Contractor

Forth Crossing Bridge Constructors

HOCHTIEF Solutions
American Bridge International
DRAGADOS
Morrison Construction

Project

FORTH REPLACEMENT CROSSING

Document title

AIR QUALITY MONITORING REPORT DECEMBER 2013

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Contents

1. INTRODUCTION

1.1. Air quality monitoring is being undertaken by FCBC during the construction of the Forth Replacement Crossing and the associated road network. This report details the air quality monitoring that is currently being undertaken across the site and presents the monitoring results for December 2013.

1.2. Air quality monitoring during this period has been undertaken in accordance with the Code of Construction Practice (CoCP) and the Dust and Air Pollution Management Plan (DAPMP) contained within the Environmental Management Plan (EMP).

2. MONITORING EQUIPMENT AND LOCATIONS

2.1. Air quality is being monitored on site using both automatic light scatter dust meters and Frisbee gauge dust deposition monitoring. Thirteen Frisbee gauges are set up at sensitive locations across the site to measure dust deposition rates (Figure 1). Seven automatic light scatter meters have also been installed at various sensitive locations to measure real time particulate matter (PM_{10}) concentrations and the Total Suspended Particle (TSP) concentrations (Figure 2). These meters are calibrated annually. Table 1 lists the air quality monitoring equipment present at each monitoring location. The installation of the air quality monitoring equipment was not simultaneous across the site, thus installation dates are also given in Table 1.

2.2. Light scatter type monitoring equipment have been selected as a site monitoring tool to create a live network which assesses the levels of fugitive particulate matter, principally airborne dust. These monitors require less space, maintenance and power than other real time monitors such as a Tapered Element Oscillating Microbalance (TEOM) which is used and designed to measure particulate levels to exceedingly high standards, including measuring long-term compliance to statutory limits. Light scatter meters are more practicable to deploy. However, the meters do generally record levels higher than those measured by the TEOM. The meters can also be affected by atmospheric moisture content which further increases reported levels. Accordingly, any elevations of statutory limits should be treated as precautionary exceedances. The monitors are reliable for on-site monitoring and the establishment of action thresholds to ensure unforeseen activities generating significant dust are identified and suitably controlled. Light scatter meters are becoming the construction and waste industries norm for particulate dust monitoring.

2.3. In association with air quality monitoring across the site, weather conditions (temperature and relative humidity) are also continually measured by the light scatter meters at Inchgarvie Lodge and Clufflat Brae. Weather stations, located at the sound level meters at Echline and Linn Mill which are adjacent to the light

scatter meters at these monitoring locations, also continually record weather data, including temperature, relative humidity, wind speed and wind direction.

2.4. In addition to the fixed monitoring equipment used at sensitive locations across the site, a daily dust log for both the North and South sites has been kept by the FCBC Environmental Department. This daily dust inspection is used to identify any dust occurring as a result of construction works and any actions required. This log also records the weather conditions at the time of the inspection.

2.5. Frequent environmental site inspections are also undertaken by members of the FCBC Environmental Department. These inspections include a dust check to assess the following:

- dust levels on site;
- suppression/dampening down; and
- transportation of materials.

In relation to these inspections, the FCBC Environmental Department hold an environmental actions register where any environmental issues, including those relating to air quality, can be noted and closed out appropriately.

Figure 1: Example of an Installed Frisbee Gauge Meter

Figure 2: Example of an installed Automatic Light Scatter Dust Meter

Table 1: Air Quality Monitoring Locations

Ref:	Monitoring Location	Monitoring Equipment	Installation Date	Construction Activities in December
M1	Whinny Hill	Frisbee	21/03/12	• Drainage, kerbing and placing of type 1 at Castlandhill Road
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	• Marine works • Society Road planting • Concreting, fixing rebar and installation of tie beam at S7/S8
M8	Barracks West	Frisbee	31/08/11	• Marine works • Society Road works • Concreting, fixing rebar and installation of tie beam at S7/S8 • Access to S5 causeway • Preparation of rebar prefabrication area at S5 causeway • Fixing rebar at S6
M9	Barracks East	Frisbee	31/08/11	
M10	Inchgarvie Lodge	Frisbee	22/08/11	• Launch – delivery and assembly of steel sections • South abutment –launch of west section • Concreting, fixing rebar and installation of tie beam at S7/S8 • Society Road planting
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	• Launch – delivery and assembly of steel sections • South abutment –launch of west section • Concreting, fixing rebar and installation of tie beam at S7/S8
		Automatic light scatter meter	06/12/11	
M12	Clufflat	Frisbee	29/08/11	• South abutment – launch of west section • Concreting, fixing rebar and installation of tie beam at S7/S8 • Society Road planting
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	• South abutment – launch of west section • Concreting, fixing rebar and installation of tie beam at S7/S8

M15	Echline	Frisbee	16/08/11	• Launch – delivery and assembly of steel sections • South abutment – launch of west section • Echline cut – ripping rock and crushing • Gyratory – rebar works and concreting • A904 tie in road works, including drainage works and placing of type 1 to west
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	• Utilities works • Structure works
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	• Utility works
		Automatic light scatter meter	23/02/12	
M18	Newton	Frisbee	22/08/11	• None
		TEOM	23/05/12	

3. AIR QUALITY MONITORING RESULTS

3.1. Automatic Light Scatter Dust Meter Monitoring Results

3.1.1. Light scatter results for December 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM_{10} levels were below threshold levels throughout December and generally followed the same pattern across the site. It should be noted that no works were undertaken over the Christmas period (21 December 2013 to 6 January 2014).

3.1.2. The PM_{10} results have also been compared to the daily mean results obtained from the TEOM air quality monitoring stations located in Newton, Rosyth, and Broxburn, and from the TEOM FDMS stations located at Queensferry Road, Edinburgh and St Leonards, Edinburgh (an urban background site). The TEOM at Newton was installed by West Lothian Council, facilitated by FCBC, during May 2012. The comparison between the light scatter and TEOM results demonstrates that both sets of results generally follow the same pattern at similar levels, indicating that the pattern observed throughout December was largely driven by regional changes in air quality. One deviation from the

observed pattern can be noted on 4 December at three locations (Clufflat Brae, Linn Mill and Whinny Hill). However, it should be noted that stormy conditions were prevalent on this date and no exceedances of the site threshold were observed.

