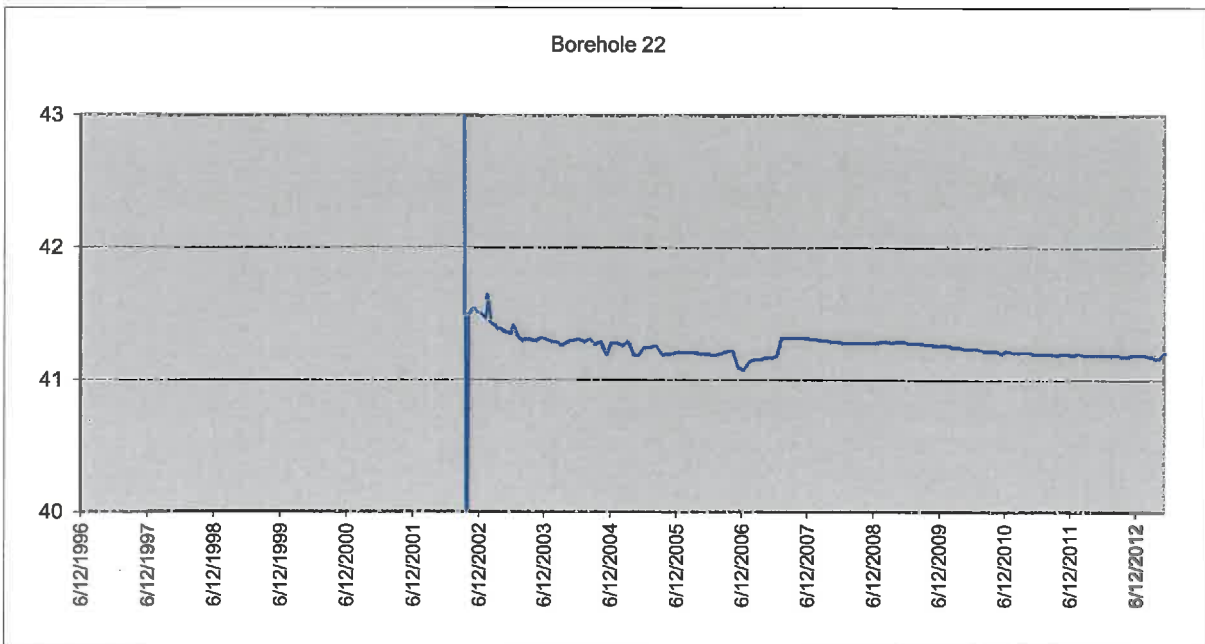
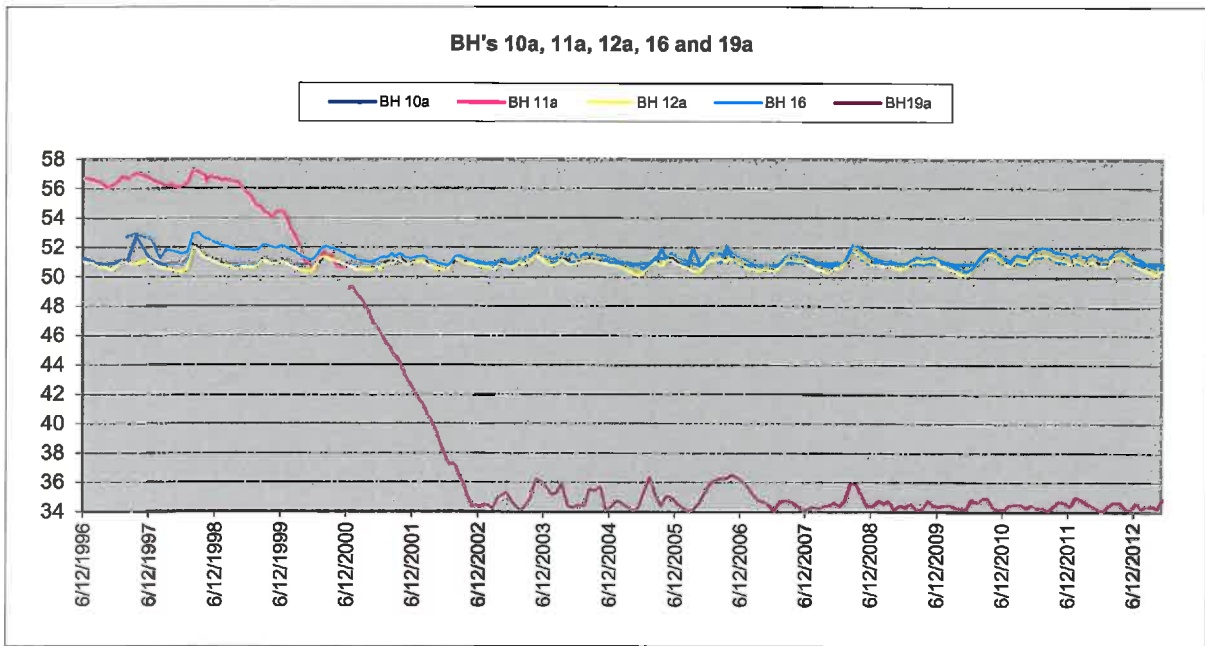
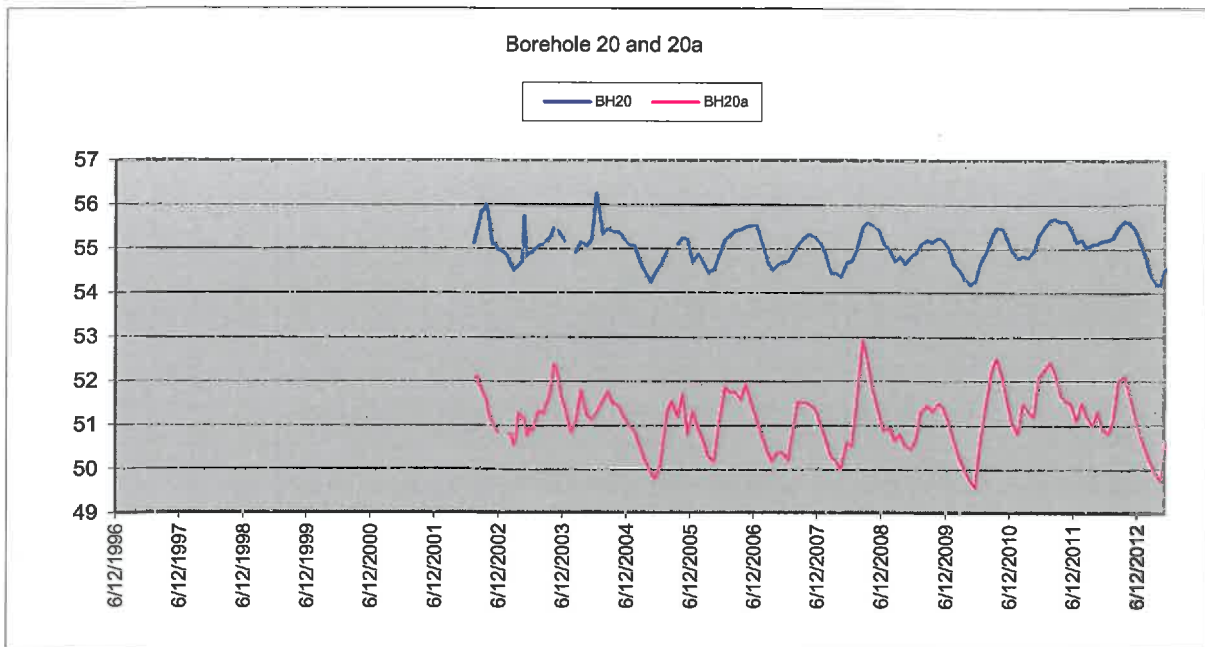


