Hampshire & Isle of Wight Wildlife Trust

Repeat Assessment of Favourable Condition for the Southern Damselfly *Coenagrion mercuriale* on the New Forest Special Area of Conservation (SAC), Hampshire, England

Higher Level Stewardship Agreement
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Front Cover: View of suitable habitat for southern damselfly at Shipton Bottom

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Repeat Assessment of Favourable Condition for the Southern Damselfly *Coenagrion mercuriale* on the New Forest Special Area of Conservation (SAC), Hampshire, England.

CONTENTS

1. Summary

- Twenty-two sites in the New Forest were sampled for habitat attributes and adult southern damselfly abundance in June and July 2013 (see sections 3 and 4). This represents a re-assessment of 20 of the 21 sites included within the original condition assessment (Harvey *et al*., 2005), and the addition of two sites considered to have the potential to support this species.
- These data were used to inform a condition assessment of each site (see sections 5 and 6).
- Of the 22 sites assessed (see section 6), six were judged to be in Favourable condition, 16 in Unfavourable condition, and none in Unfavourable-recovering condition. The total habitat area assessed was 22.74 hectares (ha), of which 12.25ha (53.9%) was Favourable and 10.49ha (46.1%) Unfavourable. This corresponds to a total of 16,418 metres (m) surveyed, of which 6,280m (32.3%) was Favourable, and 10,138m (61.7%) Unfavourable.
- The reasons for judging sites as Unfavourable were:
    - too shady / encroached by scrub (10 sites);
    - too small and / or isolated (8 sites);
    - concerns over lack of water or poor flow (8 sites);
    - too few plants for oviposition (6 sites);
    - adjacent to clearly unfavourable habitat that could be restored (4 sites);
    - poor vegetation structure, lack of shelter for adults (3 sites);
    - extensive presence of bracken (2 sites);
    - fragmentation within site (1 sites);
    - extensive presence of eutrophication (1 site).
- Immediate and / or future management recommendations are provided for each site (where appropriate) to assist the person(s) / organisation(s) responsible for the management of these sites to achieve and / or maintain Favourable condition for this species, and to secure the mechanisms for sustaining these populations for the foreseeable future (see section 6).
- It is important to emphasise that these recommendations specifically relate to actions that would enhance the habitat at the site for southern damselfly. It is essential that other interest features of the New Forest Special Area of Conservation (SAC) and associated Sites of Special Scientific Interest (SSSIs), protected species, and protected habitats are considered when determining the selection and delivery of works. Where possible, timing of the works should be scheduled to minimise the risk of negatively impacting the site and its associated flora and fauna. The authors consider that these factors can be addressed through the application of due process (see section 6).
- The under-management and level of fragmentation of southern damselfly sites are the key reasons for the conclusion of this study that the New Forest SAC is in Unfavourable condition for southern damselfly (see section 7).
- It is recommended that a feasibility study, including a hydrological assessment of all existing and potential futures sites, be undertaken to determine a programme of habitat restoration / creation for this species (see section 7).
- It is concluded that inter-connected sites of favourable condition (in regard to habitat attributes) that can operate as meta-populations must be established for the New Forest SAC to be considered as in Favourable condition for southern damselfly (see section 8).
- A number of recommendations (see section 8) are given for further refining the methodology for future monitoring of the SAC for this species.
- Photomonitoring was undertaken at each site. The resulting photographs are shown in Appendix 7 (bound separately) and have been supplied on CD.

2. Background

This project was initiated by the Forestry Commission England and funded from the New Forest Higher Level Stewardship Scheme (HLS). The project objective was to undertake a repeat survey (originally conducted in 2004) of southern damselfly *Coenagrion mercuriale* populations and their habitats on the New Forest Special Area of Conservation (SAC) in Hampshire (England), in order to report on Favourable Condition as part of the assessment of Favourable Conservation Status for the Natura 2000 features. In addition, these findings would be used to report on the response of the above species to on-going habitat restoration associated with the New Forest HLS Scheme.

The inclusion of the southern damselfly on Annex II of the EU Habitats and Species Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna, and flora) and transposed into UK law through The Conservation of Habitats and Species Regulations 2010 requires English Nature (now Natural England) to identify SACs for the species and to ensure that Favourable Conservation Status applies. On individual sites, Favourable Conservation Status is a combination of the species feature being regarded as in Favourable condition while ensuring that the mechanisms that sustain the population are reliably secured for the foreseeable future. Favourable condition is defined by a number of Conservation Objectives assessed by monitoring attributes against agreed thresholds. It is intended that the assessment of Favourable Conservation Status for the Natura 2000 features is repeated every six years to allow on-going monitoring of the SAC.

It is the intention of this project to repeat the surveys of those 21 sites originally assessed in 2004, plus an additional two sites as identified by the Forestry Commission and Natural England, incorporating the recommendations for future site condition assessment monitoring set out in Harvey *et al.* (2005).

The Hampshire and Isle of Wight Wildlife Trust (hereafter referred to as the 'Trust') was contracted in May 2013 to undertake this work. The project was managed by Deborah Whitfield, the Ecology and Evidence Manager for the Trust. All fieldwork was undertaken by Dr Ben Rushbrook and Sarah Bignell, assisted by Thomas Selby and Ruth Kernohan respectively. Data entry and analysis was undertaken by the Trust under the direction of Deborah Whitfield.

2.1. Species information

The southern damselfly is one of five resident members of the *Coenagrion* genus currently found in the UK. Males of this genus are predominately blue and black in colouration and, together with the common blue damselfly *Enallagma cyathigerum* and white-legged damselfly *Platycnemis pennipes*, constitute the 'blue damselflies' (Thompson *et al*., 2003a).

Male southern damselfly (Figure 1) can be distinguished from other 'blue damselflies' by the 'mercury mark' located on the second abdominal segment (Thompson *et al*., 2003a). However, there is considerable variety in the extent of this mark both within and between sites (Rouquette, 2005), and markings along abdominal segments 3-5 and the shape of the anal appendage are considered to be more reliable identification features. Furthermore, males are typically smaller and darker than the other species of 'blue damselflies' found in the UK, and have a weaker flight pattern.

Detailed accounts for this species in the UK are provided by Purse (2002), Thompson *et al*. (2003a) and Rouquette (2005), and the key habitat attributes used in this assessment process are discussed in detail in section 5. However, the central conclusion of these studies have been summarised below to provide context for the wider criteria (e.g. site isolation) used within the Favourable Condition assessments (see section 6), and to provide background to the discussion points and recommendations raised in sections 6 and 7.

2.1.1. Distribution and status

The southern damselfly is one of Europe's and Britain's rarest and most threatened damselflies (Thompson *et al*., 2003a; Boudot, 2006; Daguet *et al*., 2008). In addition to its inclusion on Annex II of the EU Habitats and Species Directive 1992 (as outlined above), its listed on Schedule 5 (full protection) of the Wildlife and Countryside Act 1981 (as amended), and is the only species of damselfly to be given priority status in the UK Biodiversity Action Plan.

Figure 1: Adult male southern damselfly with second abdominal segment enlarged, showing 'mercury mark' (main picture); additional example of 'mercury mark' shown (inset).

The distribution of southern damselfly is predominantly restricted to southern and western Europe. Though still widespread in France and Spain, it is declining over much of Europe and is now considered *endangered* in the UK, Switzerland and Slovakia; *critically endangered* in Germany, Belgium, Liechtenstein and Austria; and *extinct* in Luxembourg, the Netherlands and Slovenia (Rouquette, 2005; Bordet, 2006). It should be noted that populations in Italy and northern Africa are considered to consist of different sub-species (*C. m. castellani* and *C. m. hermeticum* respectively) to other European populations (Askew, 1988 cited in Thompson *et al*., 2003a).

Within the UK, the southern damselfly has a fragmented distribution, and is restricted to a small number of localities in the south and west of England and Wales (Rouquette, 2005). Major strongholds (colonies) occur in the New Forest in Hampshire, the Preseli Hills in Pembrokeshire, and in the Itchen Valley in Hampshire (Thompson *et al*., 2003a; Rouquette, 2005). All these locations have been designated as SACs, with the southern damselfly listed as a key interest feature. Smaller colonies exist in Devon, Dorset, and the Gower Peninsula, and single populations are present in both Anglesey and Oxfordshire (Thompson *et al*., 2003a).

The UK populations of southern damselfly are considered to comprise a significant proportion of the European total. Despite this, the southern damselfly has suffered an at least 30% decline in distribution in the UK since 1960 (Purse, 2002). It has disappeared from Cornwall and St David's Peninsula in Pembrokeshire, and has declined in Devon and Dorset.

Furthermore, this species has been lost from at least three sites in the New Forest where it was recorded during a systematic survey of Hampshire undertaken in 1998 (Stevens & Thurner, 1999), and potentially a number of other historic sites prior to that date.

This decline of southern damselfly in the UK is believed to be due to the following main factors (adapted from Rouquette, 2005):

- **Under-management** – resulting in the loss of the habitat conditions and structure required by this species (see section 2.1.3);
    - Cessation of traditional grazing practices (under-grazing) is considered to be one of the main reasons for the decline of southern damselfly in the UK, allowing scrub and invading emergent vegetation to encroach and / or enclose small streams and channels.
    - On-going management is required to maintain populations associated with artificially ditched watercourses (i.e. historic water meadow ditches).
- **Over-management** – resulting in the loss of larval habitat and / or shelter and roosting sites for adults;
    - This includes the wholesale clearance or burning of bankside or emergent vegetation and over-zealous clearance of ditches and streams to remove in-channel vegetation or accumulated silt.
- **Abstraction and water-level management** – often results in a lowering of the water table and therefore increases the likelihood of sites drying up in the summer;
- **Dredging and canalisation of streams** – destroys aquatic habitat;
- **Pollution / nutrient enrichment**;
- **Fragmentation of suitable sites** – the southern damselfly appears to be a poor disperser and has difficulty colonising new sites (see section 2.1.2).

2.1.2. Life history

Adult southern damselfly are characterised by their slow and erratic flight, with frequent pauses to perch on low vegetation. They are considered to have the weakest flight of the British coenagrionids, which is reflected in the limited dispersal capabilities of this species (Purse, 2002; Watts *et al*., 2004; Rouquette, 2005). A mark-release-recapture study by Rouquette (2005) found that adult damselflies rarely moved greater than 500m from their original site of capture, with only 0.1% of individuals moving over 1km, and the longest lifetime movement less than 2km. Furthermore, it is clear that the availability of suitable habitat between populations is fundamentally important in determining the dispersal capabilities of this species, and therefore the genetic diversity of populations within a wider 'colony' (Watts *et al*., 2004, 2005, 2006).

Despite their weak flight pattern, southern damselfly are able to fly earlier in the day than most species (Rouquette, 2005), and males can remain active in overcast conditions (Jenkins, personal communication). However, general activity of this species peaks in the middle of the day (Purse, 2002).

Adult males spend a significantly greater portion of their lifetime at breeding sites than females do, the latter believed to visit only when they have a clutch of eggs to lay (Thompson *et al*., 2003a). Males are not territorial, and will scramble to seize females when they visit a breeding site. Following copulation, the male will typically remain in contact with the female throughout oviposition (egg-laying), a behaviour know as contact guarding, and which ensures the female is not inseminated by another male prior to egg-laying (Thompson *et al*., 2003a). Copulations occur throughout the day, though there is a peak around midday.

Female southern damselfly oviposit (lay their eggs) directly into the submerged stem tissue of submerged and emergent plants. Females show a marked preference for plant species with soft stems and thin cuticles, in which it is presumably easier to make an incision with the ovipositor before laying the eggs (Thompson *et al*., 2003a; Rouquette, 2005). On heathland sites such as the New Forest, species such as bog pondweed *Potamogeton polygonifolius* and marsh St John's-wort *Hypericum elodes* are particularly favoured (Purse, 2002). However, it is evident that the selection of plants for oviposition by adult southern damselfly is

based on plant type (i.e. preference for broad-leaved vegetation) and habitat structure, rather than specific plant species themselves (Purse, 2002; Rouquette, 2005).

The southern damselfly exhibit a semi-voltine development (two-year life history) in the UK. The eggs will hatch between mid-June and mid-August, with larval development usually taking two years (Thompson *et al*., 2003a; Rouquette, 2005). The larvae develop through 13 instars, with the period of larval growth restricted between March and October in the UK. Knowledge of larval habitat preferences is limited, but both the emergent vegetation, and the associated detritus and fine sediment, are considered to be important components for the larval stage of this species (Purse, 2002; Rouquette, 2005).

Southern damselfly adults emerge from their final larval stage (instar) between mid-May and late July, though the exact timing of emergence varies with locality (altitude and latitude) and between years (Rouquette, 2005; Jenkins, personal communication). Adult southern damselfly usually emerge in the morning, the final instar larvae ascending emergent vegetation with rigid, upright stems (Thompson *et al*., 2003a; Rouquette, 2005). There is no consistent trend in the plant species used for emergence, but it is suggested that rigid stems that do not bend in the wind are selected to minimise the risk of damage to the damselfly's wings or abdomen during expansion and drying (Thompson *et al*., 2003a). Following emergence, immature adults (tenerals) leave the immediate vicinity of the water and move to feeding sites, where males develop their mature colouration and females develop clutches of eggs. It is believed that newly emerged adults do not fly far from their emergence site (Watts *et al*., 2004; Rouquette, 2005), and that during favourable weather conditions this stage lasts between five and eight days (Thompson *et al*., 2003a).

2.1.3. Habitat requirements

The southern damselfly is at the northern edge of its range in the UK, which is reflected in its south and western distribution, and in the narrow habitat types it occurs in (Purse, 2002; Rouquette, 2005).

In the UK, the southern damselfly occurs in two distinct habitat types; base-rich lowland heathland and calcareous streams / fens (Rouquette, 2005). The former is characterised by the heathland streams and valley mires found in the New Forest and Preseli Hills, and the latter most commonly by the historic meadow systems associated with the rivers Itchen and Test in Hampshire. Although these two habitat types superficially appear different, the similarities in the underlying physical and chemical habitat conditions allow both habitat types to meet the ecological requirements of this species.

Southern damselfly larvae require shallow, well oxygenated, base-rich water with a constant slow-to-moderate flow and relatively high water temperatures (Purse, 2002; Thompson *et al*., 2003a). This species is therefore often associated in close proximity to springs or groundwater due to the permanence of water flow and relatively stable temperature these provide to shallow water bodies.

The selection of sites with relatively high water temperatures is a consequence of this species being present at the northern edge of its range in the UK, and limits this species to sites at the early stages of vegetation succession (Purse, 2002). This species does not therefore tolerate heavy shading by dense bankside vegetation or trees, due to the significant cooling effect this would have on the shallow water habitats utilised by the larvae. However, the presence of some bankside vegetation structure is important, with adults utilising low shrubs (e.g. bog myrtle *Myrica gale*) for shelter and roosting (Purse, 2002; Rouquette, 2005).

Furthermore, the increased light levels associated with areas of unshaded streams facilitate the growth of submerged and emergent plants required for oviposition, and a study by Rouquette (2005) found that (on chalkstream sites) larvae were more abundant in areas open to grazing that supported abundant emergent soft-stemmed vegetation. This requirement for an early stage of vegetation succession requires active management (e.g. grazing, burning, cutting, etc.) to maintain suitable habitat conditions, and is reflected in the susceptibility of this species to under-management of its sites (see section 2.1.1).

3. Methodology

The methodology employed in this study was developed from the protocol used in the original assessment undertaken in 2004, incorporating the recommendations outlined within section 7 of the resulting report by Harvey *et al*. (2005) as appropriate. These recommendations were discussed at length with Jenny Thomas, a lead surveyor in the original study (now of Natural England), to discuss the recommendations and clarify the difficulties encountered in 2004. Based on these sources of information, a revised methodology was designed and trialled by Dr Ben Rushbrook and Sarah Bignell on the 28th and 29th May 2013. This allowed for the refinement of the definitions of the attributes to be recorded, and ensured consistency in the application of the agreed methodology.

As the southern damselfly is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), all surveys were completed by Dr Ben Rushbrook (licence holder) and / or Sarah Bignell (accredited agent under Natural England Licence 20130574), assisted by Thomas Selby and Ruth Kernohan respectively.

3.1. Site / habitat mapping

The following terms as used within this report are defined and described below:

- ***site* –** a unit of land management or ownership.
- ***transect* –** the route of samples taken through the habitat, based on the monitoring sample points assessed during the original study where feasible (see section 6 of Harvey *et al*., 2005); distinct areas of suitable habitat within a site have been treated as separate transects.
- ***transect section* –** a number of transects were divided into sections according to visual changes in habitat or other landmarks, or in keeping with the classification of the monitoring sample points assessed during the original study.
- ***sample point* –** a habitat sample point taken at approximately 10m intervals along each transect / transect section.

The contract specified 23 sites to be monitored. This included the 21 sites surveyed within the original study. These sites are considered to represent all known sites with a significant extant population of southern damselfly in the New Forest. However, due to complications with regards to securing access permission, and uncertainties associated with the recent and future management of the site, Kingston Great Common National Nature Reserve is not included within the assessment and subsequent analysis.

Two additional sites, Dibden Bottom / Applemore and Howen Bottom, were identified by the Forestry Commission and Natural England to potentially contain suitable habitat to sustain populations of southern damselfly and were therefore included within this study. A number of other sites within the New Forest from which southern damselfly are believed to have been lost were not included.

The 22 sites are listed in Table 1; the central grid reference and area were calculated from Geographic Information System (GIS) mapping (see below and section 4.1). Sites for the southern damselfly in the New Forest have been known by a variety of names, and Table 1 cross-references the names used by other recent sources of information. All site names used with this report are consistent with those used in the study by Harvey *et al*. (2005).

The Forestry Commission England provided the Trust with a series of location maps generated by (GIS) using Ordnance Survey 1:10,000 raster tile base mapping. These maps included site boundaries representing the areas of potential habitat for southern damselfly based on the criteria outlined below. Orthorectified aerial photography was provided by the Forestry Commission. All base mapping and aerial photographs are supplied under licence by the Ordnance Survey (© Crown copyright Ordnance Survey 100021242). The Trust possessed the transect route and site boundaries from the original assessments undertaken

in 2004 as a GIS layer, and modified these to include the additional transects and updates based on the field surveys.

Fieldworkers were provided with site maps and aerial photographs for all sites, the latter overlain with the original 2004 transect routes and site boundaries where applicable. Where appropriate, based on field annotations to the aerial photographs and using the photo-monitoring records (see section 3.4 and Appendix 7), site boundaries were re-drawn to define the areas of potential habitat available for southern damselfly at the time of habitat assessment.

Table 1: New Forest sites monitored.

Site name used in current report	**Central grid reference**	**Area (hectares)**	**Site name in Strange & Bousfield (2004)**	**Site name in Boyce (2002)**	**Site name in Stevens and Thurner (1999)**	**Site name in data supplied by Professor David Thompson to Harvey *et al*. (2005)**
Acres Down	SU27000857	0.32	2 - Acres Down	Acres Down	NF28 - Acres Down	Acres Down
Bagshot Moor	SZ36909998	0.67	*site not included*	Bagshot Moor	NF17 - Bagshot Moor	Bagshot
Bull Hill	SZ33799884	0.43	21 - Bull Hill; 7 - Greenmoor	Bull Hill	NF 14 - Greenmoor Stream North; NF15 - Greenmoor Stream South	Greenmoor
Clayhill Bottom	SU23170091	0.2	10 - Holmsley Station	Clayhill Bottom	NF13 - Holmsley Station	Holmsley Station
Common Moor	SU20520440	0.03	4 - Common Moor	*site not included*	NF21 - Common Moor	Common Moor
Crockford Stream (Lower)	SZ35499895	0.82	3 - The Crockford Complex	Crockford Bridge	NF02 - Lower Crockford	Lower Crockford
Crockford Stream (Upper)	SZ34579943	4.26	3 - The Crockford Complex	Crockford Bridge	NF01 - Upper Crockford West; NF** - Upper Crockford East; NF01 - Lower Crockford	Upper Crockford; Deep Moor; Two Bridges Bottom
Dibden Bottom*	SU39430710	0.01	1 - Applemore	Dibden Bottom	NF30 - Applemore Stream	*site not included*
Duckhole Bog	SU25290215	0.2	5 - Duckhole Bog	Duckhole Bog	NF26 - Duckhole Bog	Duckhole Bog
Foulford	SU18890552	0.28	6 - Foulford	*site not included*	*site not included*	Foulford
Hatchet Stream	SU35860120	1.16	9 - Hatchet	Hatchet Pond	NF19 - Hatchet Moor; NF20 - Hatchet Pond Stream	Hatchet
Howen Bottom*	SU23111506	0.23	*site not included*	*site not included*	*site not included*	*site not included*
Latchmore	SU19111289	1.56	8 - Gypsey / Gipsey Hollies; 12 - Lay Valley Gutter	Latchmore Bottom	NF06 - Gypsey Hollies; NF27 - Lay Gutter Valley	Lay Gutter Valley; Gipsey Hollies

Site name used in current report	**Central grid reference**	**Area (hectares)**	**Site name in Strange & Bousfield (2004)**	**Site name in Boyce (2002)**	**Site name in Stevens and Thurner (1999)**	**Site name in data supplied by Professor David Thompson to Harvey *et al*. (2005)**
Mill Lawn	SU23190360	3.45	13 - The Mill Lawn Complex	Mill Lawn	NF22 - Mill Lawn; NF23 - Burley Lawn, west of Rooks Bridge; NF09 - Burley Lawn east of Rooks Bridge; NF24 - Rock Hills-Creek Bottom	Mill Lawnseque; Mill Lawn; East Rook's Bridge; Creek Bottom
Millersford Bottom	SU18561643	1.29	13.5 - Millersford East and West	Millersford Bottom	NF10 - Millersford Bottom West; NF11 - Millersford Bottom East	Millersford Bottom West; Millersford Bottom East
Round Hill	SU32970192	0.91	14 - Roundhill Stream and Mire	Round Hill	NF33 - Round Hill	Roundhill
Shipton Bottom	SZ36159931	4.2	3 - The Crockford Complex	Shipton Bottom	NF03 - Upper Peaked Hill; NF04 - Lower Peaked Hill	Shipton Bottom; Peaked Hill West; Peaked Hill East
Shobley	SU18440610	0.75	16 - Shobley	*site not included*	*site not included*	Shobley
Stag Brake	SU24620306	0.4	17 - Stag Brake Bog	Stag Brake	NF25 - Stag Brake Bog	Stag Brake Bog
Stony Moors	SZ21319969	0.63	18 - Stony Moors	Stony Moors	NF12 - Stony Moors	Stony Moors
Three Beech Bottom	SU29350022	0.59	19 - Three Beeches Bottom; 15 - Setley Plain	Three Beeches Bottom	NF08 - Three Beeches Bottom; NF05 - Setley Plain	Three Beeches Bottom; Setley Plain
Widden Bottom	SZ28949930	0.35	20 - Widden Bottom	Widden Bottom	NF07 - Widden Bottom	Widden Bottom

* site not included in Harvey *et al*. (2005)

The southern damselfly is known to utilise two broad habitat types within the New Forest, linear (i.e. where there is a discernible stream or main flow) and non-linear habitats (i.e. mires and areas where no main flow is discernible). For linear habitats fieldworkers mapped the waterway plus approximately 5m of bank each side. All potential habitat was included (i.e. incorporating areas that were currently lacking in suitable ovipositing plants but that may be contributing to adult or larval habitat), but areas of clearly unsuitable habitat were excluded (e.g. areas under extensive mature tree cover, bodies of standing water, roads etc.).

For non-linear habitats a boundary was drawn around the area that contained potential habitat, specifically the area of wet vegetation with suitable plants scattered throughout. Where linear habitats were transitional into non-linear habitats, a suitable boundary to include all potential habitat was drawn based on the field surveyor's assessment.

The project brief stated that habitat attribute surveys should be conducted between the 17th June and 2nd August to correspond with the timings of the 2004 surveys. However, in light of the difficulties encountered during the original study (see section 7.3 of Harvey *et al*., 2005), it was determined that habitat attribute surveys should be completed within June and July as outlined by Harvey *et al*. (2005) and Rumble *et al*. (2006).

This decision allowed habitat attribute surveys to be conducted prior to adult count surveys (as outlined in project brief), whilst maximising the likelihood that the latter were conducted within the date criteria set out in section 3.3. As a result, habitat transect surveys were completed at three sites, and started at one further site, prior to the 17th June (Table 2).

Table 2: Habitat samples at each site.

Site name	Number of samples	Samples per hectare of suitable habitat	Date/s	Recorder/s
Acres Down	41	128.13	05 July 2013	Ben Rushbrook and Tom Selby
Bagshot Moor	36	53.73	14 June 2013	Ben Rushbrook and Tom Selby
Bull Hill	45	104.65	02 July 2013	Ben Rushbrook and Tom Selby
Clayhill Bottom	20	100.00	16 July 2013	Sarah Bignell and Ruth Kernohan
Common Moor	7	233.33	04 July 2013	Sarah Bignell and Ruth Kernohan
Crockford Stream (Lower)	92	112.20	19 July 2013	Ben Rushbrook and Tom Selby
Crockford Stream (Upper)	220	51.64	01 July 2013	Ben Rushbrook and Tom Selby
			03 July 2013	Ben Rushbrook and Tom Selby
Dibden Bottom	21	2100.00	23 July 2013	Sarah Bignell and Ruth Kernohan
Duckhole Bog	12	60.00	25 June 2013	Sarah Bignell and Ruth Kernohan
Foulford	31	110.71	04 July 2013	Ben Rushbrook
Hatchet Stream	72	62.07	06 June 2013	Ben Rushbrook and Tom Selby
			07 June 2013	Ben Rushbrook
			10 June 2013	Ben Rushbrook, Sarah Bignell, Ruth Kernohan and Tom Selby
Howen Bottom	28	N/A	17 June 2013	Ben Rushbrook
			18 June 2013	Ben Rushbrook
Latchmore	102	65.38	20 June 2013	Ben Rushbrook and Tom Selby
			21 June 2013	Ben Rushbrook and Tom Selby
Mill Lawn	374	108.41	04 July 2013	Sarah Bignell and Ruth Kernohan
			05 July 2013	Sarah Bignell and Ruth Kernohan
			08 July 2013	Sarah Bignell and Ruth Kernohan
			09 July 2013	Sarah Bignell and Ruth Kernohan
Millersford Bottom	95	73.64	15 June 2013	Ben Rushbrook and Tom Selby
			17 June 2013	Ben Rushbrook and Tom Selby
Round Hill	79	86.81	13 June 2013	Ben Rushbrook and Tom Selby
			14 June 2013	Ben Rushbrook and Tom Selby
Shipton Bottom	202	48.10	24 June 2013	Ben Rushbrook and Tom Selby
			25 June 2013	Ben Rushbrook and Tom Selby
			26 June 2013	Ben Rushbrook and Tom Selby
Shobley	60	80.00	04 July 2013	Ben Rushbrook and Tom Selby
Stag Brake	17	42.50	25 June 2013	Sarah Bignell and Ruth Kernohan

Site name	Number of samples	Samples per hectare	Date/s	Recorder/s
Stony Moors	38	60.32	26 June 2013	Sarah Bignell and Ruth Kernohan
Three Beech Bottom	67	113.56	22 July 2013	Sarah Bignell and Ruth Kernohan
Widden Bottom	34	97.14	16 July 2013	Sarah Bignell and Ruth Kernohan

3.2. Sampling of habitat attributes

Measurements of habitat attributes were recorded from a series of sample points at all sites, by the surveyors listed in Table 2. Habitat samples were taken at approximately 10m intervals (distance estimated by pacing), and according to the sampling pattern described below. In contrast to Harvey *et al*. (2005), the numbering of sampling points was restarted for each individual transect section.

For linear habitats, a 2m length of the linear habitat (1m upstream / 1m downstream) was assessed at each sample point and the habitat attributes set out below recorded. The transect routes for sampling followed the flow of water, choosing what seemed to be the main flow where there was a choice. The annotated aerial photographs allowed fieldworkers to essentially replicate the routes of the original transects / transect sections at the majority the 20 sites repeated from the original surveys in 2004 (see sections 6.14, 6.16 and 6.21 for exceptions). Where considered appropriate, areas of unsuitable habitat were retained within the 2013 transect routes to allow for a more direct comparison between the two studies. Furthermore, this will allow for an assessment of how a site has responded should future management actions be implemented to improve these areas of unsuitable habitat for southern damselfly.

For non-linear habitats, a circle 1m in radius was assessed at each sample point. The transect routes selected were chosen to zig-zag across the non-linear habitat, selecting areas of flowing water where feasible. Replicating the corresponding transect / transect section routes surveyed in 2004 was more difficult for mire habitats due to the absence of a defined channel or area of main flow to orientate against, or as result of differences in the hydrological conditions encountered between the two studies. The latter is discussed in greater detail in section 4.2.1.

Where linear habitats were transitional into non-linear habitats the surveyor first followed the main flow as far as possible, treating it as a linear habitat, then added a zig-zag route to sample any remaining habitat away from the main linear flow.

The location of the start, end, and each of the sample points within each transect / transect section was determined using handheld Global Positioning System (GPS) devices (with an inherent error between 3m and 7m). The location was both manually recorded on field survey forms, and stored on the handheld GPS devices, with the exception of transect sections 1.6 and 1.7 at Crockford Stream (upper), and transect sections 1.2, 1.3, 1.4, and 3.1 at Mill Lawn, where difficulties storing to the GPS devices arose.

The attributes recorded at each sample point were (see Appendix 4 for the survey forms):

- habitat type* (linear or mire);
- water flow* (dry; damp but with no open water; open water with no discernible flow; or open flowing water);
- percentage cover of emergent broad-leaved herbs (including bog pondweed *Potamogeton polygonifolius*, and / or lesser spearwort *Ranunculus flammula*, and / or marsh St-John's-wort *Hypericum elodes*);
- percentage cover of submerged vegetation;
- percentage of channel (or of sample area in non-linear habitat) in shade from overhanging bankside shrubs and trees (shrubs to include bog myrtle *Myrica gale* where this is shading the channel);
- percentage cover of bog myrtle in watercourse;
- presence / absence of bracken *Pteridium aquilinum*;

- evidence of eutrophication* (based on the presence of green filamentous, but not brown flocculent, algae);
- bankside vegetation structure within 5m radius of sample point*,† (uniformly low sward height, no shelter; uniformly high sward height, too shady; mixed sward height but too shady; or mixed sward height with good structure, sheltered but not too shady: Figure 2);
- the relative abundance of stiff emergent vegetation* (none; scarce; frequent; choking channel);
- percentage of channel substrate composed of each of: boulders; pebbles; gravel; sand; silt / mud / peat*,‡ (record % coverage of all types including zero values; final value should equal 100%).

