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LAND AT LADIES MILE, CLIFTON DOWNS,

BRISTOL ZOO CAR-PARKING AREA

VEGETATION MONITORING 2019

for

**BRISTOL, CLIFTON AND WEST OF ENGLAND ZOOLOGICAL
SOCIETY**

LAND AT LADIES MILE, CLIFTON DOWNS, BRISTOL ZOO CAR-PARKING AREA

VEGETATION MONITORING 2019

1 INTRODUCTION

Bristol, Clifton and West of England Zoological Society has been granted planning permission to continue use of an area of Clifton Down as a controlled overflow carpark on an occasional basis. Large areas of Clifton Down are of nature conservation value, largely owing to the unimproved and semi-improved limestone grassland they support.

In order to assess any impact on the nature conservation value of the area that car parking has, and to ensure that any necessary mitigation and remediation measures are implemented, a programme of vegetation monitoring has been carried out. This report describes the findings of a monitoring visit made on 2nd December 2019. Previous monitoring visits have been carried out annually from 2006.

The main conclusions of these earlier surveys have been consistent from year to year, as follows:

- That the grassland in the car-parking area continues to be of nature conservation value due to the presence of several plant species characteristic of limestone grassland.
- That damage probably occurred in the past as a result of use of the area as a car-park, but that damage was not worsening and the grassland in the area had stabilised, retaining ecological interest but showing some evidence of damage.
- That re-instatement will probably be possible once use as a car-park has ceased, but whilst use continues only small-scale works at site entrances are likely to be effective.

Any ongoing impact of car-parking on the biodiversity interest of the grassland could be detected by:

- An increase in the frequency of plant species tolerant of trampling; and
- A decrease in species associated with unimproved grassland.

The survey aims in particular to measure the frequency and abundance of these two groups of species.

2 METHODS

The 2019 survey was carried out on 2nd December 2019.

The methodology used was agreed with Bristol City Council's Nature Conservation Officer at the outset of the monitoring programme.

The area used for car-parking was walked and a species list was compiled, with an assessment of frequency using the DAFOR (dominant, abundant, frequent, occasional, rare) scale. Five quadrats measuring two by two metres were then surveyed in the area. Each quadrat was placed in a patch of turf with an appearance typical of the area – areas with any heavy wear around access points from the road and at the start of the footpath to the zoo were avoided. The percentage frequency of each plant species in each quadrat was recorded.

This survey methodology was repeated in the control area. Definition of a control area is problematic. The composition of the grassland on Clifton Down changes significantly over short distances, even where the gross appearance of the vegetation is similar, due to differences in soil composition and fertility. It is therefore difficult to define an area which is similar to the car-parking area in all respects other than the occasional use for car parking. In order to define a suitable control area a survey of

the Downs carried out for Bristol City Council in 2005 was referred to and areas around the carpark were walked. The control area chosen is immediately to the east of the car-parking area and separated from it by a broken belt of scrub, much of which was removed in 2018 as part of Bristol City Council's scrub and tree management programme. There are localised changes in grassland composition here, and quadrats were placed in patches similar in appearance to the car-parking area. These were grassy areas, with frequent upright brome (*Bromopsis erecta*), giving the sward a rough, bluish-green tufted appearance, and lower frequencies of perennial rye-grass (*Lolium perenne*) and red fescue (*Festuca rubra*). The same control area has been used in each of the surveys.

3 SURVEY RESULTS

Both the car-parking area and the control area were mown to a height of between 2cm and 7cm at the time of survey and are mown regularly using the standard Downs amenity cut throughout the summer.

The appearance of the car-parking area is similar to that described in previous years: a rather uneven sward with frequent upright brome and less frequent perennial rye-grass and red fescue interspersed with smaller patches of lower grassland. The extent of bare patches was higher than in either of the previous two surveys.

The sward in the control area is slightly lusher than in the zoo car parking area. It is mostly dominated by upright brome, with frequent red fescue and perennial rye-grass. There are patches where perennial rye-grass is dominant. Bare ground was very prominent here, with several patches virtually devoid of grass cover and with variable growths of herb species.

