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VE23742 Bells Reserve Monitoring_Letter

Mr Jai O'Toole
Department of Environment, Water and Natural Resources
(DEWNR)
101 Grenfell Street
Adelaide
SA
5000

17 December 2012

VE231232 / Bells Reserve, Monteith / Rev0

Dear Jai,

RIVERBANK COLLAPSE HAZARD, LOWER REACHES RIVER MURRAY STABILITY RISK MANAGEMENT, BELLS RESERVE, MONTEITH, MONITORING REVIEW – APRIL 2012 TO DECEMBER 2012

Introduction

Sinclair Knight Merz (SKM) are pleased to provide the Department of Environment, Water and Natural Resources (DEWNR) with a review of ground survey monitoring data collected from the foreshore at Bells Reserve, Monteith in the lower reaches of the River Murray, South Australia.

Survey monitoring was carried out by Alexander & Symonds Pty Ltd (Alexander & Symonds) on behalf of DEWNR. Monitoring data collected consists of eight data sets (including the initial survey) between 16 April 2012 and 6 December 2012. The data on 16 April 2012 is taken as the baseline with minor variances on that date distributed across the survey as a whole. The aim of the monitoring was to measure vertical and lateral surface movements of fixed survey points installed adjacent to the river bank in order to monitor surface deformations along the foreshore at Bells Reserve over time.

The analysis has been conducted to allow efficiency in interpretation and ease of analysis for future survey monitoring rounds at the site.

The site plan indicating the location of the riverbank monitoring points is included as Figure 1.

Brief Background

Unprecedented low water level occurred in the Lower River Murray from 2008 to 2010 as a result of drought (Reference 1). Subsiding water levels has been a major contributing factor to a large number of riverbank cracking and collapse incidents along the River during this time.



A number of incidents were investigated in detail by DEWNR (previously the Department of Water, Land and Biodiversity Conservation (DWLBC)) to analyse the severity and public risk of potential riverbank instability.

On 30 March 2009, a 1000 m² area along riverbank at Bells Reserve was recorded on DEWNR's incident register to have subsided with extensive cracking noted adjacent upstream of the boat ramp. SKM conducted a site inspection on 23 September 2009 at which time the water level (in the vicinity of the boat ramp) was recorded at -0.715 m AHD (Reference 1). Extensive tension cracks 0.5 to 1 m wide and 1 m deep with water at their base were observed as well as signs of rotational slips upstream of the boat ramp. Tension cracks and bank failures were attributed to increased surcharge resulting from lowering water levels at that time.

The site was flagged as a critical site with high potential for bank failure to occur (at the time considered to pose a serious threat). Subsequently pedestrian and vehicle access was prevented by fencing off areas that had slipped and where cracking had occurred.

The risk of riverbank collapse has reduced with the recent post-drought recovery of river levels along the lower River Murray. The river level at the Long Island monitoring station (station ID A4261162) in Murray Bridge (approximately 5.5 km upstream of Bells Reserve) was reported at 0.835 m AHD on 11 December 2012 (Reference 2). A number of ground monitoring programs have been implemented by DEWNR to enable reassessment of the safety of areas previously classified as of high risk.

Monitoring Programme

Ground survey monitoring of riverbank deformation at Bells Reserve was conducted by Alexander & Symonds between 16 April 2012 and 6 December 2012. Monthly monitoring data is presented in Appendix A.

The monitoring involved establishing three dimensional (Easting (E), Northing (N), Elevation(y)) co-ordinates using total station survey methods at a total of 68 reference points. Reference points consisted either of 'Y' section steel pins driven into the ground to a depth of 0.5 m or targets attached to buildings, Stobie poles, posts or tree stumps. Survey accuracy is reported to be within ± 3 mm horizontally (E and N) and ± 2 mm vertically (y). The accuracy has not been qualified where reference points are perceived as unstable (e.g. attached to submerged tree stumps).

The first survey (including 61 of the 68 survey points) was carried out on 16 April 2012 and has been used as the baseline survey from which relative movement was determined for the majority of the survey points. Three of the survey points (126, E1, F1) were installed on 6 September 2012 and an additional four survey points were installed on 4 October 2012 (D0, E2, F2, G2). The 6 September 2012 and 4 October 2012 surveys have been used as baseline surveys for these points, respectively.



Survey differences (movement) have been reported in millimetres (mm).

Review and Analysis of Monitoring Data

Eight sets of monthly data collected between 16 April 2012 and 6 December 2012 have been reviewed. As indicated on Figure 1, the site was split into three sections for ease of analysis of river bank stability; Section 1 – Boat Ramp Area, Section 2 – Previously Slumped Area, and Section 3 – Wetland Area.

Section 1 is currently open to the public while Section 2 and Section 3 are fenced off to restrict public access to the river bank area.

The review and analysis of lateral and vertical movement at each monitoring point was conducted according to a set pattern, referred to hereafter as the *Preliminary Filter*. The Preliminary Filter consisted of the following tasks:

1. Establish the cumulative difference between the first and last surveys (positive or negative) for each of the three components (E, N, y) at each survey pin.
2. Highlight all points with a cumulative deformation of 5 mm or greater in any direction over the full monitoring period for further analysis.
3. Check that greater movement on a single axis on any individual survey did not exceed the value represented by the cumulative value. If cumulative movement was exceeded, consider this point for further analysis.

Five of the monitoring points (A3, C2, E1, F1 and P4) experienced vertical deformation greater than or equal to 5 mm. Three points (C1, E1 and F1) showed lateral movement greater than 5 mm. These points have been further analysed.

To gain a visual appreciation of the lateral and vertical deformation occurring across the site the monitoring data for 4 October 2012 (at which time all monitoring points had been installed) and 6 December 2012 (most recent monitoring survey) has been graphically presented as Figure 2 and Figure 3, respectively. Contours of vertical movement have been incorporated to identify local vertical deformation (heave and settlement) and vectors demonstrate the magnitude and direction of lateral movements.

Section 1 – Boat Ramp Area

Analysis of this section centred on points with cumulative vertical and lateral deformation exceeding the 5 mm threshold.

Monitoring data for points A3 and C2 have shown cumulative changes in vertical elevation exceeding 5 mm. These changes are inferred as localised depressions as adjacent points show little to no discernible vertical movement above the survey accuracy of ± 2 mm. To



inspect the development of the vertical movements at these points over time, a plot of elevation against time is presented in Appendix B for both points.

Elevation data for A3 shows vertical movement within survey accuracy throughout the monitoring period, with the exception of a 4 mm settlement (compared to the baseline survey) which occurred between 30 July 2012 and 6 September 2012. Subsequent heave and settlement movements did not exceed survey accuracy, with the elevation currently at -5 mm compared to the baseline survey. This may indicate a single, localised event caused by interference with the monitoring target.

All vertical movement at C2 over the monitoring period has been within survey accuracy; however there has been a cumulative settlement of 5 mm since the baseline survey. Two incremental settlement events occurred between 16 April 2012 and July 2012, and 4 October 2012 and 6 December 2012. Settlement increments of 1 to 2 mm were recorded between subsequent monitoring events. It is noted that point C2 is adjacent to the boat ramp access path.

Contours of vertical elevation Figure 2 and Figure 3 illustrate the localised nature of both depressions in Section 1, and the slightly increased settlement over time between the October and December monitoring events for C2. The graph included in Appendix B further indicates that the timing of settlement between A3 and C2 did not coincide, and were likely caused by independent incidents.

Cumulative lateral movement of 7 mm Northward (resultant movement), towards the river, was recorded during the December monitoring round at C1 located adjacent to the boat ramp. The change in lateral position with time has been plotted and included in Appendix C. This indicates no dominant direction of movement over the total monitoring period. The last three monitoring periods have both shown movement towards the river (Westerly at 1 November 2012, Northerly at 4 October and 6 December 2012) however the October and November monitoring rounds indicated resultant movement of only 2 and 3 mm, respectively.

Lateral movement indicated by vectors shown on Figure 2 and Figure 3 further show only small lateral movements without an overriding dominant direction in October but a general riverwards trend in December (within survey tolerance). Lateral deformation in Section 1 may be influenced by survey tolerance and very minor shrinkage and swelling governed by localised ground material.

Section 2 – Previously Slumped Area

Significant movement exceeding the 5 mm threshold was only observed in the submerged, riverside area of Section 2. All lateral and vertical deformation landside of the fence were within survey accuracy or cumulatively below 5 mm.

Survey points E1 and F1 (installed on 6 September 2012) both exhibited excessive lateral and vertical movement, however these targets have been installed on submerged tree stumps and



were noted by Alexander & Symonds as being unstable. Four additional monitoring points (D0, E2, F2 and G2) were installed on posts in the shallow water on 4 October 2012 and are considered to be more stable and representative of movements in this area.

Changes in elevation and lateral position with time are presented in Appendix B and Appendix C for both points. Only three rounds of monitoring have been carried out on these points to date. E1 has shown gradual heave amounting to 5 mm since being installed in September while F1 has subsided by 7 mm over the same time period.

E1 has shown horizontal movement of 21 mm in a Northerly direction (towards the river) while F1 has exhibited 18 mm of movement towards the North-East (away from the river). The time series data shown in Appendix C indicates that E1 has moved in the same direction over the past three monitoring periods, while F1 has varied in direction towards and away from the river.

Only two rounds of monitoring data are available for the additional monitoring points installed in October (with the exception of E2 which was not observed in the December monitoring due to access issues). Nonetheless horizontal and lateral movement recorded to date at these more stable monitoring points have been within survey accuracy or below the 5 mm threshold.

Section 3 – Wetlands Area

This section of the riverbank demonstrated minimal lateral and vertical movement with only one point (P4) indicating local heave exceeding the 5 mm threshold over time. The change in elevation since the first monitoring period is included in Appendix B, and indicates gradual heave to a maximum of 6 mm recorded on 6 September 2012 with gradual settlement having occurred since then. Elevation is currently at 4 mm compared to the baseline survey.

This trend indicates possible seasonal variation, with heave and shrinkage occurring due to changes in moisture content affecting local (adjacent to monitoring point) ground conditions. Vertical movement of adjacent points indicate slight settlement within survey accuracy range.

Discussion and Conclusions

Vertical movement recorded in Section 1 indicates two localised depressions of 5 mm compared to the baseline survey at points A3 and C2. Time series data indicates most movement was within survey accuracy range, with independent localised events causing subsidence. Given this section of the reserve is open to public access, these movements are most likely attributed to human interference, particularly at C2 located adjacent to the boat ramp access path. Overall the area shows very slow vertical subsidence, however this remains within survey accuracy and is therefore considered inconclusive.

Lateral deformation at Section 1 shows no overriding dominant direction of movement prior to December 2012 with only C1 showing resultant movement exceeding 5 mm towards the river. Overall lateral movements in this area appear to be very small and generally random, with the proximity of C1 to the boat ramp possibly affecting the variability in direction of movement over



time. Again while the area is starting to show slow movement towards the river, this remains within survey accuracy and is not conclusive at this point in time. **Access restrictions are not considered necessary in this area.**

The monitoring data collected since 16 April 2012 has not indicated discernible movement on the landward side of the fence in Section 2. The negligible movement in this area suggest that access restrictions are not required. Data collected from recently installed monitoring targets in the submerged, slumped area are considered inconclusive due to the instability of two of the monitoring points showing significant movement and the small amount of data available for more stable targets at the time of this review. **This area should remain fenced off such that near-shore access is prohibited.**

There has been no evidence of accelerated vertical or lateral movement riverside of the installed fence in Section 3 since monitoring commenced in April 2012. Slight heave and settlement, possibly caused by seasonal variations, has occurred over time at P4 located landside of the fence with no discernible movement detected along the northern boundary of the houses near the riverbank. **There appears to be no justifiable reason to keep Section 3 fenced off from public access, although future quarterly monitoring (upon completion of the first 12 months of monthly monitoring) is recommended to track potential changes in deformation in the area.**

Recommendations

Based on the review and analysis of eight sets of monitoring data collected at Bells Reserve, Monteith since 16 April 2012, the following recommendations are made for future monitoring and management of the site:

1. Continuous monthly survey monitoring cannot be justified based on the ground deformation trends recorded over the past eight months. It is recommended that the first monthly annual sequence is completed (up to, and including, April 2013). Thereafter, provided that the overall trends continue as they have been recorded in this review over the first year, monitoring frequency can be reduced to quarterly intervals over the course of 2013/14 (July 2013 to July 2014)) and a review and reassessment should be conducted after the next four (quarterly) measurements. Depending on the results of the July 2014 review it may be appropriate to move to bi-annual or annual surveys provided the river level remains within its normal range of approximately 0.25 m AHD to 1.75 m AHD as measured at the Long Island monitoring station in Murray Bridge (Reference 2, Figure 4).
2. On present indications:
 - No access restriction are required for Section 1
 - The previously slumped areas in Section 2 should remain fenced off with appropriate signage



- No access restrictions are required on the landward side of Section 2
- No access restrictions are required in Section 3

All of the above recommendations should be reviewed if survey monitoring shows unexpected adverse trends, or if new evidence of cracking or riverbank collapse is observed or if the river level falls below its normal range. River levels below 0.25 m AHD at the Long Island monitoring station in Murray Bridge should serve as a trigger point to review monitoring (Reference 2, Figure 4).

3. It is further recommended that during all future monitoring rounds the reduced level of the water is established and recorded with the monitoring results.

Limitations

This review is based on the data provided by DEWNR from Alexander & Symonds. It is assumed that the data provided is a true indication of ground movement that has occurred at Bells Reserve, Monteith since 16 April 2012.

