VEGETATION SURVEY & ASSESSMENT

SALISBURY PLAIN SITE OF SPECIAL SCIENTIFIC INTEREST

BRYOPHYTE SITE DOSSIER

FOR NATURAL ENGLAND

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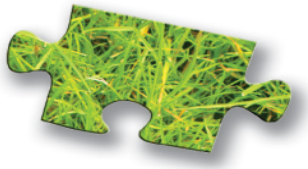

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1. SUMMARY

This Bryophyte Site Dossier documents the current status of populations of nine species of moss and liverwort which together comprise the *non-vascular plant assemblage feature* of Salisbury Plain Site of Special Scientific Interest (SSSI).

Healthy and sustainable populations of all nine species were confirmed, along with a further two nationally scarce mosses that were discovered in the course of fieldwork. Certain parts of the eastern SSSI are known to be of high importance for these species, including disturbed calcareous grassland habitats at Sidbury Hill, the Cross Country Driving Area (CCDA), Silk Hill, Beacon Hill and the Bulford firing ranges.

As a result, the targets used to measure condition of the feature in the SSSI are considered to have been met and the feature is therefore considered to be in Favourable Condition. The current backdrop of military training and estate management appears to be creating and maintaining extensive areas of disturbed calcareous grassland that in turn supports healthy populations of key bryophytes. However, there is no previous measure of population size or extent for any of the target species so it is not possible to say how species are faring compared to previous years.

Only a few recommendations for habitat management/intervention have been considered necessary where assemblage species are considered to be at imminent risk of loss or damage.

It is also recommended that *Bryum torquescens* and *Grimmia orbicularis* should be added to the non-vascular plant assemblage feature.

2. INTRODUCTION

Salisbury Plain SSSI is a large site in Wiltshire with 31 different notified features. One of these is a *non-vascular plant assemblage* of nine qualifying mosses and liverworts. Under Natural England's obligations to undertake regular monitoring of SSSI notified features, a survey and condition assessment of the assemblage of the SSSI was undertaken in 2015, the findings of which are described in this Bryophyte Site Dossier.

2.1 Non-vascular Plant Assemblage Feature

The current notified bryophyte interest feature is set out in the Salisbury Plain SSSI Favourable Condition Tables (Final Version, March 2015) and the nine nationally rare (NR) and nationally scarce (NS) species which currently comprise the assemblage are given in Table 1. Conservation status refers to the most recent lists published for Red List species (Hodgetts 2011), and nationally rare/nationally scarce species (Preston 2010 and 2006 respectively).

Table 1. Non-vascular Plant Assemblage

Species Name	Conservation Status	Most recent record in SSSI
Abietinella abietina var. hystricosa	NS	2014
Aloina rigida	NS	2014
Didymodon acutus	NS	2014
Ephemerum recurvifolium	NS	2009
Lophozia perssonii	NR	2010
Pleurochaete squarrosa	NS	1986
Pottiopsis caespitosa	NS	No records
Racomitrium canescens	NS	2012
Weissia sterilis	NS, BAP, Section 41, RDB Near Threatened	1998

The Favourable Condition Tables (FCT) also lists several locally distinctive species: *Scapania aspera*, *Weissia controversa var. crispata* and *Entodon concinnus*. For the purpose of this assessment, a former assemblage species, *Leptodon smithii*, has also been included.

Nomenclature of species throughout this site dossier follows the current British Bryological Society checklist published in Hill et al (2008) whilst the naming of vascular plants follows Stace (2010).

2.2 Condition Assessment

The Salisbury Plain SSSI FCT sets out four mandatory site-specific targets against which condition of the assemblage can be measured (Appendix I). The first of these (*presence/absence*) is a direct measure of condition, whilst *niche availability*, *vegetation structure* and *niche diversity* are indirect targets relating to the habitat which supports populations of the assemblage species.

2.3 Acknowledgements

The author is grateful to Sarah Grinsted (Natural England) for helpful discussions and direction during survey planning and Julie Swain (Defence Infrastructure Organisation) who provided assistance with accessing the SSSI. Thanks are also given to Jenny Bennett, Andrew Branson, David Morris and Lucia Ruffino for giving freely of their time to assist with some of the fieldwork.

3. METHODS

3.1 Data Search

Initially a comprehensive desk study was undertaken to collect as many relevant historical records for the individual assemblage species as possible. Sources of records included the:

- Wiltshire and Swindon Biological Records Centre;
- South Wiltshire (Vice-county 8) Regional Recorder for the British Bryological Society; and
- Author's own database of records.

These records are tabulated in Appendix II. By overlaying the dataset on aerial photography and Ordnance Survey mapping in Quantum GIS software, detailed maps were produced, enabling targeting of fieldwork to search for existing populations.

3.2 Field Survey

All of the fieldwork was led by Sharon Pilkington in good weather conditions between February 10 and April 6 2015. By undertaking the surveys at this time of year, the probability of finding certain seasonally-restricted species was high. Although it is possible to identify most of the species in Table 1 at any time of year, *P. caespitosa* and *W. sterilis* cannot be reliably identified if capsules are absent; in both mosses these are produced in late winter and spring.

An earlier survey (Preston et al 2009) had demonstrated that populations of the bryophytes of interest were mainly concentrated in the eastern part of the SSSI, with 'hotspots' of diversity in certain areas. As such, and because it would be impractical to survey the whole SSSI, fieldwork concentrated on the following areas:

- Beacon Hill;
- Bulford Firing Ranges;
- Cross-country Driving Area (CCDA);
- Sidbury Hill; and
- Silk Hill.

Time was also set aside to search for historical populations of *W. sterilis* in the western ranges near Imber and – more speculatively - in a selection of shell craters in the Larkhill Artillery Range.

Historical records of the target mosses and liverworts were used in the first instance to guide searches for populations but as familiarity was gained with the often very specific microhabitats preferred by each species, the focus of the survey shifted to searching for discrete areas of such habitat in order to find new populations.

When a population was found, its location was recorded with a WAAS/EGNOS enabled GPS receiver (Garmin Etrex Vista HCX) averaged to at least 200 readings per location to give a positional accuracy of 1-3 m. A representative example of at least one population per species was photographed and a record was made of a group of attributes including:

- Description of the habitat type;
- Associated NVC community (where relevant);
- Associated species of bryophyte and vascular plant;
- Population size and extent;
- Threats; and
- Management recommendations.

For most species, identification in the field was straightforward; where uncertainty arose a few shoots were collected to check microscopically. One species – *G. orbicularis* – was accepted as a new species for Wiltshire by the British Bryological Society's national Recorder for Mosses (Mr Tom Blockeel).

4. RESULTS

The GPS co-ordinates of all discrete populations of NR and NS mosses and liverworts recorded during the fieldwork created a layer in Quantum GIS, producing detailed distribution maps (Appendix III, Figures 1-5). Numerous new populations of species were recorded although time did not allow for verification of all previous records. The figures also show a number of potential monitoring locations referred to in Section 4.1.

Where the distribution of species extended discontinuously over a large area, e.g. as in the case of *A. abietina*, *D. acutus* and *P. caespitosa* at Sidbury Hill, point data represented in Figures 1-6 should be regarded as sampling points within the wider meta-populations of the species.

Appendix IV includes a list of all species of moss and liverwort recorded in the course of the fieldwork.

4.1 Populations of Nationally Rare and Nationally Scarce Bryophytes

4.1.1 Abietinella abietina var. hystricosa

A relatively large and distinctive moss (Plate 1), *A. abietina* is widely but locally distributed in three discrete areas in the eastern SSSI (Figures 1a and 1b), with a small outlying population in the central ranges (Figure 1c).

Although the species occurs discontinuously across the areas where it was found, it is reasonable to consider that it is mostly found in two large metapopulations. The largest of these is associated with parts of Sidbury Hill, extending into Haxton Down, the edges of the CCDA and around Dunch Hill Plantation. In this area it is often found in tightly-grazed species-rich unimproved calcareous grassland referable to National Vegetation Classification (NVC) communities CG2 *Festuca ovina – Avenula pratensis* grassland, CG3 *Bromus erectus* grassland and CG7 *Festuca ovina – Hieracium pilosella – Thymus praecox/pulegioides* grassland.

A. abietina frequently grows on sunny slopes and terraces, often in a short, tightly grazed sward where other mosses are prominent. It is tolerant of some disturbance from training activities and appears to have the ability to readily colonise cleared or disturbed chalk and gaps in the turf.

Associated species include (vascular plants): *Festuca ovina* (Sheep's-fescue), *Carex flacca* (Glaucous Sedge), *Poterium sanguisorba* (Salad Burnet), *Linum catharticum* (Fairy Flax), *Helianthemum nummularium* (Common Rock-rose), *Briza media* (Quaking-grass), *Pilosella officinarum* (Mouse-ear Hawkweed) and (bryophytes): *Ctenidium molluscum*, *Ditrichum gracile*, *E. concinnus*, *Homalothecium lutescens* and *Aloina aloides*.

Plate 1. *A. abietina* is a large perennial moss with a red stem and pinnate, golden-brown branches. When dry, the leaves shrink against the branches.

Another large metapopulation is present to the south, extending discontinuously across approximately 5km^2 of Beacon Hill and the Bulford firing ranges. Here it is locally abundant in chalk grassland and disturbed ground in the ranges but is more local on Beacon Hill, the main exception being around Halters Hole, where it is locally abundant in CG2. The colonies in the Bulford firing ranges further demonstrate the ability of this moss to colonise and tolerate man-made habitats. In most of the ranges (especially disused ones) it is associated with populations of several other scarce bryophytes in broken turf.

At Silk Hill, a smaller population is present on the northern scarp of the hill, in grassland and tracks close to Silk Hill Plantation. Although this population occupies a smaller area than the other two, *A. abietina* is frequent to abundant throughout, in CG2, CG3 and CG7 grassland communities.

In the central part of the SSSI, *A. abietina* is associated with observation posts on the edge of the Larkhill Artillery Range where it grows as small colonies in species-rich sheltered grassland with a sunny, open aspect.

Suitable monitoring locations for this species are shown in Plate 2 (Sidbury Hill), Plate 3 (Bulford Range A) and Plate 4 (Silk Hill).

Plate 2. Sidbury Hill (east) at SU2180450177 (Map ID AA1). *A. abietina* is frequent across an east-facing slope above and below a stone track (arrowed, foreground) in species-rich broken CG7. The slope in the distance (also arrowed) also supports numerous plants.

Plate 3. Bulford Firing Range A at SU2010544561 (Map ID AA2). *A. abietina* is widespread across a flat terrace of broken CG2/CG7 in front of targets.

Plate 4. Silk Hill at SU1845447070 (Map ID AA3). *A. abietina* dominates the verge of the stone track and extends into a parallel earth track and grassland to the right.

4.1.2 Aloina rigida

A. rigida is an extremely small moss which grows as scattered, bud-like plants only a millimetre or so high in disturbed species-rich chalk grassland, often where small ledges on sunny banks afford some shelter from the wind. Being so small, it is a difficult plant to find and candidate material requires microscopic examination to separate it from immature or stunted plants of the very common *A. aloides*, with which it often grows.

Plate 5. Earth track at northern end of Sidbury Hill SU2145450938 (Map ID AR1). Numerous scattered plants of *Aloina rigida* grow on the crumbling upper part of the bank. Other plants also grow on ledges on the side of a disused earth track/holloway approximately 20m west. This photograph is taken looking south.

Four populations were confirmed during the fieldwork, two from disturbed CG2 or CG3 below the western and northern flanks of Sidbury Hill, one from the CCDA and one from Silk Hill (Figures 2a-b). It is, however, very likely that other populations remain to be found. Plate 5 indicates a locality where plants are relatively abundant.

Other species associated with populations of *A. rigida* include (vascular plants): *Thymus polytrichus* (Wild Thyme), *F. ovina*, *Festuca rubra* (Red Fescue), *Bromopsis erecta* (Upright Brome), *Koeleria macrantha* (Crested Hair-grass), *B. media*, *Plantago lanceolata* (Ribwort Plantain), *Medicago lupulina* (Black Medick), *P. sanguisorba*, *Daucus carota* (Wild Carrot), *Clinopodium acinos* (Basil Thyme) and (bryophytes): *Leiocolea badensis*, *H. lutescens*, *A. aloides* and *Dicranella varia*.

4.1.3 Bryum torquescens

Bryum torquescens has not previously been recorded in the SSSI and so is not currently a member of the non-vascular plant assemblage. However, as an NS moss it is of interest, and for the purposes of this Bryophyte Site Dossier it has been reported in the same way as the nine assemblage species. It is a difficult species to identify, as it closely resembles the very common *B. capillare*; positive identification is only possible if fertile plants are present. Two small sub-populations of *B. torquescens* were found approximately 200m apart on the western slopes of Sidbury Hill in strikingly similar habitat (Figure 3a and Plate 6).

Plate 6. A penknife marks a patch of *B. torquescens* at SU2129950127 (Map ID BT1). Other patches grow in similar flinty ground uphill of this point.