3.2. Total Suspended Particles

3.2.1. The TSP results for December 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during November were found to be low and all within the threshold level. All locations were mostly found to follow a similar pattern across the site, demonstrating that, in general, the levels were influenced by regional changes in TSP levels, rather than construction works.

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for December 2013 have been presented in charts and can be found in Appendix C. To present results, all the monitoring locations have been grouped, based on locality, into the following:

- ***Group 1:*** M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill;
- ***Group 2:*** M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline;
- ***Group 3:*** M16 Scotstoun Park and M17 Dundas Home Farm;
- ***Group 4:*** M18 Newton; and
- ***Group 5:*** M1 Whinny Hill.

3.3.2. Frisbee dust deposition results were collected fortnightly, and the results averaged over this fortnight period to give a daily dust deposition rate. One collection was made in December, on the 11th. Due to the festive period no collection was made on the 25th. The next collection will take place on the 8th January 2014.

3.3.3. The site action level for the dust deposition rate has been set at 250 mg/m^2/day. Exceedances of this level are treated as a potential incident and a formal review of the works in the vicinity of the site is instigated. A lower, site

review level has been set at 140 mg/m^2/day. Where concentrations exceed the lower action threshold the site works are reviewed to ensure good practice is implemented; it is essentially a warning that additional controls may be required.

3.3.4. During December there were two exceedances of the site review level (see Table 4). There was one exceedance of the site action level. With the exception of the locations where exceedances occurred, Frisbee results from monitoring locations across site were generally found to be low.

Table 4: Exceedances of the dust deposition thresholds

Fortnight ending	Threshold Exceeded	Monitoring Location	Considerations	Weather conditions during period
11/12/13	Action	Newton	Frisbee gauge found knocked over upon collection	High winds/ Generally damp
	Review	Springfield	Frisbee gauge found knocked over upon collection	
	Review	Echline	Adverse weather likely responsible. Some works in area.	

3.3.5. For each of the exceedances of the review level, a review of the works in each of the areas, weather conditions, and the mitigation measures in place was undertaken. Other considerations were also made, such as where the gauge is located. Where available, the Frisbee results were also considered alongside the particulate matter data for the same period; particulate matter levels were low and within the threshold levels.

3.3.6. With regard to the exceedances at Newton and Springfield, these are not thought to be related to construction works. On collection of the gauges they were found to have been knocked or blown over by strong winds during the period. It is likely, therefore, that this influenced the results at this location, due to contamination of the sample, and therefore no further investigations were deemed necessary.

3.3.7. The exceedance of the review level at Echline initiated a further review into dust levels at this location, with factors such as the location of the gauge, any works undertaken and the weather conditions taken into account. Whilst this gauge is located close to an area where ripping work was on-going (a distance of around 250 metres), an additional Frisbee was located closer to these works (a distance of around 100 metres) between 05/12/13 and 12/12/13 (Figure 3). This additional gauge was positioned to the south of the A904 with the intention of monitoring dust from operations more closely. The results from this additional Frisbee showed no exceedance of the threshold during the monitoring period (results were 97 mg/m^2/day). No other works with the potential to give rise to dust were on-going in this area during the period and it should also be noted that no exceedances of particulate matter were noted during this period.

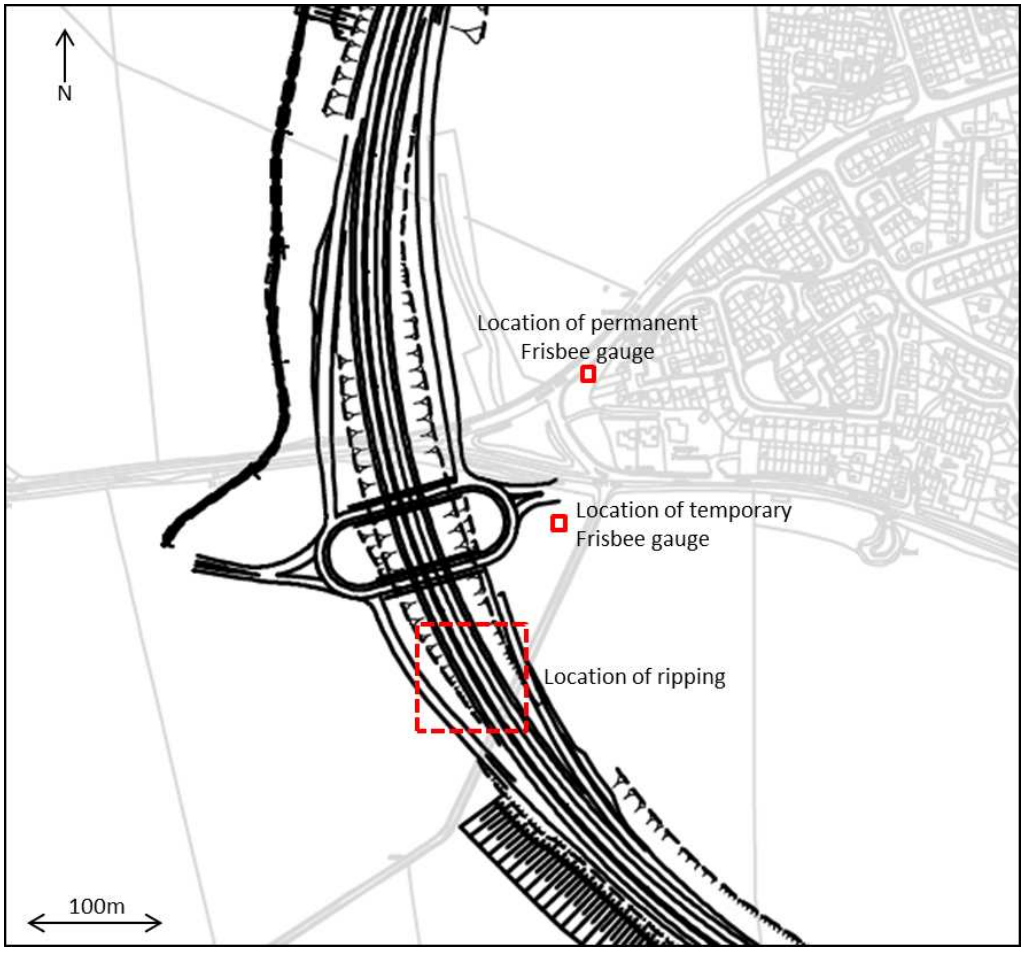


Figure 3: Location of temporary Frisbee, ripping works and permanent Frisbee

3.3.8. It is possible, therefore, that adverse weather conditions during this period impacted the results at Echline; strong winds may have mobilised particles from surrounding vegetation and roads, increasing the Frisbee gauge deposition results. It should also be noted that ground conditions on site were wet or damp throughout the period in which the exceedance of the review level threshold occurred.