References

- Reference 1: SKM Report, February 2012, 'Study into River Bank Collapsing – Lower River Murray, Inspection Report'
- Reference 2: DEWNR, 'River Murray Water Data', <https://www.waterconnect.sa.gov.au/RMWD/Pages/default.aspx>, accessed 11/12/2012

Yours sincerely

Robert Scott

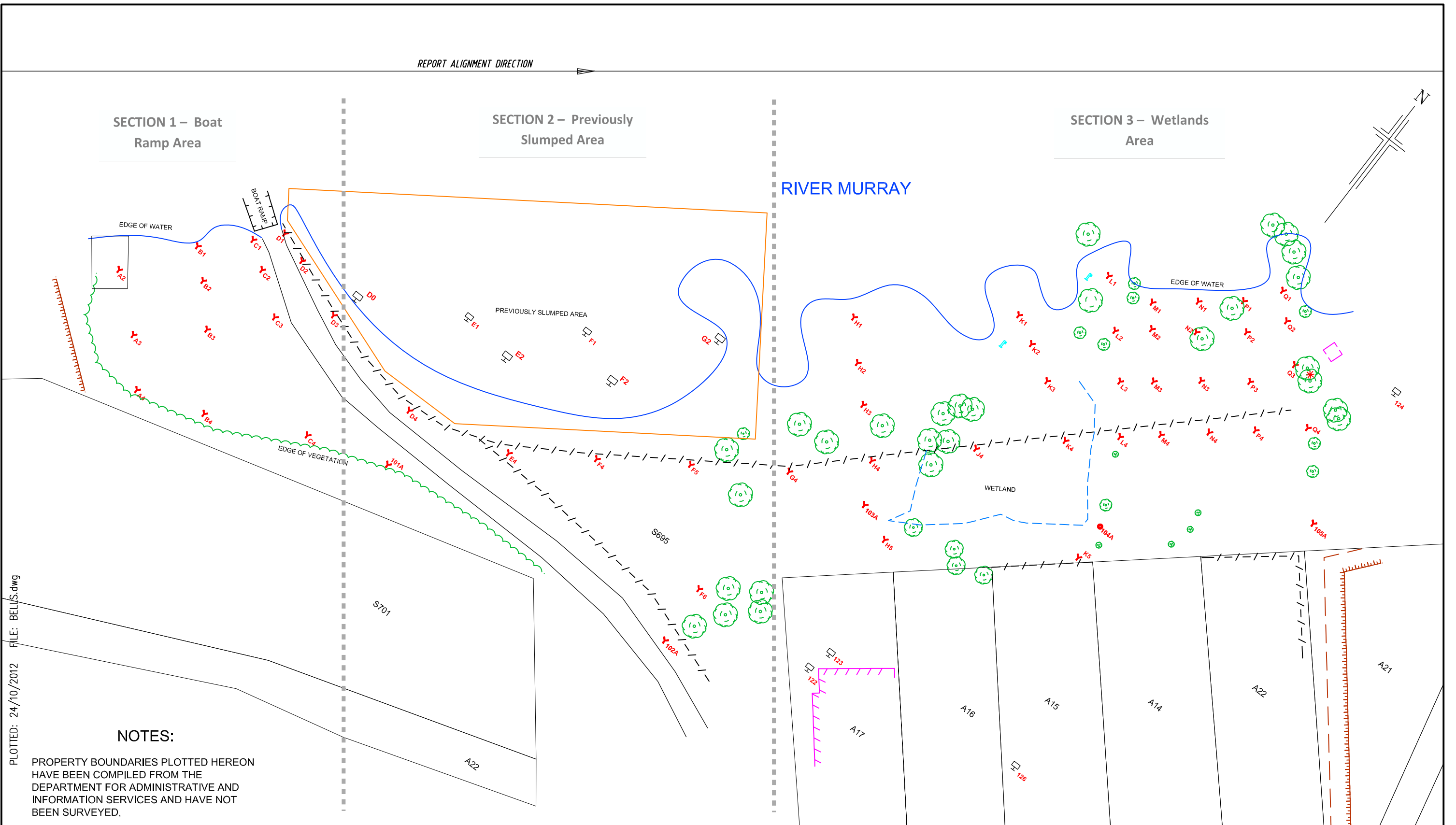
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Figure 1 Site Plan



PLOTTED: 24/10/2012 FILE: BELLS.dwg

NOTES:

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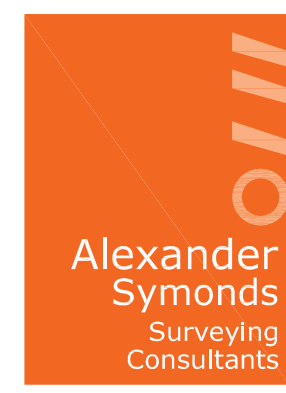
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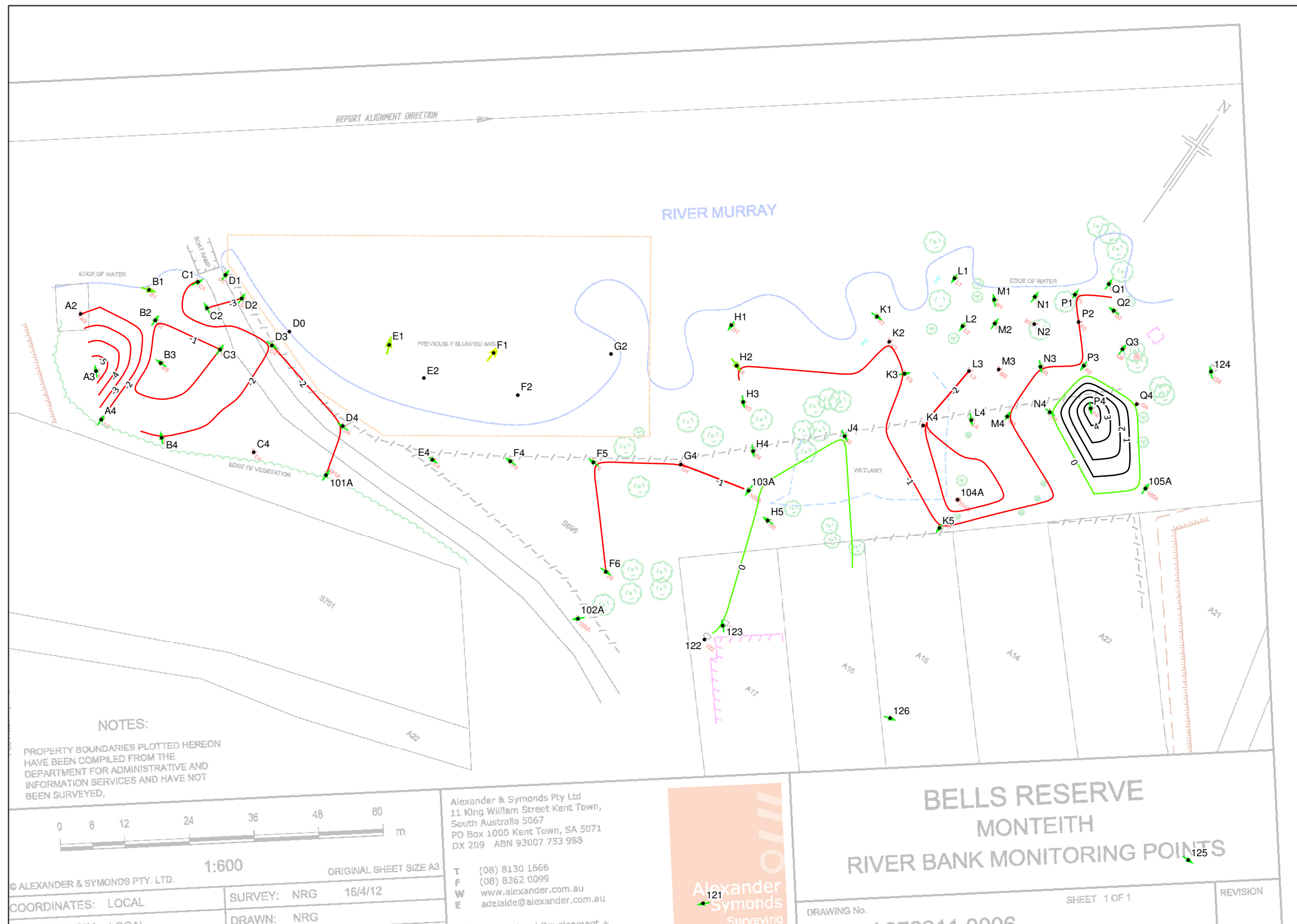
BELLS RESERVE MONTEITH RIVER BANK MONITORING POINTS

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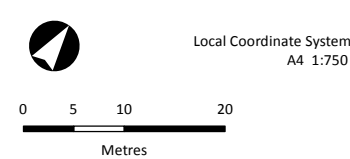
Figure 2 Lateral and Vertical Deformation Modelling, 4 October 2012

Bell's Reserve, Monteith - River Bank Movement Monitoring - 16 April 2012 to 04 October 2012



- Monitoring point
- Distance
- 0.1 - 3mm
- 3 - 6mm
- 6 - 9mm
- 9 - 12mm
- 12 - 15mm
- 15 - 18mm
- 18 - 21mm
- 21 - 24mm
- Difference Vertical Position
- Settlement (1mm increments)
- 0
- Heave (1mm increments)

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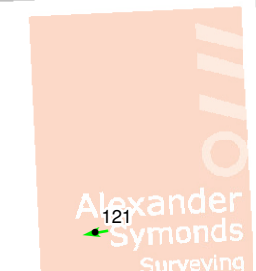
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**BELLS RESERVE
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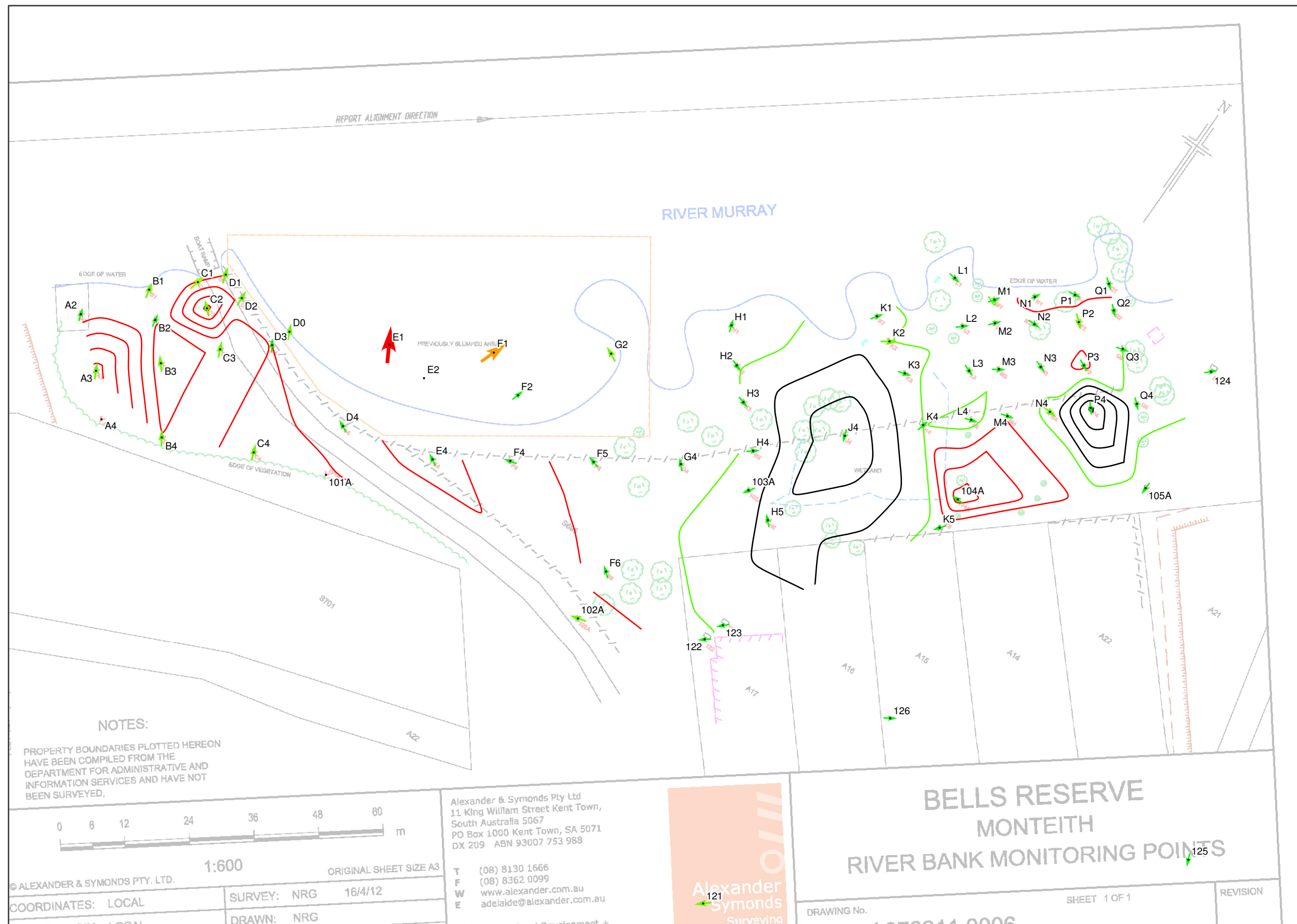
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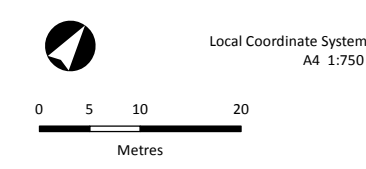
Figure 3 Lateral and Vertical Deformation Modelling, 6 December 2012

Bell's Reserve, Monteith - River Bank Movement Monitoring - 16 April 2012 to 06 December 2012



- Monitoring point
- Distance
 - ↑ 0.1 - 3mm
 - ↑ 3 - 6mm
 - ↑ 6 - 9mm
 - ↑ 9 - 12mm
 - ↑ 12 - 15mm
 - ↑ 15 - 18mm
 - ↑ 18 - 21mm
 - ↑ 21 - 24mm
- Contour
 - Settlement (1mm increments)
 - 0
 - Heave (1mm increments)

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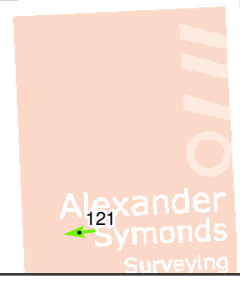
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Figure 4 Long Island, Murray Bridge Historical Water Levels

DEWNR, 'River Murray Water Data',

<https://www.waterconnect.sa.gov.au/RMWD/Pages/default.aspx>, accessed 11/12/2012