Borehole 18, 18A and 18B

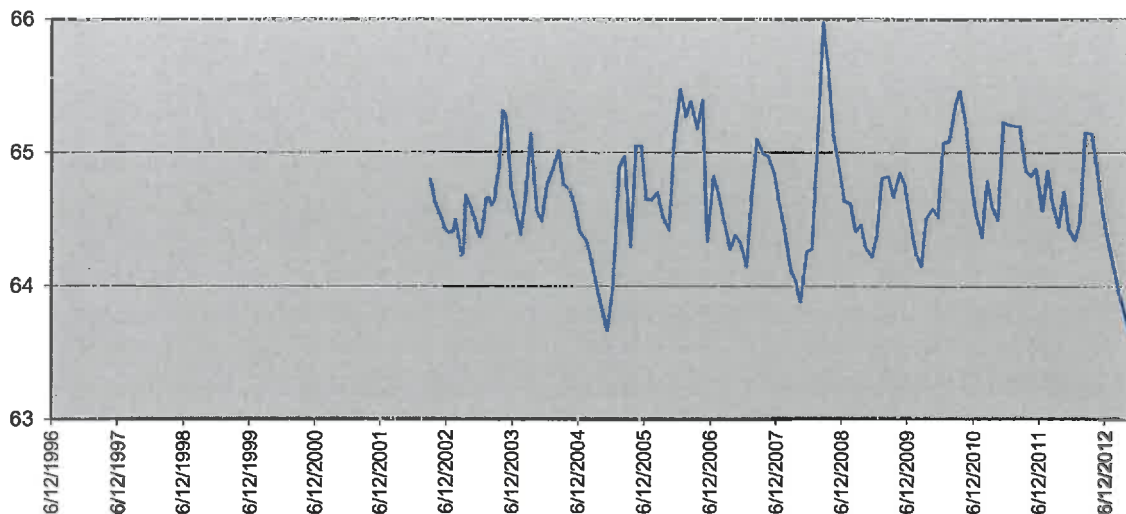


Borehole MW1a, MW1b and BH30

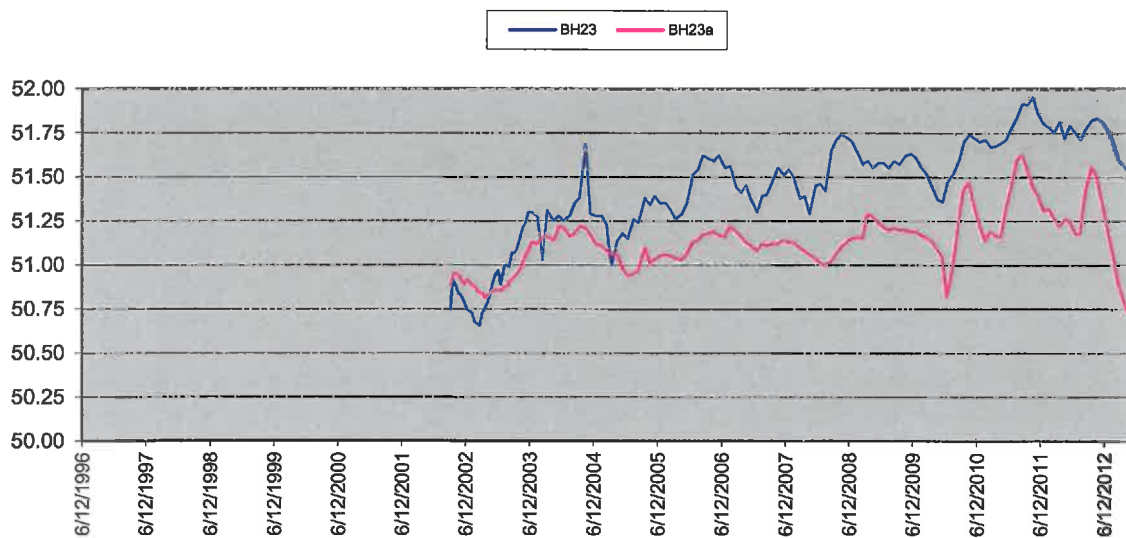




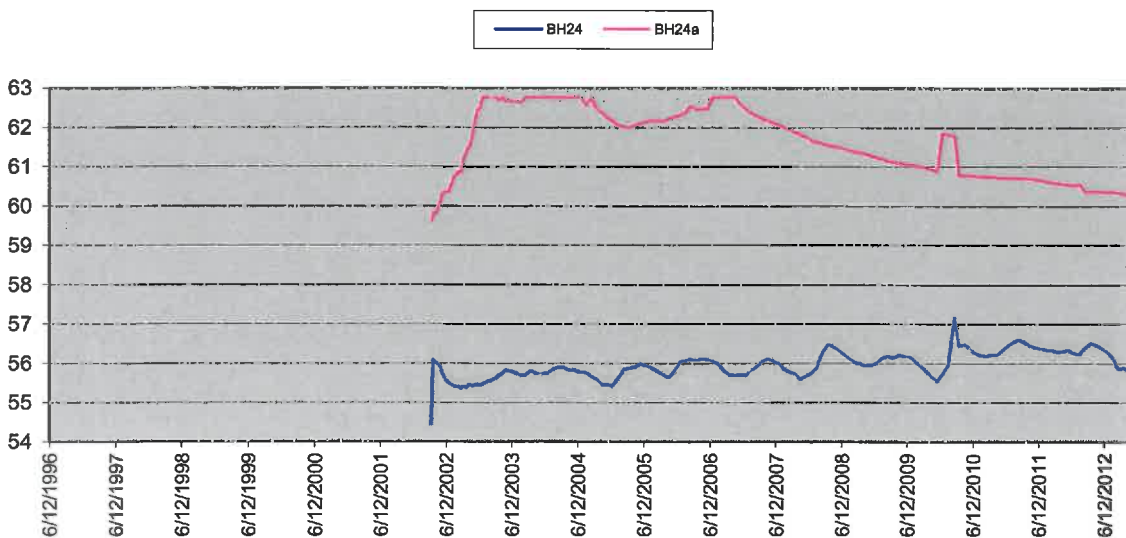
Borehole 22a



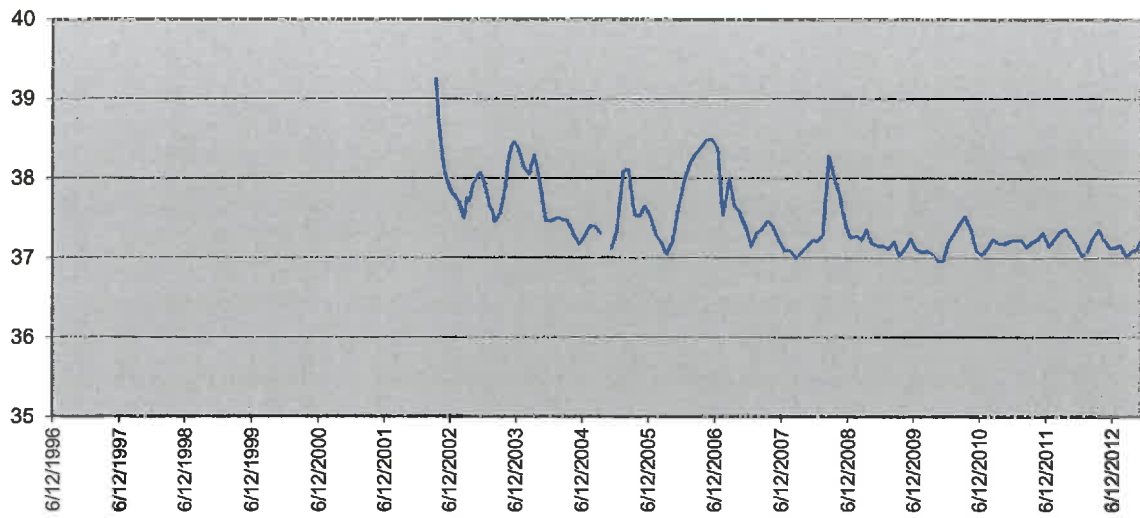
Borehole 23 and 23a



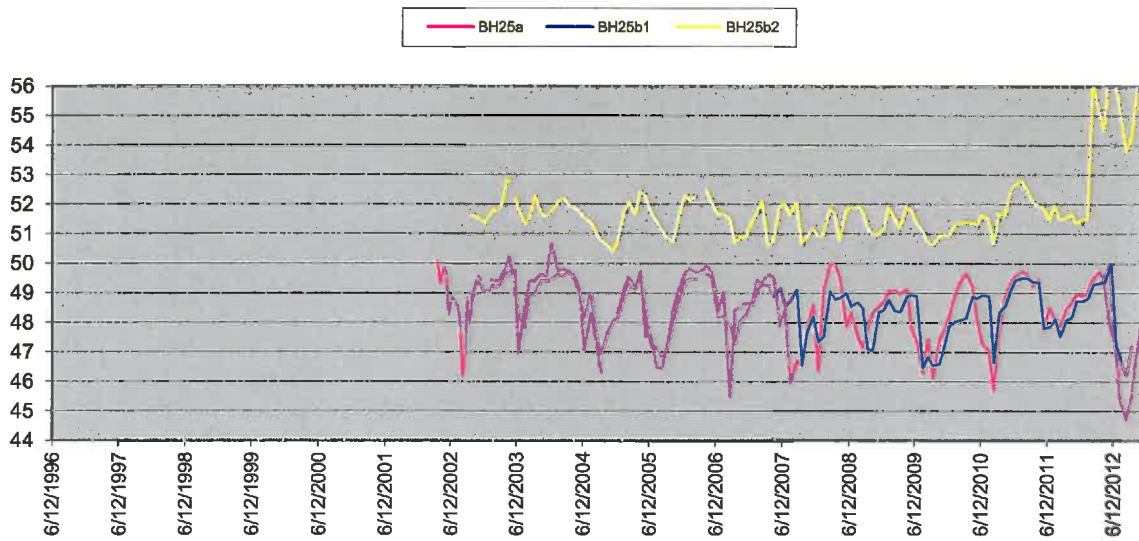
Borehole 24 and 24a



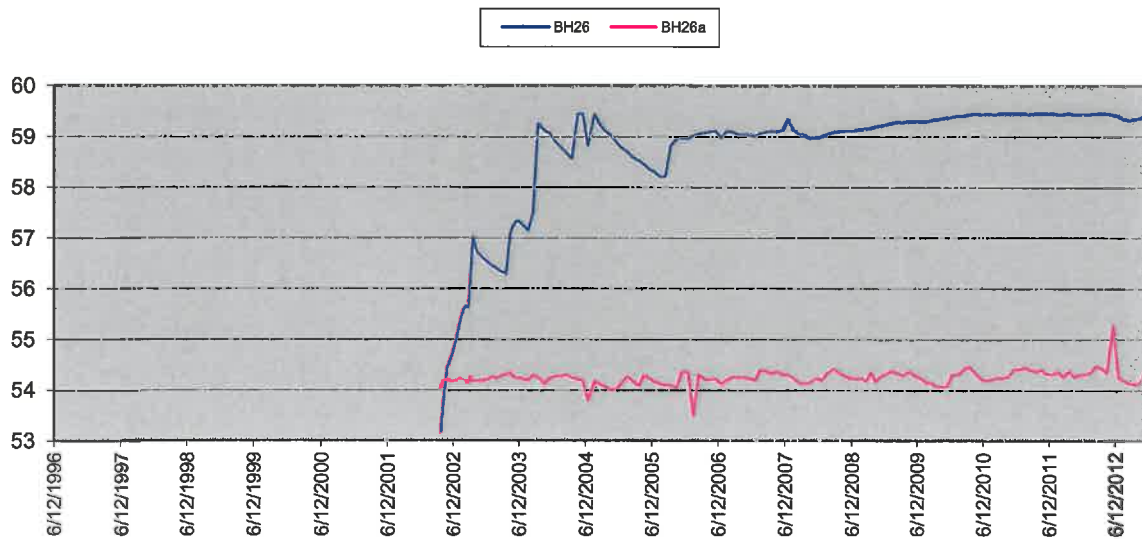
Borehole 25



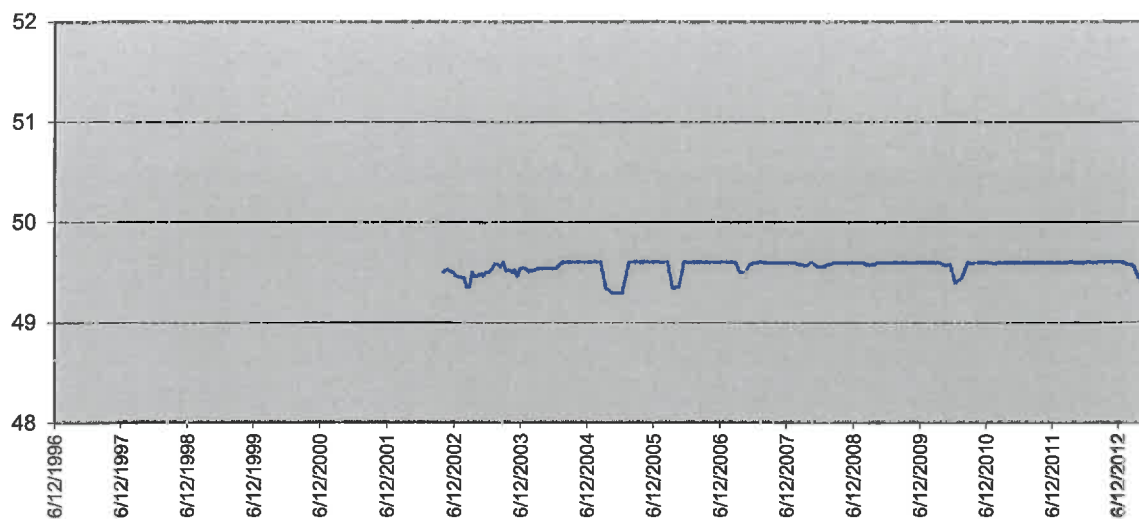
Borehole 25a, 25b1 and 25b2



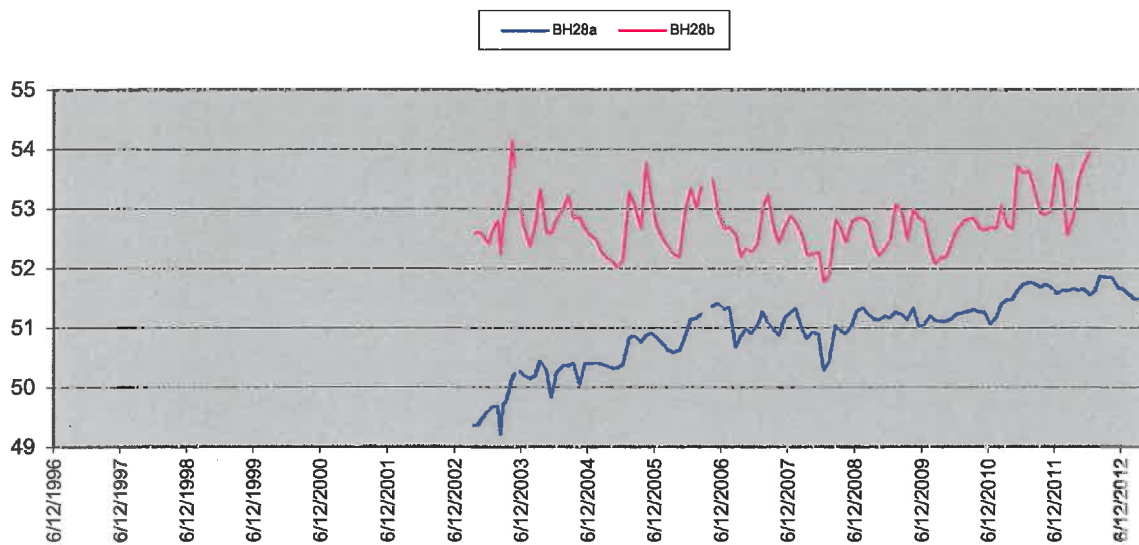
Borehole 26 and 26a



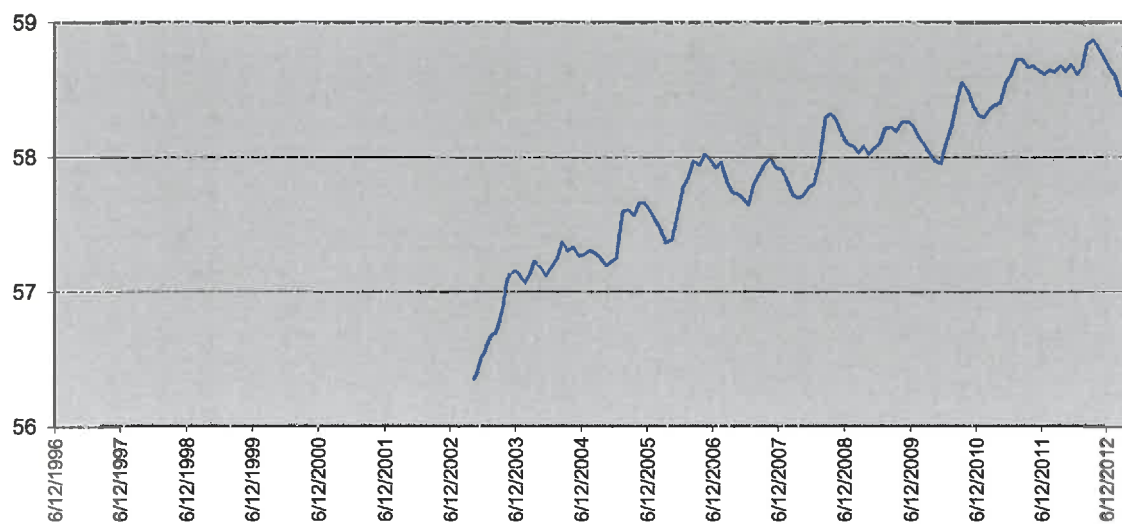
Borehole 27



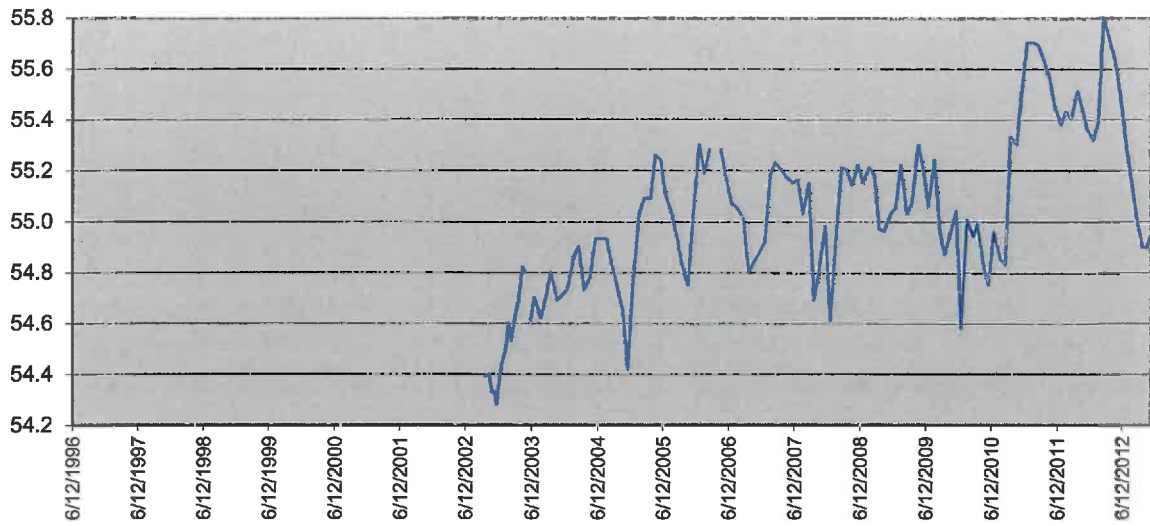
Borehole 28a and 28b



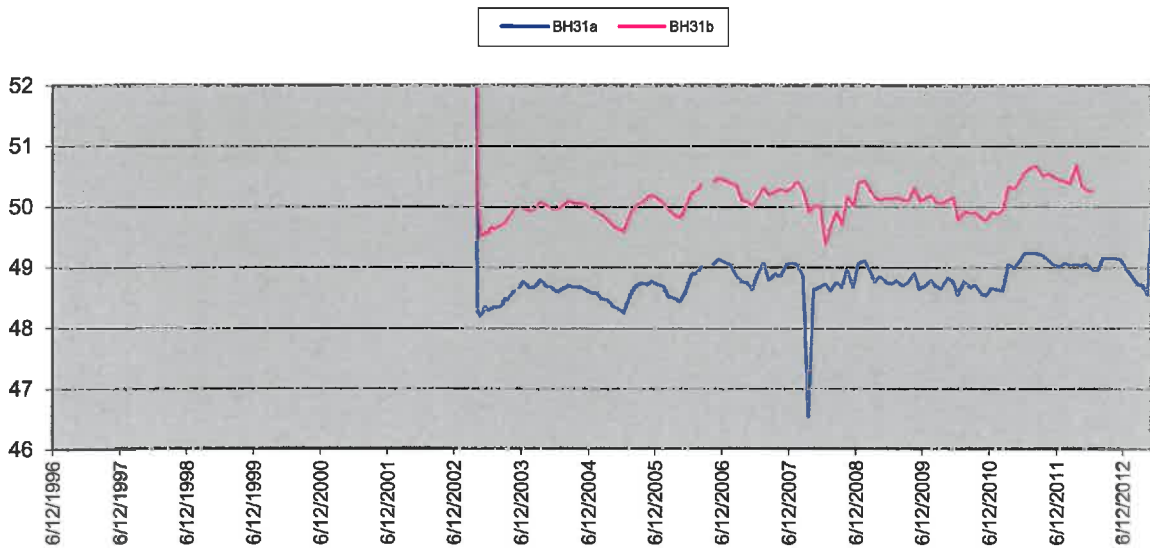
Borehole 29



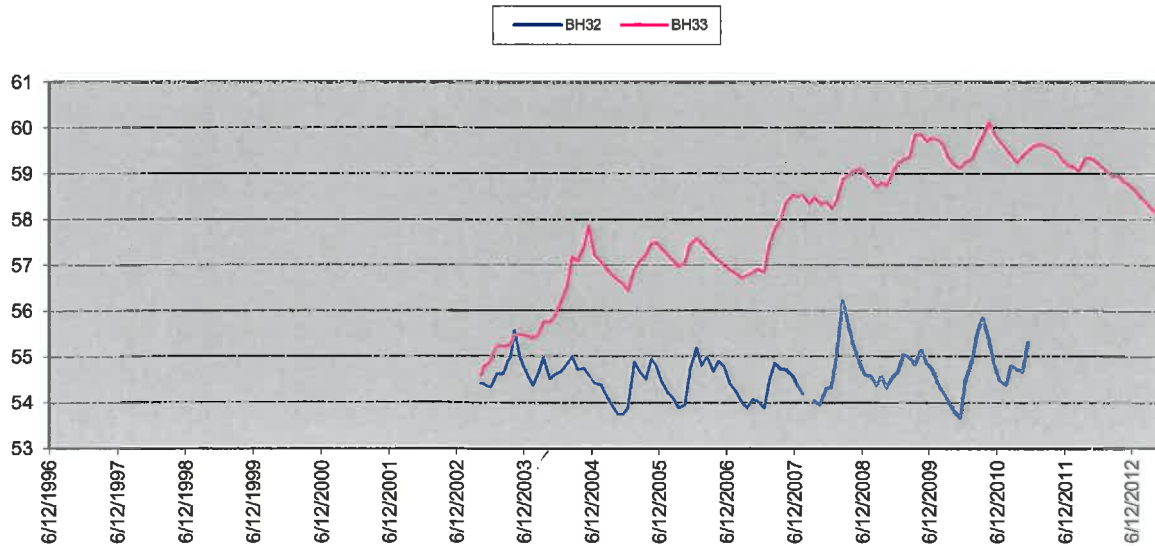
Borehole 30



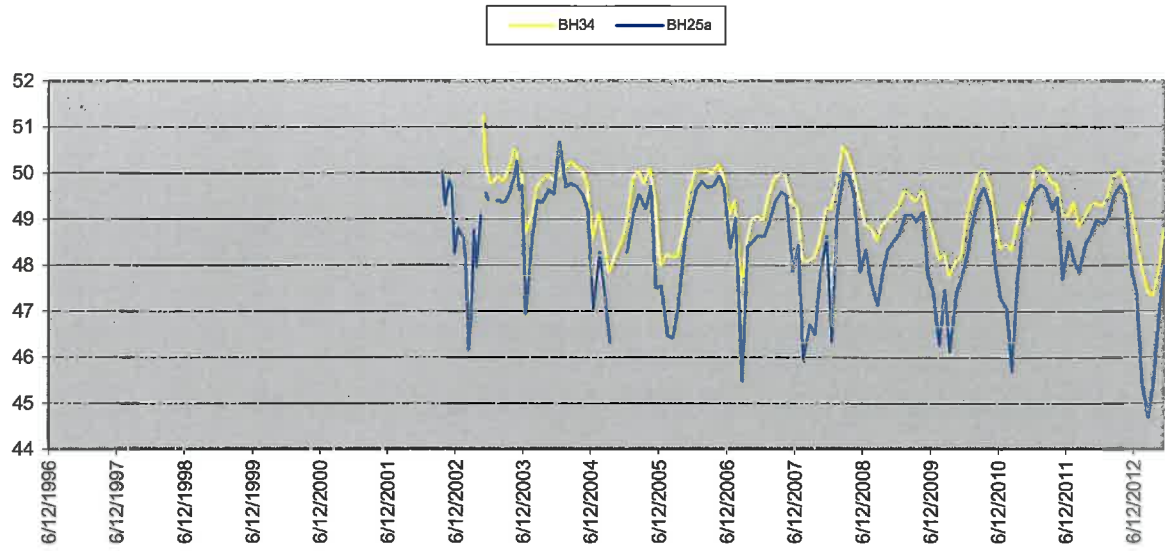
Borehole 31



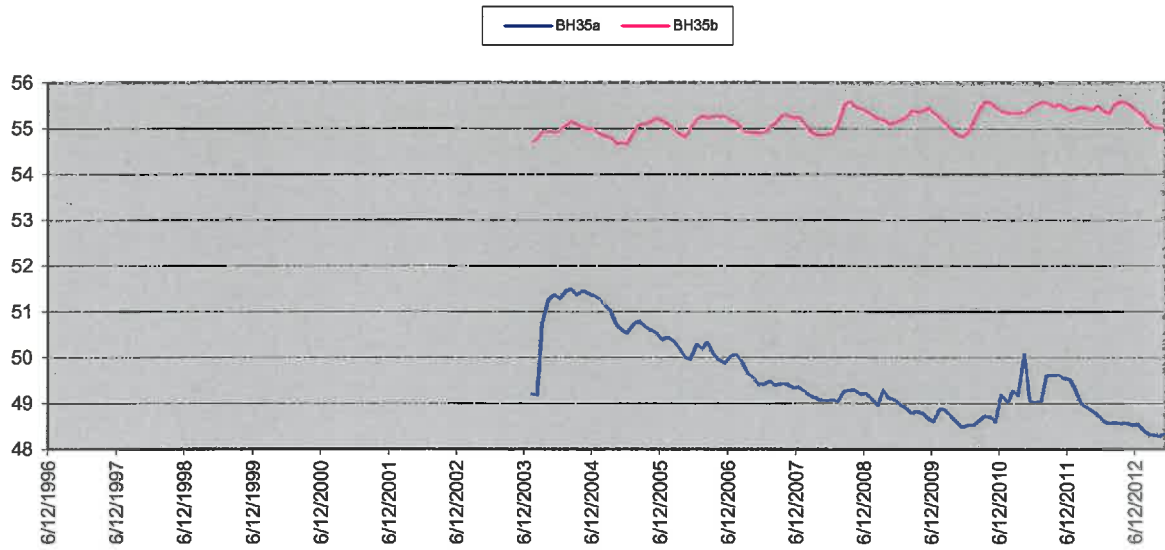
Borehole 32 and 33



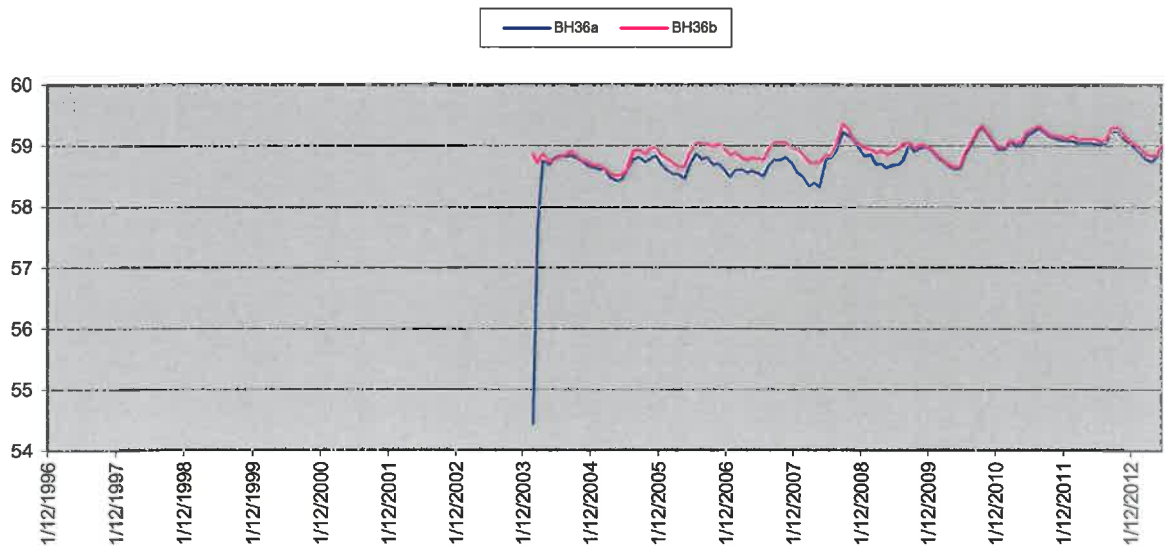
Boreholes 25a and 34



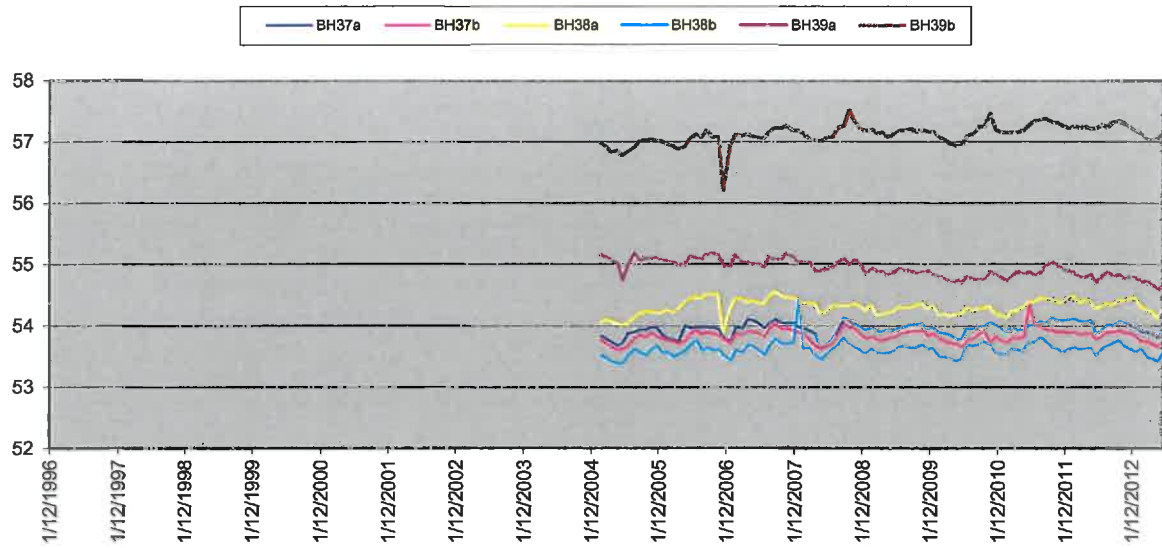
Borehole 35a and 35b



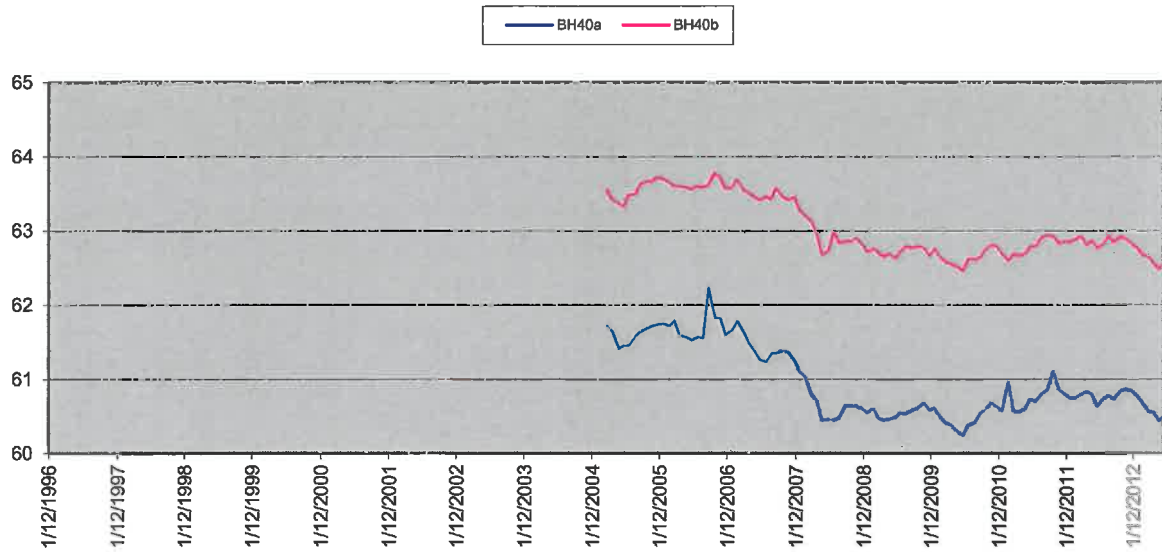
Borehole 36a and 36b



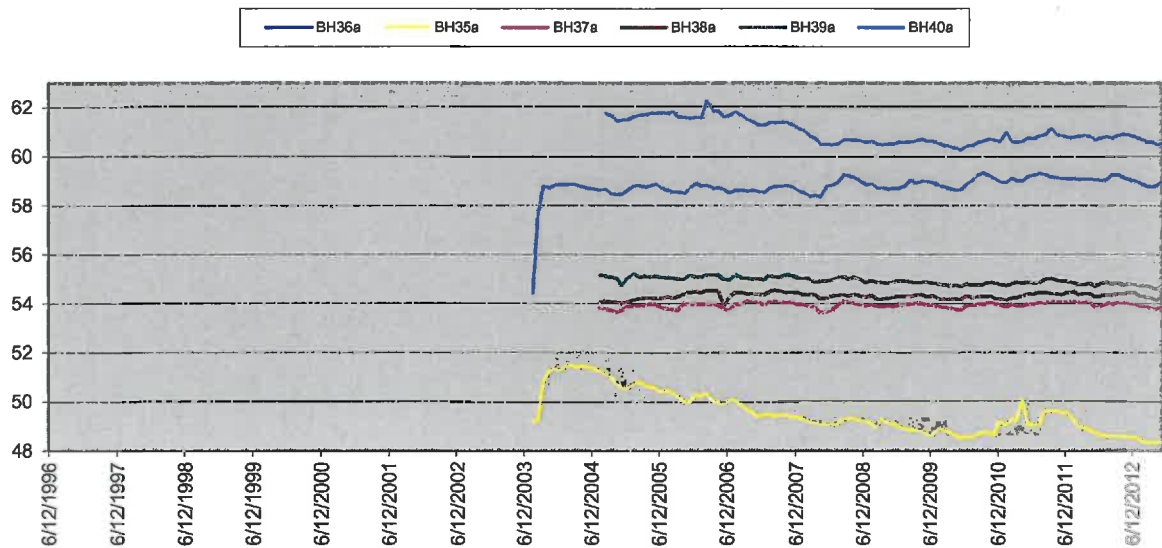
Boreholes 37, 38 and 39

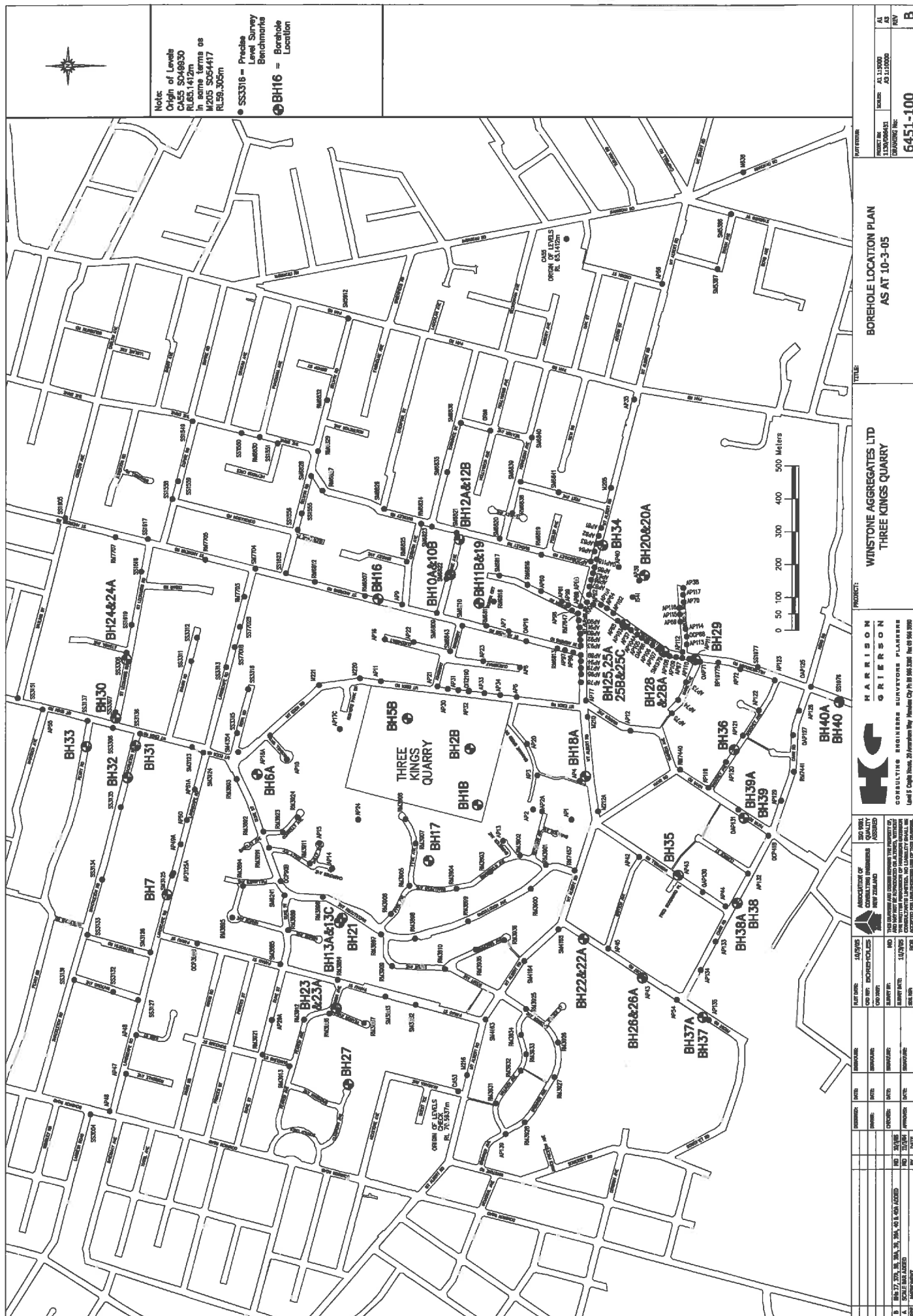


Borehole 40



Borehole 35a, 36a, 37a, 38a, 39a, and 40a



[illegible]

Precise Level Survey Results
(Precise Level Mark Location Plan)

THREE KINGS PRECISE LEVEL SURVEY RECORD

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		May 13 of Mar 12 (mm)
		mN	mE		Mar-12	May-13	Mar-12	May-13	
SS 3136	Mt Eden Rd	697910.68	299385.730	63.047	63.030		-17		
AP 3136A	Mt Eden Rd	697911.32	299386.400	63.111		63.111			
SS 3137	Mt Eden Rd	698072.60	299427.080	63.343	63.339		-4		
CN 3137A	Mt Eden Rd	698072.60	299427.080	63.327		63.327			
M 212A	Mt Albert Rd	696504.39	299153.170	86.127	86.110	86.109	-17	-18	-0.6
SM 4163	Mt Albert Rd	696843.03	298513.030	74.142	74.142	74.142	0	0	-0.4
SM 4164	Mt Albert Rd	696728.57	298688.370	75.851	75.843	75.842	-8	-9	-0.7
SM 4165	Mt Albert Rd	696625.11	298783.310	83.632	83.621	83.622	-11	-11	0.5
SM 3882	Parau St	697063.26	298555.520	63.302	63.300	63.301	-2	0	1.2
RM 3898	McCullough Ave	697067.11	298760.280	76.078	76.063	76.064	-15	-14	1
RM 3899	McCullough Ave	696900.99	298813.230	77.811	77.800	77.801	-11	-10	0.9
RM 3900	McCullough Ave	696713.60	298916.530	76.657	76.641	76.640	-16	-16	-0.7
RM 3901	Smallfield Ave	696669.58	298986.570	78.931	78.900	78.899	-31	-32	-1.4
RM 3902	Smallfield Ave	696747.40	299014.210	80.177	80.162	80.162	-15	-16	-0.2
RM 3903	Smallfield Ave	696834.73	298965.090	82.524	82.513	82.514	-11	-10	0.9
RM 3904	Smallfield Ave	696939.98	298912.450	82.708	82.696	82.697	-12	-11	1.4
RM 3907	Fyvie Ave	697063.27	299054.590	80.321	80.314	80.314	-7	-7	-0.4
RM 3910	Scout Ave	696974.91	298672.880	83.414	83.402	83.404	-12	-10	2.3
RM 3925	Bremner Ave	696727.72	298541.520	65.423	65.424	65.425	1	1	0.5
RM 3926	Bremner Ave	696630.47	298448.990	59.088	59.090	59.091	2	3	0.6
RM 3933	Milliken Rd	696725.14	298412.650	71.049	71.054	71.054	5	5	0
RM 3934	Milliken Rd	696742.66	298472.300	66.303	66.307	66.307	4	4	0
RM 3935	Simmonds Ave	696876.97	298725.700	91.755	91.742	91.747	-13	-8	4.5
RM 3936	Simmonds Ave	696788.84	298756.780	90.869	90.850	90.853	-19	-17	2.8
RM 7440	Hayr Rd	696258.10	299279.700	84.033	84.023	84.023	-10	-11	-0.3
RM 7457	Mt Albert Rd	696575.40	298967.900	85.707	85.690	85.689	-17	-18	-1
AP 1	Plaza, Mt Albert Rd	696589.80	299127.200	81.269	81.248	81.247	-21	-22	-0.6
AP 2	Plaza, Mt Albert Rd	696706.40	299158.200	76.290	76.273	76.272	-17	-18	-1.1
AP 2A	Plaza, Mt Albert Rd	696679.30	299152.500	77.582	77.566	77.566	-16	-17	-0.4
AP 3	Plaza, Mt Albert Rd	696693.00	299259.100	77.367	77.353	77.353	-14	-14	0.2
AP 4	Plaza, Mt Albert Rd	696564.80	299244.900	83.366	83.344	83.344	-22	-22	0.1
AP 13	Barrister Ave	696796.00	299064.300	79.867	79.859	79.859	-8	-8	0.4
AP 20	Grahame Breed Dr	696723.10	299358.500	76.792	76.785	76.784	-7	-9	-1.3
SM 3123	Mt Eden Rd	697750.13	299344.750	75.676	75.657		-19		
AP 3123A	Mt Eden Rd	697748.50	299343.990	75.902		75.902			
SM 3124	Landscape Rd	697715.79	299327.990	77.724	77.704		-20		
AP 3124A	Landscape Rd	697715.17	299326.910	77.906		77.906			
SM 3125	Landscape Rd	697810.23	298959.440	69.440	69.428	69.425	-12	-15	-3
SM 3126	Landscape Rd	697873.04	298716.420	63.015	63.008	63.005	-7	-10	-3.2
SS 3127	Landscape Rd	697911.99	298565.740	59.724	59.721	59.717	-3	-7	-4.3
SS 3132	Waitomo St	697987.80	298590.900	61.689	61.687	61.683	-2	-6	-4.2
SM 3883	Parau St	697156.95	298581.040	64.371	64.366	64.368	-5	-3	1.8
RM 3884	Parau St	697301.96	298629.210	62.539	62.534	62.535	-5	-5	0.5
SM 3885	Duke St	697474.42	298680.340	61.857	61.846	61.846	-11	-10	0.3
RM 3886	Fearon Ave	697329.55	298529.490	55.236	55.234	55.235	-2	-1	0.9
RM 3887	Fearon Ave	697221.32	298498.220	51.548	51.537	51.536	-11	-12	-0.9
OCP 3888	Parau St	697732.59	298744.430	62.513	62.503	62.503	-10	-10	-0.1
RM 3889	Duke St	697452.34	298785.500	69.233	69.211	69.211	-22	-23	-0.2
RM 3891	Duke St	697515.89	299039.800	77.575	77.559	77.558	-16	-18	-1.2
RM 3892	Duke St	697529.22	299086.260	78.012	77.997	77.995	-15	-17	-1.6
RM 3893A	Duke St	697610.68	299248.020	79.110	79.110	79.108	0	-2	-2.3
RM 3894	Fulljames Ave	697589.82	298923.430	72.082	72.060	72.054	-22	-28	-6.1
RM 3895	Hamon Ave	697620.41	298829.460	65.188	65.157	65.155	-31	-33	-2.1
AP 3895A	Hamon Ave	697631.96	298839.080	65.612	65.613	65.612	1	-1	-1.5
RM 3896	McCullough Ave	697345.49	298887.040	69.820	69.798	69.798	-22	-21	0.3
RM 3897	McCullough Ave	697170.56	298776.560	75.084	75.067	75.068	-17	-17	0.6
RM 3905	Fyvie Ave	697080.60	298923.970	75.813	75.804	75.805	-9	-8	1
RM 3906	Fyvie Ave	697134.57	298836.070	77.447	77.433	77.434	-14	-13	1.4
RM 3908	Fyvie Ave	697093.64	299129.180	82.069	82.063	82.064	-6	-5	0.9
RM 3909	Scout Ave	697136.38	298680.630	80.056	80.043	80.044	-13	-13	0.8
RM 3911	Dally Tce	697387.46	298991.050	88.894	88.878	88.878	-16	-16	0.1
RM 3912	Fearon Ave	697399.31	298512.830	51.652	51.653	51.654	1	2	0.5
RM 3913	Fearon Ave	697445.84	298362.010	49.238	49.243	49.244	5	6	1
RM 3921	Duncumb St	697530.84	298402.670	50.034	50.037	50.037	3	4	0.4
RM 3923	Connelly Ave	697465.89	299086.330	74.293	74.278	74.277	-15	-17	-1.4
RM 3924	Connelly Ave	697424.55	299131.880	73.034	73.018	73.016	-16	-18	-1.6
SM 4354	Mt Eden Rd	697606.00	299322.200	80.155	80.130	80.128	-25	-27	-1.8
SM 6241	Duke St	697468.58	298893.360	70.012	69.985	69.982	-27	-30	-3.1
OCP 90B	Duke St	697480.39	298934.300	71.805	71.785	71.785	-20	-19	0.4
AP 10	Roskill Way	697458.10	299308.700	82.673	82.661	82.659	-12	-14	-2.3
AP 14	Churches Ave	697318.10	298969.200	91.334	91.320	91.320	-14	-14	-0.3
AP 15	Dally Terrace	697357.20	299055.900	90.821	90.807	90.807	-14	-15	-0.2
AP 17C	Hunters Park Dr	697293.89	299402.870	74.602	74.594	74.593	-8	-9	-0.9

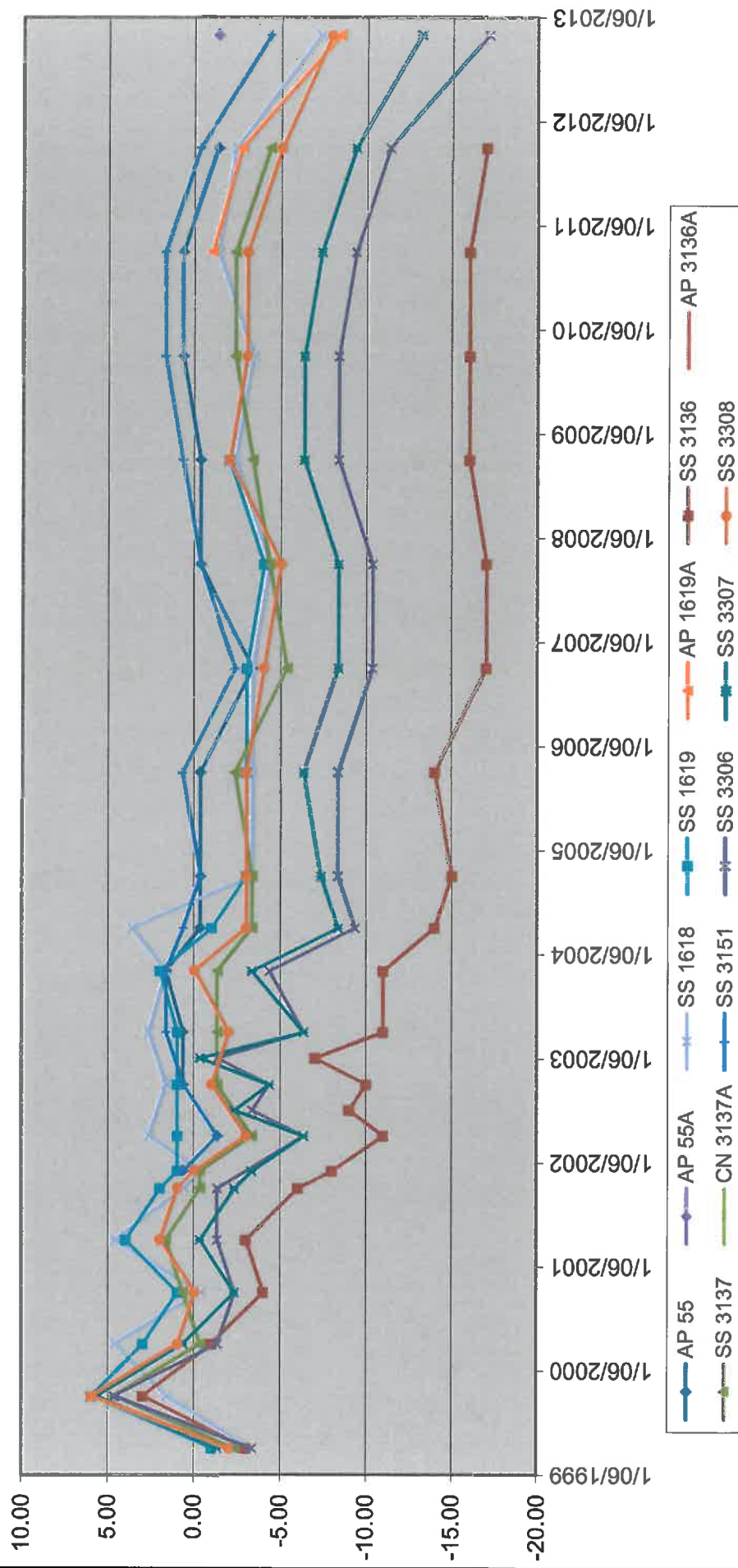
Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		May 13 cf Mar 12 (mm)
		mN	mE		Mar-12	May-13	Mar-12	May-13	
AP 29A	Duke St	697501.58	298517.840	49.542	49.540	49.536	-2	-5	-3.6
M 220	Mt Eden Rd	697232.61	299557.190	81.700	81.665	81.664	-35	-36	-0.8
M 221	Mt Eden Rd	697359.09	299539.940	83.449	83.434	83.433	-15	-15	-0.7
SS 1555	Selwyn Rd	697413.60	300062.900	99.584	99.581	99.582	-3	-2	1.4
SS 1556	Selwyn Rd	697425.87	300012.810	102.373	102.370	102.370	-3	-3	0.4
SS 1617	St Andrews Rd	697887.68	299983.320	81.442	81.443	81.440	1	-2	-2.7
SS 1618	St Leonards Rd	697906.03	299884.480	78.478	78.476	78.471	-2	-7	-4.9
AP 1619A	St Leonards Rd	697935.70	299724.630	66.609	66.608	66.602	-1	-6	-5.7
SS 1623	St Andrews Rd	697461.10	299874.960	107.522	107.515	107.514	-7	-8	-0.8
SS 3306	Mt Eden Rd	697993.20	299406.800	60.565	60.554	60.548	-11	-17	-5.8
SS 3307	St Leonards Rd	697985.83	299454.690	59.661	59.652	59.648	-9	-13	-3.9
SS 3308	St Leonards Rd	697952.15	299635.990	63.275	63.270	63.267	-5	-8	-2.9
SS 3311	Rahiri Rd	697752.00	299610.940	95.306	95.293	95.290	-13	-17	-3.5
SS 3312	Rahiri Rd	697733.64	299682.970	95.929	95.917	95.914	-12	-15	-2.8
SS 3313	Landscape Rd	697648.30	299592.510	112.633	112.617	112.616	-16	-17	-0.7
SS 3315	Rewa Rd	697613.41	299396.640	80.938	80.915	80.913	-23	-25	-2.3
SS 3316	Rewa Rd	697579.48	299529.800	98.902	98.886	98.882	-16	-20	-4.4
RM 6807	St Andrews Rd	697216.70	299808.100	102.487	102.473	102.473	-14	-14	-0.4
RM 6812	St Andrews Rd	697370.60	299846.600	108.907	108.895	108.894	-12	-12	-0.6
SM 6826	Buckley Rd	697157.90	300077.500	74.710	74.705	74.707	-5	-3	1.6
RM 6827	Buckley Rd	697345.96	300128.040	83.332	83.332	83.333	0	1	1.4
SM 6828	Buckley Rd	697383.80	300177.400	87.952	87.952	87.954	0	2	1.6
SS 7701B	Landscape Rd	697619.71	299657.050	115.509	115.507	115.507	-2	-1	0.2
SS 7702B	Landscape Rd	697602.26	299725.780	110.538	110.535	110.536	-3	-2	0.6
RM 7703	Landscape Rd	697589.21	299808.370	100.149	100.132	100.130	-17	-19	-1.6
SM 7704	St Andrews Rd	697556.90	299894.500	97.816	97.809	97.808	-7	-8	-0.7
AP 7705A	St Andrews Rd	697700.05	299930.560	88.195	88.195	88.194	0	-1	-0.7
AP 9	St Andrews Rd	697103.90	299782.200	92.802	92.782	92.782	-20	-20	-0.1
AP 11	Mt Eden Rd	697168.40	299548.700	80.191	80.182	80.181	-9	-9	-0.6
AP 16	Queens Way	697156.20	299676.200	83.646	83.637	83.636	-9	-9	-0.8
AP 18B	Mt Eden Rd	697509.31	299384.270	81.641	81.640	81.637	-1	-4	-2.6
M 205	Mt Albert Rd	696471.16	300138.540	59.305	59.302	59.304	-3	-1	2.2
AP 206A	Mt Albert Rd	696527.29	299919.360	59.997	59.993	59.994	-4	-3	1
M 210	Mt Albert Rd	696536.06	299441.550	83.050	83.029	83.029	-21	-21	-0.2
SM 1979	Hillsborough Rd	696308.02	299637.250	61.241	61.212	61.214	-29	-26	2.3
BP 1977B	Hillsborough Rd	696141.75	299609.930	71.993	71.984	71.987	-9	-6	3.1
SM 6809	St Andrews Rd	697001.27	299757.440	81.800	81.778	81.777	-22	-23	-0.7
SM 6810	St Andrews Rd	696925.56	299720.860	76.956	76.936	76.936	-20	-20	-0.1
RM 6811	St Andrews Rd	696849.02	299715.440	76.526	76.503	76.502	-23	-24	-1.3
RM 6813	St Andrews Rd	696631.95	299652.970	80.905	80.878	80.879	-27	-27	0.5
RM 6816	Rowan Rd	696721.88	299845.690	78.908	78.884	78.884	-24	-24	0.4
SM 6817	Rowan Rd	696808.83	299876.790	80.995	80.976	80.976	-19	-19	-0.1
RM 6818	Rowan Rd	696826.70	299791.250	81.966	81.945	81.945	-21	-20	0.3
RM 6819	Buckley Rd	696678.00	299942.250	65.620	65.605	65.607	-15	-13	1.6
SM 6820	Buckley Rd	696808.11	299988.790	71.955	71.946	71.947	-9	-8	1
SM 6821	Buckley Rd	696938.51	300004.300	71.114	71.107	71.108	-7	-6	0.9
SM 6822	Corrie Ave	696973.90	299863.230	81.874	81.856	81.856	-18	-18	0.3
SM 6823	Buckley Rd	697012.43	300021.720	70.593	70.585	70.583	-8	-10	-1.8
RM 6824	Buckley Rd	697044.38	300030.360	71.084	71.079	71.080	-5	-4	1
RM 6825	Quentin Ave	697092.90	299916.800	81.386	81.372	81.373	-14	-13	1.4
SM 6835	Torrance St	696969.98	300185.700	70.784	70.784	70.785	0	1	0.9
SM 6836	Torrance St	696930.33	300343.260	65.955	65.956	65.958	1	3	1.5
RM 6838	Fernleigh Ave	696773.28	300065.800	70.304	70.297	70.299	-7	-5	1.5
SM 6839	Fernleigh Ave	696748.10	300163.470	67.487	67.485	67.487	-2	0	2
SM 6840	Fernleigh Ave	696714.69	300296.020	63.278	63.278	63.280	0	2	1.6
SM 6841	Peet Ave	696626.68	300131.570	65.698	65.694	65.696	-4	-2	2
AP 6843A	Kings Way	696958.45	299642.050	75.221	75.219	75.218	-2	-3	-0.6
RM 7647	Mt Albert Rd	696565.00	299755.100	67.601	67.574	67.574	-27	-27	0
ORM.I	Weaver Street	696836.50	300316.200	63.578	63.579	63.581	1	3	1.9
AP 5	Mt Eden Rd	696757.00	299500.900	75.746	75.735	75.734	-11	-12	-1.3
AP 6	Queens Way	696746.90	299590.600	75.306	75.286	75.285	-20	-21	-1.3
AP 7A	St Andrews Rd	696778.94	299702.100	76.820	76.816	76.817	-4	-4	0.8
AP 8B	Mt Albert Rd	696559.06	299633.480	75.740	75.723	75.724	-17	-16	0.9
AP 12	Warren Ave	696409.10	299402.200	94.357	94.339	94.339	-18	-18	-0.1
OAP 19	St Andrews Rd	696725.00	299676.400	77.508	77.482	77.482	-26	-27	-0.4
AP 21B	Mt Eden Rd	696995.04	299530.410	77.649	77.649	77.648	0	-1	-0.8
AP 22	Queens Way	697069.30	299667.600	78.352	78.346	78.344	-6	-8	-1.6
AP 23	Queens Way	696858.57	299609.620	74.402	74.391	74.391	-11	-11	-0.3
AP 30	Mt Eden Rd	696966.19	299525.130	77.329	77.319	77.318	-10	-11	-1
AP 31	Mt Eden Rd	696934.22	299521.420	76.857	76.852	76.852	-5	-6	-0.3
AP 32	Mt Eden Rd	696902.63	299517.810	76.203	76.193	76.192	-10	-10	-0.7
AP 33	Mt Eden Rd	696855.06	299512.270	75.121	75.111	75.110	-10	-11	-0.6
AP 34	Mt Eden Rd	696807.28	299506.750	74.937	74.925	74.923	-12	-14	-1.9
SM 5387	Erson Ave	696146.21	300815.940	56.747	56.747	56.748	0	1	1.1
SM 5386	Symonds St	696104.12	300983.290	55.184	55.185	55.186	1	2	1.1

Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		May 13 of Mar 12 (mm)
		mN	mE		Mar-12	May-13	Mar-12	May-13	
M 638	Manukau Rd	696081.51	301109.250	54.690	54.689	54.690	-1	0	1.4
CA 55	Manukau Rd	696605.90	300894.300	65.141	65.141	65.141	0	0	0
CA 53	Akarana Ave	696935.90	298292.100	70.594	70.594	70.594	0	0	0
M 216	Mt Albert Rd	696903.54	298347.910	72.658	72.658	72.658	0	1	0.2
SS 1977	Hillsborough Rd	696020.20	299595.820	74.453	74.447	74.450	-6	-3	2.7
RM 3927	Bremner Ave	696633.32	298338.770	62.651	62.650	62.651	-1	0	0.6
RM 3928	Bremner Ave	696727.76	298195.810	56.144	56.143	56.144	-1	0	1.1
AP 139	Bremner Ave	696788.02	298157.420	56.225	56.222	56.223	-3	-2	1.3
RM 3931	Milliken Ave	696817.47	298257.510	62.500	62.500	62.501	0	1	0.8
RM 3932	Milliken Ave	696733.95	298363.240	71.719	71.718	71.719	-1	0	0.6
SS 3004	Dominion Rd	698058.80	298223.460	51.812	51.810	51.806	-2	-6	-4
SS 3131	Shackleton Rd	698110.53	298631.800	59.419	59.416	59.412	-3	-7	-3.7
SS 3133	Shackleton Rd	698071.30	298770.710	59.554	59.549	59.545	-5	-9	-3.6
SS 3134	Shackleton Rd	698021.66	298946.500	61.479	61.472	61.467	-7	-11	-4.8
SS 3135	Shackleton Rd	697966.25	299165.810	61.684	61.680	61.676	-4	-8	-3.6
SS 3151	Mt Eden Rd	698285.87	299497.700	67.987	67.987	67.983	0	-4	-4
SS 1905	St Andrews Rd	698147.73	300049.390	88.810	88.809	88.807	-1	-4	-2.5
AP 7707A	St Andrews Rd	697977.74	300004.980	81.535	81.536	81.534	1	-1	-1.9
RM 1558A	Empire Rd	697816.18	300105.630	91.683	91.684	91.681	-1	-1	-2.9
SS 1559	Empire Rd	697800.00	300165.500	96.024	96.023	96.021	-1	-4	-2.3
SS 1549	The Drive	697753.34	300348.670	85.871	85.870	85.869	-1	-2	-1
SS 1550	The Drive	697589.88	300306.710	84.432	84.431	84.432	-1	-1	0.5
AP 6830A	The Drive	697538.37	300293.820	81.766	81.766	81.766		0	0.1
SS 1551	The Drive	697492.54	300281.710	77.481	77.477	77.477	-4	-5	-0.4
RM 6829	Selwyn Rd	697363.05	300258.050	79.864	79.856	79.856	-8	-7	0.4
RM 6832	Selwyn Rd	697337.40	300403.570	80.190	80.189	80.190	-1	0	1.4
SM 5912	Pah Rd	697278.09	300666.240	74.285	74.285	74.285	0	0	0.2
AP 35	Mt Albert Rd	696402.12	300407.230	54.190	54.192	54.194	2	3	1.6
AP 37	Hillsborough Rd	696407.39	299705.880	59.335	59.320	59.321	-15	-14	1.3
AP 38	Budock Rd	696246.76	299834.650	69.274	69.266	69.268	-7	-5	2.3
AP 39	Hillsborough Bowling	696383.07	299856.280	56.297	56.290	56.291	-7	-6	0.7
AP 40	Hillsborough Bowling	696445.91	299895.620	55.757	55.752	55.750	-5	-7	-1.7
IS 41	Hillsborough Bowling	696403.82	299804.750	56.336	56.329	56.329	-7	-7	-0.1
AP 42	Dornwell Rd	696378.41	299015.870	76.373	76.360	76.360	-13	-13	-0.1
AP 43	Dornwell Rd	696260.57	298956.760	66.002	65.991	65.992	-11	-10	0.7
AP 44	Dornwell Rd	696110.00	298858.850	58.493	58.480	58.482	-13	-11	2
AP 45	Frost Rd	696471.85	298726.920	64.920	64.909	64.909	-11	-11	0
AP 54	Frost Rd	696264.66	298577.840	57.855	57.840	57.839	-15	-16	-0.8
AP 46	Dominion Rd	697995.61	298226.640	50.443	50.439	50.436	-4	-7	-3.3
AP 47A	Landscape Rd	697951.78	298343.100	52.565	52.565	52.561	0	-4	-4.4
AP 48A	Landscape Rd	697937.88	298463.580	57.065	57.063	57.060	-2	-5	-3.4
AP 49B	Landscape Rd	697788.49	299044.880	70.340	70.338	70.334	-2	-6	-4
AP 50B	Landscape Rd	697766.32	299132.160	71.659	71.658	71.655	-1	-4	-2.6
AP 51B	Landscape Rd	697745.03	299214.610	74.120	74.119	74.116	-1	-4	-3.1
AP 55	Mt Eden Rd	698209.04	299461.780	68.263	68.262		-1		
AP 55A	Mt Eden Rd	698208.56	299461.650	68.300		68.300			
AP 56	Mt Albert Rd	696314.42	300774.760	58.409	58.409	58.410	0	1	1.1
AP 60	Rowan Rd	696681.05	299826.310	76.276	76.265	76.263	-11	-13	-2.4
AP 61	Rowan Rd	696616.53	299797.110	71.310	71.298	71.293	-12	-17	-4.8
AP 62A	Mt Albert Rd	696527.21	299808.440	62.894	62.894	62.895		0	0.6
AP 63A	Mt Albert Rd	696520.06	299875.150	61.370	61.366	61.367	-4	-3	1.3
AP 64	Hillsborough Rd	696478.45	299774.300	60.579	60.569	60.571	-10	-9	1.5
AP 65	Hillsborough Rd	696446.58	299735.840	59.546	59.533	59.534	-13	-12	1
OAP 66	Hillsborough Rd	696359.44	299672.760	59.987	59.978	59.980	-9	-7	1.9
AP 67	Hillsborough Rd	696248.43	299622.210	63.871	63.862	63.863	-9	-8	1.3
OCP 68	Budock Rd	696235.97	299684.440	66.304	66.297	66.300	-7	-4	2.7
AP 69	Budock Rd	696249.57	299731.190	65.977	65.970	65.972	-7	-5	2
AP 70	Budock Rd	696244.13	299790.390	71.208	71.202	71.205	-6	-3	2.6
OAP 71	Hillsborough Rd	696195.17	299615.830	67.651	67.644		-7		
AP 71A	Hillsborough Rd	696194.39	299616.380	67.816		67.816			
AP 72	Hillsborough Rd	696072.41	299594.010	74.077	74.071	74.075	-6	-3	3.5
AP 73	Marie Ave	696238.34	299544.470	70.874	70.864	70.868	-10	-6	3.5
AP 74	Marie Ave	696260.93	299489.180	80.330	80.320		-10		
AP 74A	Marie Ave	696253.83	299498.690	78.302		78.302			
AP 75	Marie Ave	696280.07	299452.860	86.876	86.871	86.874	-5	-2	2.9
AP 77A	Mt Albert Rd	696539.72	299479.950	83.034	83.034	83.034		0	-0.3
AP 78	Mt Albert Rd	696559.36	299551.480	81.022	81.012	81.012	-10	-11	-0.5
AP 79	Mt Albert Rd	696558.48	299588.520	78.663	78.653	78.654	-10	-9	0.8
AP 80	Mt Albert Rd	696561.89	299691.520	71.414	71.401	71.402	-13	-13	0.7
AP 81A	Mt Albert Rd	696501.72	300015.210	58.551	58.547	58.549	-4	-2	2
AP 82A	Mt Albert Rd	696507.72	299991.380	58.575	58.572	58.573	-3	-2	1.4
AP 83	Mt Albert Rd	696514.36	299966.950	58.863	58.858	58.858	-5	-6	-0.2
AP 84	Mt Albert Rd	696520.40	299943.250	59.350	59.344	59.346	-6	-4	1.5
AP 85	Mt Albert Rd	696516.23	299894.400	60.619	60.611	60.612	-8	-7	1
AP 86	Mt Albert Rd	696524.80	299855.750	62.051	62.044	62.046	-7	-5	2.2

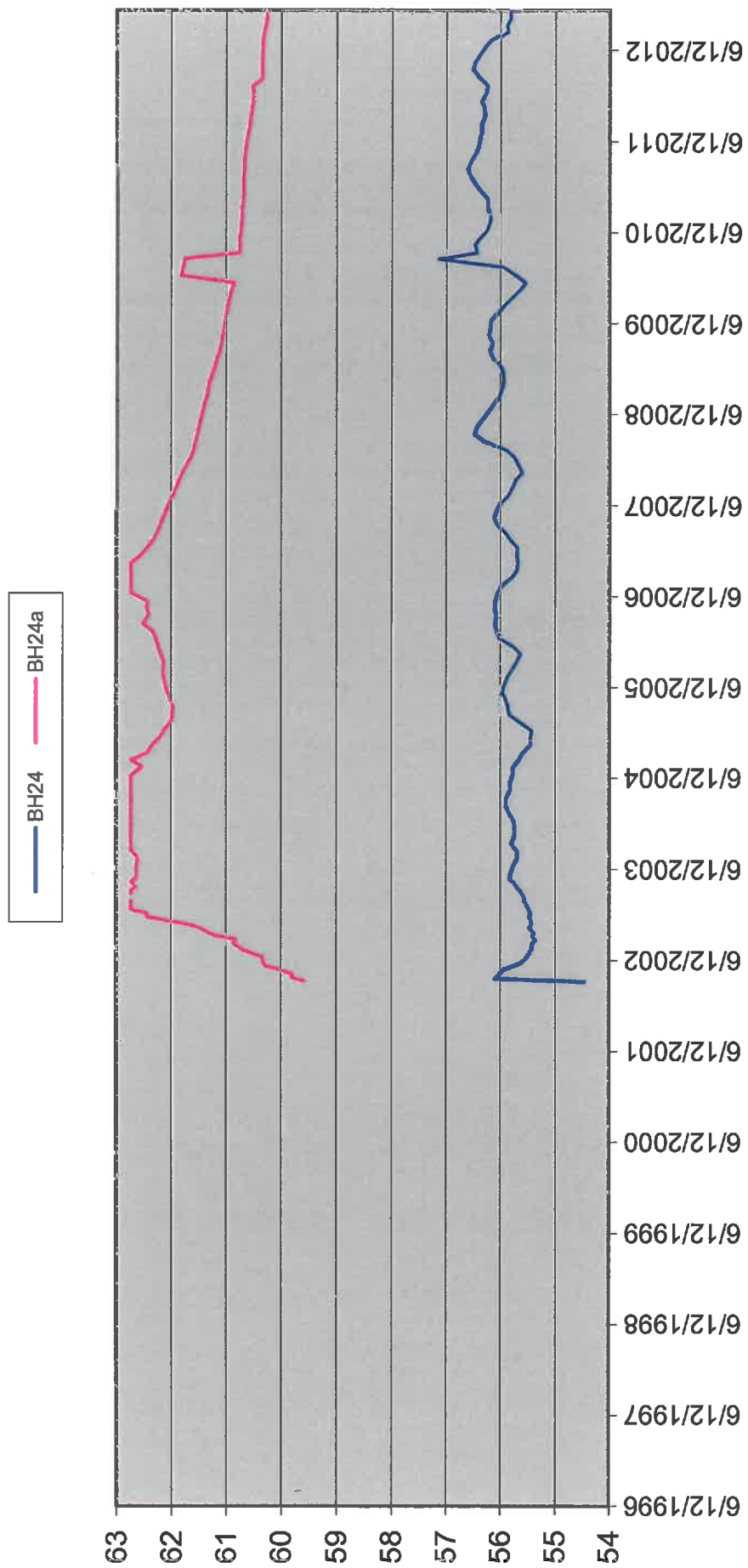
Station ID	Location	Coordinates		Averaged Level	Surveyed Levels (metres)		Change from Averaged Level (mm)		May 13 of Mar 12 (mm)
		mN	mE		Mar-12	May-13	Mar-12	May-13	
AP 87	Mt Albert Rd	696530.55	299833.500	62.733	62.726	62.727	-7	-7	0.7
AP 88A	Mt Albert Rd	696541.44	299788.970	64.679	64.679	64.679		0	-0.4
AP 89	Mt Albert Rd	696560.86	299777.800	65.939	65.929	65.928	-10	-10	-0.6
AP 90	Mt Albert Rd	696562.93	299734.250	68.687	68.677	68.678	-10	-10	0.5
AP 91	Mt Albert Rd	696562.43	299712.450	70.075	70.066	70.067	-9	-9	0.6
AP 92	Mt Albert Rd	696560.50	299673.840	72.613	72.620	72.623	7	9	2.5
AP 93	Mt Albert Rd	696559.89	299657.170	73.864	73.856	73.856	-8	-8	0.3
AP 94	Mt Albert Rd	696558.57	299610.310	77.101	77.093	77.093	-8	-7	0.3
AP 95	Mt Albert Rd	696559.21	299569.960	79.957	79.948	79.948	-9	-9	0
AP 96	St Andrews Rd	696582.87	299641.100	77.897	77.890	77.890	-7	-7	-0.3
AP 97	St Andrews Rd	696607.72	299646.900	80.321	80.313	80.313	-8	-8	0.3
AP 98	Rowan Rd	696588.07	299763.680	68.501	68.493	68.494	-8	-7	0.8
AP 99	Rowan Rd	696594.23	299786.130	69.478	69.470	69.469	-8	-9	-0.7
AP 100	Hillsborough Rd	696521.99	299784.890	62.966	62.955	62.957	-11	-9	1.7
AP 101	Hillsborough Rd	696494.72	299786.950	61.359	61.350	61.350	-9	-9	0.4
AP 102	Hillsborough Rd	696457.24	299761.130	60.006	59.997	59.998	-9	-8	0.9
AP 103	Hillsborough Rd	696427.81	299719.780	59.404	59.393	59.392	-11	-12	-1.3
AP 104A	Hillsborough Rd	696385.14	299690.230	59.554	59.545	59.549	-9	-5	3.5
AP 105	Hillsborough Rd	696373.80	299682.700	59.711	59.702	59.704	-9	-7	2.4
AP 106	Hillsborough Rd	696341.88	299660.520	60.458	60.452	60.453	-6	-5	1.4
AP 107	Hillsborough Rd	696324.59	299648.550	60.881	60.874	60.876	-7	-5	2.3
AP 108	Hillsborough Rd	696290.76	299628.820	62.060	62.054	62.056	-6	-4	2.3
AP 109	Hillsborough Rd	696270.02	299627.790	62.806	62.799	62.803	-7	-4	3.8
AP 110	Hillsborough Rd	696230.60	299619.620	64.997	64.988	64.989	-9	-8	1.3
AP 111	Hillsborough Rd	696213.05	299617.070	66.322	66.316	66.319	-6	-3	2.6
AP 112	Budock Rd	696247.78	299639.800	63.699	63.693	63.696	-6	-3	2.5
AP 113	Budock Rd	696235.55	299662.370	65.546	65.543	65.545	-3	-1	2
AP 114	Budock Rd	696238.48	299707.280	65.879	65.884	65.886	5	7	2.1
AP 115	Budock Rd	696251.17	299753.130	67.579	67.573	67.575	-6	-4	2
AP 116	Budock Rd	696251.91	299773.340	69.485	69.481	69.483	-4	-1	2.3
AP 117	Budock Rd	696245.16	299811.840	70.833	70.842	70.844	9	11	1.8
OAP 118	Mt Albert Rd	696509.17	299918.390	59.895	59.887	59.887	-8	-8	0.4
AP 119B	Haughey Ave	696153.08	299217.860	71.931	71.930	71.932		1	1.6
AP 120	Haughey Ave	696109.88	299304.270	67.450	67.443	67.446	-7	-4	2.9
AP 121	Haughey Ave	696056.80	299385.050	66.666	66.659	66.663	-7	-3	3.7
AP 122	Haughey Ave	696006.86	299462.680	66.032	66.026	66.029	-6	-3	3
AP 123A	Haughey Ave	695959.41	299557.720	73.518	73.517	73.520	-1	2	2.8
AP 125A	Hillsborough Rd	695847.28	299535.570	69.946	69.944	69.949	-2	3	5.1
SS 1976	Hillsborough Rd	695759.40	299503.940	71.137	71.127	71.130	-10	-7	3
AP 126A	Carr Rd	695885.14	299465.230	65.244	65.240	65.244	-4	0	3.9
AP 127A	Carr Rd	695905.29	299374.820	61.514	61.511	61.514	-3	0	2.5
RM 7441	Carr Rd	695901.87	299261.380	58.499	58.492	58.494	-7	-5	1.5
AP 129A	Carr Rd	695938.31	299190.920	58.156	58.152	58.158	-4	2	5.6
OAP 130	Dornwell Rd	696185.75	298907.645	60.670	60.664	60.665	-6	-5	1
OAP 131	Hayr Rd	696067.40	299157.710	63.120	63.115	63.118	-5	-3	2.5
AP142	Carr/Hayr Rds	695981.15	299082.870	58.437	58.436	58.436	-1	-1	0.4
AP 132B	Carr Rd	696036.51	298977.060	58.356	58.355	58.356		1	1.1
AP 133	Carr Rd	696128.84	298776.820	58.156	58.151	58.152	-5	-5	0.6
AP 134	Carr Rd	696177.86	298685.470	58.033	58.029	58.030	-4	-2	1.3
AP 135	Frost Rd	696157.94	298506.100	57.399	57.397	57.398	-2	-2	0.5
AP 136	Frost Rd	696363.44	298640.340	59.265	59.260	59.261	-5	-4	0.7

Precise Level Graphs and Groundwater Level Graphs for Precise Level Marks
recording settlements greater than 5mm since the previous precise level survey

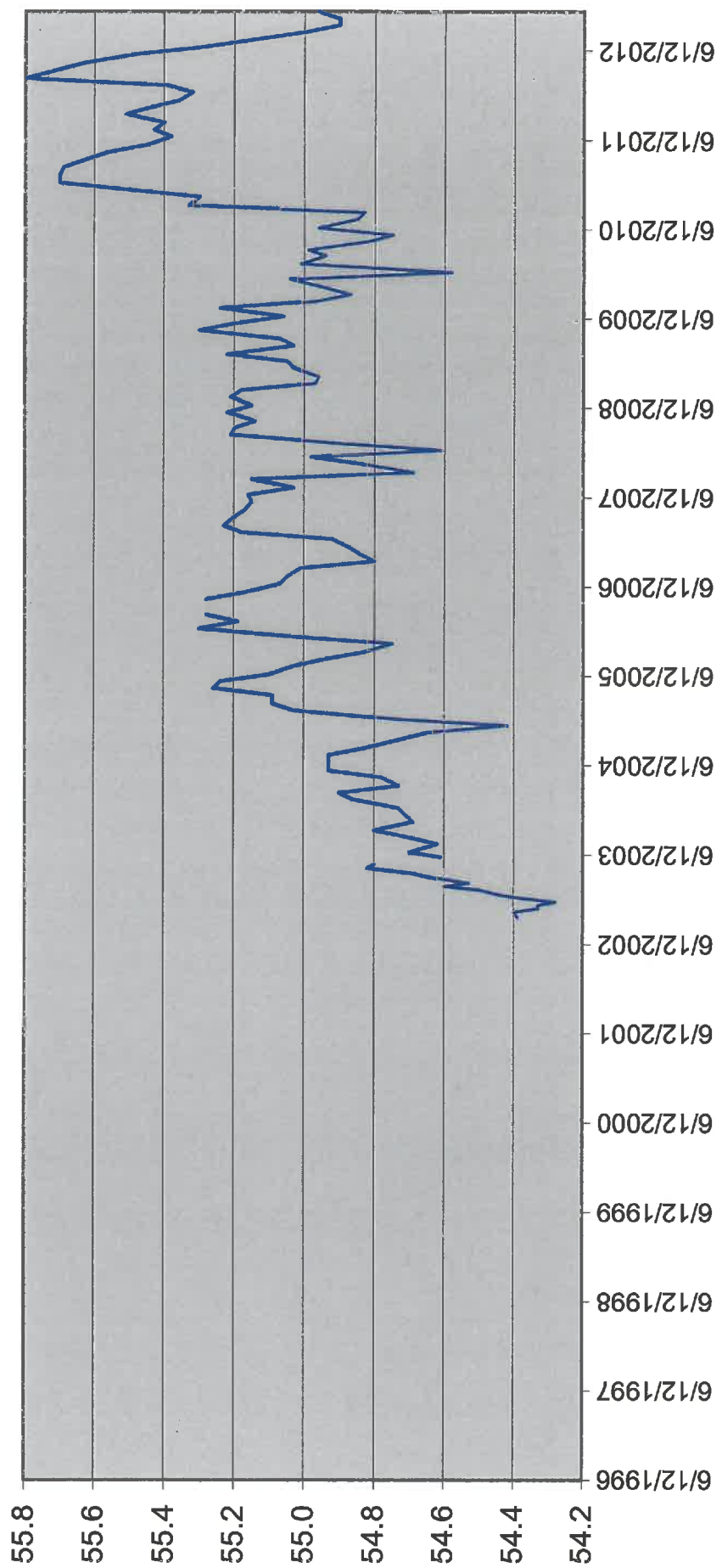
The graph displays the evolution of the 10-year yield curve from 1999 to 2013. The Y-axis represents the yield rate (0.00 to 10.00). The X-axis represents time (1/06/1999 to 1/06/2013). Multiple lines represent different maturities, showing a general downward trend in yields over time, with a significant increase in the short-term rate around 2007-2008.



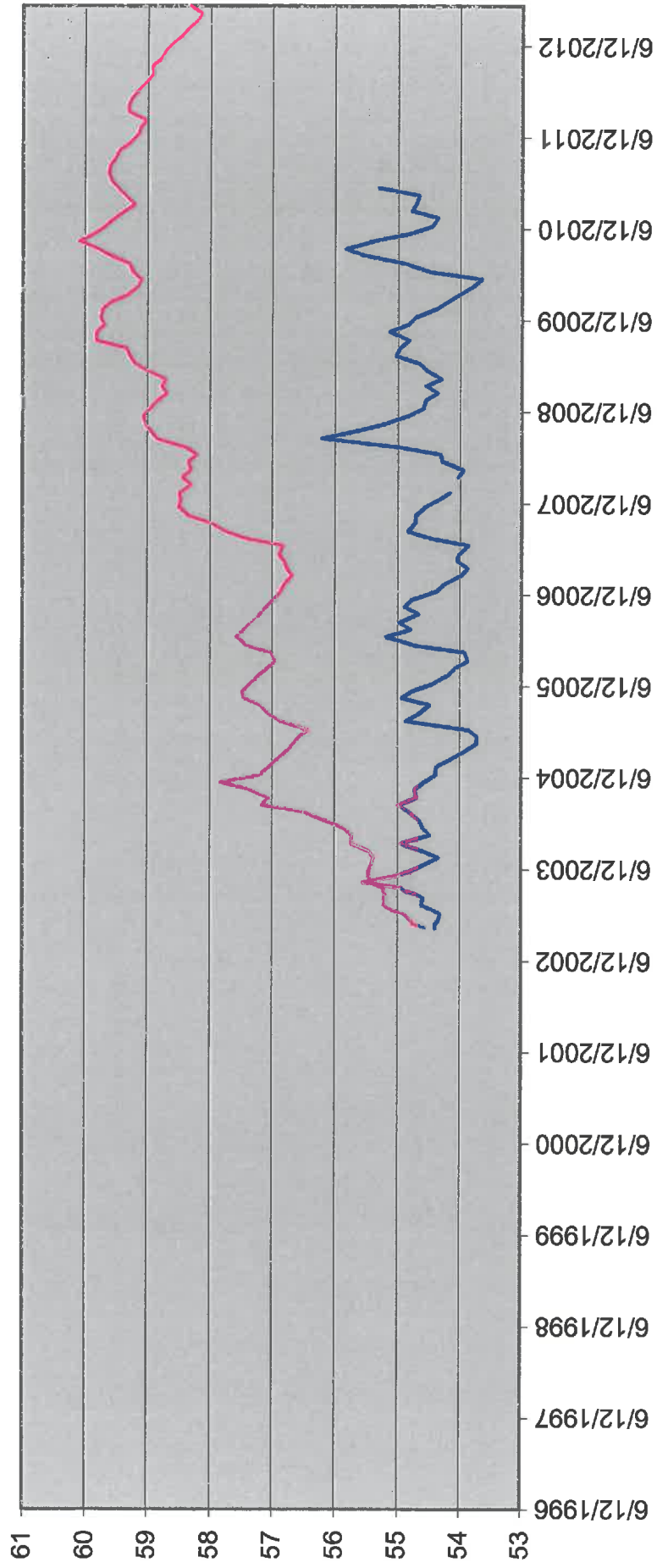
Borehole 24 and 24a

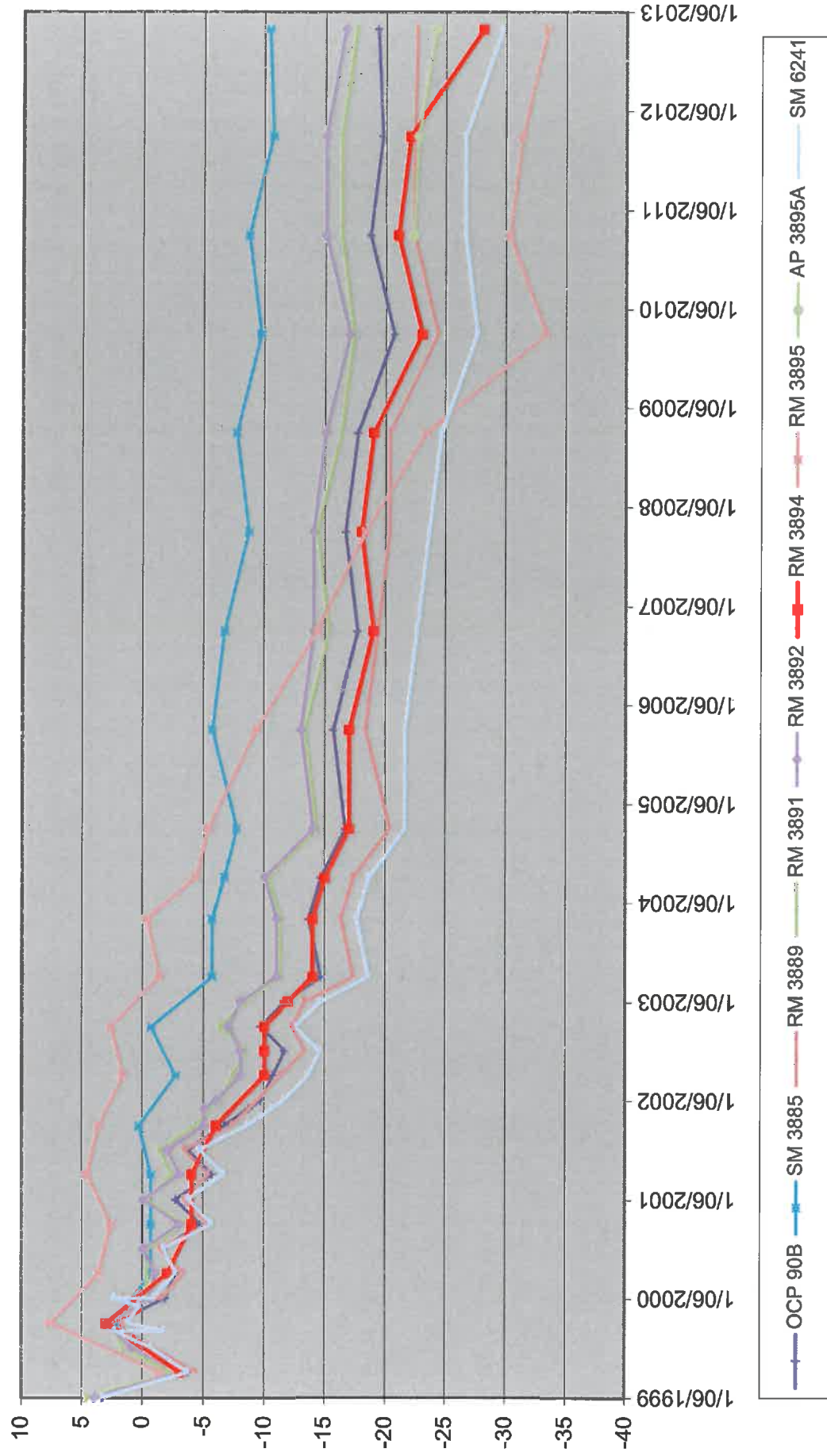


Borehole 30

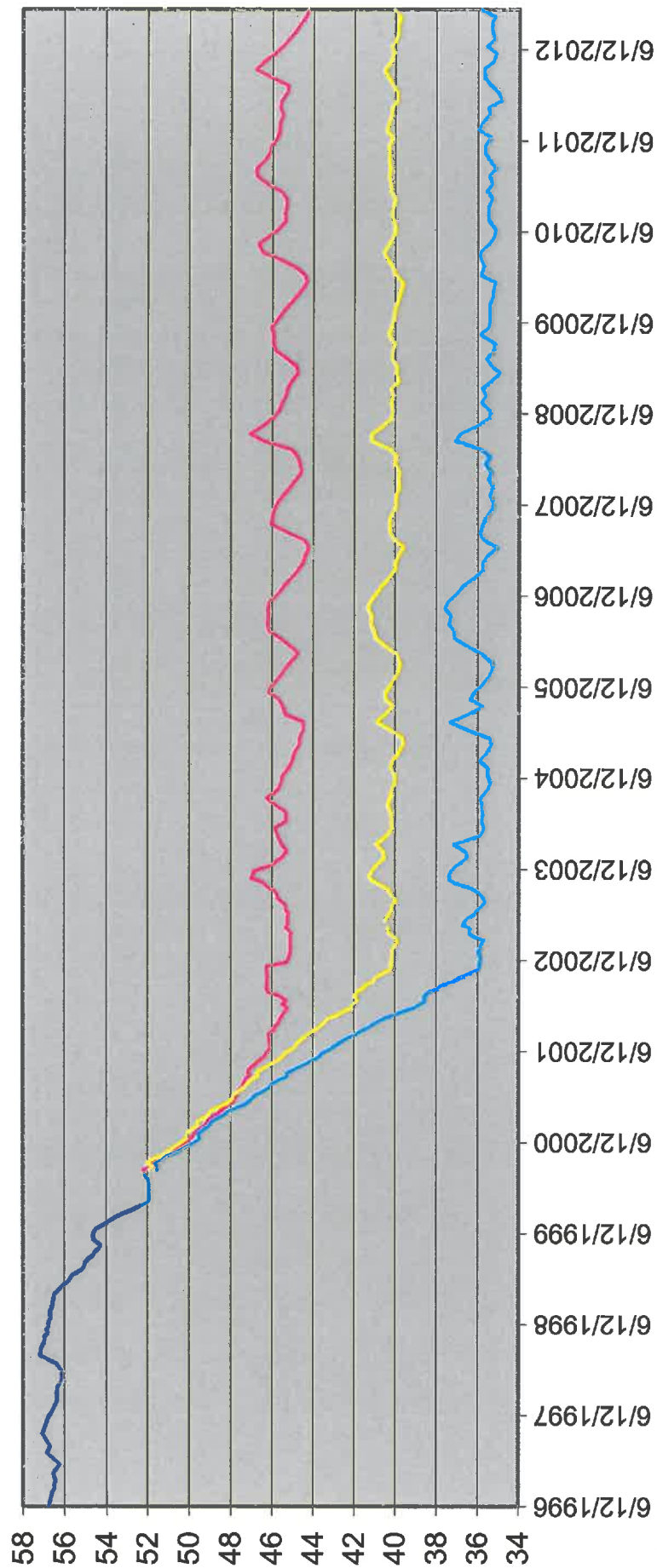
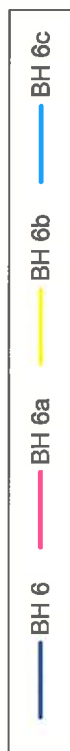