In both of its Sidbury Hill localities it grows upslope in disused west-facing stone tracks, preferring consolidated, sharply-draining pockets of thin soil between embedded flints. The vegetation of these tracks is very sparse but is likely to be close to CG2 or CG7. Associated species include (vascular plants): *F. ovina*, *C. flacca*, *T. polytrichus*, *P. sanguisorba*, *H. nummularium*, *P. officinarum* and (bryophytes): *Hypnum cupressiforme* var. *lacunosum*, *H. lutescens* and *C. molluscum*.

4.1.4 Didymodon acutus

Historical records of *D. acutus* (Plate 7) suggested a population centred on Sidbury Hill, with a few small outliers elsewhere. In the current survey, two clear metapopulations were confirmed, the largest (and most extensive) associated with disturbed ground at track edges on and below Sidbury Hill (Figure 1a). It is particularly abundant along the earth track which follows the dry valley below

the western side of the hill, where the population extends discontinuously along at least 1km of track and is likely to number many hundreds (or even thousands) of plants.

Elsewhere on Sidbury Hill and its surroundings, *D. acutus* grows in the edge of stone (limestone chippings) tracks. It appears to have the ability to colonise such tracks once the track surface has have consolidated and weathered. It is not clear how *D. acutus* colonises such areas as it does not produce spores; it may disperse via detachment of leaves or shoots from existing plants. Since the fieldwork was undertaken a section of stone track across Sidbury Hill has been resurfaced and some plants may have been temporarily lost.

Common associates of this moss include (vascular plants): *F. ovina*, *P. lanceolata*, *H. nummularium*, *T. polytrichus*, *Aphanes arvensis* (Parsley-piert), *Bellis perennis* (Daisy) and (bryophytes): *Didymodon fallax*, *H. lutescens* and *Barbula convoluta*. In some earth tracks, *P. caespitosa* is a frequent associate.

Plate 7. *D. acutus* forms dark, loose patches of stems 1-2cm high. It frequently grows in mixed populations with the very common similar-looking *D. fallax*.

The second metapopulation of *D. acutus* is associated with several of the Bulford firing ranges, where locally, numerous plants grow in stone tracks and footways (Figure 1b). In this area the plant seems equally at home in little-used stone/earth tracks (such as the one running around the side of disused Range C). In such situations associated species are limited in number but include (vascular plants): *Poa annua* (Annual Meadow-grass), *Cerastium* spp. (mouse-ears), *Arenaria serpyllifolia* (Thyme-leaved Sandwort), *Prunella vulgaris* (Self-heal) and (bryophytes): *B. convoluta*, *B. unguiculata*, *D. fallax*, *D. nicholsonii*, *Syntrichia ruralis* var. *ruralis* and (locally) *S. latifolia*.

There is also a small outlying population of *D. acutus* in the Larkhill Artillery Ranges, where it grows in quite dense patches in two secondary tracks where limestone chippings have been laid down in the past (Figure 1c).

Suitable monitoring locations for *D. acutus* are shown in Plate 8 (near Sidbury Hill) and Plate 9 (Bulford Range E).

Plate 8. Dark tufts of *D. acutus* in typical flinty track edge habitat in the dry valley at the foot of Sidbury Hill at SU2113150315 (Map ID DA1). There is a very strong population of *D. acutus* along at least 1km of this valley track. This photo was taken facing north.

Plate 9. Numerous dark tufts of *D. acutus* in a passing place/parking bay surfaced with limestone chips at Bulford Range E SU2114145770 (Map ID DA2). This photo was taken facing south toward Beacon Hill.

4.1.5 Ephemerum recurvifolium

Historical records of this minute moss indicated a patchy distribution across Salisbury Plain SSSI. However, as it is minute (plants typically 1mm high) and often occurs in small numbers in any given location it is an easy plant to overlook. It is possible that plants are less visible in spring than in autumn or winter, when it normally bears a profusion of capsules.

During the current survey it was only seen in two places – both on the scarp slope of Beacon Hill near Bulford Camp (Figure 4). It grows small patches in sheltered positions on the bank of a disused earth track ascending the slope, at the edge of broken CG2 grassland (Plate 10). Associated species include (vascular plants): *F. ovina*, *F. rubra*, *C. acinos*, *A. serpyllifolia* and *Scorzoneroides autumnalis* (Autumn Hawkbit) and (bryophytes): *C. molluscum*, *H. lutescens*, *A. abietina*, *D. fallax*, *L. badensis* and *D. varia*.

The other population – a tiny patch of plants measuring less than 1cm^2 – grows in broken CG2 grassland at the very foot of The Kiwi, a chalk figure on the scarp slope. It is, however, highly likely that other populations are still present elsewhere in the SSSI in sheltered situations such as below turf overhangs on banks and track edges.

Plate 10. *E. recurvifolium* grows at the edge of a disused track on Beacon Hill at SU2010444125 (Map ID ER1). This track is rich in other bryophytes including *A. abietina* and *L. perssonii*.

4.1.6 Grimmia orbicularis

There are no previous records of *G. orbicularis* (NS) in Salisbury Plain SSSI or in Wiltshire itself. It is a moss of sun-baked hard calcareous natural rocks and old weathered concrete walls and structures. Bulford Range A and E support a small population, which grows on the steps and walls of the target galleries (Figure 4). Plates 11 and 12 show both localities which could be used for future monitoring.

G. orbicularis forms irregular, black-green hoary cushions with capsules borne on a curved stalk that pushes them back down into the leaves. In its appearance and habitat it is very similar to the common *G. pulvinata*, alongside which it usually grows. When fertile, the capsule lids of *G. orbicularis* are mammilate, whereas those of *G. pulvinata* normally have a long point. However, confident identification is only possible after examining the leaf cells under a high-power microscope.

Associated saxicolous bryophytes include *G. pulvinata*, *Tortula muralis*, *Orthotrichum anomalum*, *Schistidium crassipilum* and *Didymodon rigidulus*.

Plate 11. Cushion of *G. orbicularis* on the south-facing gallery wall of Range A at SU1994744722. (Map ID GO1). At least 5 separate plants were counted on this wall, although it is likely that plants without capsules could have been overlooked.

Plate 12. Large cushion of *G. orbicularis* among other bryophytes on the steps of the gallery in Range E at SU2110146101 (Map ID GO2). Four smaller plants with capsules were found on the gallery wall below.

4.1.7 Lophozia perssonii

This minute leafy liverwort was first discovered in Salisbury Plain SSSI in 2009 and subsequent recording effort determined that it was found to occur in a number of localities within a 6km radius of Silk Hill. It is an ephemeral species, usually growing in small, pale green patches on barely vegetated chalk and is very easy to overlook.

Fieldwork confirmed the presence of two metapopulations of this species, which appears to be confined to the eastern part of the SSSI. It appears to be quite frequent on earth tracks below Sidbury Hill and in the CCDA (Figure 2a and Plate 13), with a second metapopulation on the earth tracks of Beacon Hill (Figure 2b). However, most patches of *L. perssonii* are very small and many were not where they had been previously seen, which is unsurprising for a pioneering species. It is likely to occur elsewhere in the SSSI.

L. perssonii colonises small gaps in short, disturbed chalky turf and rarely strays far from earth tracks. Although it does not produce spores, it readily disperses by means of brown gemmae (vegetative propagules) which are usually produced in abundance at shoot tips. It is likely that the movement of vehicles and troops around the SSSI plays a major role in its dispersal. Unlike *D. acutus*, it avoids stone tracks and typically occupies a narrow 'edge zone' along the margins of compacted chalk tracks. It also colonises small gaps in turf in heavily disturbed trackside vegetation, often alongside *P. caespitosa* and exceptionally, turns up in bare soil pockets created by rabbits or rainfall run-off.

It may be associated with a wide range of chalk grassland and ruderal species, including (vascular plants): *F. ovina*, *Agrostis stolonifera* (Creeping Bent), *P. annua*, *L. catharticum, P. sanguisorba*, *A. serpyllifolia*, *Senecio jacobaea* (Common Ragwort) and (bryophytes): *L. badensis*, *D. varia*, *A. aloides*, *Microbryum curvicollum* and *H. lutescens*.

Plate 13. *L. perssonii* grows in abundance on an eroding bank next to a heavily used earth track in the CCDA at SU2213449609 (Map ID LP1).

4.1.8 Pleurochaete squarrosa

This moss (Plate 14) is one of the SSSI's rarest bryophytes, having previously been recorded only once, in 1986. A small population is still present, consisting of two small colonies approximately 300m apart on the western side of Sidbury Hill (Figure 3a).

Both colonies are small and highly localised. At location PS1 (Plate 15), approximately 10 separate small patches grow in an area no more than 1m^2 in the eroding edge of rabbit-grazed CG2 on a west-facing bank of the main valley track that skirts below the western slope of Sidbury Hill. The soil ground at this point is highly flinty and the colony grows within a few metres of the track. Associated vascular plants include: *H. nummularium*, *F. ovina*, *C. flacca*, *P. sanguisorba*, *T. polytrichus* and *L. catharticum* whilst associated bryophytes include *Fissidens dubius*, *H. lutescens*, *H. cupressiforme var. lacunosum*, *Pseudoscleropodium purum*, *C. molluscum* and *Encalypta vulgaris*.

Plate 14. *P. squarrosa*. Once known, a relatively straightforward moss to identify, forming loose patches of yellow-green shoots a few centimetres high. When dry, its leaves curl and crisp up and then care must be taken not to confuse it with several similar mosses, e.g. *Weissia* spp.

A second, slightly smaller colony grows about in a disused earth track on the western slope of Sidbury Hill at location PS2 (Plate 16). This track is very flinty and supports semi-open bryophyte-dominated vegetation that is probably close to CG7. Species associated with *P. squarrosa* include (vascular plants): *A. stolonifera*, *T. polytrichus*, *P. officinarum*, *P. vulgaris* and *Centaurium erythraea* (Common Centaury) and (bryophytes): *H. lutescens*, *D. fallax*, *Calliergonella cuspidata* and *H. cupressiforme var. lacunosum.*

Plate 15. Colony of *P. squarrosa* on bank between the lower Sidbury Hill fence and the main valley track at SU2112050282 (Map ID PS1). Photo taken looking north.

Plate 16. A penknife marks the location of a patch of *P. squarrosa* in the middle of a highly flinty disused track ascending Sidbury Hill at SU2125050106 (Map ID PS2). At least three small patches are present within a 1m radius of the knife.

4.1.9 Pottiopsis caespitosa

P. caespitosa is a tiny moss with a short life-cycle, growing in the autumn and producing its spores in late winter and early spring. Plants are only about 5mm high and are difficult to separate from several similar small species. Although this species was a long-standing member of the non-vascular plant assemblage in the SSSI, the data search produced no historical records; nor was it seen during the 2009 bryophyte monitoring survey.

Plate 17. Near Sun Plantation. Many hundreds of plants of *P. caespitosa* grow on disturbed ground where several chalk-flint valley tracks cross at SU2104249865 (Map ID PC1). This is near the southern end of the metapopulation, which follows the main valley track around the base of Sidbury Hill to the north and east.

Therefore it was surprising to find a very large and extensive metapopulation of *P. caespitosa*, which appears to be confined to the eastern ranges and is most abundant in disturbed flinty tracksides around the base of Sidbury Hill (Figures 5a and 5b). In fact its distribution there mirrors that of *D. acutus*, although *P. caespitosa* prefers a slightly different niche in the same trackside habitat.

Many thousands of plants grow along the edges of the chalk-flint valley track that runs from Sun Plantation (Plate 17) skirting Sidbury Hill northwards and eastwards to Pennings Wood (Plate 18), a distance of approximately 1.5km. Small outlying populations are also present in the CCDA, at Silk Hill, on Beacon Hill and in the Bulford Firing Ranges.

In the SSSI *P. caespitosa* requires short broken turf kept open by regular but not excessive disturbance. It avoids friable soil, preferring instead pockets of shallow calcareous clay (often between embedded flints) that retain moisture in winter but bake hard in summer.

Much of the short vegetation in which *P. caespitosa* grows has been highly compacted and disturbed by training activities and would probably best be described as degraded CG2 or CG7 grassland, moving toward vegetation defined more by pioneering species of vascular plant and bryophyte. Associated members of the trackside community include (vascular plants): *F. ovina*, *A. stolonifera*, *P. officinarum*, *H. nummularium*, *C. acinos*, *T. polytrichus*, *Odontites vernus* (Red Bartsia) and *P. sanguisorba* and (bryophytes): *H. lutescens*, *A. abietina*, *C. molluscum*, *D. fallax*, *A. aloides* and *M. curvicollum*.

Plate 18. Near Pennings Wood, looking east at SU2216650831 (Map ID PC2). Many thousands of plants of *P. caespitosa* grow with *A. abietina* in broken short turf on both sides of the earth track.

4.1.10 Racomitrium canescens

R. canescens was first discovered on Salisbury Plain SSSI in 2009, in Bulford Range B. This population remains and the current survey also noted a second colony nearby in Range C (Figure 4). This small population remains the only known station for *R. canescens* in Wiltshire.