Department for Water Surface Water Archive

HYPLOT V133 Output 02/12/2012

Period 4 Year Plot Start 00:00_01/01/2009

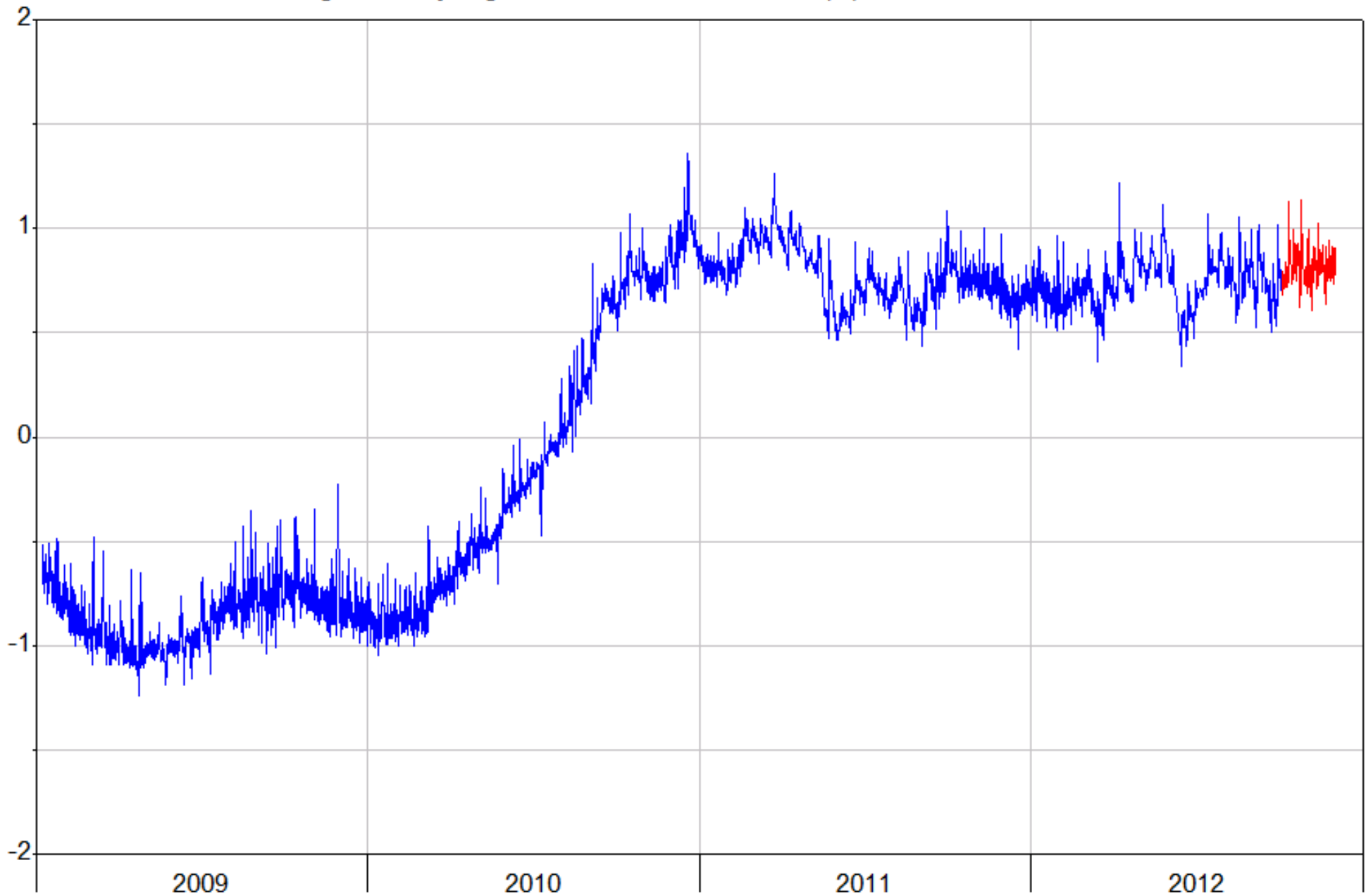
2009-13

Interval 1 Day Plot End 00:00_01/01/2013

A4261162 Long Is Murray Brg 100.00 Max & Min Level (m)

Continuous

AT





Appendix A Monthly Monitoring Data

16-April-2012

Date of survey	16-Apr-12
Equipment	Set 59
Surveyed by:	NRG

References:
BELLS REVERSE
A&S: A078911.0006

Point	First Survey 16 APRIL 2012					Current Survey					Current Survey Comparisons						Point Description
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	difference from first survey			difference from last survey			
											Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.162	9.280	102.911	64.680	0	0	0	0	0	0	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.416	1918.137	9.001	148.417	93.565	0	0	0	0	0	0	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.783	1955.822	8.895	181.248	71.312	0	0	0	0	0	0	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.560	1976.750	9.151	219.980	74.798	0	0	0	0	0	0	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.496	10.179	254.974	74.362	0	0	0	0	0	0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.864	1888.117	11.983	169.182	147.557	0	0	0	0	0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.752	98.559	0	0	0	0	0	0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.499	10.437	175.250	96.153	0	0	0	0	0	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.172	53.293	0	0	0	0	0	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.103	1946.441	15.331	259.632	143.754	0	0	0	0	0	0	Target on Stobie
A2	832.244	1911.482	9.331	58.760	32.679	832.244	1911.481	9.331	58.759	32.679	-1	0	0	-1	0	0	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.623	1904.454	9.341	61.092	43.364	0	0	0	0	0	0	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.615	1897.653	9.179	61.674	52.409	0	1	-1	0	1	-1	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.082	1922.443	8.955	71.665	28.800	0	0	-1	0	0	-1	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.246	1918.487	9.336	72.541	34.476	-1	0	0	-1	0	0	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.660	1912.550	9.239	73.193	42.485	-1	0	0	-1	0	0	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.758	1901.312	9.166	72.727	56.328	-1	0	-1	-1	0	-1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.653	1928.857	9.016	80.786	27.743	-1	0	-1	-1	0	-1	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.824	1925.843	9.304	82.244	32.679	0	0	-2	0	0	-2	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.246	1920.946	9.332	84.330	40.481	-1	0	0	-1	0	0	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.344	1908.890	9.289	89.694	59.864	-1	0	-1	-1	0	-1	Dropper
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.867	8.980	86.007	26.710	0	0	0	0	0	0	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.031	9.135	88.811	31.198	0	0	-1	0	0	-1	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.700	1927.129	9.175	94.008	40.147	0	0	-1	0	0	-1	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.100	1922.346	9.331	106.433	55.796	0	1	0	0	1	0	Dropper
E4	901.323	1926.794	9.200	122.781	62.809	901.323	1926.794	9.200	122.780	62.809	-1	0	0	-1	0	0	Dropper
F4	913.348	1934.873	9.116	137.235	63.770	913.348	1934.873	9.115	137.235	63.771	0	1	-1	0	1	-1	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.123	1943.598	9.039	152.679	64.679	-1	-1	0	-1	-1	0	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.708	1928.265	9.086	154.051	85.119	0	0	0	0	0	0	Dropper
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.588	8.864	168.864	65.827	0	0	0	0	0	0	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.536	1979.128	8.851	179.482	40.490	1	1	0	1	1	0	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.603	1973.586	8.973	180.101	47.974	0	1	0	0	1	0	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.533	1968.719	9.085	181.025	54.839	0	0	0	0	0	0	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.257	1962.337	8.834	182.443	64.001	0	1	0	0	1	0	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.880	1953.315	8.811	184.538	77.024	-1	0	0	-1	0	0	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.606	1974.354	8.661	199.561	62.045	0	1	0	0	1	0	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.782	1996.006	9.027	206.613	40.128	0	0	0	0	0	0	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.332	1993.519	9.109	208.692	44.879	0	0	1	0	0	1	Dropper
K3	964.074	1990.260	8.813	211.242	50.969	964.075	1990.260	8.814	211.242	50.970	0	1	1	0	1	1	Dropper
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.340	8.709	214.233	60.763	0	0	0	0	0	0	Dropper
K5	985.839	1970.468	9.041	216.358	79.939	985.839	1970.468	9.040	216.359	79.939	1	0	-1	1	0	-1	Dropper

L1	961.505	2010.139	8.949	221.366	33.670	961.505	2010.139	8.950	221.366	33.670	0	0	1	0	0	1	Dropper	
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.648	9.209	222.409	42.680	-1	0	0	-1	0	0	Dropper	
L3	973.597	1997.556	8.982	223.238	51.020	973.597	1997.556	8.982	223.238	51.020	0	0	0	0	0	0	Dropper	
L4	979.165	1990.336	9.018	223.229	60.138	979.165	1990.335	9.019	223.228	60.138	-1	0	1	-1	0	1	Dropper	
M1	969.861	2011.070	9.009	228.547	38.042	969.860	2011.071	9.010	228.547	38.042	0	0	1	0	0	1	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.453	2007.549	9.289	228.445	42.414	1	-1	0	1	-1	0	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.949	2000.941	9.067	228.752	51.003	0	0	0	0	0	0	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.252	1994.720	9.144	229.935	59.780	0	0	0	0	0	0	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.741	2015.825	9.136	236.107	37.877	0	0	0	0	0	0	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.560	2011.634	9.393	235.774	42.916	0	-1	0	0	-1	0	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.053	2005.802	9.177	236.554	50.890	0	0	0	0	0	0	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.307	1999.881	9.320	237.881	59.400	-1	0	1	-1	0	1	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.599	2020.433	9.106	243.560	37.813	0	-1	0	0	-1	0	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.680	9.519	244.033	42.923	0	0	0	0	0	0	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.523	2010.573	9.415	244.591	51.072	-1	-1	0	-1	-1	0	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.115	2004.820	9.430	245.497	59.043	-1	-1	2	-1	-1	2	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.631	2025.715	9.226	249.981	36.100	0	1	0	0	1	0	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.208	2022.142	9.291	250.626	41.114	0	-1	0	0	-1	0	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.643	2017.248	9.693	251.933	48.310	0	-1	0	0	-1	0	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.667	2010.369	9.775	254.074	58.660	0	-1	1	0	-1	1	Dropper	
											Max	1	1	2	1	1	2	
											Min	-1	-1	-2	-1	-1	-2	
											Average	-0	0	-0	-0	0	-0	

Notes:

Max, Min & Average values are for monitoring droppers only
Coordinates are calculated from least squares adjustment.
Chainage & offset is relative to line approximately parallel to river bank
Origin of Chainage & Offset Alignment: E 1 616.395, N 9 718.221
End of Chainage & Offset Alignment: E 1 556.687, N 9 940.384
Cross movement is positive away from the river bank in a south easterly direction
Upstream movement is positive in an upstream (north easterly) direction
Movement shown is relative to first survey 16 April 2012
Design co-ordinate accuracy is +/- 3mm
Design elevation accuracy is +/- 2mm



BELL'S RESERVE - MONTEITH

RIVER BANK MOVEMENT MONITORING

04-June-2012

Date of survey	4-Jun-12
Equipment	Set 89
Surveyed by:	NRG

References:
 BELLS RESERVE
 A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
											difference from first survey			difference from last survey			
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.162	9.280	102.911	64.680	0	0	0	0	0	0	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.416	1918.137	9.001	148.417	93.565	0	0	0	0	0	0	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.783	1955.822	8.895	181.248	71.312	0	0	0	0	0	0	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.560	1976.750	9.151	219.980	74.798	0	0	0	0	0	0	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.496	10.179	254.974	74.362	0	0	0	0	0	0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.864	1888.117	11.983	169.182	147.557	0	0	0	0	0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.752	98.559	0	0	0	0	0	0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.499	10.437	175.250	96.153	0	0	0	0	0	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.172	53.293	0	0	0	0	0	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.103	1946.441	15.331	259.632	143.754	0	0	0	0	0	0	Target on Stobie
A2	832.244	1911.482	9.331	58.760	32.679	832.244	1911.481	9.331	58.759	32.679	-1	0	0	-1	0	0	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.623	1904.454	9.341	61.092	43.364	0	0	0	0	0	0	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.615	1897.653	9.179	61.674	52.409	0	1	-1	0	1	-1	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.082	1922.443	8.955	71.665	28.800	0	0	-1	0	0	-1	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.246	1918.487	9.336	72.541	34.476	-1	0	0	-1	0	0	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.660	1912.550	9.239	73.193	42.485	-1	0	0	-1	0	0	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.758	1901.312	9.166	72.727	56.328	-1	0	-1	-1	0	-1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.653	1928.857	9.016	80.786	27.743	-1	0	-1	-1	0	-1	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.824	1925.843	9.304	82.244	32.679	0	0	-2	0	0	-2	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.246	1920.946	9.332	84.330	40.481	-1	0	0	-1	0	0	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.344	1908.890	9.289	89.694	59.864	-1	0	-1	-1	0	-1	Dropper
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.867	8.980	86.007	26.710	0	0	0	0	0	0	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.031	9.135	88.811	31.198	0	0	-1	0	0	-1	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.700	1927.129	9.175	94.008	40.147	0	0	-1	0	0	-1	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.100	1922.346	9.331	106.433	55.796	0	1	0	0	1	0	Dropper
E4	901.323	1926.794	9.200	122.781	62.809	901.323	1926.794	9.200	122.780	62.809	-1	0	0	-1	0	0	Dropper
F4	913.348	1934.873	9.116	137.235	63.770	913.348	1934.873	9.115	137.235	63.771	0	1	-1	0	1	-1	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.123	1943.598	9.039	152.679	64.679	-1	-1	0	-1	-1	0	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.708	1928.265	9.086	154.051	85.119	0	0	0	0	0	0	Dropper
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.588	8.864	168.864	65.827	0	0	0	0	0	0	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.536	1979.128	8.851	179.482	40.490	1	1	0	1	1	0	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.603	1973.586	8.973	180.101	47.974	0	1	0	0	1	0	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.533	1968.719	9.085	181.025	54.839	0	0	0	0	0	0	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.257	1962.337	8.834	182.443	64.001	0	1	0	0	1	0	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.880	1953.315	8.811	184.538	77.024	-1	0	0	-1	0	0	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.606	1974.354	8.661	199.561	62.045	0	1	0	0	1	0	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.782	1996.006	9.027	206.613	40.128	0	0	0	0	0	0	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.332	1993.519	9.109	208.692	44.879	0	0	1	0	0	1	Dropper
K3	964.074	1990.260	8.813	211.242	50.969	964.075	1990.260	8.814	211.242	50.970	0	1	1	0	1	1	Dropper
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.340	8.709	214.233	60.763	0	0	0	0	0	0	Dropper
K5	985.839	1970.468	9.041	216.358	79.939	985.839	1970.468	9.040	216.359	79.939	1	0	-1	1	0	-1	Dropper
L1	961.505	2010.139	8.949	221.366	33.670	961.505	2010.139	8.950	221.366	33.670	0	0	1	0	0	1	Dropper
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.648	9.209	222.409	42.680	-1	0	0	-1	0	0	Dropper
L3	973.597	1997.556	8.982	223.238	51.020	973.597	1997.556	8.982	223.238	51.020	0	0	0	0	0	0	Dropper
L4	979.165	1990.336	9.018	223.229	60.138	979.165	1990.335	9.019	223.228	60.138	-1	0	1	-1	0	1	Dropper