Borehole 32 and 33

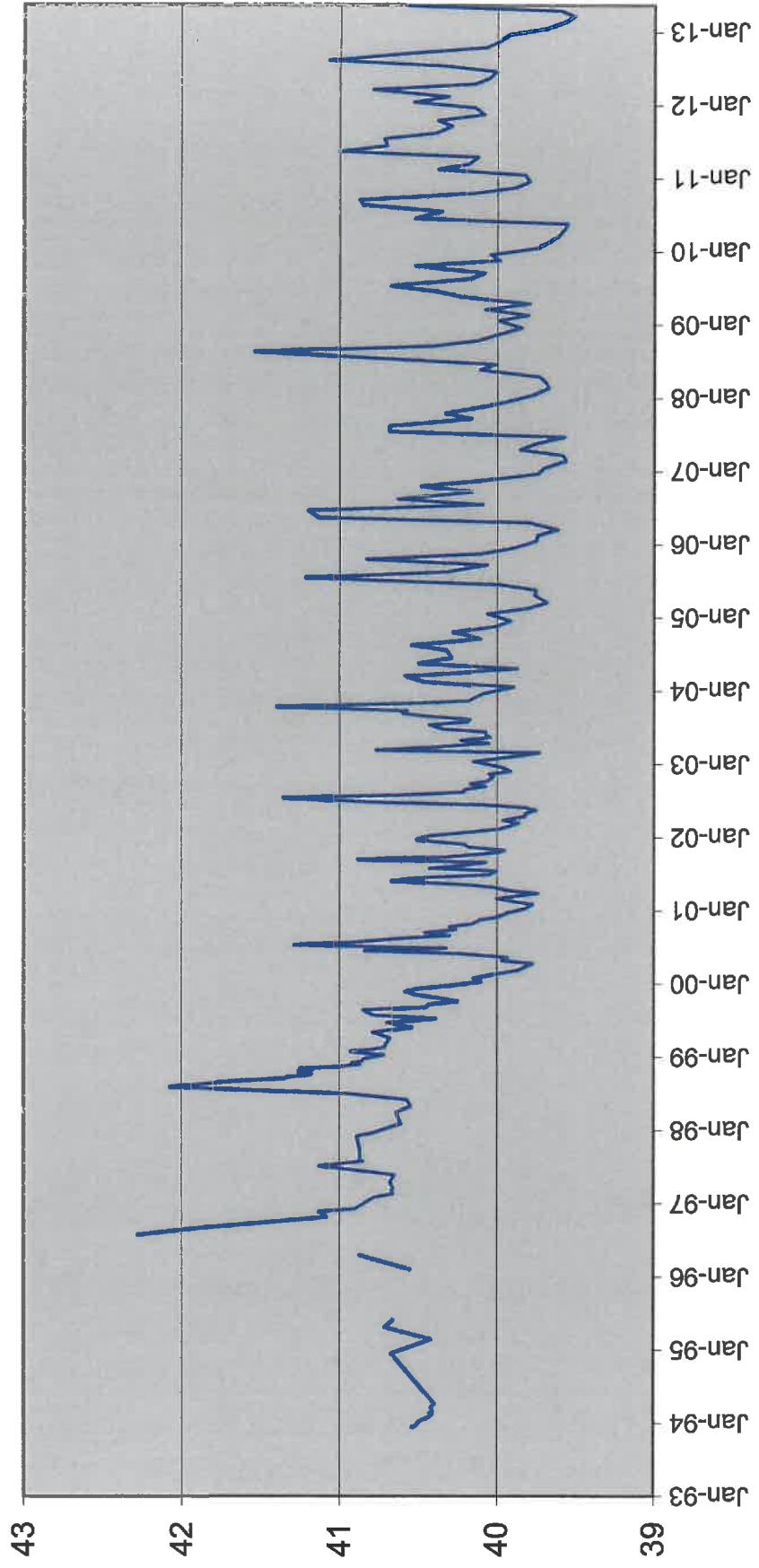




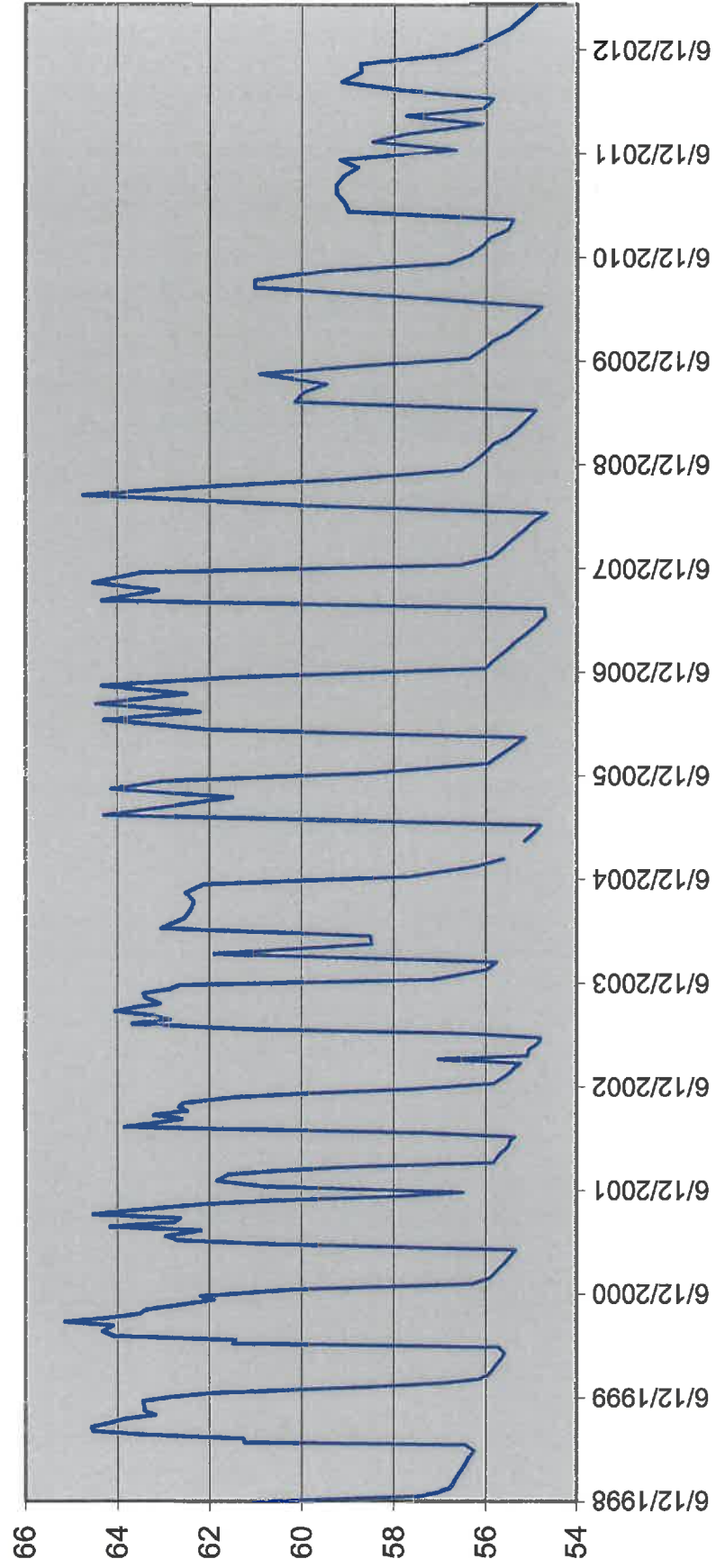
Borehole 6



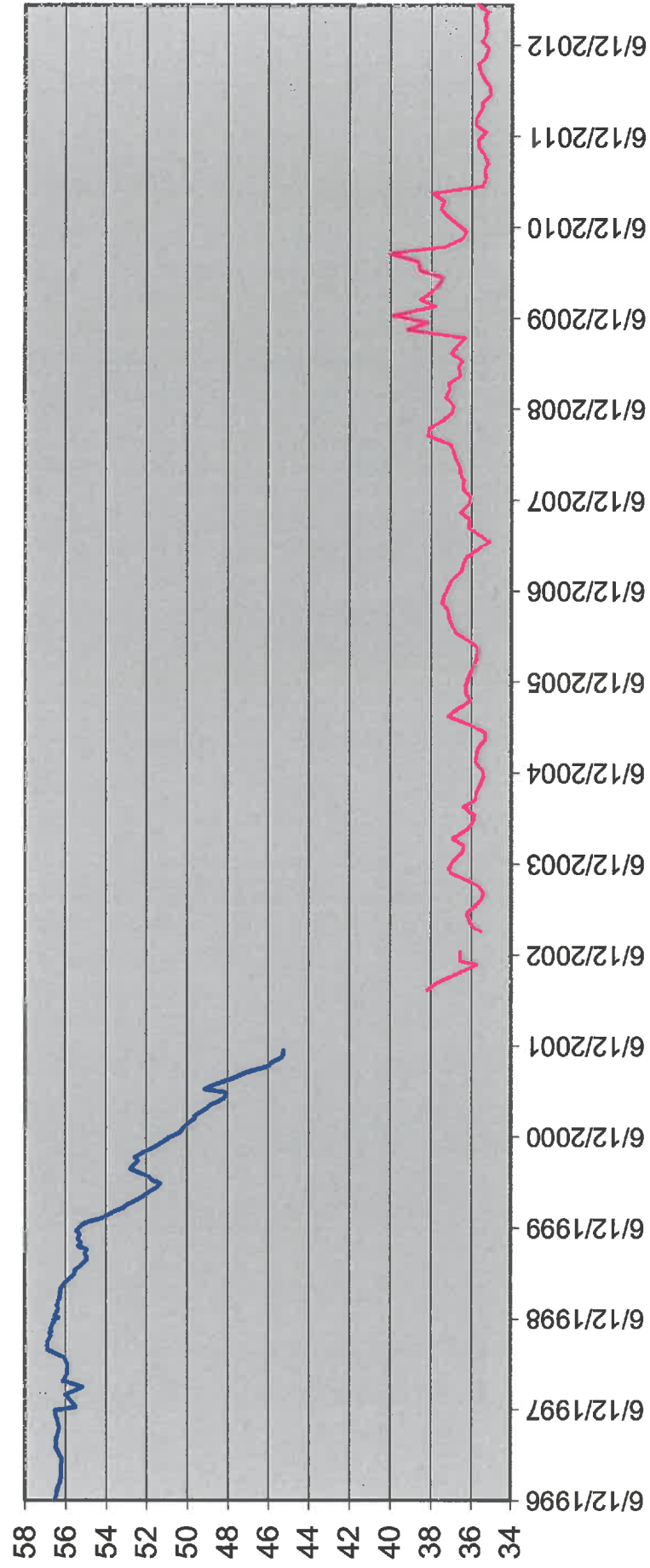
Borehole 7



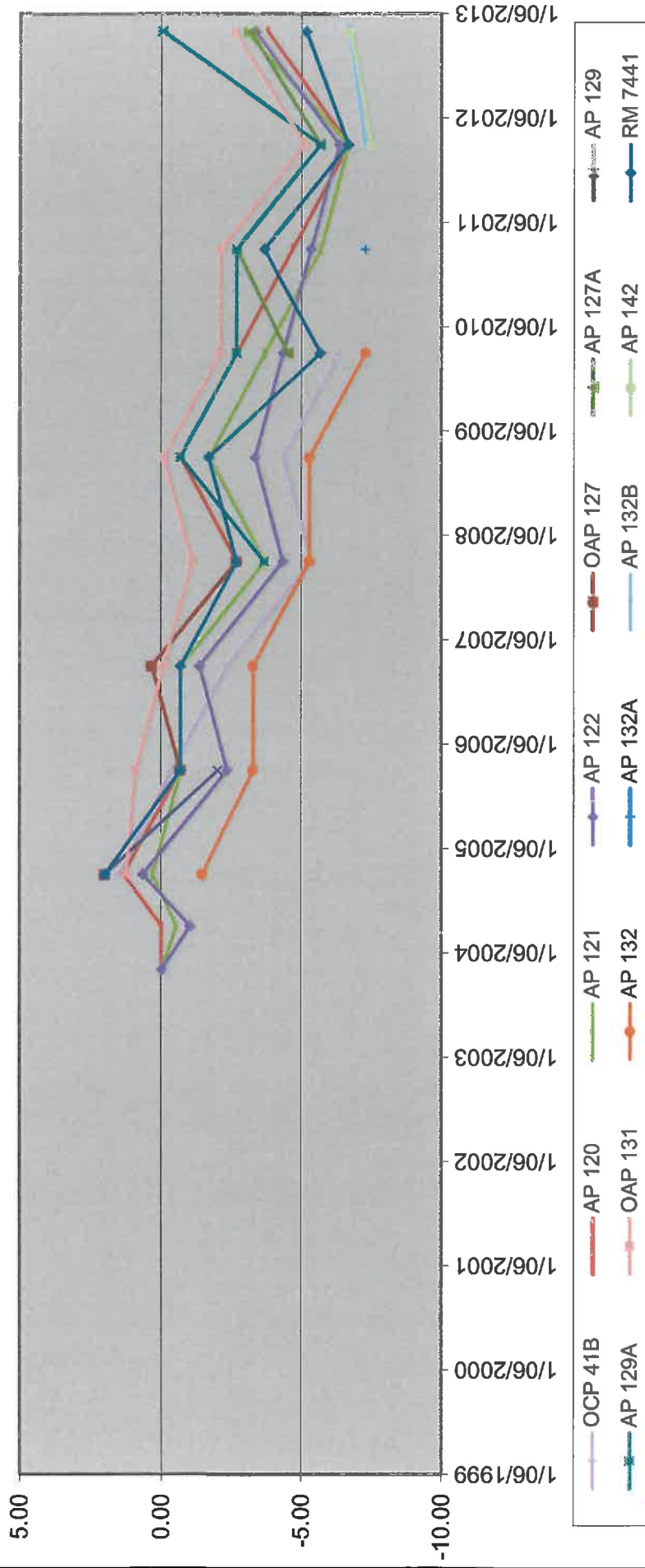
Borehole 13A



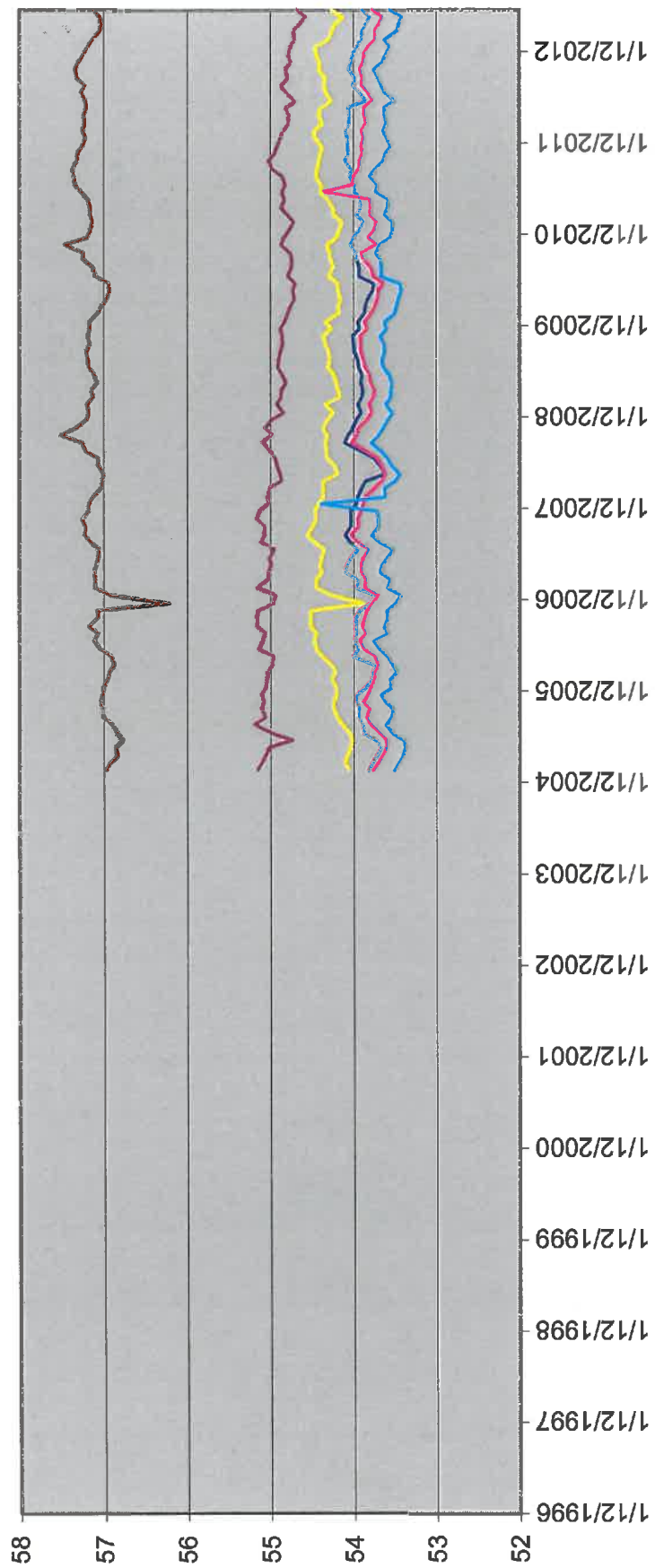
Borehole 13B and 21



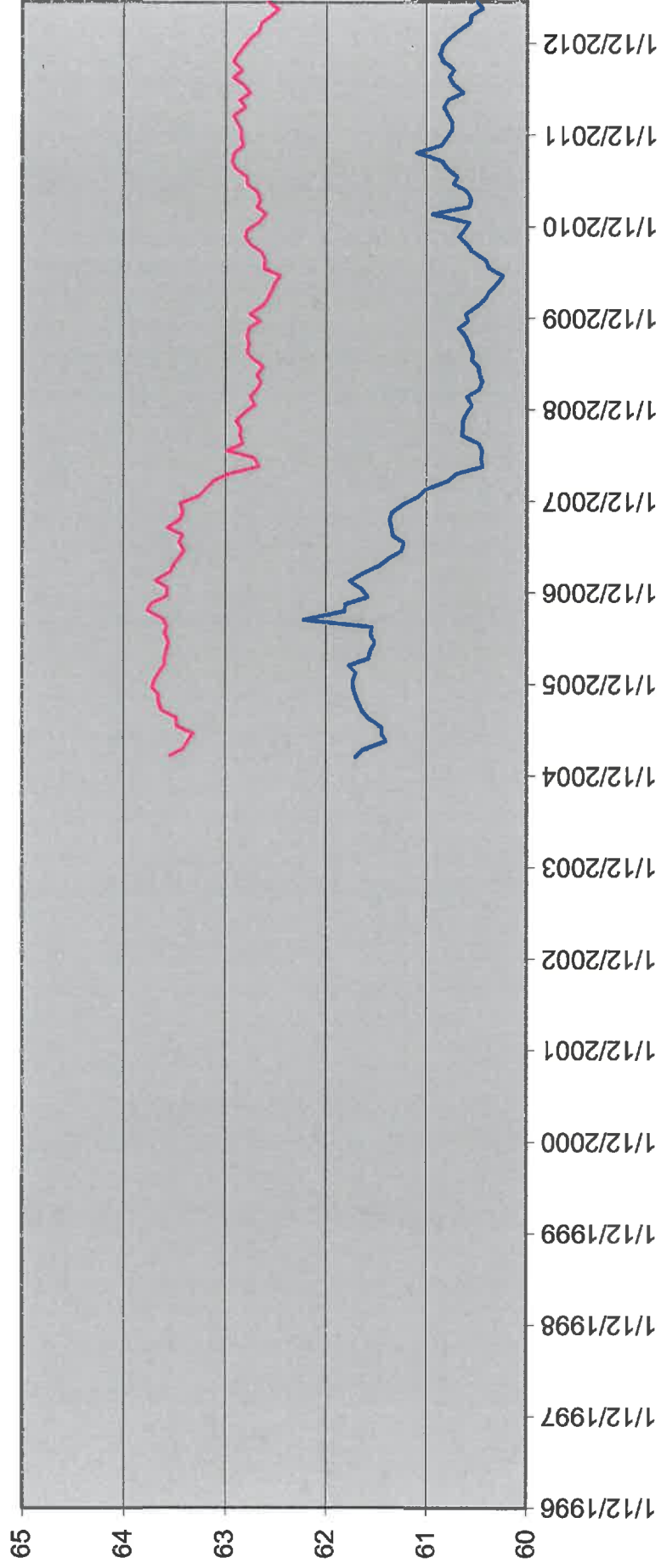
Carr Road Area - Adjusted Settlement (mm)