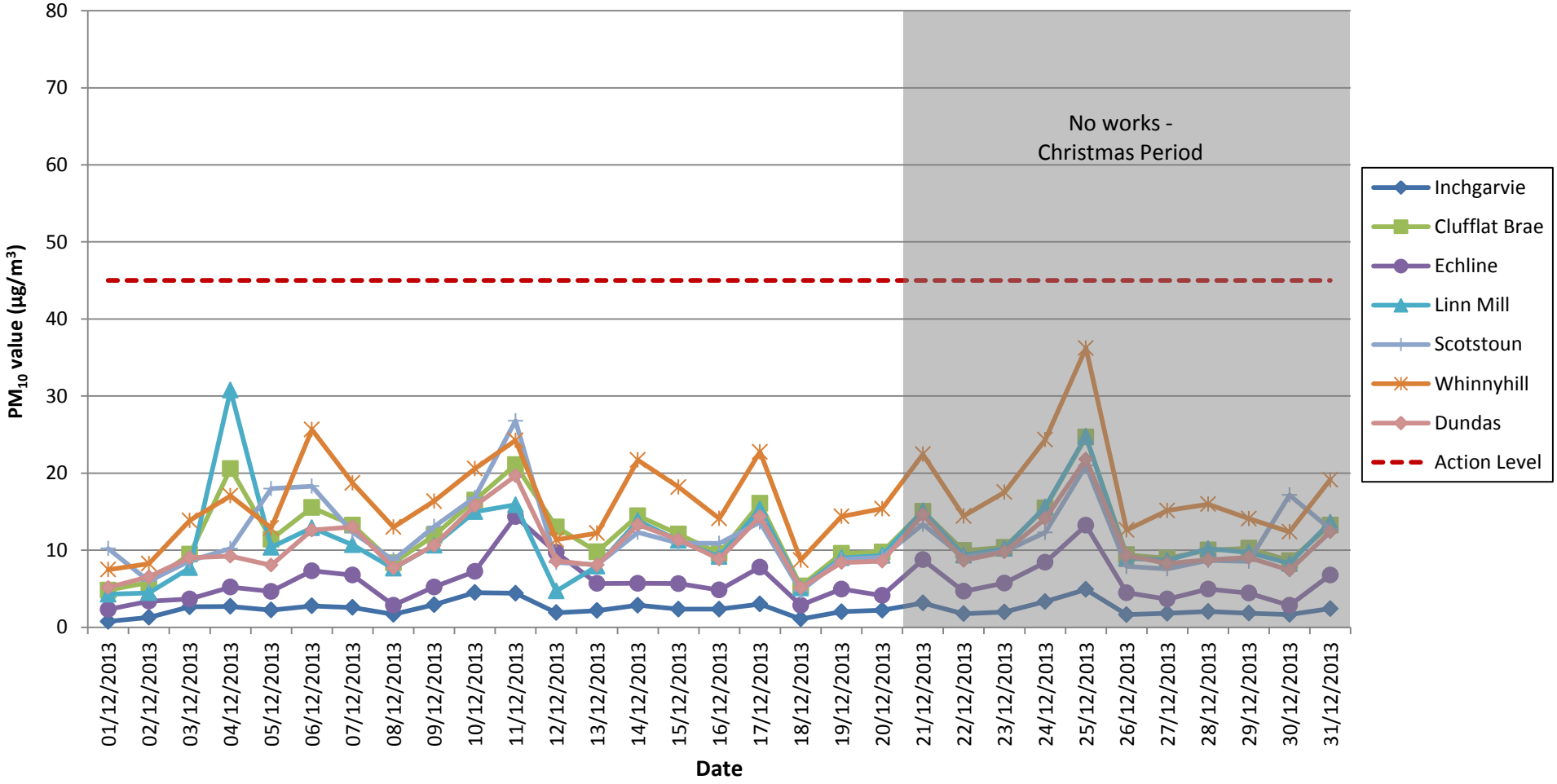
3.4. Daily Dust Log and Environmental Inspections

3.4.1. A summary of the daily dust log for December can be found in Appendix D. During this period no instances of dust were noted on site.

3.4.2. During this period full environmental inspections were also undertaken across the site and covered areas where works were being undertaken. In December, no instances of dust were noted during inspections.