* added / modified as recommended by Harvey *et al*. (2005).

† single measurement for non-linear habitats; separate measurements for left and right banks for linear habitats, left and right banks being in the context of the direction walked along the sample route.

‡ following size ranges were used to categorise substrate type: *boulders* (and cobbles) – equal or larger than fist size; *pebbles* – smaller than fist size but larger than thumb nail; *gravel* – smaller than thumbnail but with individual particles visually discernible; *sand* – individual particles not easily visually discernible but grains felt when rubbed between fingers); *silt / mud / peat* – substrate feels smooth when rubbed between fingers.

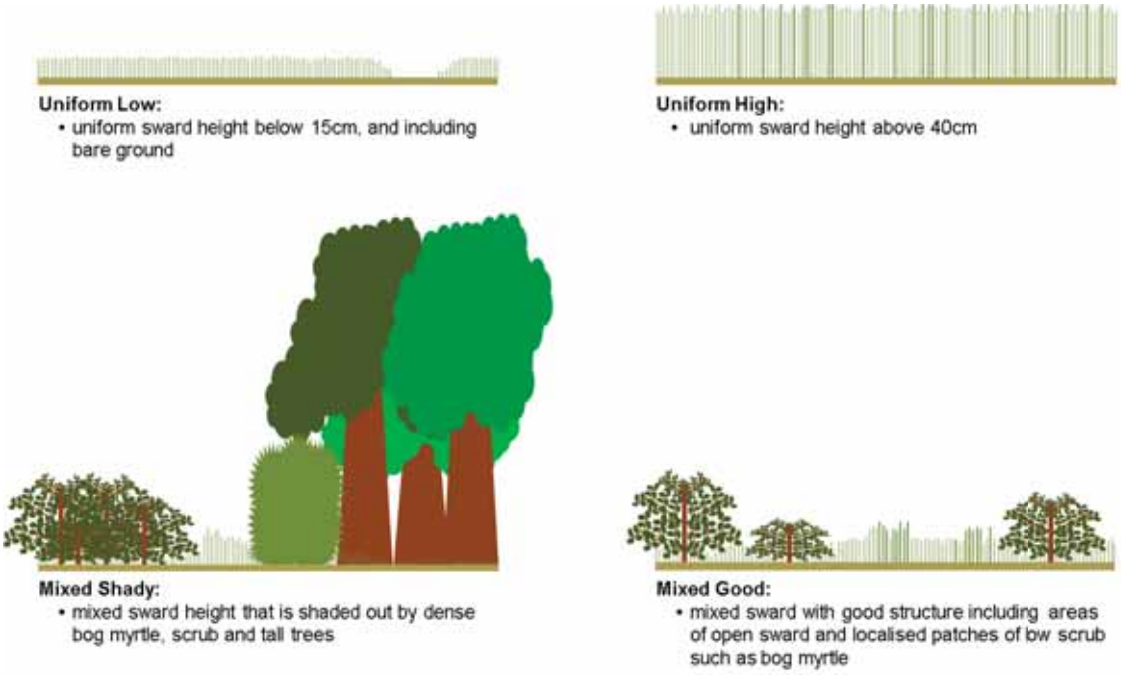


Figure 2: Diagrammatic illustration of the four categories of bankside vegetation structure.

Percentage cover was recorded at 5% interval levels in most cases, except where habitat attributes were present in very small amounts, and a 2% level of cover was recorded following the analysis protocol used by Harvey *et al*. (2005).

Due to the difficulties in assessing the size of southern damselfly populations encountered in 2004, and following the recommendations of Harvey *et al*. (2005), the presence and abundance of adult male southern damselfly was recorded for each transect section during the habitat assessment.

The field recording sheet (see Appendix 4) also included boxes for:

- start and finish grid references;
- name and location of photographs;
- additional notes.

The sheets also included a specific section for notes on the following (to inform management recommendations made in section 6.1-6.22):

- presence / absence of evidence for recent grazing pressure at the site and its intensity (e.g. light, extensive, heavy, poaching);
- hydrology of the site;
- vegetation structure across the wider site and any evidence of succession (annotating aerial maps and / or survey forms with 'target notes' to identify locations where specific management is required, providing a grid reference or relative position to a specific sample point or points);
- the vegetation structure of the adjoining habitat and the opportunity for southern damselfly expansion from the site.

There were some problems in clearly defining some of the habitat attributes; see discussion in section 5.1 below.

3.3. Counts of adult male southern damselfly

Transect routes for recording damselflies were, as far as possible, the same as transect routes for habitat sampling. Both habitat and the damselfly sampling were carried out by the same lead surveyor, though usually on different dates. Damselfly sampling was prioritised in order to meet suitable weather conditions (provided below) where possible. This prioritisation was not always feasible during the original surveys performed in 2004, with a number of surveys completed during unsuitable weather conditions and / or after the peak flight period for southern damselfly (Harvey *et al*., 2005).

Flight periods for southern damselfly in Hampshire are discussed in Taverner *et al*. (2004). Southern damselfly have been recorded from early May to late September, but the main flight period is from week 24 to week 30 (from 10th June to 28th July in 2013), with a peak in week 26 (from 24th to 30th June in 2013). It was intended that all adult transect counts were undertaken within the main flight period (Taverner *et al*., 2004), and completed by the 18th July as outlined within Harvey *et al.* (2005).

The entire length of all transect sections were walked (Harvey *et al*., 2005), with start and end points directly corresponding to those recorded for the habitat surveys. For linear habitats, all male southern damselflies seen within an approximate 2 metre width across the waterway were recorded. For non-linear habitats, the area surveyed for damselflies was approximately 1 metre either side of the route walked.

Other variables recorded for each transect section were (see Appendix 5 for survey forms):

- start time;
- finish time;
- shade temperature;
- wind direction and speed (Beaufort Scale);
- % of sunshine;
- additional notes (e.g. changes in weather conditions during surveys, evidence of changes in habitat conditions since habitat attribute surveys).

Within the main flight period, it was intended that transects were walked between 11am and 3pm British Summer Time (BST), with shade temperatures at least 17°C, at least 50% sunshine, and with wind speed not exceeding force 4 on the Beaufort scale.

3.4. Photography

Photographs were taken at the discretion of the field surveyors in order to indicate site condition. The location of each photograph was recorded using a handheld GPS device. Wherever possible these locations directly correspond with one of the habitat sampling points.

For linear habitats, a photograph was taken both upstream and downstream of the point selected. This method was followed even at the start and end of habitat sections, to show where habitat conditions became unsuitable (e.g. showing tree cover at the end of a habitat section, in order to compare with any changes in such cover in the future).

For non-linear habitats a central location was used where possible, and a number of photographs were taken for subsequent combination into a panoramic view of the site where feasible. Where this was not feasible / considered appropriate, the methodology for linear habitats was followed with additional photographs taken to show the adjacent habitat. Alternatively, photographs were taken from the edge of the site, or another vantage point.

Photographs were saved as digital images using the following name convention:

> site name – transect number – sample point – viewpoint – reverse date (i.e. 20130626 for 26th June 2013)
>
> Example:
> Shipton Bottom – 1.2 – 24 – downstream – 20130626

3.5. Data Analysis

All statistical analyses were performed using Microsoft™ Excel (2010) and Minitab™ (version 14.0). Where appropriate, and prior to more detailed analysis, data was tested to ensure it conformed to the assumptions associated with parametric testing. All continuous variable data was tested for normal distribution using the Anderson-Darling test. Data that deviated from normal distribution was first Log10 transformed to normalise variance and subsequently tested using parametric tests. Discrete or small sets of data that could not be normalised were tested using non-parametric equivalents, with all results from non-parametric testing adjusted for ties as appropriate.

Survey day was calculated from the date of the first adult transect survey (i.e. survey day 1 represents the 21st June 2013). The relative abundance of damselflies (i.e. damselflies per 100m surveyed) recorded per day was calculated at both the site and transect section level. At the site level, where multiple sites were visited in a single day (i.e. date), the value for each individual site has been included in the analysis. Furthermore, where an individual site was surveyed across multiple days (i.e. Clayhill Bottom and Mill Lawn), the relative abundance of damselflies across all transect sections surveyed within a single day has been calculated, with each day included in the analysis as an individual value.

4. Results

4.1. Habitat mapping

The Forestry Commission has been provided with GIS layers for the areas of potential habitat (polygon data), habitat sample points (point data) and transect routes (polyline data). The habitat area and transect data are mapped in the site accounts in sections 6.1-6.22. Due to the inherent error associated with the use of handheld GPS devices (see section 3.2), where the sample points clearly deviate from a surveyed linear feature (i.e. stream or runnel) as shown on the aerial photograph, the plotted transect route (polyline data) was amended to correspond to the linear feature surveyed.

It is recommended that the current and original datasets are used, along with the most up-to-date set of aerial photographs available, for any future monitoring.

4.2. Habitat survey

4.2.1. Sites sampled

Habitat samples were taken at all 22 sites assessed. All sites were visited between the 6th June and 23rd July 2013 (Table 2).

Since the transects for adult male southern damselfly counts followed the same route as that taken for habitat sampling it was possible for the two sets of measurements to be directly linked, and for analytical comparisons to be made at the site and transect section level (see section 5.5; Tables 7 and 8).

All transects surveyed within this current study were based on those surveyed during the original 2004 survey (Harvey *et al*., 2005) with the following exceptions:

- Mill Lawn: transect section 1.4 was sub-divided into transect sections 1.4 and 1.12 due to the presence of an extensive area of gorse creating a long expanse of unsuitable habitat;
- Mill Lawn: transect section 4.2 was shifted south west since the location of the original transect was completely dry at the time of survey;
- Round Hill: transect sections 3.1 and 3.2 were shortened and extended respectively to reflected the visual change in habitat observed during the current survey;
- Three Beech Bottom: an additional transect section (1.4) was added as the field surveyors could not determine which feature corresponded to transect section 1.1 in the original 2004 survey;
- Dibden Bottom: additional site for this study with transect selected based on conditions at the site during the habitat attribute survey;
- Howen Bottom: additional site for this study with transect sections selected based on conditions at the site during the habitat attribute surveys.

The amount of suitable habitat present at the two additional sites (Dibden Bottom and Howen Bottom) included within the study was substantially lower at the time of the habitat assessment than was reflected within the location maps provided by the Forestry Commission. This was reflected within the length of channel included within the habitat attribute surveys (see sections and 6.8 and 6.12).

In the project brief, it was identified that the length of transect to be included within the habitat sampling at Duckhole Bog and Millersford Bottom (transect section 1.6 only) may need to be extended from that assessed in the original study, to reflect recent management at these sites. However, conditions encountered at these sites during the habitat attribute surveys did not warrant these extensions, due to a lack of discernible flow and high levels of shading at each site respectively.

There was a highly significant reduction in the area of potentially suitable habitat for southern damselfly recorded at the 20 sites repeated from the original 2004 surveys (Paired t-test: t-value = -7.40, n = 20, $p < 0.001$). This is to some degree a consequence of inherent

differences in the assessment of these areas between the two studies. The criteria for the assessment of the areas of potentially suitable habitat used in this study (see section 3.1) were consistent with that detailed in the Harvey *et al*. (2005). However, it is evident that some areas that have been assessed as unsuitable (e.g. areas of dense tree cover, roads, etc.) and therefore excluded from the area of potential habitat mapped in this study (see sections 6.1–6.22), were included in the areas mapped by Harvey *et al*. (2005; sections 6.1–6.21).

The differences in the assessment of the potential habitat areas is believed to explain only a small degree of this variation, and it is considered that the results reflect true differences in the hydrology at a number of sites between the two studies. Comparisons of the habitat areas mapped in the site accounts clearly indicate that less potential habitat is available across the majority of sites. This is a consequence of a reduction in the width of the valley mires associated with the transects surveyed at these sites. This assessment is supported by the fact that there is no statistical difference in the length of habitat surveyed between the 20 sites repeated from the original study (Paired t-test: t-value = 0.36, n = 20, p = 0.724).

The effects of management at specific sites cannot be excluded without more detailed assessment. However, it is considered likely that the amount of permanent / perennial habitat available to southern damselfly is in fact smaller than originally assessed. To a degree, this is likely to reflect the different weather conditions experienced during the two survey periods, with June and in particular July 2004 notably wetter in southern England than the corresponding months in 2013 (Centre for Ecology and Hydrology, 2014). The associated increase in the level of surface water is likely to have resulted in the temporary expansion of areas of non-linear habitat, which would therefore appear to provide suitable habitat for southern damselfly at the time of the 2004 surveys. The reduction in the area of suitable habitat available at a number of sites during the current survey is considered to be a direct result of a reduction in the area of non-linear habitat present in 2013 (e.g. see sections 6.5, 6.14, 6.16 etc.).

Despite the contrasts in the availability of water explained by the differences in rainfall between the two study years, it is considered possible that annual variations in rainfall may only partly explain the observed reduction in the areas of potential habitat available for southern damselfly, and may reflect a long-term reduction in the availability of water at these sites. This possible trend is discussed in detail in section 7.

4.2.2. Sample data

All raw data from the field recording sheets was transcribed onto a Microsoft™ Access 2010 database. The Forestry Commission have been provided with copies of the full dataset in spreadsheet (Microsoft™ Excel 2010) and database format. Appendix 1 provides a summary of the data, giving the average (mean or mode as appropriate) value for each attribute at each site.

Appendix 2 shows the percentage of sampling points falling outside the Favourable Condition limits as set out in Table 6, section 5.2, for each transect. Where limits have not been set (e.g. % channel open flowing water) percentage presence data are shown. The current and original data can be used for comparison with any repeat monitoring, to assess whether sites are improving, remained stable, or declining.

4.3. Transect counts of adult damselflies

All 22 sites assessed were surveyed between 21st June and 22nd July 2013, with only Three Beech Bottom surveyed after the intended 18th July cut-off point (Table 3). Therefore, all sites were visited within the main flight period for southern damselfly although, with the exception of Howen Bottom, Bagshot Moor and Hatchet Stream, after the standard peak flight period as outlined in section 3.3. This reflected the superior weather conditions experienced during July in comparison with June, and in response to its likely associated effect on emergence and flight patterns in this species. Furthermore, there is no evidence that lower relative abundances of adult male southern damselflies were recorded later in the main flight period at either the site (Spearman's rank correlation: r_s = 0.030, n = 27, p = 0.832; Figure 3) or transect section (Spearman's rank correlation: r_s = 0.036, n = 99, p = 0.726; Figure 4) level.

Table 3: Numbers of adult male southern damselflies recorded on transects.

Site name	Transect length (m)	Total number of male southern damselfly	Damselflies per 10 m^2	Damselflies per 100 m of transect	Weather/date/time criteria met	Date recorded
Acres Down	336	39	0.12	11.61	yes	05 July 2013
Bagshot Moor	358	26	0.04	7.26	yes	29 June 2013
Bull Hill	431	10	0.02	2.32	yes	08 July 2013
Clayhill Bottom	183	55	0.27	30.05	yes	16 July 2013
					yes	18 July 2013
Common Moor	67	23	0.77	34.33	yes	04 July 2013
Crockford Stream (Lower)	837	223	0.27	26.64	yes	01 July 2013
Crockford Stream (Upper)	2086	644	0.15	30.87	yes	08 July 2013
Dibden Bottom	225	0	0.00	0.00	yes	18 July 2013
Duckhole Bog	140	2	0.01	1.43	yes	16 July 2013
Foulford	266	1	<0.01	0.38	yes	11 July 2013
Hatchet Stream	735	60	0.05	8.16	yes	29 June 2013
Howen Bottom	250	0	N/A	0.00	no - temperature and sunshine	21 June 2013
Latchmore	964	248	0.16	25.73	yes	07 July 2013
Mill Lawn	3749	429	0.12	11.44	yes	04 July 2013
					no - time	04 July 2013
					yes	05 July 2013
					yes	08 July 2013
					yes	09 July 2013
					no - time	09 July 2013
					yes	17 July 2013
Millersford Bottom	924	169	0.13	18.29	yes	06 July 2013
Round Hill	797	138	0.15	17.31	yes	09 July 2013
Shipton Bottom	1968	876	0.21	44.51	yes	17 July 2013
Shobley	533	73	0.1	13.70	yes	18 July 2013
Stag Brake	169	14	0.03	8.28	yes	16 July 2013
Stony Moors	408	77	0.12	18.87	yes	16 July 2013
Three Beech Bottom	624	41	0.07	6.57	no - date	22 July 2013
Widden Bottom	368	53	0.15	14.40	no - time	16 July 2013

Surveys were conducted within the recommended time of day at all but two (90.1%) of the 22 sites (Table 3), and for the majority (97.0%) of transect sections (Appendix 3). Weather conditions criteria were fully met for all 22 sites with the exception on Howen Bottom (Table 3). Therefore, all criteria were met at 18 (81.2%) of the 22 sites assessed; in comparison only five (23.8%) of the 21 sites assessed during the 2004 surveys met all criteria, a consequence of the poor weather conditions experienced during the flight period.

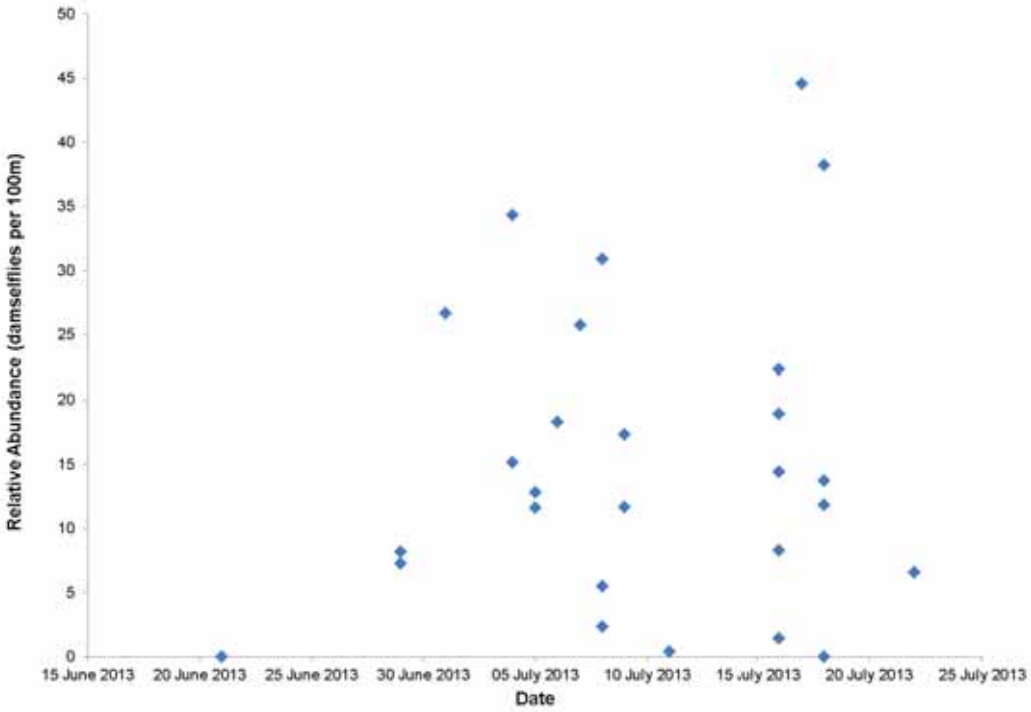


Figure 3: Relationship between relative abundance of adult male damselflies and date of survey at site level.

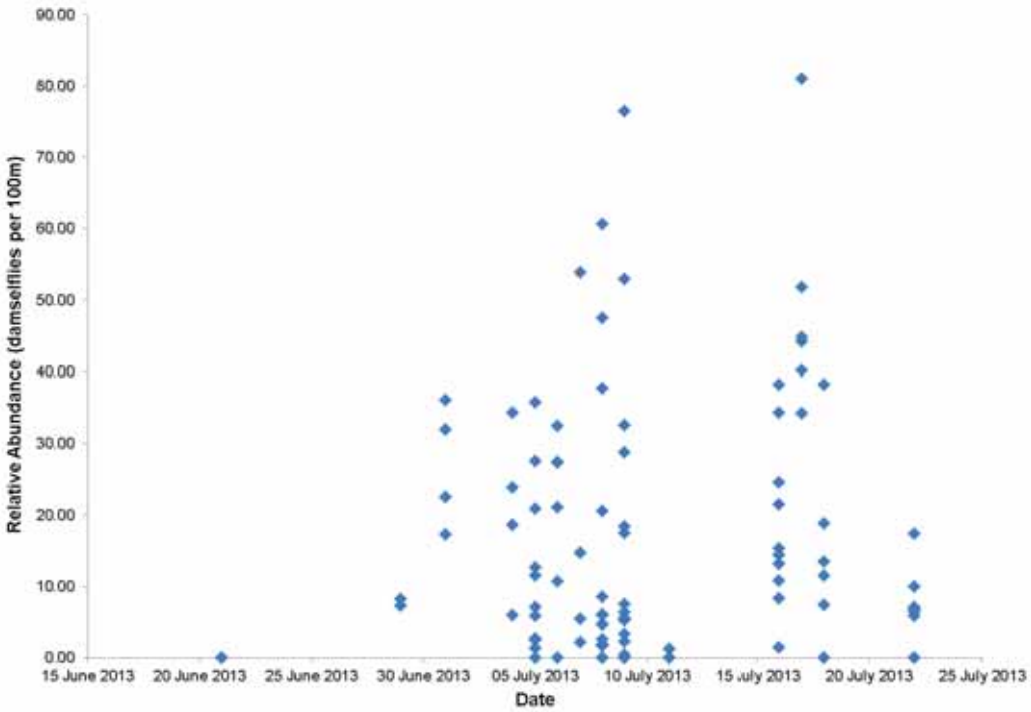


Figure 4: Relationship between relative abundance of adult male damselflies and date of survey at transect section level.

Total number, density (damselflies per $10m^2$) and relative abundance of southern damselflies recorded at each site are shown in Table 3. Figures given for site area and transect length are calculated from the GIS mapping (see sections 3.1 and 4.1). Weather and time data are shown in Appendix 3.

In addition to formal transect counts, the presence and abundance of observed adult male southern damselfly was recorded during the habitat attribute surveys. A cautionary subjective assessment of population strength for each site is provided in sections 6.1-6.23, and is based on the criteria used by Thurner and Stevens (1999):

- Not assessed = no individuals counted
- Weak = 1 to 29 individuals counted
- Medium = 30 to 99 individuals counted
- Strong = 100 or more individuals counted

There was a highly significant positive correlation between the total number of adult male damselflies recorded during formal and informal counts at both the site (Pearson's correlation: $r = 0.822$, $n = 22$, $p < 0.001$; Figure 5) and transect section (Pearson's correlation: $r = 0.721$, $n = 99$, $p < 0.001$; Figure 6) level.

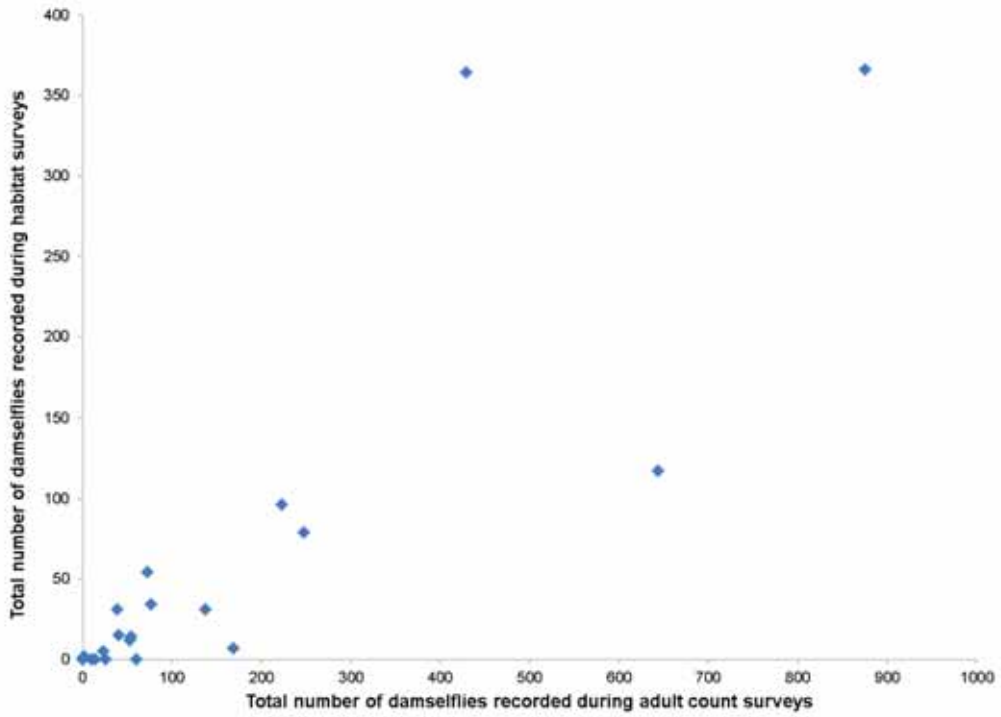


Figure 5: Relationship between relative abundance of adult damselflies recorded during adult count and habitat attribute surveys at the site level.

It must be emphasised that to increase the likelihood of gaining robust monitoring data for adult male damselflies, formal adult count surveys were given preference on days forecast to provide favourable weather condition within the main flight period (as outlined in section 3.3). As a consequence, the informal presence and abundance assessments (performed in association with the habitat sampling) met the required criteria for time, date and weather at only a limited number of transect sections. The strongly significant correlation recorded is therefore of particular note.

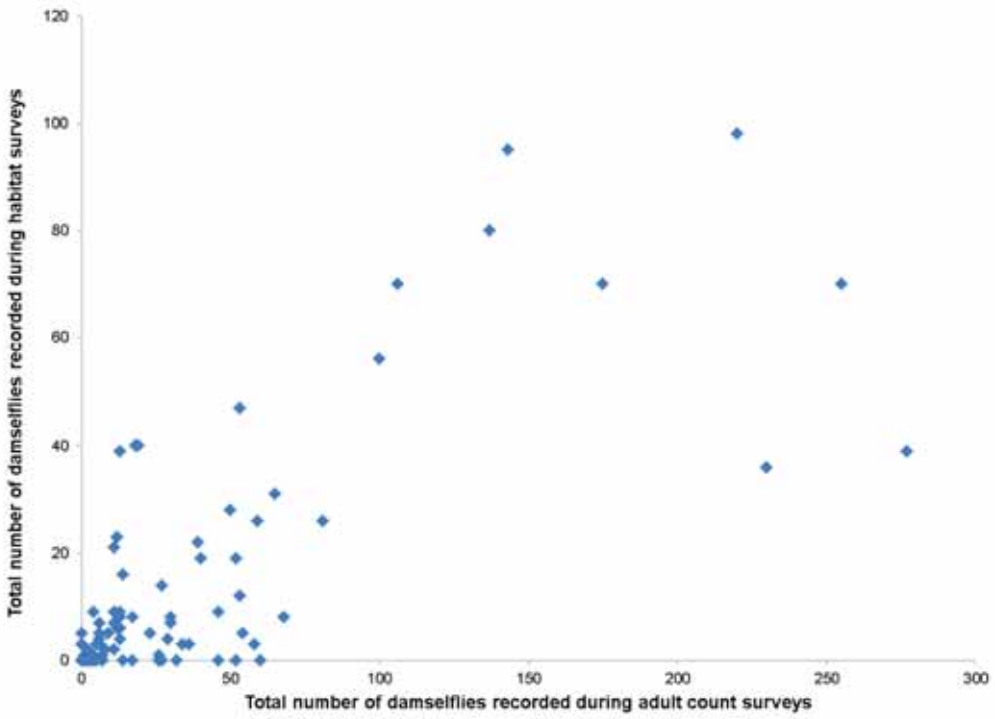


Figure 6: Relationship between relative abundance of adult damselflies recorded during adult count and habitat attribute surveys at the transect section level.

5. Interpretation of data for site condition assessment

The condition assessment process has two stages: the objective collection of quantitative and qualitative data on attributes selected to provide information on the condition of the habitat; and the rather more subjective judgement as to what limits the attribute measurements must fall between for the site to be classed as being in Favourable condition. Sections 5.1 and 5.3 discuss the attributes recorded, and sections 5.2, 5.4 and 5.5 show how the data was interpreted to inform the site condition assessment given in section 6.

This project builds upon the work conducted by Harvey *et al*. (2005) and Daguet (2006), both of whom proposed favourable thresholds for southern damselfly habitats: the former exclusively for the heathland sites of the New Forest in Hampshire, the latter for sites where southern damselfly are an interest feature of SACs and SSSIs in England.

5.1. Habitat attributes used

The project brief asked for a number of habitat attributes to be measured, based on those assessed during the original 2004 surveys, and incorporating the recommendations included within Harvey *et al*. (2005). In addition, assessment criteria and recommendations set out in Daguet (2006) were incorporated where appropriate.

Table 4 summarises habitat attributes used and the rationale for their relevance to condition assessment based on Thompson *et al*. (2003b), incorporating the recommendations presented in Harvey *et al*. (2005) and Daguet (2006) as outlined above. It can be seen that there is a good match between the majority of attributes recorded in the present assessment, and those identified as 'key attributes' by these authors.

Table 4: Notes on habitat features measured.

Attribute recorded in present study	Field recording experience	Assumed relevance to condition assessment
Water flow	Flowing water was used as an attribute for selecting transects through suitable habitat, and the majority of samples did therefore have flowing water. However, this resulted in some discrepancies between transects routes surveyed during this and the original survey work undertaken in 2004. Particular care was taken by all surveyors when determining between "open water, no visible flow" and barely discernible "open flowing water", following concerns raised by Daguet (2006) regarding possible discrepancies between surveyors in making this distinction.	Year-round flow of water is considered an essential attribute (matches key attribute 1 in Thompson *et al*. [2003b]).
% cover of emergent broad-leaved herbs	As outlined in Harvey *et al*. (2005) and Daguet (2006), values recorded included suitable plants in damp / drier areas as presence could indicate potential suitable habitat if levels rose again.	Clearly important as an indication of suitable oviposition sites (matches key attribute 2 in Thompson *et al*. [2003b]).
% cover of submerged vegetation	Females were observed ovipositing in association with submerged broad-leaved / herbaceous vegetation at a small number of sites. However, as outlined in Harvey *et al*. (2005), submerged vegetation was rarely recorded in the mires, where the water table was not deep enough for submerged vegetation. Furthermore, where observed in mires and within some narrow runnels, this feature general comprised submerged grasses and rushes, which are considered unsuitable for ovipositing (Rouquette, 2005).	Indicates suitable oviposition microhabitat (partly matches key attribute 2 in Thompson *et al*. [2003b]).