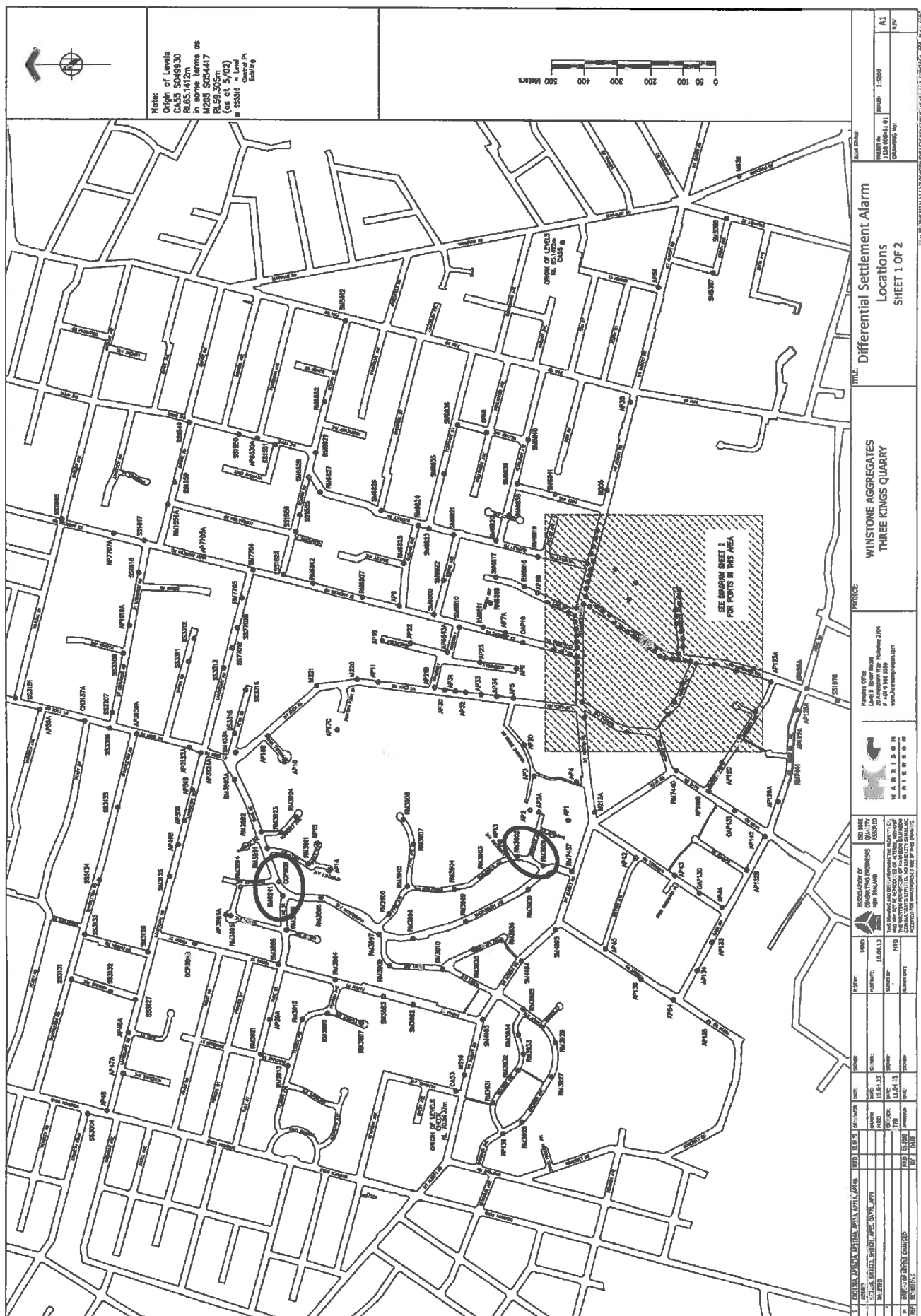
Boreholes 37, 38 and 39

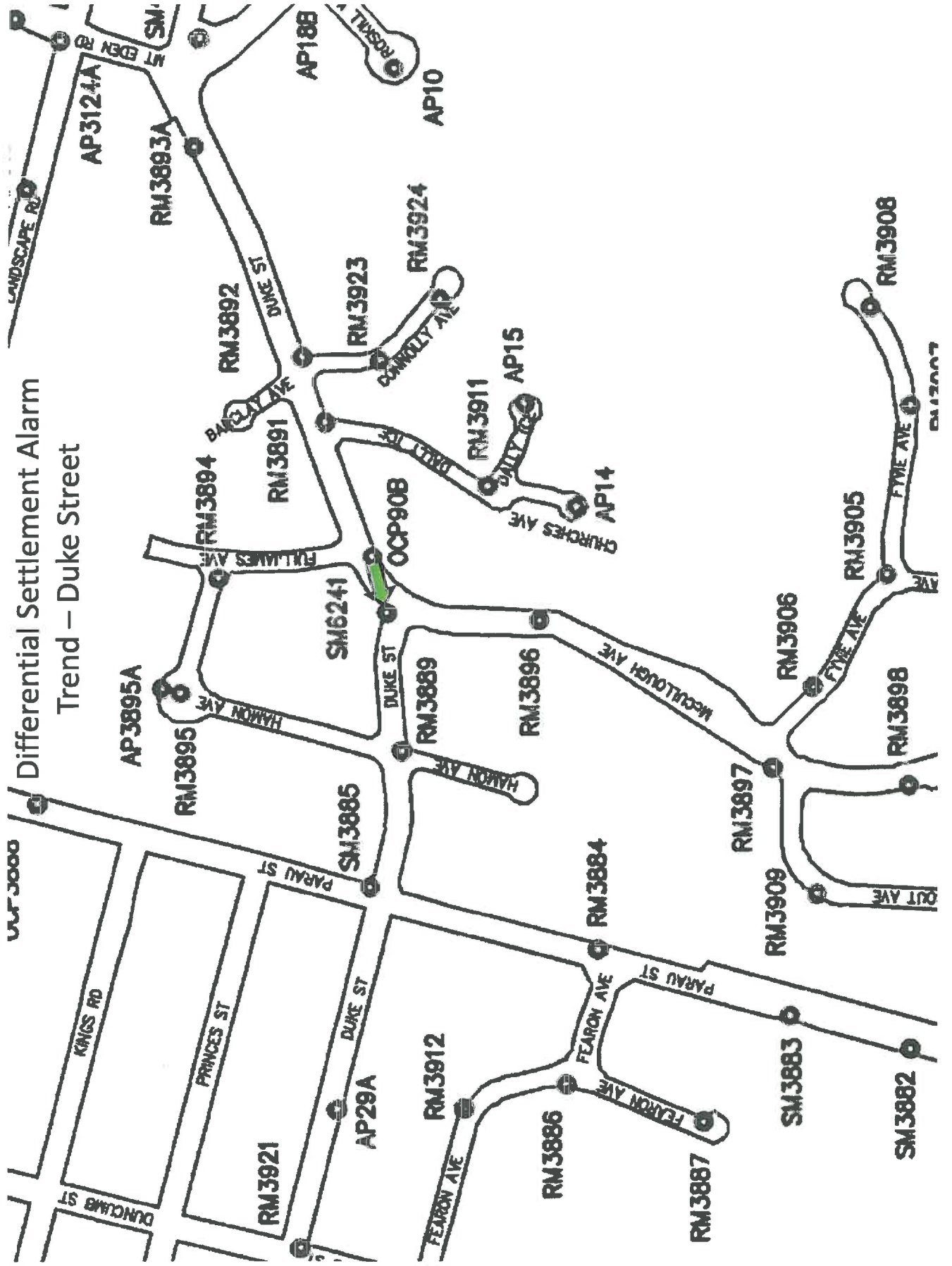


Borehole 40

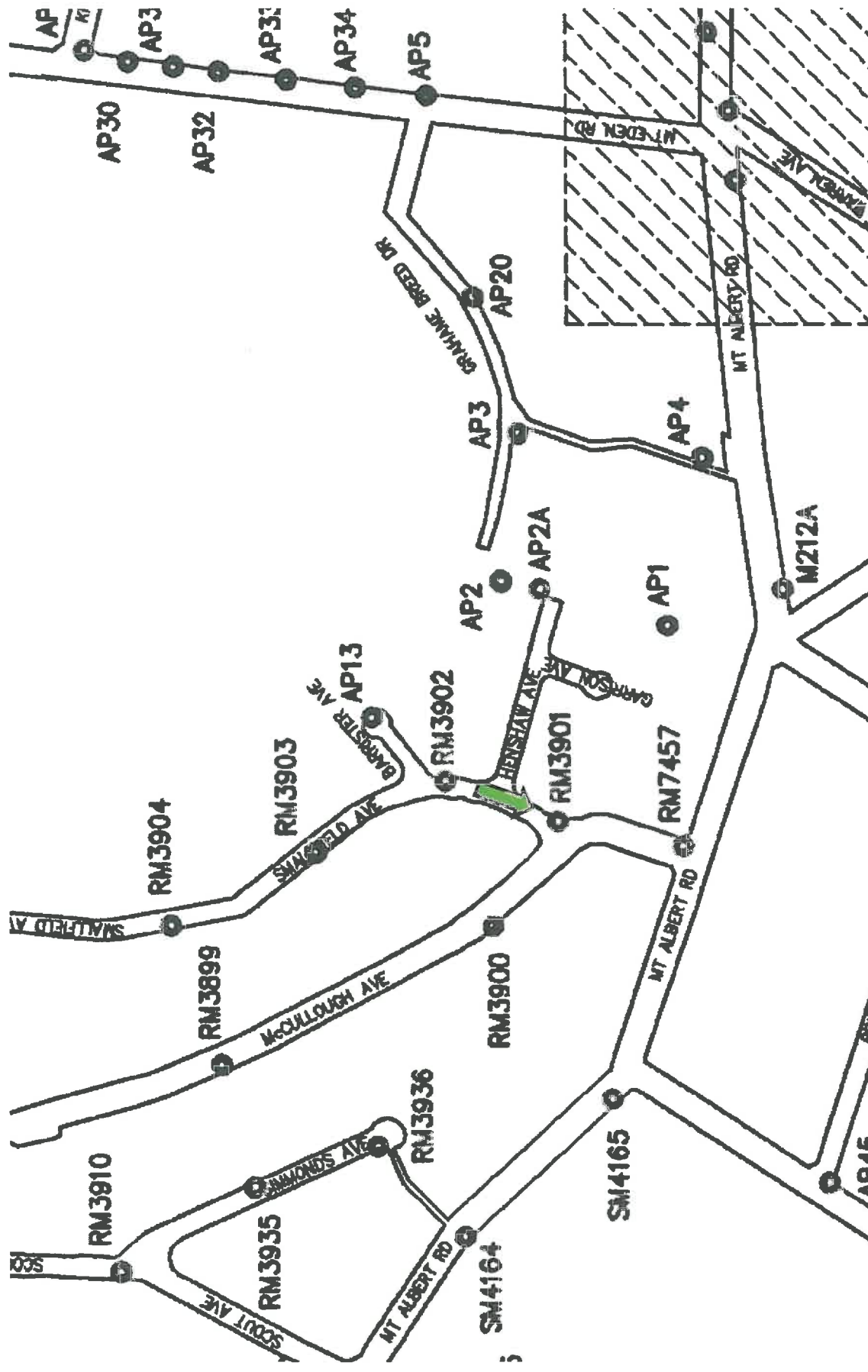


Differential Settlement Alarm Trend Analysis

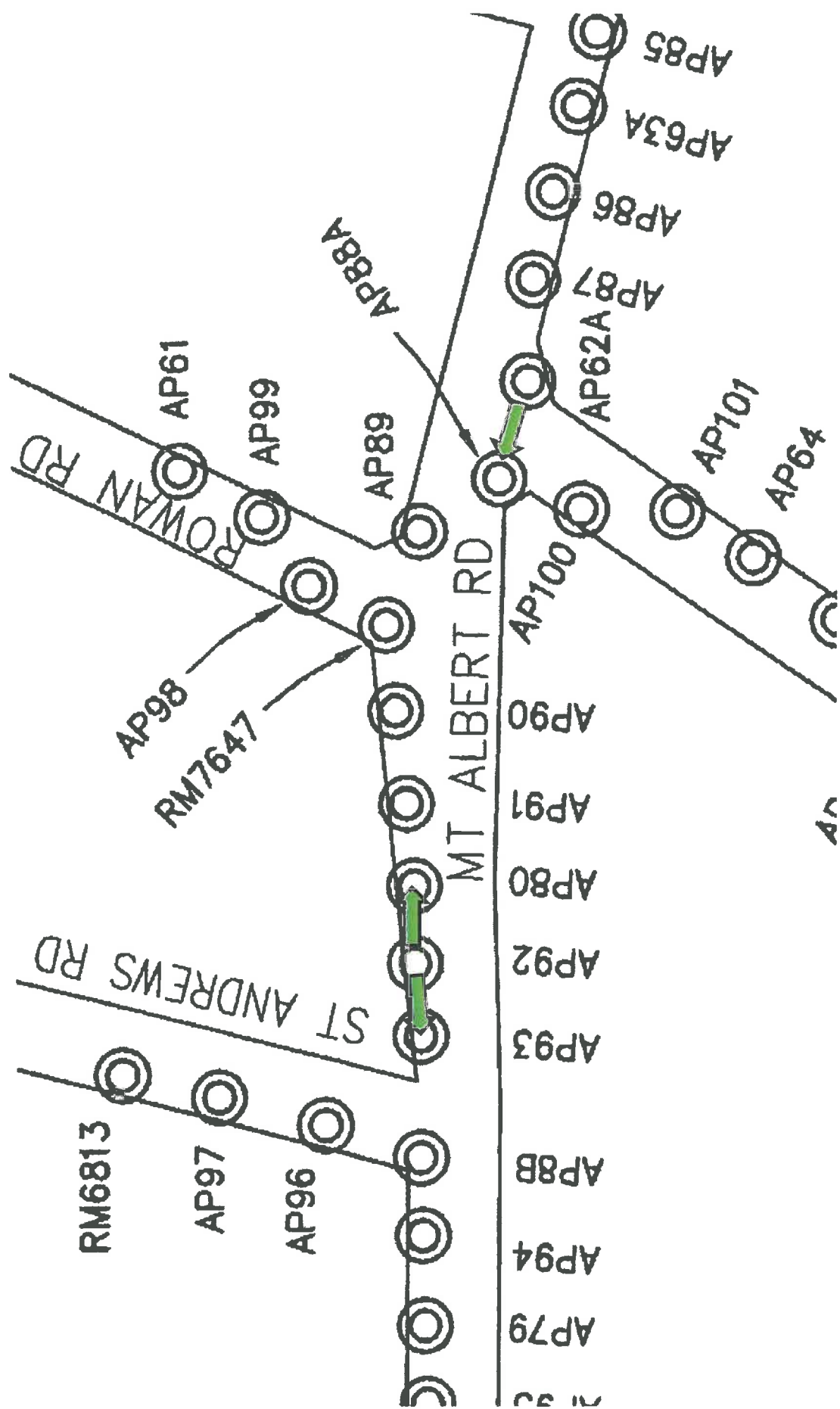




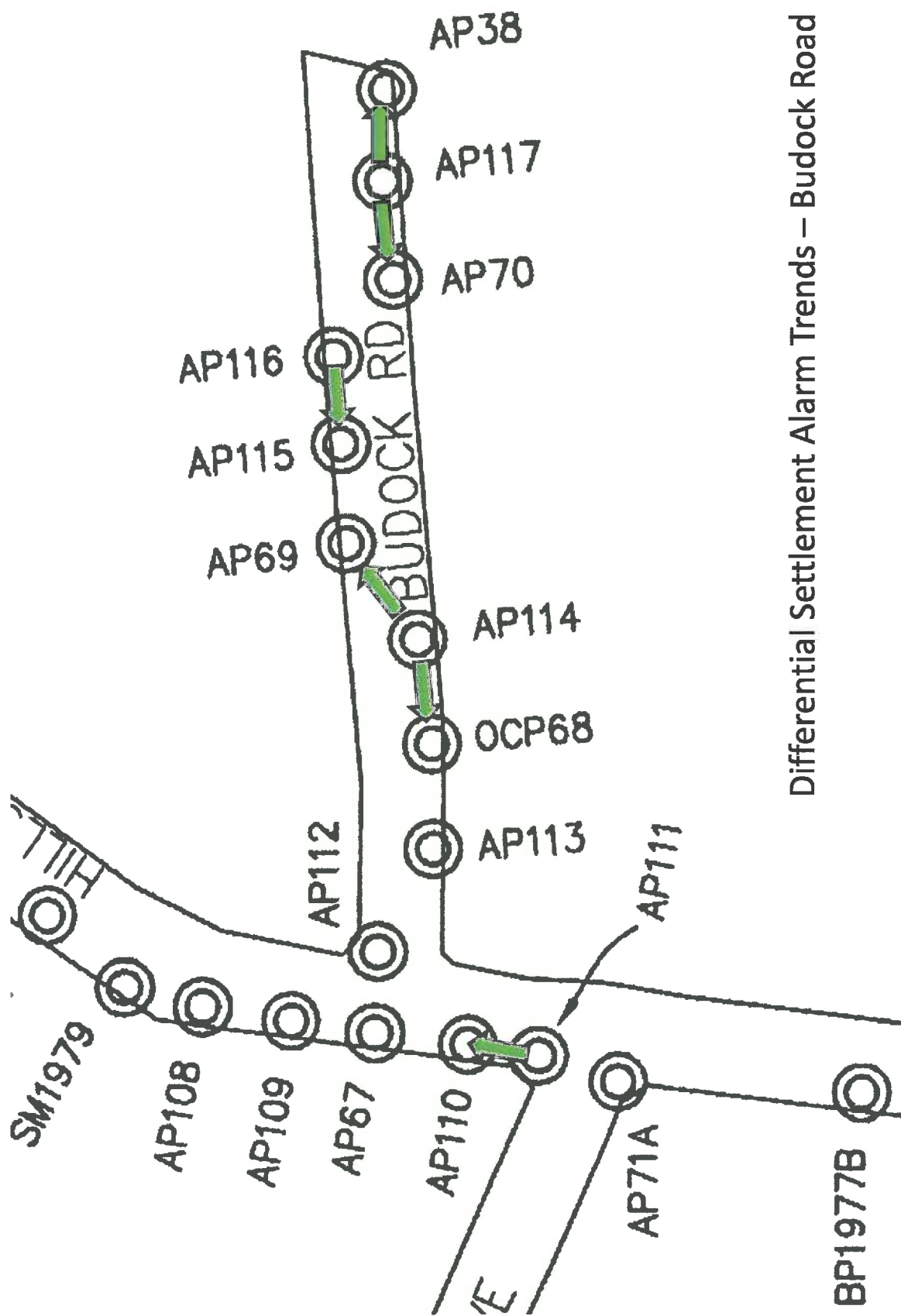
Differential Settlement Alarm
Trend – Duke Street



Differential Settlement Alarm Trend – Smallfield Avenue

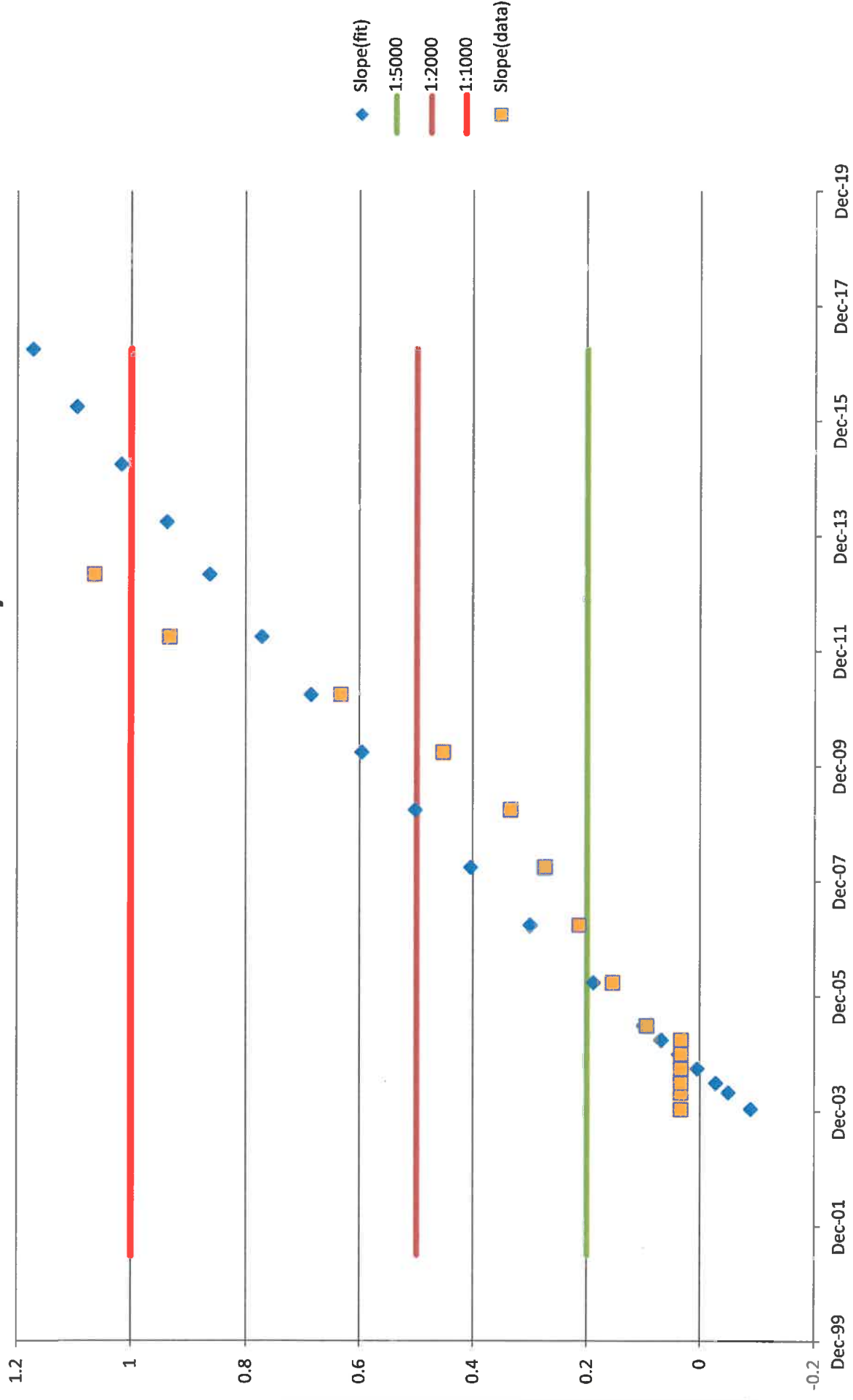


Differential Settlement Alarm Trends – Mt Albert Road

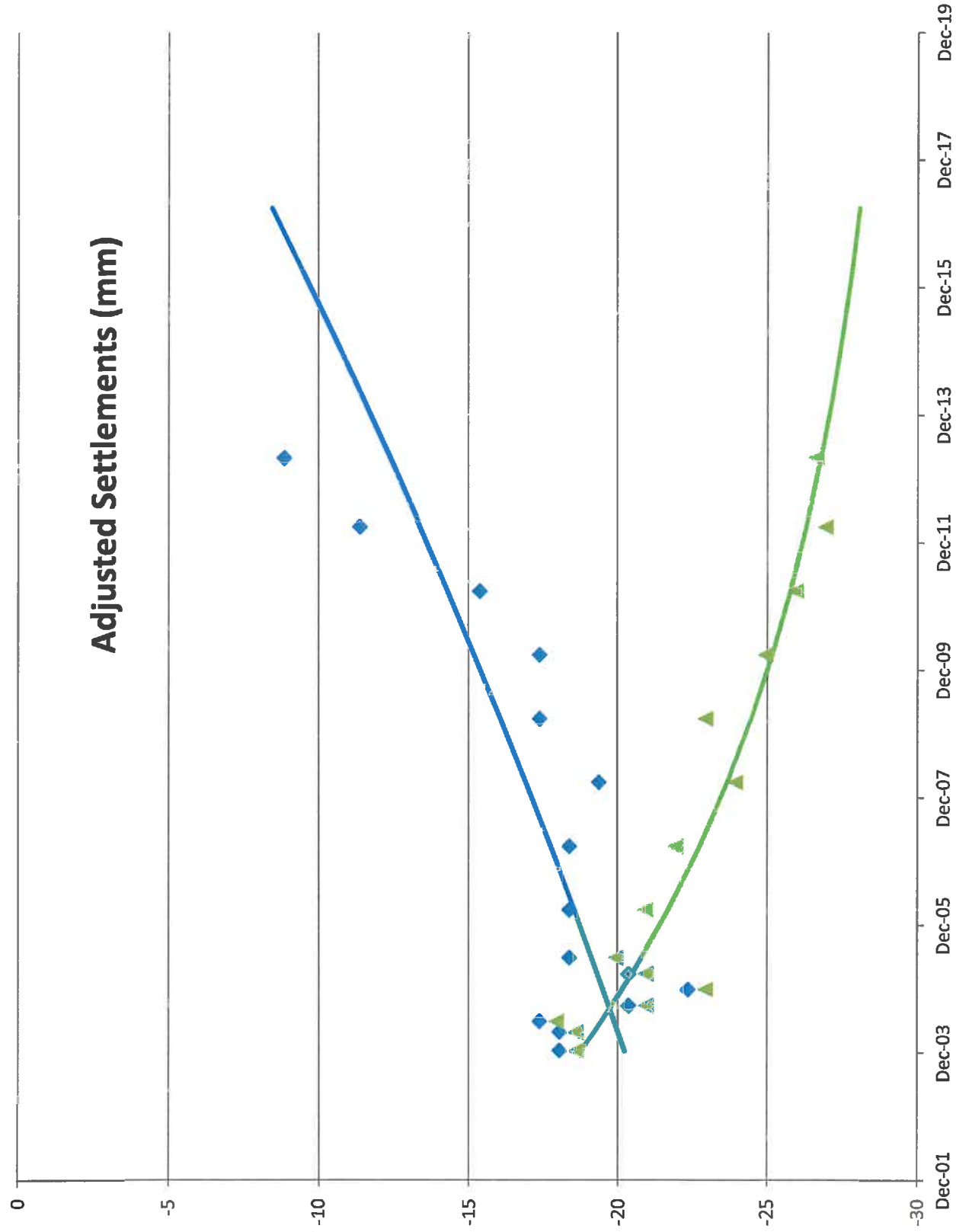


Differential Settlement Alarm Trends – Budock Road

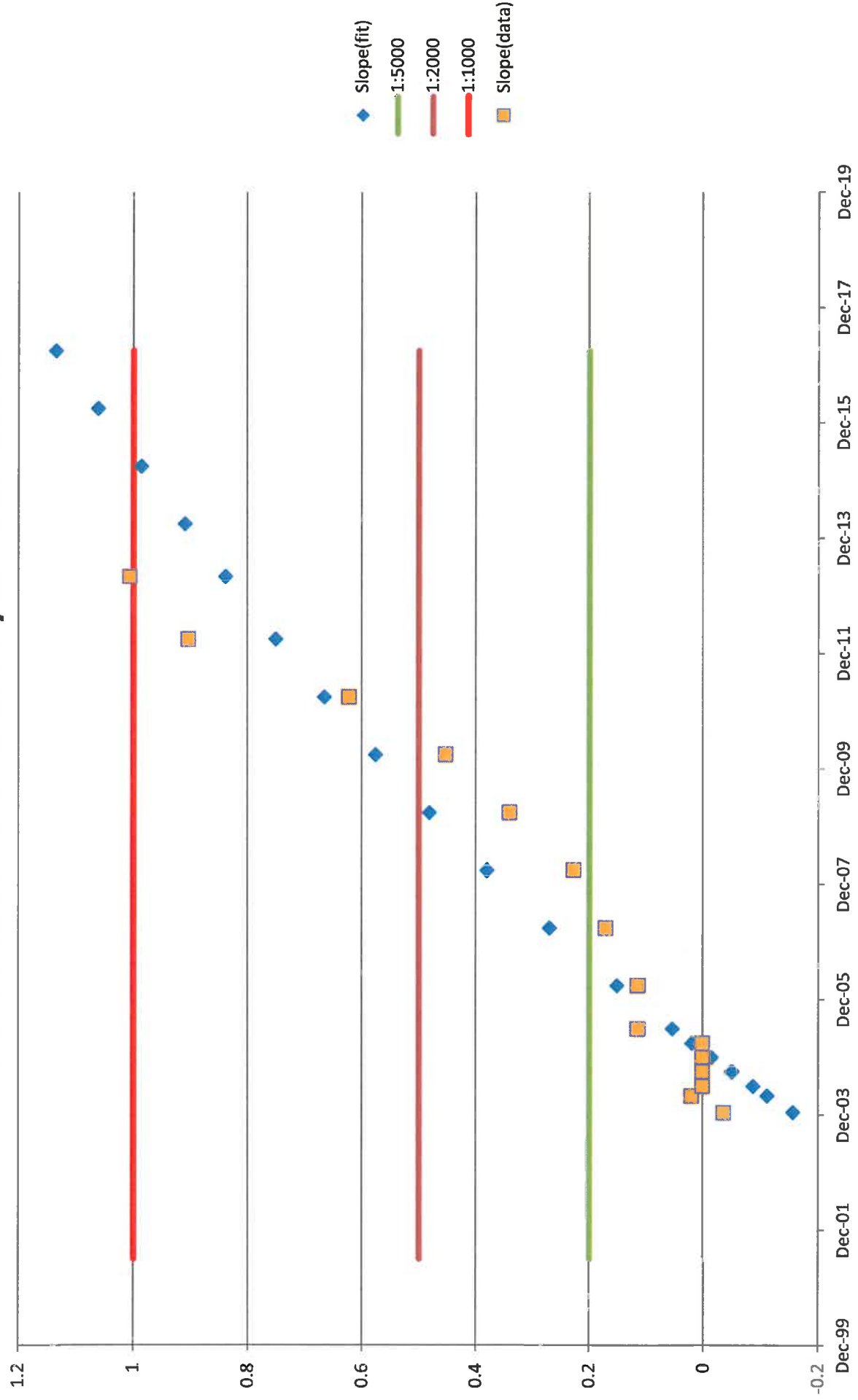
Differential Settlement Trend Analysis - AP92 vs AP93

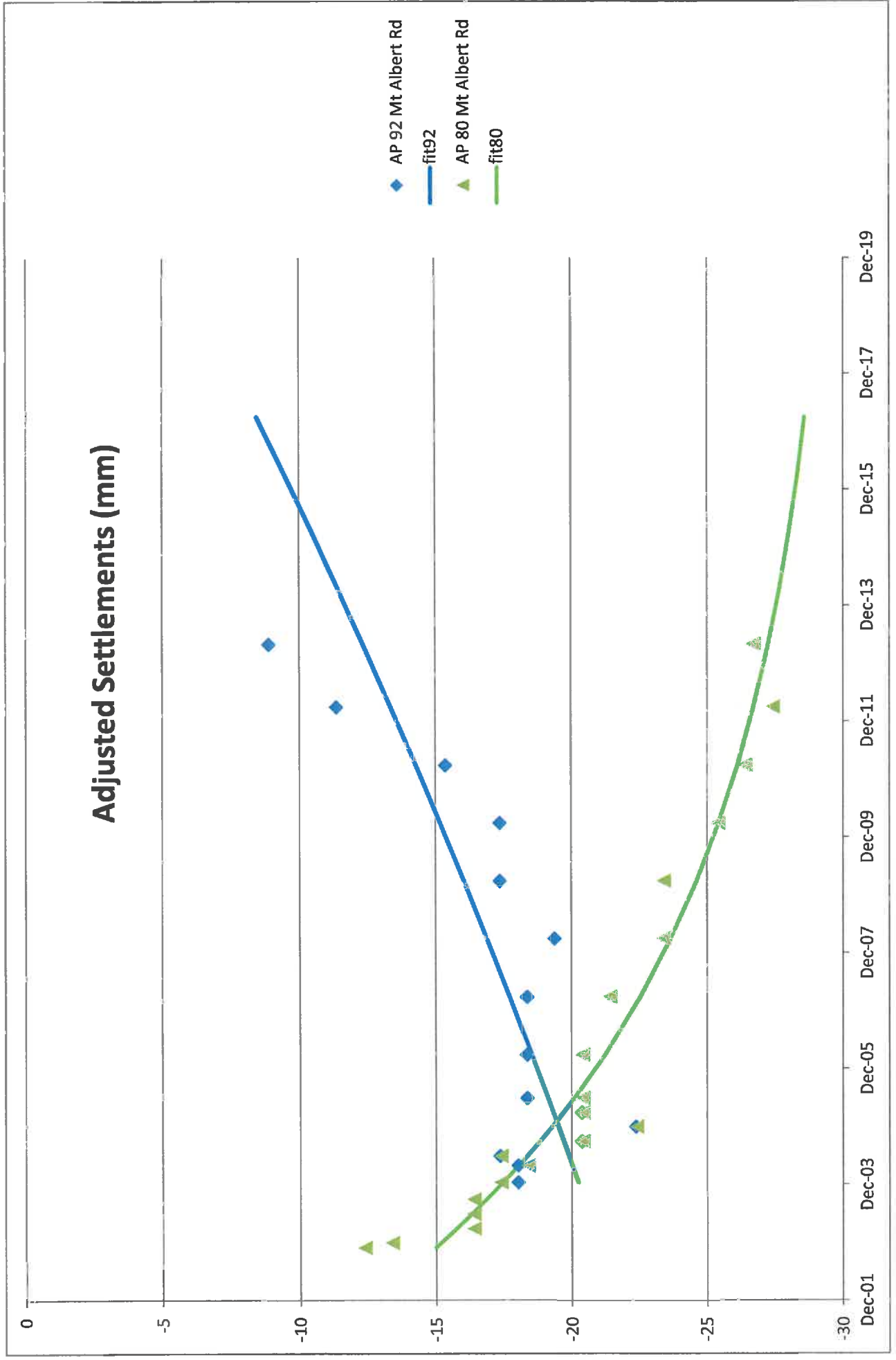


Adjusted Settlements (mm)

