



Contractor



**Forth Crossing** Bridge Constructors

HOCHTIEF Solutions  
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Project

**FORTH REPLACEMENT CROSSING**

Document title

**AIR QUALITY MONITORING REPORT**  
**JUNE 2013**

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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 June 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<sub>10</sub>) 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 June
M1	Whinny Hill	Frisbee	21/03/12	Band drains at King Malcolm Drive Excavation works at Castlandhill Road
		Automatic light scatter meter	16/02/12	
M7	Butlaw Fisheries	Frisbee	05/10/11	Pier S6 – cleaning and backfilling Marine works Society Road embankment works
M8	Barracks West	Frisbee	31/08/11	Pier S6 – cleaning and backfilling Marine works Society Road embankment works S7/S8 area – scaffolding for pier rebar prefabrication Marine works
M9	Barracks East	Frisbee	31/08/11	Pier S6 – cleaning and backfilling Marine works Society Road embankment works S7/S8 area – scaffolding for pier rebar prefabrication Marine works
M10	Inchgarvie Lodge	Frisbee	22/08/11	South Abutment works, including concreting and backfilling Launch – reconditioning of batters, installation of drains and crane rails, excavation for launch foundations, backfill of lay down area Pier trials Society road embankment works
		Automatic light scatter meter	17/10/11	

M11	Linn Mill	Frisbee	22/08/11	South Abutment works, including concreting and backfilling Launch – reconditioning of batters, installation of drains and crane rails, excavation for launch foundations, backfill of lay down area Pier trials Society road embankment works
		Automatic light scatter meter	06/12/11	
M12	Clufflat	Frisbee	29/08/11	South Abutment works, including concreting and backfilling Launch – reconditioning of batters, installation of drains and crane rails, excavation for launch foundations, backfill of lay down area Pier trials
M13	Clufflat Brae	Frisbee	21/09/11	
		Automatic light scatter meter	24/10/11	
M14	Springfield	Frisbee	15/08/11	South Abutment works, including concreting and backfilling Launch – reconditioning of batters, installation of drains and crane rails, excavation for launch foundations, backfill of lay down area Pier trials Gyratory – structures
M15	Echline	Frisbee	16/08/11	Launch – reconditioning of batters, installation of drains and crane rails, excavation for launch foundations, backfill of lay down area Completion of U221 Bulk excavation for mainline
		Automatic light scatter meter	10/11/11	



M16	Scotstoun	Frisbee	07/09/11	Bus link embankment works including import of fill Vegetation clearance to West of B800
		Automatic light scatter meter	14/02/12	
M17	Dundas Home Farm	Frisbee	29/08/11	Utilities works Fill using clay for road network
		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 June 2013 have been presented in a monthly chart; this can be found in Appendix A. Results show that the PM<sub>10</sub> levels were largely below threshold levels and generally followed the same pattern across the site. During June there were ten days on which exceedances of the threshold occurred. The majority of these exceedances occurred at Scotstoun, with one exceedance also recorded at Clufflat and exceedances on three days at Dundas. Table 2 lists the locations at which the exceedances occurred on these dates. 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.

**Table 2: Exceedances of the PM10 threshold**

Date	Monitoring Location	Notable conditions
03/06/13	Scotstoun	Vehicle movements - monitor in very close proximity to road
05/06/13	Dundas	Foggy conditions
11/06/13	Dundas	Hazy conditions. Rain showers in afternoon
14/06/13	Scotstoun	No dust observed during inspection. Likely to be due to close proximity to road
19/06/13	Scotstoun and Clufflat	Strong winds. Some dust blowing.
20/06/13	Dundas	Hazy conditions
21/06/13	Scotstoun	Hazy/misty conditions. Vehicle movements – monitor in very close proximity to road.
24/06/13	Scotstoun	High levels due to proximity to road and works between B800 and Dakota hotel – access track.
25/06/13	Scotstoun	High levels due to proximity to road and works between B800 and Dakota hotel – access track. Additional mitigation deployed
26/06/13	Scotstoun	High levels due to proximity to road and works between B800 and Dakota hotel – access track. Additional mitigation deployed.

- 3.1.2.** It is likely that construction works contributed to some of these exceedances. However, 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). The exceedance on 21 June at Scotstoun may also have been influenced by atmospheric conditions. Furthermore, the exceedances on 19 July coincide with a day that was affected by strong winds which influenced dust levels. On these dates, dust was also noted blowing in areas outwith the site boundary, including dust being generated by agricultural activities in surrounding fields beyond the construction site. Therefore any dust exceedances on these dates cannot be solely attributed to dust arising from site.
- 3.1.3.** The exceedances at Scotstoun on 3, 14, 21, 24, 25 and 26 June appear to be localised dust events. It is likely that the results for this monitor were affected by dust associated with the adjacent road. A road sweeper is in operation at this location which reduces the dust levels. Additionally, dust was noted when vehicles were entering and exiting the access track in to the works alongside the A90, between the B800 and the Dakota Hotel. During periods of high dust levels, the environmental department were notified by trigger alerts and there was close liaison with the works manager and section head of the south networks area to ensure that mitigation was in place. A bowser works full time on dust suppression in the south network areas; however, as a result of the dust levels during dry periods, an additional bowser was deployed in the south networks area.
- 3.1.4.** With regard to the exceedances at Scotstoun, it should also be noted that the monitor at this location is in a position that would result in higher dust levels than at the nearest sensitive receptors. The monitor is located immediately adjacent to the B800 road, whereas the nearest properties are located approximately 100m from the construction site

entrance, and 25m from the road, behind a strip of mature trees and shrubs.

**3.1.5.** The PM<sub>10</sub> 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. 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 June was largely due to regional changes in air quality, with the exceptions as discussed above.