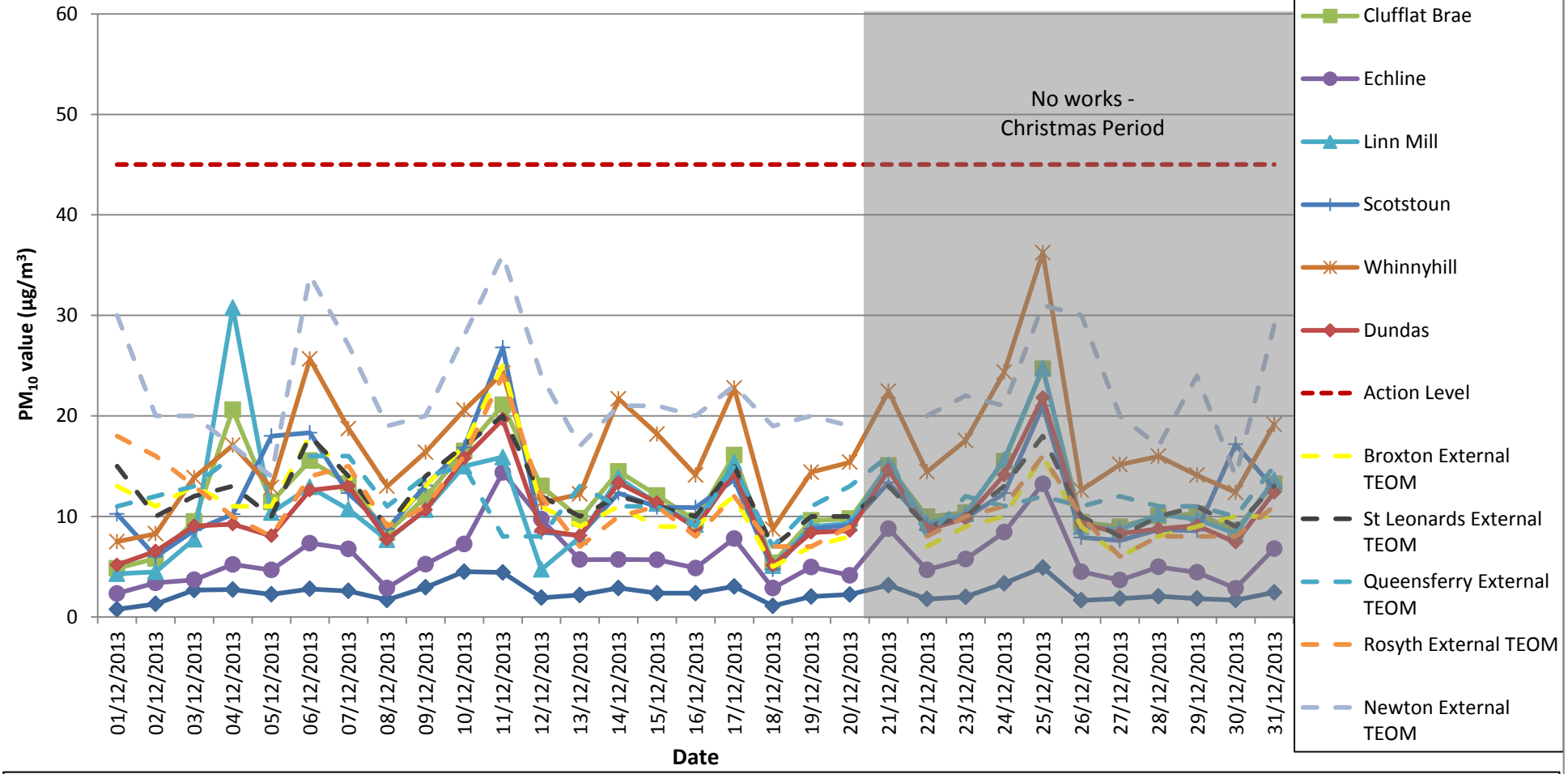
APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring
Particulate Matter (PM10) Results for all Monitoring Locations
December 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: December 2013. No works were conducted over the Christmas period (21/12/13 to 06/01/14). A correction factor has been applied to the data for Whinny Hill following consulation with the supplier; an error was identified with the settings on the meter and it was therefore required to make an adjustment to the data.

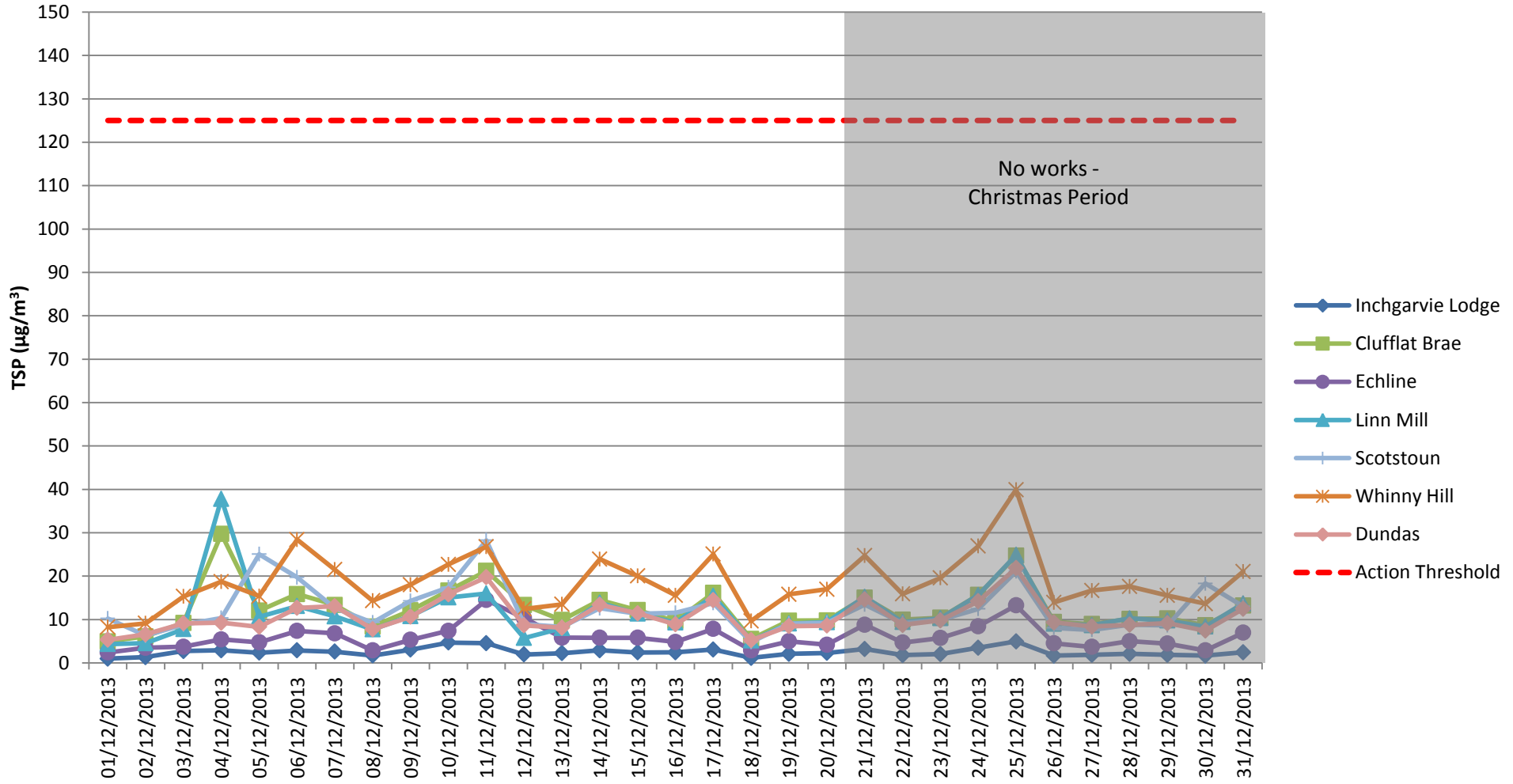
Air Quality Monitoring
Particulate Matter (PM10) Results for all Monitoring Locations
December 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: December 2013. No works were conducted over the Christmas period (21/12/13 to 06/01/14). A correction factor has been applied to the data for Whinny Hill following consulation with the supplier; an error was identified with the settings on the meter and it was therefore required to make an adjustment to the data.

