

Fieldwork to Support Habitat Restoration Work at Webb's Fen, Thelnetham



Vegetation Monitoring Programme Fieldwork Report June 2017

Undertaken on behalf of the Little Ouse Headwaters project

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SUMMARY

1. The core of the Little Ouse Headwaters Project (LOHP) area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). Webb's Fen is situated between the two remaining fragments of Thelnetham Fen, which are part of the Special Area of Conservation. It also adjoins the LOHP Bleyswycks Bank and Oak Tree Fens sites and is on the opposite side of the river from the LOHP's Blo' Norton Fen, which is also part of the SAC.
2. LOHP has requested a repeat survey of the two permanent monitoring plots established in 2011, prior to the initial phase of site restoration, as part of the Vegetation Monitoring Programme. The objective of this second survey is to assess the changes that have occurred in the structure and composition of the swards since 2011.
3. The permanent monitoring plots were re-located and re-surveyed on 30th June 2017:
W01 Fen Meadow. This plot was located in the northwest quarter of Webb's Fen in 2011 to sample what was the most developed area of fen meadow on the site.
W02 Fen Meadow – Tussock Grassland. In 2011, this plot was located adjacent to one of the rushy hollows on noticeably drier ground in the northeast field, in order to represent vegetation that was transitional between False Oat-grass grassland and Fen Meadow.
4. Since 2011, stock grazing has largely removed the grassy supra-canopy and greatly reduced the frequency of occurrence of 'non-target' species. Although the changes to the sward and the appearance of Lesser Spearwort and Marsh Willowherb are very encouraging, several grazing-sensitive reed-fen species have been lost and little colonisation by other fen species has occurred.
5. The **Fieldwork Report** makes three recommendations, that:
 - a) The Vegetation Monitoring Programme is maintained at Webb's Fen as an aid to management decision-making;
 - b) The means of achieving target conditions for each sward should be reviewed, to prevent dominance by rushes and the prevalence of trampling and lodging, and also to enhance natural processes of colonization by fen species.
 - c) Monitoring surveys should be repeated regularly, and the results incorporated into the management decision-making process.

CONTENTS

1. INTRODUCTION	1
1.1 Background	1
1.2 Survey requirements and objectives	1
1.3 Survey reporting	2
2. FIELD SURVEY METHODOLOGY	3
2.1 Vegetation monitoring survey methodology	3
2.2 Limitations to the survey	3
3. VEGETATION MONITORING PROGRAMME – FIELDWORK REPORT 2017	4
3.1 Locating the Monitoring Plots	4
3.2 Monitoring Plot Report – W01 Fen Meadow 2017	6
3.3 Monitoring Plot Report – W02 Fen Meadow – Tussock Grassland 2017	10
3.4 Interpretation of the Monitoring Plot surveys	16
3.5 Recommendations of the Vegetation Monitoring Programme	19
4. REFERENCES	21