Both ranges are disused; in both *R. canescens* grows on level ground that presumably used to be bare chalk when the ranges were operational, between targets and deflection bank. Much of this ground is now clothed in a short, rabbit-grazed and disturbed mossy turf dominated by *D. gracile* and *H. lutescens*. Typically, *R. canescens* grows through other bryophytes as small, loose patches (Plate 19), mainly in sunny, open ground, but also where some shelter is afforded by light scrub.

Plate 19. *R. canescens* is a very distinctive moss. It forms loose patches several centimetres high and the white hair-points of the leaves make the plants look 'frosted'. In the Bulford Ranges it usually grows within a matrix of the moss *D. gracile* (as here).

The vegetation it grows within is referable to CG2 and/or CG7 which supports other species including (vascular plants): *T. polytrichus*, *F. ovina*, *C. flacca*, *Asperula cynanchica* (Squinancywort), *P. sanguisorba*, *Gentianella amarella* (Autumn Gentian), *Erigeron acris* (Blue Fleabane) and (bryophytes): *A. abietina* and *E. concinnus*. Lichens of the *Cladonia* genus are also locally frequent in the turf and in Range B it is sometimes associated with seedlings and young bushes of *Juniperus communis* subsp. *communis* (Common Juniper). For monitoring purposes both extant colonies are described in Plates 20 and 21.

Plate 20. Bulford Firing Range C at SU2049045414 (Map ID RC1). This is the smaller of the two colonies, with an estimated 50+ plants growing in an area 20m x 3m. *A. abietina* is also abundant in the turf here.

Plate 21. Bulford Firing Range B (disused) at SU2016945210 (Map ID RC2). At least 100 plants of *R. canescens* grow in moss-dominated turf among *J. communis* and *Pinus sylvestris* (Scots Pine) in an area measuring approximately 20m x 5m.

4.1.11 Weissia sterilis

W. sterilis forms loose, branched tufts which are dull green above and often tinged brown below. It is a difficult plant to identify unless it has capsules, which tend to be hidden among the upper leaves in small clusters. Plants without capsules are indistinguishable from several closely related common species with which it often grows.

Only two historical records of *W. sterilis* came to light in the data search, both from 1998 in the Chitterne Down area of the western SSSI. The current survey confirmed that the moss is still present (in very small quantity) at Chitterne Down and located a new site for it nearby, at Berril Down.

A larger and previously unknown population of *W. sterilis* is also present on the western slope of Sidbury Hill, where the majority of plants grow within two distinct sub-populations approximately 300m apart within disused earth tracks which ascend the slope (Figure 3a). These tracks have remarkably similar sparse CG2/CG7 vegetation and the *W. sterilis* colonies are confined to the upper parts, which are very flinty. At location WS1 (Plate 22), at least 10 plants grow near the top of the track whilst more are present just above the livestock fence and at the junction with another earth track which follows the contour north toward the hill fort. A larger sub-population grows in another disused track to the south, where at least 50 plants grow on sparsely vegetated flinty ground along approximately 50m of track, with a few in CG2 on its bank.

Associated species in the tracks include (vascular plants): *F. ovina*, *Brachypodium sylvaticum* (False Brome), *C. flacca*, *T. polytrichus*, *P. officinarum*, *P. sanguisorba*, *H. nummularium*, *C. acinos* and *L. catharticum* and (bryophytes): *A. aloides*, *H. lutescens*, *C. molluscum* and *H. cupressiforme var. lacunosum*.

A small outlying sub-population is also present just off the hill, in rich CG2 on a west-facing bank above highly disturbed valley bottom ground. Only one plant with capsules was found here (in February) but a few probable non-fertile plants were present nearby.

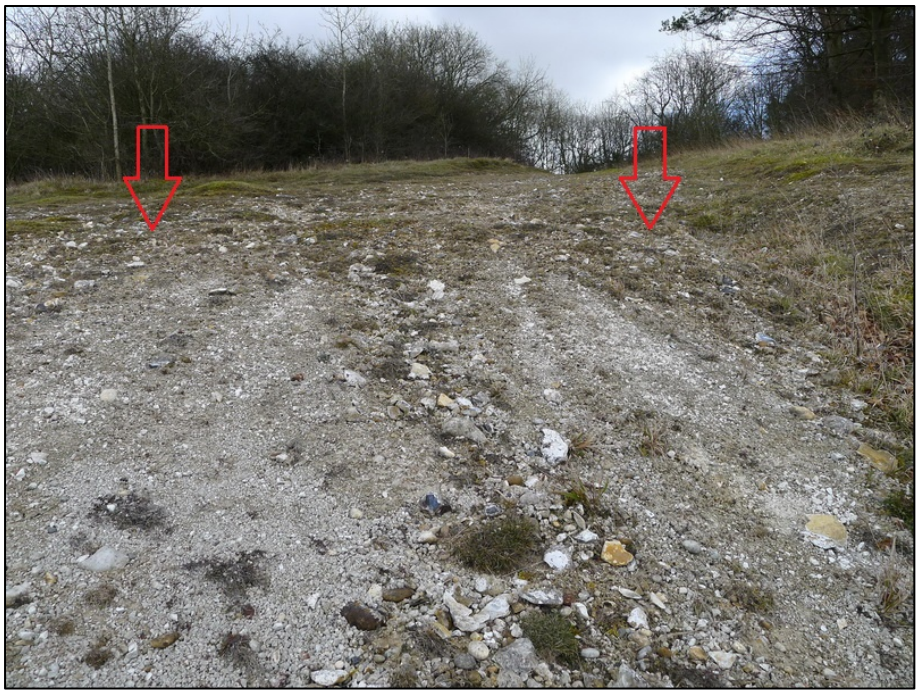

Plate 22. Sidbury Hill. *W. sterilis* grows at the top of a fenced-off former track at SU2137550418 (Map ID WS1). It also grows around the junction of a similar chalk-flint track just above the fence (not visible in photo).

In the western SSSI ranges, a very small population of *W. sterilis* grows in CG3 near the Inscribed Stone (Chitterne Down). This may be the same population recorded by R.C. Stern in 1998. Approximately 5-10 plants grow in short, slightly disturbed grassland approximately 5m away from a well-used track (Plate 23). Both localities are shown in Figure 3b.

Plate 23. Chitterne Down near the Inscibed Stone at SU0056747712 (Map ID WS2). Note the main track to the right; photo taken looking west toward Kill Barrow.

Generally, the CG3 in this area, though species-rich, is too coarse and closed to support *W. sterilis* and the population appears to be isolated and vulnerable. Several fertile plants were also located in a flinty opening in quite coarse CG3 on a north-facing slope more than 1km south-west in the Berril

Valley in a new location, so it is possible that other small colonies remain to be discovered in the area.

Close associates of these small western populations include (vascular plants): *B. erecta*, *F. ovina*, *F. rubra*, *Catapodium rigidum* (Fern-grass), *T. polytrichus*, *Scabiosa columbaria* (Small Scabious), *H. nummularium*, *P. sanguisorba*, *Anthyllis vulneraria* (Kidney Vetch) and (bryophytes): *H. lutescens*, *D. fallax*, *Bryum* spp., and *P. purum*.

4.2 Populations of Locally Distinctive Bryophytes

Figures 6a-c (Appendix III) show the occurrence of the locally distinctive bryophytes (including *L. smithii*); *E. concinnus* and *W. controversa var. crispata* are widespread and locally abundant in short, species-rich and often lightly disturbed summer-parched grassland in the vicinity of Sidbury Hill, the CCDA, Dunch Hill, Silk Hill, the Bulford firing ranges and Beacon Hill.

E. concinnus is frequently associated with other notable bryophytes, particularly *A. abietina* and locally (in the Bulford firing ranges) it is a common associate of *R. canescens*. It flourishes in very short, species-rich rabbit-grazed chalk grassland (CG2, CG3 and CG7) and although it prefers a sheltered, sunny location, it appears to be tolerant of light military disturbance and some shade.

W. controversa var. *crispata* prefers south and west-facing warm sunny slopes and banks, typically where a degree of shelter from cold winds is afforded by vegetation and micro-topography. It appears to be less tolerant of disturbance than *E. concinnus* but on Sidbury Hill, has extensively colonised bare ground where there has been tree clearance. Most sub-populations are in the east of the SSSI, where it appears to be locally abundant. A population of *W. controversa* var. *crispata* also grows in at least one shell crater in the Larkhill Artillery Range, suggesting that the central part of the SSSI could theoretically support quite a large metapopulation of this species.

S. aspera has been known from one locality in a holloway/linear earthwork just north of Sidbury Hill since 2009. The population remains strong and extends in numerous small patches of plants in species-rich, crumbling CG2/CG3 along c. 50 metres of the north-facing bank of the holloway. This remains its sole station in Salisbury Plain SSSI; it remains very rare in Wiltshire generally and may have been lost from some of its other localities e.g. Brimsdown Hill SSSI.

L. smithii has been known from trees in Imber village for many years and the population there remains strong. It grows on the trunks and branches of a range of trees, many of which have clearly been planted. Its host trees grow mostly along the roadside from the edge of the village several hundred metres to its heart, where a particularly dense colony grows on at least three roadside *Tilia* x *europaea* (Common Lime) trees and one adjacent *Acer pseudoplatanus* (Sycamore).

4.3 Areas of High Importance for Bryophytes

The results of the fieldwork clearly demonstrate that certain parts of the SSSI (i) support important mixed communities of NR and NS bryophytes, and/or (ii) support particularly strong populations of one or more such species. These localities are shown in Figures 7a-c (Appendix III), with annotations 1 to 11 providing more detailed context.

It is no coincidence that all of these areas are in the eastern part of Salisbury Plain SSSI, although scattered populations of some notable species do occur elsewhere. It is possible to speculate on the reasons for this disparity but it is almost certainly due to a complex interplay of factors including soils and geology, climate, historical management, disturbance and the proximity of other populations (sources of spores) nearby.

4.3.1 Sidbury Hill

Sidbury Hill is undoubtedly the richest part of the SSSI for bryophytes and extensive tracts of disturbed chalk grassland on its slopes and tracks support populations of many of the assemblage species. In particular, it supports strong and extensive metapopulations of *A. abietina*, *D. acutus* and *P. caespitosa* as well as the only known populations of *B. torquescens* and *P. squarrosa*.

In Figure 7a, note 1 refers to rich bryophyte habitat distributed along the edges of a well-used earth track which originates at the north-western corner of the CCDA near Sun Plantation, continuing northward along the bottom of the dry valley which skirts the western slopes of Sidbury Hill. Trackside disturbed ground in the transitional zone between the bare chalk and flint of the track and the adjacent CG2/CG3/CG7 supports very large populations of *D. acutus* (many hundreds or even thousands of plants) and *P. caespitosa* (certainly thousands of plants) extending discontinuously over a distance of 1.5–2.0 km to Pennings Plantation. One of the two sub-populations of *P. squarrosa* also grows on a bank near the same track. At the time of survey, *D. acutus* was also locally abundant in the edges of the stone track which crosses Sidbury Hill from north-west to south, although the track has since been resurfaced, reducing its bryophyte interest, at least temporarily.

Note 2 marks a disused earth track which ascends Sidbury Hill and supports populations of *B. torquescens* and *P. squarrosa*, both of which are only present in one other place in the SSSI, together with a substantial colony of *W. sterilis*. All of these mosses grow close to each other, within the former track where the ground is sparsely vegetated and flint-strewn. *W. controversa var. crispata* (locally distinctive species) is locally abundant in the nearby grassland, colonising ground where trees have been removed.

One of the hotspots for bryophyte diversity around Sidbury Hill is at note 3, in and around a holloway / disused track just north of Sidbury Hill. The sheltered situation and juxtaposition of various microhabitats means that it supports a healthy population of *A. rigida* (this species also grows on the bank of an adjacent track), *P. caespitosa* (within the large metapopulation around Sidbury Hill) and *L. perssonii*. Furthermore, *A. abietina* is abundant in closed, species-rich CG2 and CG3 on the sides of the holloway and extending further west and north across and area of modern earthworks (possibly WWII trenches). The holloway also supports the only extant population of *S. aspera* in the SSSI as well as strong populations of *E. concinnus* and *W. controversa var. crispata.*

Tracks and trackside ground around the bottom of the northern slopes of Sidbury Hill also support strong sub-populations of *A. abietina* var. *hystricosa* (often with *P. caespitosa*). Note 4 marks a locality where three wide chalk terraces lie below the northern slope. Although now scrubbed up to a certain extent, *A. abietina* var. *hystricosa* has become abundant within the regenerating chalk grassland, and is equally abundant in closed but eroding CG on a nearby bank.

Finally, note 5 marks the southern end of the metapopulation of *P. caespitosa*; this moss is very abundant in this area on lightly to moderately disturbed trackside ground. *A. abietina* is locally frequent where grassland has been lightly disturbed or is grazed very short by rabbits and there are also small sub-populations of *A. rigida*, *D. acutus* and *W. sterilis*.