### **3.2. Total Suspended Particles**

**3.2.1.** The TSP results for June 2013 have been presented in a monthly chart; this can be found in Appendix B. The TSP levels at monitoring locations during June were generally low and all within the threshold level, with the exception of 24 and 25 June at Scotstoun. These exceedances were related to the high PM<sub>10</sub> levels noted above (see 3.1). 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, with some exceptions relating to the PM<sub>10</sub> levels discussed in section 3.1.

### **3.3. Frisbee Dust Deposition Results**

**3.3.1.** The Frisbee dust deposition results for June 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 June; 12 and 26 June.

**3.3.3.** The site action level for the dust deposition rate has been set at 250 mg/m<sup>2</sup>/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<sup>2</sup>/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.

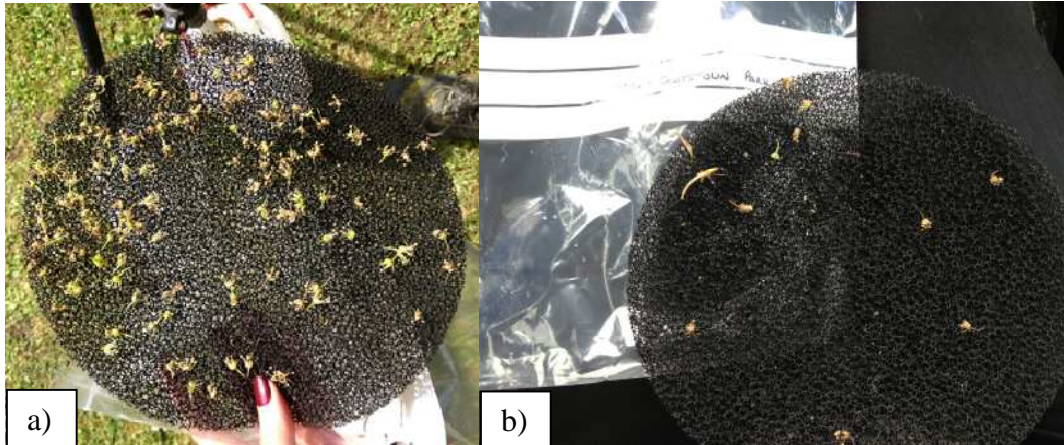
**3.3.4.** During June there were no exceedances of the site action level and six exceedances of the site review level (see table 3). With the exception of the locations where exceedances occurred, frisbee results from monitoring locations across site were generally found to be low.

**Table 3: Exceedances of the dust deposition thresholds**

Fortnight ending	Threshold Exceeded	Monitoring Location	Notable conditions at time of collection
12/06/13	Review	Springfield	Positioned under trees with presence of some vegetation particles on discs on both collections (see figure 3a).
26/06/13			
12/06/13	Review	Scotstoun	Positioned under trees with presence of some small vegetation particles on discs on both collections (see figure 3b).
26/06/13			
12/06/13	Review	Newton	Frisbee located under scaffolding and immediately adjacent to building works at property.
26/06/13	Review	Barracks East	Positioned at a turning area for vehicles using S5 causeway.

**3.3.5.** With regard to the exceedances at Scotstoun and Springfield, an appropriate review of the works in the area, the potential of works to have affected dust levels and any mitigation measures in place was undertaken. It is possible that these were caused by construction works due to the dust observed during some inspections and the particulate matter levels recorded by the light scatter meter at Scotstoun. Additional mitigation measures were therefore put in place (refer to 3.1.3). However, it should be noted that the samples collected were found to be contaminated with vegetation from mature trees above the gauge (see figures 3a and 3b) and therefore the exceedances are not considered to be entirely related construction works.





**Figure 3: Vegetation contamination on Frisbee discs**

- a) example of contaminated sample from Springfield (taken on 12/06/13)
- b) example of contaminated sample from Scotstoun (taken on 12/06/13)

**3.3.6.** The exceedance of the review level at Newton is not considered to be related to construction works. On-going building works at the property are immediately adjacent to the Frisbee gauge and therefore are thought to have contributed to the levels recorded at this location.

**3.3.7.** The exceedance of the review threshold at Barracks East is thought to have been caused by vehicles turning immediately adjacent to the Frisbee gauge and the deposition of fill material close by for the construction of the S5 causeway. However, this was an entirely localised exceedance as the results at Barracks West (located within 100 meters of Barrack East) show no high results. It should also be noted that there are no sensitive receptors in the immediate vicinity of the Barracks East gauge.

#### **3.4. Daily Dust Log and Environmental Inspections**

**3.4.1.** A summary of the daily dust log for June can be found in Appendix D. Dust was noted in the southern areas of site on seven occasions and on one occasion on the north. Vehicle movements were largely noted to be the cause of dust on site, with strong winds also found to be blowing

dust on site, and on to site from adjacent areas, on one occasion. 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.

**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 June one instance of dust was noted during one of these inspections in the south networks area (see table 4). Dust was seen to be rising from site. However, dampening down was subsequently observed during the inspection. Furthermore, contact with the works manager and section head of the area involved ensured that additional dampening down was undertaken.