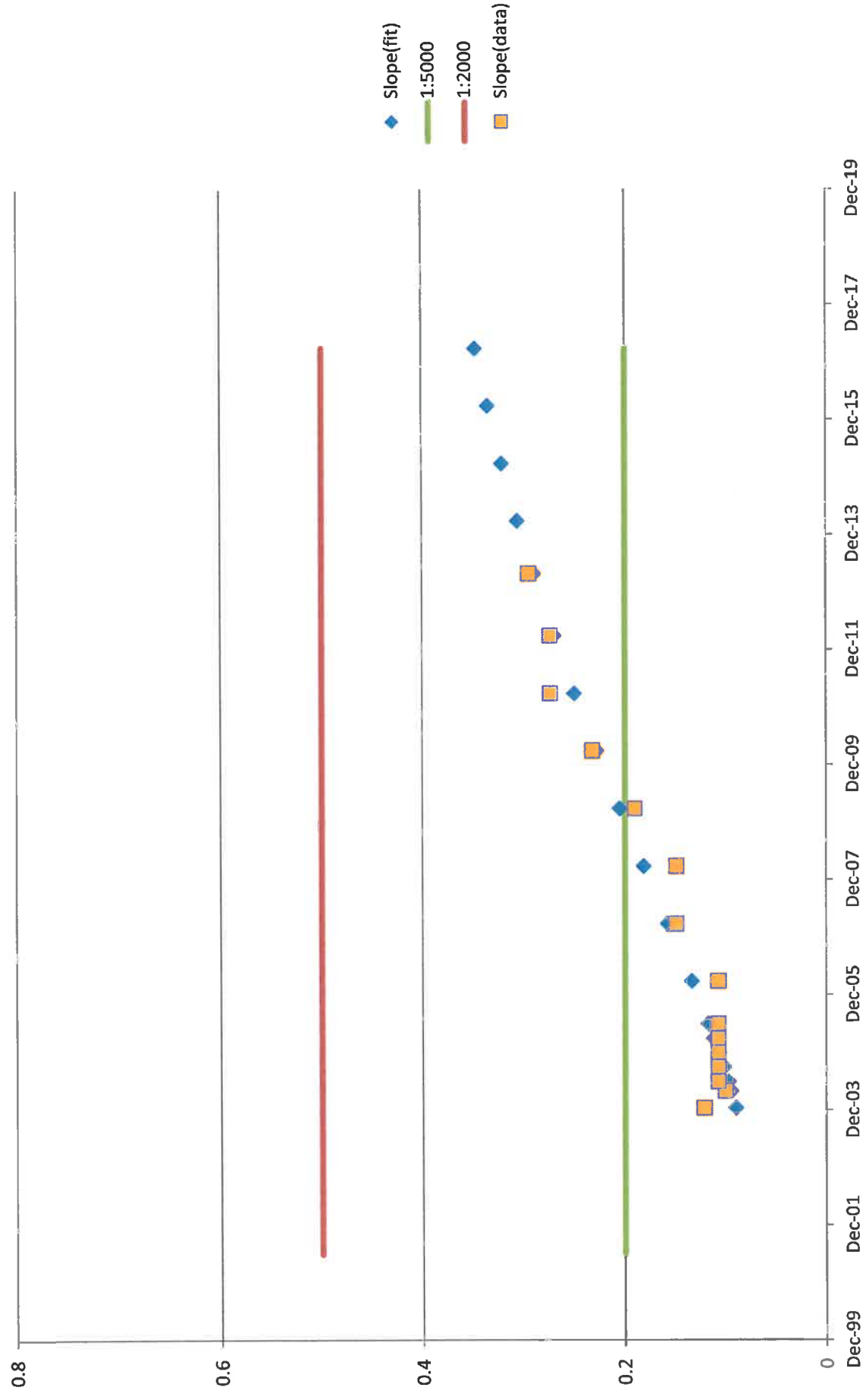


Differential Settlement Trend Analysis - AP80 vs AP92

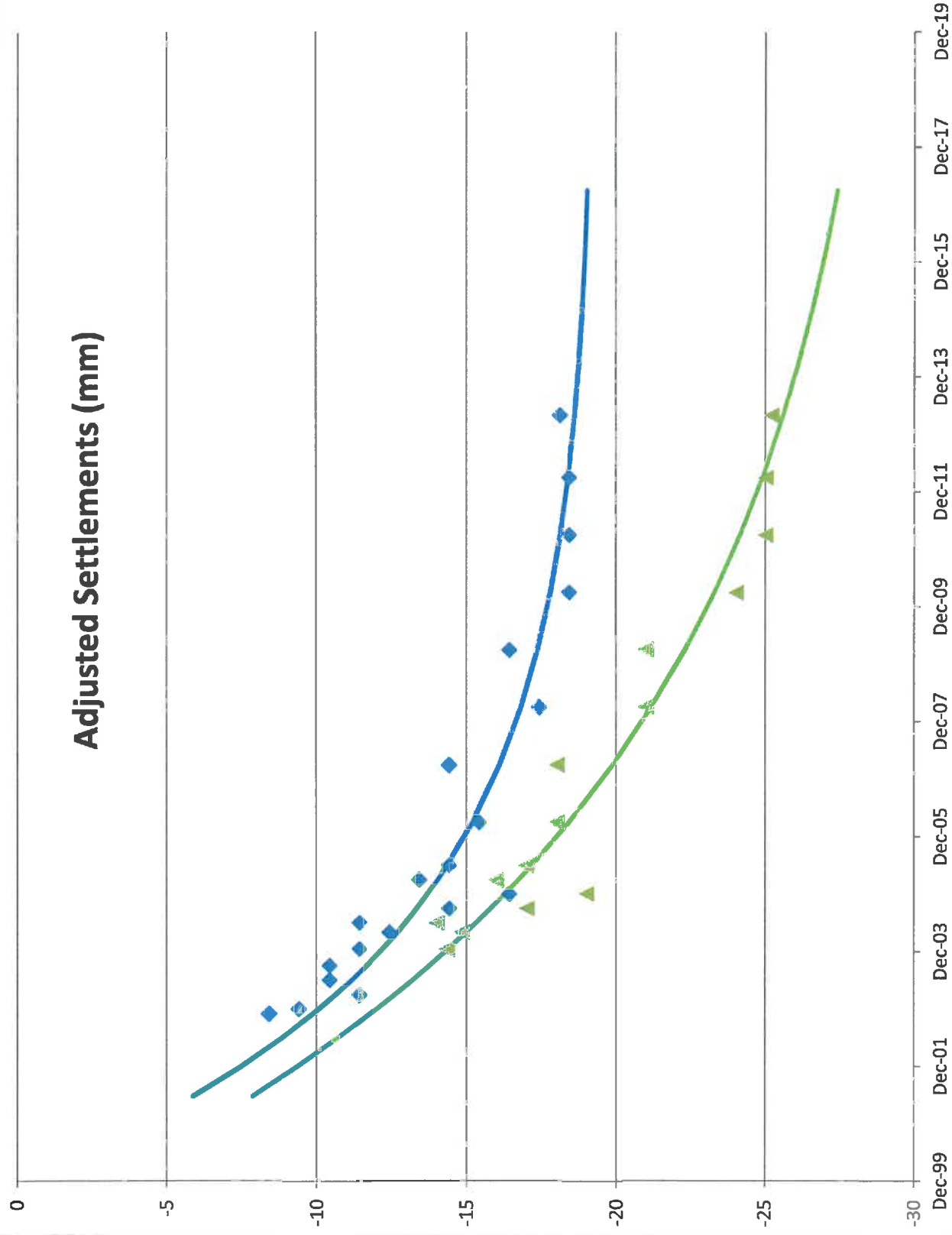




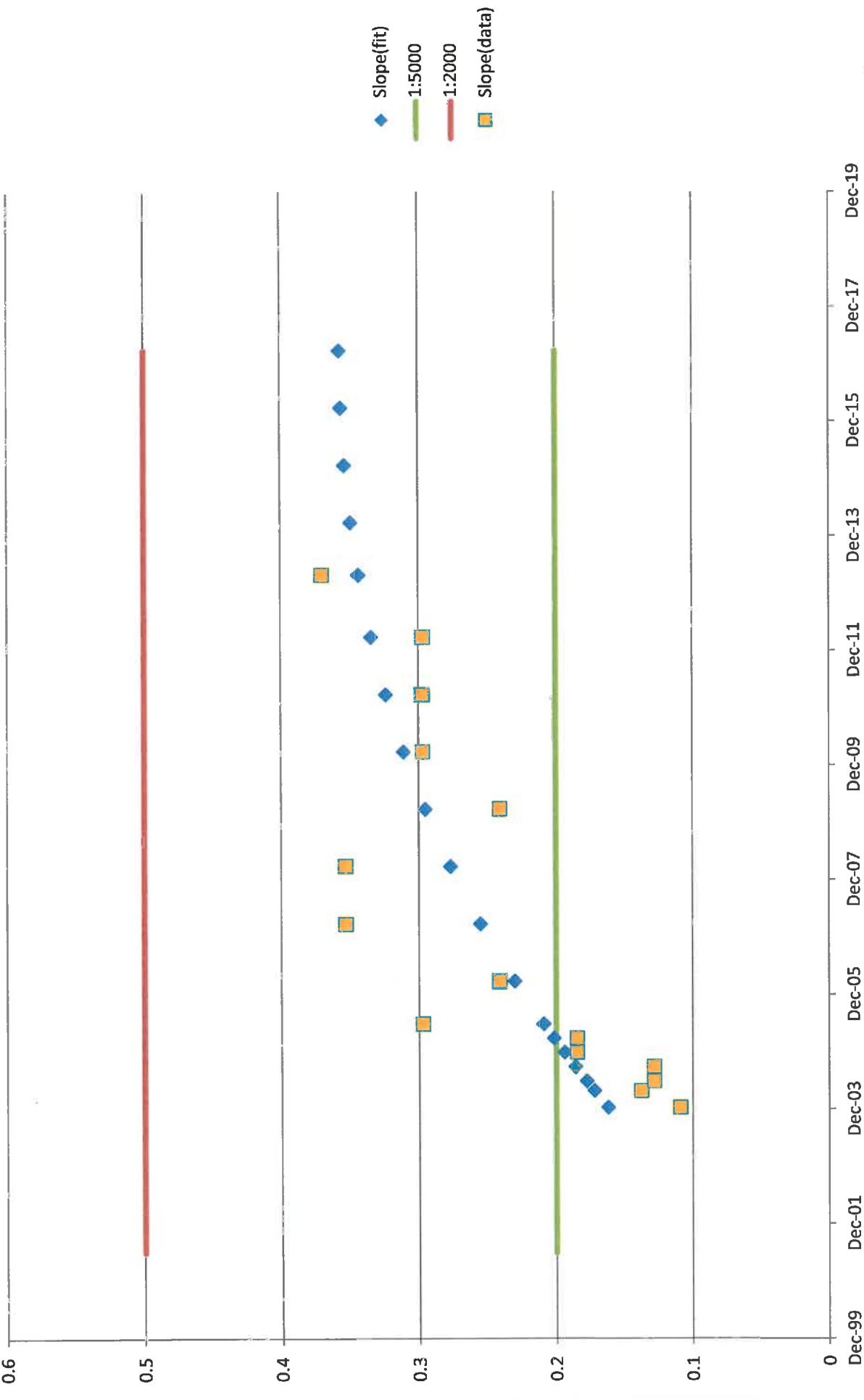
Differential Settlement Trend Analysis - AP62 vs AP88



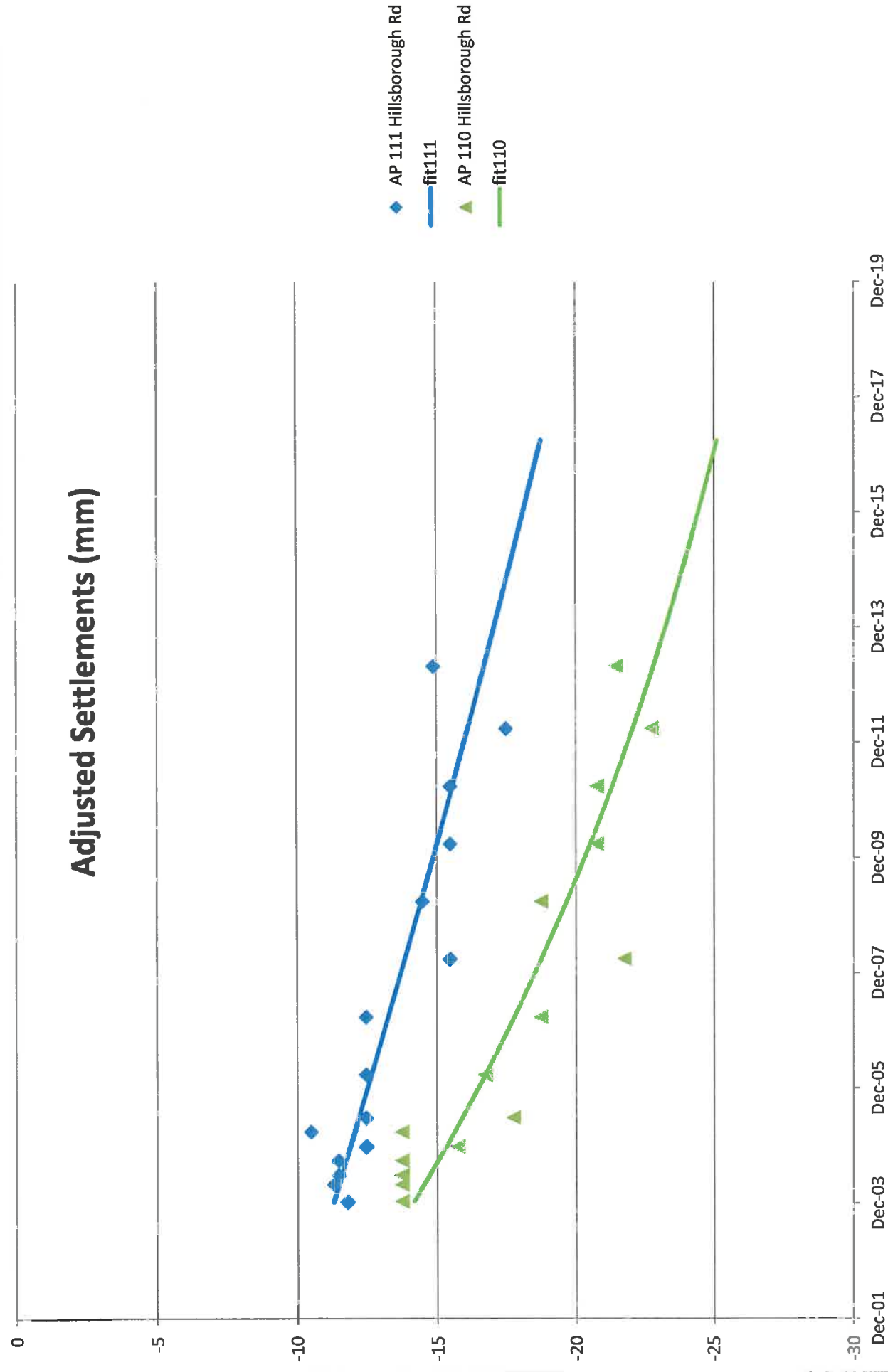
Adjusted Settlements (mm)



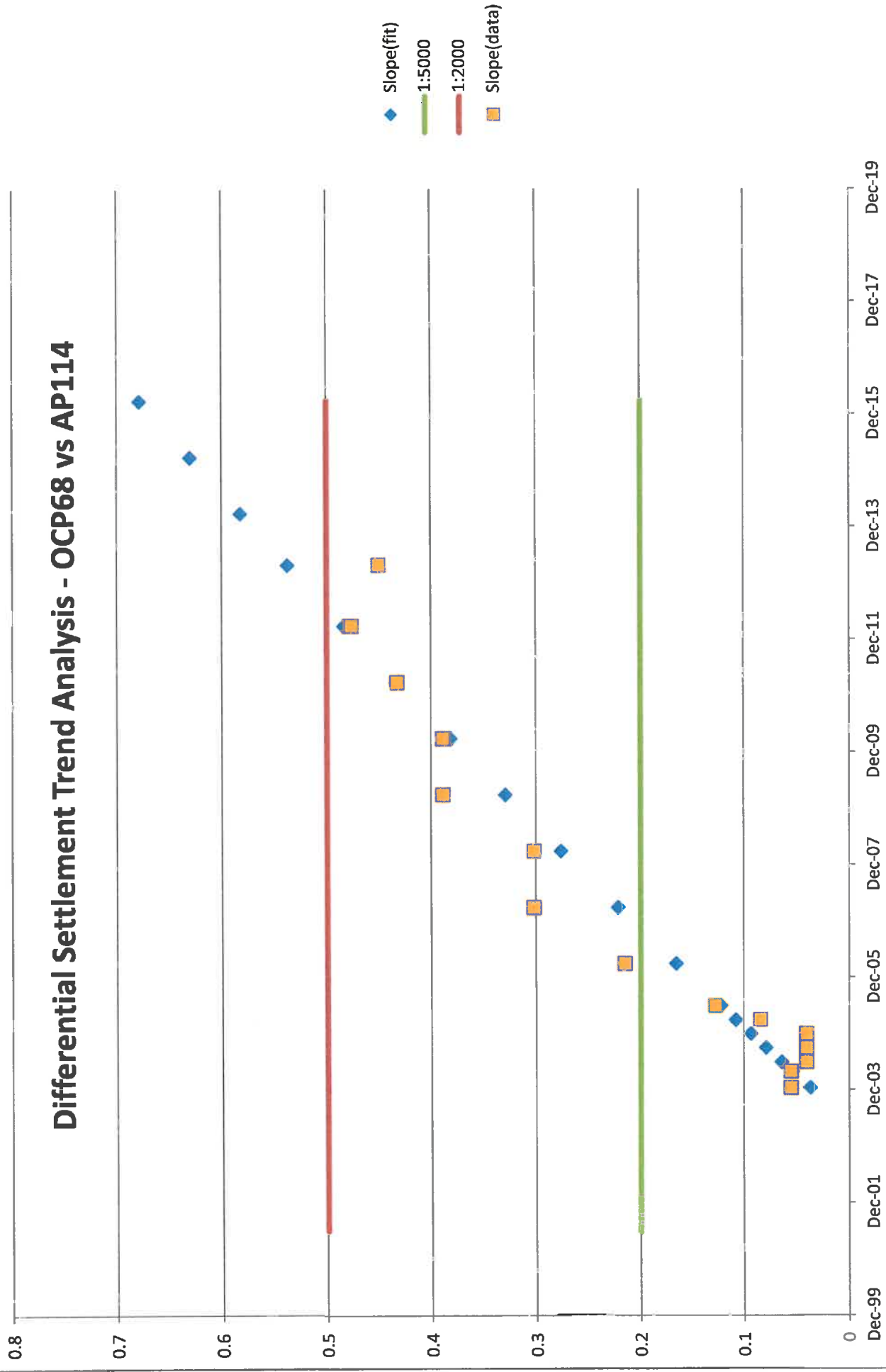
Differential Settlement Trend Analysis - AP110 vs AP111



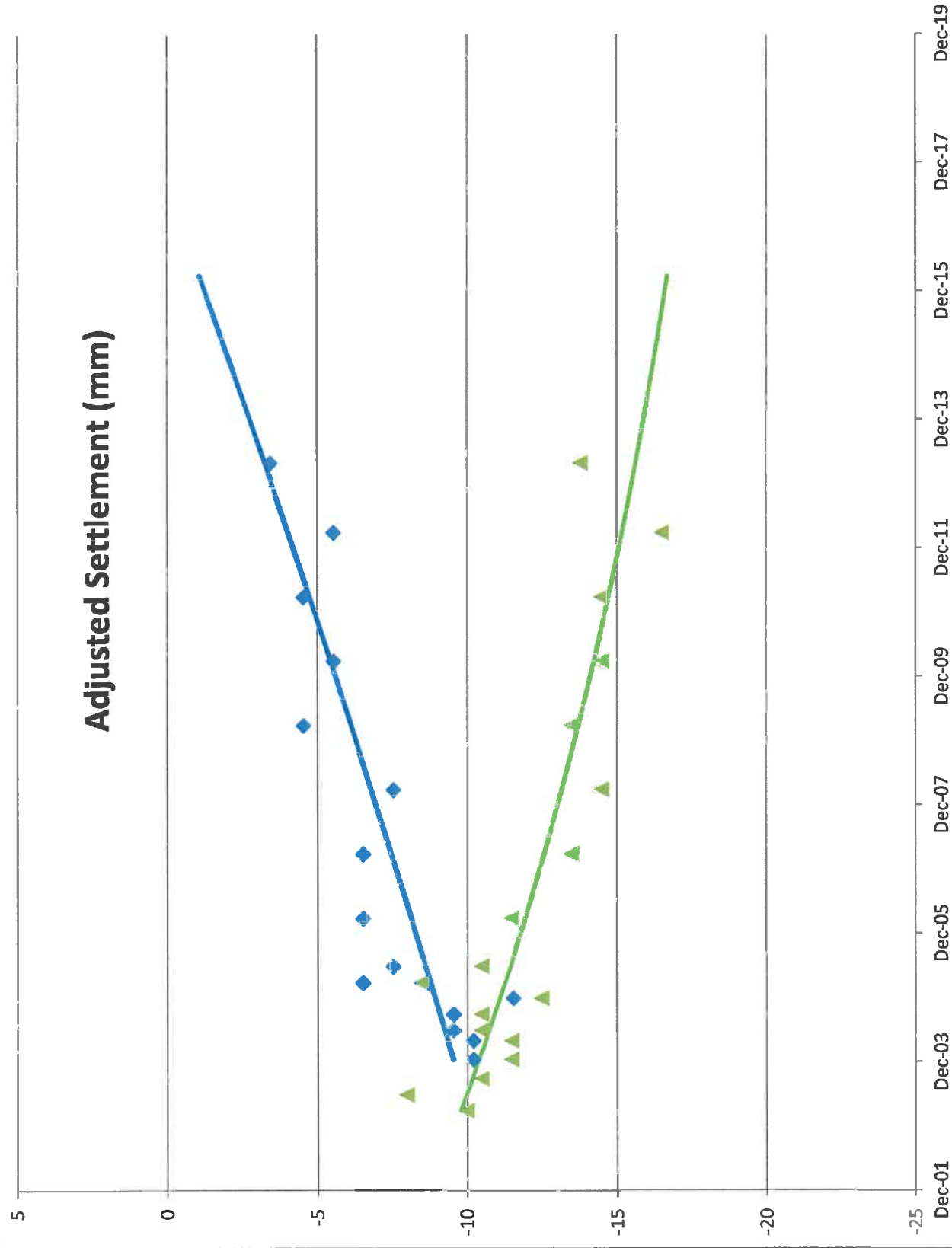
Adjusted Settlements (mm)



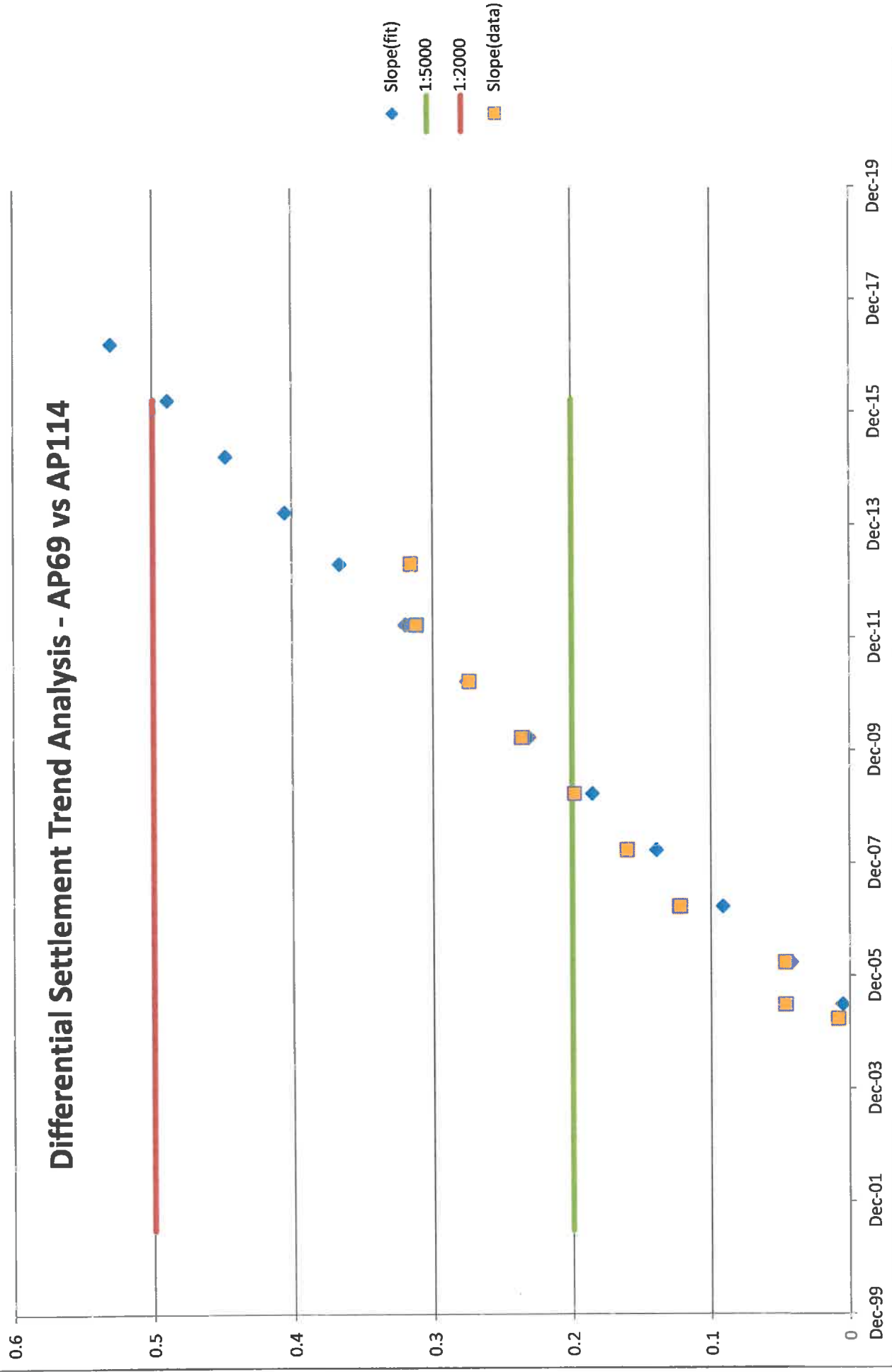
Differential Settlement Trend Analysis - OCP68 vs AP114

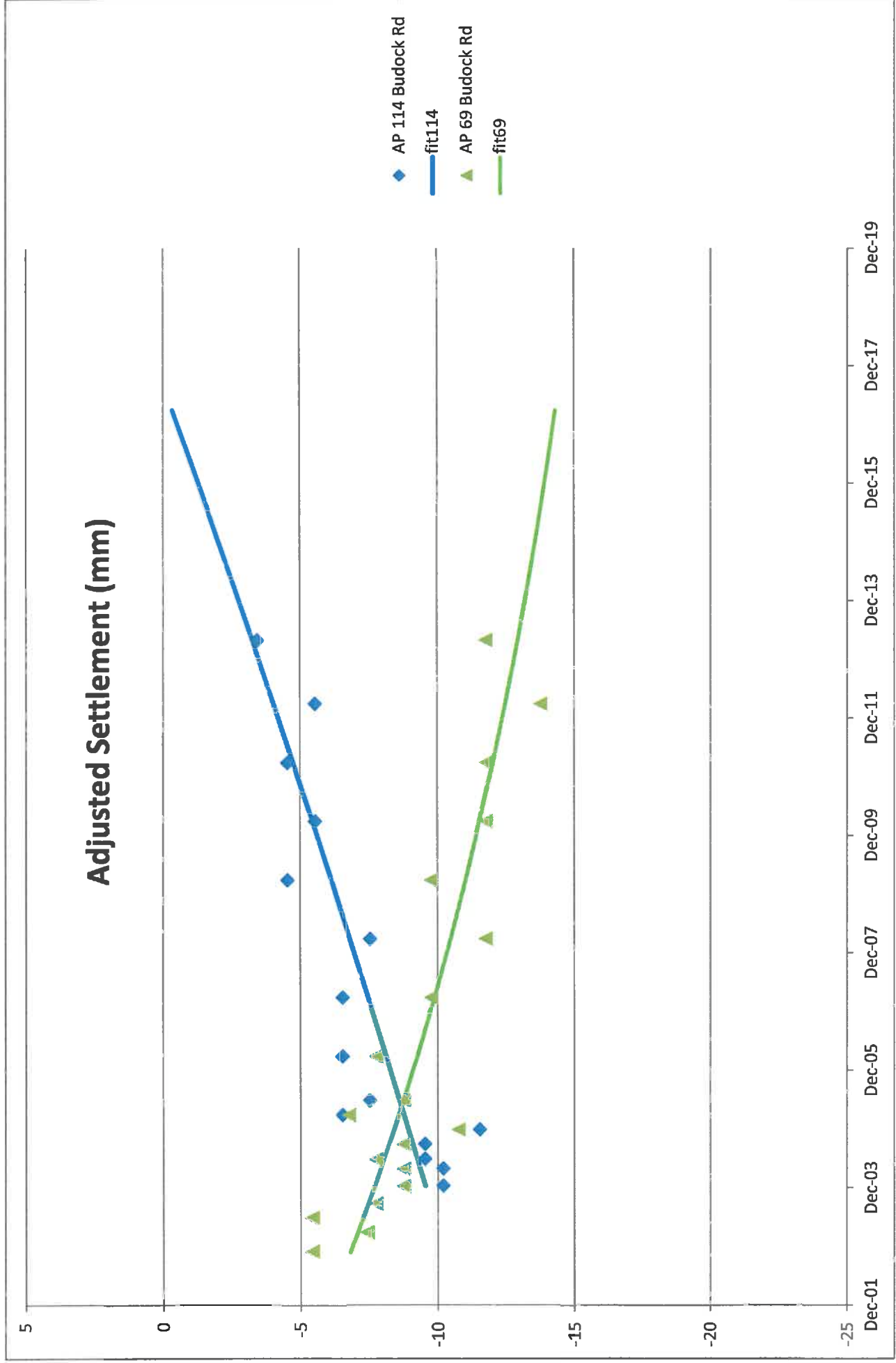


Adjusted Settlement (mm)