Figure 1. The location of Webb’s Fen and surrounding land

Figure 2. Location of permanent marker posts

Figure 3. Plot W01 physiognomy – comparison between 2011 and 2017

Figure 4. Plot W02 physiognomy – comparison between 2011 and 2017

Appendix 1. SPECIES RECORDED IN MONITORING PLOTS

Appendix 2. FIELD RECORD FOR WE01 MONITORING PLOT

Appendix 3. FIELD RECORD FOR WE02 MONITORING PLOT

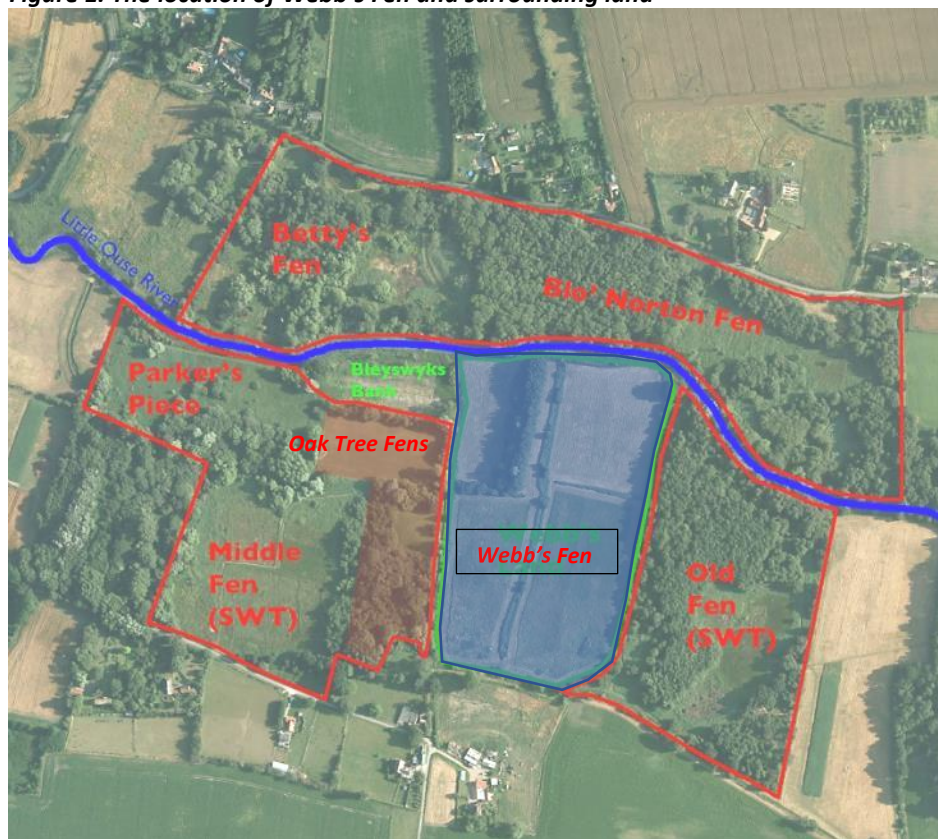
1. INTRODUCTION

1.1 Background

The Little Ouse Headwaters Project (LOHP) was formally constituted as a Charitable Company in 2002 to restore and link fenland remnants along the upper Little Ouse Valley, and to promote access and enjoyment of the wildlife and landscape of the valley. The core of the project area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). These valley fens are remnants of what was formerly more extensive habitat, for which East Anglia had one of the most important concentrations in Western Europe.

Webb's Fen is a largely drained fen purchased by LOHP in 2011 as a 5.7 ha block consisting of immature and fertile fen regeneration from sown grassland. As shown in Figure 1, Webb's Fen is situated between the two remaining fragments of Thelnetham Fen, which are part of the Special Area of Conservation. It also adjoins the LOHP Bleyswyck's Bank and Oak Tree Fens sites and is on the opposite side of the river from the LOHP's Blo' Norton Fen, which is also part of the SAC.

Figure 1. The location of Webb's Fen and surrounding land



1.2 Survey requirements and objectives

Following several years of post-restoration management, LOHP have requested a re-survey of the two permanent monitoring plots established in 2011. This is a continuation of the Vegetation Monitoring Programme established on other LOHP sites and follows the Monitoring Plan field

methodology (OHES 2010) with the objective of assessing the changes that may have occurred in the structure and composition of the swards since 2011.

1.3 Survey reporting

Jonny Stone has been commissioned by LOHP to undertake this vegetation survey on Webb's Fen. The vegetation monitoring methodology is summarised in Section 2. The results of the re-survey of the established monitoring plots are given in the 2017 Fieldwork Report in section 3.

2. FIELD SURVEY METHODOLOGY

2.1 Vegetation monitoring survey methodology

Documentation for a Vegetation Monitoring Programme was initially developed for LOHP to aid the ecological restoration of Bleyswyck's Bank and Parkers Piece in 2010. The development, methodology and functions of the programme were described in detail in the Monitoring Plan (OHES 2010) for those sites and is not repeated here. The methodology was subsequently applied to Webb's Fen in 2011 to establish two permanent plots, with the following objectives:

1. To establish permanent monitoring plots in two specified vegetation types, using the protocols developed in the Monitoring Plan.
2. To undertake the initial monitoring survey, using the 'full' Fieldwork Protocols.
3. To interpret the fieldwork results, and provide guidance on the establishment of initial target conditions.