**Table 4: Extract from Environmental Actions Register**

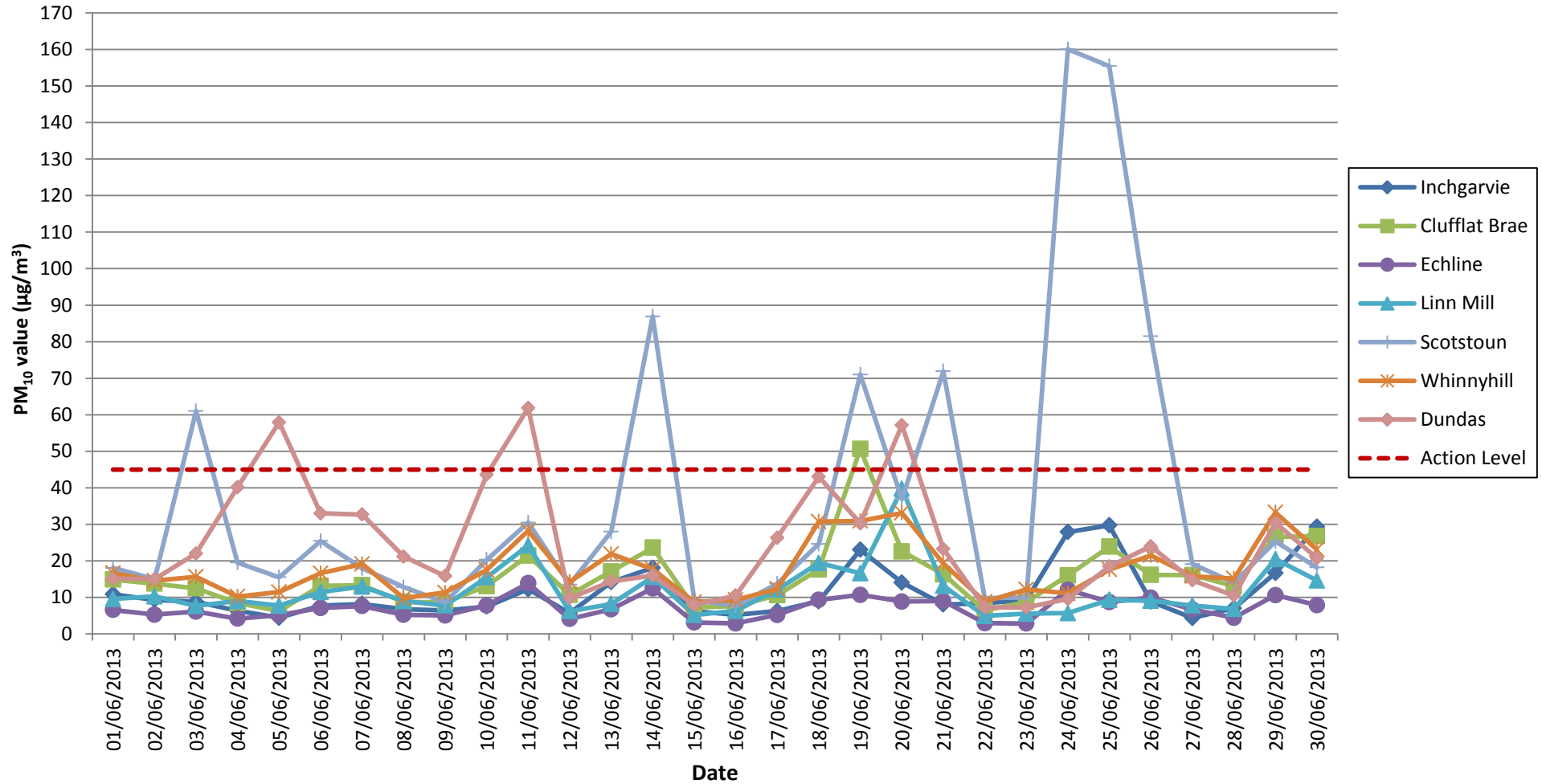
Date	Inspection by	Location	Issue identified	Due date	Date actioned	Actioned by	Actions
03/06/2013	ELS	South - A90 South Bound Bus Link	Dust seen rising from site due to vehicle movement	03 - June	03 - June	ESE	ESE reported this immediately following the inspection, contacting the works manager and section head. Additional dampening down was subsequently undertaken further to the dampening down that was observed at the time of the inspection.



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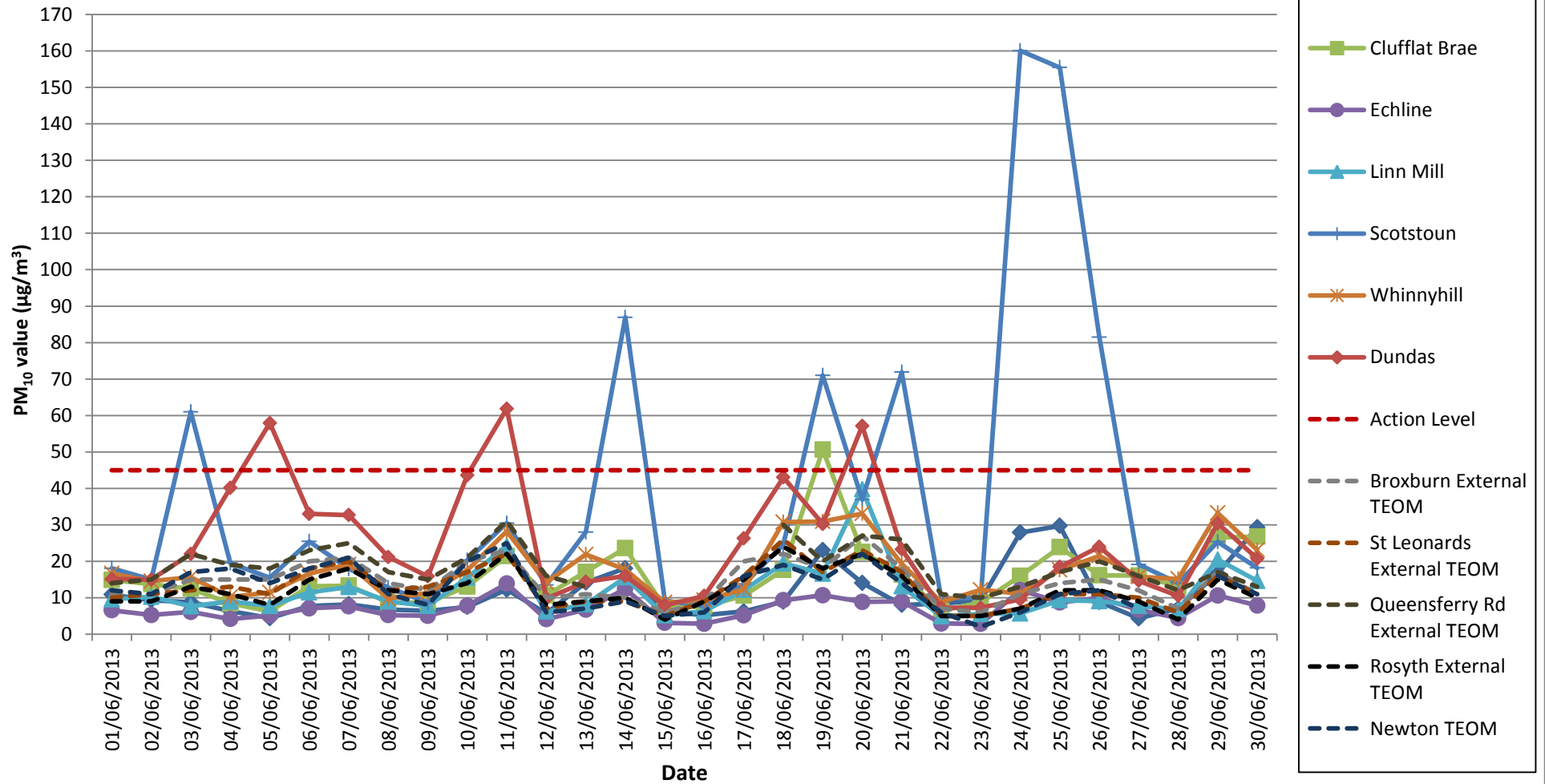
## **APPENDIX A: LIGHT SCATTER METER RESULTS**