Species lists for the two areas are attached as appendix 1. The quadrat results for the car-parking and control areas are shown below. Note that percentage cover exceeds 100% due to overlapping vegetation. Calcareous grassland indicator species in italics

		Quadrat Number				
		1	2	3	4	5
		Percentage Frequency				
<i>Agrostis stolonifera</i>	Creeping bent		2			
<i>Bellis perennis</i>	Common daisy				12	8
<i>Bromopsis erecta</i>	<i>Upright brome</i>	75	50	80	60	70
<i>Crepis capillaris</i>	Smooth hawksbeard	2			5	
<i>Dactylis glomerata</i>	Cocksfoot		5	2		
<i>Festuca rubra</i>	Red fescue	10	15	10	5	5
<i>Hypochaeris radicata</i>	Common catsear			8		
<i>Lolium perenne</i>	Perennial rye-grass	10	40	20	30	20
<i>Plantago lanceolata</i>	Ribwort plantain			10	8	
<i>Poa annua</i>	Annual meadow-grass	1				
<i>Ranunculus repens</i>	Creeping buttercup	5			2	
<i>Sonchus oleraceus</i>	Smooth sow-thistle		2			
<i>Taraxacum vulgare agg</i>	Dandelion				2	
Bare soil		5			10	4

Table 1: Percentage coverage in quadrats, zoo car-parking area.

		Quadrat Number				
		1	2	3	4	5
		Percentage Frequency				
<i>Achillea millefolium</i>	Yarrow			4		
<i>Agrostis capillaris</i>	Common bent					2
<i>Agrostis stolonifera</i>	Creeping bent					5
<i>Bellis perennis</i>	Common daisy	10		2	10	
<i>Bromopsis erecta</i>	<i>Upright brome</i>	60	80	70	60	65
<i>Cerastium fontanum</i>	Common mouse-ear					1
<i>Crepis capillaris</i>	Smooth hawksbeard	4		5	2	3
<i>Dactylis glomerata</i>	Cocksfoot	2		2		
<i>Festuca rubra</i>	Red fescue					5
<i>Hypochaeris radicata</i>	Common catsear	6		5	4	1
<i>Lolium perenne</i>	Perennial rye-grass	20	10	10	15	30
<i>Pimpinella saxifrage</i>	<i>Burnet saxifrage</i>					1
<i>Plantago lanceolata</i>	Ribwort plantain	10	5	2	5	4
<i>Ranunculus repens</i>	Creeping buttercup	5	12	15	10	5
<i>Taraxacum vulgare</i> agg	Dandelion					4
<i>Trifolium repens</i>	White clover	1				
Bare soil		15	4			

Table 2: Percentage coverage in quadrats, control area.

The summary results for the two areas, using the notation employed in the National Vegetation Classification (NVC) are shown below:

	Oct 2006	Jan 2008	June 2009	Oct 2010	Oct 2011	Oct 2012	Nov 2013	Oct 2014	Dec 2015	Sept 2016	Oct 2017	Jan 2019	Dec 2019
<i>Bromopsis erecta</i>	V (5-9)	V (4-8)	V (4-8)	IV (7-9)	V (5-9)	V (7-9)	V (6-9)	V (8-9)	V (8-9)	V (8-9)	V (5-9)	V (7-9)	V (7-9)
<i>Lolium perenne</i>	V (5-6)	V (4-7)	V (4-7)	V (3-8)	V (4-8)	V (4-5)	V (4-7)	V (4-5)	V (4-5)	V (4-5)	V (5-8)	V (4-8)	V (4-7)
<i>Festuca rubra</i>	V (4-9)	V (4-7)	V (4-6)	V (4-5)	IV (4)	IV (4-5)	II (4)	V (3-5)	V (4-5)	IV (4-5)	III (4-5)	IV (3-4)	V (4-5)
<i>Plantago lanceolata</i>	V (4-5)	II (5)	V (2-5)	V (2-4)	IV (4-5)	IV (4)	IV (4-5)	V (4)	III (2-4)	V (3-4)	IV (4)	IV (2-4)	II (4)
<i>Ranunculus repens</i>	V (4-5)	III (4)		III (1-4)	III (2-4)	I (2)	IV (1-4)	IV (1-4)	III (3-4)	IV (2)	II (2-4)	V (2-3)	II (2-4)
Bare soil	V (4-5)	V (4-5)	III (4)	III (2-4)	II (2)	I (2)	III (3-5)	II (2)	V (3-4)	III (3-4)	II (4)	IV (3-5)	III 4
<i>Taraxacum vulgare</i> agg	IV (4)			IV (1-3)	IV (4)	III (2-4)	III (1-3)	II (3-4)	II (2)	IV (1-4)	II (3-4)	II (1-4)	I (2)
<i>Trifolium repens</i>	III (4-5)	IV (4-5)	IV (4-5)	IV (2-4)	IV (4)	V (4-5)	II (4)		I (3)	V (2-4)	V (4-6)	I (1)	
<i>Bellis perennis</i>	III (4)	V (4-5)	IV (4)	IV (1-2)	IV (1-4)	II (2-3)	III (1-2)	V (1-4)	V (4-5)	IV (1-2)	III (4)	V (2-4)	II (4-5)
<i>Ranunculus bulbosus</i>	II (4)				I (1)	I (1)	III (2-4)				II (1-2)	III (1-2)	
<i>Crepis capillaris</i>	II (4)			I (1)				I (4)		II (2)		I (2)	II (1-4)
<i>Scorzonoides autumnalis</i>	II (4)		I (4)	I (1)									
<i>Dactylis glomerata</i>	I (4)	II (4)	II (4-6)	III (1-5)	III (1-4)	I (4)	II (2-4)	I (4)	III (1-4)	II (1-2)	III (1-4)	IV (2-4)	II (2-4)

	Oct 2006	Jan 2008	June 2009	Oct 2010	Oct 2011	Oct 2012	Nov 2013	Oct 2014	Dec 2015	Sept 2016	Oct 2017	Jan 2019	Dec 2019
<i>Lotus corniculatus</i>	I (4)			I (4)						I (2)			
<i>Poterium sanguisorba</i>	I (4)												
<i>Plantago media</i>	I (4)	I (4)	I (2)						I (4)				
<i>Festuca ovina</i>	I (4)					I (4)	I (4)						
<i>Trifolium dubium</i>	I (3)							I (2)	I (1)				
<i>Poa annua</i>	I (2)					I (1)			I (1)			II (1)	I (1)
<i>Plantago major</i>			I (1)	II (1-2)		I (4)	I (2)			II (2-4)	II (2-4)		
<i>Achillea millefolium</i>		I (4)	II (1-4)										
<i>Hypochaeris radicata</i>			I (1)	I (4)						I (1)	I (4)		I (4)
<i>Bromus hordaceus</i>			I (4)										
<i>Trifolium pratense</i>			I (1)										
<i>Medicago lupulina</i>			I (2)										
<i>Jacobaea vulgaris</i>				I (1)									
<i>Helictotrichon pratense</i>										I (2)			
<i>Cynosurus cristatus</i>					II (4)			I (3)	I (4)				
<i>Leontodon saxatile</i>					I (2)								
<i>Helictochloa pratense</i>					I (2)								
<i>Koeleria macrantha</i>						I (4)	I (3)						
<i>Pimpinella saxifraga</i>								I (4)					
<i>Taraxacum erythrosepala</i>								II (1)	I (1)			I (1)	
<i>Sherardia arvensis</i>									I (1)				
<i>Smyrniolum olustranum</i>												I (4)	
<i>Sonchus asper</i>												II (1-2)	
<i>Trifolium scabrum</i>												I (2)	
<i>Sonchus oleraceus</i>													I (1)