Attribute recorded in present study	**Field recording experience**	**Assumed relevance to condition assessment**
% of channel / sample area in shade	To remain consistent with the original study (Harvey *et al*., 2005), only shade from trees or scrub where overhanging the habitat was recorded. This may have led to an underestimate of shade values, but reflects the potential that direct sunlight may be received for at least part of the day. On linear transects, scrub and bog myrtle over-hanging from the bank top was the main cause of shade; within mire habitats, raised dry tussocks supporting heather *Calluna vulgaris,* cross-leaved heath *Erica tetralix* and bog myrtle was the main cause of shade over the 'wetted area'.	Clearly important as a negative indicator, too much shade would prevent the warm conditions required by larvae (partly matches key habitat attributes 3 & 6 in Thompson *et al.* [2003b]).
% cover of bog myrtle	Bog myrtle within the water was present at many but not all sites. It was considered that though an assessment of structural variety and patchiness may be more informative, determining an appropriate way of quantifying this that would be consistently applied by different surveyors would be problematic. It was therefore determined that a measure of percentage cover does provide valuable assessment of habitat structure and remained the most appropriate measure to use.	Forms an important part of habitat structure on many (but not all) sites, though it remains unclear how this should be quantified for analysis (partly matches key habitat attribute 3 in Thompson *et al*. [2003b]).
Presence of bracken	Bracken within 2m of the habitat was rarely recorded. In the majority of cases where it was present, it did reflect a drying up of the habitat. Where over-hanging the channel / sample area, bracken was also included in the value for percentage cover of shade.	Added to original methodology in the assumption that bracken is a negative indicator, both through its potential to cast shade, and the possibility that its presence suggests that the habitat is getting drier.
Presence of eutrophication	Only green algae was included within the assessment, though it was occasionally found associated with brown, flocculent algae. Only recorded at few sites, but often locally common and easily detected. Generally associated with areas of high livestock access and / or footfall.	A negative indicator, high levels of algal cover indicate unsuitable conditions (i.e. eutrophic rather than dystrophic or mesotrophic; matches key habitat attribute 4 in Thompson *et al*. [2003b]).
Bankside vegetation structure	The categories recommended by Harvey *et al*. (2005) and Daguet (2006) generally provided a valuable qualitative assessment of the suitability of adjacent habitat for adult damselflies at most sample points. This was particularly valuable where there was a consistency in habitat structure within the area assessed. However, difficulties arose in defining bankside vegetation structure where two distinct types were recorded within the same sample point (i.e. tightly cropped grasses interspersed with localised stands of dense scrub or bracken).	Very high (too shady) or very low (too exposed) bankside cover would be detrimental to adult damselfly (partly matches key habitat 3 in Thompson *et al*. [2003b]).
Relative abundance of stiff emergent vegetation	The categories recommended by Harvey *et al*. (2005) and Daguet (2006) generally provided a valuable qualitative assessment of the availability of sites for damselfly emergence. Assessment was based on distribution as well as number of stems, with a moderate numbers of stems, highly localised within a small number of patches, recorded as scarce rather than frequent.	Indicates suitable sites for damselfly emergence (matches key attribute 2 in Thompson *et al*. [2003b]).
Substrate composition: % cover of each of boulders; pebbles; gravel; sand; silt / mud / peat	Assessment was more difficult in channels covered by dense scrub and / or bog myrtle, but it remained possible to assess the relative % cover of each of the substrate categories.	Some cover of silt / mud / peat is beneficial for the damselfly; cover of other categories is an indicator for lack of organic substrate (matches key habitat attribute 5 in Thompson *et al*., [2003b]).

Following the completion of the habitat attribute surveys, concerns were raised regarding the inclusion of submerged vegetation within the assessment of the availability of plants for oviposition (as outlined in Table 4). Specifically, submerged vegetation was predominantly comprised of submerged grasses and other fine-leaved vegetation, which are rarely utilised by southern damselfly for oviposition (Rouquette, 2005). Furthermore, Daguet (2006) raised concerns regarding the relevance of this attribute at New Forest sites, and Rouquette (2005) found evidence that southern damselfly larva avoid areas of dense submerged vegetation in chalkstreams. As a consequence, this attribute was removed from the habitat attribute analysis detailed below.

Based on the recommendations of Harvey *et al*. (2005), the presence or absence of grazing was removed from the list of habitat attributes measured at each sample point. This reflects the extensive nature of grazing that is characteristic of much of the New Forest. However, the presence and intensity of grazing is important in determining the suitability of habitats at a given site for southern damselfly; light grazing is considered to be beneficial in maintaining a suitable sward structure, and heavy grazing potentially damaging as it will reduce the sward height leaving adult damselflies more exposed (Purse, 2002; Thompson *et al*., 2003a; Rouquette, 2005). It was considered that at each sample point, this would be reflected by the measurements of bankside vegetation structure. Instead the presence / absence of evidence for grazing and its relative intensity was qualitatively assessed per 100m of transect / transect section, and used in the final assessment of Favourable or Unfavourable condition for each site and transect section.

Additional notes where recorded for each 100m length of transect / transect section on the following, which were used to inform the overall Favourable Condition assessment of the site:

- hydrology of the site;
- vegetation structure across the wider site and any evidence of succession;
- vegetation structure of the adjoining habitat and the opportunity for southern damselfly expansion from the site.

The presence of flowing water across the majority of the site was considered to be a key habitat attribute for determining the 'condition' of individual sites. The amount of channel in shade, and to a lesser extent the quality of bank-side structure, also provided a good indication of the condition of sites.

The other attributes provided useful additional information about the sites, but there was no clear associations between these and site condition (i.e. sites considered to be in Favourable condition did not necessarily pass on these attributes, and vice versa). However, as identified by Harvey *et al*. (2005) and Daguet (2006), it is difficult to judge from a single monitoring event which of these attributes might be most important for indicating habitat change.

Recommendations are provided in section 7 for proposed changes to attributes for future recording.

5.2. Habitat attributes limits for Favourable Condition assessment

The database used allows the sampled sites to be tested against proposed limits for the recorded attributes. These analyses can be re-run for a variety of different limits in order to establish a set of limits that best reflects the suitability of the sites for the southern damselfly.

Initially attribute limits (Table 5) were set to match as closely as possible those used during the analysis of the original database by Harvey *et al*. (2005), incorporating where relevant recommended additional attributes (highlighted in blue) included in section 7 of that report and the study by Daguet (2006). These limits produced some anomalies and, after some experimentation with different thresholds, a second set of limits was used to inform the final site and transect section condition assessments given in section 6. The revised limits are highlighted in red in Table 6.

Tables 5 and 6 are arranged with those habitat attributes considered to provide the 'best' information on site condition first, as judged by Harvey *et al*. (2005) and the authors of this study respectively.

Table 5: Suggested habitat attribute limits to indicate Favourable condition, following Harvey *et al*. (2005) and Daguet (2006).

Extent for attribute (i.e. % of sample points that must fall within limits to achieve Favourable condition)	Limits for attribute	Reason for change
At least 80% of samples within limits for channel shaded	% channel shaded: 0%-40%	n/a
At least 33% of samples within limits for oviposition plants	Emergent broad-leaved herb cover: 10-80% and / or submerged vegetation cover: 10-80%	n/a
At least 50% of samples (include both left and right banks for linear sample points) within limits for **bankside vegetation structure**	**Bankside vegetation structure = mixed good (MG)**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)
At least 25% of samples within limits for bog myrtle	Cover: 10%-80%	n/a
At least 75% within limits for bracken	Bracken not present	n/a
At least 33% of samples within limits for the **relative abundance of stiff emergent vegetation**	**Stiff emergent vegetation = frequent**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)
At least 33% of samples within limits for silt/mud/peat substrate	% silt/mud/peat: 25%-100%	n/a
At least **80%** of samples within limits for **eutrophication**	**Eutrophication not present**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)
At least **80%** of samples within limits for **water flow**	**Open flowing water**	Attribute extent and limits as set out in Daguet (2006)

Table 6: Suggested habitat attribute limits to indicate Favourable condition as used for the site assessments.

Extent for attribute (i.e. % of sample points that must fall within limits to achieve Favourable condition)	Limits for attribute	Reason for change
At least **80%** of samples within limits for **water flow**	**Open flowing water**	Attribute extent and limits as set out in Daguet (2006)
At least 80% of samples within limits for channel shaded	% channel shaded: 0%-40%	n/a
At least 50% of samples (include both left and right banks for linear sample points) within limits for **bankside vegetation structure**	**Bankside vegetation structure = mixed good (MG)**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)
At least 33% of emergent broad-leaved herb samples within limits for oviposition plants	Emergent broad-leaved herb cover: **20**-80%	Removal of submerged vegetation cover from analysis based on field observations and recommendations made in Daguet (2006); lower limit raised in line for oviposition plants set by Thompson *et al*. (2003b) – see section 5.5.1 for rationale
At least 25% of samples within limits for bog myrtle	Cover: 10-**60**%	Upper limit reduced as 80% upper limit considered to constitute too much shading over watercourse; new upper limit set in line with Thompson *et al.* (2003b)
At least 75% within limits for bracken	Bracken not present	n/a
At least 33% of samples within limits for the **relative abundance of stiff emergent vegetation**	**Stiff emergent vegetation = frequent**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)

Extent for attribute (i.e. % of sample points that must fall within limits to achieve Favourable condition)	**Limits for attribute**	**Reason for change**
At least 33% of samples within limits for silt/mud/peat substrate	% silt/mud/peat: 25%-100%	n/a
At least **80%** of samples within limits for **eutrophication**	**Eutrophication not present**	Revision of attribute limit required as a consequence of recommended changes in methodology included in Harvey *et al*. (2005) and Daguet (2006)

5.3. Species attributes used

The remaining attribute that was formally recorded was adult male abundance on each transect section. Despite the limitations in basing a vigorous site assessment on population estimates gained from a single visit, error was minimised by imposing limits on weather conditions and sampling time and date (see section 3.3), with all criteria met at most sites (81.2%) and transect sections (85.9%) (see section 4.3). This reflects a period of fine weather during July 2013. This data was supplemented by field surveyors recording the numbers of southern damselfly observed during the habitat attribute surveys.

It is therefore considered that the adult count surveys provide an indicative relative estimate of abundance for comparing one site with another. These indicative values, with reference to the subjective appraisal of abundance conducted during the habitat attribute surveys where appropriate, were used to inform the site assessments in section 6.

5.4. Species attributes limits

Comparative measures of adult male damselfly density (per $10m^2$) and abundance (per 100m) were provided for each site by Harvey *et al*. (2005), and have been calculated for the present study (see Table 3 in section 4.3). However, the former has been excluded from any further analysis in this study, as a different method of habitat mapping focusing exclusively on oviposition habitat was employed.

Comparisons made between sites and / or transect sections based on a single count do not allow robust assessments of sites (Harvey *et al*., 2005; Dauget, 2006). However, it is suggested that comparative measures of adult damselfly abundance per 100m (calculated under suitable conditions) could be used to indicate transect section and site favourability. These should only be considered in association with formal habitat assessments, as a correlation between habitat attribute pass rates and damselfly abundance was only recorded at the transect section level (see section 5.5.2), and relatively high abundances of damselflies were recorded at a number of sites considered to be in Unfavourable condition (see section 6).

A value of 10 damselflies per 100m was cautiously proposed as a possible lower limit for favourable condition if sampling took place in optimal weather conditions (Harvey *et al*., 2005), with the caveat that more transect counts were required before suitable limits can be confidently proposed (Harvey *et al*., 2005), perhaps tailored to individual sites as suggested by Thompson *et al*. (2003b). Interestingly, a study by Buchwald *et al*. (1989 cited by Rouquette, 2005) in Germany, considered populations with a density of less than 10 per 100m to be endangered, and less than 20 individuals per 100m to be threatened. However, based on a five year dataset from the Crockford Stream and collected and summarised by Jenkins (1991), Thompson *et al*. (2003b) calculated values of 30-100 per 100m across four sub-sections of this site. The authors suggest that, due to the prolific nature of this site, “actual population targets for other sites still in favourable condition will be considerably lower than those described here”.

The surveys conducted during this study were predominantly undertaken during favourable conditions, and therefore provide valuable information with regards to southern damselfly abundances in New Forest populations. It was noted that the upper quartile range for abundance was between 25.73–44.51 and 25.91–81.00 damselflies per 100m at the site and

transect section level respectively. As the majority of sites surveyed were considered to be in Unfavourable condition, this supports the suggestions that a value of 10 damselflies per 100m could be considered to be an underestimate of the lower limit for favourable condition. However, for the reasons outlined below (see section 5.5.1), there still remains insufficient data to set a robust mean value of damselflies per 100m at either site level, or for the New Forest as a whole.

As set out in Harvey *et al*. (2005) and Daguet (2006), if the condition of the SAC is to only be formally assessed once every six years, a numerical limit is not considered appropriate, as sampling once every six years is not sufficient to monitor change in an invertebrate population. It is agreed that from the time, resources and knowledge available for this current study, noting the presence of southern damselfly on site, with a subjective assessment of population strength (undertaken during suitable date and weather conditions), is all the condition assessment can robustly be based upon. The collection of sufficient information on population strengths / comparative abundances (that could be used in future rounds of condition assessment) may be better achieved through the involvement of local volunteers, as discussed in section 8.3.

5.5. Assessment based on habitat attribute limits

Using the limits set out in section 5.2 a database query was set up to show which transect sections and sites pass or fail against the various attribute criteria. These data were used to inform the final site condition assessments given in section 6.

5.5.1. Site assessments

The percentage pass rate for each site is shown in Table 7, with the numbers of damselflies per 100m of each transect provided for comparison. The attribute columns are ordered with those considered most important for the selection of favourable condition given first.

There was no significant correlation between relative abundance of damselflies and site pass rate (Spearman's rank correlation: $r_s = 0.353$, $n = 22$, $p = 0.070$). However, these results are based on combining all samples into one overall site assessment, and a more detailed assessment can be made by looking at each transect section within the sites (see section 5.5.2).

Possible explanations for the inconsistencies between damselfly abundance and habitat attribute passes could be that the attributes chosen are not clear enough indicators of habitat quality or that pass / fail limits are not set at the correct levels.

A further possible explanation is that habitat attribute passes reflects the quality of the site for the range of life stages (egg, larva, and adult) of this species, whereas the counts reflect adult abundance only. Detailed studies by Purse (2002) and Rouquette (2005) identified that southern damselfly larvae prefer habitat attributes associated with a slightly later successional stage than adults. Therefore discrepancies could occur where sites with high densities of adults are failing on features important for larvae or egg laying; if good egg laying opportunities were present two years previously, and there is an availability of stiff emergent vegetation for the final instar larvae to exit the water, a high density of adults may be recorded despite failure of those habitat attributes representing favourable condition for oviposition or larval quality (i.e. water flow and substrate). This could explain the situation recorded at Acres Down in 2004, where good numbers of adult damselflies were recorded despite the low percentage cover of plants for oviposition (Harvey *et al*., 2005). Furthermore, the return of low adult counts at sites that pass on all / the most important habitat attributes may reflect poor weather or site conditions two years previously, due to the semi-voltine development of this species in Britain.

Alternatively, it may simply be that damselfly abundance and densities can fluctuate widely even on sites with good habitat quality.

Table 7: Pass rate for each site against habitat attribute limits, compared to adult damselfly relative abundance.

Site	Weather/date criteria met	Damselflies per 100m of transect	Transect length (m)	Site pass rate (%)	Flow	Channel shaded	Bankside vegetation structure	Oviposition plants	Bog myrtle	Bracken	Stiff emergent vegetation	Silt/ mud/ peat	Eutrophication
Acres Down	yes	11.61	336	**66.67**	fail	pass	pass	fail	pass	fail	pass	pass	pass
Bagshot Moor	yes	7.26	358	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Bull Hill	yes	2.32	431	**77.78**	pass	pass	pass	pass	fail	pass	fail	pass	pass
Clayhill Bottom	yes yes	30.05	183	**77.78**	pass	pass	pass	pass	pass	pass	pass	fail	fail
Common Moor	yes	34.33	67	**77.78**	fail	pass	pass	fail	pass	pass	pass	pass	pass
Crockford Stream (Lower)	yes	26.64	837	**77.78**	pass	fail	pass	pass	pass	pass	fail	pass	pass
Crockford Stream (Upper)	yes	30.87	2086	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Dibden Bottom	yes	0.00	225	**55.56**	fail	fail	fail	fail	pass	pass	pass	pass	pass
Duckhole Bog	yes	1.43	140	**77.78**	fail	pass	pass	pass	pass	pass	pass	pass	fail
Foulford	yes	0.38	266	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Hatchet Stream	yes	8.16	735	**77.78**	pass	pass	pass	fail	fail	pass	pass	pass	pass
Howen Bottom	no	0.00	250	**66.67**	fail	pass	fail	pass	fail	pass	pass	pass	pass
Latchmore	yes	25.73	964	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Mill Lawn	yes/no	11.44	3749	**77.78**	fail	pass	pass	pass	fail	pass	pass	pass	pass
Millersford Bottom	yes	18.29	924	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Round Hill	yes	17.31	797	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Shipton Bottom	yes	44.51	1968	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Shobley	yes	13.7	533	**88.89**	pass	pass	pass	pass	pass	fail	pass	pass	pass
Stag Brake	yes	8.28	169	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Stony Moors	yes	18.87	408	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Three Beech Bottom	no	6.57	624	**77.78**	fail	pass	pass	pass	pass	pass	pass	pass	fail
Widden Bottom	no	14.4	368	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass

5.5.2. Transect section assessments

Table 8 presents the same data as the previous table, but is separated into the individual transect sections within each site. There was a significant positive correlation (Spearman's rank correlation: r_s = 0.243, n = 99, p = 0.015) between abundances of damselflies and transect section pass rates (Figure 7).

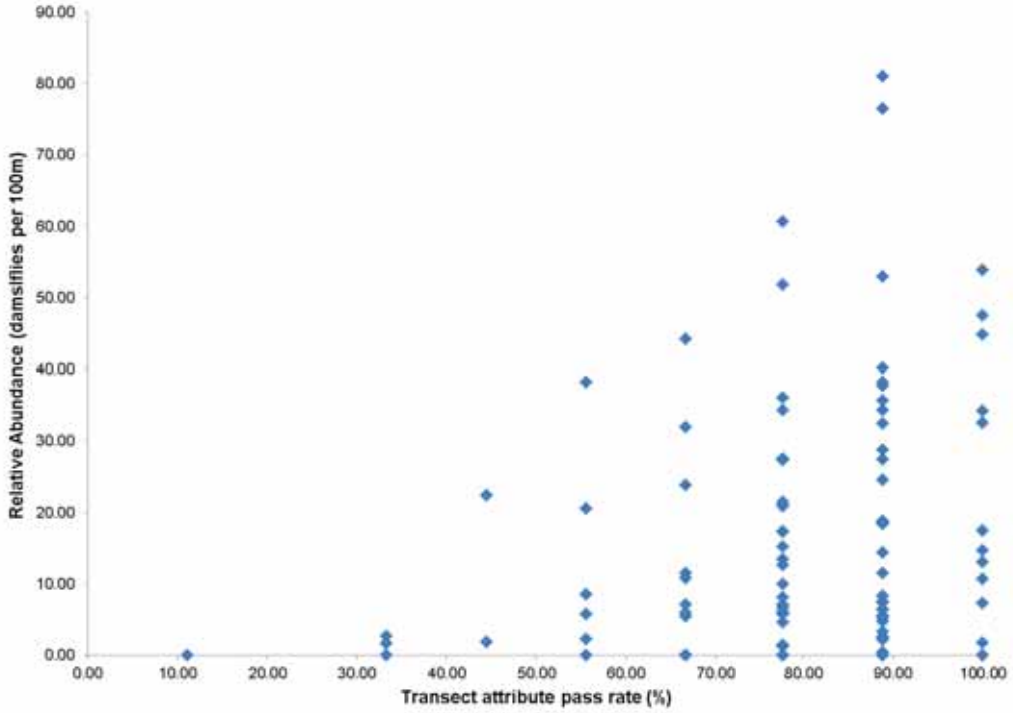


Figure 7: Relationship between attribute pass rate and the relative abundance of adult male southern damselflies at the transect section level.

Despite the significant positive correlation between damselfly abundance and habitat attribute pass rate (at the transect section level), there remains considerable variation in the habitat pass rate between transect sections within a number of the sites, and previous studies have questioned how many of the sub-sites need to pass the assessment criteria for the whole site to be considered favourable. For example, Round Hill has a 100% pass rate at the site level, but its individual transect sections vary from a pass rate of 33.33%-100%, a consequence of those transect sections failing on a variety of habitat attributes, and is / was assessed as being in Unfavourable condition in this and the original study (Harvey *et al*., 2005). Furthermore, Foulford has a 100% pass rate when the data is collated at the site level, but the three individual transects pass only 77.78% of the habitat attributes, with the two shorter transects both failing on a key attribute (too much shading).

As transect sections are not uniform in length, it is not considered appropriate to simply base the Favourable Condition assessment on the relative number or percentage of transect sections that pass on all / key habitat attributes, as shorter transect sections would be over-represented and vice-versa. An alternative method (to site pass rate) of assessing the overall condition of the site, would be to sum the individual section pass rates weighted by their relative contribution to the length of habitat surveyed so that:

Overall section pass rate (%) = (SP_{n1} × (SL_{n1} ÷ TL)) + (SP_{n2} × (SL_{n2} ÷ TL)) + (SP_{n3} × (SL_{n3} ÷ TL))…

Where *nx* represents each individual transect section, *SP* = the section pass rate, *SL* the section length and *TL* represents the total length of all transect sections surveyed at the site. A comparison of site pass rates and overall section pass rate is provided in Table 9.

Table 8: Pass rate for each transect section against habitat attribute limits, compared to adult damselfly relative abundance.

Site and transect section	Weather/ date/ time criteria met	Damselflies per 100m of transect	Transect section length (m)	Section pass rate (%)	Flow	Channel shaded	Bankside vegetation structure	Oviposition plants	Bog myrtle	Bracken	Stiff emergent vegetation	Silt/ mud/ peat	Eutrophication
Acres Down 1.1	yes	1.32	76	**77.78**	fail	pass	pass	fail	pass	pass	pass	pass	pass
Acres Down 1.2	yes	27.55	98	**77.78**	pass	pass	pass	fail	pass	fail	pass	pass	pass
Acres Down 1.3	yes	11.54	52	**88.89**	pass	pass	pass	fail	pass	pass	pass	pass	pass
Acres Down 1.4	yes	5.80	69	**55.56**	fail	fail	pass	fail	pass	fail	pass	pass	pass
Acres Down 1.5	yes	2.44	41	**88.89**	pass	pass	pass	fail	pass	pass	pass	pass	pass
Bagshot Moor 1.1	yes	7.26	358	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Bull Hill 1.1	yes	2.52	159	**88.89**	pass	pass	pass	pass	pass	pass	fail	pass	pass
Bull Hill 1.2	yes	1.89	106	**44.44**	pass	fail	fail	pass	fail	fail	fail	pass	pass
Bull Hill 1.3	yes	0.00	42	**88.89**	pass	pass	pass	pass	pass	pass	fail	pass	pass
Bull Hill 1.4	yes	1.67	60	**33.33**	pass	fail	fail	fail	fail	fail	fail	pass	pass
Bull Hill 1.5	yes	4.69	64	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Clayhill Bottom 1.1	yes	15.25	59	**77.78**	pass	fail	pass	pass	pass	pass	pass	fail	pass
Clayhill Bottom 1.2	yes	34.29	35	**88.89**	pass	pass	pass	pass	pass	pass	pass	fail	pass
Clayhill Bottom 1.3	yes	38.20	89	**55.56**	pass	pass	pass	fail	fail	pass	pass	fail	fail
Common Moor 1.1	yes	34.33	67	**77.78**	fail	pass	pass	fail	pass	pass	pass	pass	pass
Crockford Stream (Lower) 1.1	yes	17.31	312	**77.78**	pass	fail	pass	pass	pass	pass	fail	pass	pass
Crockford Stream (Lower) 1.2	yes	36.11	144	**77.78**	pass	fail	pass	pass	pass	pass	fail	pass	pass
Crockford Stream (Lower) 1.3	yes	31.93	332	**66.67**	pass	fail	pass	fail	pass	pass	fail	pass	pass
Crockford Stream (Lower) 1.4	yes	22.45	49	**44.44**	pass	pass	fail	fail	pass	fail	fail	pass	fail
Crockford Stream (Upper) 1.1	yes	20.54	224	**55.56**	pass	fail	fail	fail	pass	pass	fail	pass	pass
Crockford Stream (Upper) 1.2	yes	60.61	457	**77.78**	pass	pass	pass	fail	pass	pass	fail	pass	pass
Crockford Stream (Upper) 1.3	yes	37.68	138	**88.89**	pass	pass	pass	fail	pass	pass	pass	pass	pass

Site and transect section	Weather/ date/ time criteria met	Damselflies per 100m of transect	Transect section length (m)	Section pass rate (%)	Flow	Channel shaded	Bankside vegetation structure	Oviposition plants	Bog myrtle	Bracken	Stiff emergent vegetation	Silt/ mud/ peat	Eutrophication
Crockford Stream (Upper) 1.4	yes	47.49	537	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Crockford Stream (Upper) 1.5	yes	8.51	94	**55.56**	pass	pass	pass	fail	fail	pass	fail	pass	fail
Crockford Stream (Upper) 1.6	yes	1.70	352	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Crockford Stream (Upper) 1.7	yes	0.00	284	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Dibden Bottom 1.1	yes	0.00	225	**55.56**	fail	fail	fail	fail	pass	pass	pass	pass	pass
Duckhole Bog 1.1	yes	1.43	140	**77.78**	fail	pass	pass	pass	pass	pass	pass	pass	fail
Foulford 1.1	yes	0.00	60	**77.78**	pass	fail	pass	fail	pass	pass	pass	pass	pass
Foulford 1.2	yes	0.00	123	**77.78**	fail	pass	pass	pass	fail	pass	pass	pass	pass
Foulford 1.3	yes	1.20	83	**77.78**	pass	fail	pass	pass	pass	fail	pass	pass	pass
Hatchet Stream 1.1	yes	8.16	735	**77.78**	pass	pass	pass	fail	fail	pass	pass	pass	pass
Howen Bottom 1.1	no	0.00	75	**66.67**	pass	pass	fail	fail	fail	pass	pass	pass	pass
Howen Bottom 1.2	no	0.00	87	**77.78**	pass	pass	fail	pass	fail	pass	pass	pass	pass
Howen Bottom 1.3	no	0.00	88	**77.78**	fail	pass	pass	pass	fail	pass	pass	pass	pass
Latchmore 1.1	yes	2.17	138	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Latchmore 1.2	yes	14.66	464	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Latchmore 1.3	yes	53.85	325	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Latchmore 1.4	yes	5.41	37	**66.67**	pass	pass	fail	pass	fail	fail	pass	pass	pass
Mill Lawn 1.1	yes	11.52	165	**66.67**	fail	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 1.2	yes	7.11	422	**66.67**	fail	pass	pass	pass	fail	pass	pass	pass	fail
Mill Lawn 1.3	yes	2.68	112	**33.33**	fail	fail	fail	fail	fail	pass	fail	pass	pass
Mill Lawn 1.4	yes	35.71	140	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Mill Lawn 1.5	yes	20.87	254	**77.78**	pass	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 1.6	yes	4.64	237	**77.78**	fail	pass	pass	pass	fail	pass	pass	pass	pass
Mill Lawn 1.7	yes	5.91	203	**77.78**	pass	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 1.8	yes	6.07	214	**77.78**	pass	pass	fail	pass	fail	pass	pass	pass	pass

Site and transect section	Weather/ date/ time criteria met	Damselflies per 100m of transect	Transect section length (m)	Section pass rate (%)	Flow	Channel shaded	Bankside vegetation structure	Oviposition plants	Bog myrtle	Bracken	Stiff emergent vegetation	Silt/ mud/ peat	Eutrophication
Mill Lawn 1.9	no	5.94	219	**66.67**	fail	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 1.10	yes	18.63	161	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Mill Lawn 1.11	yes	23.81	168	**66.67**	fail	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 1.12	yes	12.68	142	**77.78**	pass	fail	pass	pass	fail	pass	pass	pass	pass
Mill Lawn 2.1	yes	0.00	136	**66.67**	fail	pass	fail	pass	fail	pass	pass	pass	pass
Mill Lawn 3.1	no	0.41	246	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Mill Lawn 3.2	yes	5.26	266	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Mill Lawn 3.3	yes	28.82	347	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Mill Lawn 4.1	yes	7.49	227	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Mill Lawn 4.2	yes	5.56	90	**88.89**	pass	fail	pass	pass	pass	pass	pass	pass	pass
Millersford Bottom 1.1	yes	21.01	276	**77.78**	pass	pass	pass	fail	fail	pass	pass	pass	pass
Millersford Bottom 1.2	yes	32.50	80	**88.89**	pass	fail	pass	pass	pass	pass	pass	pass	pass
Millersford Bottom 1.3	yes	27.42	62	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Millersford Bottom 1.4	yes	27.35	117	**77.78**	fail	fail	pass	pass	pass	pass	pass	pass	pass
Millersford Bottom 1.5	yes	10.71	336	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Millersford Bottom 1.6	yes	0.00	53	**11.11**	pass	fail	fail	fail	fail	fail	fail	fail	fail
Round Hill 1.1	yes	3.30	91	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Round Hill 1.2	yes	17.50	40	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Round Hill 1.3	yes	32.62	141	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Round Hill 1.4	yes	0.00	31	**66.67**	pass	fail	fail	pass	pass	fail	pass	pass	pass
Round Hill 2.1	yes	76.47	51	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Round Hill 2.2	yes	18.42	38	**88.89**	pass	pass	pass	pass	pass	fail	pass	pass	pass
Round Hill 2.3	yes	0.00	79	**33.33**	pass	fail	fail	fail	fail	fail	fail	pass	pass
Round Hill 2.4	yes	0.00	21	**66.67**	pass	fail	pass	pass	fail	pass	fail	pass	pass
Round Hill 3.1	yes	52.94	51	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Round Hill 3.2	yes	2.29	175	**55.56**	pass	pass	fail	pass	fail	fail	fail	pass	pass
Round Hill 3.3	yes	6.33	79	**88.89**	pass	pass	pass	pass	pass	fail	pass	pass	pass

Site and transect section	Weather/ date/ time criteria met	Damselflies per 100m of transect	Transect section length (m)	Section pass rate (%)	Flow	Channel shaded	Bankside vegetation structure	Oviposition plants	Bog myrtle	Bracken	Stiff emergent vegetation	Silt/ mud/ peat	Eutrophication
Shipton Bottom 1.1	yes	40.21	572	**88.89**	pass	fail	pass	pass	pass	pass	pass	pass	pass
Shipton Bottom 1.2	yes	34.21	418	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Shipton Bottom 1.3	yes	81.00	100	**88.89**	pass	fail	pass	pass	pass	pass	pass	pass	pass
Shipton Bottom 1.4	yes	44.22	147	**66.67**	pass	pass	pass	fail	fail	pass	pass	pass	fail
Shipton Bottom 1.5	yes	51.76	425	**77.78**	pass	fail	pass	fail	pass	pass	pass	pass	pass
Shipton Bottom 1.6	yes	44.77	306	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Shobley 1.1	yes	18.85	313	**88.89**	pass	pass	pass	pass	pass	fail	pass	pass	pass
Shobley 1.2	yes	0.00	104	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Shobley 1.3	yes	13.48	89	**77.78**	pass	pass	pass	fail	pass	fail	pass	pass	pass
Shobley 1.4	yes	7.41	27	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Stag Brake 1.1	yes	8.28	169	**88.89**	pass	pass	pass	pass	fail	pass	pass	pass	pass
Stony Moors 1.1	yes	13.10	84	**100.00**	pass	pass	pass	pass	pass	pass	pass	pass	pass
Stony Moors 1.2	yes	38.24	34	**88.89**	pass	fail	pass	pass	pass	pass	pass	pass	pass
Stony Moors 1.3	yes	24.53	53	**88.89**	pass	pass	pass	fail	pass	pass	pass	pass	pass
Stony Moors 1.4	yes	21.48	135	**77.78**	fail	pass	fail	pass	pass	pass	pass	pass	pass
Stony Moors 2.1	yes	10.78	102	**66.67**	fail	pass	pass	fail	pass	pass	fail	pass	pass
Three Beech Bottom 1.1	no	6.67	90	**77.78**	fail	pass	pass	pass	pass	pass	pass	pass	fail
Three Beech Bottom 1.2	no	0.00	104	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Three Beech Bottom 1.3	no	0.00	52	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass
Three Beech Bottom 1.4	no	6.45	93	**88.89**	pass	pass	pass	pass	pass	pass	pass	pass	fail
Three Beech Bottom 2.1	no	17.33	75	**77.78**	pass	pass	pass	fail	pass	pass	pass	pass	fail
Three Beech Bottom 2.2	no	10.00	70	**77.78**	pass	pass	pass	fail	pass	pass	pass	pass	fail
Three Beech Bottom 2.3	no	5.80	69	**77.78**	pass	pass	pass	fail	pass	pass	pass	pass	fail
Three Beech Bottom 2.4	no	7.04	71	**77.78**	pass	pass	pass	fail	pass	pass	pass	pass	fail
Widden Bottom 1.1	no	14.40	368	**88.89**	fail	pass	pass	pass	pass	pass	pass	pass	pass

Whilst using this formula provides similar levels of pass rates for most sites, and inherently will return identical values at sites of a single transect section, it does remove erroneous high pass rates, such that Round Hill and Foulford return values of 77.14% and 77.78 respectively. However, though this value may be more indicative of the condition of a site than the simple calculation of site pass rate, with five of the six sites assessed as in Favourable condition (see section 6.23) returning five of the top seven scores for this value, it is evident that it would still be inappropriate to set a threshold at which a site is considered to be in Favourable condition. Instead, it could be used as additional information in the subjective assessment of the condition of these sites.