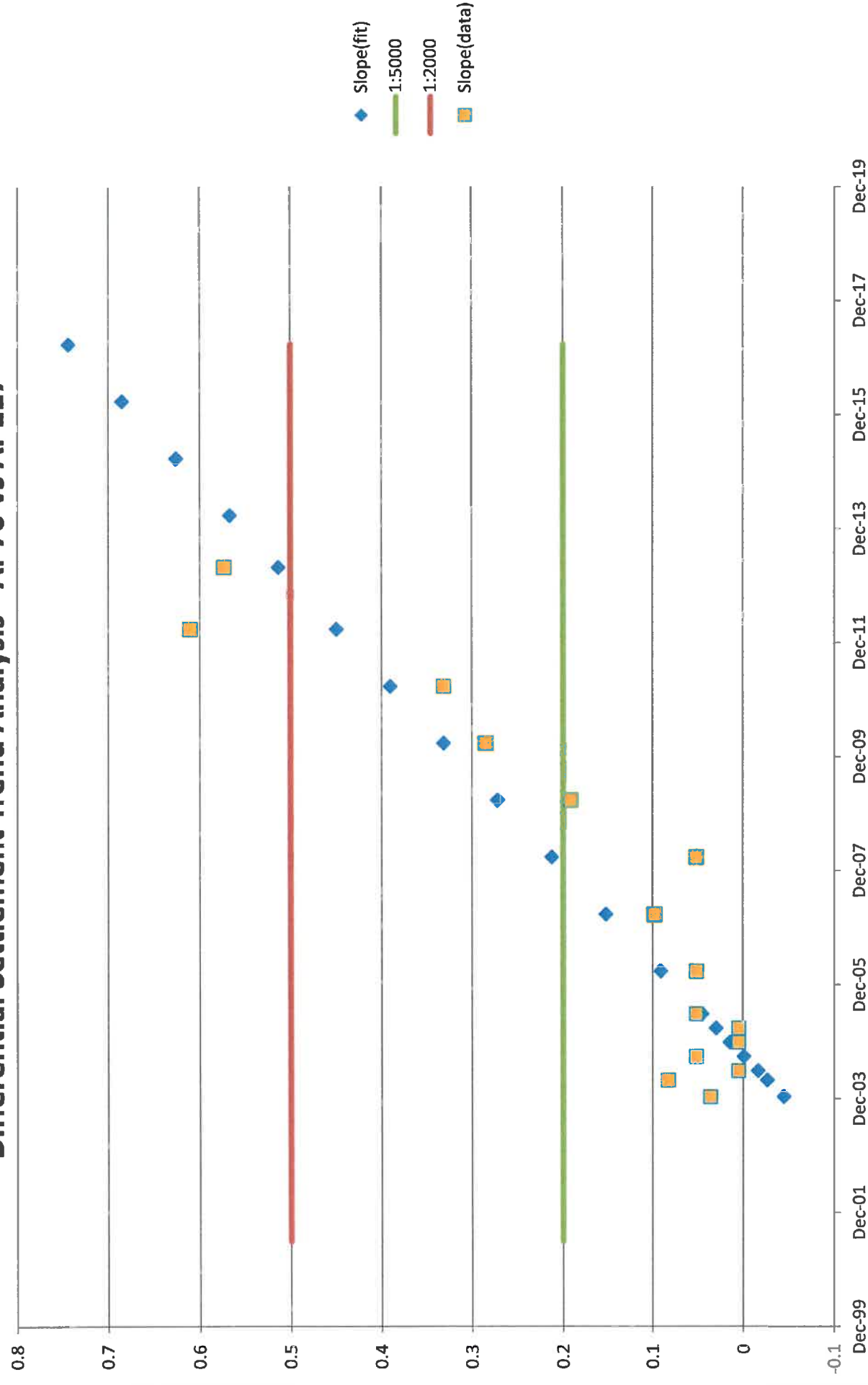


Differential Settlement Trend Analysis - AP69 vs AP114

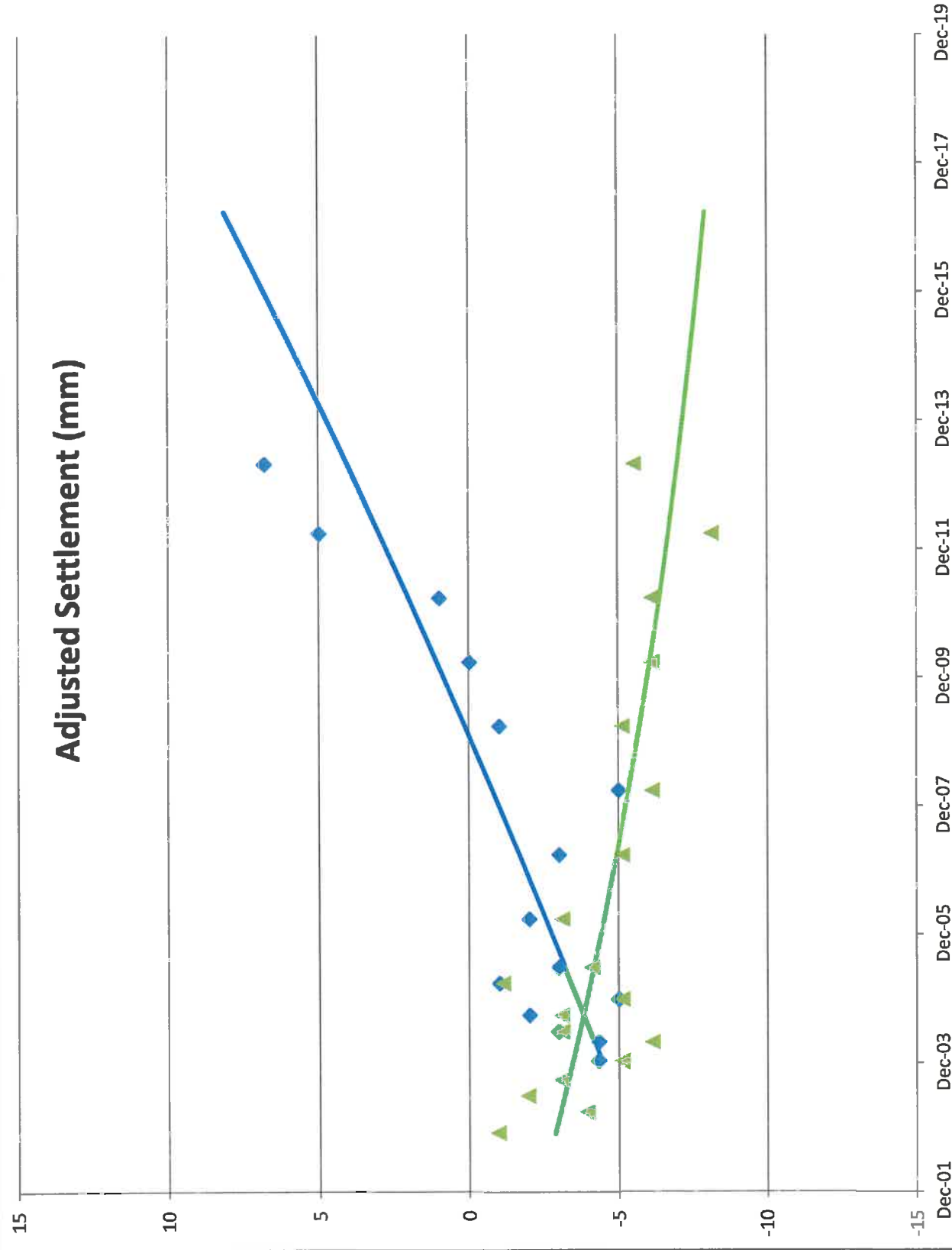




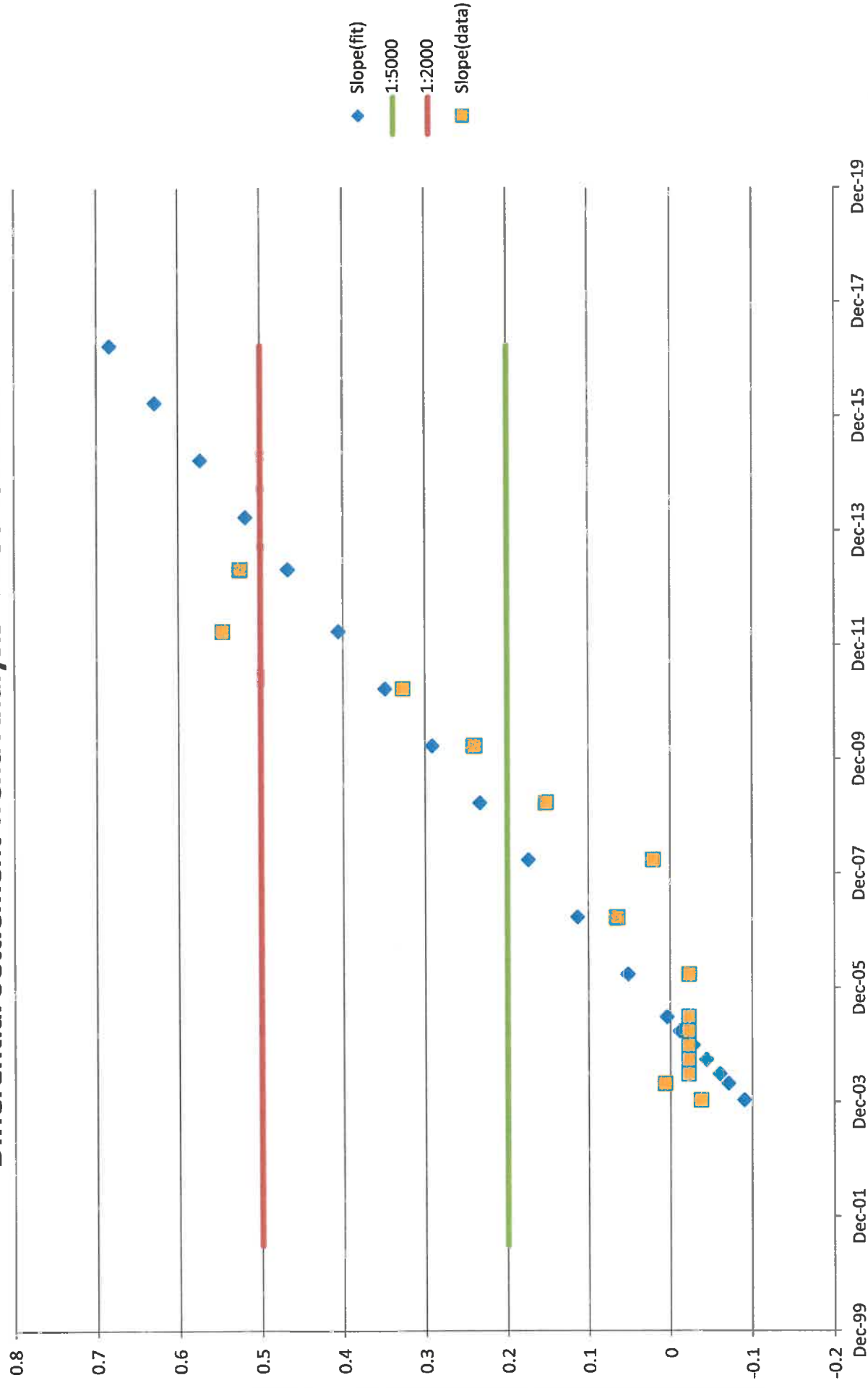
Differential Settlement Trend Analysis - AP70 vs AP117



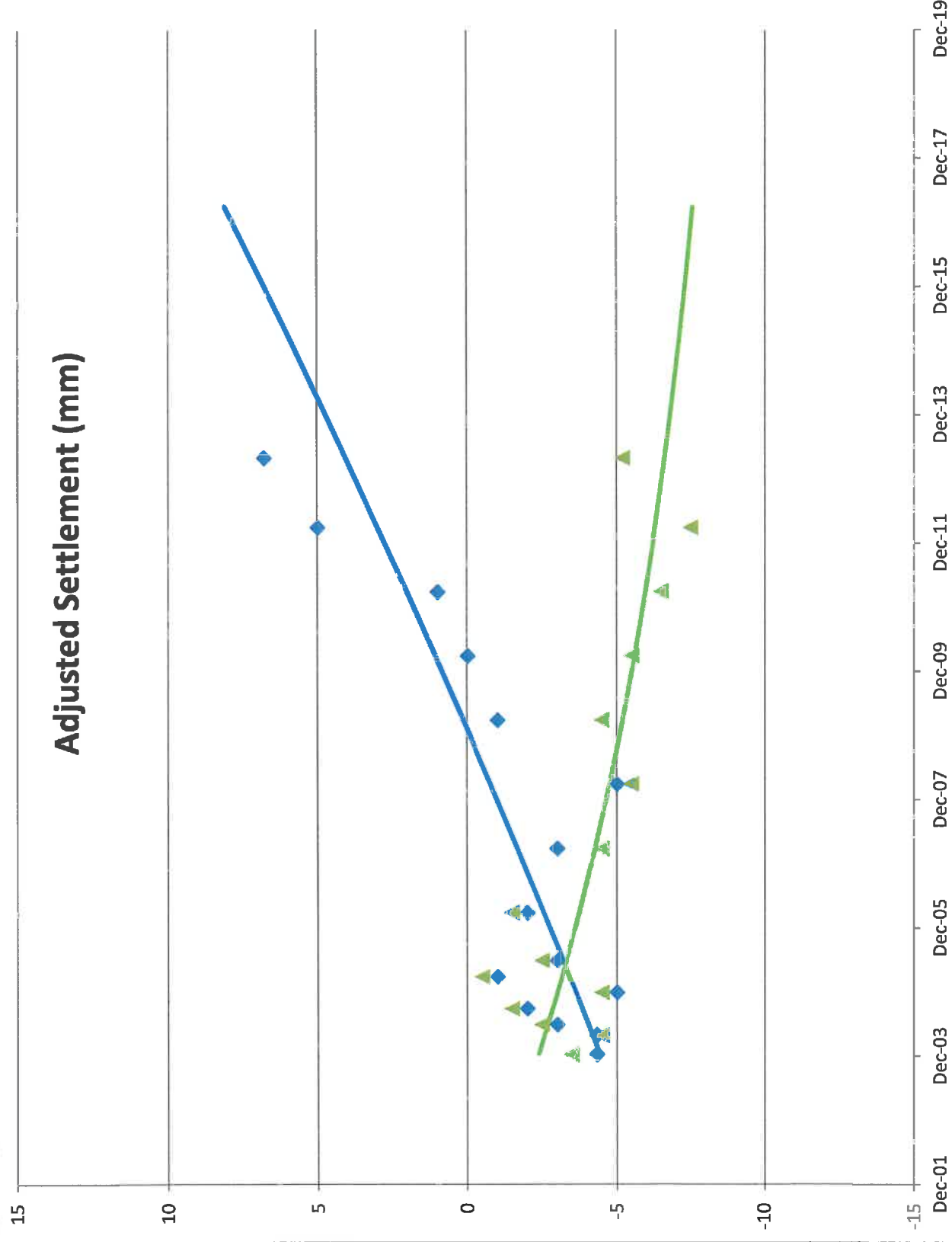
Adjusted Settlement (mm)



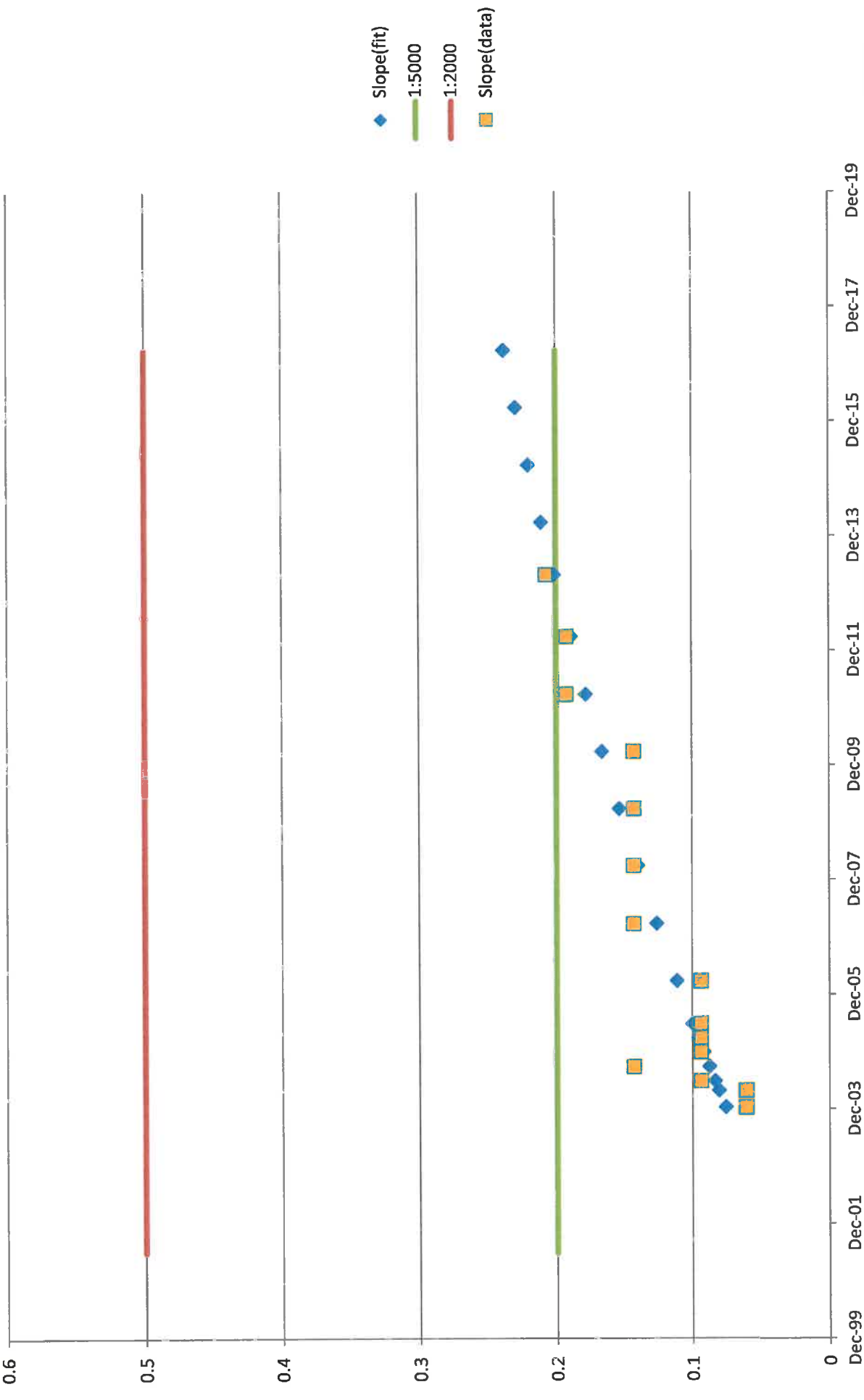
Differential Settlement Trend Analysis - AP38 vs AP117



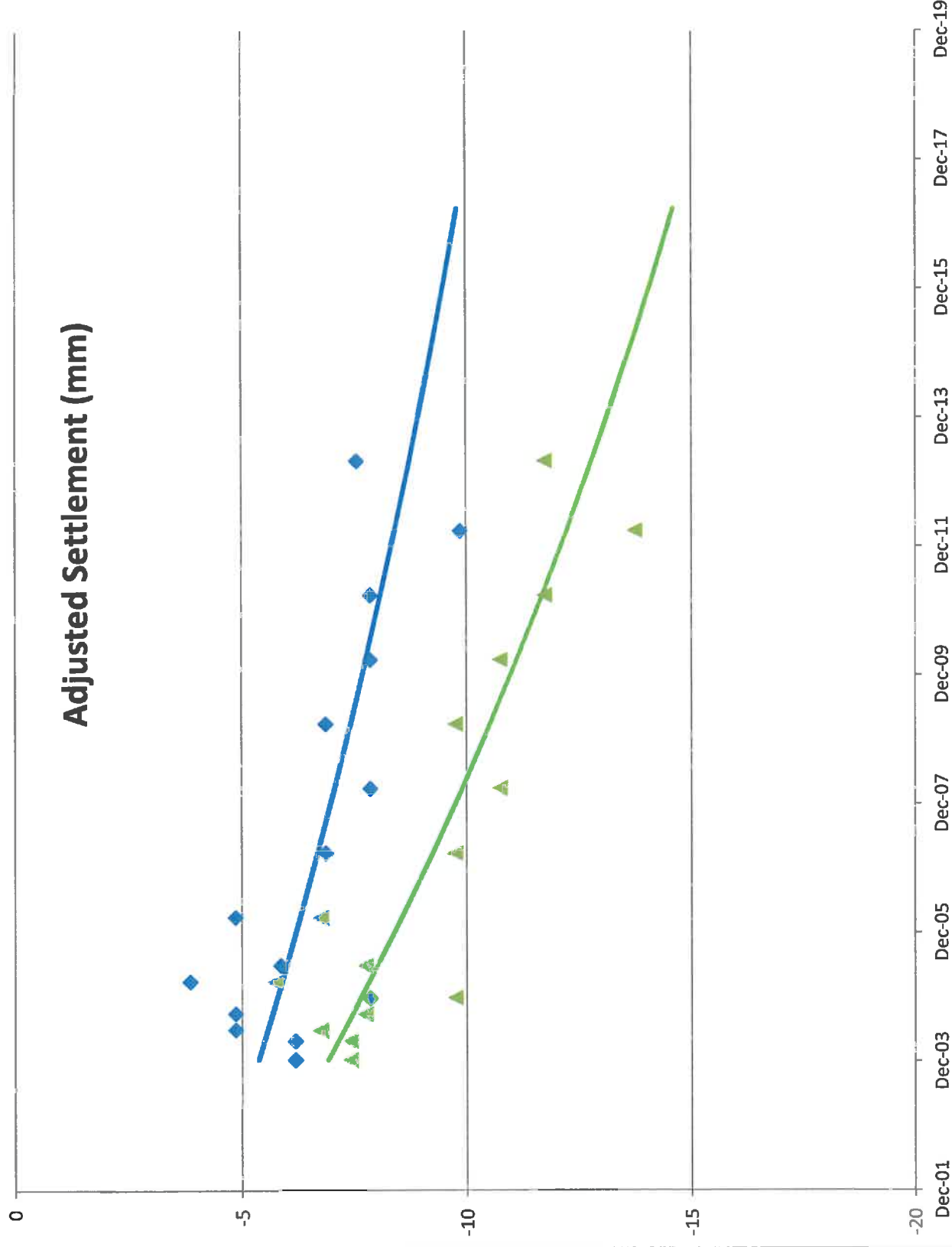
Adjusted Settlement (mm)



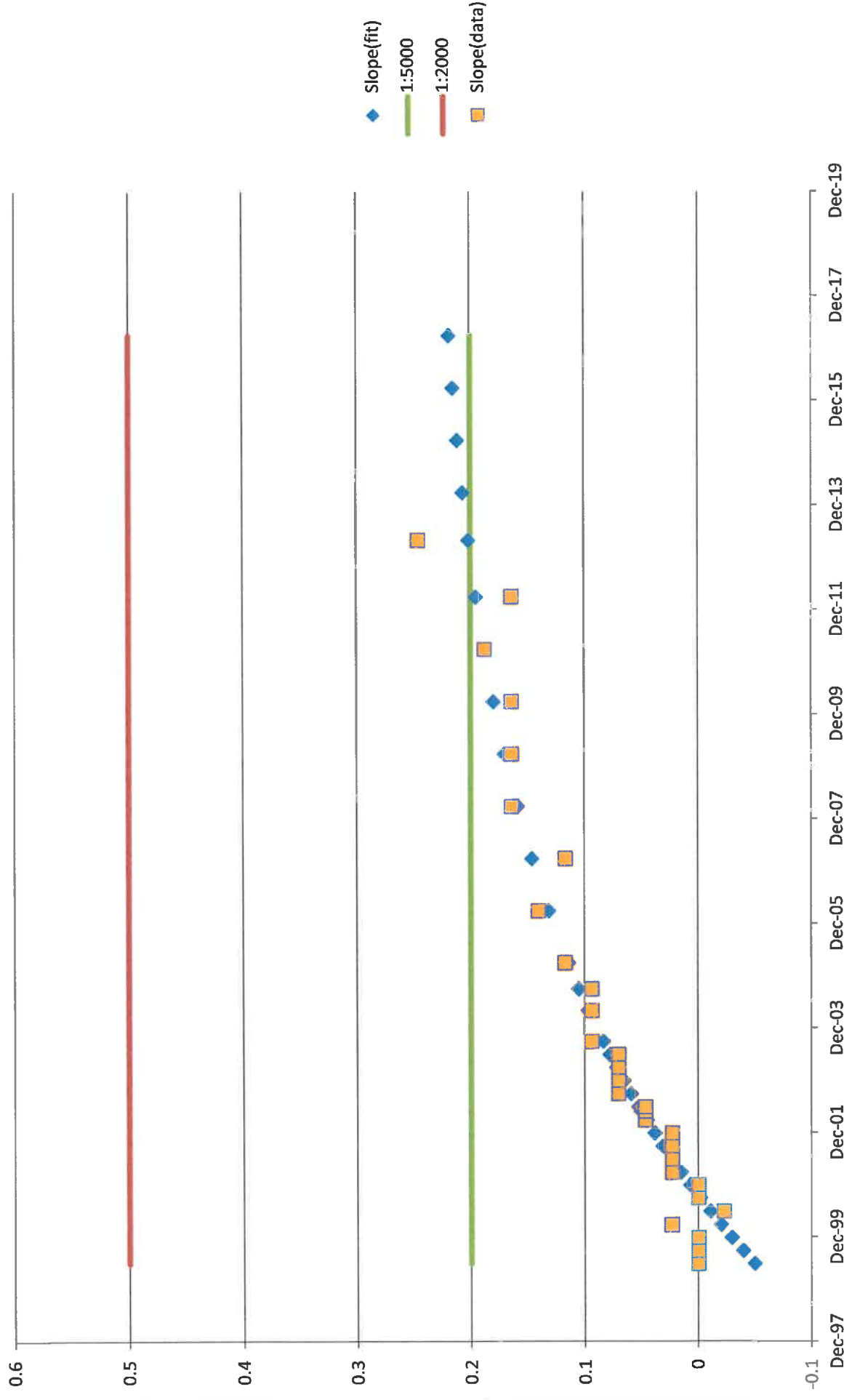
Differential Settlement Trend Analysis - AP115 vs AP116



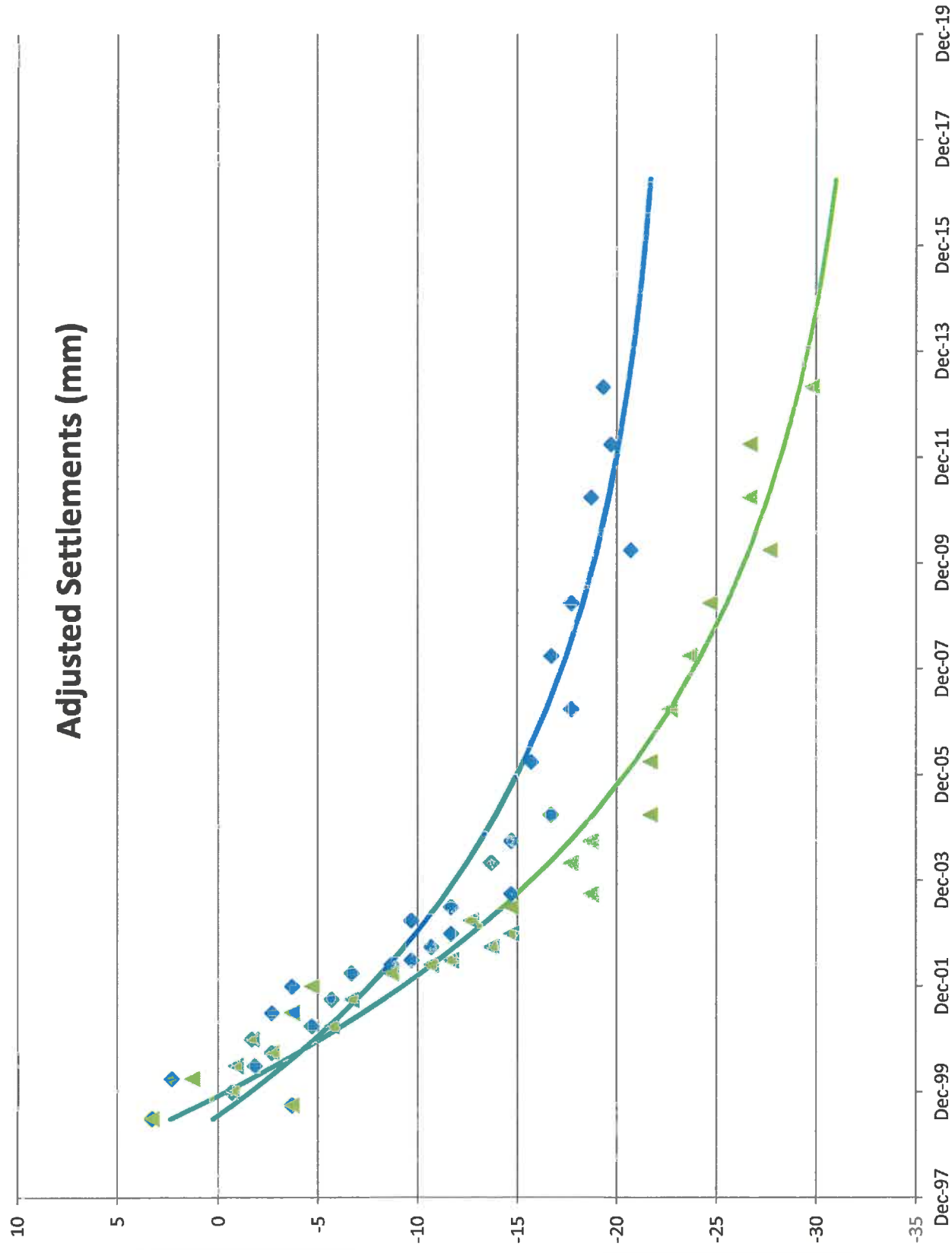
Adjusted Settlement (mm)



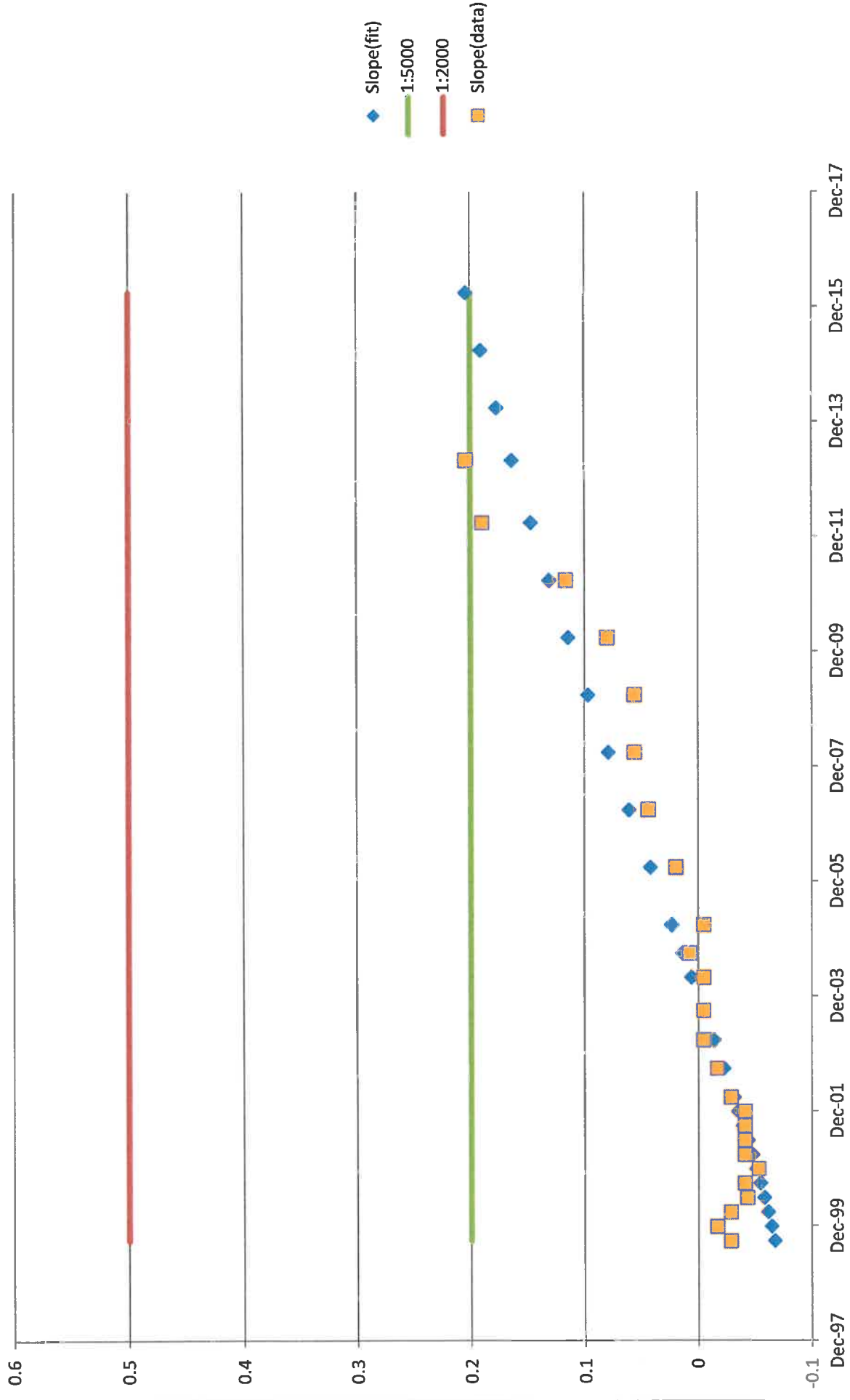
Differential Settlement Trend Analysis - OCP90B vs SM6241

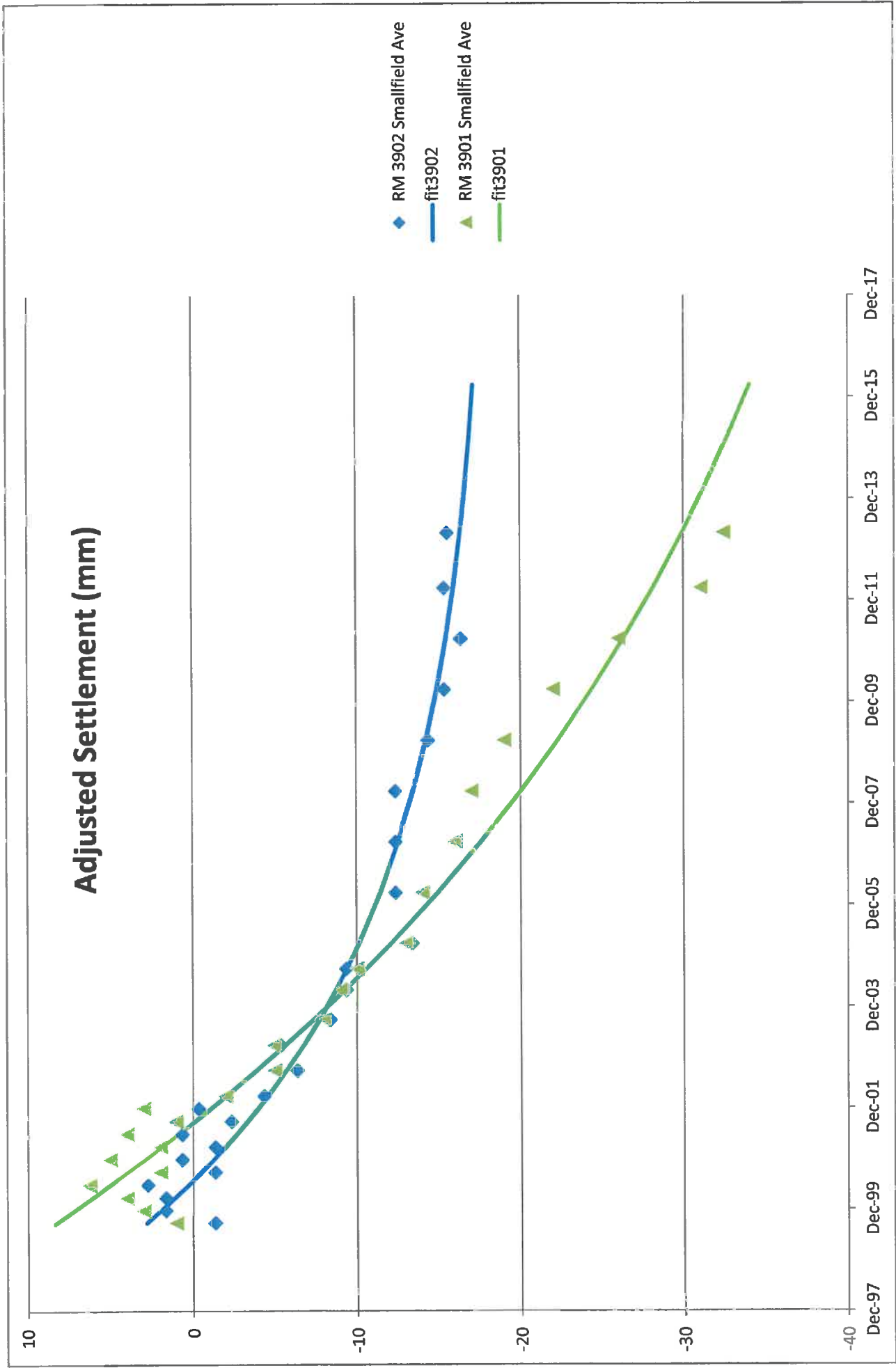


Adjusted Settlements (mm)