This second Fieldwork Report follows the prescriptions of the Monitoring Plan (OHES 2010) and repeats the 'full' survey protocol carried out in 2011, using all Fieldwork Elements summarised in Table 1.

Table 1. Summary of survey techniques

Survey intensity	Fieldwork Element	Function within the Survey
Rapid	1 Locating Monitoring Plots	To establish locations for the Monitoring Plots
	2 Photographic Record	To produce a record of surveillance images showing the condition of the developing vegetation
Full	3 Vegetation structural characters	To record features of the vegetation structure against which management requirements can be established.
	4 Floristic sub-sampling	To record the floristic composition of the plot in order to judge to success of the restoration measures against target floristic conditions.

In addition to the photographic record, the structural characters of the vegetation were assessed from each quarter of the two 10 x 10 m plots. Floristic composition was tabulated by stratified sub-sampling of the monitoring plots using twenty 1 x 1 metre sub-samples. All vascular plants are named following Stace (2010); the bryophyte flora follows Hill et al. (2008). Species recorded in the monitoring plots are listed in Appendix 1. The field records for floristic sampling are given in Appendices 2 and 3.

2.2 Limitations to the survey

The monitoring plots survey was carried out in late June 2017 at an optimal time of year for both grassland and fen. No access issues were encountered. The locations of all permanent markers for the monitoring plots were re-located without any problems and the plots were re-established without issue.

Although it is possible that some plant species were not recorded by the sampled plots, this is not considered to have significantly affected the conclusions of this report.

3. VEGETATION MONITORING PROGRAMME – FIELDWORK REPORT 2017

Fieldwork to establish the permanent plots and undertake the repeat vegetation survey was undertaken on 30th June 2017.

3.1 Locating the Monitoring Plots

The two Monitoring Plots were re-established in the fen meadow units using the method given in the Monitoring Plan; each plot is 10 m x 10 m in size, and lies between two permanent marker posts. The locations of the permanent marker posts are given in Figure 2 and are visible as fence posts topped by white paint, or as free-standing posts. The precise location of the monitoring plot is re-established by stretching a 50 metre tape between the posts. From known lengths along this baseline, the plot is reconstructed at right angles to it, as indicated in Table 2.

Figure 2. Location of permanent marker posts

Source: Map data c 2017 Google Imagery, GigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky



The original descriptive titles of the plots are retained:

W01 Fen Meadow. This plot was located in the northwest quarter of Webb's Fen in order to sample what was the most developed area of fen meadow on the site in 2011.

W02 Fen Meadow – Tussock Grassland. In 2011, this plot was located adjacent to one of the rushy hollows on noticeably drier ground in the northeast field, in order to represent vegetation that was transitional between False Oat-grass grassland and Fen Meadow.

Table 2. Details of permanent monitoring plot locations

VEGETATION TYPE	PLOT CODE	MARKER POSTS	Marker Post Location	EASTING	NORTHING	Plot location
Fen Meadow	W01	W01-01	This post is part of the fenceline along the western boundary; it is situated beside the ditch just to the south of a mature willow tree.	01645	78898	The southwest corner of the plot is 15 metres east of W01-01
		W01-02	This post is situated near the edge of the scrape, on the margin of the former plantation.	601685	278892	
Fen Meadow – Tussock Grassland	W02	W02-01	This post was originally on the eastern edge of the central drain; post-restoration, it is now located near the eastern edge of the scrape.	601734	278906	The southwest corner of the plot is 30 metres east of W02-01
		W02-02	This freestanding post is located close to the northeast edge of a shallow hollow.	601778	278897	