M1	969.861	2011.070	9.009	228.547	38.042	969.860	2011.071	9.010	228.547	38.042	0	0	1	0	0	1	Dropper
M2	972.453	2007.548	9.289	228.444	42.415	972.453	2007.549	9.289	228.445	42.414	1	-1	0	1	-1	0	Dropper
M3	977.949	2000.941	9.067	228.752	51.003	977.949	2000.941	9.067	228.752	51.003	0	0	0	0	0	0	Dropper
M4	984.253	1994.720	9.144	229.935	59.780	984.252	1994.720	9.144	229.935	59.780	0	0	0	0	0	0	Dropper
N1	975.741	2015.824	9.136	236.107	37.877	975.741	2015.825	9.136	236.107	37.877	0	0	0	0	0	0	Dropper
N2	978.560	2011.633	9.393	235.774	42.917	978.560	2011.634	9.393	235.774	42.916	0	-1	0	0	-1	0	Dropper
N3	984.053	2005.802	9.177	236.554	50.890	984.053	2005.802	9.177	236.554	50.890	0	0	0	0	0	0	Dropper
N4	990.308	1999.881	9.319	237.882	59.400	990.307	1999.881	9.320	237.881	59.400	-1	0	1	-1	0	1	Dropper
P1	981.599	2020.432	9.106	243.560	37.814	981.599	2020.433	9.106	243.560	37.813	0	-1	0	0	-1	0	Dropper
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.680	9.519	244.033	42.923	0	0	0	0	0	0	Dropper
P3	990.524	2010.573	9.415	244.592	51.073	990.523	2010.573	9.415	244.591	51.072	-1	-1	0	-1	-1	0	Dropper
P4	996.116	2004.820	9.428	245.498	59.044	996.115	2004.820	9.430	245.497	59.043	-1	-1	2	-1	-1	2	Dropper
Q1	985.631	2025.716	9.226	249.981	36.099	985.631	2025.715	9.226	249.981	36.100	0	1	0	0	1	0	Dropper
Q2	989.209	2022.142	9.291	250.626	41.115	989.208	2022.142	9.291	250.626	41.114	0	-1	0	0	-1	0	Dropper
Q3	994.643	2017.247	9.693	251.933	48.311	994.643	2017.248	9.693	251.933	48.310	0	-1	0	0	-1	0	Dropper
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.667	2010.369	9.775	254.074	58.660	0	-1	1	0	-1	1	Dropper
Max											1	1	2	1	1	2	
Min											-1	-1	-2	-1	-1	-2	
Average											-0	0	-0	-0	0	-0	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm



BELL'S RESERVE - MONTEITH

RIVER BANK MOVEMENT MONITORING

03-July-2012

Date of survey	3-Jul-12
Equipment	Set 59
Surveyed by:	NRG

References:
 BELLS RESERVE
 A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
											difference from first survey			difference from last survey			
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.163	9.277	102.911	64.679	0	-1	-3	0	-1	-3	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.414	1918.136	8.999	148.415	93.565	-2	0	-2	-2	0	-2	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.783	1955.821	8.892	181.248	71.312	0	0	-3	0	0	-3	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.560	1976.750	9.150	219.980	74.798	0	0	-1	0	0	-1	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.496	10.179	254.975	74.362	1	0	0	1	0	0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.864	1888.117	11.983	169.182	147.557	0	0	0	0	0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.752	98.559	0	0	0	0	0	0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.499	10.437	175.250	96.153	0	0	0	0	0	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.172	53.293	0	0	0	0	0	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.103	1946.441	15.331	259.632	143.754	0	0	0	0	0	0	Target on Stobie
A2	832.244	1911.482	9.331	58.760	32.679	832.245	1911.480	9.329	58.760	32.681	0	2	-2	1	2	-2	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.624	1904.455	9.340	61.094	43.364	2	0	-1	2	0	-1	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.614	1897.656	9.178	61.675	52.406	1	-2	-2	1	-3	-1	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.082	1922.443	8.953	71.665	28.800	0	0	-3	0	0	-2	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.248	1918.488	9.335	72.543	34.476	1	0	-1	2	0	-1	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.661	1912.550	9.238	73.194	42.485	0	0	-1	1	0	-1	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.758	1901.314	9.165	72.730	56.327	2	-1	-2	3	-1	-1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.654	1928.859	9.015	80.788	27.742	1	-1	-2	2	-1	-1	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.826	1925.844	9.303	82.246	32.679	2	0	-3	2	0	-1	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.248	1920.947	9.331	84.332	40.481	1	0	-1	2	0	-1	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.345	1908.891	9.287	89.696	59.864	1	0	-3	2	0	-2	Dropper
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.868	8.978	86.008	26.710	1	0	-2	1	0	-2	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.114	1931.031	9.133	88.811	31.197	0	-1	-3	0	-1	-2	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.701	1927.129	9.173	94.009	40.148	1	1	-3	1	1	-2	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.101	1922.346	9.329	106.433	55.796	0	1	-2	0	0	-2	Dropper
E4	901.323	1926.794	9.200	122.781	62.809	901.324	1926.794	9.198	122.781	62.810	0	1	-2	1	1	-2	Dropper
F4	913.348	1934.873	9.116	137.235	63.770	913.349	1934.872	9.113	137.236	63.771	1	1	-3	1	0	-2	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.124	1943.597	9.037	152.679	64.681	-1	1	-2	0	2	-2	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.709	1928.265	9.084	154.051	85.119	0	0	-2	0	0	-2	Dropper
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.590	8.862	168.865	65.826	1	-1	-2	1	-1	-2	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.537	1979.129	8.850	179.482	40.490	1	1	-1	0	0	-1	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.606	1973.586	8.971	180.103	47.975	2	2	-2	2	1	-2	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.534	1968.719	9.083	181.026	54.839	1	0	-2	1	0	-2	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.257	1962.338	8.832	182.443	64.000	0	0	-2	0	-1	-2	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.880	1953.316	8.810	184.539	77.023	0	-1	-1	1	-1	-1	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.605	1974.354	8.659	199.561	62.044	0	0	-2	0	-1	-2	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.782	1996.007	9.025	206.613	40.128	0	0	-2	0	0	-2	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.334	1993.518	9.106	208.693	44.881	1	2	-2	1	2	-3	Dropper
K3	964.074	1990.260	8.813	211.242	50.969	964.077	1990.260	8.812	211.244	50.970	2	1	-1	2	0	-2	Dropper
K4	972.430	1984.340	8.709	214.233	60.763	972.429	1984.340	8.707	214.233	60.762	0	-1	-2	0	-1	-2	Dropper
K5	985.839	1970.468	9.041	216.358	79.939	985.837	1970.466	9.041	216.356	79.940	-2	1	0	-3	1	1	Dropper
L1	961.505	2010.139	8.949	221.366	33.670	961.506	2010.138	8.947	221.366	33.671	0	1	-2	0	1	-3	Dropper
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.648	9.207	222.410	42.680	0	0	-2	1	0	-2	Dropper
L3	973.597	1997.556	8.982	223.238	51.020	973.598	1997.555	8.980	223.239	51.021	1	1	-2	1	1	-2	Dropper
L4	979.165	1990.336	9.018	223.229	60.138	979.164	1990.336	9.017	223.228	60.138	-1	0	-1	0	0	-2	Dropper

M1	969.861	2011.070	9.009	228.547	38.042	969.861	2011.070	9.008	228.548	38.043	1	1	-1	1	1	-2	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.453	2007.549	9.288	228.444	42.414	0	-1	-1	-1	0	-1	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.949	2000.942	9.066	228.753	51.003	1	0	-1	1	0	-1	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.252	1994.722	9.143	229.936	59.779	1	-1	-1	1	-1	-1	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.741	2015.823	9.134	236.106	37.878	-1	1	-2	-1	1	-2	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.559	2011.634	9.392	235.774	42.916	0	-1	-1	0	0	-1	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.053	2005.802	9.176	236.554	50.890	0	0	-1	0	0	-1	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.308	1999.880	9.319	237.882	59.401	0	1	0	1	1	-1	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.599	2020.433	9.105	243.560	37.814	0	0	-1	0	1	-1	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.681	9.519	244.034	42.922	1	-1	0	1	-1	0	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.524	2010.573	9.414	244.592	51.073	0	0	-1	1	1	-1	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.117	2004.820	9.432	245.499	59.044	1	0	4	2	1	2	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.630	2025.718	9.224	249.982	36.097	1	-2	-2	1	-3	-2	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.208	2022.142	9.291	250.625	41.114	-1	-1	0	-1	0	0	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.644	2017.248	9.693	251.933	48.311	0	0	0	0	1	0	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.667	2010.369	9.775	254.074	58.660	0	-1	1	0	0	0	Dropper	
											Max	2	2	4	3	2	2	
											Min	-2	-2	-3	-3	-3	-3	
											Average	0	0	-1	1	0	-1	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm



BELL'S RESERVE - MONTEITH

RIVER BANK MOVEMENT MONITORING

30-July-2012

Date of survey	30-Jul-12
Equipment	Set 59
Surveyed by:	NRG

References:
 BELLS RESERVE
 A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
											difference from first survey			difference from last survey			
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.162	9.279	102.910	64.680	-1	-0	-1	-1	1	2	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.416	1918.135	8.999	148.416	93.567	-1	2	-2	1	2	0	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.783	1955.820	8.894	181.247	71.314	-1	2	-1	-1	2	2	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.561	1976.749	9.151	219.980	74.800	0	1	-0	0	1	1	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.982	1998.496	10.179	254.975	74.363	1	1	0	-0	1	0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.864	1888.117	11.983	169.182	147.557	-0	-0	0	-0	-0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.752	98.559	0	-0	-0	0	-0	-0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.500	10.437	175.250	96.153	-0	-0	0	-0	-0	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.173	53.293	0	-0	0	0	-0	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.103	1946.441	15.331	259.632	143.754	0	-0	-0	0	-0	-0	Target on Stobie
A2	832.244	1911.482	9.331	58.760	32.679	832.245	1911.479	9.329	58.760	32.682	-0	3	-2	-0	1	-0	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.623	1904.452	9.340	61.091	43.365	-1	1	-1	-3	1	0	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.616	1897.654	9.178	61.675	52.409	1	1	-2	0	3	-0	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.081	1922.442	8.953	71.664	28.800	-1	0	-3	-1	0	0	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.248	1918.487	9.335	72.542	34.477	-1	1	-2	-2	1	-1	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.661	1912.548	9.238	73.193	42.486	-1	1	-1	-1	1	0	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.758	1901.312	9.167	72.728	56.328	-0	0	-0	-2	1	2	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.654	1928.857	9.015	80.787	27.744	0	1	-2	-1	2	-0	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.826	1925.843	9.303	82.244	32.680	0	1	-3	-2	1	-0	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.248	1920.945	9.331	84.331	40.482	-0	1	-1	-1	1	0	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.345	1908.889	9.288	89.694	59.865	-1	1	-2	-2	1	1	Dropper
D1	850.152	1932.867	8.980	86.007	26.710	850.153	1932.867	8.978	86.008	26.711	1	1	-3	-0	1	-1	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.030	9.133	88.811	31.199	0	1	-3	0	2	0	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.700	1927.128	9.174	94.008	40.148	0	1	-2	-1	0	1	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.101	1922.345	9.330	106.433	55.797	-0	2	-1	-0	1	1	Dropper
E4	901.323	1926.794	9.200	122.781	62.809	901.323	1926.793	9.200	122.780	62.810	-1	1	-0	-1	-0	2	Dropper
F4	913.348	1934.873	9.116	137.235	63.770	913.348	1934.872	9.115	137.235	63.771	-0	1	-1	-1	0	2	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.124	1943.598	9.039	152.679	64.680	-1	-0	-0	0	-1	2	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.710	1928.264	9.085	154.051	85.121	0	2	-1	0	2	1	Dropper
G4	939.631	1952.588	8.864	168.864	65.827	939.632	1952.588	8.864	168.865	65.828	1	1	-0	-0	2	2	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.537	1979.128	8.851	179.482	40.490	1	1	-0	-0	0	1	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.606	1973.586	8.973	180.103	47.975	2	2	-0	0	0	2	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.534	1968.719	9.085	181.026	54.840	1	1	-1	0	1	2	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.258	1962.338	8.834	182.444	64.001	1	1	-0	1	1	2	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.880	1953.315	8.812	184.539	77.024	-0	0	1	-0	1	2	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.606	1974.352	8.661	199.561	62.046	0	2	-0	0	2	2	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.782	1996.006	9.027	206.613	40.128	-0	0	0	-0	0	2	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.332	1993.519	9.108	208.692	44.879	-0	0	0	-1	-2	2	Dropper
K3	964.074	1990.260	8.813	211.242	50.969	964.076	1990.260	8.814	211.244	50.971	2	2	1	-0	1	2	Dropper
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.339	8.708	214.232	60.764	-1	1	-1	-1	2	1	Dropper
K5	985.839	1970.468	9.041	216.358	79.939	985.839	1970.465	9.042	216.356	79.941	-2	2	1	0	1	1	Dropper
L1	961.505	2010.139	8.949	221.366	33.670	961.506	2010.138	8.949	221.366	33.671	-0	1	0	-0	0	2	Dropper
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.647	9.209	222.409	42.680	-1	0	-0	-1	0	2	Dropper
L3	973.597	1997.556	8.982	223.238	51.020	973.597	1997.555	8.982	223.238	51.021	-0	1	-0	-1	0	2	Dropper
L4	979.165	1990.336	9.018	223.229	60.138	979.166	1990.335	9.019	223.229	60.139	-0	1	0	1	1	2	Dropper

M1	969.861	2011.070	9.009	228.547	38.042	969.862	2011.070	9.009	228.547	38.043	0	1	0	-1	0	1	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.454	2007.549	9.288	228.445	42.414	1	-1	-1	1	0	0	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.950	2000.941	9.066	228.752	51.003	0	0	-1	-1	0	0	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.254	1994.720	9.144	229.936	59.781	1	1	-0	-0	2	1	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.742	2015.824	9.135	236.107	37.878	0	0	-1	1	-1	1	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.561	2011.634	9.392	235.775	42.917	1	0	-1	1	1	0	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.054	2005.802	9.176	236.554	50.891	0	1	-1	0	1	0	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.310	1999.880	9.319	237.883	59.402	1	2	0	1	1	0	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.600	2020.432	9.105	243.560	37.815	-0	1	-1	-0	1	0	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.680	9.519	244.033	42.923	0	-0	-0	-1	1	-0	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.525	2010.571	9.414	244.592	51.075	-0	2	-1	-0	2	0	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.117	2004.820	9.434	245.498	59.045	0	1	6	-1	1	2	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.632	2025.716	9.224	249.982	36.100	1	1	-2	-0	3	0	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.209	2022.141	9.291	250.626	41.115	-0	0	-0	1	1	-0	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.644	2017.247	9.694	251.933	48.312	0	1	1	0	1	1	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.668	2010.368	9.775	254.074	58.661	0	0	1	0	1	-0	Dropper	
											Max	2	3	6	1	3	2	
											Min	-2	-1	-3	-3	-2	-1	
											Average	0	1	-1	-0	1	1	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm



BELL'S RESERVE - MONTEITH

RIVER BANK MOVEMENT MONITORING

06-September-2012

Date of survey	6-Sep-12
Equipment	Set 59
Surveyed by:	NRG

References:
 BELLS RESERVE
 A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
											difference from first survey			difference from last survey			
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.745	1913.162	9.279	102.910	64.680	-1	-1	-1	-0	-0	0	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.413	1918.137	9.000	148.414	93.564	-3	-1	-2	-2	-3	0	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.782	1955.821	8.894	181.247	71.312	-1	-0	-1	-0	-2	-0	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.560	1976.750	9.150	219.980	74.798	0	0	-1	-0	-1	-1	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.496	10.179	254.974	74.361	0	-1	-0	-1	-1	-0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.864	1888.117	11.983	169.182	147.557	-0	0	0	0	0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.934	1928.458	10.428	171.754	98.559	2	-0	-0	1	-0	0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.228	1932.500	10.437	175.250	96.152	-0	-1	0	-0	-1	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.172	53.292	0	-1	0	-0	-0	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.104	1946.440	15.331	259.633	143.755	0	1	-0	0	1	0	Target on Stobie
126	998.611	1936.271	12.111	205.551	114.807	998.611	1936.271	12.111	205.551	114.807	0	0	0	0	0	0	Target on Building
A2	832.244	1911.482	9.331	58.760	32.679	832.244	1911.479	9.330	58.759	32.681	-1	2	-1	-1	-1	1	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.623	1904.454	9.336	61.092	43.363	-0	-1	-5	1	-2	-4	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.615	1897.654	9.178	61.674	52.408	0	0	-2	-1	-1	0	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.082	1922.443	8.955	71.665	28.800	-0	-0	-1	1	-0	2	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.247	1918.488	9.336	72.542	34.476	0	-0	-0	1	-2	1	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.660	1912.549	9.239	73.193	42.486	-1	1	-0	-1	-1	1	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.757	1901.312	9.166	72.727	56.328	-1	-0	-1	-0	-0	-1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.653	1928.858	9.016	80.787	27.743	0	-0	-2	-0	-1	1	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.826	1925.843	9.303	82.245	32.680	1	1	-3	1	-0	0	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.248	1920.946	9.331	84.331	40.481	0	0	-1	1	-1	0	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.344	1908.889	9.288	89.694	59.865	-1	1	-2	-0	-0	-1	Dropper
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.867	8.979	86.007	26.710	-0	0	-1	-1	-1	1	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.114	1931.030	9.134	88.810	31.198	-1	0	-2	-1	-0	0	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.699	1927.127	9.174	94.007	40.148	-1	1	-2	-1	-1	-0	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.099	1922.346	9.330	106.432	55.795	-1	0	-1	-1	-2	-0	Dropper
E1	882.481	1939.696	9.833	115.763	41.078	882.481	1939.696	9.833	115.763	41.078	0	0	0	0	0	0	Target on tree stump
E4	901.323	1926.794	9.200	122.781	62.809	901.323	1926.794	9.199	122.780	62.809	-1	0	-1	1	-1	-1	Dropper
F1	899.260	1949.647	9.564	135.123	43.466	899.260	1949.647	9.564	135.123	43.466	0	0	0	0	0	0	Target on tree stump
F4	913.348	1934.873	9.116	137.235	63.770	913.349	1934.873	9.114	137.236	63.771	1	1	-2	1	0	-1	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.123	1943.598	9.038	152.679	64.679	-1	-1	-1	-0	-1	-0	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.709	1928.266	9.085	154.052	85.119	1	-0	-1	1	-2	0	Dropper
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.589	8.863	168.865	65.827	0	-0	-1	-0	-1	-0	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.535	1979.128	8.850	179.480	40.489	-1	0	-1	-1	-1	-1	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.606	1973.586	8.972	180.103	47.975	2	2	-1	-0	-0	-1	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.533	1968.720	9.084	181.025	54.838	0	-1	-1	-1	-2	-1	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.257	1962.339	8.833	182.444	63.999	1	-1	-1	0	-2	-1	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.879	1953.315	8.812	184.538	77.023	-1	-1	1	-1	-1	0	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.604	1974.353	8.662	199.560	62.045	-1	1	1	-1	-1	1	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.782	1996.007	9.026	206.613	40.128	0	-0	-1	0	-1	-1	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.333	1993.519	9.108	208.693	44.880	0	1	0	1	0	-0	Dropper
K3	964.074	1990.260	8.813	211.242	50.969	964.075	1990.261	8.814	211.244	50.969	2	-0	1	0	-2	-0	Dropper
K4	972.430	1984.340	8.709	214.233	60.763	972.429	1984.341	8.708	214.233	60.762	-0	-1	-1	1	-2	-0	Dropper
K5	985.839	1970.468	9.041	216.358	79.939	985.837	1970.467	9.041	216.356	79.939	-2	-0	0	0	-2	-1	Dropper
L1	961.505	2010.139	8.949	221.366	33.670	961.504	2010.138	8.948	221.365	33.670	-1	0	-1	-0	-1	-1	Dropper

L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.647	9.208	222.409	42.681	-1	1	-1	-0	0	-1	Dropper
L3	973.597	1997.556	8.982	223.238	51.020	973.597	1997.555	8.981	223.238	51.021	-0	1	-1	0	-0	-1	Dropper
L4	979.165	1990.336	9.018	223.229	60.138	979.165	1990.336	9.018	223.228	60.138	-1	0	0	-1	-1	-0	Dropper
M1	969.861	2011.070	9.009	228.547	38.042	969.859	2011.071	9.009	228.546	38.041	-1	-1	-0	-2	-2	-1	Dropper
M2	972.453	2007.548	9.289	228.444	42.415	972.452	2007.549	9.288	228.444	42.413	-0	-2	-1	-1	-1	0	Dropper
M3	977.949	2000.941	9.067	228.752	51.003	977.948	2000.943	9.066	228.752	51.001	-0	-2	-1	-1	-2	-0	Dropper
M4	984.253	1994.720	9.144	229.935	59.780	984.253	1994.721	9.143	229.936	59.780	0	-0	-1	-0	-1	-0	Dropper
N1	975.741	2015.824	9.136	236.107	37.877	975.740	2015.825	9.135	236.107	37.876	-0	-1	-1	-1	-2	-0	Dropper
N2	978.560	2011.633	9.393	235.774	42.917	978.559	2011.634	9.393	235.773	42.916	-1	-1	-0	-1	-2	0	Dropper
N3	984.053	2005.802	9.177	236.554	50.890	984.052	2005.800	9.177	236.552	50.891	-2	1	-0	-2	-0	0	Dropper
N4	990.308	1999.881	9.319	237.882	59.400	990.308	1999.881	9.319	237.882	59.400	-0	0	0	-1	-2	0	Dropper
P1	981.599	2020.432	9.106	243.560	37.814	981.600	2020.432	9.105	243.560	37.814	-0	0	-1	0	-0	-0	Dropper
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.680	9.519	244.033	42.923	-0	-1	-0	-1	-0	0	Dropper
P3	990.524	2010.573	9.415	244.592	51.073	990.524	2010.573	9.415	244.592	51.073	-0	-0	-0	0	-2	0	Dropper
P4	996.116	2004.820	9.428	245.498	59.044	996.116	2004.820	9.434	245.497	59.044	-1	0	6	-1	-1	1	Dropper
Q1	985.631	2025.716	9.226	249.981	36.099	985.630	2025.716	9.224	249.980	36.099	-1	-0	-2	-1	-1	-0	Dropper
Q2	989.209	2022.142	9.291	250.626	41.115	989.207	2022.142	9.291	250.625	41.114	-1	-1	0	-1	-1	1	Dropper
Q3	994.643	2017.247	9.693	251.933	48.311	994.643	2017.248	9.694	251.933	48.311	-0	-1	1	-0	-2	0	Dropper
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.667	2010.368	9.775	254.074	58.661	0	0	1	0	-0	0	Dropper
Max											2	2	6	1	1	2	
Min											-3	-2	-5	-2	-3	-4	
Average											-0	-0	-1	-0	-1	-0	

Notes: Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm

6/09/2012
New control point 126 added
New monitoring points E1 and F1 added on tree stumps in water
Tree stumps are not very stable additional more stable points to be added



BELL'S RESERVE - MONTEITH

RIVER BANK MOVEMENT MONITORING

04-October-2012

Date of survey	4-Oct-12
Equipment	Set 59
Surveyed by:	NRG

References:
 BELLS RESERVE
 A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
											difference from first survey			difference from last survey			
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.163	9.278	102.911	64.680	0	0	-2	1	1	-1	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.415	1918.136	9.000	148.416	93.565	-1	0	-1	2	1	1	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.783	1955.821	8.894	181.248	71.312	0	0	-1	1	0	-2	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.560	1976.750	9.148	219.980	74.798	0	0	-3	0	-0	-0	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.497	10.179	254.975	74.361	1	-1	0	1	-0	0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.863	1888.116	11.983	169.181	147.557	-1	0	0	-1	-0	-0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.753	98.559	1	0	0	-1	0	0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.228	1932.500	10.437	175.249	96.152	-1	-1	0	-1	0	-0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.538	2023.238	12.358	268.172	53.292	0	-1	0	-0	-0	-0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.104	1946.441	15.331	259.633	143.754	1	0	0	0	-1	0	Target on Stobie
126	998.611	1936.271	12.111	205.551	114.807	998.612	1936.271	12.110	205.552	114.807	1	0	-1	1	0	-1	Target on Building
A2	832.244	1911.482	9.331	58.760	32.679	832.244	1911.482	9.329	58.760	32.679	0	0	-2	1	-2	-1	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.623	1904.455	9.335	61.092	43.363	0	-1	-6	0	-0	-1	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.614	1897.655	9.178	61.675	52.407	1	-1	-2	1	-1	0	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.085	1922.444	8.954	71.668	28.801	3	1	-2	3	1	-1	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.247	1918.489	9.335	72.543	34.475	1	-1	-1	1	-1	-1	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.660	1912.550	9.239	73.193	42.484	-1	-1	0	0	-2	0	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.757	1901.313	9.165	72.728	56.327	0	-1	-2	1	-1	-1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.654	1928.860	9.015	80.789	27.742	2	-1	-2	2	-0	-0	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.823	1925.844	9.303	82.244	32.677	0	-2	-3	-1	-3	0	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.247	1920.947	9.331	84.331	40.480	0	-1	-1	-0	-1	-0	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.344	1908.891	9.287	89.695	59.863	0	-1	-3	1	-2	-0	Dropper
D0	865.926	1931.057	9.523	97.382	37.789	865.926	1931.057	9.523	97.382	37.789	0	0	0	0	0	0	Target on post 4/10/12
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.868	8.978	86.008	26.709	1	-1	-2	1	-1	-1	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.032	9.133	88.812	31.197	1	-1	-3	2	-1	-1	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.701	1927.128	9.174	94.009	40.148	1	1	-2	2	0	0	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.099	1922.346	9.329	106.433	55.795	0	0	-2	1	-0	-1	Dropper
E1	882.481	1939.696	9.833	115.763	41.078	891.346	1939.704	9.836	115.765	41.070	2	-8	3	2	-8	3	Target on tree stump 6/9/12
E2	891.346	1938.320	9.229	121.935	47.588	901.324	1938.320	9.229	121.935	47.588	0	0	0	0	0	0	Target on post 4/10/12
E4	901.323	1926.794	9.200	122.781	62.809	901.324	1926.794	9.199	122.781	62.809	0	0	-1	1	-0	-0	Dropper
F1	899.260	1949.647	9.564	135.123	43.466	899.260	1949.656	9.561	135.129	43.459	6	-7	-3	6	-7	-3	Target on tree stump 6/9/12
F2	907.475	1945.731	9.446	139.229	51.588	907.475	1945.731	9.446	139.229	51.588	0	0	0	0	0	0	Target on post 4/10/12
F4	913.348	1934.873	9.116	137.235	63.770	913.347	1934.873	9.114	137.235	63.770	0	0	-2	-1	-1	0	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.123	1943.598	9.038	152.679	64.680	-1	0	-1	-0	1	-0	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.709	1928.266	9.085	154.052	85.119	1	0	-1	0	0	-0	Dropper
G2	917.247	1962.010	9.426	156.916	44.684	917.247	1962.010	9.426	156.916	44.684	0	0	0	0	0	0	Target on post 4/10/12
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.588	8.863	168.864	65.827	0	0	-1	-0	0	-0	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.536	1979.127	8.850	179.481	40.490	0	1	-1	1	1	-0	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.606	1973.585	8.972	180.103	47.975	2	2	-1	0	-0	-0	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.534	1968.718	9.084	181.025	54.840	0	1	-1	-0	2	0	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.258	1962.337	8.833	182.443	64.001	0	1	-1	-1	2	-0	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.879	1953.315	8.812	184.538	77.024	-1	0	1	0	1	-0	Dropper
J4	961.605	1974.354	8.661	199.561	62.044	961.607	1974.353	8.661	199.562	62.045	1	1	0	2	0	-1	Dropper
K1	953.782	1996.007	9.027	206.613	40.128	953.783	1996.007	9.025	206.614	40.128	1	0	-2	1	0	-1	Dropper
K2	958.332	1993.519	9.108	208.692	44.879	958.332	1993.519	9.107	208.692	44.879	0	0	-1	-0	-1	-1	Dropper

K3	964.074	1990.260	8.813	211.242	50.969	964.075	1990.261	8.812	211.244	50.969	2	0	-1	0	0	-2	Dropper	
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.340	8.707	214.233	60.763	0	0	-2	0	1	-1	Dropper	
K5	985.839	1970.468	9.041	216.358	79.939	985.839	1970.465	9.040	216.357	79.941	-1	2	-1	1	2	-1	Dropper	
L1	961.505	2010.139	8.949	221.366	33.670	961.505	2010.138	8.948	221.366	33.670	0	0	-1	1	0	-0	Dropper	
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.647	9.208	222.410	42.681	0	1	-1	1	0	-0	Dropper	
L3	973.597	1997.556	8.982	223.238	51.020	973.597	1997.556	8.980	223.238	51.020	0	0	-2	0	-1	-1	Dropper	
L4	979.165	1990.336	9.018	223.229	60.138	979.166	1990.335	9.017	223.229	60.139	0	1	-1	1	1	-1	Dropper	
M1	969.861	2011.070	9.009	228.547	38.042	969.859	2011.072	9.008	228.546	38.040	-1	-2	-1	0	-1	-1	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.453	2007.549	9.288	228.444	42.414	0	-1	-1	0	1	-0	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.949	2000.941	9.066	228.752	51.003	0	0	-1	0	2	-0	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.253	1994.721	9.143	229.936	59.780	1	0	-1	1	0	-0	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.741	2015.825	9.134	236.107	37.877	0	0	-2	0	1	-1	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.560	2011.633	9.392	235.774	42.917	0	0	-1	1	1	-1	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.054	2005.801	9.176	236.554	50.892	0	2	-1	2	1	-1	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.309	1999.881	9.319	237.883	59.401	1	1	0	1	1	-0	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.599	2020.433	9.105	243.560	37.814	0	0	-1	0	-0	-0	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.098	2016.680	9.518	244.033	42.922	0	-1	-1	0	-1	-1	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.524	2010.572	9.414	244.591	51.073	-1	0	-1	-1	0	-1	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.117	2004.819	9.433	245.498	59.045	0	1	5	1	1	-1	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.631	2025.717	9.224	249.982	36.098	1	-1	-2	2	-1	-0	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.208	2022.142	9.291	250.625	41.114	-1	-1	0	0	-0	-0	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.643	2017.249	9.693	251.933	48.310	0	-1	0	0	-0	-1	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.667	2010.368	9.774	254.074	58.661	0	0	0	-0	-0	-1	Dropper	
											Max	6	2	5	6	2	3	
											Min	-1	-8	-6	-1	-8	-3	
											Average	0	-0	-1	1	-0	-0	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm

6/09/2012

New control point 126 added
New monitoring points E1 and F1 added on tree stumps in water
Tree stumps are not very stable additional more stable points to be added

4/10/2012

New monitoring points D0,E2, F2 and G2 added - targets on posts in shallow water

01-November-2012

Date of survey 1-Nov-12
Equipment Set 59
Surveyed by: AJW

References:
BELLS REVERSE
A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	difference from first survey			difference from last survey			
											Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)	
101A	886.746	1913.162	9.280	102.911	64.680	886.746	1913.163	9.278	102.911	64.679	-0	-1	-2	-0	-1	0	Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.413	1918.135	8.999	148.413	93.565	-4	-0	-2	-3	-0	-1	Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.781	1955.821	8.895	181.246	71.311	-2	-1	-0	-2	-1	1	Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.559	1976.750	9.148	219.979	74.797	-1	-1	-3	-1	-1	0	Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.982	1998.496	10.179	254.975	74.362	1	0	-0	-0	1	-0	Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.863	1888.116	11.983	169.180	147.557	-2	0	0	-1	0	0	Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.933	1928.457	10.428	171.753	98.559	0	0	-0	-0	0	-0	Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.499	10.437	175.250	96.153	-0	0	0	1	1	0	Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.239	12.358	268.173	53.291	1	-2	0	1	-1	0	Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.104	1946.441	15.331	259.633	143.755	1	1	-0	-0	1	-0	Target on Stobie
126	998.611	1936.271	12.111	205.551	114.807	998.612	1936.271	12.111	205.552	114.807	1	0	0	0	-0	1	Target on Building
A2	832.244	1911.482	9.331	58.760	32.679	832.243	1911.482	9.329	58.759	32.678	-1	-1	-2	-1	-1	-0	Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.621	1904.452	9.336	61.089	43.364	-3	-0	-5	-3	1	1	Dropper
A4	846.614	1897.654	9.180	61.674	52.408	846.614	1897.655	9.178	61.674	52.406	0	-2	-2	-1	-1	0	Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.082	1922.444	8.953	71.666	28.799	1	-1	-3	-2	-2	-1	Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.245	1918.487	9.334	72.540	34.475	-2	-1	-2	-3	0	-1	Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.659	1912.550	9.239	73.192	42.484	-2	-1	-0	-1	-0	-0	Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.757	1901.312	9.166	72.728	56.328	-0	-1	-1	-0	1	1	Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.651	1928.860	9.015	80.787	27.740	-0	-3	-2	-2	-3	0	Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.822	1925.843	9.302	82.242	32.678	-2	-1	-4	-2	1	-1	Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.247	1920.948	9.332	84.332	40.480	1	-1	-0	1	-0	1	Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.343	1908.892	9.287	89.695	59.862	-0	-2	-3	-0	-1	0	Dropper
D0	865.926	1931.057	9.523	97.382	37.789	865.923	1931.057	9.523	97.379	37.787	-3	-2	-0	-3	-2	-0	Target on post 4/10/12
D1	850.152	1932.867	8.980	86.007	26.710	850.152	1932.869	8.978	86.008	26.709	1	-1	-2	0	-0	-0	Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.031	9.134	88.811	31.198	0	-0	-2	-1	1	1	Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.699	1927.129	9.173	94.008	40.146	-0	-1	-3	-1	-2	-1	Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.098	1922.345	9.330	106.431	55.795	-2	0	-1	-2	0	1	Dropper
E1	882.481	1939.696	9.833	115.763	41.078	891.345	1939.711	9.838	115.765	41.061	3	-17	5	0	-9	2	Target on tree stump 6/9/12
E2	891.346	1938.320	9.229	121.935	47.588	901.322	1938.321	9.230	121.935	47.587	-0	-1	1	-0	-1	1	Target on post 4/10/12
E4	901.323	1926.794	9.200	122.781	62.809	901.322	1926.794	9.200	122.780	62.808	-2	-1	-0	-2	-1	1	Dropper
F1	899.260	1949.647	9.564	135.123	43.466	899.258	1949.660	9.560	135.130	43.454	7	-12	-5	1	-5	-1	Target on tree stump 6/9/12
F2	907.475	1945.731	9.446	139.229	51.588	907.473	1945.733	9.445	139.229	51.585	-0	-3	-1	-0	-3	-1	Target on post 4/10/12
F4	913.348	1934.873	9.116	137.235	63.770	913.346	1934.873	9.114	137.233	63.769	-2	-1	-2	-2	-1	0	Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.122	1943.599	9.038	152.678	64.678	-2	-2	-1	-1	-2	0	Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.708	1928.264	9.085	154.050	85.120	-1	1	-1	-2	1	-0	Dropper
G2	917.247	1962.010	9.426	156.916	44.684	917.244	1962.011	9.425	156.914	44.681	-2	-3	-1	-2	-3	-1	Target on post 4/10/12
G4	939.631	1952.588	8.864	168.864	65.827	939.631	1952.589	8.863	168.864	65.827	0	-0	-1	0	-0	0	Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.538	1979.127	8.851	179.482	40.492	1	3	0	1	2	1	Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.605	1973.583	8.974	180.100	47.977	-1	4	1	-3	2	2	Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.534	1968.718	9.083	181.025	54.841	-0	2	-2	-0	1	-1	Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.258	1962.337	8.833	182.443	64.001	0	1	-1	0	0	0	Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.878	1953.316	8.812	184.538	77.022	-1	-2	1	0	-2	0	Dropper

J4	961.605	1974.354	8.661	199.561	62.044	961.605	1974.353	8.663	199.561	62.044	-1	0	2	-2	-1	2	Dropper	
K1	953.782	1996.007	9.027	206.613	40.128	953.783	1996.007	9.026	206.614	40.129	1	1	-1	0	1	1	Dropper	
K2	958.332	1993.519	9.108	208.692	44.879	958.334	1993.518	9.108	208.693	44.881	1	2	-0	1	2	1	Dropper	
K3	964.074	1990.260	8.813	211.242	50.969	964.076	1990.261	8.813	211.244	50.970	2	1	0	-0	1	1	Dropper	
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.339	8.709	214.233	60.764	-1	1	-0	-1	1	2	Dropper	
K5	985.839	1970.468	9.041	216.358	79.939	985.838	1970.466	9.040	216.357	79.940	-1	1	-1	0	-1	-0	Dropper	
L1	961.505	2010.139	8.949	221.366	33.670	961.508	2010.138	8.949	221.368	33.672	2	2	-0	2	2	1	Dropper	
L2	967.841	2003.648	9.209	222.410	42.680	967.841	2003.649	9.208	222.410	42.680	0	-0	-1	0	-1	-0	Dropper	
L3	973.597	1997.556	8.982	223.238	51.020	973.596	1997.558	8.981	223.239	51.019	1	-2	-1	1	-2	1	Dropper	
L4	979.165	1990.336	9.018	223.229	60.138	979.166	1990.335	9.018	223.229	60.139	0	1	-0	0	0	1	Dropper	
M1	969.861	2011.070	9.009	228.547	38.042	969.860	2011.072	9.009	228.547	38.041	0	-1	-0	1	1	1	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.453	2007.550	9.288	228.445	42.413	1	-2	-1	1	-1	0	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.951	2000.942	9.067	228.754	51.004	2	1	-0	2	1	1	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.253	1994.721	9.143	229.936	59.780	1	0	-1	0	0	-0	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.743	2015.824	9.135	236.108	37.879	1	2	-1	1	2	1	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.562	2011.632	9.392	235.775	42.919	1	2	-1	1	2	0	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.054	2005.799	9.176	236.553	50.893	-1	2	-1	-1	0	-0	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.310	1999.882	9.319	237.884	59.400	2	0	-1	1	-1	-1	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.600	2020.433	9.105	243.561	37.814	1	0	-1	1	0	-0	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.100	2016.679	9.518	244.034	42.924	1	1	-1	1	2	-0	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.526	2010.573	9.413	244.593	51.074	1	1	-2	2	1	-1	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.118	2004.820	9.433	245.499	59.046	1	2	5	1	1	-0	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.633	2025.715	9.224	249.982	36.101	1	2	-2	0	3	-0	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.211	2022.142	9.290	250.628	41.116	1	1	-2	2	2	-2	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.646	2017.249	9.693	251.936	48.312	3	1	-0	3	2	-0	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.668	2010.366	9.774	254.074	58.663	0	2	0	0	2	0	Dropper	
											Max	7	4	5	3	3	2	
											Min	-4	-17	-5	-3	-9	-2	
											Average	0	-0	-1	-0	-0	0	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm

6/09/2012

New control point 126 added
New monitoring points E1 and F1 added on tree stumps in water
Tree stumps are not very stable additional more stable points to be added

4/10/2012

New monitoring points D0,E2, F2 and G2 added - targets on posts in shallow water

06-December-2012

Date of survey 6-Dec-12
Equipment Set 59
Surveyed by: AJW

References:
BELLS REVERSE
A&S: A078911.0006

Point	First Survey 16 April 2012					Current Survey					Current Survey Comparisons						Point Description	
	Easting	Northing	Elevation	Chainage	Offset	Easting	Northing	Elevation	Chainage	Offset	difference from first survey			difference from last survey				
											Upstream (mm)	Cross (mm)	Up (mm)	Upstream (mm)	Cross (mm)	Up (mm)		
101A	886.746	1913.162	9.280	102.911	64.680													Dropper
102A	940.416	1918.137	9.001	148.417	93.565	940.412	1918.136	8.999	148.413	93.564	-4	-1	-2	-0	-1	0		Dropper
103A	952.783	1955.822	8.895	181.248	71.312	952.782	1955.820	8.895	181.246	71.313	-2	1	0	-0	1	1		Dropper
104A	985.560	1976.750	9.151	219.980	74.798	985.559	1976.750	9.148	219.979	74.798	-1	-1	-3	0	1	-1		Drillhole in rock
105A	1012.981	1998.496	10.179	254.974	74.362	1012.981	1998.495	10.178	254.974	74.362	-0	0	-1	-1	0	-0		Dropper
121	989.864	1888.117	11.983	169.182	147.557	989.861	1888.114	11.983	169.178	147.558	-4	1	0	-2	0	0		Target on Stobie
122	961.933	1928.457	10.428	171.752	98.559	961.932	1928.456	10.428	171.751	98.559	-1	-0	-0	-2	-0	0		Target on Building
123	963.229	1932.499	10.437	175.250	96.153	963.229	1932.499	10.437	175.250	96.153	-0	0	0	-0	0	0		Target on Building
124	1010.539	2023.237	12.358	268.172	53.293	1010.539	2023.237	12.358	268.173	53.293	0	-0	0	-1	2	0		Target on Stobie
125	1059.103	1946.441	15.331	259.632	143.754	1059.104	1946.440	15.331	259.632	143.755	-0	1	-0	-1	0	0		Target on Stobie
126	998.611	1936.271	12.111	205.551	114.807	998.612	1936.271	12.111	205.552	114.807	1	0	0	-0	0	0		Target on Building
A2	832.244	1911.482	9.331	58.760	32.679	832.243	1911.484	9.330	58.761	32.676	1	-3	-1	2	-2	1		Dropper
A3	840.624	1904.454	9.341	61.092	43.364	840.622	1904.457	9.336	61.094	43.361	2	-3	-5	4	-3	-0		Dropper
A4	846.614	1897.654	9.180	61.674	52.408													Dropper
B1	840.082	1922.443	8.956	71.665	28.800	840.081	1922.447	8.954	71.667	28.796	2	-4	-2	1	-3	1		Dropper
B2	844.247	1918.488	9.336	72.542	34.476	844.246	1918.491	9.335	72.543	34.473	1	-3	-1	3	-2	1		Dropper
B3	849.661	1912.550	9.239	73.194	42.485	849.659	1912.553	9.239	73.194	42.482	-0	-4	-0	2	-2	-0		Dropper
B4	857.758	1901.312	9.167	72.728	56.328	857.756	1901.315	9.166	72.728	56.324	0	-4	-1	1	-3	0		Dropper
C1	846.653	1928.858	9.017	80.787	27.743	846.654	1928.865	9.015	80.792	27.738	5	-5	-2	5	-2	-0		Dropper
C2	850.825	1925.843	9.306	82.244	32.679	850.822	1925.845	9.301	82.244	32.676	-0	-3	-5	2	-2	-1		Dropper
C3	857.247	1920.946	9.332	84.331	40.481	857.246	1920.949	9.331	84.332	40.478	1	-3	-1	0	-2	-1		Dropper
C4	873.344	1908.891	9.290	89.695	59.864	873.343	1908.894	9.287	89.696	59.860	1	-4	-3	1	-2	0		Dropper
D0	865.926	1931.057	9.523	97.382	37.789	865.925	1931.060	9.523	97.382	37.785	-0	-4	0	3	-2	0		Target on post 4/10/12
D1	850.152	1932.867	8.980	86.007	26.710	850.151	1932.870	8.978	86.009	26.707	1	-3	-2	0	-1	0		Dropper
D2	855.115	1931.031	9.136	88.811	31.198	855.115	1931.034	9.134	88.813	31.196	2	-3	-2	2	-2	0		Dropper
D3	864.700	1927.128	9.176	94.008	40.147	864.699	1927.130	9.174	94.008	40.145	0	-2	-2	1	-1	1		Dropper
D4	884.100	1922.346	9.331	106.433	55.795	884.099	1922.347	9.330	106.433	55.794	-1	-1	-1	1	-2	-0		Dropper
E1	882.481	1939.696	9.833	115.763	41.078	891.345	1939.714	9.839	115.766	41.057	3	-21	5	0	-4	1		Target on tree stump 6/9/12
E2	891.346	1938.320	9.229	121.935	47.588													Target on post 4/10/12
E4	901.323	1926.794	9.200	122.781	62.809	901.322	1926.795	9.200	122.780	62.807	-1	-2	-0	0	-0	0		Dropper
F1	899.260	1949.647	9.564	135.123	43.466	899.265	1949.663	9.558	135.138	43.456	15	-10	-7	8	2	-2		Target on tree stump 6/9/12
F2	907.475	1945.731	9.446	139.229	51.588	907.476	1945.733	9.446	139.230	51.587	1	-1	0	2	1	1		Target on post 4/10/12
F4	913.348	1934.873	9.116	137.235	63.770	913.346	1934.872	9.114	137.233	63.770	-2	-0	-2	0	1	0		Dropper
F5	926.124	1943.598	9.039	152.680	64.680	926.122	1943.599	9.039	152.678	64.678	-2	-2	-0	0	0	1		Dropper
F6	939.708	1928.266	9.086	154.051	85.119	939.708	1928.266	9.086	154.051	85.118	0	-1	-0	1	-2	1		Dropper
G2	917.247	1962.010	9.426	156.916	44.684	917.244	1962.011	9.427	156.914	44.681	-2	-3	1	0	-0	2		Target on post 4/10/12
G4	939.631	1952.588	8.864	168.864	65.827	939.630	1952.589	8.864	168.864	65.826	0	-1	-0	-0	-1	1		Dropper
H1	932.536	1979.128	8.851	179.481	40.489	932.536	1979.129	8.851	179.481	40.489	0	0	-0	-0	-3	-0		Dropper
H2	937.603	1973.586	8.973	180.101	47.973	937.605	1973.585	8.973	180.102	47.975	1	2	-0	2	-2	-1		Dropper
H3	942.533	1968.719	9.085	181.025	54.839	942.534	1968.719	9.085	181.026	54.840		1	0	1	-1	2		Dropper
H4	949.257	1962.338	8.834	182.443	64.000	949.259	1962.339	8.834	182.445	64.000	2	-0	0	2	-1	1		Dropper
H5	958.880	1953.315	8.811	184.539	77.024	958.878	1953.317	8.813	184.538	77.022	-1	-2	2	0	-0	0		Dropper

