



Contractor



Forth Crossing Bridge Constructors

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Project **FORTH REPLACEMENT CROSSING**

Document title

AIR QUALITY MONITORING REPORT
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Contents

- 1. Introduction**
- 2. Monitoring Equipment and Locations**
- 3. Air Quality Monitoring Results**
 - 3.1. Automatic Light Scatter Meter Particulate Matter Monitoring Results**
 - 3.2. Total Suspended Particle Results**
 - 3.3. Frisbee Dust Deposition Results**
 - 3.4. Daily Dust Log and Weekly Environmental Inspections**

Appendices:

- Appendix A: Particulate Matter Results**
- Appendix B: Total Suspended Particle Results**
- Appendix C: Frisbee Dust Deposition Results**
- Appendix D: Daily Dust Log Summary**

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 September 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 (PM₁₀) concentrations and the Total Suspended Particle (TSP) concentrations (Figure 2). 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 September
M1	Whinny Hill	Frisbee	21/03/12	<ul style="list-style-type: none"> Excavation and breaking rock at Castlandhill Road
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	<ul style="list-style-type: none"> Marine works Society Road works
M8	Barracks West	Frisbee	31/08/11	<ul style="list-style-type: none"> Marine works Society Road works Installation of rebar and formwork and preparation of construction joints at S7/S8
M9	Barracks East	Frisbee	31/08/11	<ul style="list-style-type: none"> Concrete pour at S5 (delivery of concrete from land)
M10	Inchgarvie Lodge	Frisbee	22/08/11	<ul style="list-style-type: none"> Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Society Road works
		Automatic light scatter meter	17/10/11	
M11	Linn Mill	Frisbee	22/08/11	<ul style="list-style-type: none"> Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and preparation of construction joints at S7/S8 Works at pier trials area Society Road works
		Automatic light scatter meter	06/12/11	
M12	Clufflat	Frisbee	29/08/11	<ul style="list-style-type: none"> Launch – assembly of stillages, delivery and assembly of structural steel sections Installation of rebar and formwork and
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light	24/10/11	



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		scatter meter		<ul style="list-style-type: none"> preparation of construction joints at S7/S8 • Works at pier trials area • Society Road works • Echline field – excavation of mainline
M14	Springfield	Frisbee	15/08/11	<ul style="list-style-type: none"> • Launch – assembly of stillages, delivery and assembly of structural steel sections • Installation of rebar and formwork and preparation of construction joints at S7/S8 • Works at pier trials area • Echline field – excavation of mainline • Gyrotory – structures
M15	Echline	Frisbee	16/08/11	<ul style="list-style-type: none"> • Launch – assembly of stillages, delivery and assembly of structural steel sections • Installation of rebar and formwork and preparation of construction joints at S7/S8 • Works at pier trials area • Echline field – excavation of mainline • Gyrotory – structures
		Automatic light scatter meter	10/11/11	
M16	Scotstoun	Frisbee	07/09/11	<ul style="list-style-type: none"> • Bus link works
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	<ul style="list-style-type: none"> • Backfilling of utility works • Environmental bund
		Automatic light scatter meter	23/02/12	
M18	Newton	Frisbee	22/08/11	<ul style="list-style-type: none"> • 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 September 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM₁₀ levels were below threshold levels and generally followed the same pattern across the site, with the exception of two days at Dundas. However, no September exceedances are thought to be related to construction works.

3.1.2. Table 2 lists the locations at which the exceedances occurred. The dust log (section 3.4 and Appendix D) provides further details with regard to the conditions and the actions taken as a result of each exceedance, where applicable.

Table 2: Exceedances of the PM₁₀ threshold

Date	Monitoring Location	Notable conditions
23/09/13	Dundas	Damp conditions on site
25/09/13	Dundas	Damp conditions on site – low level cloud and drizzle

3.1.3. The results at Dundas are not considered to be related to construction. The meter at Dundas is particularly sensitive to foggy, misty and hazy conditions (see 2.2) and therefore it is likely that the results were affected by the damp conditions. On 23 September, an error appeared to occur between 5.20pm and 5.25pm, which caused unrealistically high levels (greater than 50,000µg). With regard to the exceedance on 25 September, high levels were noted between 12.30am and 4.15am, indicating that foggy conditions during the night, as recorded at local weather stations, may have caused the exceedance.

3.1.4. Throughout September, the environmental department were notified by trigger alerts where any exceedances of the threshold levels occurred.

Where necessary, there was close liaison with the works manager and section head of the south networks area to ensure that mitigation was in place. This ensured that no exceedances of the 24 hour threshold occurred as a result of construction during September.

3.1.5. The PM₁₀ results have also been compared to the daily mean results obtained from the TEOM air quality monitoring stations located in Newton, Rosyth, Broxburn, 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. Apart from the exceedances noted above, 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 September was largely driven by regional changes in air quality. Slight deviations from the regional pattern can be seen at the beginning of the September which may have been caused by construction activities, with dust noted on site on some of these days. However, there were no exceedances of the threshold during this period and mitigation measures, including dampening down and the cleaning of public roads (A904 and B800), were in place to keep dust levels down and prevent dust from leaving the site boundary.