APPENDIX B: TOTAL SUSPENDED PARTICLES

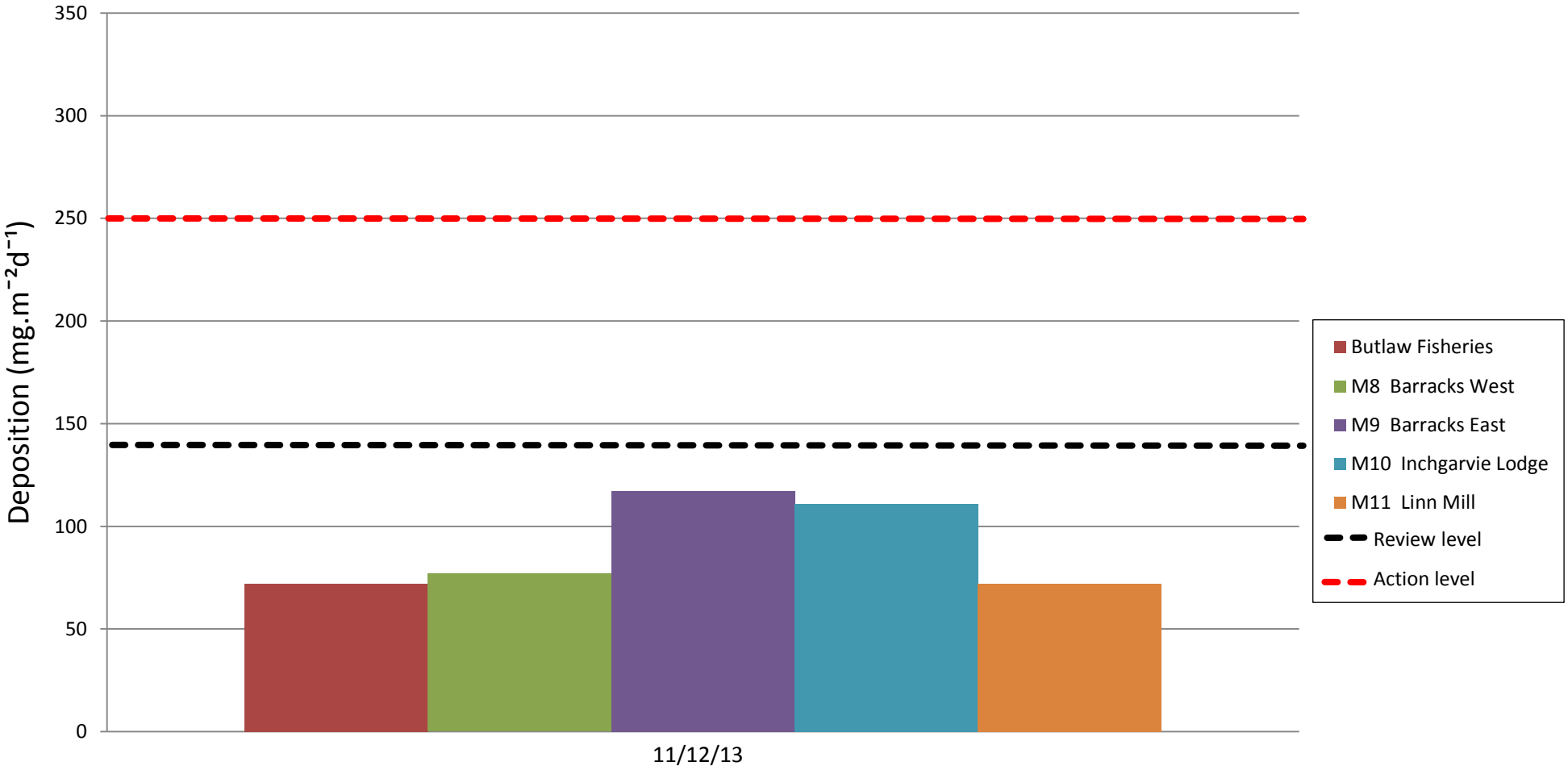
Total Suspended Particles (TSP) Results
December 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: December 2013. No works were conducted over the Christmas period (21/12/13 to 06/01/14). A correction factor has been applied to the data for Whinny Hill following consulation with the supplier; an error was identified with the settings on the meter and it was therefore required to make an adjustment to the data.