J4	961.605	1974.354	8.661	199.561	62.044	961.606	1974.353	8.664	199.561	62.045	-0	1	3	0	1	2	Dropper	
K1	953.782	1996.007	9.027	206.613	40.128	953.783	1996.009	9.027	206.615	40.127	2	-1	0	1	-1	1	Dropper	
K2	958.332	1993.519	9.108	208.692	44.879	958.335	1993.521	9.108	208.695	44.879	3	0	0	2	-2	0	Dropper	
K3	964.074	1990.260	8.813	211.242	50.969	964.076	1990.261	8.813	211.244	50.970	2	1	0	1	0	0	Dropper	
K4	972.430	1984.340	8.709	214.233	60.763	972.430	1984.341	8.709	214.234	60.762	1	-1	0	1	-2	0	Dropper	
K5	985.839	1970.468	9.041	216.358	79.939	985.838	1970.467	9.041	216.357	79.939	-1	0	-0	-0	-0	1	Dropper	
L1	961.505	2010.139	8.949	221.366	33.670	961.507	2010.139	8.948	221.368	33.671	2	1	-1	-0	-1	-0	Dropper	
L2	967.841	2003.648	9.209	222.410	42.680	967.842	2003.649	9.209	222.411	42.680	1	-0	-0	1	0	1	Dropper	
L3	973.597	1997.556	8.982	223.238	51.020	973.599	1997.555	8.981	223.239	51.022	1	2	-1	0	3	0	Dropper	
L4	979.165	1990.336	9.018	223.229	60.138	979.167	1990.337	9.019	223.230	60.138	1	0	0	1	-1	1	Dropper	
M1	969.861	2011.070	9.009	228.547	38.042	969.862	2011.072	9.009	228.549	38.042	2	0	0	2	2	0	Dropper	
M2	972.453	2007.548	9.289	228.444	42.415	972.455	2007.550	9.289	228.446	42.414	2	-1	-0	2	1	1	Dropper	
M3	977.949	2000.941	9.067	228.752	51.003	977.951	2000.943	9.067	228.755	51.004	3	1	-0	1	-0	-0	Dropper	
M4	984.253	1994.720	9.144	229.935	59.780	984.254	1994.720	9.143	229.937	59.781	1	1	-1	0	1	0	Dropper	
N1	975.741	2015.824	9.136	236.107	37.877	975.742	2015.826	9.134	236.108	37.877	1	-0	-2	0	-2	-0	Dropper	
N2	978.560	2011.633	9.393	235.774	42.917	978.562	2011.633	9.393	235.775	42.919	1	2	-1	0	-1	0	Dropper	
N3	984.053	2005.802	9.177	236.554	50.890	984.054	2005.802	9.176	236.555	50.891	1	1	-1	2	-1	0	Dropper	
N4	990.308	1999.881	9.319	237.882	59.400	990.311	1999.881	9.319	237.885	59.402	3	2	0	0	2	1	Dropper	
P1	981.599	2020.432	9.106	243.560	37.814	981.600	2020.432	9.105	243.560	37.814	0	0	-1	-1	0	0	Dropper	
P2	985.098	2016.680	9.519	244.033	42.923	985.101	2016.678	9.518	244.034	42.926	1	3	-1	0	2	0	Dropper	
P3	990.524	2010.573	9.415	244.592	51.073	990.526	2010.572	9.414	244.593	51.075	1	2	-1	-0	1	0	Dropper	
P4	996.116	2004.820	9.428	245.498	59.044	996.117	2004.818	9.432	245.498	59.046	0	2	4	-1	1	-0	Dropper	
Q1	985.631	2025.716	9.226	249.981	36.099	985.632	2025.715	9.224	249.981	36.101	0	2	-2	-1	-0	0	Dropper	
Q2	989.209	2022.142	9.291	250.626	41.115	989.210	2022.141	9.291	250.627	41.117	0	2	-0	-1	1	1	Dropper	
Q3	994.643	2017.247	9.693	251.933	48.311	994.645	2017.248	9.693	251.934	48.312	1	1	0	-2	0	0	Dropper	
Q4	1002.667	2010.368	9.774	254.074	58.661	1002.668	2010.367	9.774	254.074	58.663	0	2	0	0	-0	0	Dropper	
											Max	15	3	5	8	3	2	
											Min	-4	-21	-7	-2	-4	-2	
											Average	1	-1	-1	1	-1	0	

Notes:

Max, Min & Average values are for monitoring droppers only
 Coordinates are calculated from least squares adjustment.
 Chainage & offset is relative to line approximately parallel to river bank
 Origin of Chainage & Offset Alignment: E 765.768, N 1 901.403
 End of Chainage & Offset Alignment: E 1 003.130, N 2 084.867
 Cross movement is positive away from the river bank in a south easterly direction
 Upstream movement is positive in an upstream (north easterly) direction
 Movement shown is relative to first survey 16 April 2012
 Design co-ordinate accuracy is +/- 3mm
 Design elevation accuracy is +/- 2mm

6/09/2012

New control point 126 added
New monitoring points E1 and F1 added on tree stumps in water
Tree stumps are not very stable additional more stable points to be added

4/10/2012

New monitoring points D0,E2, F2 and G2 added - targets on posts in shallow water

6/12/2012

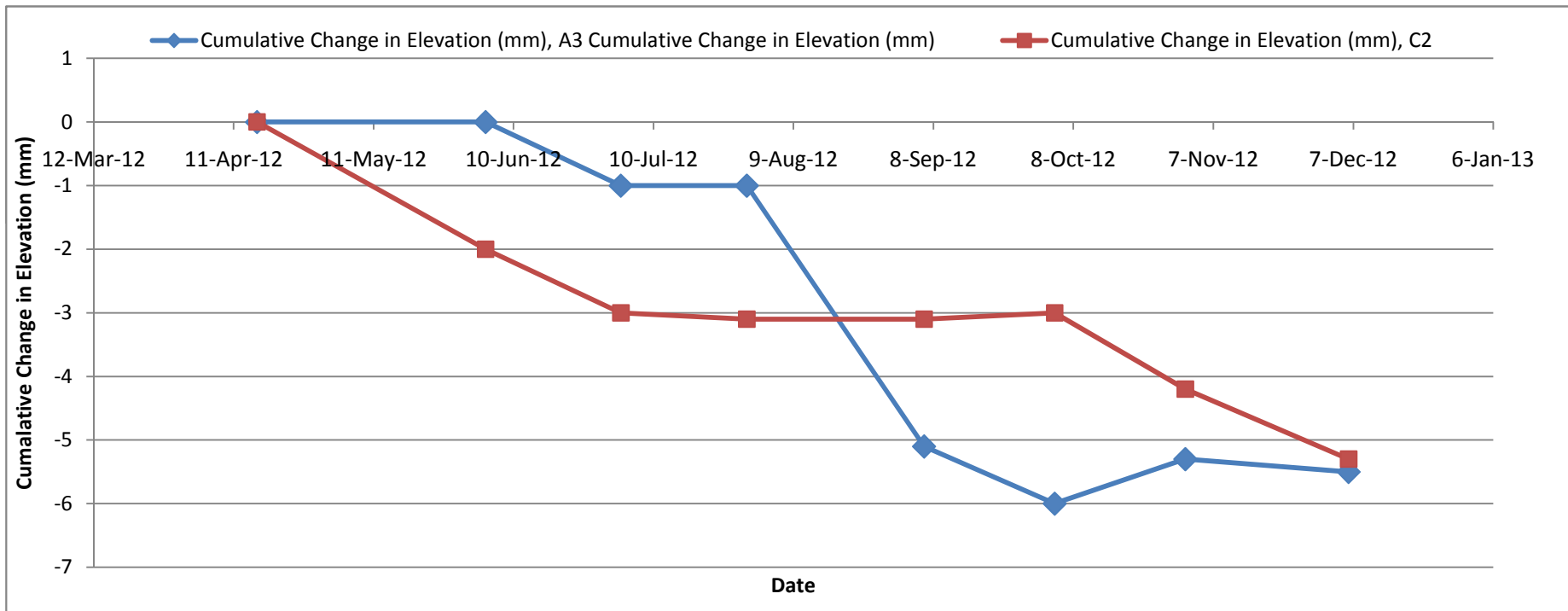
101A, A4 & E2 not observed due grass/foliage growth



Appendix B Analysis of Cumulative Vertical Movement

A3	Cumulative Change in Elevation (mm)	Change in Elevation (mm)
Date		
16-Apr-12	0	0
4-Jun-12	0	0
3-Jul-12	-1	-1
30-Jul-12	-1	0
6-Sep-12	-5	-4
4-Oct-12	-6	-1
1-Nov-12	-5	1
6-Dec-12	-5	0

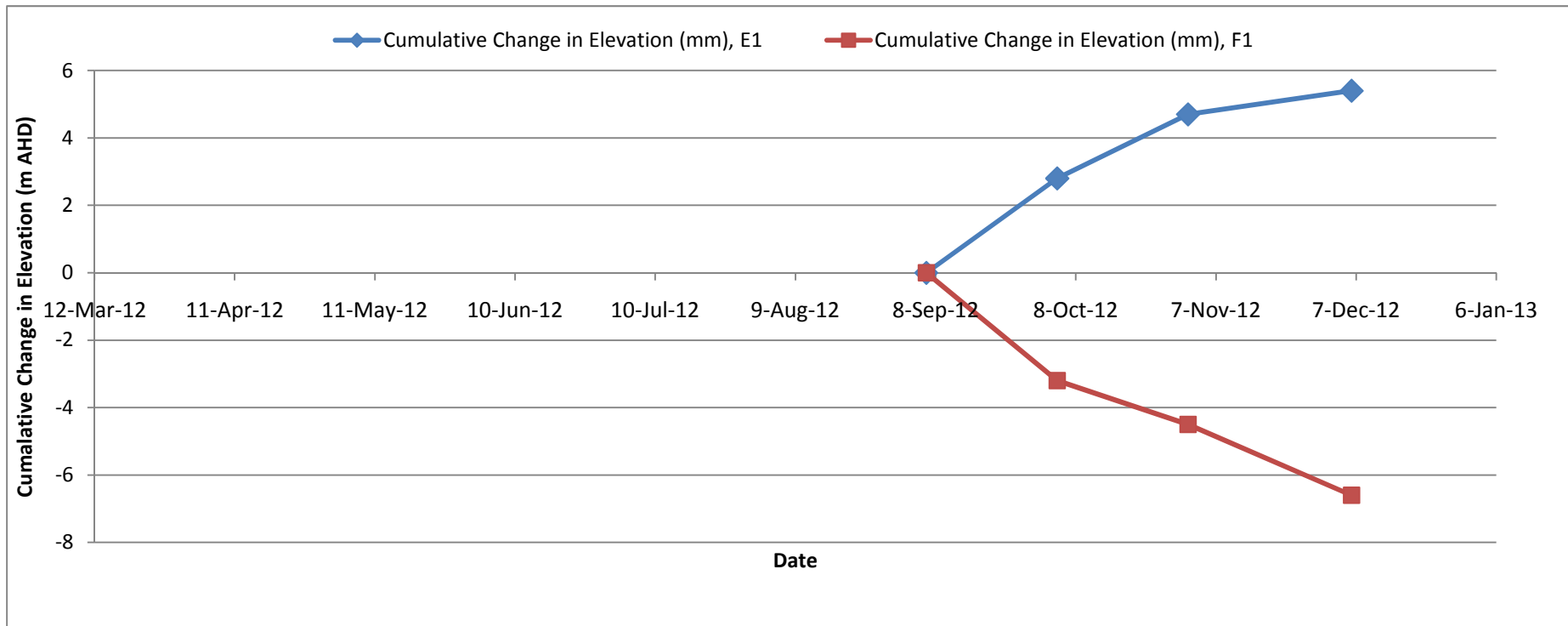
C2	Cumulative Change in Elevation (mm)	Change in Elevation (mm)
Date		
16-Apr-12	0	0
4-Jun-12	-2	-2
3-Jul-12	-3	-1
30-Jul-12	-3	0
6-Sep-12	-3	0
4-Oct-12	-3	0
1-Nov-12	-4	-1
6-Dec-12	-5	-1