3.2. Total Suspended Particles

3.2.1. The TSP results for September 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during September were generally low and all within the threshold level, with the exception of 23 September at Dundas. This exceedance was related to an error with the device that is likely to relate to the weather conditions on this date (Table 3), as discussed in relation to the high PM₁₀ levels noted above (see 3.1). No exceedances were, therefore, found to occur as a result of construction activities. 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.

Table 3: Exceedances of the TSP threshold

Date	Monitoring Location	Notable conditions
23/09/13	Dundas	Damp conditions

3.3. Frisbee Dust Deposition Results

3.3.1. The Frisbee dust deposition results for September 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 data deposition results were collected fortnightly, and the results averaged over this fortnight period to give a daily dust deposition rate. Two collections were made in September; 4 and 18 September. A collection made on 2 October will cover the 12 days at the end of September and will be reported in Air Quality Monitoring Report: October 2013.

3.3.3. The site action level for the dust deposition rate has been set at 250 mg/m²/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/m²/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 September there were four exceedances of the site review level and two exceedances of the site action level (see Table 4). 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	Notable conditions at time of collection
04/09/13	Review	Scotstoun	Particles of vegetation in sample as located underneath trees
	Action	Barracks West	No notable conditions
18/09/13	Review	Barracks East	Located in vehicle turning area
		Springfield	Located underneath vegetation that is beginning to fall
		Scotstoun	Located underneath vegetation that is beginning to fall
	Action	Barracks West	No notable conditions

- 3.3.5.** Following the exceedance of the site review levels at Scotstoun, Springfield and Barracks East, a review of the works in each of the areas, and the mitigation measures in place, was undertaken. 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. Additionally, it should be noted that this gauge is located underneath vegetation which may give rise to false increased levels. On-going use of the bowser for dampening down was generally deemed sufficient mitigation, with road washing undertaken on the B800 close to the Scotstoun meter. Additional mitigation measures were not considered necessary as daily site observations did not indicate a dust problem at these locations.

3.3.6. With regard to the exceedances at Barracks West, no notable conditions were found that could have caused such high dust levels at this location. The Barracks West gauge is located in an area where no viaducts works were undertaken during September. Whilst it is possible that the on-going works at Society Road may have partially influenced the result, it should be noted that the results from nearby monitors, located closer to residential properties, indicated lower levels of dust deposition for this period, with no exceedances of the thresholds. However, due to the high results at this location, the programme of works for the immediate area is being reviewed for any dust generating activities and to ensure that appropriate mitigation is in place where necessary.

3.4. Daily Dust Log and Environmental Inspections

3.4.1. A summary of the daily dust log for September can be found in Appendix D. Dust was noted in the southern areas of site on four occasions. Vehicle movements were largely noted to be the cause of dust on site, with strong winds also found to be blowing dust on site on one occasion. However, generally it was noted that the instances of dust were localised and the dust was not observed to be leaving the site boundary. In each instance, measures to dampen down the works areas as far as reasonably practicable were employed, notably the use of the bowser to dampen down the tracks and excavation areas. Furthermore, the road sweeper was also in operation as required, with further road cleaning occurring in response to dust noted at the beginning of September. However, during this period, dust generated by local farming activities was also noted in the area, particularly on the A904 where farm vehicles were seen to be transporting mud onto the road. This was then dried and resulted in the generation of airborne dust.