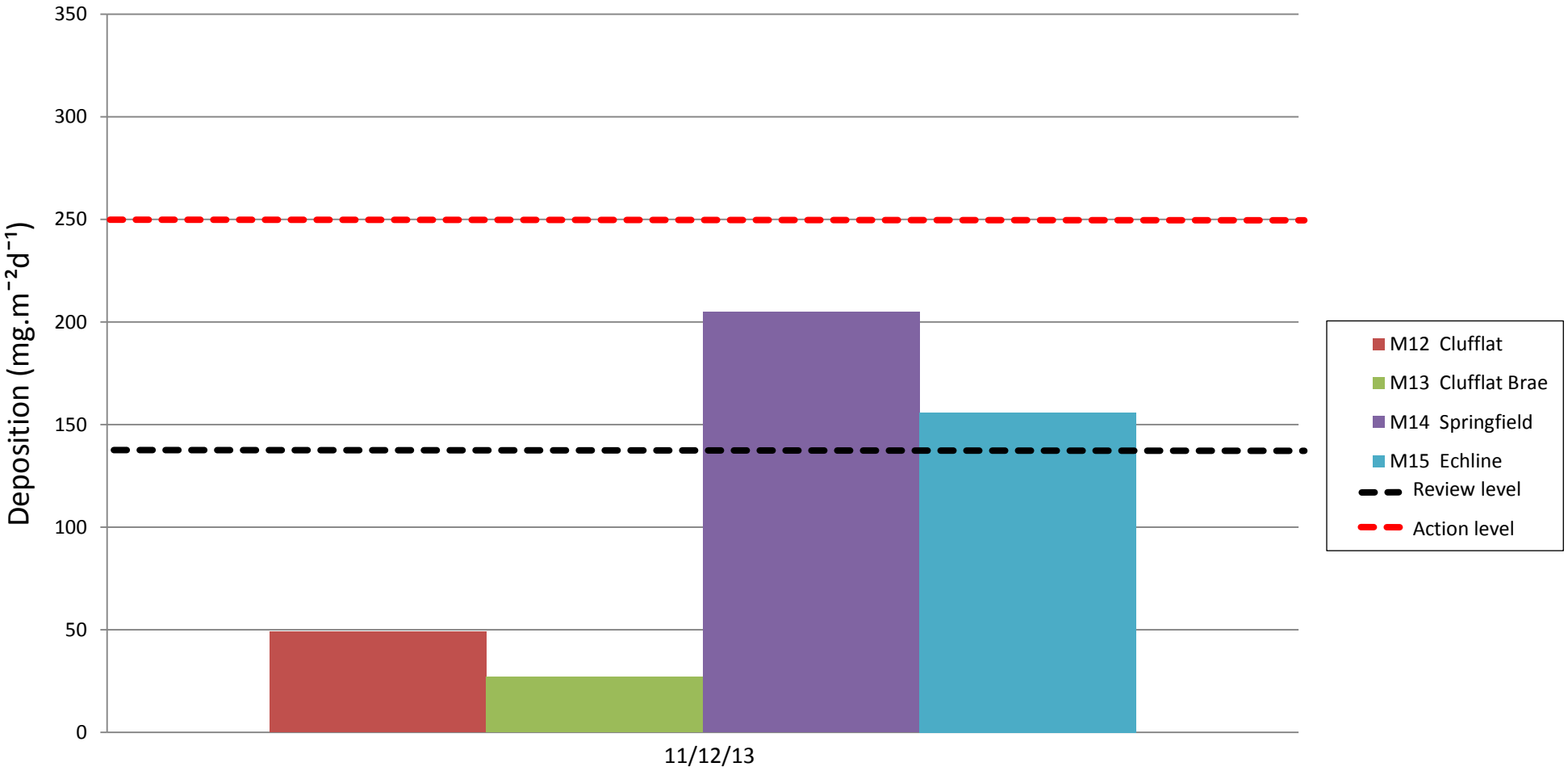
APPENDIX C: FRISBEE GAUGE RESULTS

Frisbee Dust Deposition Results: Group 1
Locations: M7 Butlaw Fisheries, M8 Barracks West, M9 Barracks East, M10 Inchgarvie Lodge and M11 Linn Mill



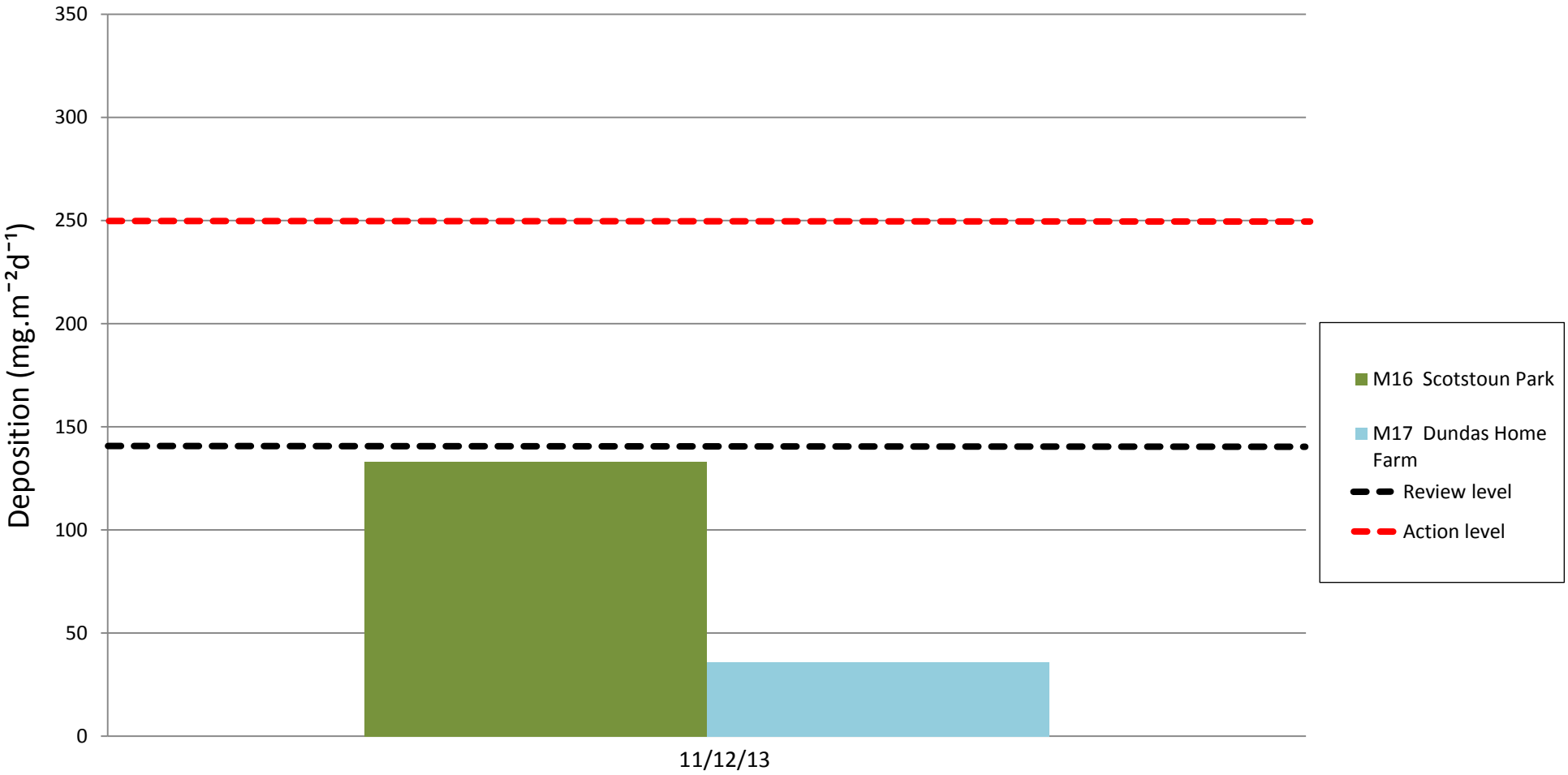
Note: When collected, the gauges located at the Barracks were found to have blown over in strong winds.