SECTION 1 - ANALYSIS OF CUMULATIVE VERTICAL MOVEMENTS, WORST CASE

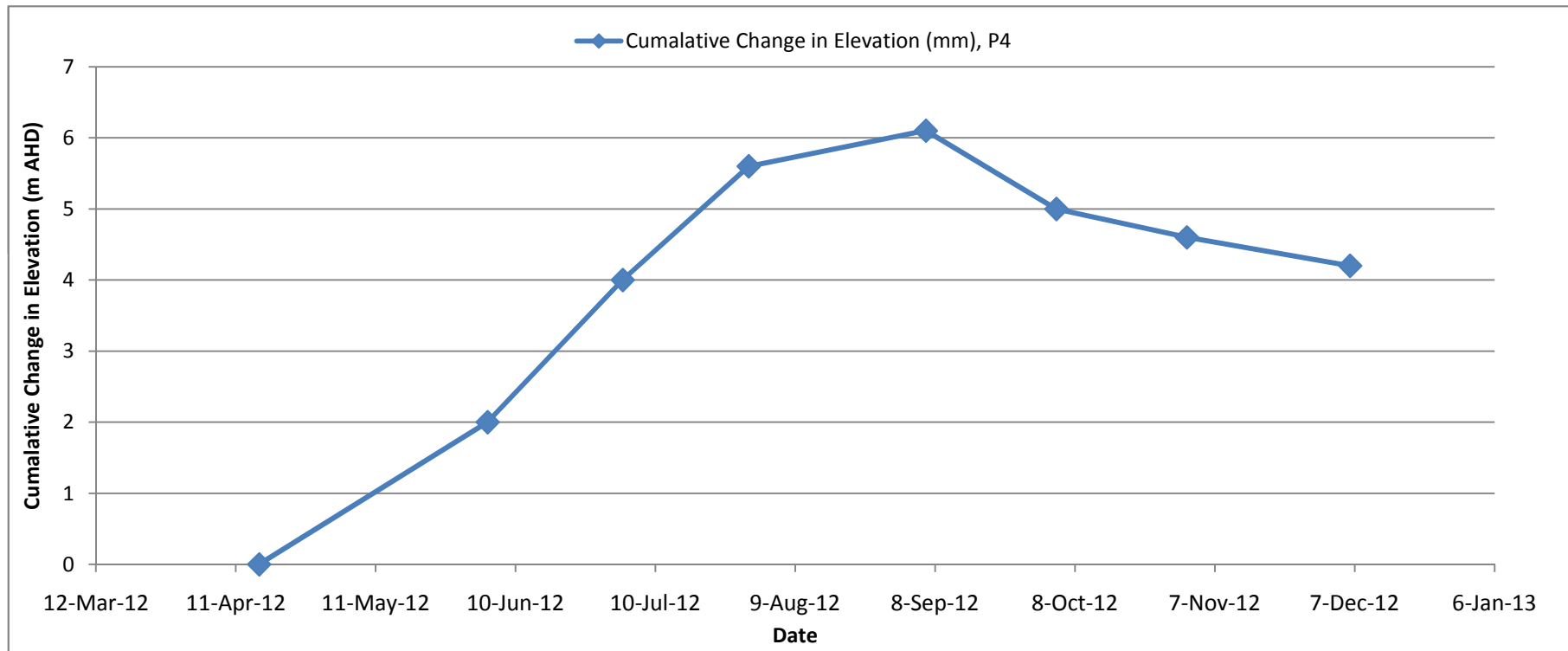
E1	Cumulative Change in Elevation (mm)	Change in Elevation (mm)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	3	3
1-Nov-12	5	2
6-Dec-12	5	1

F1	Cumulative Change in Elevation (mm)	Change in Elevation (mm)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	-3	-3
1-Nov-12	-5	-1
6-Dec-12	-7	-2



SECTION 2 - ANALYSIS OF CUMULATIVE VERTICAL MOVEMENTS, WORST CASE

P4	Cumalative Change in Elevation (mm)	Change in Elevation (mm)
Date		
16-Apr-12	0	0
4-Jun-12	2	2
3-Jul-12	4	2
30-Jul-12	6	2
6-Sep-12	6	1
4-Oct-12	5	-1
1-Nov-12	5	0
6-Dec-12	4	0



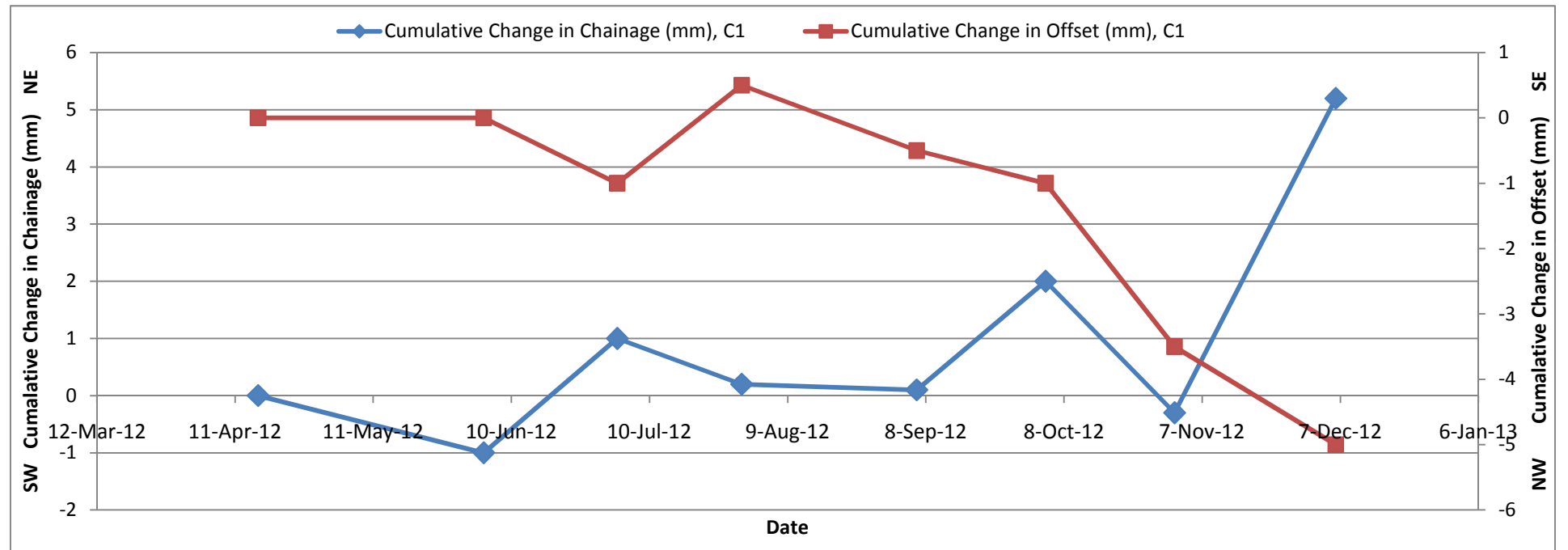
SECTION 3 - ANALYSIS OF CUMULATIVE VERTICAL MOVEMENTS, WORST CASE



Appendix C Analysis of Cumulative Lateral Movement

C1	Cumulative Change in Chainage (mm)	Change in Chainage (mm)
Date		
16-Apr-12	0	0
4-Jun-12	-1	-1
3-Jul-12	1	2
30-Jul-12	0	-1
6-Sep-12	0	0
4-Oct-12	2	2
1-Nov-12	0	-2
6-Dec-12	5	5

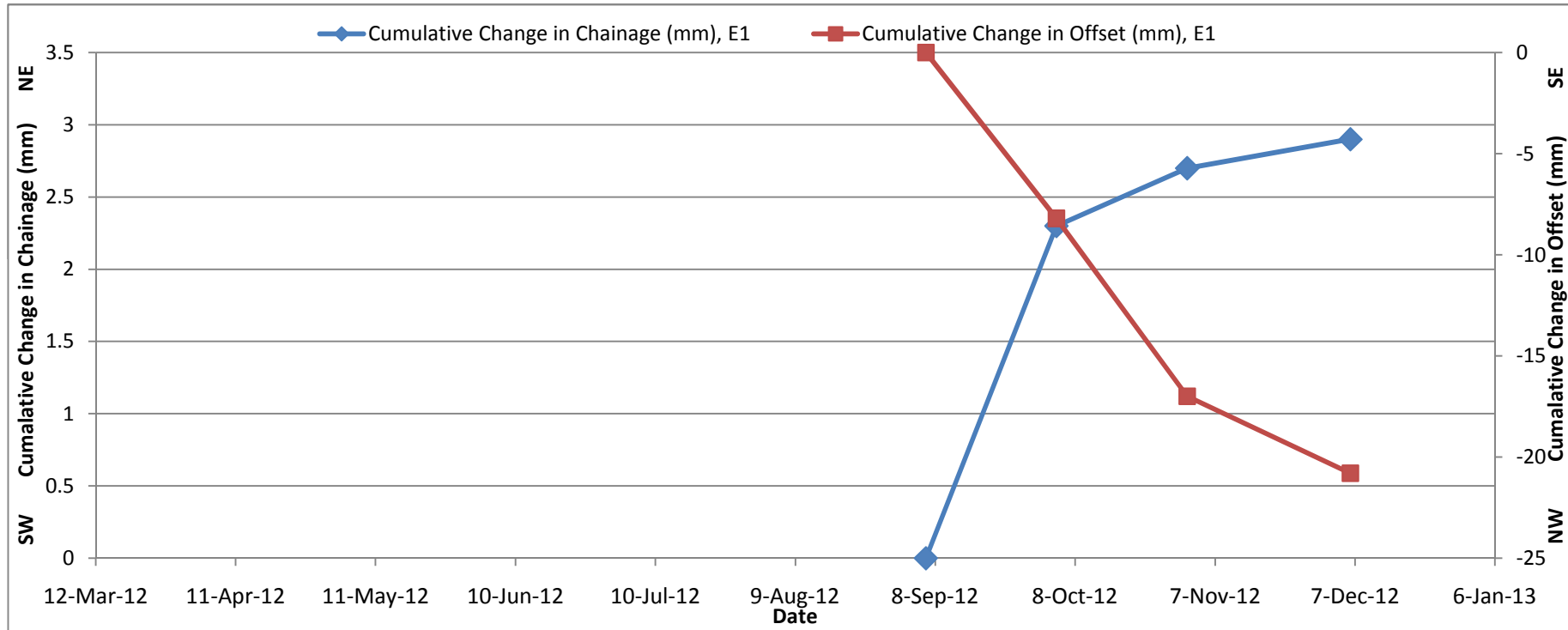
C1	Cumulative Change in Offset (mm)	Change in Chainage (mm)
Date		
16-Apr-12	0	0
4-Jun-12	0	0
3-Jul-12	-1	-1
30-Jul-12	1	2
6-Sep-12	0	-1
4-Oct-12	-1	0
1-Nov-12	-3	-3
6-Dec-12	-5	-2



SECTION 1 - ANALYSIS OF CUMULATIVE LATERAL MOVEMENTS, WORST CASE

E1	Cumulative Change in Chainage (mm)	Change in Chainage (mm)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	2	2
1-Nov-12	3	0
6-Dec-12	3	0

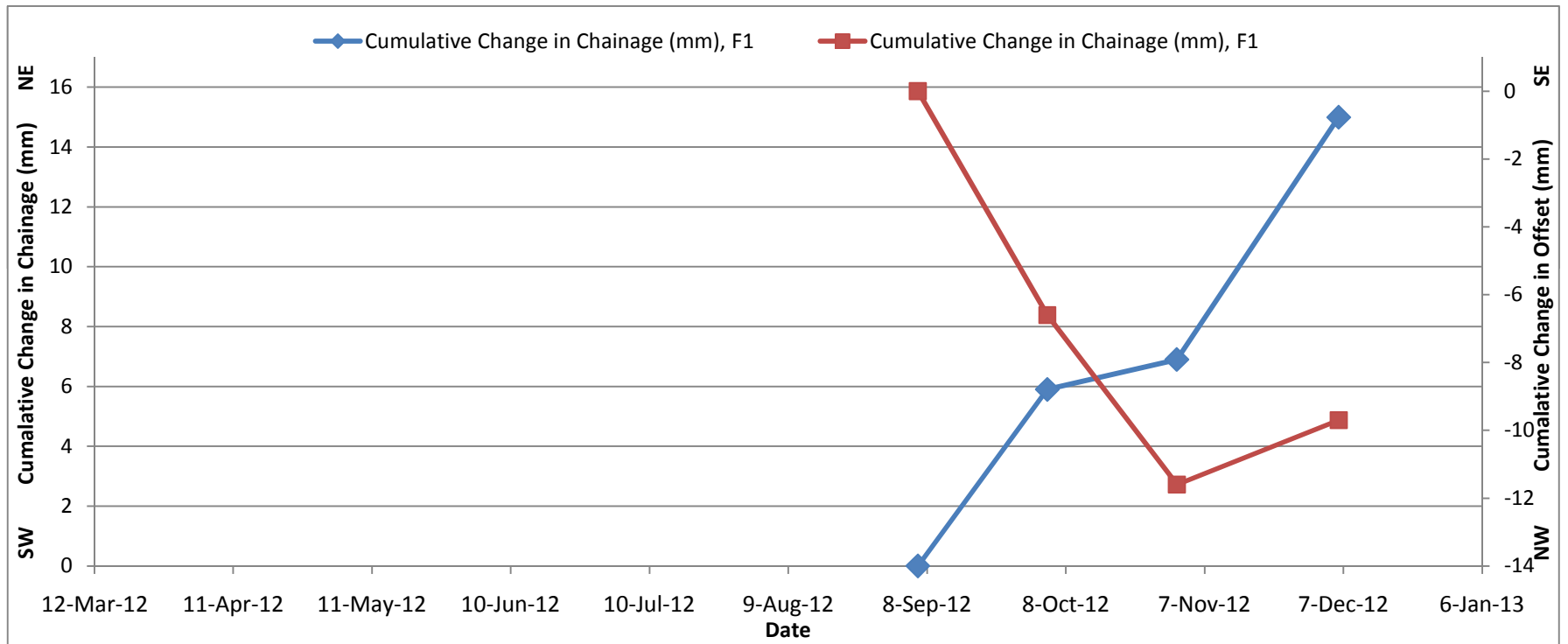
E1	Cumulative Change in Offset (mm)	Change in Chainage (mm)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	-8	-8
1-Nov-12	-17	-9
6-Dec-12	-21	-4



SECTION 2 - ANALYSIS OF CUMULATIVE LATERAL MOVEMENTS, WORST CASE (E1)

F1	Cumulative Change in Chainage (mm)	Change in Chainage (mm)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	6	6
1-Nov-12	7	1
6-Dec-12	15	8

F1	Cumulative Change in Chainage (mm)	Change in Offset (mm AHD)
Date		
16-Apr-12	No data	No data
4-Jun-12	No data	No data
3-Jul-12	No data	No data
30-Jul-12	No data	No data
6-Sep-12	No data	No data
4-Oct-12	-7	-7
1-Nov-12	-12	-5
6-Dec-12	-10	2



SECTION 2 - ANALYSIS OF CUMULATIVE LATERAL MOVEMENTS, WORST CASE (F1)