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



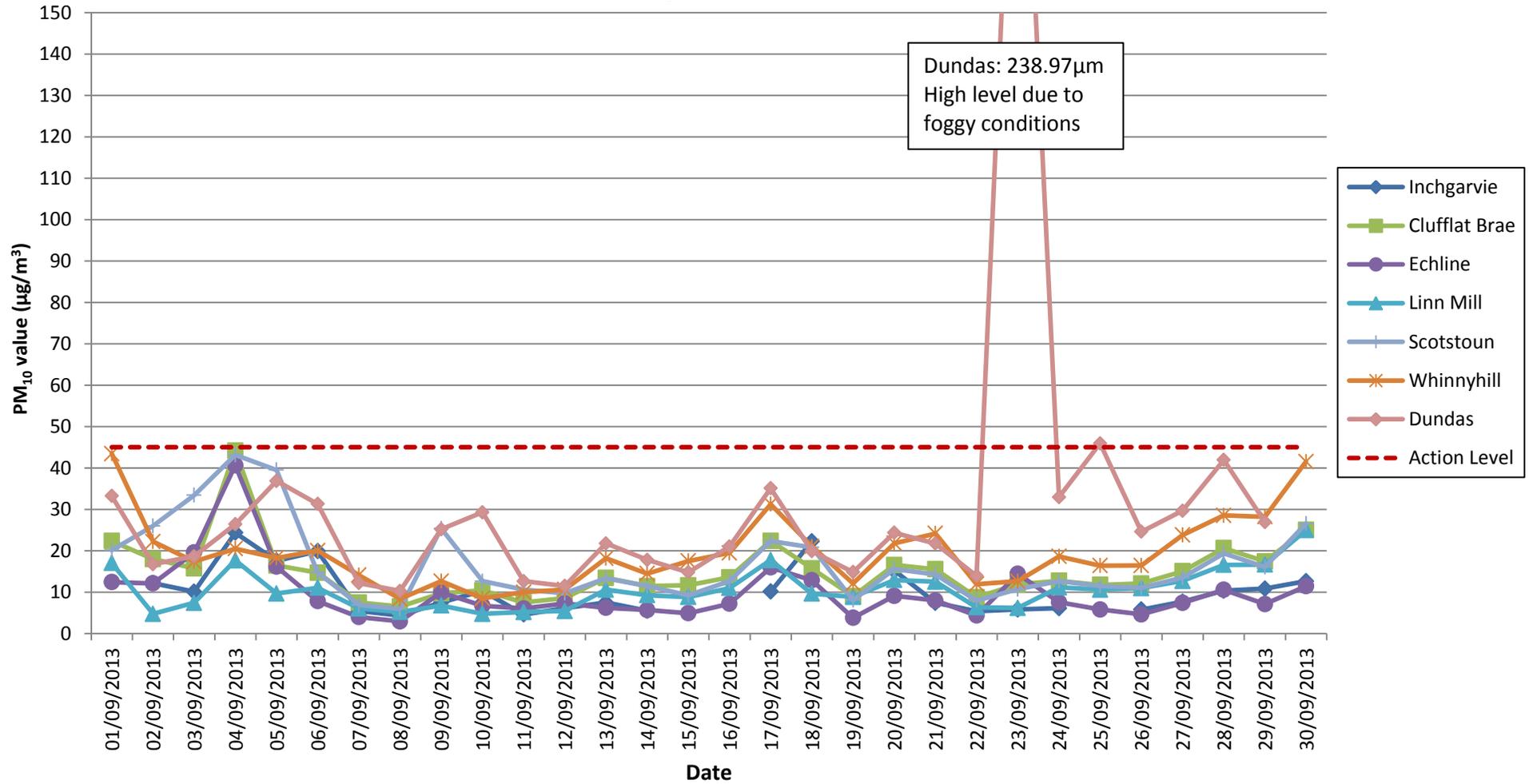
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APPENDIX A: LIGHT SCATTER METER RESULTS

Air Quality Monitoring

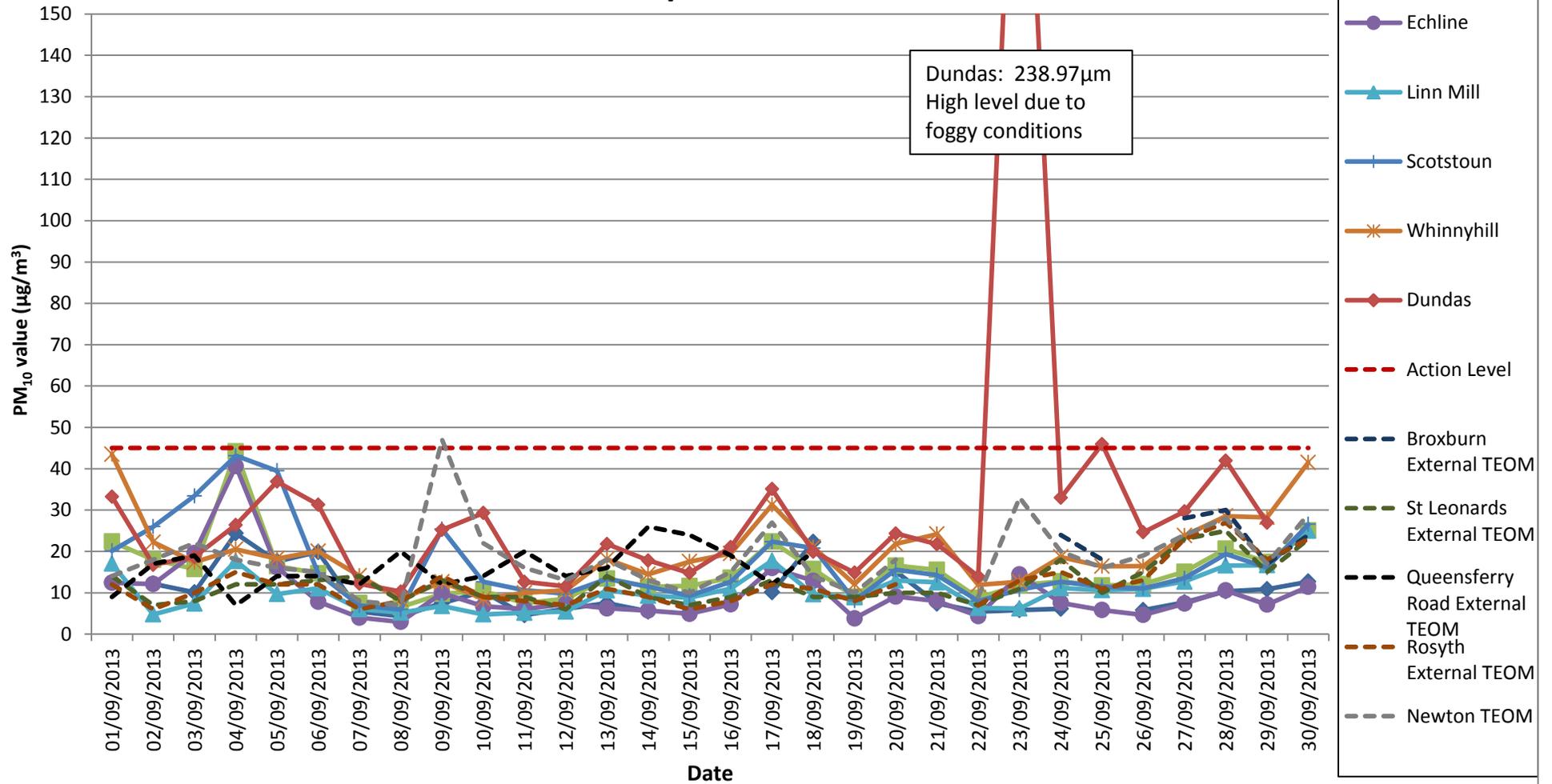
Particulate Matter (PM10) Results for all Monitoring Locations