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



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

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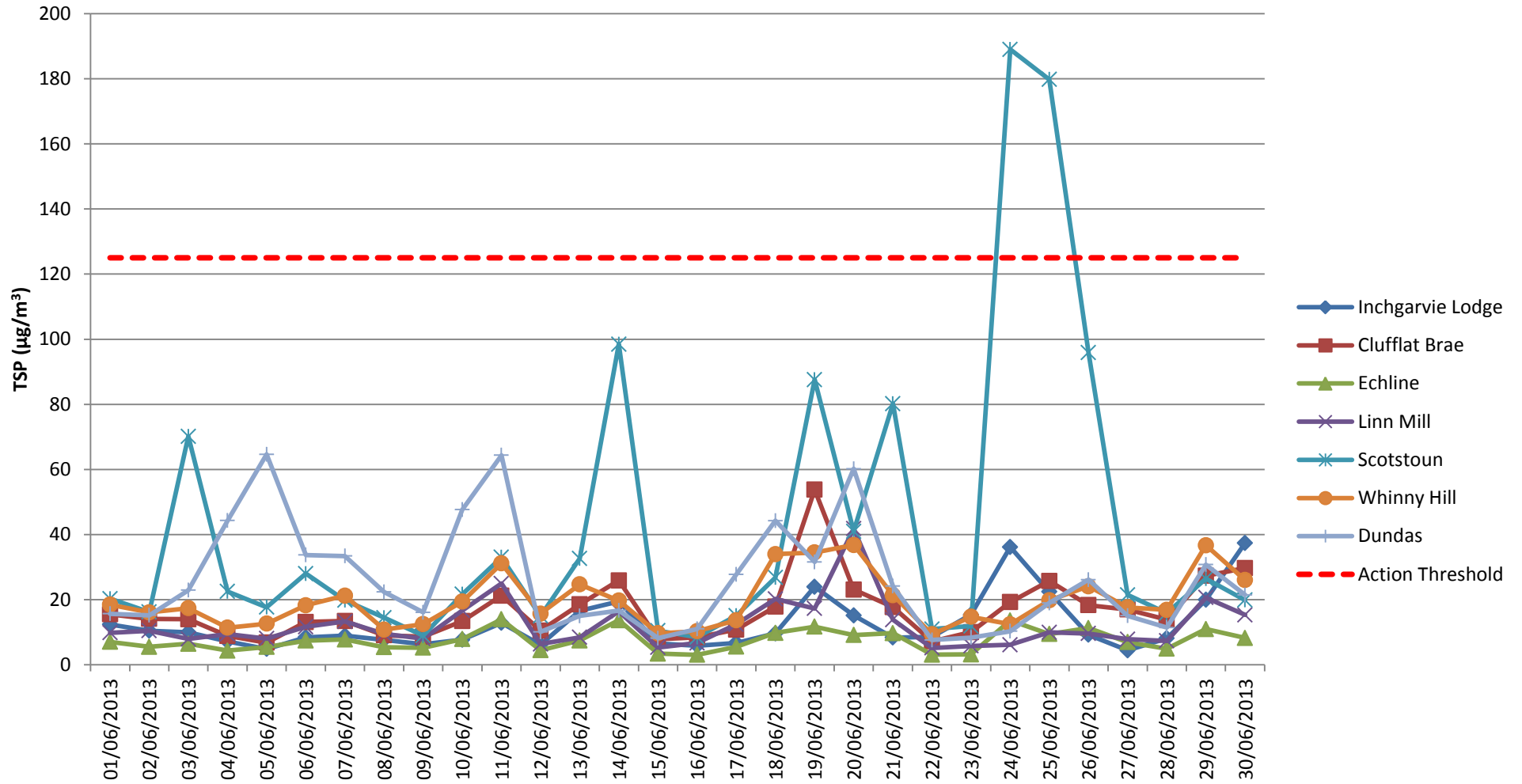


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## **APPENDIX B: TOTAL SUSPENDED PARTICLES**