Differential Settlement Trend Analysis - RM3901 vs RM3902

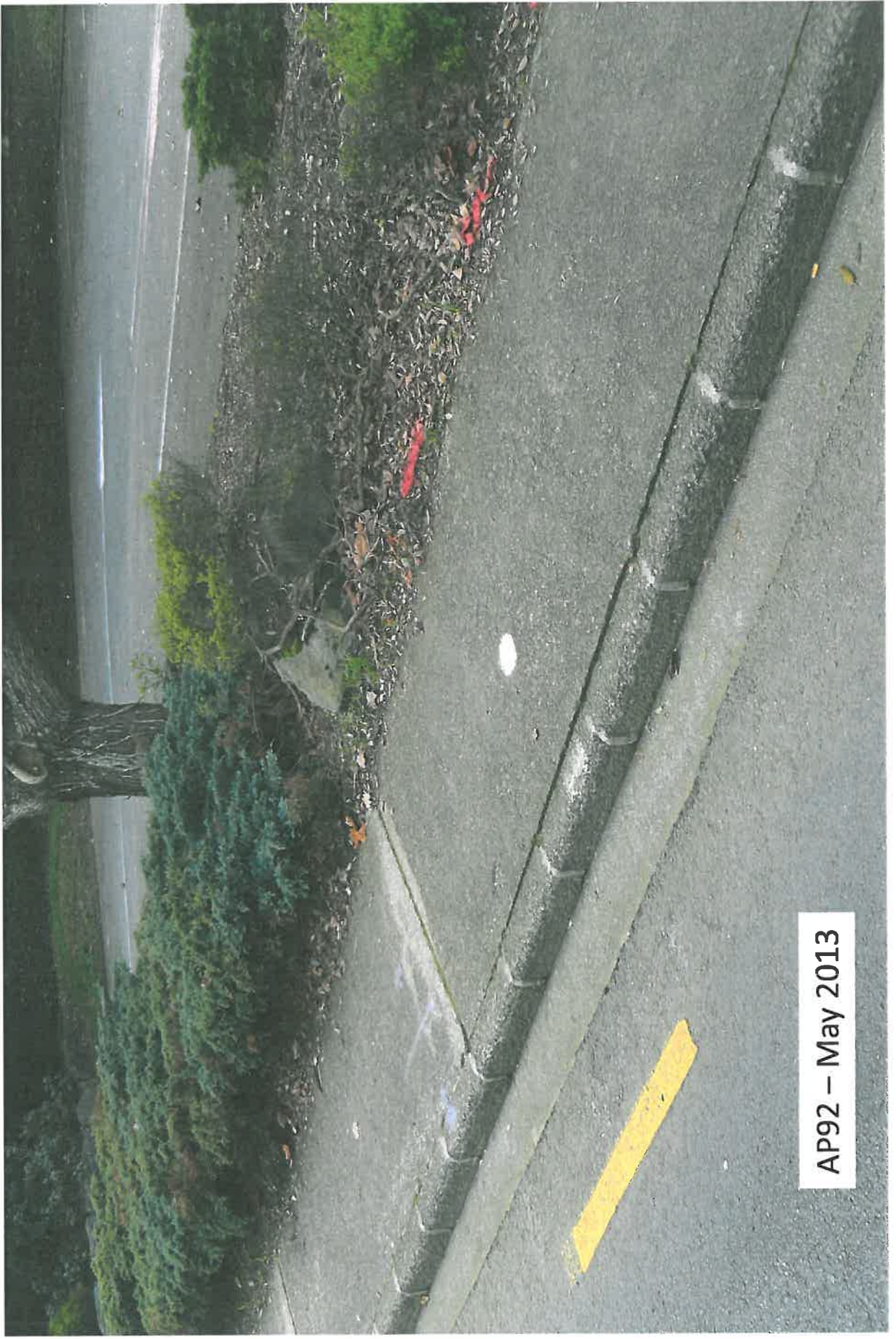




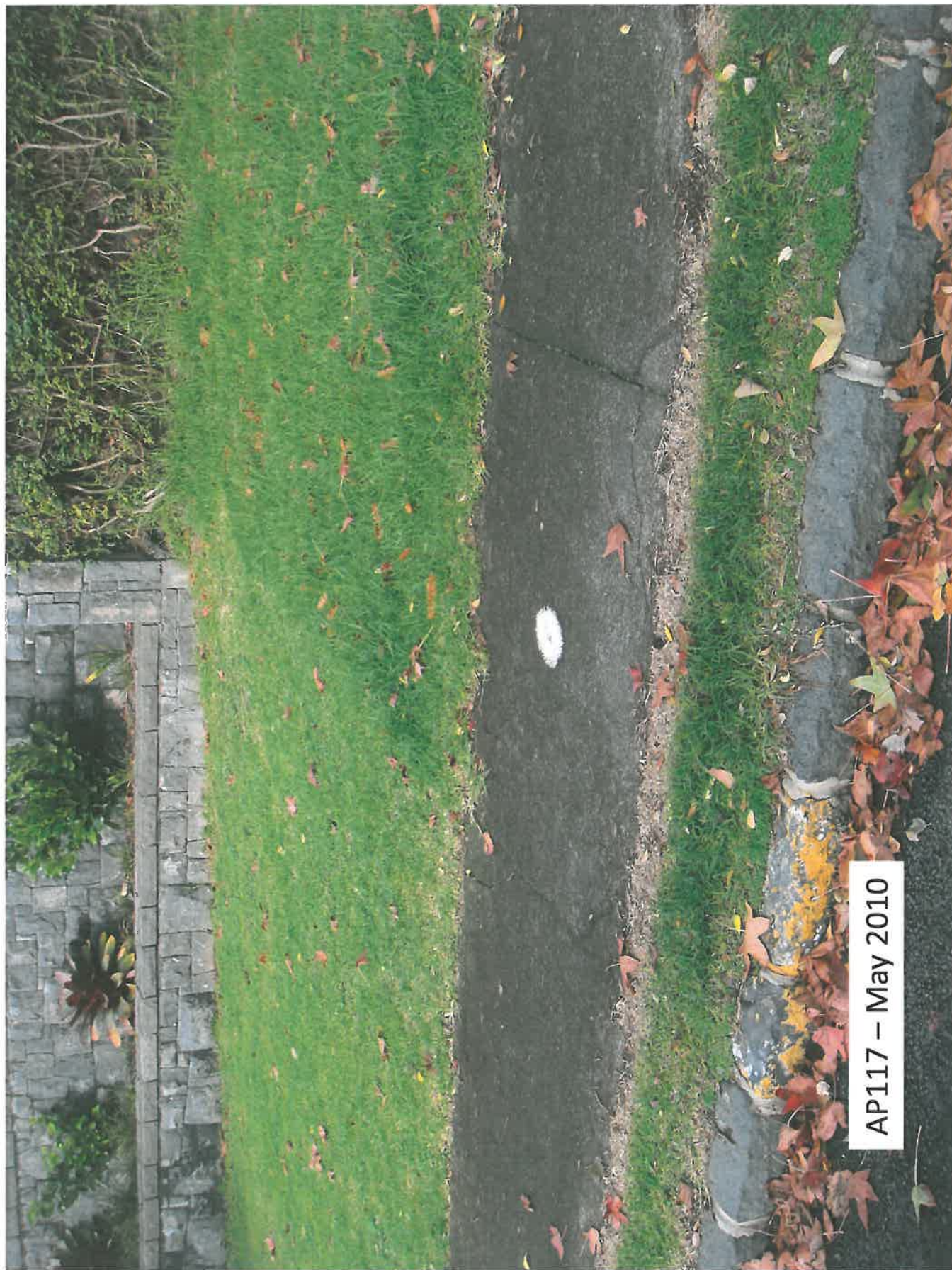
Photographs of Precise Level Marks AP92 and AP117



AP92 – May 2010



AP92 – May 2013



AP117 – May 2010



Graphs of Stage Control Intermediate Triggers
(Settlement Zone Plan and Stage Control Trigger Plan)

NOTES

1. All dimensions are in metres unless noted otherwise.

LEGEND

Quarry

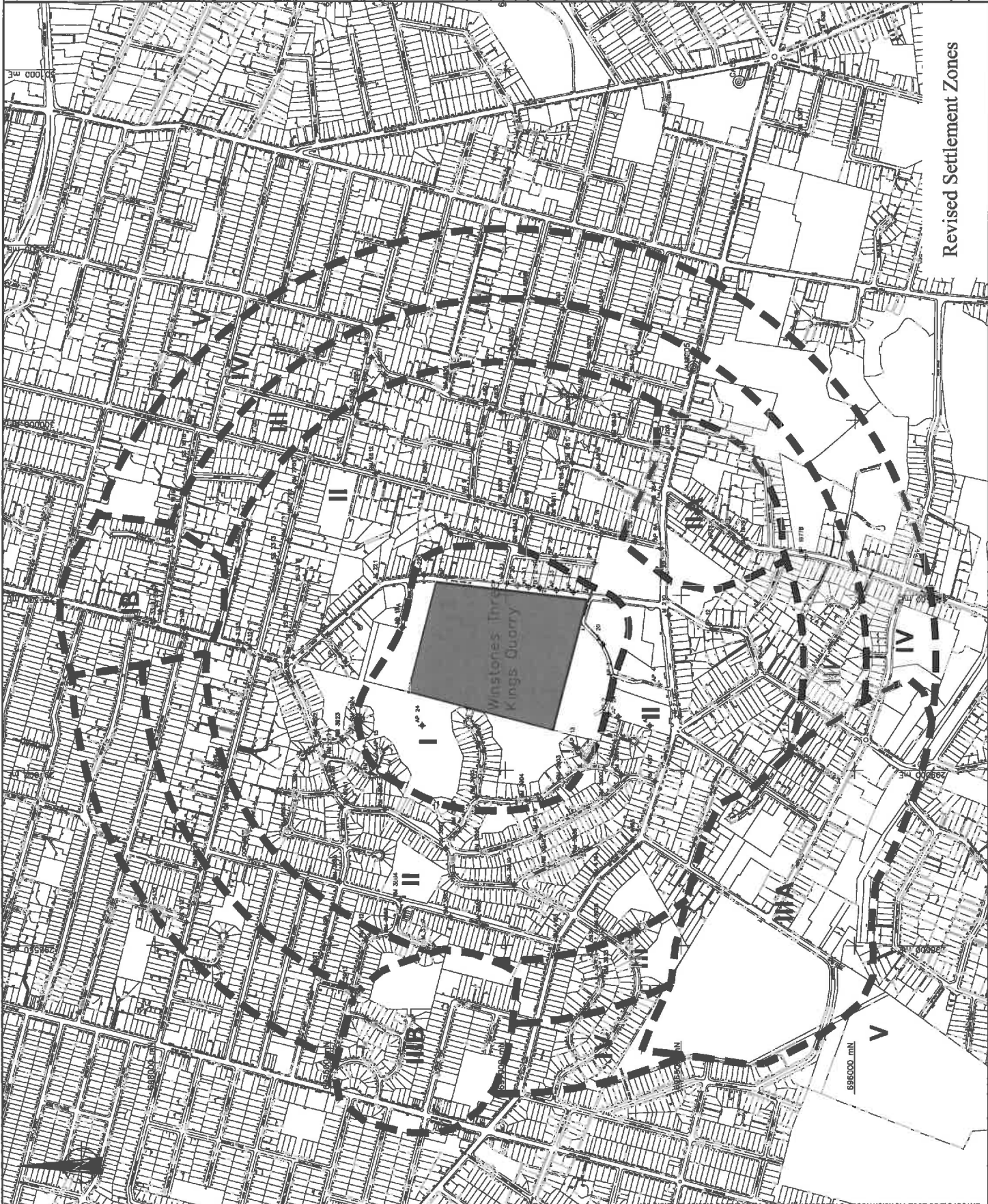
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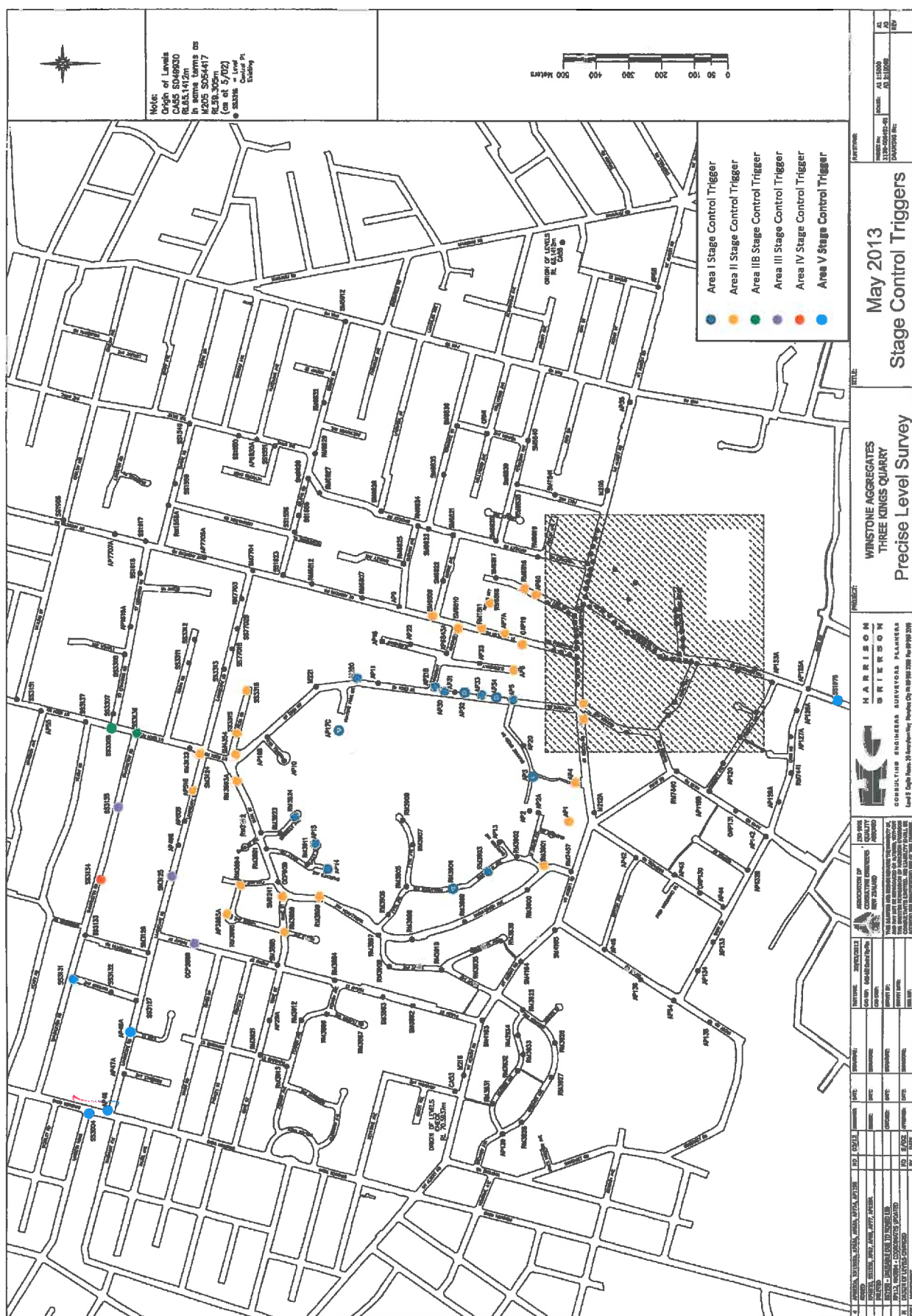
DRAWN : L.V. 18670-01
 DATE : 18/06/04
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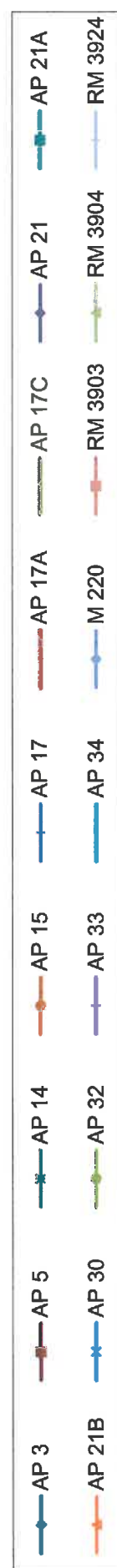
Tentek & Taylor
 Environmental & Engineering Consultants
 Auckland 19 Merton St. Newmarket
 Tel: (09) 306 5000 Fax: (09) 307 0265
 E-mail: auckland@tentek.co.nz
 D.Wellington D.Cheltenham D.Hamilton D.Whangarei

WINSTONE
AGGREGATES LTD
THREE KINGS QUARRY
DEWATERING
REVIEW OF
SETTLEMENT PREDICTIONS

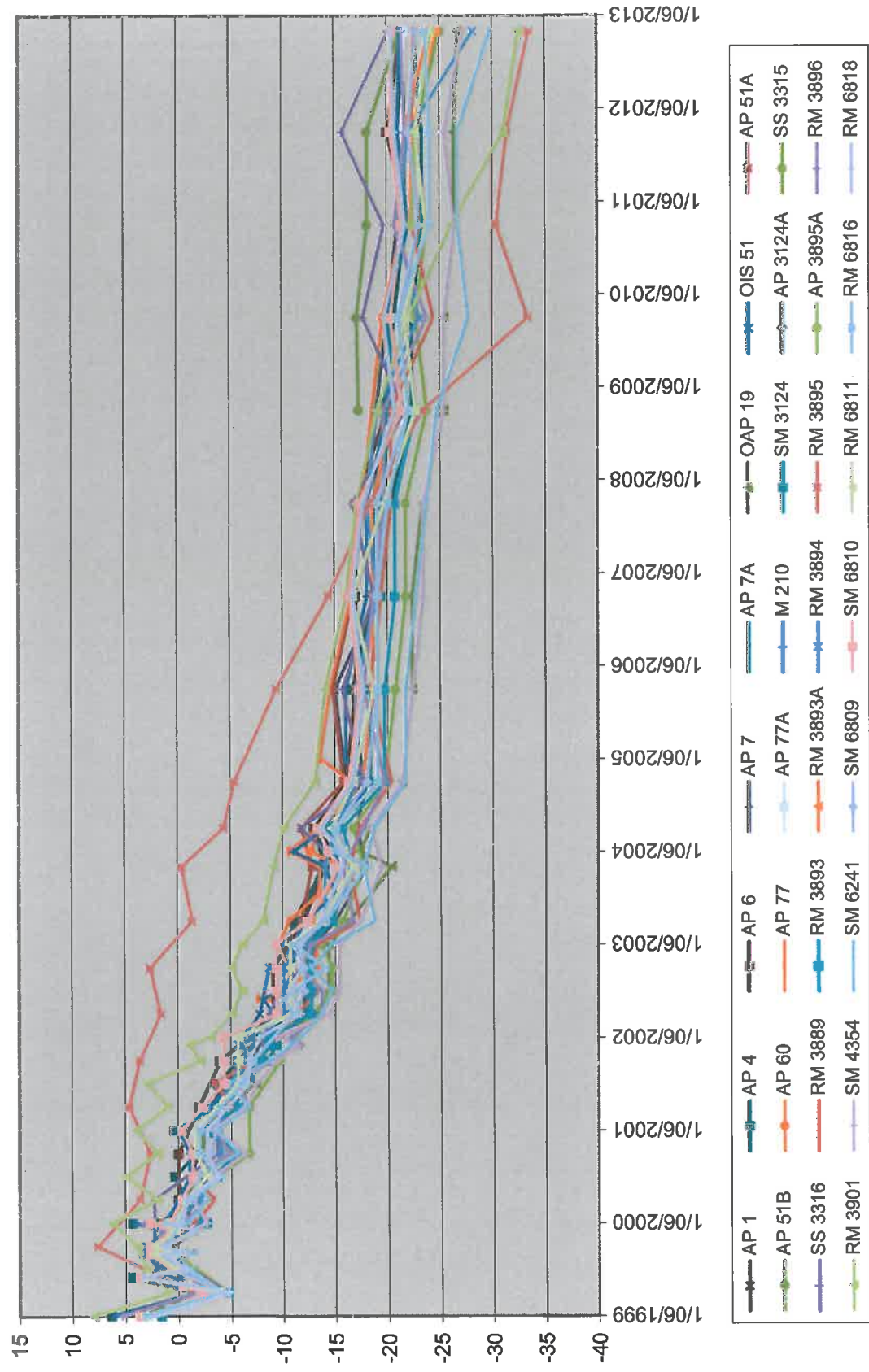
Figure 7
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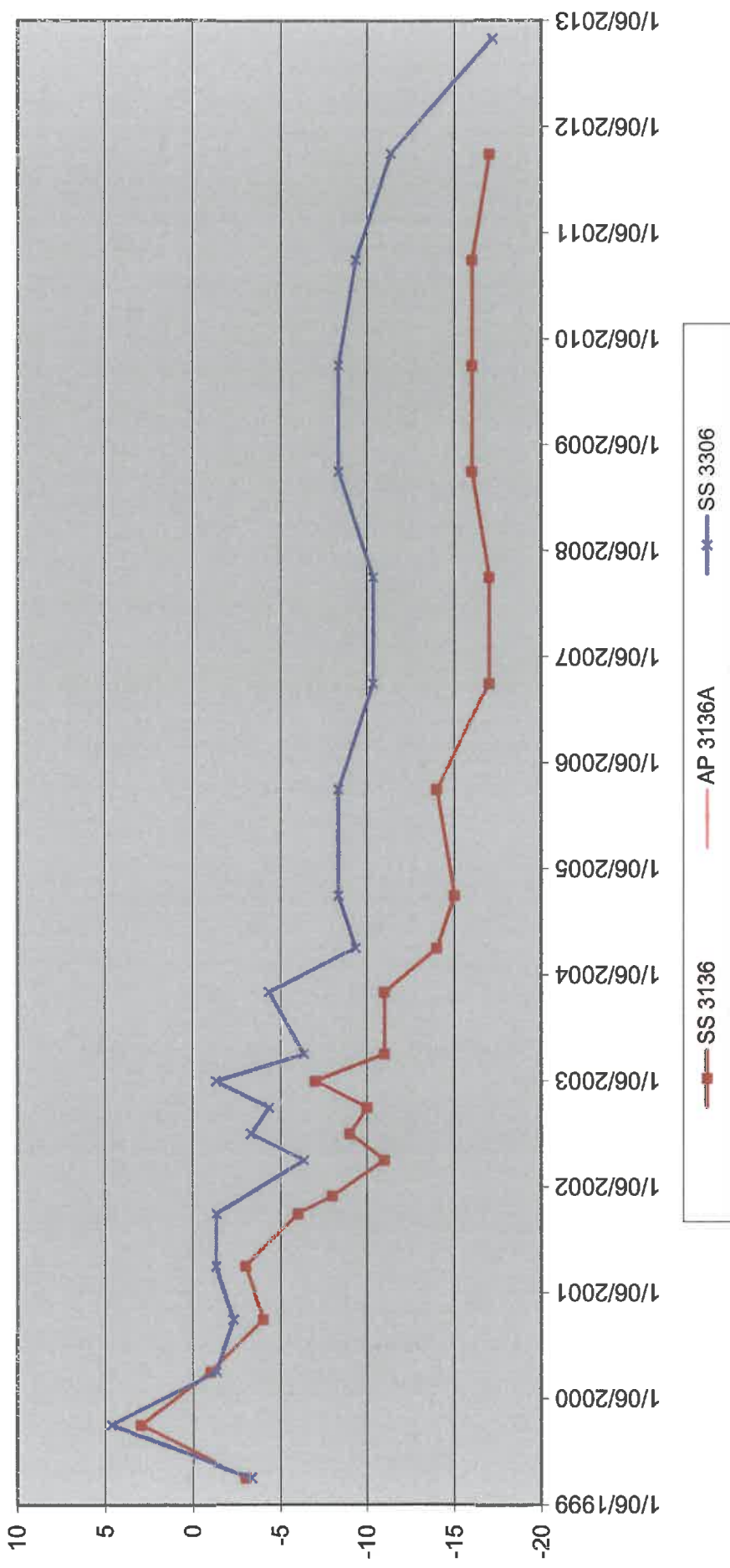




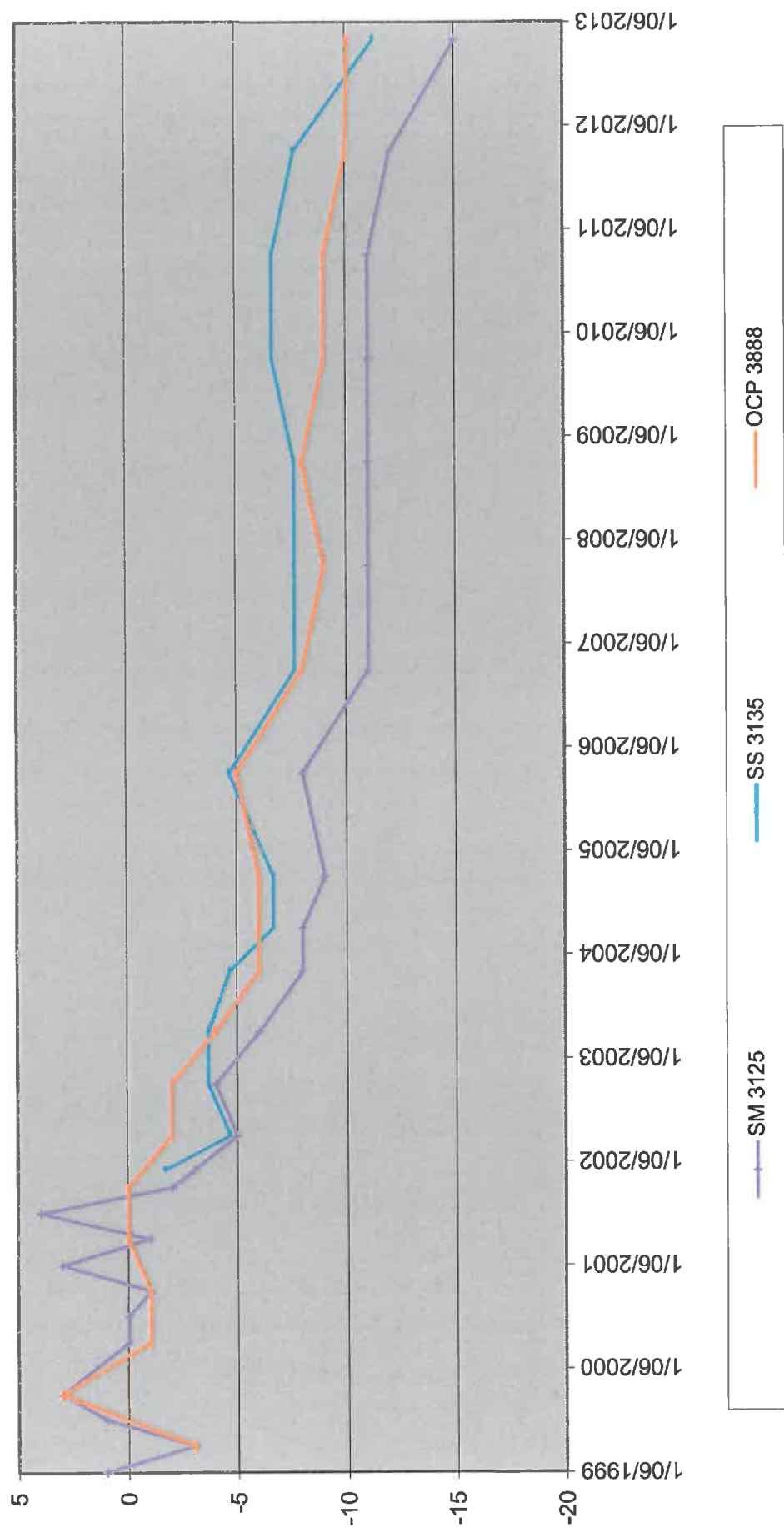
Area II - Marks with Adjusted Settlements Greater than 20mm



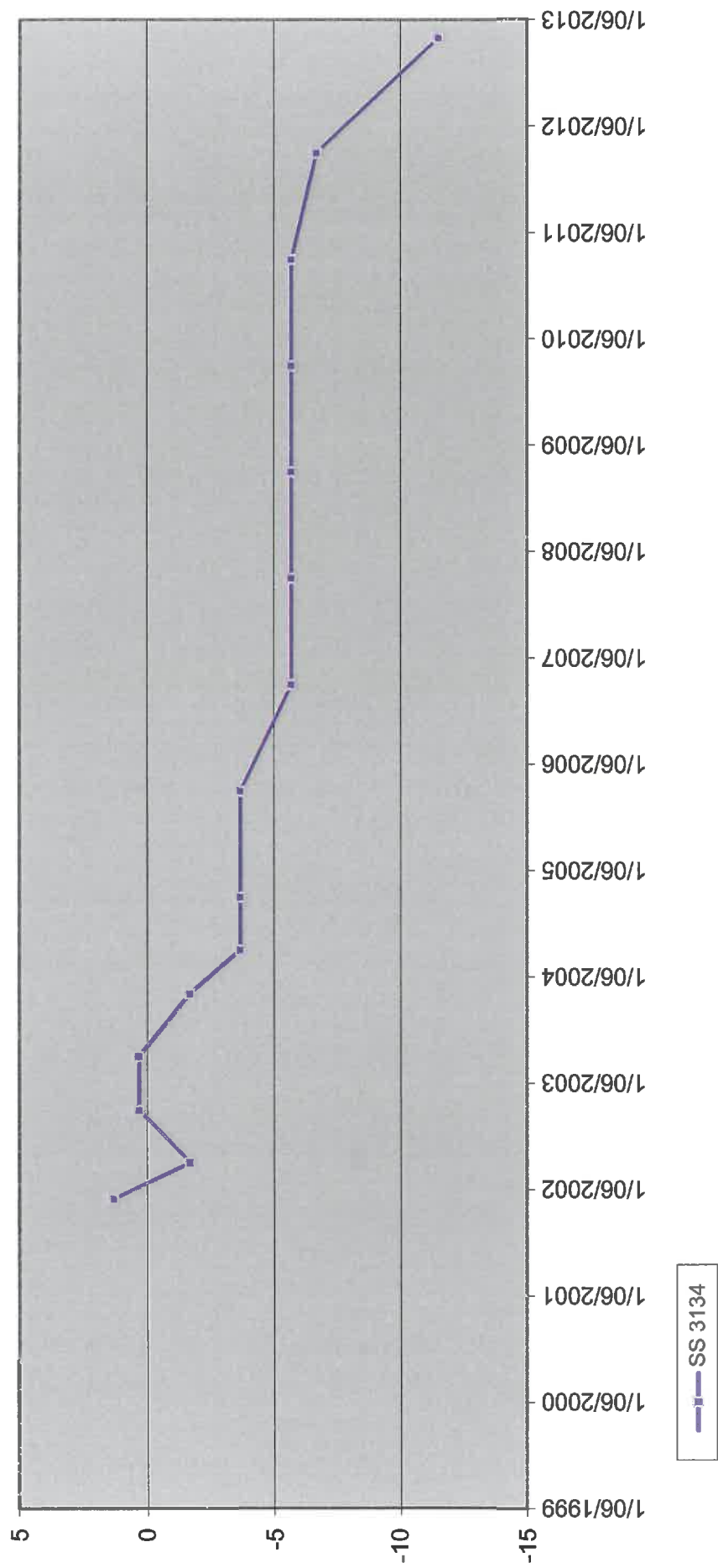
Area IIB - Marks with Adjusted Total Settlement Greater than 15mm



Area III - Marks with Adjusted settlement Greater than 10mm



Area IV - Marks with Adjusted Settlement Greater than 10mm



Area V - Marks with Adjusted Settlement Greater than 5mm