September 2013



Note: Please refer to section 3 of the Air Quality Monitoring Report: September 2013.

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



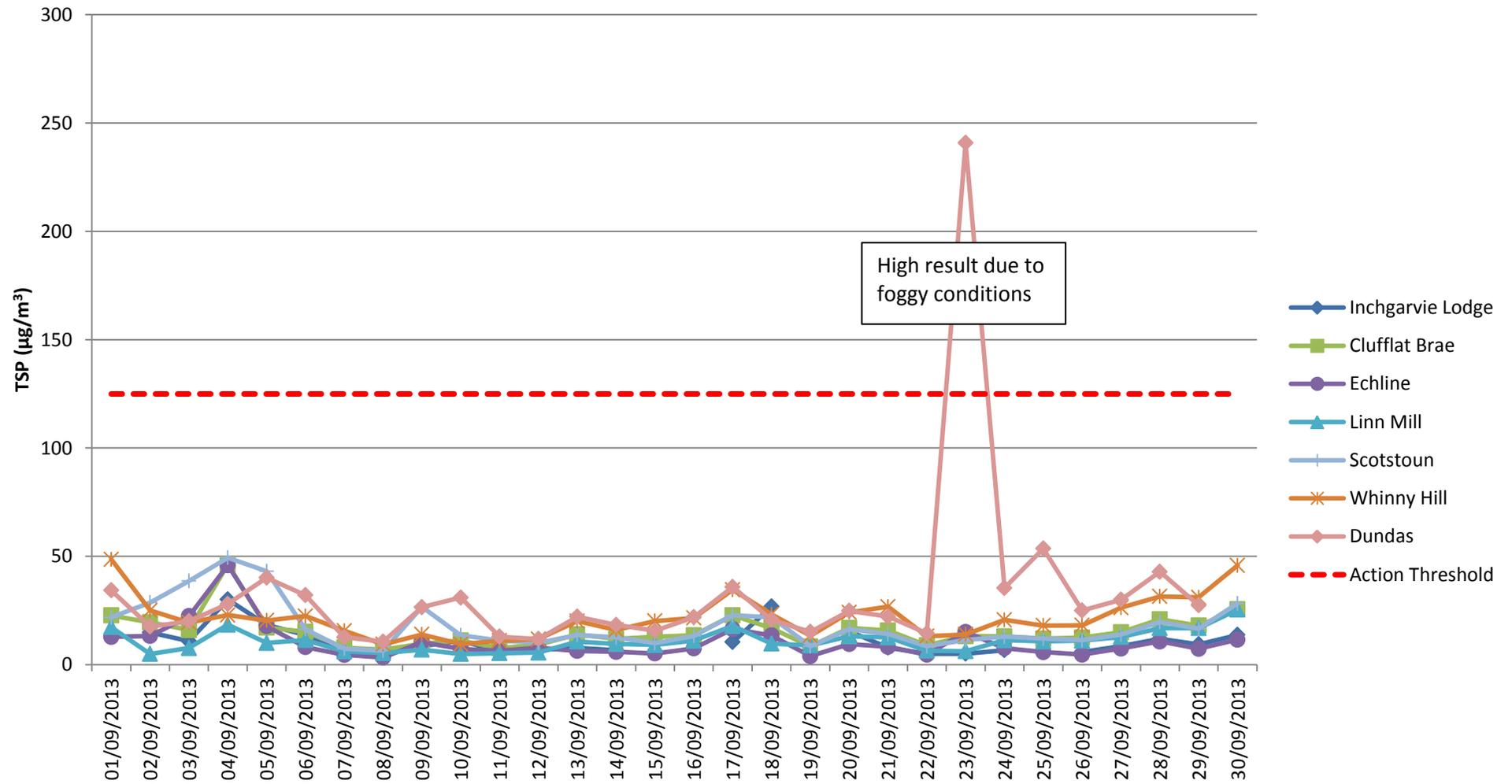
Note: Please refer to section 3 of the Air Quality Monitoring Report: September 2013