4.3.2 Cross Country Driving Area

The CCDA comprises a mosaic of heavily used and often highly eroded chalk tracks, seasonal pools and outliers of species-rich chalk grassland. Its bryophyte interest appears to be mostly but not exclusively associated with the edges, where disturbance from training vehicles is slightly less severe than in the centre. *L. perssonii* was found in good quantity at several locations in the CCDA and will almost certainly be scattered throughout. Its favoured microhabitat is disturbed but compacted chalky ground and tracksides, where it often grows with other diminutive pioneers (including occasional *P. caespitosa*). The margins of the CCDA – especially the west-facing grassy slopes of Chalkpit Hill – also support strong but disjunct populations of *A. abietina*.

4.3.3 Bulford Firing Ranges

Taken together, the various active and disused firing ranges near Bulford Camp are of very high importance, supporting numerous populations of many of the assemblage species and species of local distinctiveness. They also support populations of *G. orbicularis* and *R. canescens*, two NS mosses not known from anywhere else in the SSSI or Wiltshire. Within the ranges, the bryophytes tend to be associated with species-rich, often disturbed chalk grassland on terraces and banks near the targets and back wall and include. *A. abietina*, *P. caespitosa*, *R. canescens* and *E. concinnus*. Some stone access tracks and walkways support strong populations of *D. acutus* and concrete structures near the targets are home to *G. orbicularis*.

In Figure 7b, note 6 refers to the bryophyte populations in Range E, an active firing range accessed by a long stone track from the nearby road. Large sub-populations of *A. abietina* are present in short CG2 on terraces in front of the targets and also in highly disturbed semi-vegetated ground between targets and the back wall of the range, as well as on various other banks nearby. *E. concinnus* is a frequent associate. Sections of the stone access track support numerous plants of *D. acutus* and the range also supports a population of *G. orbicularis* (on gallery masonry) and *P. caespitosa*.

Disused Range C is referred to in note 7. This large former range has been allowed to revegetate naturally and now supports a bryophyte-dominated ground flora with scattered scrub. This range is of particular interest as it supports a sub-population of *R. canescens* on the ground, as well as a large and healthy sub-population of *A. abietina*. The bryological interest extends to a lightly-used vehicle track just west of the range where clay patches within the track support hundreds of plants of *P. caespitosa*, while stony ruts nearby provide a home to scattered tufts of *D. acutus*.

4.3.4 Beacon Hill

Beacon Hill is extensive but much of it – especially where there has been past disturbance due to scrub and tree clearance – is of relatively low bryological interest. However, its grassland does support scattered sub-populations of *A. abietina*, whilst some earth tracks support scattered small colonies of *L. perssonii*.

Of particular note are two disused earth tracks which climb up the hill. Note 8 marks one of these, which runs parallel to an ancient linear earthwork. This track supports a good-sized sub-population of *A. abietina*, together with *L. perssonii* and a small population of *P. caespitosa* at its southernmost limit in the SSSI.

Note 9 marks to another track near The Kiwi. This runs parallel to an actively used track and may be disused simply because it has become too eroded to use safely. However, it too is rich in bryophytes and its broken, flinty, species-rich turf supports more *A. abietina* and *L. perssonii*. *E. recurvifolium* grows in sheltered, broken turf on the track edge and *E. concinnus* and *W. controversa var. crispata* are frequent in CG2 nearby.

Note 10 indicates an area of very short, high quality CG2 near Halters Hole and Pearl Wood. Although this area does not support many notable species, it is remarkable for its abundance of *A. abietina*, which dominates the turf in places and extends across a large area. *E. concinnus* and *W. controversa var. crispata* are also frequent here.

4.3.5 Silk Hill

Silk Hill supports at least five NR and NS bryophytes. The grassland adjacent to Silk Hill Plantation is particularly important for *A. abietina*, which is frequent to abundant across a large area, from trackside grassland west of the plantation to the scarp slope just east of it. It is a prominent feature of CG2 in a lightly-used earth track which runs parallel to the top (southern) edge of the wood. Surprisingly, considering the similarity of this track to those on Sidbury Hill, only a small population of *P. caespitosa* is present in this track.

Note 11 marks the western scarp, where a disused steep chalky track mirrors the route of an actively used stone route. Rich, broken turf in the chalky ground here supports small populations of *A. rigida*, *D. acutus* and *L. perssonii*.

5. CONDITION ASSESSMENT

The results of the survey enable the specific attributes of the non-vascular plant assemblage criteria feature (Appendix I) to be assessed as being in **Favourable Condition.** The rationale applied to measuring each target is set out below.

5.1 Direct Attributes

Attribute: Presence/Absence
Site-specific Target: Assemblage score threshold should be met

The current scoring system for selection of SSSI for non-vascular plants uses a score of 100 points for nationally rare bryophytes and 50 points for nationally scarce species. Accordingly, a combined score of 200 points or more in most parts of Britain, excluding parts of the south-west, Wales, the Lake District and much of Scotland (Hodgetts 1992) is the threshold for site selection. As stated previously, presence of all nine members of the assemblage listed in the current version of the FCT would score 500 points, well above the assemblage score of 350 points at the time of notification, and far in excess of the site selection threshold of 200 points.

The current survey confirmed populations of all nine assemblage species, meeting the FCT target. If the two additional nationally scarce mosses – *B. torquescens* and *G. orbicularis* – are also included in the calculation (Table 2) then this would increase the SSSI score to 600 points. The recent publication of new national distribution data for British and Irish bryophytes (Blockeel et al 2014) has demonstrated that *E. recurvifolium* has been recorded in 112 10km squares between 1990 and 2013, meaning it is more common than previously thought. A revision of the current nationally rare and nationally scarce lists is likely to remove this moss from the nationally scarce list. However, even if this happens, it will have little effect on the overall threshold score.

Table 2. NR and NS species currently present in SSSI

Species Name	Status[1]	Score (points)	Species of current non-vascular plant assemblage?
Abietinella abietina var. hystricosa	NS	50	Yes
Aloina rigida	NS	50	Yes
Bryum torquescens	*NS*	*50*	*No*
Didymodon acutus	NS	50	Yes
Ephemerum recurvifolium	NS	50	Yes
Grimmia orbicularis	*NS*	*50*	*No*
Lophozia perssonii	NR	100	Yes
Pleurochaete squarrosa	NS	50	Yes
Pottiopsis caespitosa	NS	50	Yes
Racomitrium canescens	NS	50	Yes
Weissia sterilis	NS	50	Yes
	Total points	600	

[1] As currently recognised by Preston (2006) and Preston (2010).

5.2 Indirect Attributes

Attribute: Niche availability
Site – specific Target: Sufficient area of suitable habitat to maintain population

Indirect monitoring of bryophyte interest features in Salisbury Plain SSSI is concerned with assessing the condition of '*special habitat 7 – disturbed open lowland calcareous grassland*' as defined in *Common Standards for Monitoring – Generic guidance on objective setting and condition assessment – Bryophytes and lichens* (JNCC 2005). All of the current non-vascular plant assemblage species are to a significant degree associated with this special habitat, although if *G. orbicularis* were to be added to the assemblage it would be more appropriately monitored using indirect attributes associated with *special habitat 23: Anthropogenic – man-made structures*.

Figures 7a-c indicate the areas where the target bryophytes are concentrated within the SSSI; for the purposes of the condition assessment the same areas may also be considered to represent the extent of *special habitat 7* which is currently known to support the important species. These areas include several different microhabitats which fall within the scope of *special habitat 7*:

- Disturbed active earth (chalk and flint) and stone (limestone chippings) track edges and banks;
- Disused earth (chalk and flint) tracks;
- Disturbed open grassland (CG2, CG3 and CG7) associated with active and disused firing ranges; and
- Short-grazed open CG2 and CG3 grassland associated with areas of historical trenching and other ground disturbance.

Given that this Bryophyte Site Dossier represents the results of the first detailed baseline of the populations of bryophyte species in the SSSI, it is not possible to say whether the extent of habitat is similar to previous years. However, the presence of large and healthy populations of some species over large areas would suggest that the target is being met.

Site – specific Target: 10-25% sparsely vegetated / bare ground within defined areas

It is difficult to quantify how much of the ground within the key areas in Figures 7a-7c is sparsely vegetated or bare but as a rough estimate it is likely to be at least 15% and therefore probably meets this site-specific target.

Attribute: Vegetation Structure
Site – specific Target: Turf height less than 2 cm over at least 50% of the area supporting the interest feature.

Typically within the areas supporting the majority of the target bryophytes (Figures 7a-7c), the disturbed grassland is typically only a few centimetres high so this target is probably being satisfied.

Attribute: Niche Diversity
Site – specific Target: Anthills, soil slippage on steep slopes, terracing, S- and N-facing banks, etc. should be maintained where present

This is a difficult attribute to measure within such a large area and over terrain that is inevitably dynamic due to the effects of normal military training activities. It is clear that the condition of the habitat, and in turn, the populations or sub-populations of some of the more mobile species is strongly linked to regular light disturbance of chalk grassland habitat. In particular, *P. caespitosa* appears to be very dependent on the presence of broken, clayey ground within a short and fragmented sward that is maintained by vehicles regularly driving over it. Likewise, other small ephemerals e.g. *A. rigida* and *L. perssonii* appear to rely on the provision of eroding track banks and edges that are inherently vulnerable to catastrophic loss i.e. if a vehicle collides with a bank.

However, the pioneering nature of such species means that they will naturally move around, and the SSSI is large enough to fulfil such needs through day to day training activities.

Some species require habitats that are open but relatively undisturbed by military training. For example, some of the fenced-off earth tracks on the side of Sidbury Hill are home to some of the SSSI's rarest bryophytes (*B. torquescens*, *P. squarrosa* and *W. sterilis*). Similarly, disused firing ranges near Bulford that have been left to nature now support the only populations of *R. canescens* (a disturbance-sensitive species), as well as an abundance of *A. abietina*.

At present, it seems that this target is being met through general day-to-day activities and maintenance of the SSSI.

6. THREATS AND RECOMMENDATIONS

The results of the current survey suggest that the non-vascular plant assemblage is currently in good condition maintained, to a large extent, by regular military training activities (particularly the passage of armoured/other military vehicles along earth tracks) as well as ongoing maintenance of the military training estate.

The size and extent of the populations of the most widespread and abundant bryophytes – in particular *A. abietina*, *D. acutus* and *P. caespitosa* – mean that on the whole threats are very localised and not likely to present a major problem to the integrity of the wider species populations. In any case, ephemeral species like *P. caespitosa*, *E. recurvifolium* and *L. perssonii* naturally move around to exploit new niches and are unlikely to stay in one locality for very long.

Other long-lived species are more vulnerable to local extinction, either because the population size is very small and restricted to a particular habitat feature e.g. *B. torquescens*, *Pleurochaete squarrosa*, *W. sterilis* and *R. canescens*, or because its habitat is within military infrastructure which may be modified to accommodate changing operational needs e.g. *G. orbicularis*.

There are a number of broad threats to the bryophytes in the SSSI (Section 6.1) and it is recommended that these are considered when planning management strategies. Section 6.2 highlights specific localities where assemblage species are at particular risk, along with appropriate management recommendations.

6.1 General Threats

6.1.1 Scrub and Tree Invasion

Nearly all of the assemblage bryophytes prefer open, disturbed chalk grassland without the shading or indirect coarsening of vegetation structure often caused by gradual invasion of *Rubus fruticosus* agg. (Bramble), *Crataegus monogyna* (Hawthorn) and other scrub or self-sown tree saplings.

Whilst it is neither practical or desirable to remove all scrub and tree saplings from the key bryophyte areas (Figures 7a-c), it would benefit the bryophytes to restrict woody cover to small stands or scattered bushes and to prevent further encroachment near populations of the rarest bryophytes. In particular, *W. sterilis*, *P. squarrosa*, *B. torquescens* and *G. orbicularis* all have very small and localised populations in the SSSI and all are highly intolerant of any shade. At present none of these populations is threatened by scrub/tree invasion and management of the localities where they occur should aim to maintain an open, sunny habitat.

6.1.2 Natural Succession

Over time, gradual changes to habitat supporting notable bryophytes will inevitably happen via the processes of natural succession. For those bryophytes which have colonised areas of formerly bare or semi-bare ground this may mean gradual changes in abundance as the habitat becomes more (or less) suitable. This is a threat to several of the rarest species which rely on vegetation which is

slowly recovering following a cessation of disturbance. In particular, populations of *W. sterilis*, *B. torquescens* and *P. squarrosa* are strongly associated with now-disused earth tracks on Sidbury Hill; slow regeneration of chalk grassland vegetation across the formerly bare tracks may in time reduce the area of open flinty ground which supports these species. Likewise, *R. canescens* currently grows within a transitional moss-dominated turf in two disused firing ranges. As the vegetation community matures, this species may be out-competed by more vigorous species.