Table 3: Summary quadrat results, car parking area

	Oct 2006	Jan 2008	June 2009	Oct 2010	Oct 2011	Oct 2012	Nov 2013	Oct 2014	Dec 2015	Sept 2016	Oct 2017	Jan 2019	Dec 2019
<i>Bromopsis erecta</i>	V (5-9)	V (4-8)	V (4-9)	V (4-9)	V (6-9)	V (7-9)	V (8-9)	V (6-9)	V (8-9)	V (8-9)	V (8-9)	V (7-9)	V (8-9)
<i>Lolium perenne</i>	V (5-6)	V (4-7)	II (4)	V (5-7)	V (4-8)	V (4-7)	V (4-7)	V (4-7)	V (4-6)	V (4-5)	V (4-6)	V (4-5)	V (4-6)
<i>Festuca rubra</i>	V (4-9)	V (4-7)	V (4-7)	V (4-7)	IV (4-5)	II (4)	IV (4-7)	III (2-5)	V (4-6)	V (4)	V (4-5)	III (3-4)	I (4)
<i>Plantago lanceolata</i>	V (4-5)	II (5)	V (4-5)	V (1-4)	V (3-4)	V (4)	V (4)	II (4)	III (3-4)	V (2-4)	V (4)	V (1-4)	V (2-4)
<i>Ranunculus repens</i>	V (4-5)	III (4)	I (4)	IV (1-4)	V (4-5)	IV (2-4)	V (2-5)	V (4-5)	V (4)	V (1-4)	V (4)	V (4-5)	V (4-5)
Bare soil	V (4-5)	V (4-5)	I (4)	I (1)	I (1)				IV (2-4)		III (2)	V (4-7)	II (4-5)
<i>Agrostis capillaris</i>			V (4-7)	II (4)									I (2)
<i>Taraxacum vulgare agg</i>	IV (4)			II (4)	IV (4)	III (3-4)	III (2-4)	V (2-4)	IV (2-4)	III (3-4)	II (4)	II (1-2)	I (4)
<i>Trifolium repens</i>	III (4-5)	IV (4-5)	IV (2-4)	IV (1-4)	V (4-5)	V (4)	III (2-4)	IV (1-5)	V (2-4)	V (4)	V (3-5)	I (2)	I (1)
<i>Bellis perennis</i>	III (4)	V (4-5)		II (2-3)	II (2-3)	II (1-2)		I (1)	IV (1-4)	I (2)	I (2)	III (2-4)	III (1-4)
<i>Trifolium pratense</i>				III (1-4)	I (2)					II (2-4)	II (1-2)		
<i>Ranunculus bulbosus</i>	II (4)						I (1)			I (1)	I (1)	III (2-4)	
<i>Crepis capillaris</i>	II (4)		II (4)	III (1-3)	II (2-4)	II (1-4)		I (4)	III (1-4)	IV (1-4)	IV (2-4)	III (1-2)	IV (2-4)
<i>Scorzoneroideis autumnalis</i>	II (4)		II (1-4)		I (1)		III (3-4)		I (1)	I (4)	I (3)		
<i>Dactylis glomerata</i>	I (4)	II (4)	II (4)	II (1-4)	II (2-4)	I (2)	II (2-4)	II (2-4)		I (1)	III (1-3)	IV (4-5)	II (1-2)
<i>Lotus corniculatus</i>	I (4)		II (4)	II (2-4)	I (4)	II (2-3)		II (1-4)		I (4)			
<i>Poterium sanguisorba</i>	I (4)		I (4)										
<i>Plantago media</i>	I (4)	I (4)											
<i>Festuca ovina</i>	I (4)												
<i>Trifolium dubium</i>	I (3)						I (1)			I (1)		I (2)	
<i>Poa annua</i>	I (2)												
<i>Leontodon saxatile</i>			I (4)		I (2)	III (4)							
<i>Achillea millefolium</i>		I (4)		IV (1-4)		II (1-2)	I (1)		II (1)	I (1)	I (1)	I (1)	I (4)
<i>Galium verum</i>			IV (2-4)	I (4)						I (1)			
<i>Hypochaeris radicata</i>			II (4)	I (4)	I (2)	II (2-3)	I (4)	I (4)	III (1-4)	III (2-4)	III (2-4)	II (1-2)	IV (1-4)
<i>Prunella vulgaris</i>			I (1)										
<i>Poa trivialis</i>												I (1)	
<i>Sonchus asper</i>												I (4)	

	Oct 2006	Jan 2008	June 2009	Oct 2010	Oct 2011	Oct 2012	Nov 2013	Oct 2014	Dec 2015	Sept 2016	Oct 2017	Jan 2019	Dec 2019
<i>Cirsium acaule</i>			<i>I (1)</i>										
<i>Pimpinella saxifraga</i>				<i>I (1)</i>	<i>I (1)</i>								<i>I (1)</i>
<i>Helictochloa pratense</i>					<i>I (1)</i>			<i>I (1)</i>		<i>I (1)</i>			
<i>Agrostis stolonifera</i>						II (4)				II (1- 2)	I (4)		I (4)
<i>Cerastium fontanum</i>													<i>I (1)</i>

Table 4: Summary quadrat results, control area

In tables 3 and 4 above I – V denotes frequency, i.e. the number of quadrats in which a species was recorded.