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APPENDIX B: TOTAL SUSPENDED PARTICLES

Total Suspended Particles (TSP) Results September 2013

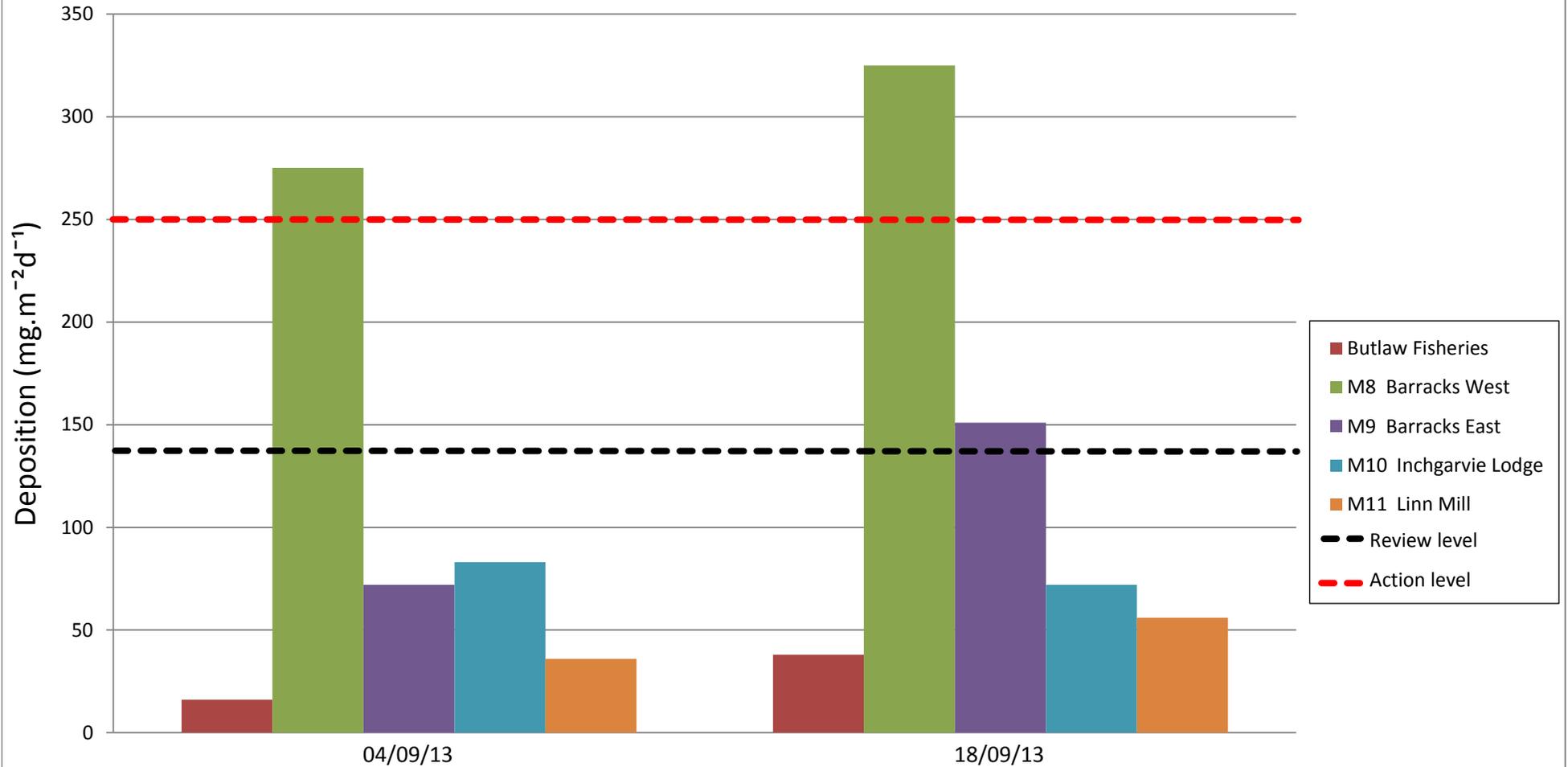




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