6.1.3 Track Management

Many of the species are strongly associated with broken and disturbed chalk grassland at the edge of operational earth tracks, or consolidated limestone tracks. In particular, large populations of *P. caespitosa* and *D. acutus* are found in such habitat. Certain earth tracks, such as the one running along bottom of Sidbury Hill's western slope, support outstanding communities of bryophyte which are at no risk unless these tracks are surfaced.

Where tracks are already surfaced with limestone chippings, they appear to be able to support locally strong populations of *D. acutus* but only once the track surface has been consolidated and weathered a little. Old ballast tracks that have not been resurfaced for many years can support numerous plants of this species, but it also appears to tolerate resurfacing at intervals of as little as 3-4 years, such as on Sidbury Hill. It is recommended that such tracks are left for as long as is practicable between surfacing and that relatively small fragments of hard limestone are used where possible.

6.1.4 Firing Range Modification

A number of the assemblage species are found in active firing ranges near Bulford Camp and the whole area is considered to have high value for bryophytes. Generally, species such as *A. abietina* and the locally distinctive *E. concinnus* appear to thrive in habitats influenced by the regular firing practice that takes place there. *G. orbicularis* is vulnerable in Ranges A and E, which retain traditional concrete galleries with manually winched targets. In Range D, similar structures were demolished a few years ago to modernise the targets and if similar work is planned for other ranges the population of this species would be at risk.

6.2 Specific Threats and Management Recommendations

A number of specific threats to populations or sub-populations of bryophytes were identified in the course of the fieldwork.

6.2.1 *A. abietina* on Sidbury Hill

A dense sub-population of *A. abietina* grows on a steep, south-facing slope on the eastern side of Sidbury Hill. Closure of a nearby stone track has meant that vehicles have been traversing the grassy slope and damaging the population (Plate 24). Recent resurfacing of the stone tracks on Sidbury Hill may mean that the primary track is open again, but it is recommended that a solution is found to prevent military drivers (and off-road motorcyclists) crossing the grassland and enabling the population to recover. This could take the form of wooden posts at the top and bottom of the slope.

6.2.2 *R. canescens* in Bulford Ranges B and C

The SSSI's whole population of *R. canescens* grows in disused Bulford Ranges B and C, within a moss-dominated sward between the target gallery and the back wall. The lack of disturbance in both ranges is ideal for this moss, but in Range B, the population is beginning to be threatened by scrub and tree encroachment into the open habitat it requires. *J. communis* is also slowly spreading across the open ground but the main threat stems from fast-growing *P. sylvestris* saplings (Plate 21). It is recommended that these saplings are cut down (but not dug up as this would disturb the ground too

much). Any dead or near-dead *J. communis* bushes should also be cut down to open up the habitat. All arisings from this work should be taken away from the range.

The sub-population in Range C is still in open habitat but it is recommended that calcicolous scrub that is developing patchily on the back wall and in depressions within the range (Plate 20) should be cut down at least once every five years to prevent further loss of habitat for *R. canescens* and *A. abietina*, which is also abundant.

Plate 24. Closure of a stone track along the east side of Sidbury Hill fort is causing vehicles to short-cut across a slope at SU21895027 (arrowed), damaging rich CG2 grassland with a strong sub-population of *A. abietina*.

6.2.3 *A. abietina* in Bulford Range E

A small but significant element of the sub-population of *A. abietina* in Bulford Range E lies just between the range perimeter fence and the edge of mature plantation woodland at SU2114145122. Close to an earth bund, an area of CG2 which supports a strong sub-population of *A. abietina* approximately 10m x 5m is threatened by invasion of *R. fruticosus* and has already been partially smothered by tree brash left there. It is recommended that this area – and a nearby bank within the range at SU21119461l8 – is cleared of brash and scrub and managed as high quality chalk grassland.

6.3 General Recommendations

The current survey confirmed populations of two previously undocumented NS mosses in the SSSI. It is recommended that *B. torquescens* and *G. orbicularis* should both be added to the non-vascular plant assemblage feature. Until the current list of NS bryophytes is reviewed to reflect the national distribution of species given in the British Bryological Society's new atlas, *E. recurvifolium* retains its NS status. However, its position within the assemblage may require review in the future.

L. smithii, whilst having no national conservation status, remains a rare moss in Wiltshire and certain trees in Imber village support a large population, the only one currently known on Salisbury Plain SSSI. It is therefore recommended that this species is considered to be a locally distinctive species in the SSSI along with *Entodon concinnus*, *S. aspera* and *W. controversa var. crispata*.

6.4 Further Survey Work

Little survey effort was made in the area between Dunch Hill and the Bulford Firing Ranges to the south, although the habitat appeared to have potential to support such species as *P. caespitosa* and L. *perssonii*. It may also have important ecological functionality, linking the Sidbury Hill and CCDA areas of importance for bryophytes to those in the ranges and on Beacon Hill. This area would certainly be worth targeting in future.

Some survey effort was concentrated on tracksides and chalk grassland from Silk Hill through Ablington Down to Bourne Bottom. This area was mostly rather disappointing but one site that would definitely be worth revisiting is a track junction just south of Bourne Bottom at SU193478. Flint-rich disturbed ground in this area supported a population of what was suspected to be *W. sterilis*. However, none of the plants seen had capsules so this could not be verified.

Some time was spent searching large shell craters and other man-made features in the Larkhill Artillery Range for species such as *A. abietina*, *E. recurvifolium* and *W. sterilis*. Areas searched included two large chalk scrapes in SU0650, as well as numerous (probably around 40) semi-vegetated large shell craters in the same area. A similar number of craters were also searched in adjacent squares (SU0749 and SU0750) especially in the vicinity of Bombard Observation Post. In general, the areas surveyed appeared to be disappointing, typically yielding a relatively limited suite of common chalk grassland species. Time constraints prevented further survey into more remote parts of the central ranges, although heavily impacted areas such as Little Hill and Church Hill would certainly be worth targeting in any further surveys of shell craters.

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APPENDIX I. TABLE 3H OF SALISBURY PLAIN SSSI FCT: SITE-SPECIFIC DEFINITIONS OF FAVOURABLE CONDITION

To maintain the **Calcareous grassland** habitat at this site in favourable condition, with particular reference to **non-vascular plant assemblage,** including **bryophyte species of disturbed open Calcareous grassland (Special Habitat 7).** Favourable condition is defined at this site in terms of the following site-specific standards:					
Site-specific details of any geographical variation or limitations (where the favourable condition standards apply)					
NB All attributes listed are mandatory, unless indicated as discretionary.					
Site-specific standards defining favourable condition					
Criteria feature	**Attributes**	**Measure**	**Site-specific Targets**	**Comments**	**Use for CA?**
Non-vascular plant assemblage (mosses and liverworts) including: *Abietinella abietina ssp. hystricosus* (previously *Thuidium abietinum ssp. hystricosum)* NS *Pleurochaete squarrosa* NS Weissia sterilis NS *Pottiopsis caespitosa* NS *Didymodon acutus* NS *Ephemerum recurvifolium* NS *Lophozia personii* NR *Racomitrum canescens* NS *Aloina rigida* NS	**Presence/absence**	Visual assessment	Assemblage score threshold should be met.		Yes
Indirect attributes:					
	Niche availability	Mapping, visual assessment	Sufficient area of suitable habitat to maintain population 10-25% sparsely vegetated / bare ground within defined areas	The site dossier should be used to identify the areas important for the feature; these should be mapped and defined in the dossier. Turf is seldom uniform across a site; tracks, banks, *etc.* will typically support a short, more open turf. Rocky broken turf with thin droughty soils is a good niche where bryophytes can gain a hold.	Yes

	Vegetation structure	Mapping, measurement	Turf height less than 2 cm over at least 50% of the area supporting the interest feature.	The site dossier must be used to define the areas where this attribute should be measured. Some species, such as *Thuidium abietinum*, can be maintained in a tight grazed fine-grass turf (coarse grass communities CG4 and CG5 are not generally favourable). Grazing would tend to create small pockets of bare ground within which bryophytes can establish.	Yes
	Niche diversity	Comparison with photographs and sketch maps	Anthills, soil slippage on steep slopes, terracing, S- and N-facing banks, *etc.* should be maintained where present	A greater diversity of niches will support a greater diversity of bryophytes.	Yes

APPENDIX II. RESULTS OF DATA SEARCH

Nb. No records were located for Pottiopsis caespitosa

Taxon	Gridref	Date	Site	Source[2]
Abietinella abietina	SU064235	01/08/1967	Croucheston Down	SLP
Abietinella abietina	SU192520	19/04/1994	Combe Hill, Salisbury Plain MOD (East) Area	AB
Abietinella abietina	SU0704949290	27/09/2011	Prospect Clump Observation Post	SLP
Abietinella abietina	SU1840447014	24/01/2010	Silk Hill Plantation	SLP
Abietinella abietina	SU1843647021	08/06/2011	Silk Hill	SLP
Abietinella abietina	SU1844847036	24/01/2010	Silk Hill Plantation	SLP
Abietinella abietina	SU18724696	31/05/2008	Silk Hill	SLP
Abietinella abietina	SU1897247048	13/03/2009	Silk Hill, DTE Salisbury Plain	SLP
Abietinella abietina	SU1967943238	18/01/2010	Beacon Hill	SLP
Abietinella abietina	SU19964478	16/01/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2000444780	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2001544805	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2003544781	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU20044483	16/01/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2015345205	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU20164520	10/09/2012	Bulford Rifle Range B	SLP
Abietinella abietina	SU20174521	16/01/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2018345231	13/03/2009	Bulford Rifle Ranges	WSBRC
Abietinella abietina	SU2018545225	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU204508	09/05/1985	Haxton Down	AB
Abietinella abietina	SU2050445429	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2075144331	18/01/2010	Beacon Hill	WSBRC
Abietinella abietina	SU2080345925	29/03/2009	Bulford Rifle Range D, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2080345925	29/03/2009	Bulford Rifle Range D, DTE Salisbury Plain	SLP
Abietinella abietina	SU208459	10/09/2012	Bulford Rifle Range D	WSBRC
Abietinella abietina	SU2085745927	29/03/2009	Bulford Rifle Range D, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU211460	03/01/2010	Bulford Rifle Range E	WSBRC
Abietinella abietina	SU21235097	14/06/2009	Sidbury Hill	WSBRC
Abietinella abietina	SU2132150772	13/03/2009	Sidbury Hill, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2135350867	13/03/2009	Sidbury Hill, DTE Salisbury Plain	WSBRC
Abietinella abietina	SU2150050669	01/07/2014	Sidbury Hill	SLP
Abietinella abietina	SU2151744898	18/01/2010	Beacon Hill	WSBRC
Abietinella abietina	SU2164850941	10/12/2009	Sidbury Hill	WSBRC
Abietinella abietina	SU2174149724	31/08/2014	Sidbury Hill	SLP
Abietinella abietina	SU217501	23/10/2010	Sidbury Hill	WSBRC
Abietinella abietina	SU21815012	31/08/2014	Sidbury Hill	SLP
Abietinella abietina	SU2191250754	03/07/2014	Sidbury Hill	SLP
Abietinella abietina	SU22174919	16/01/2009	Everleigh, tank training area SE of	WSBRC
Abietinella abietina	SU23285004	07/09/2014	SPTA DD Crossing	SLP
Abietinella abietina	SU2543548111	29/03/2009	Perham Down, Murphy's range, DTE Salisbury Plain	SLP
Abietinella abietina	SU2546048050	29/03/2009	Perham Down, Murphy's range, DTE Salisbury Plain	SLP

[2] AB Andrew Branson (BBS Regional Recorder); SLP Sharon Pilkington; WSBRC Wiltshire & Swindon Biological Records Centre.