1-9 denotes abundance using the Domin scale as follows:

- | | |
|----|--------------------------|
| 1 | <4%, few individuals |
| 2 | <4%, several individuals |
| 3 | <4%, many individuals |
| 4 | 4-10% |
| 5 | 11-25% |
| 6 | 26-33% |
| 7 | 34-50% |
| 8 | 51-75% |
| 9 | 76-90% |
| 10 | 91-100%. |

Calcareous grassland indicator species are shown in italics.

4 DISCUSSION

There are several factors that could be used to indicate an increase in damage to the car-parking area. The most significant would be:

- Changes in the dominant species in the sward;
- A decline in calcareous grassland indicator species;
- An increase in species associated with disturbed conditions – ruderal species; and
- An increase in the quantity of bare ground.

Any such changes would be significant if they occur in the car-parking area but not the control area; if they occur in both areas then factors other than damage relating to car-parking are likely to be responsible.

4.1 Changes in Dominant Species in the Sward

Table 3 above shows that the overall composition of the sward in the car-parking area has remained broadly similar since 2006: upright brome and perennial rye-grass have been consistently abundant in the sward. Ribwort plantain has been generally frequent, although there was an apparent decline in this survey. Red fescue has also been abundant in most years, with some fluctuations; it remains frequent in the car parking area but has declined in the control area.

4.2 Calcareous Grassland Indicator Species

The overall diversity of calcareous grassland indicator species recorded is as follows:

Year	Car parking area – quadrats	Car parking area – overall		Control area – quadrats	Control area – overall
2006	5	5		5	7
2008	2	4		2	6
2009	2	6		5	8
2010	2	6		4	7
2011	3	9		5	8
2012	3	9		3	10
2013	2	10		1	7
2014	3	9		3	8
2015	3	12		1	11
2016	4	12		5	11
2017	1	12		1	8
2018	3	12		1	8
2019	1	11		2	6

Table 5: Diversity of calcareous grassland indicator species

There was an apparent decline in the diversity of indicator species in both areas, although this may be due to the timing of the survey meaning that some species were not visible. The overall diversity of calcareous grassland species remains high in the car parking area but appears to have dipped slightly in the control area.

4.3 Indicator Species of Disturbed Ground

The table below shows the frequency in the quadrats of species particularly associated with disturbance.

	Creeping buttercup	Common daisy	Annual meadow-grass	Common ragwort	Ratstail plantain	Field Madder	Prickly sow-thistle	Smooth sow-thistle	Bare soil
Car parking Area									
2006	V (4-5)	III (4)	I (2)						V (4-5)
2008	III (4)	V (4-5)							V (4-5)
2009		IV (4)			I (1)				III (4-5)
2010	III (1-4)	IV (1-2)		I (1)	II (1-2)				III (2-4)
2011	III (2-4)	IV (4)							II (2)
2012	I (2)	II (2-3)	I (1)		I (4)				I (2)
2013	IV (1-4)	III (1-2)			I (2)				III (3-5)
2014	IV (1-4)	V (1-4)							II (2)
2015	III (3-4)	V (4-5)	I (1)			I (1)			V (3-4)
2016	IV (2)	IV (1-2)			II (2-4)				III (3-4)
2017	II (2-4)	III (4)			II (4)	II (1)			II (4)
2018	V (2-3)	V (2-4)					II (1-2)		IV (3-5)
2019	II (2-4)	II (4-5)	I (1)					I (1)	III (4)
Control Area									
2006	V (4-5)	III (4)	I (2)						V (4-5)
2008	III (4)	V (4-5)							V (4-5)
2009	I (4)								I (4)
2010	IV (4-5)	II (2-3)							I (1)
2011	V (4-5)	II (2-3)							I (1)
2012	IV (2-4)	II (1-2)							
2013	V (2-5)								
2014	V (4-5)	I (1)							
2015	V (4)	IV (1-4)							IV (2-4)
2016	V (1-4)	I (2)							
2017	V (4)	I (2)							III (2)
2018	V (4-5)	III (2-4)					I (4)		V (4-7)
2019	V (4-5)	III (1-4)							II (4-5)