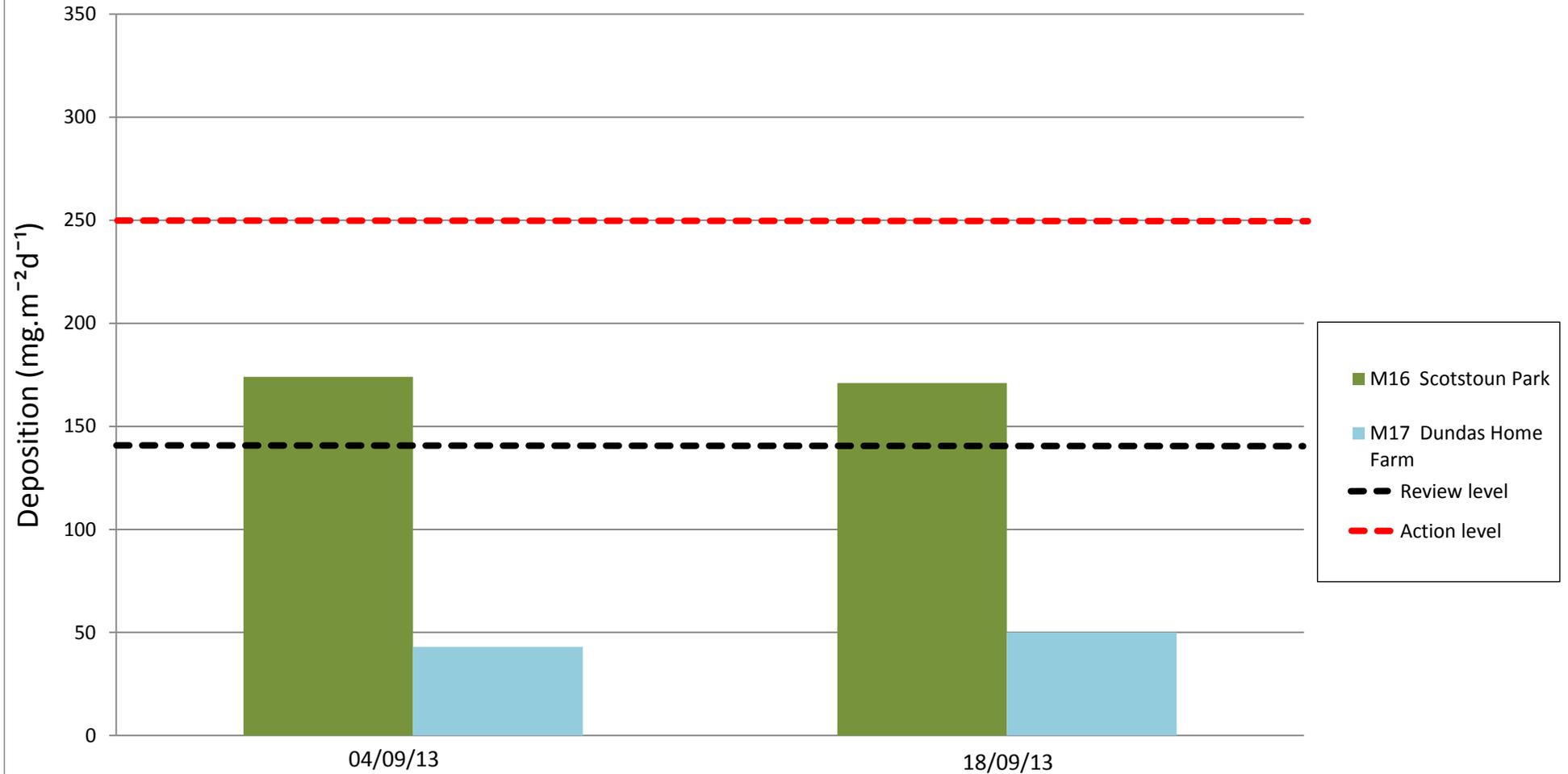
APPENDIX C: FRISBEE GAUGE RESULTS

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



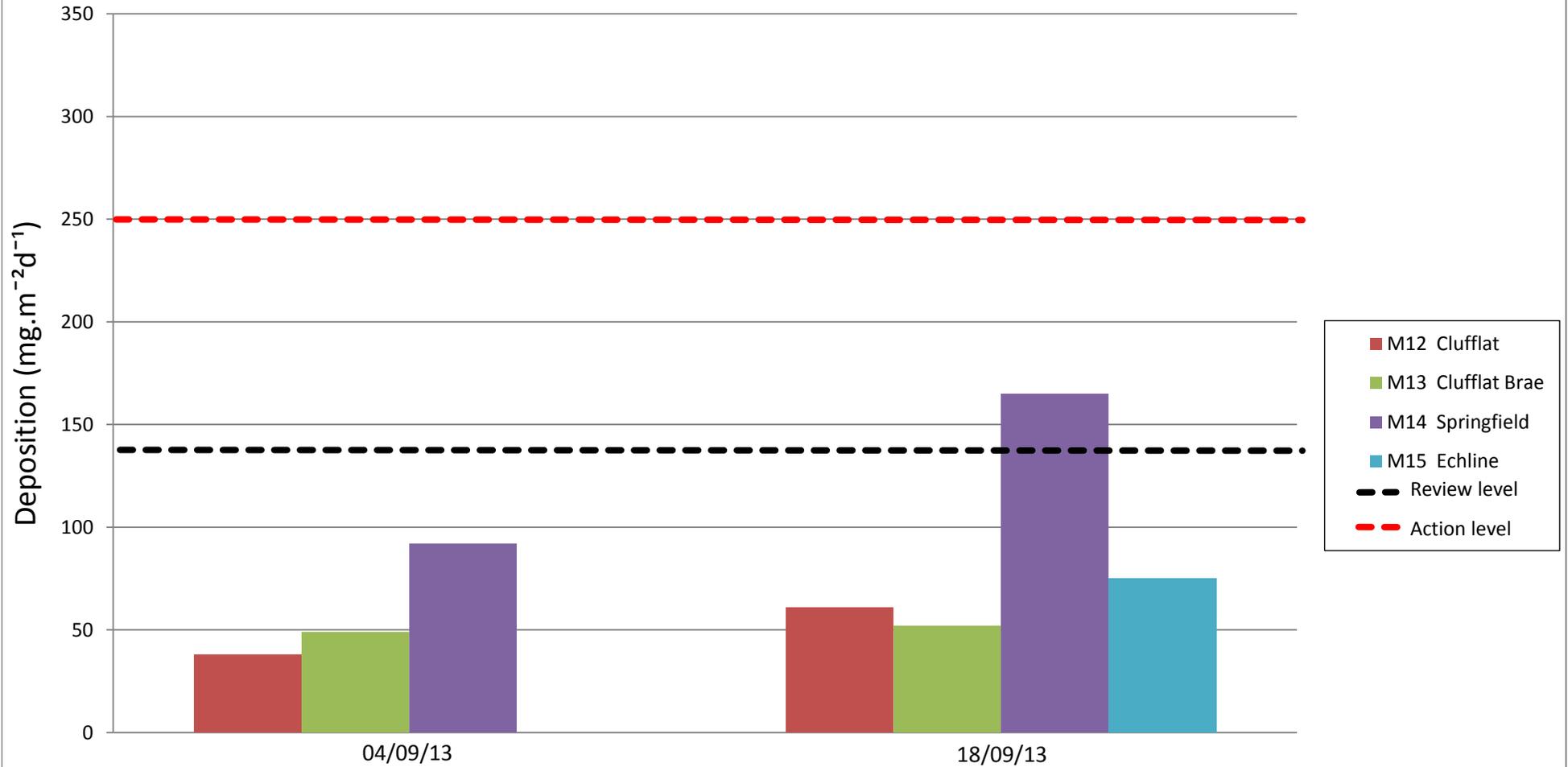
Frisbee Dust Deposition Results: Group 3