Taxon	Gridref	Date	Site	Source[2]
Abietinella abietina	SU2573747949	29/03/2009	Perham Down, Murphy's range, DTE Salisbury Plain	SLP
Abietinella abietina	SU2575447996	29/03/2009	Perham Down, Murphy's range, DTE Salisbury Plain	SLP
Aloina rigida	SU185470	19/03/2011	Silk Hill Plantation	WSBRC
Aloina rigida	SU2178549645	07/09/2014	SPTA CCDA	SLP
Aloina rigida	SU22174919	16/01/2009	Everleigh, tank training area SE of	WSBRC
Didymodon acutus	SU0625653149	08/06/2014	SPTA Central Impact Area	SLP
Didymodon acutus	SU20434932	16/01/2009	Everleigh, tank training area SE of	WSBRC
Didymodon acutus	SU204524	16/01/2009	Everleigh Down, car par by tank training area	WSBRC
Didymodon acutus	SU21084975	16/01/2009	Everleigh, tank training area SE of	WSBRC
Didymodon acutus	SU21125033	13/03/2009	Sidbury Hill	WSBRC
Didymodon acutus	SU2112750336	16/01/2009	Sidbury Hill, DTE Salisbury Plain	WSBRC
Didymodon acutus	SU2172049741	31/08/2014	Sidbury Hill	SLP
Didymodon acutus	SU21815056	23/10/2010	Sidbury Hill	WSBRC
Didymodon acutus	SU22174919	16/01/2009	Everleigh, tank training area SE of	WSBRC
Ephemerum recurvifolium	SU006475	10/01/1998		WSBRC
Ephemerum recurvifolium	SU010474	10/11/1998	SPTA(W): Inscribed Stone Area	AB
Ephemerum recurvifolium	SU04	22/12/1997	Salisbury Plain SSSI - Western Block.	SLP
Ephemerum recurvifolium	SU066507	22/12/1993	West Dean and Larkhill Impact Areas	AB
Ephemerum recurvifolium	SU076489	22/12/1997	Westdown SW (in SPTA central)	AB
Ephemerum recurvifolium	SU0783661404	14/03/2009	Ell barrow, Larkhill Artillery Range, DTE Salisbury Plain	SLP
Ephemerum recurvifolium	SU0851051226	14/03/2009	Larkhill Artillery Range, DTE Salisbury Plain	WSBRC
Ephemerum recurvifolium	SU2047652389	13/03/2009	Weather Hill, DTE Salisbury Plain	WSBRC
Ephemerum recurvifolium	SU22174919	16/01/2009	Everleigh, tank training area SE of	WSBRC
Lophozia perssonii	SU1845647052	24/01/2010	Silk Hill Plantation	WSBRC
Lophozia perssonii	SU1897247048	13/03/2009	Silk Hill, DTE Salisbury Plain	WSBRC
Lophozia perssonii	SU2079745923	29/03/2009	Bulford Rifle Range D	WSBRC
Lophozia perssonii	SU2080345925	29/03/2009	Bulford Rifle Range D, DTE Salisbury Plain	WSBRC
Lophozia perssonii	SU2147550950	10/12/2009	Sidbury Hill	WSBRC
Lophozia perssonii	SU218502	23/10/2010	Sidbury Hill	WSBRC
Pleurochaete squarrosa	SU206498	07/05/1986	Haxton Down	AB
Racomitrium canescens	SU20164520	10/09/2012	Bulford Rifle Range B	WSBRC
Racomitrium canescens	SU20174521	16/01/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Racomitrium canescens	SU2018345231	13/03/2009	Bulford Rifle Ranges	WSBRC
Racomitrium canescens	SU2018545225	13/03/2009	Bulford Rifle Ranges, DTE Salisbury Plain	WSBRC
Weissia sterilis	SU000478	10/11/1998	SPTA(W): Inscribed Stone Area	AB
Weissia sterilis	SU006475	10/01/1998		WSBRC

APPENDIX III. FIGURES

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 1a Species Populations

- Abietinella abietina var. hystricosa
- Didymodon acutus

Not to scale.

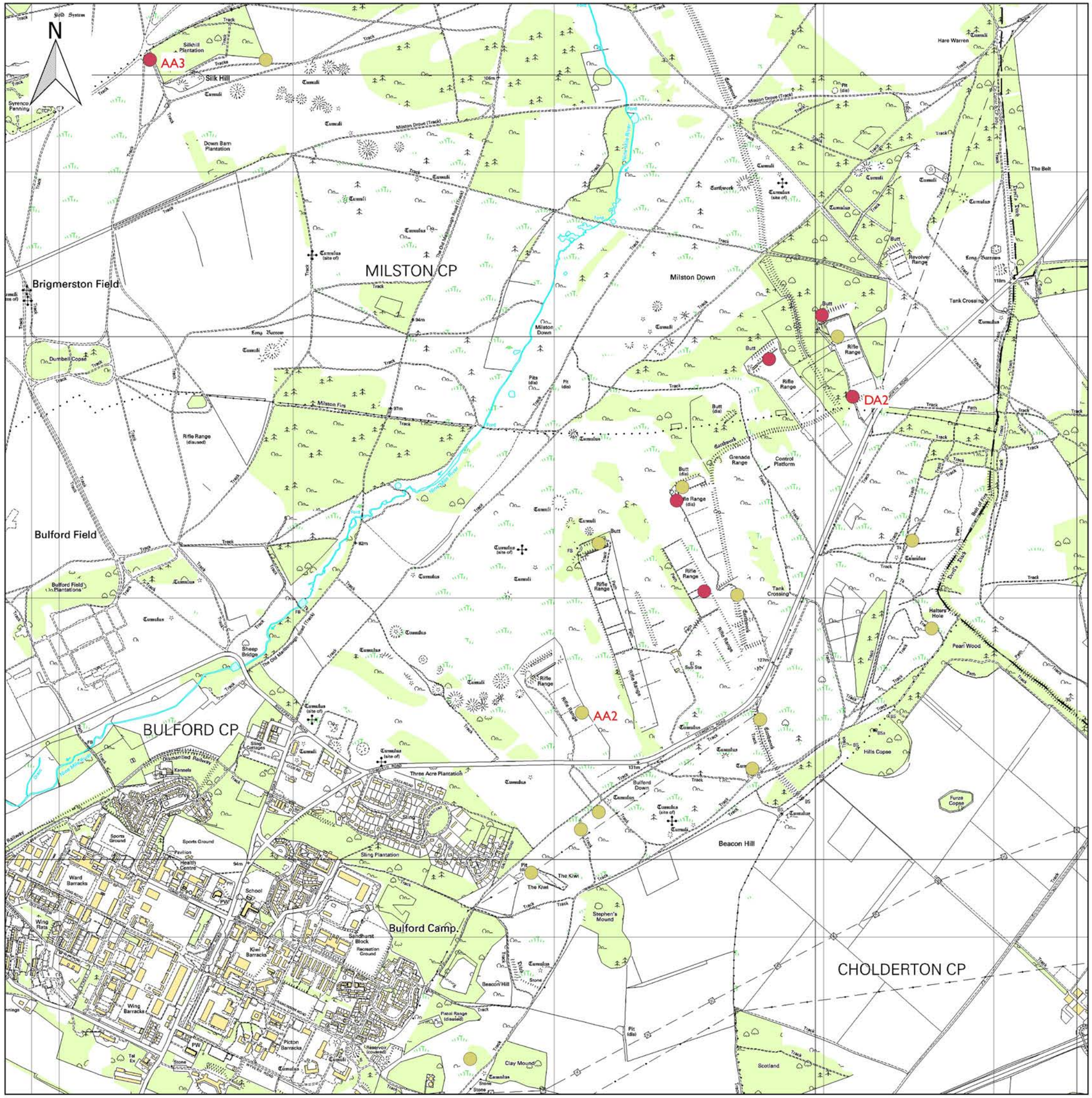
VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 1b Species Populations

- Abietinella abietina var. hystricosa
- Didymodon acutus

Not to scale.



VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 1c Species Populations

- Abietinella abietina var. hystricosa
- Didymodon acutus

Not to scale.

VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 2a Species Populations

- Aloina rigida
- Lophozia perssonii

Not to scale

VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

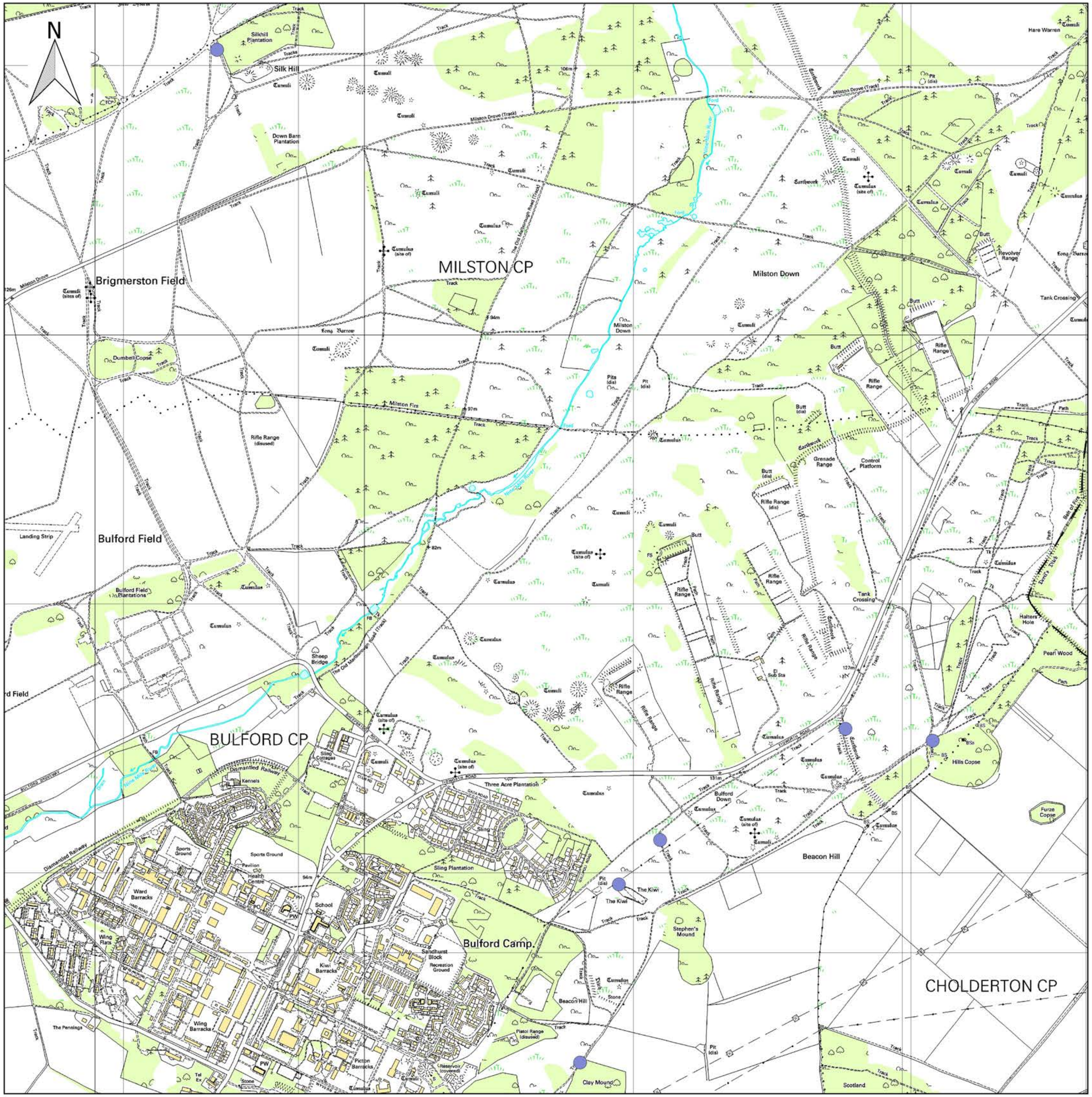


Figure 2b Species Populations

- Aloina rigida
- Lophozia perssonii

Not to scale.

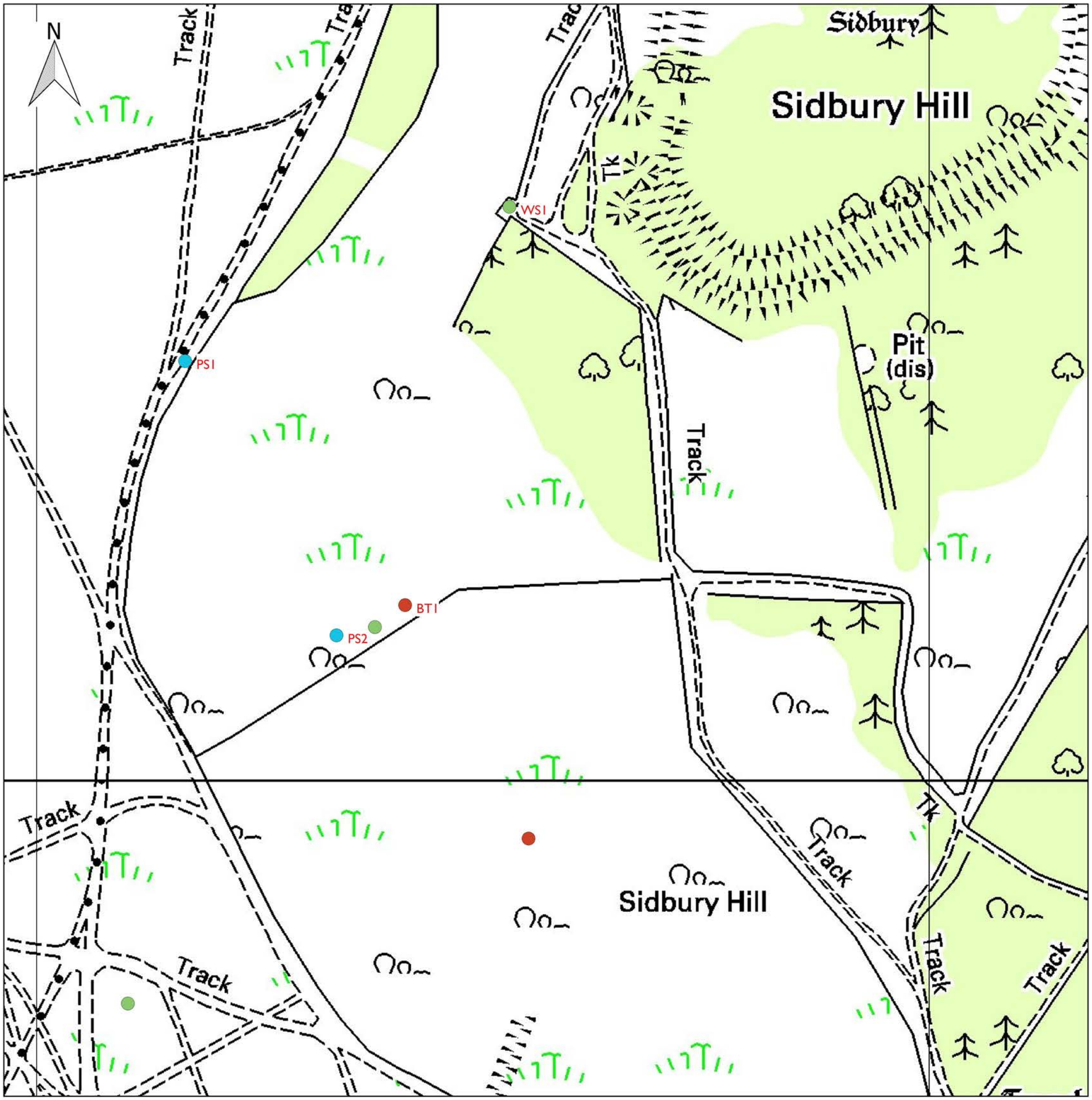
VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 3a Species Populations

- Bryum torquescens
- Pleurochaete squarrosa
- Weissia sterilis

Not to scale.