Table 9: Comparison of habitat attribute pass rate and the overall section pass rate at each site.

Site	Site pass rate (%)	Overall section pass rate (%)	Damselflies per 100m of transect
Acres Down	66.67	76.29	11.61
Bagshot Moor	100.00	100.00	7.26
Bull Hill	77.78	70.22	2.32
Clayhill Bottom	77.78	69.10	30.05
Common Moor	77.78	77.78	34.33
Crockford Stream (Lower)	77.78	71.42	26.64
Crockford Stream (Upper)	100.00	87.62	30.87
Dibden Bottom	55.56	55.56	0.00
Duckhole Bog	77.78	77.78	1.43
Foulford	100.00	77.78	0.38
Hatchet Stream	77.78	77.78	8.16
Howen Bottom	66.67	74.44	0.00
Latchmore	100.00	97.13	25.73
Mill Lawn	77.78	77.54	11.44
Millersford Bottom	88.89	83.74	18.29
Round Hill	100.00	77.14	17.31
Shipton Bottom	100.00	88.92	44.51
Shobley	88.89	89.20	13.70
Stag Brake	88.89	88.89	8.28
Stony Moors	88.89	81.94	18.87
Three Beech Bottom	77.78	82.21	6.57
Widden Bottom	88.89	88.89	14.40

6. Site accounts and condition assessment

Each site is given an overall site condition assessment of Favourable or Unfavourable. Within the Unfavourable category, sites are tentatively sub-divided into two further categories, Unfavourable-recovering or Unfavourable, based on a comparison with the results of the original study (Harvey *et al*., 2005). The latter reflects the authors' judgement that, given the limited data available, sites that are in Unfavourable-declining condition cannot be distinguished from those in Unfavourable-no-change with real confidence.

The assessment of Favourable and Unfavourable condition are based on:

- the pass rates for the various attributes as shown in Table 8;
- the area and isolation of the site from neighbouring populations;
- whether there is potential for the area of suitable habitat to be expanded (i.e. if adjacent to an area of unsuitable potential habitat then the site is considered to be unfavourable);
- notes on the hydrology of the transects and wider site made by the field surveyor;
- the presence and subjective assessment of population strength of southern damselfly.

For sites that were considered to be in an Unfavourable condition, the assessment of Unfavourable-recovering and Unfavourable condition are based on:

- a direct comparison of habitat attribute data collected in 2004 (see Tables 7, 8 and Appendix 2 in Harvey *et al*., 2005), including pass / failure rates of transect sections on key habitat attributes;
- evidence of positive or negative management action at the site since the original surveys in 2004;
- a perceived strengthening / weakening of adjacent populations that may affect opportunities for immigration / emigration.

Of the 22 sites assessed, 6 were judged to be in Favourable condition, and 16 to be in Unfavourable condition. No sites were judged to be in Unfavourable-recovering condition. The total habitat area assessed was 22.74 hectares (ha), of which 12.25ha (53.9%) was Favourable and 10.49ha (46.1%) Unfavourable. This corresponds to a total of 16,418m surveyed, of which 6,280m (32.3%) was Favourable, and 10,138m (61.7%) Unfavourable.

An aerial photograph map is included at the beginning of each individual site condition assessment (set out in sections 6.1–6.22), showing the transect sections, habitat areas and site in the context of its surrounding habitat. Aerial photograph maps are shown at scale of 1:6,667, so that the map shows a width of 1km. For four sites the scale has been altered to include the whole site and / or show the site in the context of its wider habitat, these are as follows: Crockford Stream (Upper) and Shipton Bottom are 1.65km wide and at scale of 1:11,000, Mill Lawn Brook is 1.5km wide and at a scale of 1-10,000, and Millersford Bottom is 1.2km wide and at a scale of 1-8000. The following copyright statement applies to all aerial photos: Crown copyright and database right 2013 Ordnance Survey 100021242. Used by permission of the Forestry Commission.

Associated with each site condition assessment are recommendations outlining immediate and / or future management action that will enhance / restore habitats for the benefit of southern damselfly. These are provided to assist the person(s) / organisation(s) responsible for the management of these sites to achieve and / or maintain Favourable condition for this species, and secure the mechanisms for sustaining these populations for the foreseeable future. All site based recommendations should be read in conjunction with section 6.25.

These recommendations are deliberately focused on actions that would enhance the habitat at the site for southern damselfly. It is essential that other interest features of the New Forest SAC and associated SSSIs, protected species, and protected habitats are considered when determining the selection and delivery of works. Where possible, timing of the works should be scheduled to minimise the risk of negatively impacting the site and its associated flora and

fauna. The authors consider that these factors can be addressed through the application of due process.

6.1. Acres Down

Site condition: **UNFAVOURABLE**

Reasons: Site is small and isolated (nearest site is Mill Lawn, 6 km away); cover of oviposition plants is low, and extensive areas of bracken are developing and beginning to encroach runnels; potential to expand habitat to south-west.

Transects: All transect sections fail on oviposition plants (too few); transect sections 1.1 and 1.4 fail on water flow, 1.2 and 1.4 fail on bracken and 1.4 on shade also.

Damselflies: 11.61 per 100m (total seen: 39) during adult count transect surveys.

Medium population strength based on a subjective assessment during the habitat attributes survey.

Hydrology: Primarily small runnels with limited areas of associate mire; upper slope is dominated by damp or standing water conditions, with runnels becoming more defined and supporting a slow to moderate flow on the lower sections of the slope.

Other Notes:

6.1.1. Habitat management recommendations

Priority level 1 – Immediate / Urgent Management Action Required

Acres Down is a small and isolated site with little to no opportunity of immigration from other known populations within the New Forest. The development of dense areas of bracken (in

particular associated with the lower reaches of transect sections 1.2 and 1.4) and, to a lesser degree, bog myrtle across the wider site is of particular concern and immediate management is required to open up these areas.

The lack of (flowing) water within the upper reaches of a number of the runnels is of specific concern, though it is extremely difficult to assess whether this represents a deterioration of the site or is simply a natural consequence of its hydrology. Such a hydrological assessment is beyond the remit of this study, but it is considered likely that the most appropriate conclusion would be that the amount of permanent / perennial habitat available to southern damselfly is in fact smaller than originally assessed in 2004.

General Recommendations

It is understood that a species rich plant community is associated with the bracken stands at Acres Down (Chatters, personal communication), and that the complete clearance of bracken from this site would not be appropriate. It is therefore recommended that rotational cutting of the individual bracken stands, focusing on stands immediately associated with runnels, is undertaken bi-annually commencing this year. Furthermore, it is recommended that the density of bog myrtle across the wider site is managed by rotational clearance from set areas of the site, and should be co-ordinated with the bracken management for maximum efficiency and effectiveness. Due to its small size and associated vulnerabilities it is strongly recommended that burning is not used as a management technique at this site (Purse, 2002).

Specific Recommendations

It is recommended that a specific hydrological assessment of the site is undertaken to determine whether the cause(s) of the lack of flowing water within the upper reaches (of a number of the runnels) can be determined and rectified.

6.2. Bagshot Moor

Site condition:	**FAVOURABLE**
Reasons:	Site structure predominately good with long sections with well-developed emergent broad-leaved vegetation and moderate to slow flows throughout the majority of its length; the site is relatively small, but less than 1km from the Shipton Bottom / Crockford complex.
Transects:	Passes on all criteria.
Damselflies:	7.26 per 100m (total seen: 26) during adult count transect surveys. Population strength was *not assessed* based on a subjective assessment during the habitat attributes survey as no southern damselflies were recorded; it should be noted that the time criteria was not met during any of the habitat assessment.
Hydrology:	Stream with discernible flow; small adjoining mire noted in Harvey *et al*. (2005) only supported standing water at the time of survey and was not surveyed as part of this study.
Other Notes:	Southern half of the site contains the best habitat but is deteriorating due to the development of dense stands of bog myrtle and localised areas of dense willow *Salix* spp., gorse *Ulex europaeus*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* agg. scrub.

6.2.1. Habitat management recommendations

Priority level 2 – Management Action Required

Though the site passes on all criteria, the site is beginning to enter a later stage of succession than is considered optimal for supporting southern damselfly (Purse, 2002). This is particularly evident within the southern part of the site which currently supports the best habitat where the channel remains open. Without management action in the near future this site will fall in to an unfavourable condition.

General Recommendations

It is recommended that within 1-2 years all species of woody plant (e.g. willow, gorse, etc.) are cut back from within 5m of the stream, and a partial removal of tall bog myrtle within a band 3m wide on both sides of the stream is undertaken. Since bog myrtle is considered important for providing structure for roosting and sheltering adults, if possible it is recommended that intermittent, smaller bog myrtle plants on both banks are left.

Specific Recommendations

None

6.3. Bull Hill

Site condition: **UNFAVOURABLE**

Reasons: Within the southern part of the site the bank tops have become dominated by a dense band of bog myrtle which is shading out the main stream; the north of the site is too shaded with much of the channel flowing through dense tree and scrub cover; the potentially suitable habitat available at the site is fragmented, but there is the potential for improvement and for immigration to the site due to its location within 1km of the Crockford Stream (upper).

Transects: Transect sections 1.2 and 1.4 fail on too much shade, the former heavily encroached by dense scrub on the bank top and localised scrub across the channel, and the later predominately flowing through dense scrub and tree cover; transect sections 1.1-1.4 all fail on too little stiff emergent vegetation, and 1.2, 1.4 and 1.5 all fail on too little bog myrtle in the watercourse; transect sections 1.2 and 1.4 also fail on poor bankside structure (too shaded) and the presence of bracken, and the later fails on too few plants for oviposition.

Damselflies: 2.32 per 100m (total seen: 10) during adult count transect surveys.

Population strength was *not assessed* based on a subjective assessment during the habitat attributes survey as no southern damselflies were recorded; it should be noted that weather criteria were not met during any of the habitat assessments.

Hydrology: Primarily a small stream (transect sections 1.1[lower part], 1.2 and 1.4) with flow, and small flowing runnels running into the southern

part of the main channel (1.1 [upper section] and 1.5) from the east; transect section 1.3 is a small mire with only barely discernible flow.

Other Notes: In the southern part of the site, where scrub is not present the adjacent land (particularly to the west of the main stream) is heavily grazed, providing little structure to provide shelter and roosting opportunities for adult southern damselfly.

6.3.1. Habitat management recommendations

Priority level 2 – Management Action Required

The majority of the site has entered a late stage of heathland / mire succession creating a fragmented habitat that is considered predominantly unfavourable for southern damselfly. Only a small number of adult southern damselfly were recorded during the formal adult count survey, despite weather, date and time criteria being met.

General Recommendations

It is recommended that within two years all tall scrub and tree cover (including but not exclusive to gorse, willow, birch *Betula* spp. and hawthorn) is cut back from within 5m of the stream immediately along its length between transect sections 1.2 and 1.4 inclusive. This could potentially create up to 550m additional habitat and re-connect this fragmented population.

It is recommended that partial clearance of bank top bog myrtle is undertaken along the main channel within two years to reduce the level of shading within the southern part of the site. As suitable adult habitat is locally limited within this area, it is recommended that bog myrtle is cut within a band of 3m along the western (true right) bank only, to maximise the provision of solar radiation reaching the channel whilst retaining roosting opportunities and shelter for adult southern damselfly.

Specific Recommendations

None

6.4. Clayhill Bottom

Site condition: **UNFAVOURABLE**

Reasons: Site is small and the nearest sites are over 2km away; transect section 1.3 has become encroached by dense bank-top scrub and the apparent effective exclusion of grazing, combined with the sunken nature of this channel, has resulted in densely vegetated bank tops and only limited development of emergent broad-leaved vegetation for oviposition.

Transects: All transect sections fail on the percentage cover of suitable substrate (too little silt / mud / peat) within the channels; transect section 1.1 fails on too much shade, and 1.3 fails on a lack of oviposition plants, lack of bog myrtle and the presence of eutrophication.

Damselflies: 30.05 per 100m (total seen: 55) during adult count transect surveys; in contrast to the 2004 survey most individuals were seen on transect section 1.3.

Weak population strength based on a subjective assessment during the habitat attributes survey; it should be noted that time criteria was not met during any of the habitat assessments.

Hydrology: Linear with slow to moderate flows throughout the site; the channels are generally sunk below the adjacent habitat, increasing the impact of dense bank-top vegetation where it occurs.

Other Notes: Despite the number of adult southern damselflies recorded during the formal adult counts, field surveyors and local experts have raised concerns regarding the development of scrub and the concentration

of grazing to within only short reaches of the channel (in particular on transect section 1.3). This is resulting in the channel becoming heavily encroached by grasses, heather and bog myrtle, and concentrates nutrient inputs resulting in the presence of green algae (i.e. eutrophication).

6.4.1. Habitat management recommendations

Priority level 2 – Management Action Required

The majority of the site has entered a later stage of succession than is considered optimal for supporting southern damselfly (Purse, 2002). This is either a result of encroachment by tall scrub and trees (transect 1.1) or the lack of grazing pressure allowing the development of dense bankside vegetation that is overhanging the channel (transect 1.3).

General Recommendations

It is recommended that all tall scrub and tree cover (including but not exclusive to alder *Alnus glutinosa*, willow, silver birch *Betula pendula* and bramble) is removed where necessary from within 5m of the stream along the length of transect section 1.1. It is recommended that this is done in combination with a light burn to ensure a reduced level of bank-top vegetation growth where shading has not been a limiting factor.

It is recommended that a light burn of the habitat surrounding transect sections 1.2 and 1.3 is undertaken over successive winters within the next 2-3 years to reduce the level of bank top vegetation.

Due to the small size of the site, it is recommended that the management actions outlined above are staggered over the next three years with the works associated with transect section 1.1 considered to be most urgent.

Specific Recommendations

None

6.5. Common Moor

Site condition:	**UNFAVOURABLE**
Reasons:	Site is very small, approximately 2km away from the nearest site and bordered by scrub which will further inhibit migration into the site; concerns exist in regards to water flow and opportunities for oviposition.
Transects:	Transect fails on too few sample points with a discernible flow and a lack of plants for oviposition.
Damselflies:	34.33 per 100m (but only 23 seen in total) during adult count transect surveys *Weak* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather criteria were not met during any of the habitat assessment.
Hydrology:	Predominantly linear with little to no flow present, though vegetation community and structure provides evidence that a wider mire would be present during wetter conditions.
Other Notes:	The hydrology of the site recorded during this study contrasts with the mostly non-linear habitat recorded during the survey in 2004. There is extensive coverage of bog myrtle and purple moor grass *Molinia caerulea* across the site, and no evidence of grazing was recorded.

6.5.1. Habitat management recommendations

Priority level 2 – Management Action Required

Common Moor is very small and relatively isolated with little to no opportunity of immigration from known other populations within the New Forest to consolidate this population. The extensive coverage of bog myrtle and purple moor grass across the site is of concern with regards to the future suitability of the site for southern damselfly, and management action is required to reduce the coverage of these species and increase the diversity of the sward at the site.

General Recommendations

It is recommended that partial clearance and removal of bog myrtle and purple moor grass by hand cutting is undertaken across the mire within two years. It is recommended this is complemented by an increase in grazing pressure that will help create and maintain diversity within the sward.

Due to its small size and associated vulnerabilities, it is strongly recommended that burning is not used as a management technique at this site (Purse, 2002). However, should it be considered that this is the only realistic option for the management, then a phased (over a 2-3 year period), carefully controlled burn of the site should be conducted.

Specific Recommendations

None

6.6. Crockford Stream (Lower)

Site condition: **UNFAVOURABLE**

Reasons: A large site with strong numbers of adult damselflies recorded, but with sections either enclosed within dense tree and scrub cover, or becoming encroached by trees, scrub and / or dense bands of bank-top bog myrtle from one or both banks.

Transects: Transect sections 1.1-1.3 fail on too much shade and all transects fail on too little stiff emergent vegetation; transect sections 1.3 and 1.4 fail on too few plants for oviposition, and the latter also fails due to poor bankside vegetation structure (uniform low providing little to no shelter for adult damselflies), the presence of bracken and evidence of eutrophication.

Damselflies: 26.64 per 100m (total seen: 223) during adult count transect surveys.

Medium population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather criteria were not met during any of the habitat assessments.

Hydrology: Linear stream with flowing water throughout and mires and seepages running into the main channel, predominantly from the valley side to the south.

Other Notes: Extensive areas of gorse and bracken are present on the valley side to the north of the main channel, and have the potential to encroach onto transect sections 1.1, 1.2 and 1.3 in the future; dense bands of overhanging bank top bog myrtle also shade out reaches of transect sections 1.1 and 1.3.

The channel becomes notably incised through transect sections 1.3 and 1.4, exacerbating the shading effect of tall bank-top vegetation including bog myrtle.

Recent management work has been undertaken to clear trees and scrub adjacent to transect section 1.4, however the work is considered to be unsympathetically implemented and has resulted in very little shelter or roosting opportunities for adult damselflies.

6.6.1. Habitat management recommendations

Priority level 2 – Management Action Required

Crockford Stream (Lower) is a relatively large site supporting strong numbers of damselflies. However, due to the presence of a number of sections with excessive tree, scrub and bog myrtle enclosure and encroachment, there is the potential to considerably expand the suitable habitat for southern damselfly at this site. Therefore, since this site forms part of the wider 'Crockford Complex' (comprising Crockford Stream [Upper], Crockford Stream [Lower] and Shipton Bottom), which is considered to be of both local and national importance, it is considered that management action is required to reduce the coverage of these features and expand the suitable habitat at this site.

General Recommendations

It is recommended that all semi-mature and sapling trees (primarily willow and birch) and scrub (including but not exclusive to hawthorn, blackthorn *Prunus spinosa*, guelder-rose *Viburnum opulus* and bramble) cover is removed from one or both bank-tops (as appropriate) within three years (see below for details).

It is recommended that, where bog myrtle is encroaching and / or enclosing the stream, the channel is opened up through the partial removal of tall plants within a 3m band width on each bank-top within three years.

It is considered that no management is currently required for the extensive gorse and bracken habitat on the valley side to the north of the channel, as they will provide important shelter and foraging opportunities for a number of species,. However, it is recommended that this area is monitored and managed as outlined above if encroachment of the channel occurs.

Specific Recommendations

It is recommended that:

- tree cover is removed (as outlined above) from the upstream reach of transect section 1.1 (SZ 35086 98962 to SZ 35150 98923) within 10m of each bank-top;
- partial clearance of bog myrtle by cutting is undertaken on transect section 1.1 where encroaching or enclosing the channel;
- removal of tree cover (as outlined above) and complete removal of scrub cover from within 5m of the true left (north) bank-top is undertaken along the downstream reach of transect section 1.2 (SZ 35465 98953 to SZ 35495 98961);
- partial removal of bog myrtle from within 3m of both bank-tops is undertaken along an extensive length (SZ 35502 98963 to SZ 35746 98865) of transect section 1.3;
- complete removal of scrub from within 5m of both bank-tops is undertaken along an extensive length (SZ 35502 98963 to SZ 35746 98865) of transect section 1.3;
- removal of tree cover (as outlined above) and complete removal of scrub cover from within 10m of the true left (north) bank-top is undertaken along the lower (downstream) reaches of transect section 1.3, extending to the start of transect section 1.4 (SZ 35754 98871 to SZ 35495 98961);
- an assessment is conducted of the appropriateness and value of creating a marginal berm along the true-right (south) bank of transect sections 1.3 and 1.4 to reduce the level of incision of the channel, creating a habitat more similar to that present in

transect sections 1.1 and 1.2; a consideration of the history of any previous engineering of this watercourse must be included within any such assessment.

6.7. Crockford Stream (Upper)

Site condition: **FAVOURABLE**

Reasons: The large size of this site, which passes on all attributes overall and supported a strong number of southern damselfly and forms part of the Crockford Complex 'meta-population', is considered on balance to out-weigh a number of transect section specific issues.

Transects: Multiple transect sections failed on a lack of plants for oviposition (1.1, 1.2, 1.3 and 1.5) and the absence of stiff emergent vegetation, (1.1, 1.2, and 1.5); transect section 1.1 also failed on too much shade and poor bankside vegetation structure, and 1.5 on too little bog myrtle and the presence of eutrophication.

Damselflies: 30.87 per 100m (total seen: 644) during adult count transect surveys.

Strong population strength based on a subjective assessment during the habitat attributes survey; it should be noted that time criteria was not met during habitat assessments of transect sections 1.2 (part), 1.3, 1.6 and 1.7.

Hydrology: Predominantly linear streams with clear flow and some areas of associated mire; transect section 1.6 was an equal mix of linear and mire habitats at the time of the habitat assessment, but notably reduced in area and was predominately linear at the time of the adult count survey; transect section 1.7 was dry in the upper reaches and therefore its length (in comparison with the original survey in 2004) was reduced to focus on wet / flowing habitat.

Other Notes:

The failure of transect sections 1.2 and 1.3 on the availability of oviposition plants is considered to be a reflection of the exclusion of submerged vegetation from this analysis, as this is one of the few sites where broad-leaved vegetation formed a notable component of the submerged vegetation community during habitat attribute surveys.

Very few southern damselfly were recorded on the western arm in the upper half of the site, with six and zero male damselflies recorded on transect sections 1.6 and 1.7 respectively. Based on description of the site's hydrology and the length surveyed, it is considered likely these transect sections were notably wetter in 2004.

It is understood that water supply to transect section 1.7 was historically via a single pipe associated with the disused World War II airfield. The removal of the concrete perimeter track and the associated pipe has resulted in a more dispersed distribution of water across this area through various runnels, rather than concentrated in the main channel itself (Jenkins, personal communication).

6.7.1. Habitat management recommendations

Priority level 2 – Management Action Required

Crockford Stream (Upper) is a large site supporting strong numbers of damselflies. However, the presence of a number of sections in the lower (downstream) portion of the site with excessive tree, scrub and bog myrtle enclosure and encroachment is of concern. Since this site forms part of the wider 'Crockford Complex' (comprising Crockford Stream [Upper], Crockford Stream [Lower] and Shipton Bottom), which is considered to be of both local and national importance, it is considered that management action is required to reduce the coverage of these features to maximise the potential of this site for southern damselfly.

Concerns regarding potentially lower availability of flowing water (in comparison with the 2004 surveys) were identified on the western arm on the upper part of this site during both the habitat assessments and adult count surveys. It is unclear whether this is actually a result of inappropriate management, or whether this simply reflects the drier conditions observed on almost all sites in 2013 (in comparison with 2004). Such a hydrological assessment is beyond the remit of this study, but it is considered likely that the most appropriate conclusion would be that the amount of permanent / perennial habitat available to southern damselfly is in fact smaller than originally assessed.

General Recommendations

It is recommended that all semi-mature and sapling trees (primarily willow, and birch) and scrub (including but not exclusive to hawthorn, blackthorn, guelder-rose and bramble) cover is removed from one or both bank-tops (as appropriate) within three years (see below for details).

It is recommended that, where bog myrtle is encroaching and / or enclosing the stream, the channel is opened up through the partial removal of tall plants within a 3m band width on each bank-top within three years.

It is recommended that a light burn is undertaken across the length of transect sections 1.4, 1.6 and 1.7 within four years to keep the growth of scrub (where relevant) and bog myrtle in check.

Specific Recommendations

It is recommended that:

- removal of tree cover (as outlined above) and complete removal of scrub from within 5m of both banks is undertaken along the length of transect section 1.1 (SZ 35068 98986 to SZ 34943 99160) as required;

- partial clearance of bog myrtle by cutting is undertaken on transect section 1.1 where encroaching or enclosing the channel;
- partial removal of bog myrtle by cutting from within 3m of both bank-tops is undertaken along an extensive downstream length (SZ 34842 99221 to SZ 34717 99288) of transect section 1.2;
- complete removal of scrub from within 5m of both bank-tops is undertaken along the length of transect section 1.5.

6.8. Dibden Bottom

Site condition: **UNFAVOURABLE / EXTINCT?**

Reasons: Site is isolated (nearest site is Hatchet Stream, over 6.5km away) and only a small area of suitable habitat is present due to heavy shading of the channel by a continuous line of trees on the northern bank; significant concerns exist regarding water availability.

Transects: Transect fails on water flow, with no flow present throughout the transect at the time of survey, with the channel predominantly damp mud / silt with localised small areas of standing water; also fails on too much shade, poor bankside vegetation structure (too shady) and too few plants for oviposition.

Damselflies: 0.00 per 100m (total seen: 0) during adult count transect surveys

Population strength was *not assessed* based on a subjective assessment during the habitat attributes survey as no southern damselflies were recorded; it should be noted that time criteria was not met during any of the habitat assessments

Hydrology: Linear channel with only water present within small localised areas of standing water.

Other Notes:

6.8.1. Habitat management recommendations

Priority level 4 – No Action Recommended at this time

The absence of water across the majority of the site at the time of survey raises uncertainties as to whether southern damselfly are still present at this site. Furthermore, the isolation of this

site from the nearest extant known significant population within the New Forest would strongly suggest that it is unlikely that southern damselfly can migrate into the site.

It is recommended that the presence of southern damselfly and the security of a year-round flowing water supply is confirmed at the site before any habitat management works are undertaken.

General Recommendations

None

Specific Recommendations

None

6.9. Duckhole Bog

Site condition:	**UNFAVOURABLE**
Reasons:	Site is small with concerns regarding water flow.
Transects:	Transect fails on too few sample points with a discernible flow and the presence of eutrophication.
Damselflies:	1.43 per 100m (total seen: 2) during adult count transect surveys. *Weak* population strength based on a subjective assessment during the habitat attributes assessment.
Hydrology:	Linear with variable flow, including areas with no discernible flow.
Other Notes:	Localised areas of dense scrub are present on the east bank and to the north of the site where the transect was terminated at the start of a dense scrub patch; extensive bog myrtle and heather vegetation growth is present on the west bank of the channel. Within the project brief, it was identified that the length of channel to be surveyed at this site may need to be extended from that assessed in the original study to reflect recent management at this site. However, due to the lack of discernible flow across the site, it was decided that it was more appropriate to survey the original length.

6.9.1. Habitat management recommendations

Priority level 1 – Immediate / Urgent Management Action Required

Duckhole Bog is small, with the nearest sites, Stag Brake and Mill Lawn, approximately 1km and 2km away respectively. Therefore, it is considered that there is only limited opportunity of

immigration from other populations within the New Forest to consolidate this population. The development of scrub and extensive coverage of bog myrtle and heather across the site is of concern for the future suitability of the site for southern damselfly, and immediate management is required to remove the scrub from the site.

General Recommendations

It is recommended that all scrub is removed from along the length of the transect within the next year. This clearance should extend beyond the downstream limit of the transect surveyed here to increase the length of potentially suitable habitat available to support southern damselfly.

It is recommended that a light burn is undertaken within three years to reduce the size and density of bog myrtle and heather growth. In order to limit the potential negative impacts associated with this management practice, it is recommended that it is limited to the west of the channel and undertaken two years after the removal of the scrub.

Specific Recommendations

None

6.10. Foulford

Site condition:	**UNFAVOURABLE**
Reasons:	Although the overall site passes on all criteria, this is a reflection of the fact that samples were only taken from the best habitat and that individual transect sections failed on different criteria; two transect sections fail due to shading, and the area of suitable habitat is relatively small, but has the potential for substantial expansion and is less than 0.75km from Shobley.
Transects:	Transect sections 1.1 and 1.3 fail on too much shade, with the former also failing on too few plants for oviposition and the latter on the presence of bracken respectively; transect section 1.2 fails on too little bog myrtle and on water flow.
Damselflies:	0.38 per 100m (total seen: 1) during adult count transect surveys. *Weak* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that the time criteria was not met during any of the habitat assessments.
Hydrology:	Transect section 1.1 was linear with slow water flow, becoming subterranean for short lengths; transect sections 1.2 and 1.3 were mires in their upstream reaches becoming linear downstream before joining or becoming the main channel respectively.
Other Notes:	The area surveyed is in itself becoming encroached with scrub, bog myrtle and dense tussock forming grasses.