# Total Suspended Particles (TSP) Results June 2013

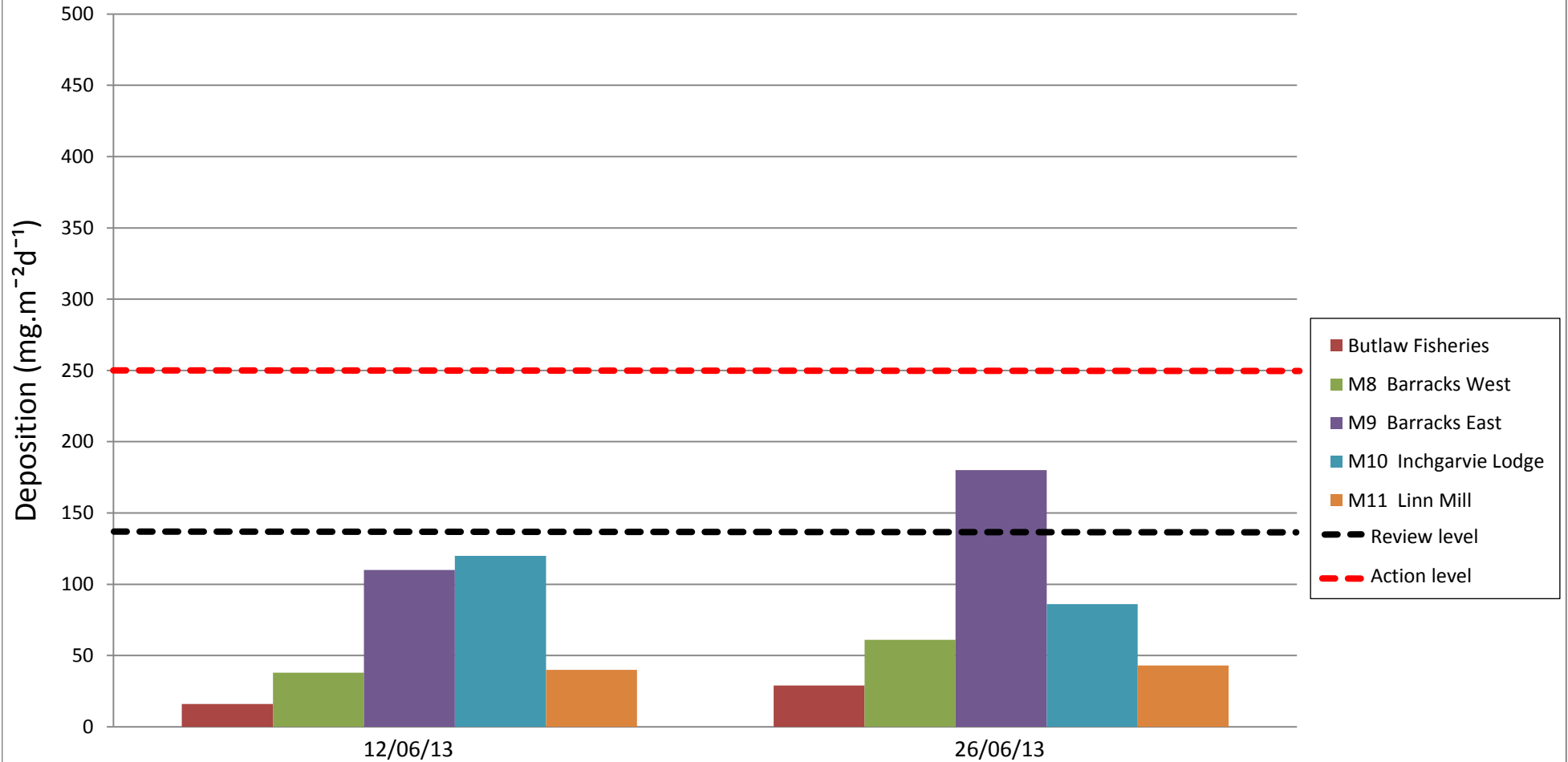




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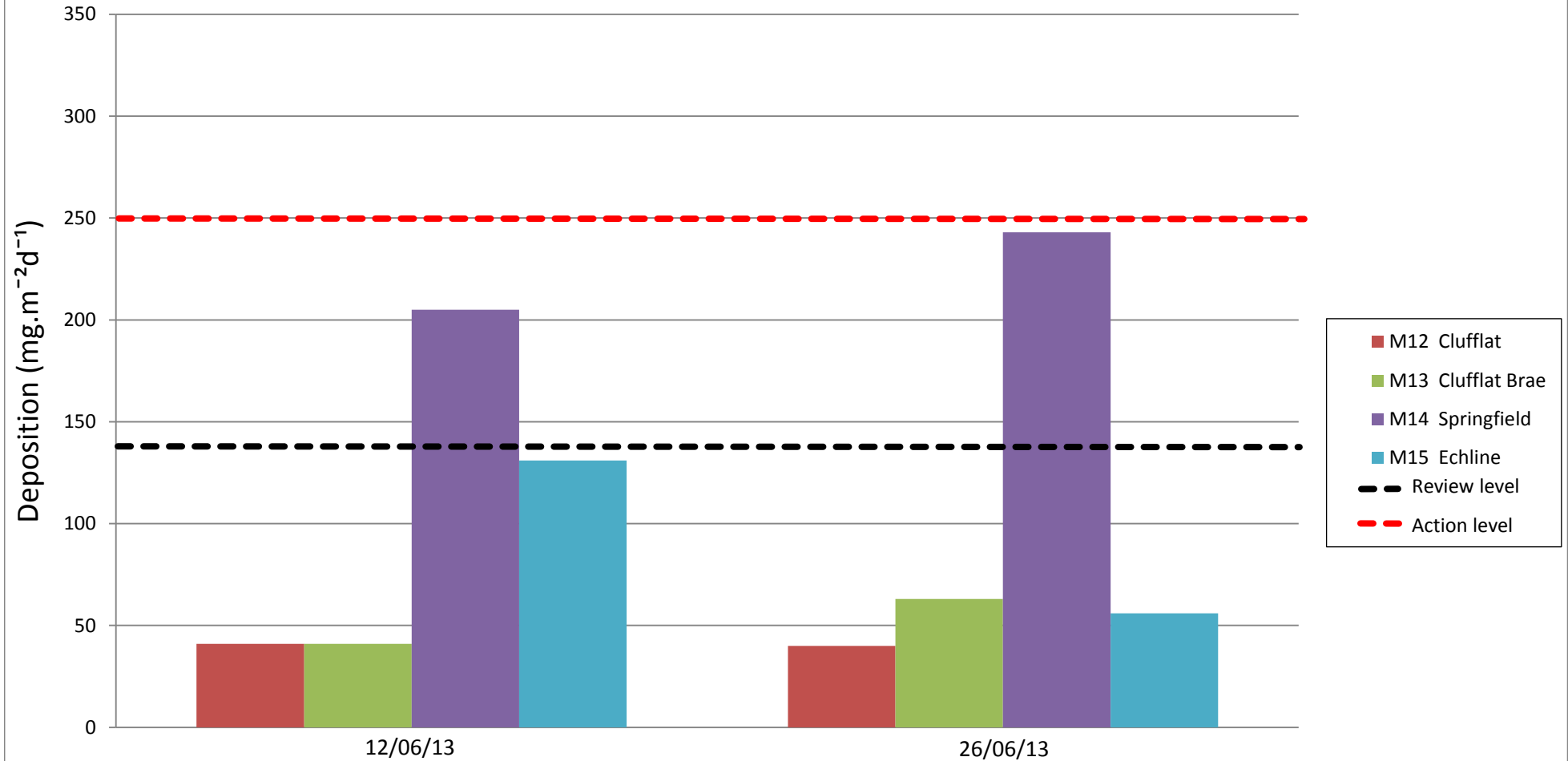
## **APPENDIX C: FRISBEE GAUGE RESULTS**