Frisbee Dust Deposition Results: Group 2
Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



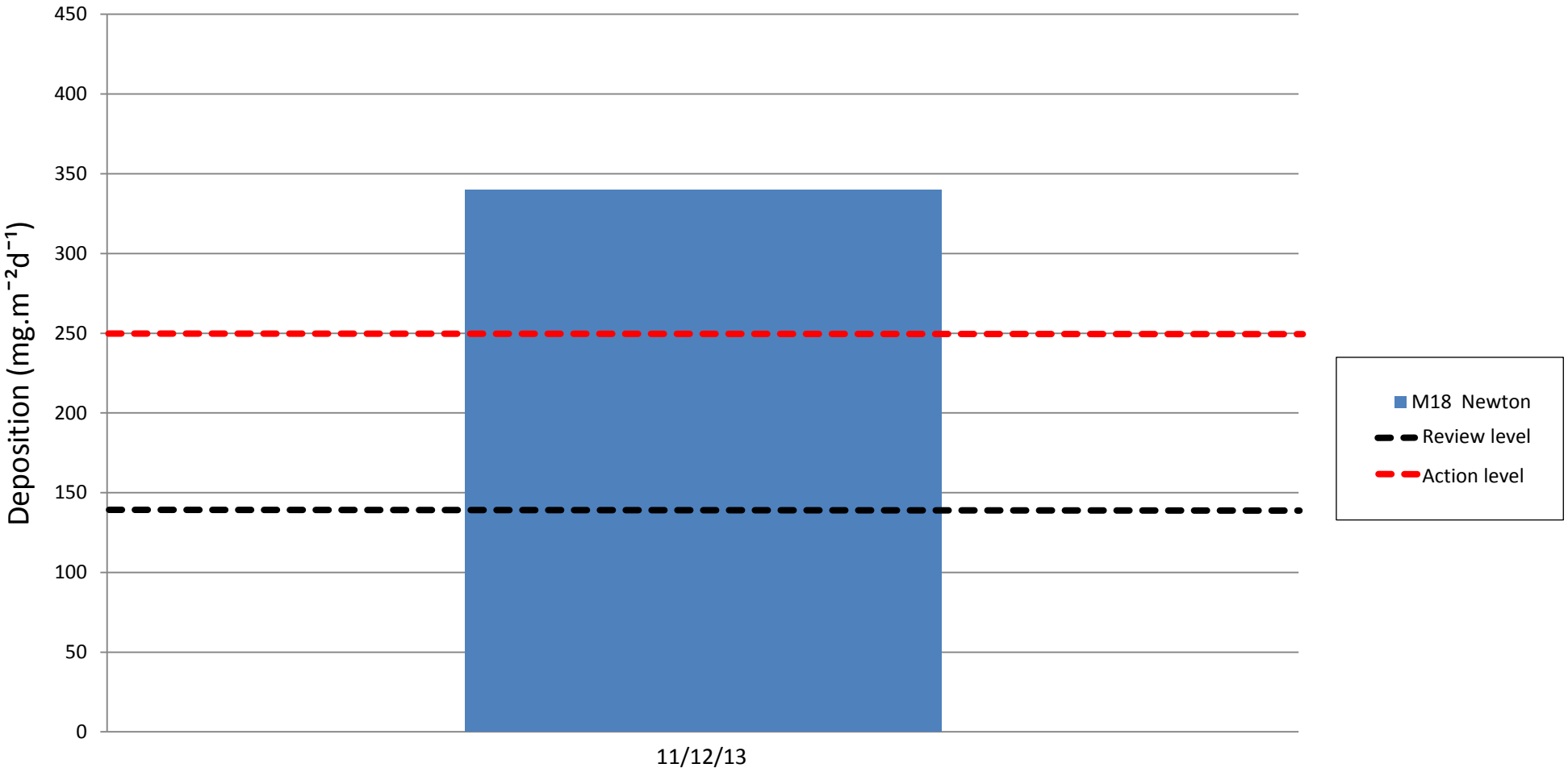
Note: When collected, the Springfield gauge was found to have blown over in strong winds.

Frisbee Dust Deposition Results: Group 3
Locations: M16 Scotstoun Park and M17 Dundas Home Farm