6.10.1. Habitat management recommendations

Priority level 1 – Immediate / Urgent Management Action Required

The area of habitat for southern damselfly at Foulford is small, potentially a consequence of insufficient grazing and / or management pressure allowing the development of semi-mature trees, dense scrub, and an extensive coverage of bog myrtle and dense grass sward. Furthermore, the areas of assessed habitat are considered to be sub-optimal as they are also becoming encroached and enclosed by scrub and dense stands of bog myrtle and grasses. Immediate management action is therefore required to reduce the coverage of these species and to open up the main channel in particular.

General Recommendations

It is recommended that a burn is undertaken along the length of transect sections 1.1 and 1.2 within the next year to reduce the density of the grass sward and to check the encroachment of bog myrtle and scrub respectively. It is recommended that this is supplemented by the complete clearance of the willow immediately upstream of transect section 1.1 to increase the length of potential habitat.

It is recommended that a partial removal of bog myrtle and a complete removal of gorse and bracken through hand cutting is undertaken within the mire section of transect section 1.3 (to the north of the main channel) and along the length where it comprises the main channel.

An established area of riparian woodland is located immediately downstream (west) of transect section 1.3. Strange & Bousfield (2004) recommended that the selective removal of 50% of the trees and scrub (chiefly willow and birch) within a 10m band to either side of the stream would be desirable. It is recommended that the local value of this woodland for its associated flora and fauna be assessed against the value of increasing the length of potentially suitable habitat for southern damselfly this could create. It is likely that such an action would need to be supplemented by further management downstream of the woodland to maximise the potential of this site for southern damselfly. It is expected that this will include the partial removal of bog myrtle within a 3m width band of both banks, and complete clearance of scrub and other trees within 10m of both bank-tops.

Specific Recommendations

None

6.11. Hatchet Stream

Site condition:	**FAVOURABLE**
Reasons:	Open site with only small localised patches of scrub; potential opportunities for limited expansion onto adjacent runnels and mire that run down north and south valley sides, but uncertainties existing whether they retain flowing water throughout the year.
Transects:	Transect fails on too few plants for oviposition and too little bog myrtle associated with the channel.
Damselflies:	8.16 per 100m (total seen: 60) during adult count transect surveys. Population strength was *not assessed* based on subjective assessment during habitat attributes survey as no southern damselflies were recorded; it should be noted that date criteria was not met during any of the habitat assessment, and that time and weather criteria were not met for parts.
Hydrology:	Mostly linear channel with clear flow becoming predominantly mire at the western (upstream) end.
Other Notes:	The habitat assessment at Hatchet Stream was undertaken early in the survey programme, during wetter conditions than was encountered during the remainder of the 2013 survey programme. This clearly has implications when assessing the potential opportunity for local expansion outlined above. Furthermore, the failure of this site on the availably of oviposition plants is considered to be a reflection of the exclusion of submerged

vegetation from this analysis (see section 5.1), as the higher water levels resulted in sections with greater coverage of submerged than emergent broad-leaved vegetation. In contrast, water levels were notably lower during the adult transect count survey, and the relative proportion of submerged versus emerged broad-leaved coverage appeared to be reversed.

6.11.1. Habitat management recommendations

Priority level 3 – On-going / Future Management Action Required

Hatchet Stream is a medium sized site that passes on all main attributes (with the exception of the availability of oviposition plants for the reasons explained above). It is therefore considered that there are no short-term management requirements at this site, though future management will be required to maintain the suitability of the site for southern damselfly.

General Recommendations

It is recommended that a burn is undertaken within 4-5 years to keep scrub, bog myrtle and other vegetation growth in check. This should be undertaken on alternate banks over successive years. In association with the management outlined above, it is recommended that the clearance of localised patches of encroaching / overhanging dense and / or tall scrub is undertaken immediately prior to burning.

Specific Recommendations

None

6.12. Howen Bottom

Site condition: **UNFAVOURABLE / EXTINCT?**

Reasons: Site is isolated (nearest site is Latchmore, approximately 4km away) and there are no records of southern damselfly at this site since 1984; potentially suitable habitat available at the site was small; the site also failed on water flow, too little bog myrtle coverage and poor bankside vegetation structure.

Transects: All transect sections fail on too little bog myrtle; transect sections 1.1 and 1.2 fail on uniformly low bankside structure, with the former also failing too few plants for oviposition; transect section 1.3 fails on water flow.

Damselflies: 0.00 per 100m (total seen: 0) during adult count transect surveys; weather criteria not met for all transects.

Population strength was *not assessed* based on a subjective assessment during the habitat attributes survey as no southern damselflies were recorded. It should be noted that weather criteria were not met for one transect section during the habitat assessments.

Hydrology: Linear wet flushes associated with the main channel at the site; transect sections 1.1 and 1.2 with predominantly good flows throughout at the time of the habitat assessment, but with no discernible flow in the majority of transect section 1.3; all transect sections were notably drier with only localised areas of standing water at the time of the adult count surveys.

Other Notes:

The habitat assessments were focused on wet flushes associated with the main channel, since the main channel was considered to be unsuitable for southern damselfly due to the substrate and general absence of in-channel vegetation. This is consistent with the conclusions of a desk top and field based study undertaken by Hayward (2011) that Howen Bottom was not a suitable site for southern damselfly. Of specific note, the main channel was observed to be dry during a site visit undertaken in the summer of 2010. This observation was made at a location approximately 250m upstream of transect section 1.3, and 150m downstream of a historic (1984) record of southern damselfly.

Heavy grazing pressure has created a uniformly low sward height surrounding the majority of the site and offering little shelter and roosting opportunities for adult damselfly.

6.12.1. Habitat management recommendations

Priority level 4 – No Action Recommended at this time

The evidence suggesting that Howen Bottom does not support a discernible perennial water flow, and in fact is prone to dying up entirely, raises uncertainties as to whether southern damselfly are still present at this site.

It is recommended that the presence of southern damselfly and the security of a year-round flowing water supply are confirmed at the site before any habitat management works are undertaken.

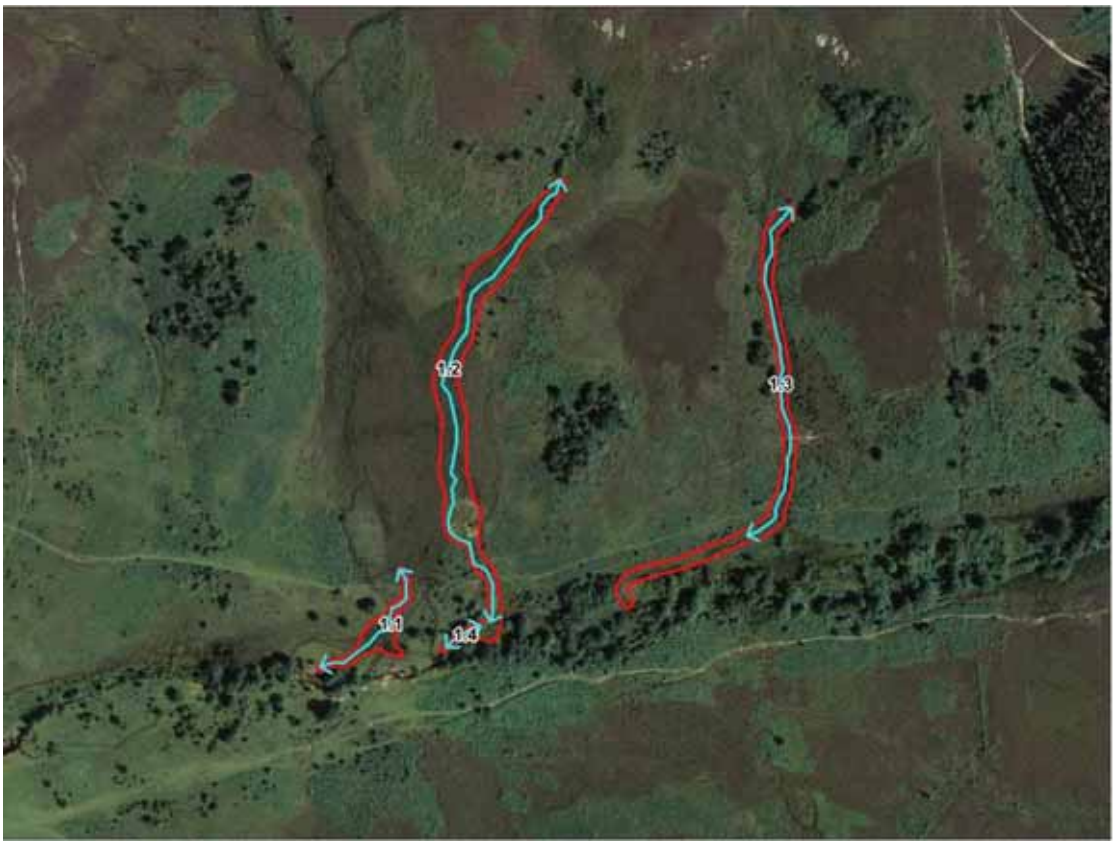
General Recommendations

None

Specific Recommendations

None

6.13. Latchmore



Site condition:	**FAVOURABLE**
Reasons:	Site is relatively large and passes on all attributes.
Transects:	Transect sections 1.1 and 1.4 fail on the lack of bog myrtle, with the latter failing on poor (uniformly low) bankside vegetation structure and presence of bracken.
Damselflies:	25.73 per 100m (total seen: 248) during adult count transect surveys; over 70% of individuals were recorded on transect 1.3, and 27% on transect 1.2. *Medium* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather and / or time criteria were not met for some transects during the habitat assessment.
Hydrology:	Transect section 1.1 is predominately mire with only barely discernible water flow; transect section 1.2 is a mix of mire and linear habitat with flow, transect section 1.3 is linear with good water flow throughout, and transect 1.4 is linear with only barely discernible water flow.
Other Notes:	Linear habitats appear to be more suitable for southern damselfly, with notably more individuals associated with linear than mire habitats on transect section 1.2, and a low (2.17 per 100m) relative abundance recorded on transect section 1.1. Bog myrtle and areas of scrub (including but not exclusive to gorse and willow) are beginning to develop and encroach parts of transect sections 1.2 and 1.3.

6.13.1. Habitat management recommendations

Priority Level 2 – Management Action Required

Latchmore is a relatively large site supporting a strong number of southern damselfly. However, the presence of localised patches of scrub and the encroachment of bog myrtle on lengths of transect section 1.2 and 1.3 will both require management in the future and are potentially limiting the opportunity for expansion across the site to other runnels and mire present in the mid and upper (north) reaches of the site.

General Recommendations

It is recommended that all scrub within 5m of both banks on transect sections 1.2 and 1.3 is removed within 2 years. This should be supplemented by a cutting back (by hand) or burning of all tall bog myrtle and coarse grasses from a 3m band width from either one or both of the bank-tops where necessary, implemented in parallel with the scrub work on transect section 1.2, and then on 1.3 on the following year. The locations for these works are outlined below.

Specific Recommendations

It is recommended that scrub is cleared from the bank-top (as outlined above unless stated) at the following locations:

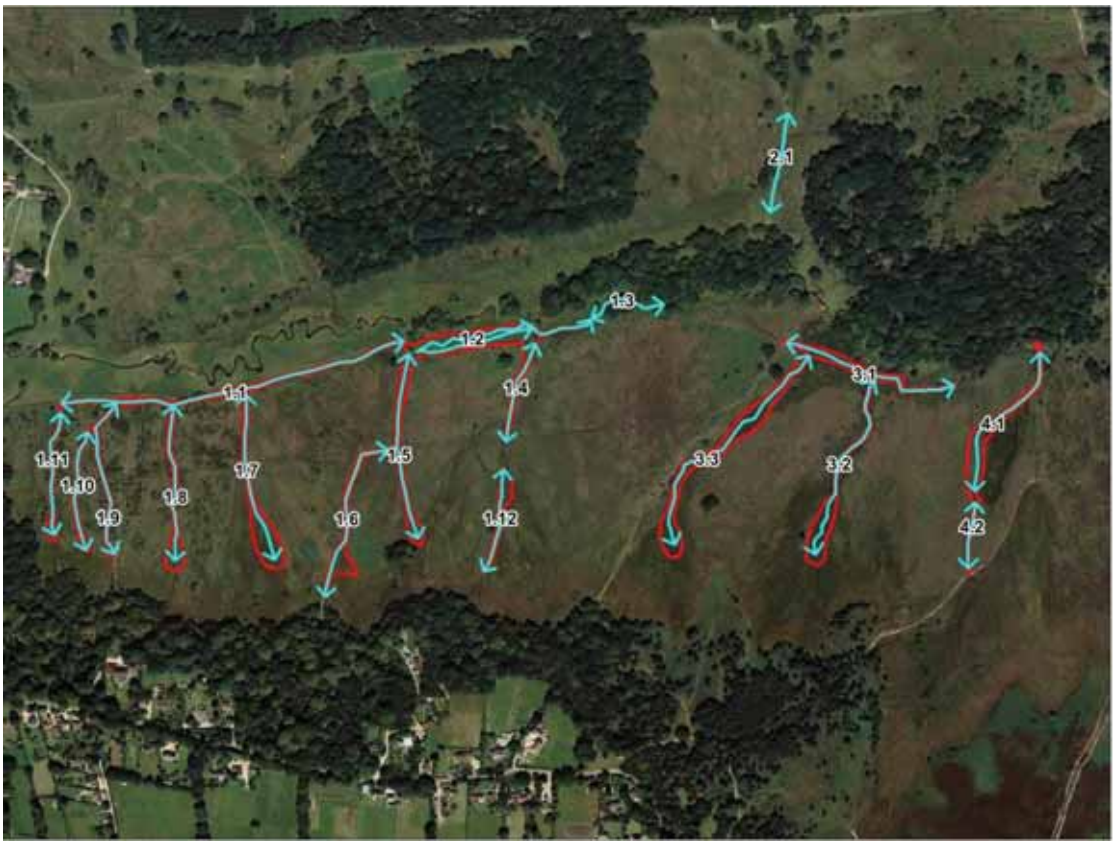
- SU 19157 12751 (transect section 1.2);
- SU 19206 13579 (to extend upstream limit of transect section 1.2) – for approximately 30m upstream selectively remove semi-mature trees and scrub (primarily pine, willow and birch) within 10m of both channel bank-tops;
- SU 19429 12826 to SU 19435 12864 (transect section 1.3);
- SU 19418 13030 (transect section 1.3);
- SU 19433 13069 (to extend upstream limit of transect section 1.3) – for approximately 40m upstream selectively remove semi-mature trees and scrub within 10m of both channel bank-tops.

It is recommended that bog myrtle and coarse grasses are cut back or burnt from the bank-top (as outlined above) at the following locations:

- SU 19122 12796 to SU 19221 13095 (approximately three-quarters of transect section 1.2);
- SU 19426 12817 to SU 19418 13030 (approximately two-thirds of transect section 1.3).

It is recommend that the dense growth of bracken present on the valley side to the west of the upper (north) reaches of transect section 1.3 is monitored and, if begins to encroach the channel, is subject to a light burn to check growth.

6.14. Mill Lawn



Site condition: **UNFAVOURABLE**

Reasons: Despite being a large site supporting reasonably high numbers of southern damselflies, there are concerns regarding water flow at the site with almost two-thirds of the transect sections failing on this habitat attribute; further concerns exist with regards to the poor vegetation structure associated with a number of transect sections, where heavy grazing of the 'lawn' has resulted in areas of uniformly low vegetation and little bog myrtle to provide shelter for adults.

Transects: Multiple transect sections failed on water flow (1.1, 1.2, 1.3, 1.6, 1.9, 1.11, 2.1, 3.1, 3.2, 3.3, 4.1), poor bankside vegetation structure (1.1, 1.3, 1.5, 1.7, 1.8, 1.9, 1.11, 2.1) too little bog myrtle (1.1–1.12, 2.1) and too much shade (1.3, 1.12, 4.2); transect section 1.2 also failed on the presence of eutrophication and 1.3 on the absence of stiff emergent vegetation and lack of suitable plants for oviposition.

Damselflies: 11.44 per 100m (total seen: 429) during adult count transect surveys; transect sections 1.9 and 3.1 failed the survey criteria on time, completed at 15:10 and 15:35 respectively.

Strong population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather and / or time criteria were not met during some of the habitat assessments.

Hydrology: Most transect sections were exclusively linear with only 1.2 and 4.1 including a substantial mire component (Appendix 2); this is in contrast to the situation in 2004 (and a training visit in May 2013) where transects 3 and 4 were predominantly mire.

	Almost two-thirds of the transect sections had no discernible flow (see list above), and transects 1.3, 2.1 and 4.2 were completely dry at the time of survey; the absence of discernible flow throughout transect 3.1 is a result of dense vegetation choking the channel.
Other Notes:	Transect section 2.1 was dry at the time of both the 2004 and 2013 habitat surveys and the reason for its inclusion is unclear. Transect section 1.3 was also completely dried out and is enclosed by trees / shade for the majority of its length, and the reason for its inclusion is also unclear. The exact location of the original transect section 4.2 could not be determined as the area believed to need surveying was dry with no evidence of channel or mire; transect section 4.2 is therefore in a different location to that surveyed in 2004.

6.14.1. Habitat management recommendations

Priority level 3 – On-going / Future Management Action Required

Though there are localised management issues at Mill Lawn, these do not threaten the security of the site. The availability of water with a discernible flow and the intense grazing pressure to the north and east of the site are the two key reasons for the Unfavourable condition assessment of this site, and neither could be rectified through simple changes or implementation of management (in contrast to most other sites). Extensive grazing is a feature of the New Forest and it would be difficult, if in fact possible or appropriate, to restrict grazing at the site.

It is unclear whether an increased water supply to the site could be secured, and such a hydrological assessment is beyond the remit of this study. However, it seems unlikely as most of the transect sections flow from south to north, and are fed from the collection of water or springs on the valley side. It is considered likely that the most appropriate conclusion will be that the amount of permanent / perennial habitat available to southern damselfly is in fact smaller than originally assessed.

General Recommendations

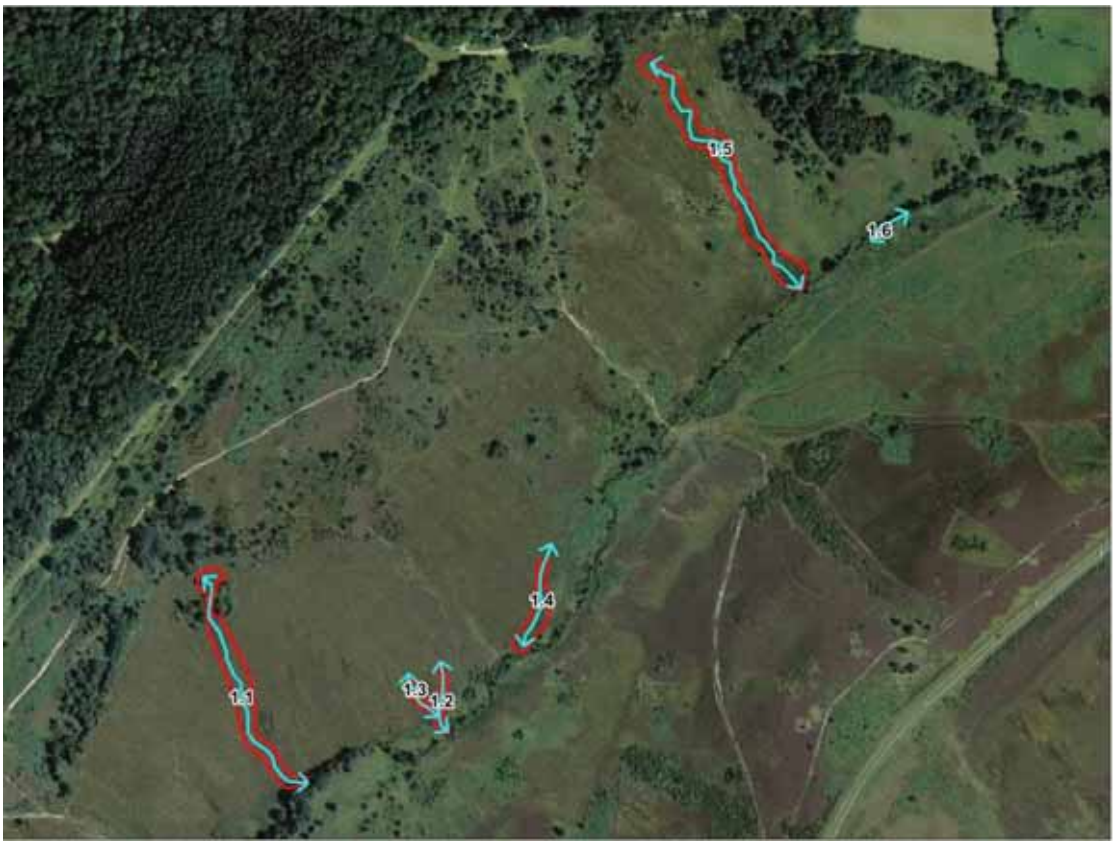
It is recommended that a light burn is undertaken across those areas of the site at a later stage of succession (i.e. no ‘Lawn’) in 3-4 years. This will check the dominance of purple moor grass and reduce any scrub encroachment of the channels.

Specific Recommendations

It is recommended that a dense area of gorse separating transect sections 1.4 and 1.12 (originally a single transect section in the 2004 survey) and encroaching much of the latter, is cleared by burning or cutting and removal. It is recommended that this is undertaken within the next year as these sections are important components of the site.

It is also recommended that a specific hydrological assessment of the site is undertaken to determine whether water availability to the site can be increased. This study should also include an assessment of whether it is appropriate (i.e. will not negatively impact on the wider hydrology of the site) to undertake vegetation removal / channel maintenance of transect section 3.1.

6.15. Millersford Bottom



Site condition:	**UNFAVOURABLE**
Reasons:	A number of sections fail on main attributes (i.e. shade and availability of plants for oviposition), and concerns exist regarding water flow in the upper half of the valley side, particularly associated with transect section 1.5; the site is over 3km from nearest site.
Transects:	Transect section 1.1 fails on too few plants for oviposition and on a lack of bog myrtle; transect section 1.2 fails on too much shade and 1.3 and 1.4 fail on water flow; transect section 1.6 fails on all habitat attributes with the exception of water flow.
Damselflies:	18.29 per 100m (total seen: 169) during adult count transect surveys. *Weak* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather and / or time criteria were not met during any habitat assessments.
Hydrology:	Transect section 1.5 is mire and 1.1 predominately mire, forming a linear channel in its lower reaches only; other sections are linear, with a clear flow throughout transect section 1.6 but with barely or no discernible flow in their upper reaches of transect sections 1.2-1.4.
Other Notes:	The best habitat was focused in the lower reaches of the site, and was reflected in the distribution of southern damselfly during the adult counts, with only 1 of the 36 individuals recorded on transect section 1.5 observed beyond the lower 100m (third) of the section. Following discussion with local experts and based on the information provided within Strange & Bousfield (2004), it is proposed that this is a

consequence of hydrological disruptions resulting from drainage works completed in the late 1990's. Despite subsequent measures undertaken to rectify this situation and return the site to its original condition, the bulk of the southern damselfly population has remained focused on the unmodified lower reaches (Jenkins, personal communication), as was observed during the current study.

The site is becoming dominated by coarse grasses and heather that is beginning to encroach the runnels in the west of the site. This is potentially due to insufficient grazing pressure (though cattle were observed on site during the surveys), creating areas of dense thatch around the upper reaches of transect sections 1.3 and 1.4.

Within the project brief, it was identified that the length of transect section 1.6 may need to be extended following recent management undertaken at this site. However, transect section 1.6 was deeply incised and subject to a high level of shading from tree cover from both bank-tops. It was therefore considered counter-intuitive to increase the length of this transect section (and by consequence it's relative contribution to the overall assessment of the site), and it was decided more appropriate to survey the original length.

It remains unclear whether the main Millersford Bottom stream (of which transect section 1.6 forms a short reach) does in fact support southern damselfly (Hayward, 2011), or whether records of this species on the stream simply represent stray adult insects. Measurements of pH taken approximately 25 years ago found that the stream ran at a pH of around 5.5 along its length, between Deadman Bottom and the road north of Godshill (Jenkins, unpublished data), suggesting conditions in this stream are not suitable for this species (see section 2.1.3).

However, it is understood that pH measurements taken in 2011 and 2012 returned values of approximately pH 8 from both the main channel downstream of Millers Ford, and the lower reaches of a small side stream that enters the main channel immediately above (Jenkins, unpublished data). This level of pH was recorded along approximately half of the distance between Millers Ford and the road, and corresponds to locations where southern damselfly have been recorded (Hayward, 2011). Interestingly, Hayward (2011) reported that the water chemistry at this site was of a different ionic composition to other known southern damselfly sites. It is therefore suggested that the main channel downstream of the Millers Ford is receiving an alkaline rich pollutant, possibly derived from adjacent land use.

6.15.1. Habitat management recommendations

Priority level 2 – Management Action Required

The development of a dense sward across the western part of the site is beginning to encroach and, in some locations, shade out and / or choke the channel. Management action is required to re-open these channels.

The potential historic disruption of the hydrology of site and its impact on the site requires further investigation, though such an assessment is beyond the remit of this study.

General Recommendations

It is recommended that a phased light burn is undertaken across the western and eastern part of the site on subsequent years to reduce the density of the sward and open up the habitat around the channels. This should be implemented over the next 2-3 years.

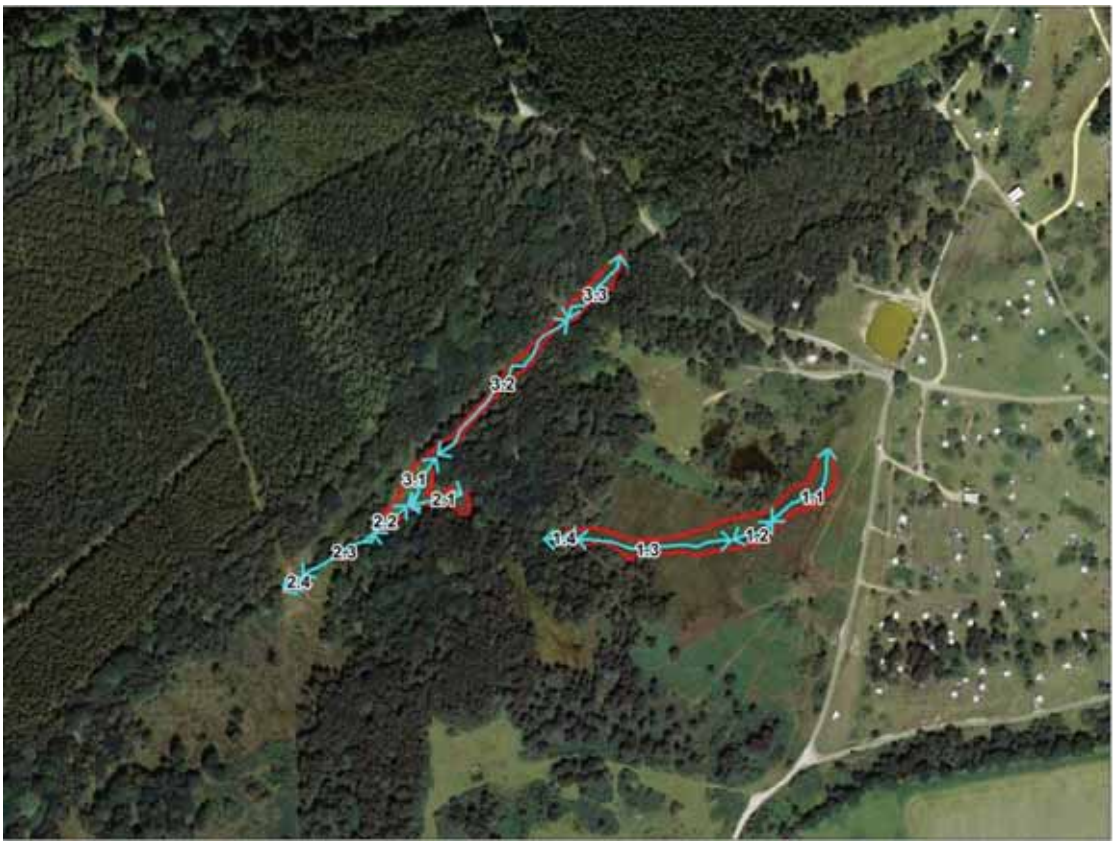
Specific Recommendations

It is recommended that a specific hydrological assessment of the site is undertaken to determine whether the causes of the highly localised distribution of southern damselfly, in particular on transect sections 1.1 and 1.5, can be determined and rectified.

It also recommended that an investiagtion of the potential pollution of the main Millersford Bottom stream is included within this study. This should look to determine the current water chemistry of the site, and how this compares to what is expected based on the geology and hydrology of the site and conditions upstream. If water chemistry deviates from the expected conditions, the source of any pollutants should be determined and addressed.

Based on these findings, the suitability of the main Millersford Bottom stream (transect section 1.6) to support southern damselfly should be re-assessed, and should be used to inform any decision making process with regard to extensive clearance of tree and scrub cover along its length.

6.16. Round Hill



Site condition: **UNFAVOURABLE**

Reasons: Some transect sections with good habitat but as a consequence of extensive tree and scrub growth, a number of sections fail on too much shade, and / or associated attributes including bankside structure and availability of plants for oviposition; it is approximately 2.5km from the nearest site, but there exists potential for habitat restoration / expansion within the sites.

Transects: Transect section 1.1 fails on water flow; transect sections 1.4, 2.3 and 2.4 fail on too much shading; transect section 2.3 fails on too few oviposition plants; transect sections 1.4, 2.3 and 3.2 fail on poor (uniform low) bankside structure; transect sections 2.1, 2.3, 2.4, 3.1 and 3.2 fail on a lack of bog myrtle coverage; transect sections 2.3, 2.4 and 3.2 fail on too little stiff emergent vegetation; transect sections 1.4, 2.2, 2.3, 3.2 and 3.3 fail on the presence of bracken.

Damselflies: 17.31 per 100m (total seen: 138) during adult count transect surveys.

Medium population strength based on a subjective assessment during the habitat attributes survey; it should be noted that weather criteria were not met for any transects during the habitat assessment.