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



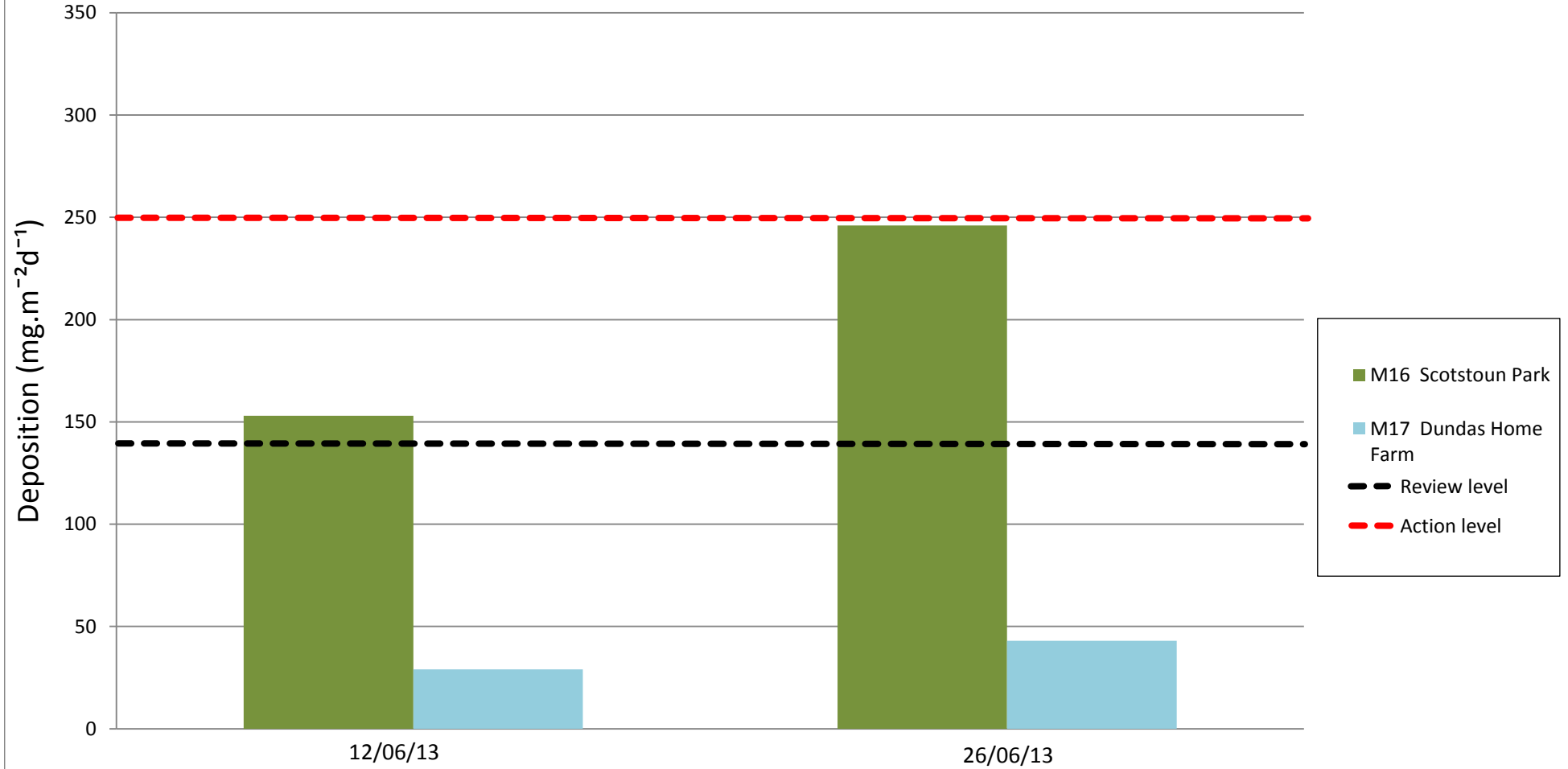
# Frisbee Dust Deposition Results: Group 2