Locations: M16 Scotstoun Park and M17 Dundas Home Farm



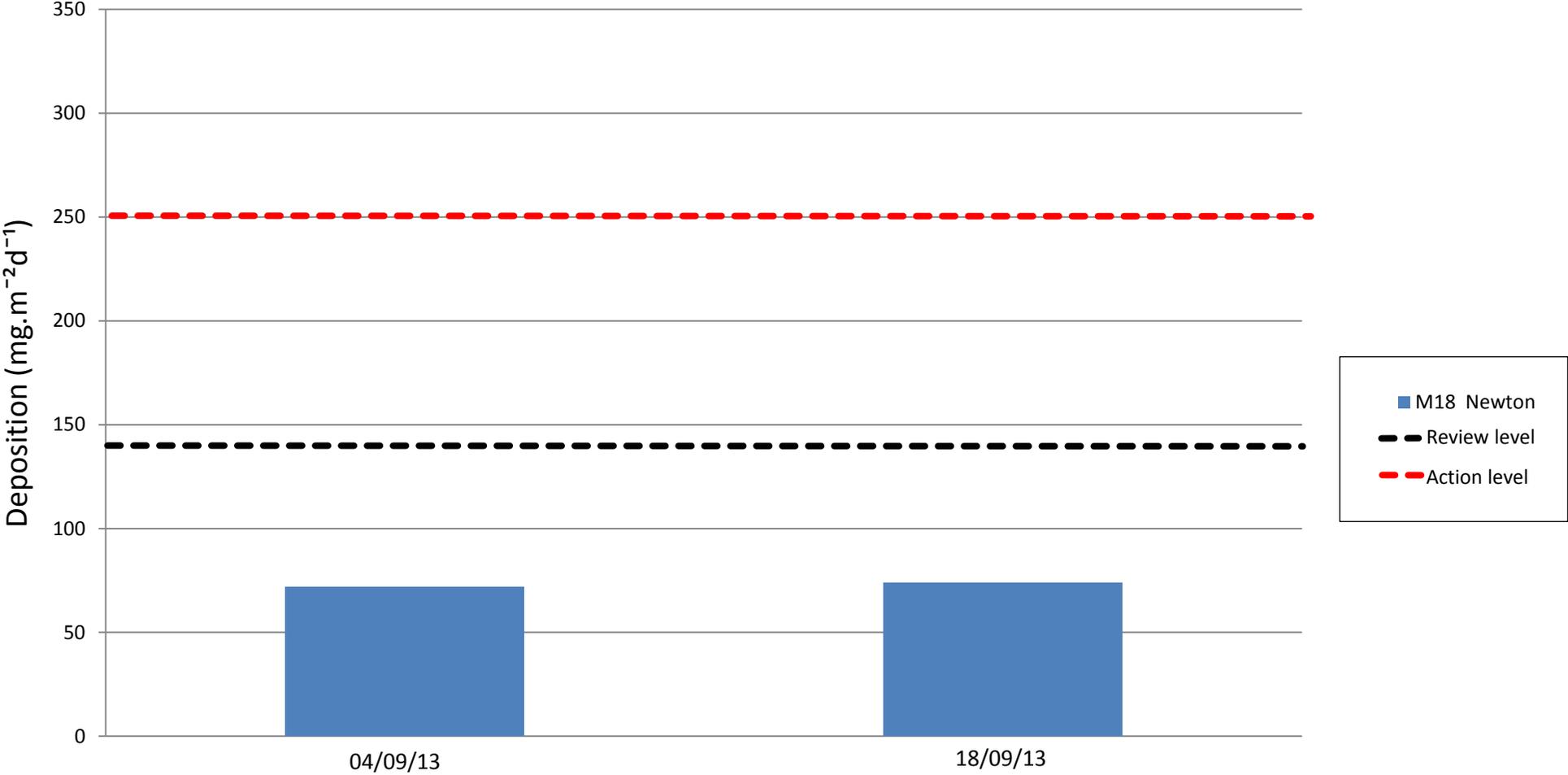
Frisbee Dust Deposition Results: Group 2