Hydrology: Transect sections 1.1 and 1.2 are predominantly mire habitat, with sections 1.3 and 3.3 a mix of mire and linear habitats; other transect sections are linear; with the exception of the upper (north) reaches of transect sections 1.1 and 1.2 (the latter during the adult count surveys only), all transects had clear flows along their length.

Other Notes: Area of suitable non-linear habitat recorded in association with Transect 1 is substantially reduced in comparison to area mapped during the original survey in 2004 (see section 6.15 of Harvey *et al*., 2005).

6.16.1. Habitat management recommendations

Priority level 2 – Management Action Required

Round Hill contains a number of transect sections with good habitat and supports a medium sized population of southern damselfly. However, the site is relatively isolated (the nearest site is Crockford Stream [Upper] approximately 2.5km away) and the western part of the site is enclosed within a woodland, limiting opportunities for movement within the site. It is considered that the reduction of tree and scrub cover across the site will be required for this site to achieve Favourable condition.

General Recommendations

It is recommended that an extensive, phased programme of tree thinning, sapling clearance and scrub removal is undertaken over the next 1-3 years (as outlined below).

Specific Recommendations

It is recommended that the following works are undertaken as part of a phased programme:

- SU 32996 01877 to SU 32893 01914 – complete removal of pine, willow, and scrub from within 10m of the channel bank-tops to create suitable habitat between transect sections 1.4 and 2.1, and check encroachment from the true right (north) bank of the latter (year 1);
- SU 32851 01900 – complete removal of dense area of bracken and scrub associated with the junction of transect sections 2.1 and 2.2 (year 1);
- SU 32833 01887 to SU 32825 01880 – partial removal of bog myrtle within 2m of both channel bank-tops to open up transect 2.2 (year 2);
- SU 32820 01875 to SU 32740 01825 – complete removal of scrub and partial removal of tall bog myrtle plants within 5m and 3m respectively of both channel bank-tops to reduce shading of transect sections 2.3 and 2.4 (year 2);
- SU 32820 01875 to SU 32740 01825 – removal of willow and birch within 10m of both channel bank-tops to reduce shading of transect sections 2.3 and 2.4 (year 2);
- SU 32873 01939 to SU 32881 01943 – complete removal of all trees within 15m of both channel bank-tops to increase light levels along transect sections 3.1 and 3.2 (year 3);
- SU 32873 01939 to SU 32881 01943 – complete removal of scrub and bracken within 5m of channel bank-tops to remove localised shading of transect sections 3.1 and 3.2 (year 3);
- SU 32873 01939 to SU 32881 01943 – partial removal of bog myrtle within 2m of both channel bank-tops to remove localised shading of transect sections 3.1 and 3.2 (year 3).

It is recommended that the potential encroachment of the lower third of transect section 1.3 (SU 33082 01864 to SU 33006 01870) by bracken and tree cover is monitored and managed as outlined above where required.

6.17. Shipton Bottom

Site condition:	**FAVOURABLE**
Reasons:	Large site supporting a strong number of southern damselfly and passes on all attributes.
Transects:	Transect sections 1.1, 1.3 and 1.5 fail on too much shade; transect sections 1.4 and 1.5 fail on too few plants for oviposition, with the former also failing on a lack of bog myrtle coverage and the presence of eutrophication.
Damselflies:	44.51 per 100m (total seen: 876) during adult count transect surveys. *Strong* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that time and / or weather criteria were not met for some transect sections during the habitat assessment.
Hydrology:	Transect sections 1.1, 1.3 and 1.5 are linear habitats, 1.4 is a mixture on linear and mire, and 1.2 is predominantly linear; clear flows recorded throughout most transect sections, with low flows only noted in a short reach of transect section 1.2.
Other Notes:	Transect section 1.4 is a relatively incised, narrow channel where linear, becoming encroached by a reed bed (*Phragmites australis*) in the upstream (north) mire section.

6.17.1. Habitat management recommendations

Priority level 2 – Management Action Required

Shipton Bottom is a large site supporting strong numbers of damselflies. However, the failure of a number of individual transect sections due to excessive tree, scrub and bog myrtle enclosure and encroachment is of concern. Since this site forms part of the wider 'Crockford Complex' (comprising Crockford Stream [Upper], Crockford Stream [Lower] and Shipton Bottom), which is considered to be of both local and national importance, it is considered that management action is required to reduce the coverage of these features and maximise the potential of this site for southern damselfly.

General Recommendations

It is recommended that the removal of localised areas of tree cover, dense scrub and dense / tall bog myrtle is undertaken over the next 1-3 years as part of a phased programme. Due to the open nature of the wider site, some cover has deliberately been retained to provide shelter during poor weather conditions.

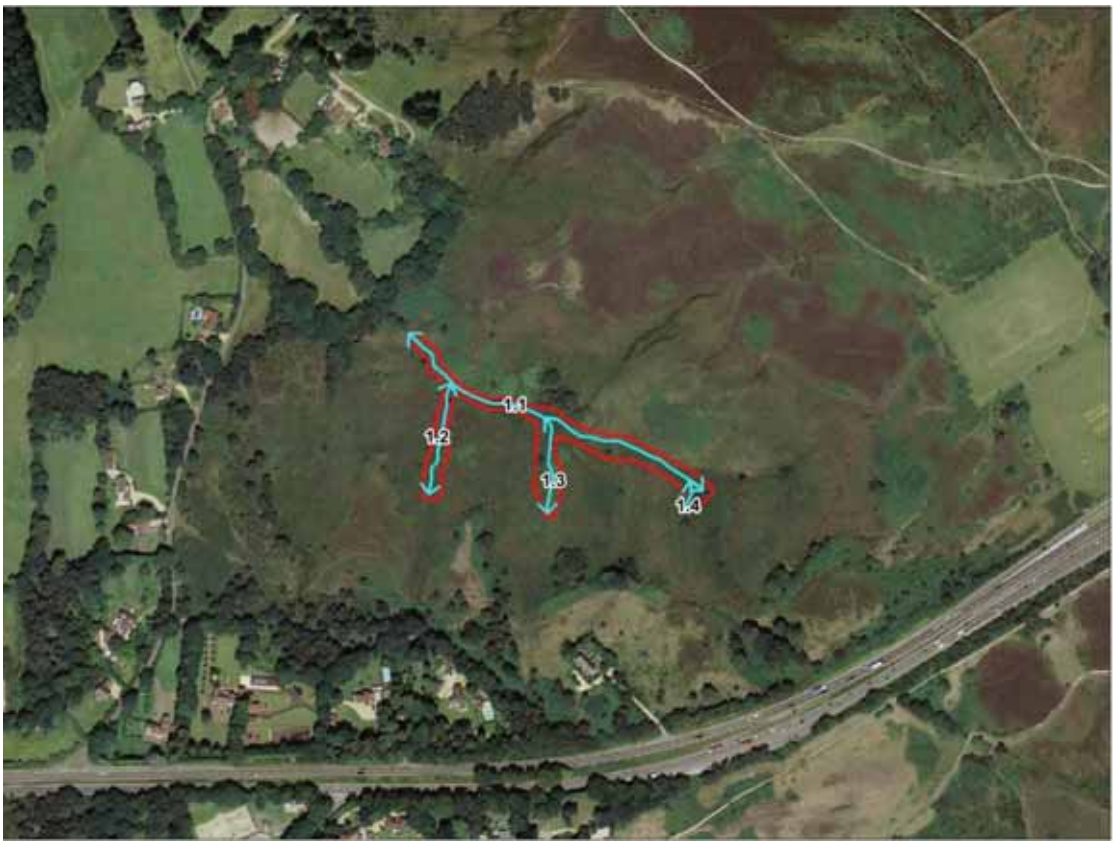
It is recommended that this is supplemented by a phased light burn across the western and eastern arms of the upper (north) section of the site on subsequent years where appropriate to reduce the density of the bog myrtle and coarse grasses and keep scrub in check. This should be implemented over the next 1-3 years.

Specific Recommendations

It is recommended that the following works are undertaken as part of a phased programme:

- SZ 35957 98847 to SZ 35978 98871 (transect section 1.1) – complete removal of scrub (primarily willow and gorse) from within 5m of the channel bank-tops (year 1);
- SZ 35990 98847 to SZ 36014 98912 (transect section 1.1) – complete removal of scrub (primarily willow, gorse and hawthorn) from within 5m of the channel bank-tops (year 1);
- SZ 36039 98953 to SZ 36049 98961 (transect section 1.1) – complete removal of scrub (primarily willow and gorse) from within 5m of the channel bank-tops (year 1);
- SZ 36098 99027 to SZ 36110 99060 (transect section 1.1) – complete removal of scrub (primarily willow) from within 5m of the channel bank-tops (year 1);
- SZ 36121 99109 to SZ 36124 99139 (transect section 1.1) – complete removal of scrub (primarily willow) from within 5m of the channel bank-tops (year 1);
- SZ 36138 99197 to SZ 36150 99234 (transect section 1.1) – complete removal of tall, dense scrub and small trees from within 5m of the channel bank-tops (year 1);
- SZ 36157 99241 to SZ 36166 99280 (transect section 1.1) – complete removal of tall, dense scrub and small trees from within 5m of the channel bank-tops (year 1);
- SZ 35938 98802 to SZ 36163 99290 (transect section 1.1) – partial removal of tall bog myrtle from within 2m of both bank-tops where it is encroaching or enclosing the channel (year 1);
- SZ 36256 99706 to SZ 36259 99714 (transect section 1.3) – complete removal of scrub (primarily willow with some gorse) from within 5m of the channel bank-tops, and of bog myrtle from within 2m of both bank-tops (year 3);
- SZ 36267 99750 to SZ 36251 99778 (transect section 1.3) – complete removal of scrub (primarily willow with some gorse) from within 5m of the channel bank-tops, and of bog myrtle from within 2m of both bank-tops (year 3);

6.18. Shobley



Site condition:	**UNFAVOURABLE**
Reasons:	Site has become dominated by dense bog myrtle, bracken and areas of localised dense scrub.
Transects:	Transect section 1.3 fails on too few plants for oviposition and 1.4 fails on water flow; transect sections 1.1 and 1.3 fail due to the presence of bracken.
Damselflies:	13.70 per 100m (total seen: 73) during adult count transect surveys. *Medium* population strength based on a subjective assessment during the habitat attributes survey. It should be noted that time and / or weather criteria were not met for some transects during the habitat assessment.
Hydrology:	Predominately linear habitat across the site with the exception of transect section 1.3, which was a mix of linear and mire habitats; in a number of short reaches on transect section 1.1 the water flow appeared to either go through areas of loose soil (i.e. become subterranean), or the bank-top has collapsed over the channel to form a 'land bridge'.
Other Notes:	Dense areas of tall bog myrtle have developed along extensive reaches of the main channel (transect section 1.1) that flows through the valley bottom, and on the mire on the south and west valley side. The valley side to the north and east of the main channel is generally drier and dominated by dense bracken and scrub.

There was very little evidence of grazing at this site, with cattle and ponies observed only on the northern valley top. It is possible that the steep sided nature of this valley and associated dense bracken vegetation is limiting access to this site by livestock.

The area of wet mire habitat recorded during the 2013 habitat assessment survey was notably smaller than that recorded in 2004, and a further reduction in this area was observed between the two week period separating the habitat assessment and adult count surveys.

6.18.1. Habitat management recommendations

Priority level 1 – Immediate / Urgent Management Action Required

Shobley has become dominated by dense bog myrtle and bracken with areas of localised dense scrub development, particularly in association with transect section 1.1. Immediate management action is therefore required to reduce the coverage of these species to return the site to Favourable condition.

General Recommendations

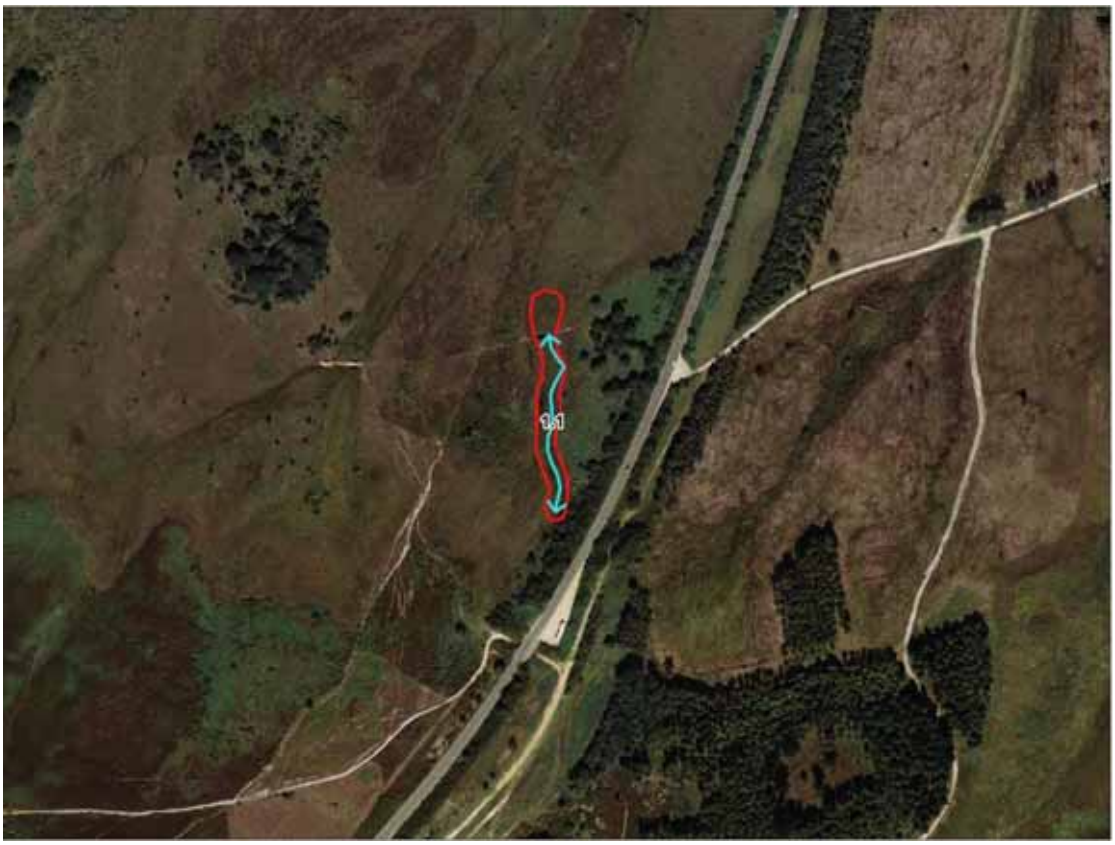
It is recommended that the selective removal of tree and scrub cover within 5m of the transect sections is undertaken across the site.

It is recommended that this is supplemented by a phased burn across the site, performed on the valley side to the north and east of the main channel in the next year, and to the south and west of the main channel in the following year.

Specific Recommendations

None

6.19. Stag Brake



Site condition:	**FAVOURABLE**
Reasons:	Passes on main attributes; small site but within 1km of Mill Lawn.
Transects:	Transect fails on too little bog myrtle.
Damselflies:	8.28 per 100m (total seen: 14) during adult count transect surveys. Population strength was *not assessed* based on a subjective assessment during the habitat attributes survey as no southern damselflies were recorded; it should be noted that weather criteria were not met during the habitat assessment.
Hydrology:	Linear in the south of the site, becoming a mire in the north.
Other Notes:	Limited management action required and field surveyor noted that recommendations of Strange & Bousfield (2004) appeared to have been implemented.

6.19.1. Habitat management recommendations

Priority level 3 – On-going / Future Management Action Required

Despite its small size and the low numbers of southern damselfly recorded, since the habitat conditions are considered to be suitable for supporting southern damselfly, and given its proximity to Mill Lawn, it is considered that there are no immediate or urgent management requirements at Stag Brake. However, on-going management will be required to maintain the suitability of the site for southern damselfly.

General Recommendations

It is recommended that a light burn is undertaken in 3-4 years to keep scrub and heather / coarse grasses in check.

Specific Recommendations

None

6.20. Stony Moors

Site condition:	**UNFAVOURABLE**
Reasons:	The site is isolated, relatively small and fails to meet criteria for water flow; concerns exist with regards to tree encroachment and density of bog myrtle across the north of the site.
Transects:	Transect sections 1.4 and 2.1 fail on water flow; transect section 1.4 also fails on poor bankside vegetation structure, with the mire comprised of uniformly low vegetation providing limited shelter for adults; transect section 1.2 fails on too much shade, transect sections 1.3 and 2.1 fail on too few plants for oviposition, and transect section 1.4 fails on too little stiff emergent vegetation.
Damselflies:	18.87 per 100m (total seen: 77) during adult count transect surveys. *Medium* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that time criteria were not met during some of the habitat assessments.
Hydrology:	Transect sections 1.1-1.3 are linear with a discernible or slow to moderate flow; transect sections 1.4 and 2.1 are mire without discernible flow.
Other Notes:	Transect sections 1.2 and 1.3 have become overgrown with dense bog myrtle, and there is the potential that bog myrtle will encroach further downstream in the near future. An area of potentially suitable habitat does extend beyond the upstream limit of transect section 1.4, though there was no discernible flow at the time of the habitat attribute survey.

6.20.1. Habitat management recommendations

Priority level 2 – Management Action Required

Stony Moor is relatively isolated (the nearest site is Clayhill Bottom over 2km away) with little to no opportunity of immigration from other known populations within the New Forest to consolidate this population. The extensive coverage of bog myrtle on transect sections 1.2 and 1.3, and the encroachment of trees and scrub on the former, is of concern for the future suitability of the site for southern damselfly. Management is required to reduce the coverage of these species and increase the diversity of the sward at the site.

The absence of flowing water in transects 1.4 and 2.1 (which had good to low flows in 2004) is also of concern. However, it is unclear whether this is actually a result of inappropriate management, or whether this simply reflects the drier conditions observed on almost all sites in 2013 (in comparison with 2004). Such a hydrological assessment is beyond the remit of this study, but it is considered likely that the most appropriate conclusion will be that the amount of permanent / perennial habitat available to southern damselfly is in fact smaller than originally assessed.

General Recommendations

It is recommended all tree or scrub cover within 5m of both banks of transect sections 1.1 and 1.2 is removed within two years, and that this is supplemented by partial clearance of all tall bog myrtle within a band of 3m width on both banks of transect sections 1.1-1.3.

It is also recommended that a specific hydrological assessment of the site is undertaken to determine whether water availability to the site can be increased.

Specific Recommendations

None

6.21. Three Beech Bottom

Site condition:	**UNFAVOURABLE**
Reasons:	Concerns exist regarding the availability of flowing water in the west of the site, and the limited amount of plants for oviposition on transect 2 to the east of the railway line.
Transects:	Transect sections 1.1-1.3 fail on water flow and 2.1-2.4 fail on too few plants for oviposition; transect sections 1.1, 1.4 and 2.1-2.4 fail on the presence of eutrophication.
Damselflies:	6.57 per 100m (total seen: 41) during adult count transect surveys; majority of damselflies recorded on transect 2. *Weak* population size based on a subjective assessment during the habitat attributes survey.
Hydrology:	Linear with slow to moderate flows on transect section 1.4 and transect 2; a discernible flow was recorded in only the lower (downstream) half of transect section 1.1, transect section 1.3 was damp at the time of survey, and 1.2 was completely dry.

Other Notes:

6.21.1. Habitat management recommendations

Priority level 2 – Management Action Required

The limited availability of flowing water within transect 1 is the key concern at Three Beech Bottom. However, this was also identified during the original surveys in 2004, and it is considered likely that this reflects the amount of permanent / perennial habitat available to southern damselfly on this part of this site.

However, it is considered that the suitability of transect 1 for supporting southern damselfly could be improved by reducing the density of purple moor grass vegetation within this area.

General Recommendations

It is recommended that a light burn is undertaken to check the growth of purple moor grass across all sections in transect 1 within two years, and then performed across transect 2 in the following year.

Specific Recommendations

None

6.22. Widden Bottom

Site condition:	**UNFAVOURABLE**
Reasons:	The site is relatively small, and concerns exist regarding the intermittency of flowing water through the length of the channel.
Transects:	Transect fails on water flow, with standing water or damp substrate recorded at 53% of sample points (Appendix 2).
Damselflies:	14.40 per 100m (total seen: 53) during adult count transect surveys. *Weak* population strength based on a subjective assessment during the habitat attributes survey; it should be noted that time criteria was not met during any of the habitat assessment.
Hydrology:	Predominately linear interspersed with short sections of mire; reaches of flowing water were present along most of the channel's length, but were regularly separated by reaches with no discernible flow or of damp substrate.
Other Notes:	

6.22.1. Habitat management recommendations

Priority level 3 – On-going / Future Management Action Required

The absence of flowing water throughout the length of Widden Bottom is the key concern at this site. However, the limited availability of flowing water across this part of the site was identified during the adult count survey conducted in 2004, and it is considered likely that this

reflects the amount of permanent / perennial habitat available to southern damselfly at this site.

However, it is considered that a reduction of the density of purple moor grass vegetation will need to be undertaken at regular intervals to maintain the suitability of the site for supporting southern damselfly.

General Recommendations

It is recommended that a light burn is undertaken to check the growth of purple moor grass within 3-4 years.

Specific Recommendations

None

6.23. Summary table and comparison with other assessments

Table 10 summarises the above assessments, and compares them with assessments from other sources. These comparisons must be considered with care, as the various assessments will be made at different times, and from different perspectives, using different criteria (with the exception of Harvey *et al*., 2005):

- Harvey *et al*., 2005: site condition assessments undertaken following similar criteria used in the current study (with the exception of modifications outlined in section 5).
- Stevens & Thurner, 1999: sites surveyed, damselfly populations categorised as:
    - Nil – no individuals counted on any of 3-4 visits;
    - Weak – 1-29 individuals counted on "best" visit;
    - Medium – 30-99 individuals counted on "best" visit;
    - Strong – 100 or more damselflies counted on "best" visit;
    - Some sites that could not be thoroughly surveyed were given assessments of "believed" strong or weak etc.
- Boyce, 2002: sites assessed on basis of extent of suitable habitat, this being defined as "an area of shallow, relatively slow-flowing water, without excessive encroachment of rank vegetation or scrub, with frequent soft emergent herbs and located within an area in which southern damselfly adults have been recorded since 1990"; where suitable habitat was found it was assessed as favourable if there was more than 200m of watercourse, and unfavourable if less than 200m, with a judgement as to whether the area of suitable habitat was stable, increasing or declining.
- Strange & Bousfield, 2004: assessment of site management requirements over a subsequent 5-10 year period.

Table 10: Current site condition assessments compared to other site assessments.

Site name	Damselflies per 100 m of transect	Site condition assessment	Site condition assessment in Harvey *et al*., 2005	Population strength in Stevens and Turner, 1999	Site assessment in Boyce, 2002	Summarised management recommendations from Strange & Bousfield, 2004
Acres Down	11.61	Unfavourable	Unfavourable	weak	Unfavourable, no change	requires clearance of scrub, bracken, and some bog myrtle
Bagshot Moor	7.26	Favourable	Favourable	weak	Unfavourable, no change	*not assessed*
Bull Hill	2.32	Unfavourable	Unfavourable	weak	Unfavourable, no change	remove trees and scrub
Clayhill Bottom	30.05	Unfavourable	Unfavourable	medium	Unfavourable, no change	light burn in 3-4 years
Common Moor	34.33	Unfavourable	Unfavourable	weak	*not assessed*	requires increased grazing and/or burn to remove *Molinia* and some scrub clearance
Crockford Stream (Lower)	26.64	Unfavourable	Unfavourable	believed strong	Favourable	remove scrub, partial removal of bog myrtle
Crockford Stream (Upper)	30.87	Favourable	Favourable	strong / believed strong	Favourable	some removal of scrub and bog myrtle
Dibden Bottom	0.00	Unfavourable / Extinct?	*not assessed*	weak	Unfavourable, no change	*not assessed*
Duckhole Bog	1.43	Unfavourable	Unfavourable	weak	Favourable	remove scrub and *Molinia*
Foulford	0.38	Unfavourable	Unfavourable	*not assessed*	*not assessed*	extensive removal of trees/scrub
Hatchet Stream	8.16	Favourable	Favourable	medium	Favourable	light burn in 4-5 years
Howen Bottom	0.00	Unfavourable / Extinct?	*not assessed*	*not assessed*	*not assessed*	*not assessed*

Site name	**Damselflies per 100 m of transect**	**Site condition assessment**	**Site condition assessment in Harvey *et al*., 2005**	**Population strength in Stevens and Turner, 1999**	**Site assessment in Boyce, 2002**	**Summarised management recommendations from Strange & Bousfield, 2004**
Kingston Great Common	*not assessed*	*not assessed*	Favourable	*not assessed*	*not assessed*	burn 3-4 years
Latchmore	25.73	Favourable	Favourable	strong / believed strong	Favourable	partial removal of bog myrtle
Mill Lawn	11.44	Unfavourable	Unfavourable	medium / strong	Favourable	light burn and slightly reduced grazing on lawns, mire restoration to the east
Millersford Bottom	18.29	Unfavourable	Unfavourable	medium	Unfavourable, no change	extensive mire restoration
Round Hill	17.31	Unfavourable	Unfavourable	strong	Unfavourable, no change	remove trees and scrub
Shipton Bottom	44.51	Favourable	Favourable	believed strong	Favourable	requires burn in 3-4 years
Shobley	13.70	Unfavourable	Unfavourable	*not assessed*	*not assessed*	burn in 5-6 years
Stag Brake	8.28	Favourable	Favourable	weak	Favourable	remove scrub
Stony Moors	18.87	Unfavourable	Unfavourable	medium	Favourable	remove trees and scrub
Three Beech Bottom	6.57	Unfavourable	Unfavourable	weak / believed strong	Favourable	burn in 6-7 years (Setley Plain burn in 3-4 years)
Widden Bottom	14.40	Unfavourable	Unfavourable	weak	Unfavourable, no change	burn in 3-4 years

All sites re-assessed within the current study were considered to be in the same condition category (i.e. Favourable or Unfavourable condition) that they judged to be within during the original study by Harvey *et al*. (2005).

6.24. Summary of reasons for Unfavourable assessments

The reasons for judging sites as Unfavourable were:

- too shady / encroached by scrub (10 sites);
- too small and / or isolated (8 sites);
- concerns over lack of water or poor flow (8 sites);
- too few plants for oviposition (6 sites);
- adjacent to clearly unfavourable habitat that could be restored (4 sites);
- poor vegetation structure, lack of shelter for adults (3 sites);
- extensive presence of bracken (2 sites);
- fragmentation within site (1 sites);
- extensive presence of eutrophication (1 site).

Sites were judged to be in an Unfavourable condition for markedly similar reasons to those provided by Harvey *et al*. (2005) in the original Favourable Condition assessment; the four principal reasons for Unfavourable condition of sites in the original study were identified as too much shade / encroachment by scrub (10 sites), small size (6 sites), concerns over lack of water or poor flow (5 sites), and isolation (3 sites).

6.25. Summary of management recommendations

Table 11 provides a summary of the management actions recommended for each site and the potential timescale for their implementation. It is important to emphasise that these recommendations specifically relate to actions that would enhance the habitat at the site for southern damselfly. It is essential that other interest features of the New Forest SAC and

associated SSSIs, protected species, and protected habitats are considered when determining the selection and delivery of works. Where possible, timing of the works should be scheduled to minimise the risk of negatively impacting the site and its associated flora and fauna. The authors consider that these factors can be addressed through the application of due process.

There has been only limited assessment of the success of previous habitat enhancements implemented to benefit southern damselfly, and concerns regarding the extent and severity of some of these works have been raised by local, independent specialists. It was specified that, on a small number of occasions, over-enthusiastic clearance of in-channel or bankside vegetation had a negative effect on the strength of the southern damselfly populations in at least the short-term. In light of this, the following recommendations are made in association with the management actions proposed in sections 6.1-6.22:

- All burning must consider how best this may be managed to avoid pollution of the watercourse (Purse, 2002) and be undertaken in the phased approach specified above where appropriate;
- The removal of bog myrtle and other bankside herbs should be undertaken using hand-tools (including powered-tools) only, and mechanical clearance of any kind should be avoided;
- When clearing bankside vegetation such as bog myrtle, it is strongly advised that intermittent smaller plants or tussocks are retained to provide sheltering and roosting opportunities for adults – for example Strange and Bousfield (2004) recommended that the partial removal of bog myrtle should include retaining approximately two smaller plants per $2m^2$ of area cleared;
- A phased or rotational approach to bankside clearance must be adhered to where specified, to ensure adequate adult habitat is retained within the wider site;
- Works undertaken during (a minimum of) the first three years of the programme should be undertaken in a conservative manner, and any concerns regarding their potential negative effects recorded;
- An annual review meeting should be held at the end of each summer (i.e. August / September) to discuss the success of the previous years' work, incorporating the results of the annual species monitoring work (see section 8.3) and any concerns raised during delivery; the outcomes of these discussions should be used to inform the implementation of the following autumn / winter's work.

Table 11: Management action plan.