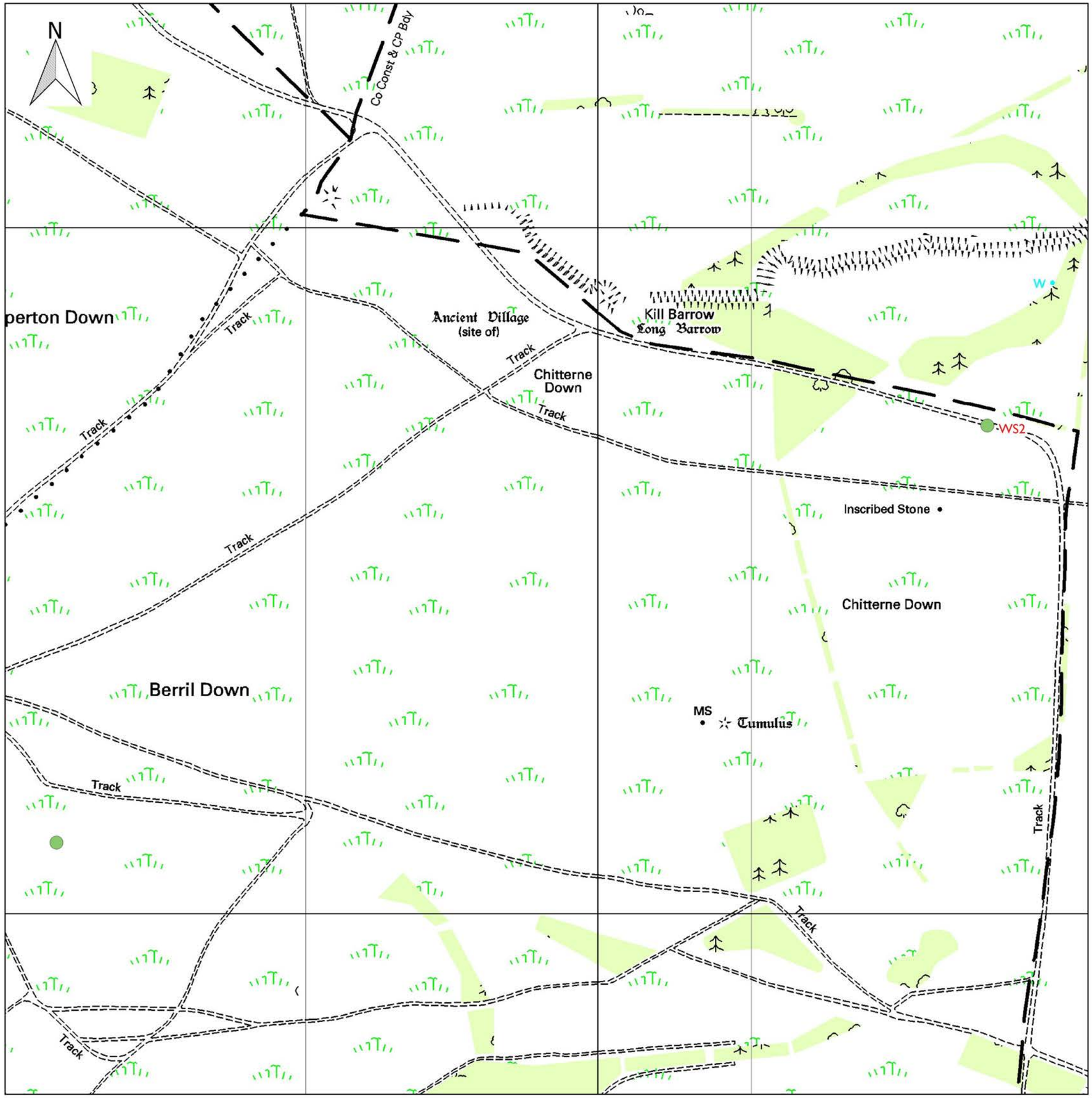
VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 3b Species Populations

- Bryum torquescens
- Pleurochaete squarrosa
- Weissia sterilis

Not to scale.



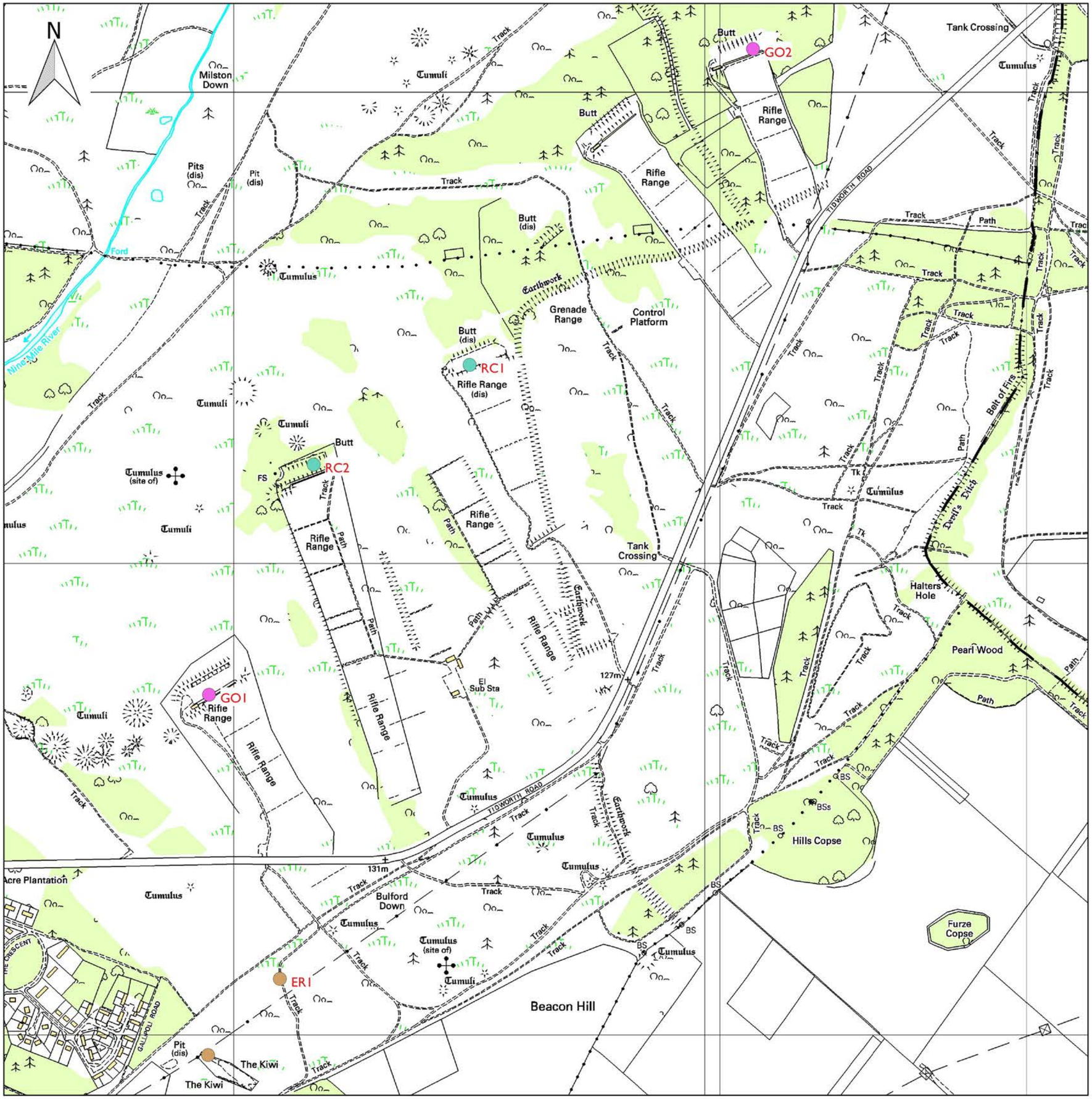
VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 4 Species Populations

- Ephemerum recurvifolium
- Grimmia orbicularis
- Racomitrium canescens

Not to scale.



VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 5a Species Populations

- Pottiopsis caespitosa

Not to scale.

VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 5b Species Populations

- Pottiopsis caespitosa

Not to scale.

VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 6a Species Populations

- Entodon concinnus
- Leptodon smithii
- Scapania aspera
- Weissia controversa var. crispata

Not to scale.

VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 6b Species Populations

- Entodon concinnus
- Leptodon smithii
- Scapania aspera
- Weissia controversa var. crispata

Not to scale.

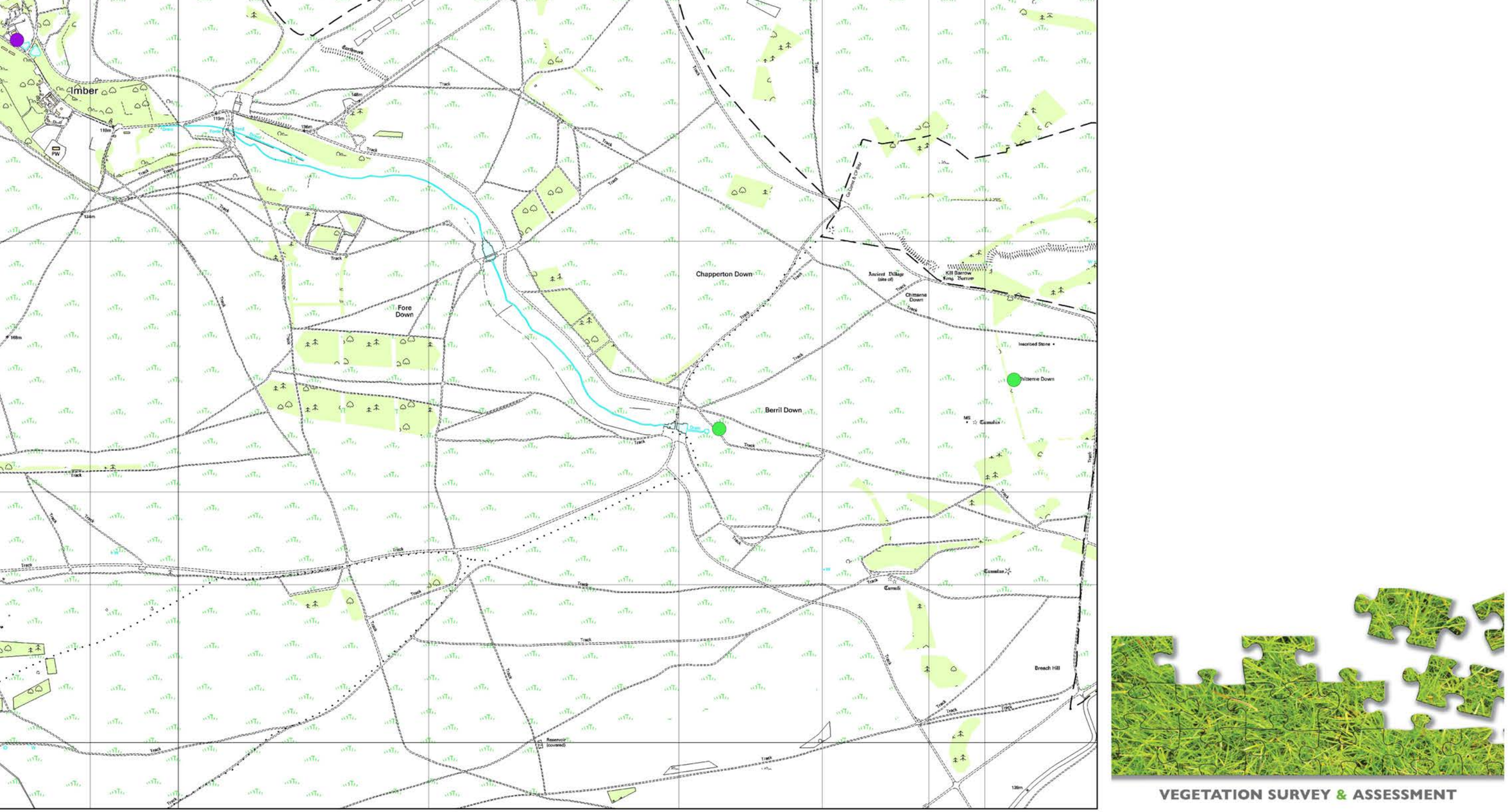
VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 6c Species Populations

- Entodon concinnus
- Leptodon smithii
- Scapania aspera
- Weissia controversa var. crispata

Not to scale.