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



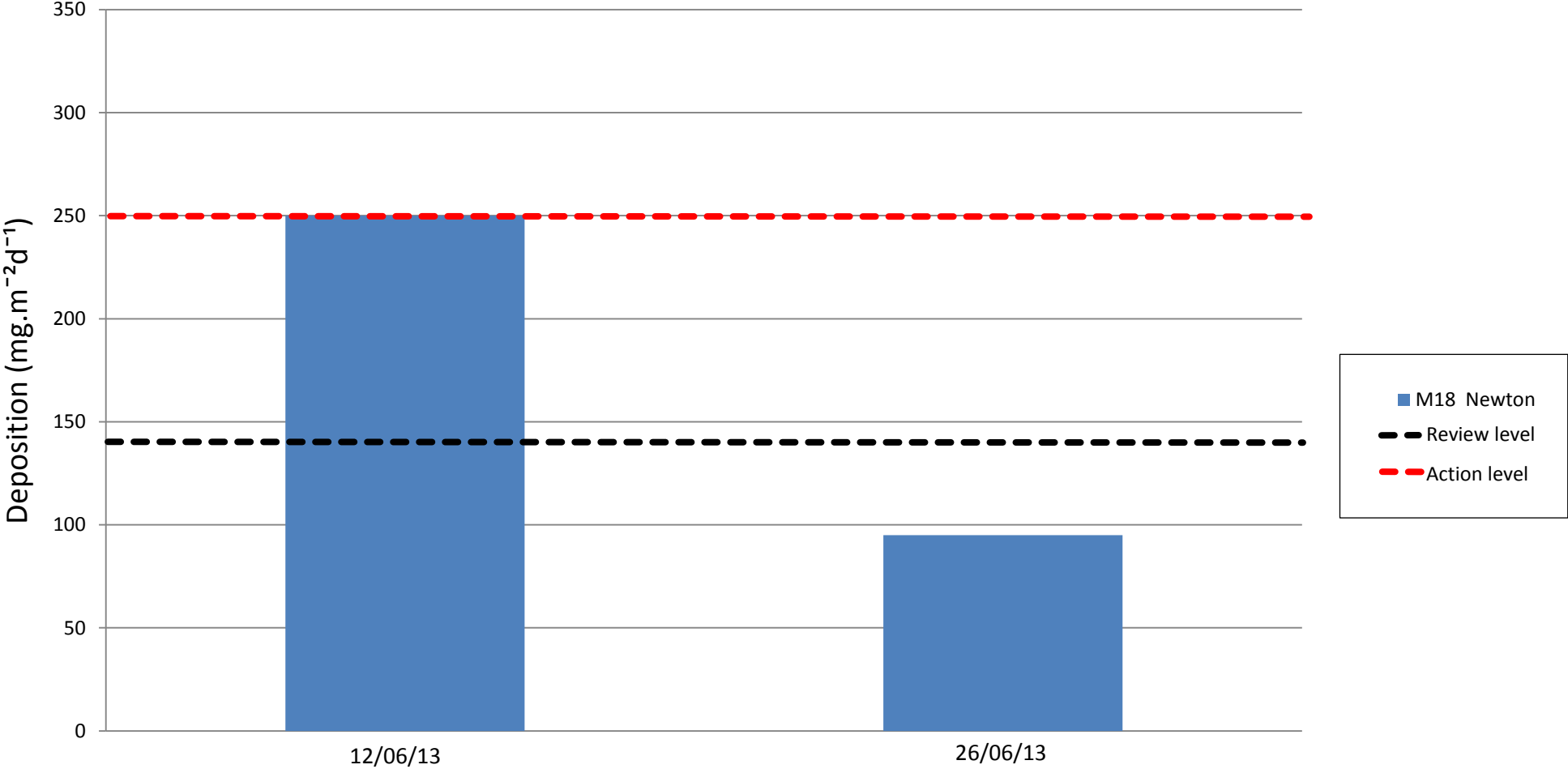
### Frisbee Dust Deposition Results: Group 3