Priority 1 - Immediate / Urgent Action	Priority 2 - Management Action Required		Priority 3 - On-going / Future Management Recommendations		No Management Action Recommended
Acres Down Rotational clearance of bracken and bog myrtle	**Bagshot Moor** Removal of woody plant species from channel and partial removal of bog myrtle as appropriate	**Acres Down** Rotational clearance of bracken and bog myrtle	**Upper Crockford** Light burn across the length of transect sections 1.4, 1.6 and 1.7	**Acres Down** Rotational clearance of bracken and bog myrtle	**Dibden Bottom** The presence of southern damselfly at the site should be confirmed before any management action is implemented for this species
Clayhill Bottom Removal of tree and scrub cover from transect section 1.1, and associated light burn of bank-top vegetation where appropriate	**Bull Hill** Removal of tree and scrub cover between transect sections 1.2-1.4 (inclusive); partial clearance of bog myrtle from main channel at site as appropriate	**Clayhill Bottom** Light burn of habitat surrounding transect section 1.3	**Foulford** Assess current intrinsic value and, if considered appropriate, selective removal of trees and scrub and partial clearance of bog myrtle downstream of transect section 1.3	**Hatchet Stream** Burn on opposite bankside along length of transect; removal of scrub prior to burning as appropriate	**Howen Bottom** The presence of southern damselfly at the site should be confirmed before any management action is implemented for this species
Duckhole Bog Removal of scrub along the length of the transect, extending below the southern limit of the transect to potentially increase suitable habitat	**Clayhill Bottom** Light burn of habitat surrounding transect section 1.2	**Lower Crockford** Wide spread clearance and removal of trees and scrub and partial removal of bog myrtle where appropriate	**Hatchet Stream** Burn on one bankside along length of transect; removal of scrub prior to burning as appropriate		
Foulford Burn along the length of transect sections 1.1 and 1.2; clearance of willow immediately upstream of transect section 1.1; partial removal of bog myrtle and complete clearance of gorse within mire habitat of transect section 1.3	**Common Moor** Partial clearance and removal of bog myrtle and purple moor grass through cutting (preferred) or burning (if necessary)	**Upper Crockford** Removal of tree and scrub cover as appropriate; removal of bog myrtle where encroaching and enclosing the channel	**Mill Lawn** Light burn across those areas at a later stage of succession		

Priority 1 - Immediate / Urgent Action	Priority 2 - Management Action Required		Priority 3 - On-going / Future Management Recommendations		No Management Action Recommended
Mill Lawn Clearance of gorse scrub that separates transect sections 1.4 and 1.12	**Latchmore** Clearance of scrub from bank-tops along transect section 1.2 and 1.3 as appropriate; cutting back or burning of bog myrtle and grasses from transect section 1.2 as necessary	**Duckhole Bog** Light burn across the site	**Round Hill** Monitor potential encroachment of transect 1.3 and manage as required		
Round Hill Removal of trees and scrub between transect sections 1.4 and 2.1; clearance of bracken at junction of transect sections 2.1 and 2.2	**Millersford Bottom** Light burn across the western part of the site (i.e. west of Millers Ford)	**Latchmore** Cutting back (by hand) or burning of bog myrtle and grasses from transect section 1.3 as necessary	**Stag Brake** Light burn across the site		
Shipton Bottom Removal of trees and scrub along transect 1.1 as appropriate; burn of western arm of upper part of site	**Round Hill** Removal of trees and scrub associated with transect 2 as appropriate; partial clearance of bog myrtle associated with transect 2 as necessary	**Millersford Bottom** Light burn across the eastern part of the site (i.e. east of Millers Ford)	**Widden Bottom** Light burn across the site		
Shobley Removal of tree and scrub cover as appropriate; burn habitat to the north and east of main channel (transect section 1.1)	**Shobley** Burn habitat to the south and west of main channel (transect section 1.1)	**Round Hill** Extensive tree, scrub and bracken removal associated with transect 3; partial removal of bog myrtle associated with transect 3 as necessary.			
	Stony Moors Remove tree and scrub from bank-tops of transect section 1.1 and 1.2; clearance of tall bog myrtle from transect sections 1.1-1.3	**Shipton Bottom** Removal of trees and scrub along transect 1.3 as appropriate; burn of eastern arm of upper part of site			
	Three Beech Bottom Light burn across all sections in transect 1	**Three Beech Bottom** Light burn across all sections in transect 2			

7. Discussion

7.1. Condition assessment of New Forest sites for southern damselfly

The key reasons for the unfavourable conditions of southern damselfly sites are under-management, the level of isolation and associated limited opportunities for immigration / emigration, small site size, and concerns regarding lack of water security and poor flow.

Under-management of vegetation, in order to suppress successional change, is considered to be the principal cause of Unfavourable condition at the site level. It is emphasised that the term 'under-management' within this document specifically refers to the level of management pressure required to suppress successional change and maintain a bank-top vegetation structure that is suitable for southern damselfly. This under-management, and the associated development of unsuitable habitat conditions at a later stage of succession, results in the deterioration / loss of suitable in-channel and bankside habitat, prevents the expansion of populations to adjacent (potentially suitable) areas, and results in the fragmentation of suitable habitat within an individual site.

The management of vegetation in the New Forest is implemented passively through extensive grazing by (predominantly) ponies and cattle, and the more active method of cutting and / or burning areas of dense woody vegetation. Though it is accepted that there has been a substantial increase in grazing pressure across the New Forest as a whole in the last 60 years (Cox, 2013), it is considered that the grazing pressure associated specifically with most southern damselfly sites is generally insufficient to suppress successional change, in particular the encroachment of linear features by scrub. The mechanism(s) driving this are not fully understood, but it is suggested that grazing animals will preferentially select areas or vegetation types other than those associated with southern damselfly sites. As a consequence, to maintain vegetation conditions suitable for southern damselfly, more active management (as is undertaken at various other locations across the New Forest SAC) is required to manage the dense and woody vegetation that has developed at a number of southern damselfly sites (see section 6.1-6.22).

The impacts of under-management are exacerbated by the small size of a number of these sites. Large sites are considerably more robust and able to withstand localised deterioration or temporary loss of habitat, retaining areas of suitable habitat within the site from which re-colonisation of under-managed areas can occur once habitat suitability has been improved or returned. Smaller sites are inherently less robust to the deterioration or loss of habitat, with a lower capacity to sustain viable numbers of southern damselfly, and therefore at greater risk of being lost.

The availability and distribution of flowing water is a particular concern at a number of sites. At those sites included within both studies, the area of potentially suitable habitat available to southern damselfly was significantly lower in 2013 than in 2004 (see section 4.2.2), primarily a result of a reduction in the non-linear habitat present at many sites. It is understood that no significant new abstractions of the aquifers supplying southern damselfly sites have been approved in that time, and that the differences observed in water availability / distribution will almost certainly be due to prevailing climatic conditions (Environment Agency, personal communication). It is therefore important that the year-on-year size of suitable habitat is accurately known to determine the robustness of a site, as an over-estimate of the size of available habitat could affect its condition assessment. Furthermore, it is important that the distribution of water across the sites is understood and monitored, as changes in their hydrology over time due to a lack of management (i.e. increased levels of scrub and trees cover resulting in drier conditions) or removal of infrastructure (i.e. Crockford Stream [Upper]) may substantially alter the area of suitable habitat available.

Isolation is considered to be the other main reason for the unfavourable condition of a number of sites. Sites present within a wider 'complex' (i.e. within the dispersal range of <1km for this species) will be considered to be more robust due to immigration / emigration between sites, which will both increase genetic diversity within the individual populations, but also allow for the re-colonisation of under-managed areas / sites once habitat suitability has been improved

or returned. This is particularly crucial to maintain the integrity of smaller sites, but all isolated sites (i.e. >1.5km from the nearest site) will be at risk from extinction due to chance 'events' such as pollution, inappropriate management or unintentional heathland fire.

7.2. Condition assessment of the New Forest SAC for southern damselfly

Despite over 50% of the area included within this study assessed to be in Favourable condition, two sites (Crockford Stream [upper] and Shipton Bottom) within the "Crockford Complex" account for 8.46ha of the total 12.25ha of favourable habitat. Therefore, favourable habitat is considered to be relatively limited and fragmented (Figure 8), with southern damselfly in the New Forest predominantly represented by small, fragmented populations, with limited opportunities for immigration / emigration or the colonisation of new sites.

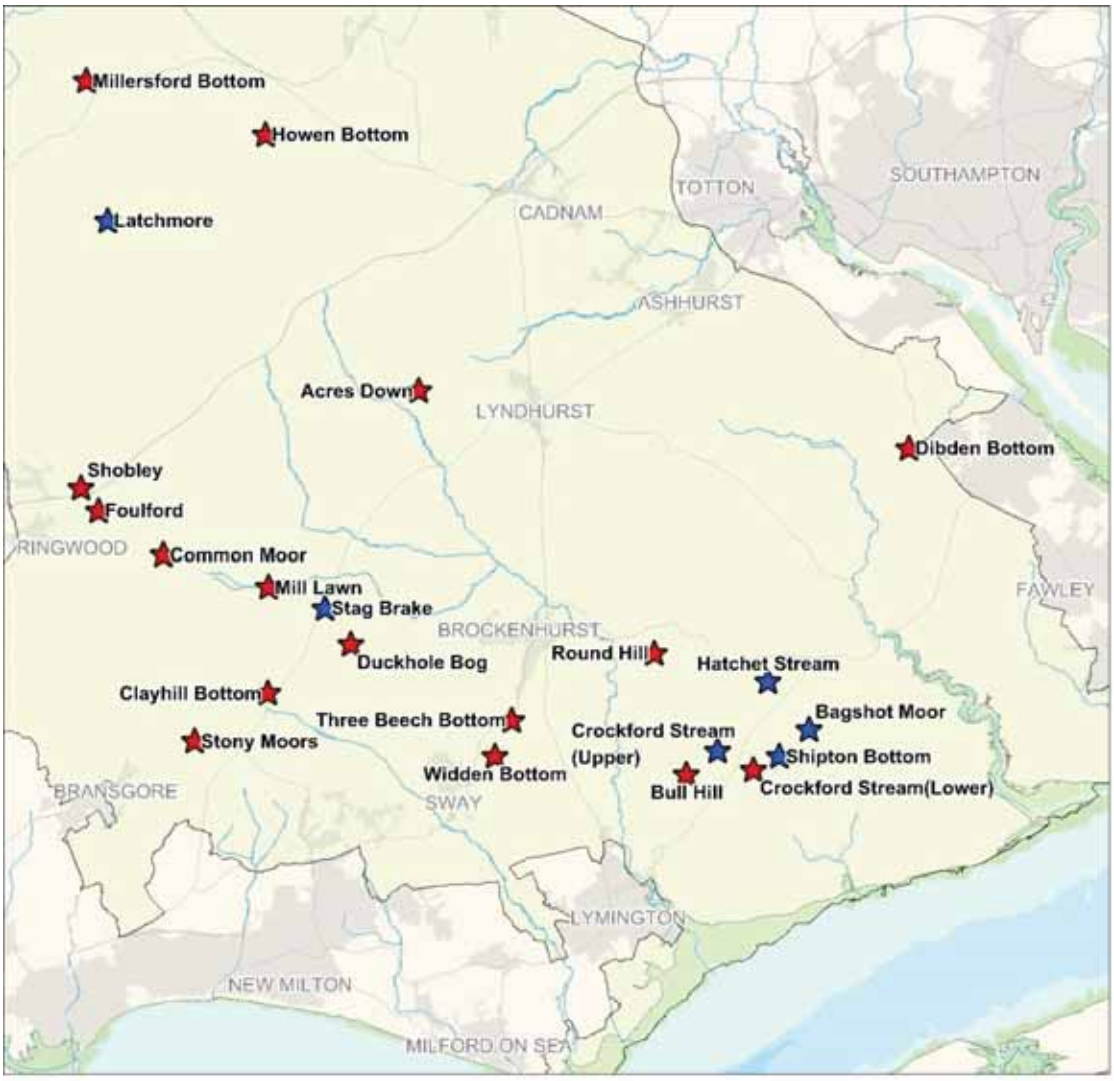


Figure 8: Map showing the location of sites in Favourable (blue) and Unfavourable (red) condition.

Meta-population theory (e.g. Hanski, 1999 cited in Rouquette, 2005) has shown that the presence of several interconnected populations in a fragmented landscape increases the probability of the long-term persistence of insect populations. The loss or decline in the suitability of sites occurring in parallel with the appearance of new suitable habitat / sites, resulting in no net decline in the condition or overall number of sites.

The unfavourable condition of a number of southern damselfly sites due to under-management is considered to be an indication that many sites are declining in their suitability to support this species. Furthermore, it is considered likely that a number of sites have been

lost in the New Forest since the systematic survey of Hampshire undertaken in 1998 (Stevens & Thurner, 1999). Both historic sites assessed within this study were considered to be in Unfavourable condition, and no southern damselfly were recorded at either. In addition, only one (Frogmoor) of four other former sites (i.e. Nomansland, Blackwell Common and Rowbarrow Pond Inlets) subject to a short walk-over survey under the appropriate conditions, provided a suitable water flow regime to support this species, with a total of three adult males recorded along the 180m length of watercourse surveyed.

With sites both being lost or declining in suitability, it is essential that either new sites are created and / or unfavourable sites are restored to allow the New Forest populations to function as a stable meta-population(s). To the authors' knowledge, no new sites have been intentionally created for southern damselfly within the New Forest since 1998, though it is recognised that sites may have emerged from recent river restoration and Inclosure clearances. Furthermore, given that under-management is the key cause of Unfavourable condition at the site level, it is considered unlikely that sites will have been created / restored naturally through the existing management regime prevailing in the New Forest.

For the reasons outlined above, there is evidence to support the assumption that there has been a net decline in the condition and overall number of southern damselfly sites in the New Forest. However, given the limited frequency (this study being the first in nine years) and quantity of formal data collected for re-assessment, and the associated difficulties / limitations in comparative analysis as outlined in section 5, it is not considered appropriate to assess whether the status of southern damselfly is in decline or recovery based on the strict parameters of the Favourable Condition assessment process. Furthermore, the original study undertaken by Harvey *et al*. (2005) provides the most recent assessment of the status of the southern damselfly sites in the New Forest preceding its designation as a SAC, and all sites re-assessed within the current study were assigned to the same condition category (i.e. Favourable or Unfavourable condition) as this original assessment.

It is therefore the conclusion of these authors that the New Forest SAC remains in an Unfavourable condition for southern damselfly, though this is ultimately a judgement for Natural England to make.

7.3. Achieving Favourable condition for southern damselfly

It naturally follows that to achieve Favourable condition of the New Forest SAC for southern damselfly, the reasons for its failure must be addressed. The potential mechanisms to rectify the under-management of existing southern damselfly sites is outlined in sections 6.1-6.22, and summarised in section 6.25. However, addressing the highly fragmented distribution of this species in the New Forest is more complex.

For southern damselfly sites to function as a meta-population, new sites within the dispersal range of this species must be created between existing populations. Movements of up 500m by southern damselflies have been readily observed, and longer distances have been achieved along continuous lines of habitat, but rarely over 1km (Purse, 2002; Rouquette, 2005). It is recommended therefore, that areas of suitable habitat are created (either through the application of appropriate management or capital works similar to those outlined in section 6.25) within 500m to 1km of existing sites to act as 'stepping stones' that would re-connect these populations.

Due to the specific requirements of this species (as set out in section 2.1.3), the selection of sites needs to be undertaken with careful consideration. The geology of the New Forest is varied and complex, and it is fully accepted there will be areas of the New Forest that are entirely unsuitable for southern damselfly, and that the creation of a single meta-population connecting sites throughout the New Forest is likely to be unfeasible. The objective should be to ensure that all sites are within the dispersal range of its nearest adjacent site, resulting in the creation of a number of localised meta-populations as is currently present in association with the "Crockford Complex" (i.e. Bagshot Moor, Bull Hill and Hatchet Stream).

Sites that have formerly supported this species are considered to be the most logical starting point in the selection of areas for the creation / restoration of suitable habitat (Figure 9), and the most realistic locations will be those where the loss of habitat was as a result of under-management. However, three of the additional four former southern damselfly sites visited (i.e. Nomansland, Blackwell Common, Rowbarrow Pond Inlets) did not support areas of open water with a discernible water flow, and year-round flowing water must be secured before measures are implemented to try and create / restore the other required habitat conditions for this species. Furthermore, these sites are all located beyond the natural dispersal range of this species, and additional sites between them and the appropriate extant population would need to be created for sites to be re-colonised naturally.

Figure 9: Map showing all sites where a population of southern damselfly have been recorded since January 1998, with sites included within the current study shown in blue, all other sites in orange, and the area within the National Park boundary shown in pale green.

It is therefore recommended that a feasibility study be undertaken to determine the most suitable areas for habitat creation / restoration for this species. This study should develop the work undertaken by Hayward (2011), and would need to focus on three key elements; the hydrology and geology of the sites, the value of its geographical location in facilitating the creation of dynamic meta-populations, and whether the mechanisms can be put in place to ensure it is appropriately managed for the foreseeable future. Of these elements, the hydrological assessment is likely to be most complex and, in light of the concerns regarding the lack of or poor water flow at a number of existing sites, it is recommended that an assessment of all known extant and potential future sites be undertaken as a matter of some

urgency. Within the context of this hydrological assessment, it is important that the history of any previous engineering of the watercourse(s) is considered.

8. Recommendations for future site condition assessment monitoring

8.1. Site selection and future assessment of Favourable Condition

Solely assessing the condition of extant populations on a six year basis fails to properly assess the condition status of the New Forest SAC for southern damselfly, as this could entail assessing a diminishing number of sites. As recommended by Harvey *et al*. (2005), additional sites should be introduced to the next round of monitoring, including all sites that have recently lost their southern damselfly population, and from any sites where habitat has been specifically restored / created for this species (see section 7.3). It is recommended that the former include all sites in the New Forest that this species was recorded at (i.e. did not record a 'nil' result) during the systematic survey of Hampshire undertaken in 1998 (Stevens & Thurner, 1999).

With reference back to the meta-population theory (see section 7), the objective will primarily be to ensure that all sites are in Favourable condition in terms of meeting the habitat attribute criteria. It is important to emphasise that not every single suitable site must be occupied by the species in the New Forest for it to function as a viable meta-population. Therefore, the presence / absence and relative strength (see section 8.3) of this species at most, but not all, of the suitable patches is relevant and important, but is not essential to the SAC achieving Favourable condition. Instead, it is proposed that for the SAC to be considered in Favourable condition for southern damselfly, there should be no net loss in the number of sites occupied by southern damselfly since 1998 (the only known systematic survey prior to the selection of the New Forest as a candidate SAC), and that all unoccupied sites are in Favourable condition (with regards to habitat), and within the dispersal range (<1km) of an extant population.

It is noted that this criteria would require both the removal of Howen Bottom from, and the inclusion of Kingston Great Common in, future site monitoring. This is supported by the authors since southern damselfly have not been recorded at Howen Bottom since 1984 and the site was assessed as unsuitable for this species by Hayward (2011), and Kingston Great Common was only excluded from this study as a result in difficulties in securing access permission.

It is recommended that the GIS maps created during this study should be used as the basis for future site monitoring, ideally using an updated set of aerial photographs if available. Furthermore, a similar route and number of samples should be used for repeat habitat sampling, although there is no need for transect sections / sample numbers to be identical, and consideration should be given to removing those transect sections (e.g. Mill Lawn 2.1) identified as being entirely unsuitable in both the 2004 and current study.

8.2. Habitat Monitoring

The site condition assessments in 2013 required some subjective appraisal in addition to the interpretation of the sample data, and it could be argued that a more subjective assessment would suffice, without the need for extensive sampling. However, it is strongly recommended that similar habitat monitoring is carried out again for the next round of condition assessment for the following reasons:

- it provides good data to monitor changes in the sites, even if their overall condition remains unaltered (as identified during the comparison of 2004 and 2013 data during this study);
- it will allow for the identification of specific locations where future management works should be focused; and
- it will allow for the identification of any specific changes in habitat conditions as a result of future management works, which is considered essential so that management actions and programmes can be reviewed and developed as appropriate (to ensure that future works are successful in maintaining / restoring / creating suitable habitat for southern damselfly).

It is recommended that the following habitat attributes are recorded as they were in 2013 (see section 3.2 for details):

- habitat type;
- water flow;
- percentage cover of emergent broad-leaved herbs;
- percentage of channel / sample area in shade from overhanging bankside shrubs and trees;
- percentage cover of bog myrtle in watercourse;
- presence / absence of bracken *Pteridium aquilinum;*
- evidence of eutrophication;
- bankside vegetation structure;
- relative abundance of stiff emergent vegetation;
- percentage of channel substrate types.

Furthermore, it is recommended that additional notes are recorded for each 100m length of transect recorded as they were in 2013 (see section 3.2 for details):

- evidence of grazing;
- hydrology of the site;
- vegetation structure across the wider site and any evidence of succession;
- vegetation structure of the adjoining habitat and the opportunity from southern damselfly expansion from the site.

It is recommended that the percentage cover of broad-leaved submerged vegetation is recorded to assess the availability of plants for oviposition in the next round of monitoring, as this will ensure that temporary elevated water levels do not result in a site / transect section failing on oviposition (i.e. Hatchet Stream / Crockford Stream [Upper]), whilst guaranteeing that sites / transect sections with limited opportunities for oviposition do not pass on oviposition due to the presence of submerged grasses (e.g. Three Beech Bottom).

It is recommended that the percentage cover of open water is included as an additional habitat attribute in the next round of monitoring. Adult southern damselflies are more likely to be associated with areas of open water, rarely occurring where the channel is choked by vegetation (Rouquette, 2005). Although a series of measures of vegetation cover are included within the habitat attributes recorded, it is possible that these could in combination result in a choked channel whilst individually being below their upper limits, and it is therefore considered that a specific measure of open water is required.

Given the importance of spatial dynamics for southern damselflies to function as meta-population(s) at a landscape scale (see section 7), an assessment of the connectivity and size of sites is considered to have an important bearing on site assessments. In the original study (Harvey *et al*., 2005), these dimensions were assessed qualitatively using maps. In the current study, quantitative measures were assigned to this parameter based on current research (Watts *et al*., 2004; Rouquette, 2005) and the authors experiences, with sites of less than 0.5ha considered small, and a site over 1.5km from the nearest extant population considered isolated. It is recommended that these figures are re-assessed for the next round of monitoring based on up to date knowledge of viable population sizes, the dispersal capabilities of this species and the proposals on site selection and condition assessment provided in section 8.1.

8.3. Species Monitoring

Gaining robust monitoring data for adult damselflies is not easy; the ability to determine the presence and size of populations is strongly influenced by the weather conditions at the time of recording, and the timing of the main flight period can vary substantially from year to year. To overcome this difficulty, two different approaches to species monitoring are recommended, and one should be selected according to the level of monitoring effort available.

As a minimum requirement for the Favourable Condition assessment, it is recommended that formal adult counts, following the criteria outlined in section 3.3, are conducted at all sites

(see sections 7.2 and 8.1) included within the next round of monitoring. Future rounds of monitoring should be undertaken every five years, or every five and then seven years to keep broadly to Natural England's six year condition assessment cycle, to take into account the semi-voltine development of this species and ensure that both cohorts are being monitored. In addition to the collection of abundance data, it is recommended that surveyors are provided with a hand-held GPS and map of all transect sections overlain with the relevant 10m by 10m grid squares (Figure 10). Using the hand-held GPS, the map should be annotated to show all the grid squares where adult male southern damselfly are recorded. This will potentially allow for changes in distribution within the site to be monitored, and would be particularly useful for identifying responses to management action implemented between monitoring rounds.

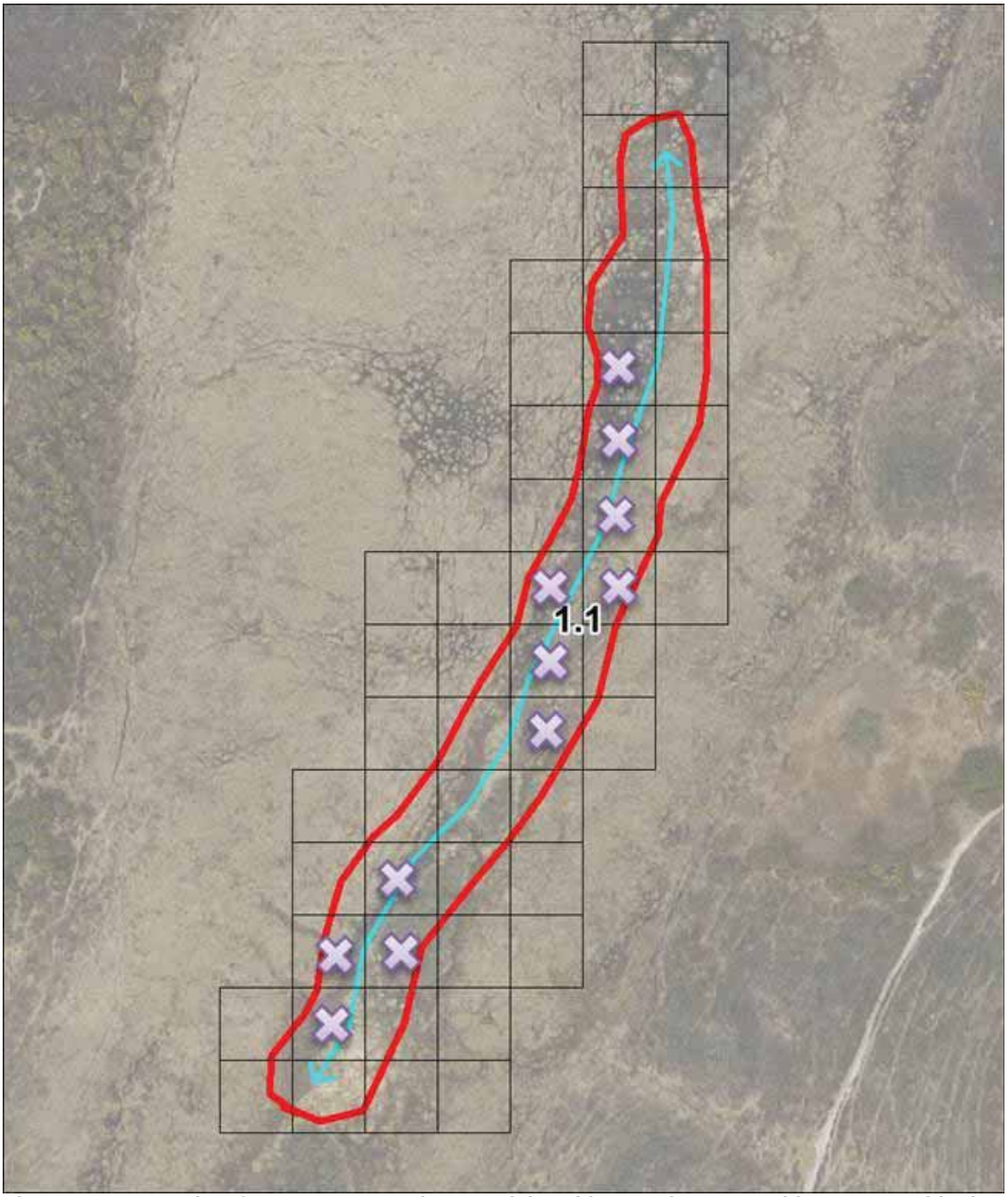


Figure 10: Example of a transect section overlain with 10m by 10m grid squares with the presence of adult male southern damselflies represented by a cross within the relevant square.

It is recommended that formal adult counts are supplemented, but not replaced by, informal counts during the habitat attribute surveys. Informal counts are useful and have been shown to significantly correlate with formal adult counts at the site and transect section level (see

section 4.3). However, it is apparent that the appropriate time, date and weather criteria must be met for both surveys for the numbers to accurately correspond at an individual site, and it is considered highly unlikely that all habitat attribute surveys could be completed if the same restrictions on date, time and weather were applied.

It is recommended that an assessment of population strength is then made from the highest count using the criteria outlined in section 4.3 (i.e. not assessed, weak, medium, strong). This data should be used to inform the condition assessment process, with not only no net loss in the number of sites occupied by southern damselfly in the New Forest SAC required for Favourable Condition status (see section 8.1), but for there also to be no reduction in the ratio of strong-medium-weak populations.

It is considered that calculating a measure of damselflies per $10m^2$ is not informative and should be removed from any future analysis, as a different method of assessment (focusing exclusively on oviposition habitat) was employed when this measure of density was used to assess 'Favourable' condition (Boyce, 2002). Furthermore, comparative measures of adult male damselfly abundance (damselflies per 100m) is also considered to be of limited value if this minimum level of monitoring is adopted, as there still remains insufficient data to set a robust value of damselflies per 100m to reflect strong, medium or weak populations at either site level, or for the New Forest as a whole.

In order to assess damselfly population status at site and transect section level more accurately, transect routes will need to be sampled more frequently. Harvey *et al*. (2005) suggested that population estimates could be derived from *ad hoc* records collated by the British Dragonfly Society (BDS). However, it is considered that this would be of only limited value, simply providing evidence of presence (and may be distribution) at a site, but could not be used for comparative analysis as neither the survey effort nor the data resolution (e.g. males only, both sexes, actual counts, estimated counts, etc.) could be standardised.

Harvey *et al*. (2005) also recommended it should be possible to encourage local BDS and Trust volunteers to help carry out a more rigorous, formal survey programme. Support for such volunteers could be provided by BDS, the Forestry Commission and / or the Trust, so that volunteers were equipped with clear site maps and instructions, and provided with training and expenses as required. Health and Safety issues would also have to be addressed, as these sites are potentially hazardous, and lone working is not recommended.

If volunteers were to be engaged to carry out surveys, it is strongly recommended that the methodology for the Favourable Condition assessment is strictly followed for all surveys to allow for direct comparison with the results of the formal condition assessment. It is considered that the level of survey effort should be tailored to the level of interest from volunteer surveyors and the resources available from the co-ordinating organisation(s). If volunteers and / or resources are limited, then it is recommended that a minimum of six sites are selected for detailed assessment, and that the remaining sites are surveyed once every three-years on a rolling programme.

The sites selected for detailed assessment should cover the range of perceived population strengths and must include sites subject to management action in the immediate future, so that the success and / or impacts of these works can be assessed and used to develop future management actions / programmes. These sites should be visited fortnightly through the main flight period if possible, or on a minimum of four occasions with at least two visits (separated by at least one week) between the 20th June and 5th July. The counts collected during these surveys should then be analysed prior to the next round of monitoring to determine whether it is appropriate to set values of damselflies per 100m to reflect strong, medium or weak populations for the New Forest as a whole. If the setting of such values is considered appropriate, then their use in the next round of the condition assessment process should be considered.

If volunteers and / or resources are more readily available, then it is recommended the number of sites selected for detailed assessment is increased.

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Appendix 1: Summary of habitat sample data, showing the average (mean or mode as appropriate) value of each recorded attribute.