Locations: M12 Clufflat, M13 Clufflat Brae, M14 Springfield and M15 Echline



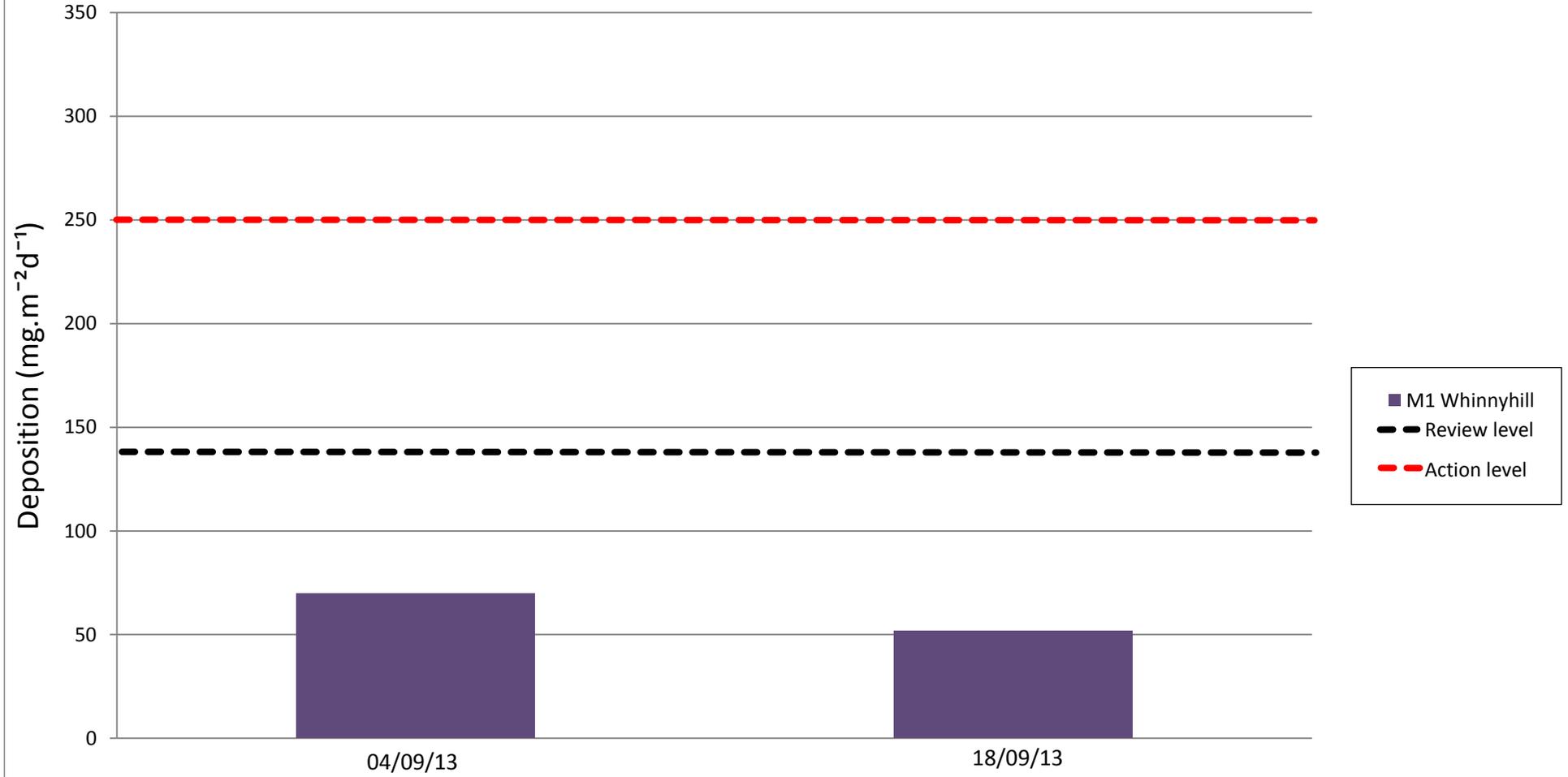
Frisbee Dust Deposition Results: Group 4

Locations: M18 Newton



Frisbee Dust Deposition Results: Group 5

Locations: M1 Whinny Hill





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APPENDIX D: DAILY DUST LOG

Daily Dust Log - North - September 2013

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

30/09/2013	S	MEDIUM	NE	DRY	N			
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