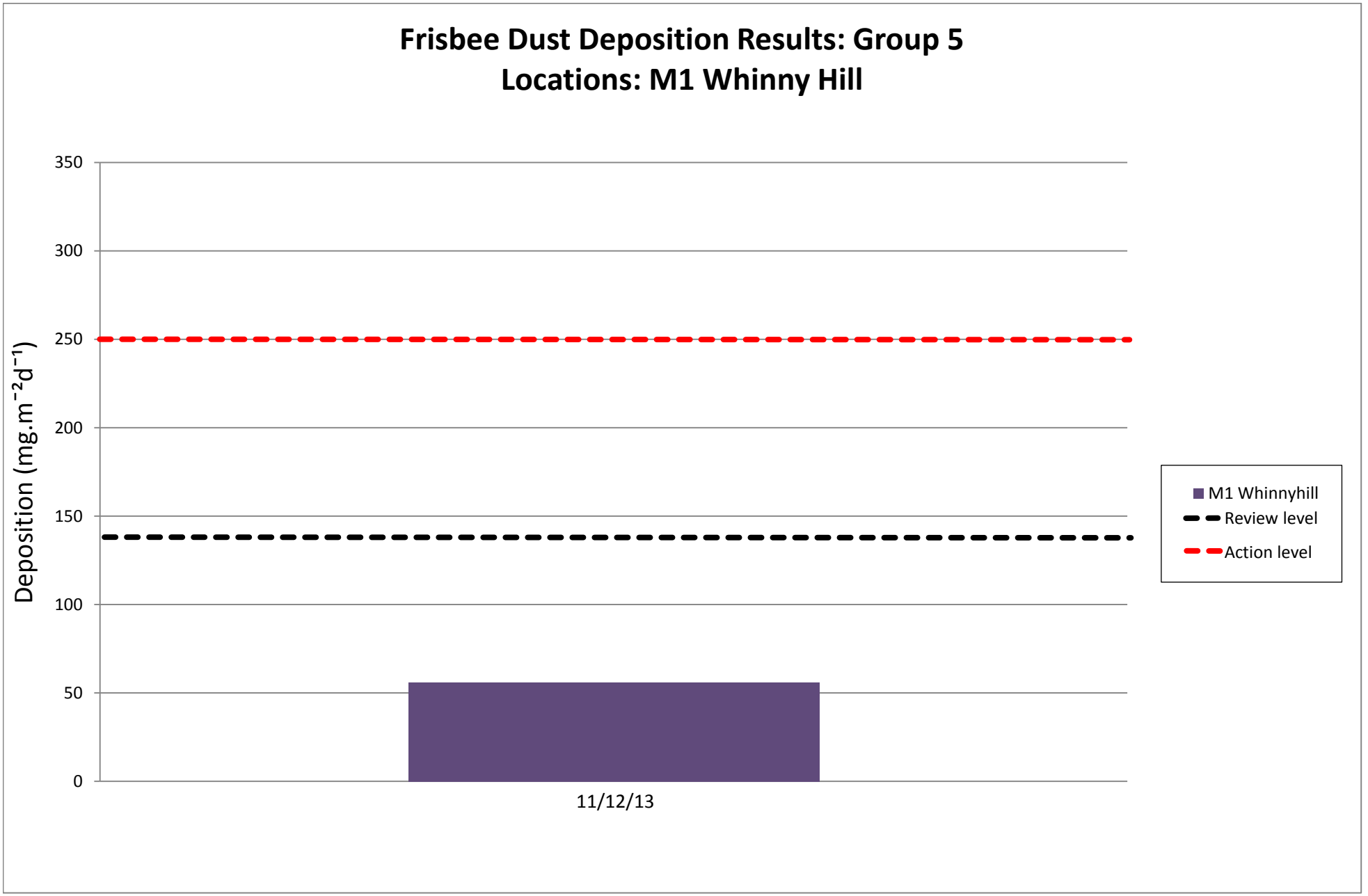


Note: When collected, the Scotsoun gauge was found to have blown over in strong winds.

Frisbee Dust Deposition Results: Group 4
Locations: M18 Newton



Note: When collected, this gauge was found to have blown over in strong winds.


Frisbee Dust Deposition Results: Group 5
Locations: M1 Whinny Hill
Deposition (mg.m⁻²d⁻¹)
350
300
250
200
150
100
50
0
11/12/13
M1 Whinnyhill
Review level
Action level

APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - December 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/12/2013	N							
02/12/2013	N	LIGHT	SSW	DAMP	N			
03/12/2013	N	MEDIUM	SSW	DAMP/WET	N			
04/12/2013	N	STRONG	SW	DAMP	N			
05/12/2013	N	STRONG	SW	WET	N			
06/12/2013	N	MEDIUM	W	WET	N			
07/12/2013	N							
08/12/2013	N							
09/12/2013	N	MEDIUM	SW	DAMP	N			
10/12/2013	N	MEDIUM	SSW	DAMP	N			
11/12/2013	N	LIGHT	SW	DAMP	N			
12/12/2013	N	LIGHT	SW	WET	N			
13/12/2013	N	MEDIUM	SSE	WET	N			
14/12/2013	N							
15/12/2013	N							
16/12/2013	N	STRONG	SSW	WET	N			
17/12/2013	N	STRONG	SSW	DAMP	N			
18/12/2013	N	STRONG	SE	DAMP/WET	N			
19/12/2013	N	STRONG	SSW	DAMP/WET	N			
20/12/2013	N	STRONG	SSW	WET	N			
21/12/2013	N							
22/12/2013	N							
23/12/2013	N							
24/12/2013	N							
25/12/2013	N							
26/12/2013	N							
27/12/2013	N							
28/12/2013	N							
29/12/2013	N							
30/12/2013	N							
31/12/2013	N							

Daily Dust Log - South - December 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/12/2013	S							
02/12/2013	S	LIGHT	SSW	DAMP	N			
03/12/2013	S	MEDIUM	SSW	DAMP/WET	N			
04/12/2013	S	STRONG	SW	DAMP	N			
05/12/2013	S	STRONG	SW	WET	N			
06/12/2013	S	MEDIUM	W	WET	N			
07/12/2013	S							
08/12/2013	S							
09/12/2013	S	MEDIUM	SW	DAMP	N			
10/12/2013	S	MEDIUM	SSW	DAMP	N			
11/12/2013	S	LIGHT	SW	DAMP	N			
12/12/2013	S	LIGHT	SW	WET	N			
13/12/2013	S	MEDIUM	SSE	WET	N			
14/12/2013	S							
15/12/2013	S							
16/12/2013	S	STRONG	SSW	WET	N			
17/12/2013	S	STRONG	SSW	DAMP	N			
18/12/2013	S	STRONG	SE	DAMP/WET	N			
19/12/2013	S	STRONG	SSW	DAMP/WET	N			
20/12/2013	S	STRONG	SSW	WET	N			
21/12/2013	S							
22/12/2013	S							
23/12/2013	S							
24/12/2013	S							
25/12/2013	S							
26/12/2013	S							
27/12/2013	S							
28/12/2013	S							
29/12/2013	S							
30/12/2013	S							
31/12/2013	S							