Site name	Mode of water flow	Mean % channel shaded from overhanging trees/shrubs	Mode of left bankside vegetation structure	Mode of right bankside vegetation structure	Mean % cover emergent broad-leaved herbs	Mean % cover bog myrtle	Mode of bracken present	Mode of stiff emergent vegetation	Mean % substrate boulder	Mean % substrate pebbles	Mean % substrate gravel	Mean % substrate sand	Mean % substrate silt/mud/peat	Mode of eutrophication present?
Acres Down	Fl	14.37	MG	MG	7.34	9.41	Not present	F	0.00	0.24	0.24	0.73	98.78	Not present
Bagshot Moor	Fl	17.92	MS	MG	35.83	13.75	Not present	F	0.28	1.86	1.31	0.42	96.42	Not present
Bull Hill	Fl	22.67	MG	MG	20.38	4.40	Not present	S	0.84	16.51	6.20	1.36	74.87	Not present
Clayhill Bottom	Fl	17.85	MG	MG	16.60	7.10	Not present	F	0.00	29.25	53.25	7.00	10.50	Not present
Common Moor	Fl	1.43	MG	MG	4.57	27.86	Not present	F	0.00	0.00	0.00	0.00	100.00	Not present
Crockford Stream (Lower)	Fl	25.93	MS	MS	19.23	9.02	Not present	S	0.62	18.40	5.89	2.41	72.67	Not present
Crockford Stream (Upper)	Fl	10.91	MG	MG	16.90	11.17	Not present	S	0.28	12.47	5.70	6.24	75.37	Not present
Dibden Bottom	Da	50.95	MS	UL	13.10	15.10	Not present	S	0.00	0.00	0.00	0.00	100.00	Not present
Duckhole Bog	Fl	3.75	MG	MG	31.67	10.83	Not present	F	0.00	0.00	0.00	0.00	100.00	Not present
Foulford	Fl	15.84	MG	MG	24.74	9.58	Not present	F	0.97	0.29	0.48	3.23	95.03	Not present
Hatchet Stream	Fl	3.86	MG	UL	15.01	5.64	Not present	F	0.75	16.42	11.26	1.85	66.39	Not present
Howen Bottom	Fl	4.36	UL	UL	29.46	0.00	Not present	F	2.71	10.46	7.07	20.18	61.18	Not present
Latchmore	Fl	9.21	MG	MG	30.25	7.15	Not present	F	0.44	0.99	0.33	1.71	96.53	Not present
Mill Lawn	Fl	5.91	UL	MG	32.43	4.18	Not present	F	0.00	0.09	1.66	1.34	96.92	Not present
Millersford Bottom	Fl	16.66	MG	MG	23.96	4.20	Not present	F	1.32	3.42	2.52	0.65	92.20	Not present
Round Hill	Fl	18.48	MG	MG	27.56	5.96	Not present	F	0.25	5.52	5.71	5.65	82.94	Not present
Shipton Bottom	Fl	16.54	MG	MG	19.72	7.33	Not present	F	0.29	9.97	4.89	6.27	78.64	Not present
Shobley	Fl	17.25	MG	MG	23.95	10.82	Not present	F	0.00	0.28	0.25	1.87	97.60	Not present
Stag Brake	Fl	0.00	MG	MG	24.12	0.00	Not present	F	0.00	0.00	0.00	2.94	97.06	Not present
Stony Moors	Fl	9.13	MG	MG	21.89	15.18	Not present	F	0.00	0.00	0.00	0.13	99.87	Not present
Three Beech Bottom	Fl	1.04	MG	MG	13.46	15.70	Not present	F	0.00	0.03	1.42	0.66	96.55	Present
Widden Bottom	Fl	0.35	MG	MG	27.35	8.91	Not present	F	0.00	0.00	0.59	0.29	99.12	Not present

Appendix 2: Percentage of sample points falling outside the Favourable condition limits of each transect section.

Site and transect section	% no flow	% too much shade	% vegetation structure not MG on either bank	% too few emergent	% too many emergent	% too much bog myrtle	% not enough bog myrtle	% bracken present	% non frequent stiff emergent	% not enough silt/ mud/ peat	% eutrophication present	% samples mire	% samples linear
Acres Down 1.1	50	20	20	80	0	0	60	10	20	0	10	100	0
Acres Down 1.2	0	0	9	91	0	0	64	55	36	0	18	9	91
Acres Down 1.3	14	14	0	100	0	0	29	14	43	0	14	0	100
Acres Down 1.4	50	38	12	88	0	0	62	75	12	0	12	0	100
Acres Down 1.5	20	0	0	80	0	0	40	20	0	0	0	60	40
Bagshot Moor 1.1	11	14	42	17	0	3	36	3	19	0	0	8	92
Bull Hill 1.1	19	12	25	50	0	0	69	6	69	25	12	6	94
Bull Hill 1.2	0	30	90	60	0	0	100	40	70	20	0	0	100
Bull Hill 1.3	20	0	0	40	0	0	20	0	80	0	20	100	0
Bull Hill 1.4	14	57	57	86	0	0	100	57	100	0	0	0	100
Bull Hill 1.5	0	0	0	43	0	0	100	0	43	0	0	0	100
Clayhill Bottom 1.1	0	50	17	17	0	0	50	0	17	83	0	0	100
Clayhill Bottom 1.2	0	0	0	25	0	0	75	0	0	75	0	0	100
Clayhill Bottom 1.3	10	0	10	100	0	0	90	0	10	90	100	0	100
Common Moor 1.1	43	0	0	100	0	0	0	0	14	0	0	14	86
Crockford Stream (Lower) 1.1	0	24	35	50	0	0	44	0	71	15	3	0	100
Crockford Stream (Lower) 1.2	0	38	25	62	0	0	56	0	81	0	12	0	100
Crockford Stream (Lower) 1.3	0	36	39	75	0	0	64	6	92	22	0	0	100
Crockford Stream (Lower) 1.4	0	0	83	100	0	0	67	33	100	33	50	0	100
Crockford Stream (Upper) 1.1	0	43	52	83	0	0	74	4	96	48	0	0	100
Crockford Stream (Upper) 1.2	0	15	0	70	0	0	38	0	81	26	11	13	87

Site and transect section	% no flow	% too much shade	% vegetation structure not MG on either bank	% too few emergent	% too many emergent	% too much bog myrtle	% not enough bog myrtle	% bracken present	% non frequent stiff emergent	% not enough silt/ mud/ peat	% eutrophication present	% samples mire	% samples linear
Crockford Stream (Upper) 1.3	0	0	0	73	0	0	67	0	53	0	7	33	67
Crockford Stream (Upper) 1.4	0	2	2	65	0	0	60	2	58	5	7	11	89
Crockford Stream (Upper) 1.5	0	0	40	90	0	0	90	0	100	30	90	0	100
Crockford Stream (Upper) 1.6	0	0	0	30	0	0	2	0	0	0	0	92	8
Crockford Stream (Upper) 1.7	7	0	0	50	0	0	53	0	37	0	7	50	50
Dibden Bottom 1.1	100	52	81	71	0	0	48	0	62	0	0	0	100
Duckhole Bog 1.1	25	0	0	25	0	0	33	0	33	0	33	0	100
Foulford 1.1	14	29	29	71	0	0	29	0	43	0	0	14	86
Foulford 1.2	21	0	7	36	0	0	79	7	29	0	0	29	71
Foulford 1.3	10	30	10	50	0	0	20	40	30	0	0	50	50
Hatchet Stream 1.1	10	0	28	72	0	0	78	0	50	18	14	10	90
Howen Bottom 1.1	0	0	100	75	0	0	100	12	38	38	0	0	100
Howen Bottom 1.2	0	0	60	30	0	0	100	0	10	10	0	0	100
Howen Bottom 1.3	60	10	30	40	0	0	100	0	20	40	0	0	100
Latchmore 1.1	0	7	27	47	0	0	100	7	20	7	13	33	67
Latchmore 1.2	9	2	6	30	2	0	64	6	28	0	2	55	45
Latchmore 1.3	0	14	20	40	0	6	66	20	37	0	0	6	94
Latchmore 1.4	0	0	100	0	20	0	100	60	0	0	0	0	100
Mill Lawn 1.1	85	3	95	3	0	0	100	0	3	0	0	0	100
Mill Lawn 1.2	50	0	42	62	0	0	100	0	38	0	27	38	62
Mill Lawn 1.3	100	70	100	100	0	0	100	0	100	30	0	0	100
Mill Lawn 1.4	8	0	38	0	0	0	100	0	0	0	0	0	100
Mill Lawn 1.5	0	0	52	48	0	0	100	0	13	9	0	0	100

Site and transect section	% no flow	% too much shade	% vegetation structure not MG on either bank	% too few emergent	% too many emergent	% too much bog myrtle	% not enough bog myrtle	% bracken present	% non frequent stiff emergent	% not enough silt/ mud/ peat	% eutrophication present	% samples mire	% samples linear
Mill Lawn 1.6	23	5	27	18	0	0	100	5	9	0	0	0	100
Mill Lawn 1.7	18	0	68	32	0	0	95	0	0	0	0	19	81
Mill Lawn 1.8	11	16	68	5	0	0	100	0	0	0	0	0	100
Mill Lawn 1.9	53	0	68	32	0	0	100	11	26	0	5	0	100
Mill Lawn 1.10	12	0	44	12	0	0	100	0	0	0	0	19	81
Mill Lawn 1.11	22	0	56	11	0	0	100	22	17	0	0	6	94
Mill Lawn 1.12	0	21	50	64	0	0	100	0	14	0	0	0	100
Mill Lawn 2.1	100	0	92	25	0	0	100	0	17	0	0	0	100
Mill Lawn 3.1	100	0	0	23	9	0	27	0	5	0	0	0	100
Mill Lawn 3.2	100	0	11	7	0	0	52	0	4	0	0	0	100
Mill Lawn 3.3	43	0	0	51	0	0	37	0	3	0	0	11	89
Mill Lawn 4.1	54	11	4	32	0	7	57	0	32	0	7	46	54
Mill Lawn 4.2	0	44	0	44	0	0	22	0	33	0	0	0	100
Millersford Bottom 1.1	7	11	4	75	0	0	89	4	11	4	4	71	29
Millersford Bottom 1.2	0	50	12	62	0	0	75	0	50	0	12	0	100
Millersford Bottom 1.3	33	17	0	67	0	0	67	0	67	0	0	0	100
Millersford Bottom 1.4	25	33	0	67	0	0	58	0	50	0	8	0	100
Millersford Bottom 1.5	3	0	29	14	3	0	74	0	9	0	0	94	6
Millersford Bottom 1.6	0	50	67	83	0	0	83	50	100	100	33	0	100
Round Hill 1.1	44	0	11	44	0	0	67	0	0	0	11	100	0
Round Hill 1.2	0	0	0	0	0	0	25	0	0	0	0	75	25
Round Hill 1.3	0	0	7	53	0	0	53	0	13	0	0	60	40
Round Hill 1.4	0	33	67	67	0	0	67	33	67	33	0	0	100
Round Hill 2.1	0	20	40	60	0	0	80	0	40	20	0	0	100
Round Hill 2.2	0	0	25	50	0	0	75	50	50	25	0	0	100

Site and transect section	% no flow	% too much shade	% vegetation structure not MG on either bank	% too few emergent	% too many emergent	% too much bog myrtle	% not enough bog myrtle	% bracken present	% non frequent stiff emergent	% not enough silt/ mud/ peat	% eutrophication present	% samples mire	% samples linear
Round Hill 2.3	0	71	100	100	0	0	100	29	100	29	0	0	100
Round Hill 2.4	0	33	33	67	0	0	100	0	100	67	0	0	100
Round Hill 3.1	0	0	0	25	0	0	100	0	25	0	0	0	100
Round Hill 3.2	0	18	53	41	0	0	82	65	71	12	0	0	100
Round Hill 3.3	0	12	0	12	0	12	25	50	12	0	0	62	38
Shipton Bottom 1.1	0	27	46	54	0	0	68	2	46	14	9	0	100
Shipton Bottom 1.2	15	0	15	15	2	0	48	0	20	0	2	82	18
Shipton Bottom 1.3	0	50	33	67	0	0	67	8	50	0	0	8	92
Shipton Bottom 1.4	0	12	0	81	0	0	81	0	38	6	38	31	69
Shipton Bottom 1.5	0	24	2	91	0	0	56	0	51	18	0	0	100
Shipton Bottom 1.6	0	3	0	64	0	0	61	0	30	0	0	30	70
Shobley 1.1	3	14	9	46	0	0	66	43	46	0	0	6	94
Shobley 1.2	18	18	27	55	0	0	36	18	36	0	0	0	100
Shobley 1.3	10	0	10	80	0	0	30	40	10	0	0	40	60
Shobley 1.4	25	0	50	25	0	0	25	0	50	0	0	0	100
Stag Brake 1.1	6	0	6	53	0	0	100	0	6	0	0	41	59
Stony Moors 1.1	0	11	0	67	0	11	44	0	11	0	0	0	100
Stony Moors 1.2	0	67	0	67	0	33	0	0	67	0	0	0	100
Stony Moors 1.3	17	0	0	100	0	0	50	0	67	0	0	0	100
Stony Moors 1.4	100	0	60	10	0	0	60	0	30	0	10	100	0
Stony Moors 2.1	80	0	0	100	0	0	70	0	80	0	10	90	10
Three Beech Bottom 1.1	40	0	0	50	0	0	20	0	0	0	100	0	100
Three Beech Bottom 1.2	100	0	0	0	0	0	0	0	10	10	0	0	100
Three Beech Bottom 1.3	100	0	43	57	0	0	29	0	0	0	0	0	100
Three Beech Bottom 1.4	11	11	0	67	0	11	11	0	22	0	33	0	100

Site and transect section	% no flow	% too much shade	% vegetation structure not MG on either bank	% too few emergent	% too many emergent	% too much bog myrtle	% not enough bog myrtle	% bracken present	% non frequent stiff emergent	% not enough silt/ mud/ peat	% eutrophication present	% samples mire	% samples linear
Three Beech Bottom 2.1	0	0	12	75	0	0	12	0	12	12	62	0	100
Three Beech Bottom 2.2	0	0	0	88	0	0	62	0	25	0	75	0	100
Three Beech Bottom 2.3	0	0	0	100	0	0	57	0	14	0	86	0	100
Three Beech Bottom 2.4	12	0	0	100	0	0	50	0	12	0	62	0	100
Widden Bottom 1.1	53	0	3	35	0	0	44	0	12	0	6	35	65

Appendix 3: Weather and time data for adult transect counts.

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Acres Down 1.1	05 July 2013	13:04	13:08	22	north-west	2	100		Ben Rushbrook & Tom Selby
Acres Down 1.2	05 July 2013	13:10	13:18	22	north-west	2	100		Ben Rushbrook & Tom Selby
Acres Down 1.3	05 July 2013	13:22	13:27	22	north-west	2	100		Ben Rushbrook & Tom Selby
Acres Down 1.4	05 July 2013	13:39	13:44	22	west	2	100		Ben Rushbrook & Tom Selby
Acres Down 1.5	05 July 2013	13:33	13:35	22	west	2	100		Ben Rushbrook & Tom Selby
Bagshot Moor 1.1	29 June 2013	12:07	12:51	18	west	3	75		Ben Rushbrook & Tom Selby
Bull Hill 1.1	08 July 2013	11:37	11:47	25	north-east	4	100		Ben Rushbrook & Tom Selby
Bull Hill 1.2	08 July 2013	11:23	11:31	25	north-east	4	100		Ben Rushbrook & Tom Selby
Bull Hill 1.3	08 July 2013	11:08	11:14	26	north-east	4	100		Ben Rushbrook & Tom Selby
Bull Hill 1.4	08 July 2013	11:00	11:06	26	north-east	3	100		Ben Rushbrook & Tom Selby
Bull Hill 1.5	08 July 2013	11:49	11:56	25	north-east	4	100		Ben Rushbrook & Tom Selby
Clayhill Bottom 1.1	16 July 2013	11:05	11:09	24	south-west	1	100		Sarah Bignell & Ruth Kernohan
Clayhill Bottom 1.2	16 July 2013	11:11	11:13	24	south-west	1	100		Sarah Bignell & Ruth Kernohan
Clayhill Bottom 1.3	18 July 2013	13:22	13:31	29	west	3	90		Sarah Bignell & Ruth Kernohan
Common Moor 1.1	04 July 2013	11:10	11:20	18	north-east	2	50		Sarah Bignell & Ruth Kernohan
Crockford Stream (Lower) 1.1	01 July 2013	12:21	13:18	18	west	3	80		Ben Rushbrook & Tom Selby
Crockford Stream (Lower) 1.2	01 July 2013	12:21	13:18	18	west	3	80		Ben Rushbrook & Tom Selby

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Crockford Stream (Lower) 1.3	01 July 2013	12:21	13:18	18	west	3	80		Ben Rushbrook & Tom Selby
Crockford Stream (Lower) 1.4	01 July 2013	12:21	13:18	18	west	3	80		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.1	08 July 2013	12:31	12:46	27	north-east	3	100		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.2	08 July 2013	12:47	13:23	27	north-east	3	100		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.3	08 July 2013	13:26	13:35	27	north-east	4	100		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.4	08 July 2013	13:39	14:09	27	north-east	4	100		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.5	08 July 2013	14:12	14:16	27	east	4	100		Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.6	08 July 2013	14:26	14:39	27	north-east	3	100	No continuous water in first 30m of upper reaches. Mid to lower reaches of channel has flowing water before becoming damp and with no real flow.	Ben Rushbrook & Tom Selby
Crockford Stream (Upper) 1.7	08 July 2013	14:41	14:56	26	north-east	3	100		Ben Rushbrook & Tom Selby
Dibden Bottom 1.1	18 July 2013	14:45	15:00	28	south-west	2	100	Transect becomes fully enclosed by trees to western end of transect. Azure damselfly *Coenagrion puella* were abundant by footbridge.	Sarah Bignell & Ruth Kernohan
Duckhole Bog 1.1	16 July 2013	13:10	13:19	31	north-east	2	100	Running and standing water remaining since site assessment.	Sarah Bignell & Ruth Kernohan
Foulford 1.1	11 July 2013	13:38	13:44	22	north-east	3	100	Channel appears to become subterranean in parts.	Ben Rushbrook & Tom Selby
Foulford 1.2	11 July 2013	13:47	13:57	22	north-east	3	100	Channel becomes visibly narrower in lower half.	Ben Rushbrook & Tom Selby
Foulford 1.3	11 July 2013	13:25	13:31	22	north	3	100	Availability of (flowing) water significantly reduced from conditions observed during habitat attribute survey.	Ben Rushbrook & Tom Selby

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Hatchet Stream 1.1	29 June 2013	13:25	14:52	19	north-west	3	80	Water level is significantly lower in middle / upper reaches than observed during habitat attribute surveys, and upper part of transect now dry. However in most reaches the flow is focussed in the centre of the channel by marginal berms. Areas of mires are now simply damp or have become a series of smaller runnels.	Ben Rushbrook & Tom Selby
Howen Bottom 1.1	21 June 2013	14:18	14:23	15	south-west	3	80	Majority of transect section is dry with standing water where water is present.	Ben Rushbrook & Tom Selby
Howen Bottom 1.2	21 June 2013	14:31	14:43	15	south-west	3	70	Intermittent areas of dry and standing water.	Ben Rushbrook & Tom Selby
Howen Bottom 1.3	21 June 2013	14:45	14:56	14	south-west	3	10	Only areas of standing water or damp substrate / vegetation present.	Ben Rushbrook & Tom Selby
Latchmore 1.1	07 July 2013	13:21	13:32	27	north-east	3	95		Ben Rushbrook & Tom Selby
Latchmore 1.2	07 July 2013	12:20	13:01	27	north-east	4	90	Noticeably greater densities of southern damselflies were recorded on runnels than were recorded on mire habitat.	Ben Rushbrook & Tom Selby
Latchmore 1.3	07 July 2013	11:08	11:43	27	north-east	3	95		Ben Rushbrook & Tom Selby
Latchmore 1.4	07 July 2013	12:06	12:10	27	north	4	80	Choked with emergent and submerged vegetation, leaving little to no visible flow.	Ben Rushbrook & Tom Selby
Mill Lawn 1.1	18 July 2013	13:49	14:07	29	south	3	80		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.2	05 July 2013	13:47	14:05	23	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.3	05 July 2013	14:05	14:11	24	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.4	05 July 2013	14:32	14:45	23	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.5	05 July 2013	14:48	14:58	24	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.6	08 July 2013	14:00	14:07	24	north-east	1	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.7	08 July 2013	14:10	14:18	25	north-east	1	100		Sarah Bignell & Ruth Kernohan

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Mill Lawn 1.8	08 July 2013	14:20	14:27	25	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.9	04 July 2013	14:55	15:10	22	north-east	3	50		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.10	04 July 2013	14:45	14:55	22	north-east	3	60		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.11	04 July 2013	14:35	14:45	24	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 1.12	05 July 2013	14:32	14:45	23	north-east	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 2.1	05 July 2013	14:18	14:21	24	north-east	2	100	No water present in channel; damp poached mud with pondweed and St John's-wort.	Sarah Bignell & Ruth Kernohan
Mill Lawn 3.1	09 July 2013	15:00	15:35	26	west	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 3.2	09 July 2013	13:02	13:15	25	west	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 3.3	09 July 2013	11:50	12:20	23	west	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 4.1	09 July 2013	14:02	14:15	26	west	2	100		Sarah Bignell & Ruth Kernohan
Mill Lawn 4.2	09 July 2013	14:02	14:15	26	west	2	100		Sarah Bignell & Ruth Kernohan
Millersford Bottom 1.1	06 July 2013	13:58	14:27	25	north-east	2	75	Lower to mid reaches overgrown; no southern damselflies recorded along incised reaches.	Ben Rushbrook & Tom Selby
Millersford Bottom 1.2	06 July 2013	13:18	13:27	24	north-east	2	90	Most southern damselfly observed within the lower two-thirds of the channel where it is more open.	Ben Rushbrook & Tom Selby
Millersford Bottom 1.3	06 July 2013	13:33	13:39	25	north-east	2	100	Most southern damselfly observed within the lower half of the channel where it is more open.	Ben Rushbrook & Tom Selby
Millersford Bottom 1.4	06 July 2013	12:40	12:56	24	south	2	90	Only two southern damselflies recorded in upper, overgrown reaches of the transect section.	Ben Rushbrook & Tom Selby

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Millersford Bottom 1.5	06 July 2013	11:39	12:11	23	south	2	60	Southern damselfly focused in the lower third of the transect where the habitat is predominantly linear; dense bog myrtle in the middle reaches of the channel need thinning.	Ben Rushbrook & Tom Selby
Millersford Bottom 1.6	06 July 2013	11:28	11:32	23	south	2	100		Ben Rushbrook & Tom Selby
Round Hill 1.1	09 July 2013	11:05	11:06	24	north-east	3	100	Upper third of the channel was dry, with flowing part only present in the lower third.	Ben Rushbrook & Tom Selby
Round Hill 1.2	09 July 2013	11:23	11:30	24	north-east	4	100	Well defined channel present in the upper reaches, becoming more disparate with reduced flow in the lower reaches.	Ben Rushbrook & Tom Selby
Round Hill 1.3	09 July 2013	11:31	11:46	23	north	3	100		Ben Rushbrook & Tom Selby
Round Hill 1.4	09 July 2013	11:52	11:57	23	north	4	100		Ben Rushbrook & Tom Selby
Round Hill 2.1	09 July 2013	13:01	13:13	23	north-east	3	100		Ben Rushbrook & Tom Selby
Round Hill 2.2	09 July 2013	13:18	13:21	23	north-east	3	100		Ben Rushbrook & Tom Selby
Round Hill 2.3	09 July 2013	13:23	13:29	23	north-east	3	100		Ben Rushbrook & Tom Selby
Round Hill 2.4	09 July 2013	13:31	13:33	23	north-east	3	100		Ben Rushbrook & Tom Selby
Round Hill 3.1	09 July 2013	12:45	12:53	24	north-east	3	100		Ben Rushbrook & Tom Selby
Round Hill 3.2	09 July 2013	12:29	12:43	25	north-east	3	100	Very dense, broad-leaved emergent vegetation is present in open reaches, despite still being shaded by wood to the west.	Ben Rushbrook & Tom Selby
Round Hill 3.3	09 July 2013	12:20	12:27	26	north-east	4	100		Ben Rushbrook & Tom Selby
Shipton Bottom 1.1	17 July 2013	11:05	11:58	27	north-west	2	100		Ben Rushbrook & Tom Selby
Shipton Bottom 1.2	17 July 2013	12:01	12:40	29	north-west	2	100		Ben Rushbrook & Tom Selby

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Shipton Bottom 1.3	17 July 2013	12:57	13:06	29	north-west	3	100		Ben Rushbrook & Tom Selby
Shipton Bottom 1.4	17 July 2013	13:09	13:23	29	north-west	3	100	Ovipositing pairs were concentrated in lower third of the transect section, and very few individuals were recorded in the upper third.	Ben Rushbrook & Tom Selby
Shipton Bottom 1.5	17 July 2013	13:59	14:30	27	south	3	100	Numbers of southern damselfly noticeably lower in areas of dense bog myrtle.	Ben Rushbrook & Tom Selby
Shipton Bottom 1.6	17 July 2013	13:35	13:57	27	south	3	100		Ben Rushbrook & Tom Selby
Shobley 1.1	18 July 2013	12:44	13:16	29	north-east	3	85		Ben Rushbrook & Tom Selby
Shobley 1.2	18 July 2013	13:44	13:50	30	north	3	100	Lower and upper thirds of this transect were only damp, with little to no flow observed in the wetter middle reach.	Ben Rushbrook & Tom Selby
Shobley 1.3	18 July 2013	13:27	13:36	30	north-east	3	100		Ben Rushbrook & Tom Selby
Shobley 1.4	18 July 2013	13:18	13:22	28	north-east	3	100		Ben Rushbrook & Tom Selby
Stag Brake 1.1	16 July 2013	13:44	13:55	29	north-east	1	100	Signs of eutrophication in upstream reach; southern damselfly observed in the upper and lower reaches only, with no individuals recorded in the stagnant middle section.	Sarah Bignell & Ruth Kernohan
Stony Moors 1.1	16 July 2013	11:48	11:55	25	north-west	2	100		Sarah Bignell & Ruth Kernohan
Stony Moors 1.2	16 July 2013	11:56	12:57	25	north-west	2	100		Sarah Bignell & Ruth Kernohan
Stony Moors 1.3	16 July 2013	11:57	12:00	25	north-west	2	100		Sarah Bignell & Ruth Kernohan
Stony Moors 1.4	16 July 2013	12:01	12:08	25	north-west	2	100	Dried out considerably since habitat attribute survey.	Sarah Bignell & Ruth Kernohan
Stony Moors 2.1	16 July 2013	11:40	11:47	25	north-east	1	100	Dried out considerably since habitat attribute survey.	Sarah Bignell & Ruth Kernohan
Three Beech Bottom 1.1	22 July 2013	11:24	11:32	29	south-east	1	100		Sarah Bignell & Ruth Kernohan

Site name and transect section	Date	Start time (BST)	Finish time (BST)	Temperature in shade(°C)	Wind direction	Beaufort number	% sunshine	Notes	Recorder/s
Three Beech Bottom 1.2	22 July 2013	12:04	12:10	29	south-east	1	100	Channels dry to damp.	Sarah Bignell & Ruth Kernohan
Three Beech Bottom 1.3	22 July 2013	11:18	11:21	29	south-east	0	100	Channels dry to damp.	Sarah Bignell & Ruth Kernohan
Three Beech Bottom 1.4	22 July 2013	11:35	11:47	29	south-east	1	100		Sarah Bignell & Ruth Kernohan
Three Beech Bottom 2.1	22 July 2013	12:30	12:40	27	south-east	2	100		Sarah Bignell & Ruth Kernohan
Three Beech Bottom 2.2	22 July 2013	12:42	12:56	27	south-east	2	100		Sarah Bignell & Ruth Kernohan
Three Beech Bottom 2.3	22 July 2013	13:13	13:17	27	south-east	2	100		Sarah Bignell & Ruth Kernohan
Three Beech Bottom 2.4	22 July 2013	13:05	13:11	27	south-east	2	100		Sarah Bignell & Ruth Kernohan
Widden Bottom 1.1	16 July 2013	14:38	15:01	28	north	2	100	Few southern damselfly sighted in central damp mire.	Sarah Bignell & Ruth Kernohan

Appendix 4: Recording sheet used for habitat attribute sampling in 2013.

Site:_____ Transect:_____

Recorder(s):_____

Section start grid ref:
Section finish grid ref:

Transect Sample No.										
Waymark No. / NGR										
Habitat type: (Linear / Mire)										
Water flow: (Dr, Da, NFl, Fl)										
% cover emergent broad-leaved herbs (Incl. *Potamogeton polygonifolius*, and/or *Ranunculus flammula*, and/or *Hypericum elodes)*										
% cover submerged vegetation										
% of channel in shade from overhanging bankside shrubs and trees										
% cover of Bog Myrtle in watercourse										
Is bracken present? (Y/N)										
Evidence of eutrophication (Y/N)										
Bankside vegetation structure: (UL / UH / MS / MG)										
Stiff emergent vegetation for emergence: (N / S / F / C)										
% Channel substrate: (record % of all types)	Boulders									
	Pebbles									
	Gravel									
	Sand									
	Silt / mud / peat									
No. southern damselfly:										

Photo point/grid ref	up- / downstream, or panorama?	photo number on camera

General Comments:
Grazing:

Hydrology:

Vegetation Structure and succession:

Adjoining habitat / expansion potential:

Additional Notes / Comments:

Appendix 5: Recording sheet used for adult count surveys in 2013.

Site:_____ Date:_____

Recorder(s):_____

Start time:	**Finish time:**	**Transect No.:**
Shade temperature (ºC):	**Wind direction and speed:**	**% sunshine:**

Transect section	**Tally of male Southern Damselflies seen**	**Total**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Comments:

Notes for transect walkers:

1) Transects should be walked between 10th June and 18th July (depending on sites).
2) Counts should take place between 11:00 and 15:00 BST
3) Weather conditions should meet the following minimum requirements:
    - The air temperature in the shade should be above 17°C
    - There should be at least 50% sunshine
    - Wind should not exceed force 4 on the Beaufort scale (i.e. no more than leaves and branches moving)

Appendix 6: Data files supplied to the Forestry Commission.

The following data has been supplied to Jay Doyle at the Forestry Commission England (electronic files are provided on two CDs):

- Database: "Southern Damselfly monitoring 2013 v1 – 1.mdb" (CD1)
    - This is the database used to analyse the habitat sample and damselfly transect data resulting from the fieldwork. It also stores details of the photomonitoring points, and of the criteria used for condition assessment. The database is in a Microsoft™ Access 2010 format. The queries are set up to analyse the full dataset within the database, and will require some editing if they are required for use in future years.

- Spreadsheet file: "database export – damselfly transect raw data.xls" (CD1)
    - Exports of raw data from the database
- Spreadsheet file: "database export – habitat sampling raw data.xls" (CD1)
    - Exports of raw data from the database
- Spreadsheet file: "database export – site photo list.xls" (CD1)
    - Exports of raw data from the database

- New Forest Southern Damselfly site assessment GIS data.zip (CD1) - this compressed file will contain four ArcGIS tables:
    - 2013 damselfly transect routes.SHP (line data showing transect routes)
    - 2013 habitat sample points with photos.SHP (i.e. those sample points from which photos were taken)
    - 2013 habitat sample points.SHP (point data showing sample points)
    - 2013 potential habitat area.SHP (polygon data showing areas assessed as being habitat for southern damselfly)

- This document (i.e. the final report) and Appendix 7 (photomonitoring report), each saved as Word documents and as a high-resolution .pdf files; this document (without Appendix 7) also saved as a low-resolution .pdf (suitable for emailing) (CD1)

- Digital photos (.jpg files) for all photo monitoring (CD2)
- Aerial photo images (.jpg files) showing location of photo monitoring points (CD2)
- Any necessary software for viewing photos (CD2)
    - The original .jpg files will be placed on CD2 (in the "images" folder), along with the photo viewing software that will provide an additional resource for viewing the photos for each site (any guidance for the photo viewing software must be presented as a Word document and also placed on CD2).