VEGETATION SURVEY & ASSESSMENT

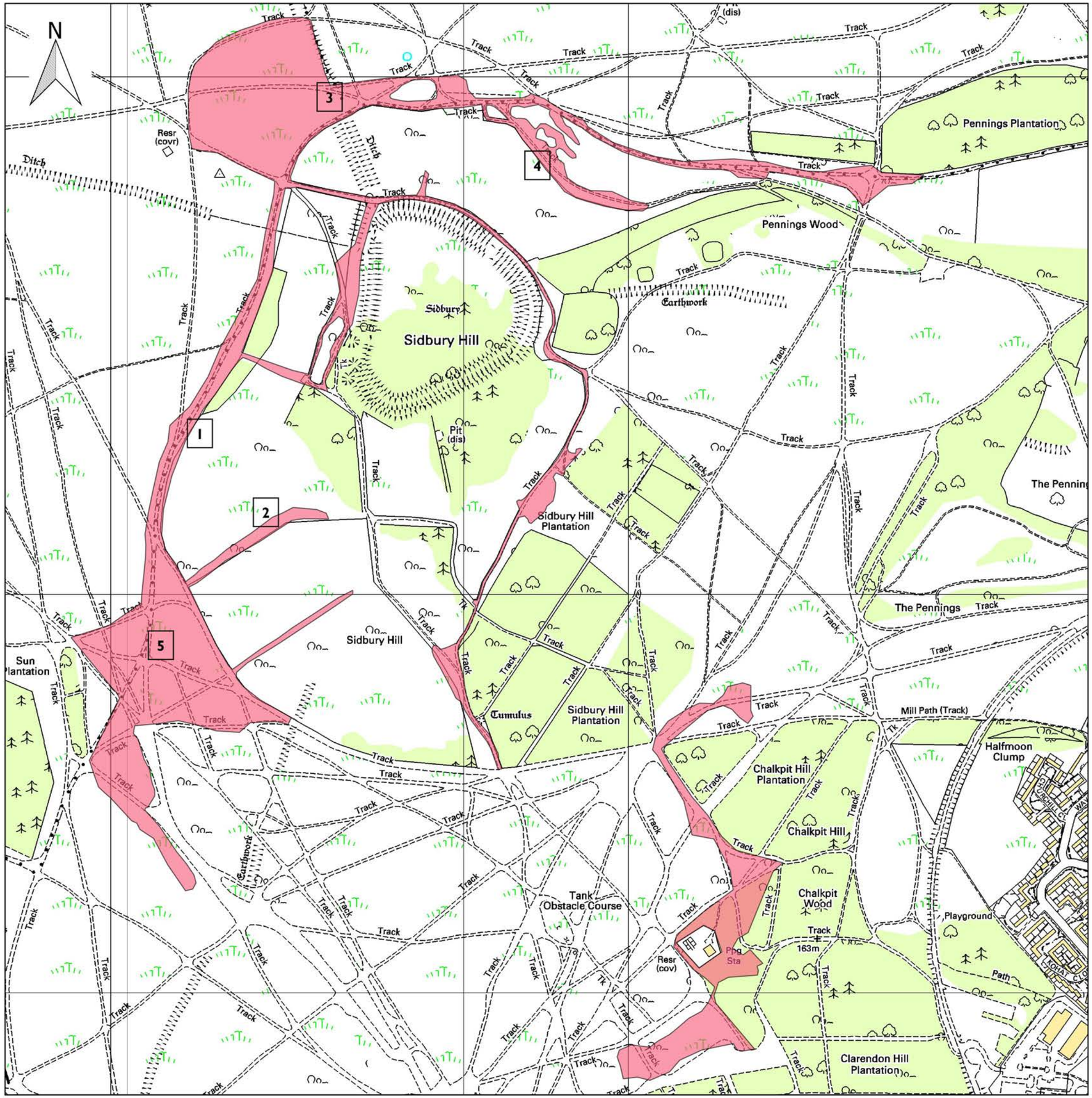
Salisbury Plain SSSI Bryophyte Site Dossier

Figure 7a

Area of High Bryophyte Interest

1 Note - see text

Not to scale.



VEGETATION SURVEY & ASSESSMENT

Salisbury Plain SSSI Bryophyte Site Dossier

Figure 7b

Area of High Bryophyte Interest

I Note - see text

Not to scale.

VEGETATION SURVEY & ASSESSMENT

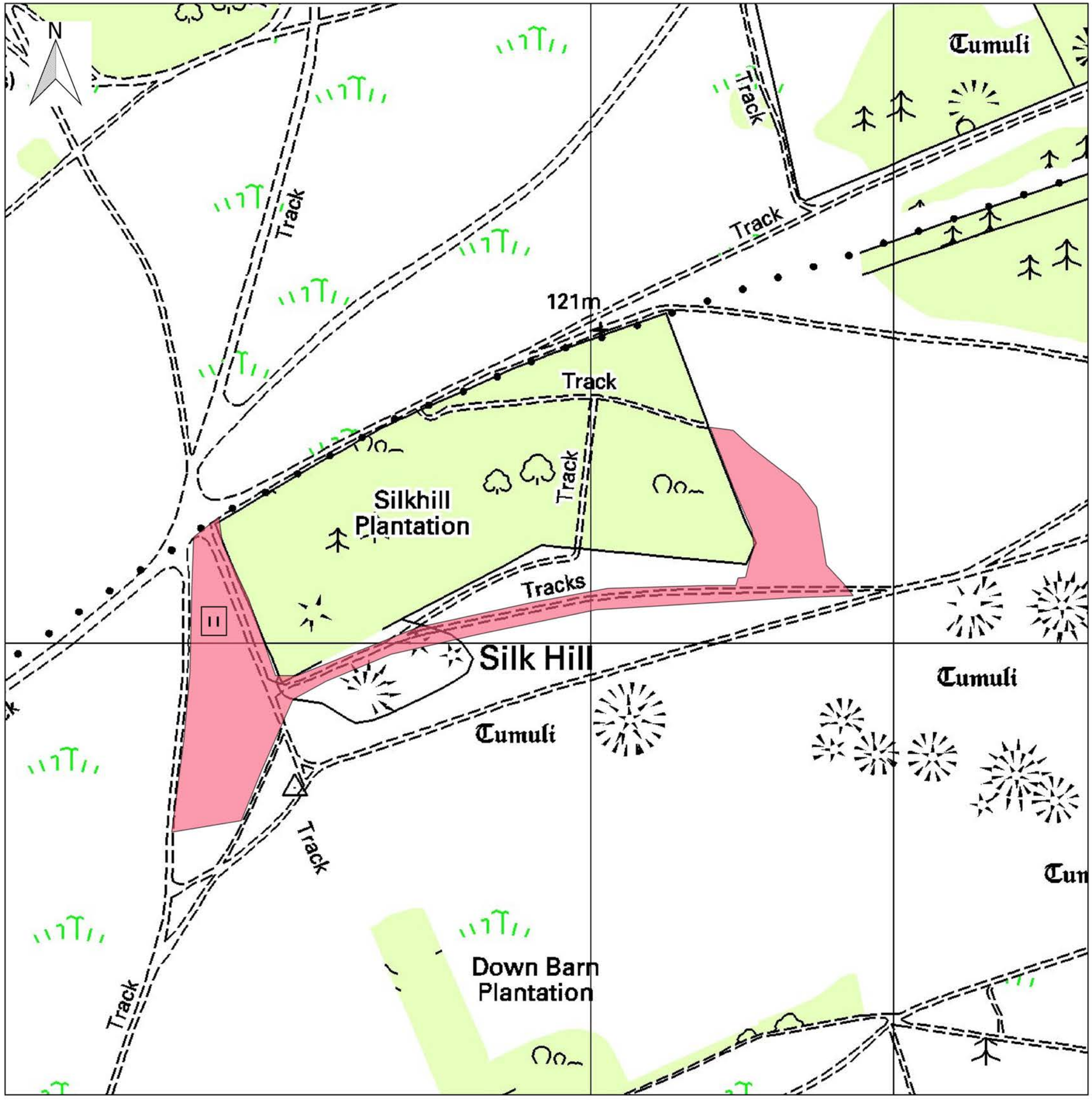
Salisbury Plain SSSI Bryophyte Site Dossier

Figure 7c

Area of High Bryophyte Interest

I Note - see text

Not to scale.



VEGETATION SURVEY & ASSESSMENT

APPENDIX IV. SPECIES LIST

Mosses

Abietinella abietina var. hystricosa
Aloina aloides
Aloina rigida
Amblystegium serpens
Anomodon viticulosus
Aulacomnium androgynum
Barbula convoluta var. convoluta
Barbula sardoa
Barbula unguiculata
Brachythecium mildeanum
Brachythecium rutabulum
Bryoerythrophyllum recurvirostrum
Bryum argenteum
Bryum capillare
Bryum dichotomum
Bryum radiculosum
Bryum rubens
Bryum torquescens
Calliergonella cuspidata
Campyliadelphus chrysophyllus
Campylium protensum
Campylopus introflexus
Cirriphyllum crassinervium
Cirriphyllum piliferum
Cratoneuron filicinum
Cryphaea heteromalla
Ctenidium molluscum
Dicranella varia
Dicranum bonjeanii
Dicranum scoparium
Didymodon acutus
Didymodon fallax
Didymodon insulanus
Didymodon luridus
Didymodon nicholsonii
Didymodon rigidulus
Didymodon sinuosus
Didymodon tophaceus
Didymodon vinealis
Ditrichum gracile
Encalypta streptocarpa
Encalypta vulgaris
Entodon concinnus
Ephemerum minutissimum
Ephemerum recurvifolium
Eurhynchium striatum
Fissidens dubius
Fissidens taxifolius
Frullania dilatata
Grimmia orbicularis
Grimmia pulvinata
Homalothecium lutescens
Homalothecium sericeum
Hylocomium splendens
Hypnum andoi
Hypnum cupressiforme var. cupressiforme
Hypnum cupressiforme var. lacunosum
Hypnum cupressiforme var. resupinatum
Hypnum jutlandicum
Isothecium myosuroides
Kindbergia praelonga
Leptodon smithii
Leskea polycarpa
Leucodon sciuroides
Microbryum curvicollum
Microbryum davallianum
Microbryum rectum
Neckera complanata
Neckera crispa
Orthodontium lineare
Orthotrichum affine
Orthotrichum anomalum
Orthotrichum cupulatum
Orthotrichum diaphanum
Orthotrichum lyellii
Orthotrichum pulchellum
Orthotrichum striatum
Orthotrichum tenellum
Oxyrrhynchium hians
Phascum cuspidatum
Plagiomnium undulatum
Pleurochaete squarrosa

Pottiopsis caespitosa
Pseudocrossidium hornschuchianum
Pseudoscleropodium purum
Racomitrium canescens
Radula complanata
Rhynchostegium confertum
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Schistidium crassipilum
Seligeria calcarea
Seligeria calycina
Syntrichia laevipila
Syntrichia latifolia
Syntrichia montana
Syntrichia ruralis var. ruralis
Thamnobryum alopecurum
Tortula lanceola
Tortula muralis
Tortula protobryoides
Tortula truncata
Trichostomum brachydontium
Trichostomum crispulum
Ulota bruchii
Weissia controversa var. controversa
Weissia controversa var. crispata
Weissia longifolia var. angustifolia
Weissia sterilis
Zygodon viridissimus

Liverworts

Leiocolea badensis
Leiocolea turbinata
Lophocolea heterophylla
Lophozia perssonii
Metzgeria consanguinea
Metzgeria furcata
Metzgeria violacea
Microlejeunea ulicina
Nowellia curvifolia
Pellia endiviifolia
Porella platyphylla
Scapania aspera

Further information

Natural England evidence can be downloaded from our **Access to Evidence Catalogue**. For more information about Natural England and our work see **Gov.UK**. For any queries contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** .

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