Table 6: Records of species associated with disturbance

The table shows a fall in the frequency of some indicators of disturbance in the car parking area after a rise in 2018. This may be due to the timing of the surveys: the 2018 survey was actually carried out in January 2019, when these species were more visible. It may also be because they were favoured by the dry summer of 2018 but less so by the wetter summer of 2019. This

explanation is favoured by the absence during this survey of the scarcer species associated with drought conditions that were recorded in 2018: parsley piert (*Aphanes arvensis*) and rough clover (*Trifolium scabrum*).

One trend that was noted during this survey is that parts of the control area are now very disturbed and showing a higher proportion of bare ground than the car parking area. This is due to Downs staff driving vehicles across the area (and elsewhere on the Downs) to a much greater degree than was the case in the past. Unlike the car parking this is not seasonally limited and use of vehicles in wet conditions is having a marked impact in places.

CONCLUSIONS

The findings of the December 2019 survey are similar to those of previous surveys, as follows:

- The composition of the vegetation in both areas has been broadly stable since 2006.
- The car parking area, when compared to the control area, has a slightly higher diversity both of plants of unimproved grassland and plants indicative of disturbance.
- There is no evidence of any ongoing decline in the diversity of plants of unimproved grassland in the car parking area.
- There is no evidence of any ongoing increase in the diversity of plants indicative of disturbed conditions in the car parking area.
- There are signs of disturbance in the control area due to use of vehicles.

The results suggest that the use of the area for car parking caused, when the practice commenced, some decline in the nature conservation of the sward although such a conclusion is tentative in the absence of detailed historical evidence. There is evidence that plants indicative of disturbed conditions are slightly more frequent in the car-parking area.

There is no evidence of any decline in the nature conservation value of the car parking area since 2006. Changes in the diversity and frequency of desirable species (limestone indicators) and of undesirable species (those associated with disturbed conditions) have been noted from one year to the next without any clear trend, or any ongoing divergence from the sward in the control area, being apparent. The overall diversity of plants indicative of unimproved grassland increased between 2010 and 2015, providing some evidence of an increase in the nature conservation value of the area, which may be due to improvements in the management of car parking. The number of these species recorded has since been stable.

5 MITIGATION

5.1 Ongoing

As regards potential mitigation or remediation there is little that can be done to reverse any minor adverse impacts whilst occasional use as a car park continues. If this use is at the same level as at present, then it is not considered likely that further deterioration will occur.

Adverse impacts can be avoided by not importing topsoil to the area, since this raises soil fertility and would introduce undesirable plant species. If patches of ground have to be made up at access points from the road limestone scalplings should be used to build up ground level. Bare patches of soil should be left to revegetate naturally where possible but where reseeding is necessary red fescue seed should be used.

The south-western part of the area is more diverse than other parts and supports most of the limestone grassland species recorded here, including the Nationally Scarce spring cinquefoil. It is recommended that use of this part of the area is kept to an absolute minimum and avoided when possible.

5.2 Long-term

If in the longer term the Ladies Mile site is no longer required for car-parking, then remediation to return the sward to the condition of nearby undisturbed areas should be feasible. The nature of the sward, with upright brome remaining frequent, suggests that soil fertility has not been raised and remediation may therefore be successful.

Elsewhere actions should be taken to counteract the impacts of soil compaction and to allow grassland plants native to the Downs to colonise. Measures **that must be avoided** include importation of any soil, use of seed from elsewhere and any measure that raises the soil fertility.