#### Locations: M16 Scotstoun Park and M17 Dundas Home Farm



# Frisbee Dust Deposition Results: Group 4

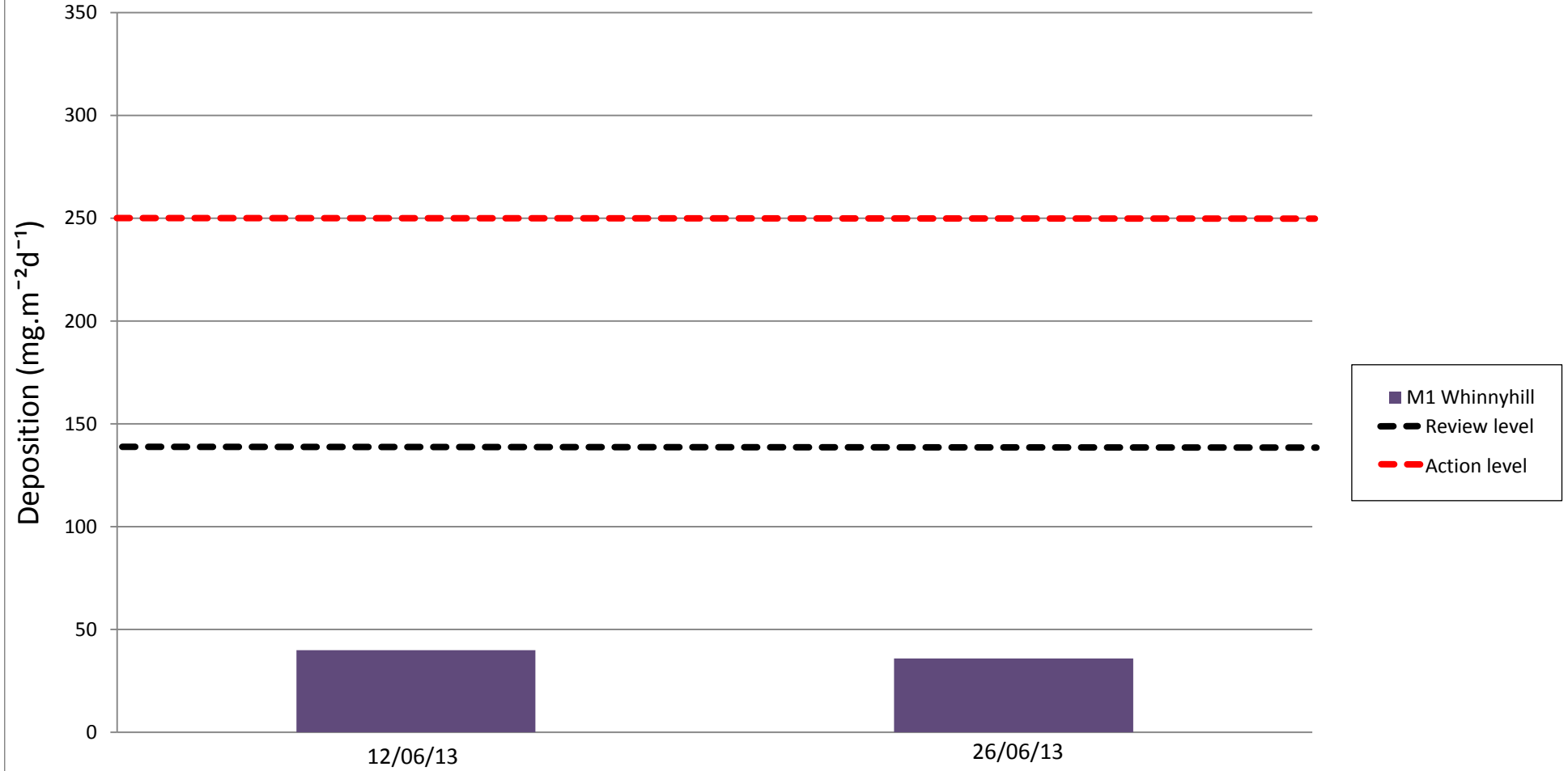
## Locations: M18 Newton





# Frisbee Dust Deposition Results: Group 5

## Locations: M1 Whinny Hill





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## **APPENDIX D: DAILY DUST LOG**



### Daily Dust Log - South - June 2013

DATE	LOCATION	WIND	WIND DIRECTION	GROUND SURFACE	VISIBLE DUST	DUST DUE TO WORKS (if applicable)	CAUSES OF DUST (if applicable)	COMMENTS AND ACTIONS
01/06/2013								
02/06/2013								
03/06/2013	S	LIGHT	WSW	DRY	Y	Y	vehicles	Alerts at Scotstoun. Additional road brush sent to the site entrance and bowser
04/06/2013	S	LIGHT	NE	DRY	N			Alerts at Dundas. No dust visible.
05/06/2013	S	LIGHT	ENE	DRY	N			Foggy conditions
06/06/2013	S	LIGHT	NE	DRY	Y	Y	vehicles	Alerts received. Dust observed at Scotsoun. Roadbrush and bowser on site.
07/06/2013	S	LIGHT	ENE	DRY	N			
08/06/2013								
09/06/2013								
10/06/2013	S	MEDIUM	NE	DRY	N			Alerts received. Hazy conditions. No dust visible.
11/06/2013	S	MEDIUM	NE	DAMP	N			Alerts received. Hazy conditions am. Rain pm. No dust visible.
12/06/2013	S	MEDIUM	SW	DRY	N			
13/06/2013	S	STRONG	WSW	DRY	N			
14/06/2013	S	MEDIUM	SSE	DRY	N			Alerts received for Scotstoun. No dust visible.
15/06/2013								
16/06/2013								
17/06/2013	S	MEDIUM	ENE	DRY	N			
18/06/2013	S	NONE	ENE	DRY	N			Hazy conditions. No dust visually noticeable during checks following alerts.
19/06/2013	S	STRONG	WSW	DRY	Y	Y	vehicles and wind blowing	Alerts received. Slight dust on site due to stong winds. Dust due to vehicles at Scotstoun. Bowser observed on site.
20/06/2013	S	LIGHT	NE	DRY	N			Alerts received. Bowser observed on site - tracks very wet. No dust visually observed. Slightly hazy conditions (likely to be cause of alerts received for Dundas).
21/06/2013	S	LIGHT	WSW	DRY	Y	Y	vehicles	Hazy/misty conditions. Alerts received for Scotstoun. Due to vehichle movements at site entrance by Scotstoun. Bowser and road sweeper operational.
22/06/2013								
23/06/2013								
24/06/2013	S	MEDIUM	W	DRY	Y	Y	vehicle movements - dust on road and blowing	Alerts received. Dust due to works between B800 and Dakota hotel and dust on B800 observed during inspections. Bowser dedicated to south networks dampening down.
25/06/2013	S	MEDIUM	SW	DRY	Y	Y	vehicle movements - dust on road and blowing	Alerts received. Dust due to works between B800 and Dakota hotel and dust on B800 oserved during inspections. Bowser dedicated to south networks dampening down. Resource to be increased due to dry weather. Roadsweeper in operation. Alert at Inchgarvie - due to dust blowing from society road works.
26/06/2013	S	LIGHT	WSW	DRY	Y	Y	vehicle movements - dust on road and blowing	Alerts received. Dust due to works between B800 and Dakota hotel and dust on B800 observed during inspections. Roadsweeper observed and second bowser in operation across south networks area.
27/06/2013	S	MEDIUM	SW	DRY	N			

28/06/2013	S	STRONG	WSW	DRY	N			
29/06/2013								
30/06/2013								