If and when use of the area ceases it is proposed that a restoration strategy is drawn up. In summary it should contain the following points:

- The more species-rich area in the south-western corner should be left undisturbed;
- The area should be harrowed. This would provide some mitigation of compaction and will open up the sward for seed germination;
- Hay from nearby areas of species-rich grassland should be spread on the area. In order to maximise the diversity of viable seed, two applications should be made, one in early July and one in late August. In both cases hay should be cut and then immediately spread over the area; and
- In the year following the hay spreading the area should be surveyed and if weed species such as docks and thistles are germinating it should be topped regularly. In subsequent years it should be mown for hay using the regime currently used on adjacent areas to the south-east.

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Wessex Ecological Consultancy

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Appendix 1

The plant species recorded in the two areas are:

		Car-parking Area	Control Area
<i>Achillea millefolium</i>	Yarrow	Rare	Rare
<i>Agrostis capillaris</i>	Common bent	Rare	Rare
<i>Agrostis stolonifera</i>	Creeping bent	Rare	Rare
<i>Bellis perennis</i>	Common daisy	Occasional	Occasional
<i>Bromopsis erecta</i>	<i>Upright brome</i>	<i>Frequent</i>	<i>Frequent</i>
<i>Carex flacca</i>	<i>Glaucous sedge</i>	<i>Rare</i>	<i>Rare</i>
<i>Centaurea nigra</i>	<i>Black knapweed</i>	<i>Rare</i>	
<i>Cerastium fontanum</i>	Common mouse-ear	Rare	Rare
<i>Crepis capillaris</i>	Smooth hawksbeard	Rare	Rare
<i>Cynosurus cristatus</i>	Crested dogstail	Rare	Rare
<i>Dactylis glomerata</i>	Cocksfoot	Occasional	Occasional
<i>Festuca rubra</i>	Red fescue	Occasional	Occasional
<i>Hypochaeris radicata</i>	Common catsear	Rare	Occasional
<i>Helictochloa pratense</i>	<i>Field oat-grass</i>	<i>Rare</i>	<i>Rare</i>
<i>Koeleria macrantha</i>	<i>Crested hair-grass</i>	<i>Rare</i>	
<i>Lolium perenne</i>	Perennial rye-grass	Frequent	Occasional
<i>Lotus corniculatus</i>	<i>Bird's-foot trefoil</i>	<i>Rare</i>	<i>Rare</i>
<i>Phleum pratense</i>	Timothy	Rare	Rare
<i>Pimpinella saxifraga</i>	<i>Burnet saxifrage</i>	<i>Rare</i>	<i>Rare</i>
<i>Plantago lanceolata</i>	Ribwort plantain	Frequent	Frequent
<i>Plantago media</i>	<i>Hoary plantain</i>	<i>Rare</i>	
<i>Poa annua</i>	Annual meadow-grass	Rare	Rare
<i>Poa pratensis</i>	Smooth meadow-grass	Rare	Rare
<i>Poa trivialis</i>	Rough-stalked meadow-grass	Rare	Rare
<i>Potentilla verna</i>	<i>Spring cinquefoil</i>	<i>Rare</i>	
<i>Poterium sanguisorba</i>	<i>Salad burnet</i>	<i>Rare</i>	<i>Rare</i>
<i>Ranunculus bulbosus</i>	Bulbous buttercup	Rare	Rare
<i>Ranunculus repens</i>	Creeping buttercup	Occasional	Occasional
<i>Sagina procumbens</i>	Procumbent pearlwort	Rare	
<i>Scorzoneroides autumnalis</i>	Autumnal hawkbit	Rare	Rare
<i>Sonchus asper</i>	Prickly sow-thistle	Rare	Rare
<i>Sonchus oleraceus</i>	Smooth sow-thistle	Rare	
<i>Taraxacum erythrosepala</i>	<i>Limestone dandelion</i>	<i>Rare</i>	
<i>Taraxacum vulgare</i> agg	Dandelion	Rare	Occasional
<i>Trifolium dubium</i>	Lesser trefoil	Rare	Rare
<i>Trifolium pratense</i>	Red clover	Rare	Rare
<i>Trifolium repens</i>	White clover	Occasional	Occasional
<i>Veronica persica</i>	Common field-speedwell	Rare	Rare

Table 3: Zoo car parking and control areas, full plant species lists – calcareous grassland indicator species in italics