3.2 Monitoring Plot Report – W01 Fen Meadow 2017

Plot code	W01 Fen Meadow
Treatment type	Summary of preceding Monitoring Plot Report
Fen Meadow	<p>In 2011, the sampled area was undisturbed by trampling with thick plant litter layers mantling the ground surface. Rush tussocks were dominant, with a marked supra-canopy formed by grasses and scattered herbs; seedlings and bryophytes were absent.</p> <p>The sward was dominated by Fen Meadow Rushes (Blunt-flowered, Soft and a little Hard Rush), with a relatively extensive suite of fenland grasses and herbs, including Meadow Vetchling and Marsh Horsetail. The swamp species Reed and Branched Bur-reed were also present. Notwithstanding, the plot had markedly high numbers of a few 'weedy' species, notably False Oat-grass, Couchgrass and Perennial Sowthistle.</p>

Vegetation structure

- In 2017, the ground surface was very soft and typically saturated, with c.20 per cent inundated to a depth of 4-5 cm.
- Thick plant litter was almost absent, though no bryophyte cover and few seedlings were present.
- The tussock structure of rushes and sedges dominates with a negligible supra-canopy of reed-like grasses; woody seedlings and saplings were absent.
- Multiple hoof-prints are evident with little dunging; trampling of the sward was marked, with c.30 per cent of the plot affected.

Floristics

- Blunt-flowered Rush is dominant – frequently entwined with Hedge Bindweed – over a grassy wet grassland formed by Creeping Bent, Yorkshire Fog, Creeping Buttercup and two *Pericaria* species, the land form of Amphibious Bistort and Redshank.
- Red Fescue and Soft Rush are almost absent as are the group of 'negative indicators', notable False Oat-grass, Perennial Sow-thistle and Couchgrass.
- Several reed-fen species – most notably Marsh Horsetail, Marsh Stitchwort and Branched Bur-reed – are no longer present in the plot, though several species more tolerant of grazing are recorded for the first time, including Lesser Spearwort, Hoary Willowherb and Meadowsweet.

Summary of records and events

- Not available at the time of reporting.
- Field evidence suggests that the plot vegetation has been periodically grazed, though areas of short sward are concentrated on drier ground and inundation swards elsewhere on the site.

Relation to past and target conditions

- The baseline survey undertaken in 2011 provides a summary description of the monitoring plot as representing 'a young, rushy fen meadow overstood by False Oat-grass but with the potential to stabilise and diversify through management'.

- Since 2011, initial site restoration has been undertaken and the plot vegetation has been subject to periodic stock grazing.
- This has largely removed the grassy supra-canopy, several weedy 'negative indicators' and a number of grazing-sensitive reed-fen species.
- Colonisation by further fen meadow species has been limited, but the appearance of Lesser Spearwort is very encouraging.
- The long-term target community is the M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow. As discussed in OHES (2011), such a target should be mediated by the character of the peat, particularly in relation to available plant nutrients.



Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	W01 Fen Meadow
Recorder	Jonny Stone
Survey Date	30th June 2017

Character of the ground surface

- The ground surface is very soft and composed of typically saturated black, earthy structureless peat.
- The ground surface is uneven, with inundated hollows; stock hoof-prints very evident.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
				I	IIII

ATTRIBUTE		SAMPLE from each plot quarter				AVERAGE
		1	2	3	4	
Layer height	Standing water (cm)	5	4	5	5	4.8 cm
	Plant litter (cm)	3	2	3	3	2.8 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	80	70	70	80	75 cm
	Reed-like grasses (cm)	35	0	0	50	20 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	20	30	20	20	22.5%
	Trampling (%)	40	30	20	20	27.5%
	Dunging (%)	5	0	5	5	3.8%
	Bare ground (%)	2	10	2	2	4%
	Plant litter (%)	1	2	2	1	1.5%
	Bryophytes (%)	0	0	0	0	0%
	Woody seedlings (%)	0	0	0	0	0%
	Large sedges / rushes (%)	90	95	90	90	91%
	Reed-like grasses (%)	+	0	0	0	0%
	Woody saplings (%)	0	0	0	0	0%

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot

W01 Fen Meadow

Recorder

Jonny Stone

Survey Date

30th June 2017

This data is collated from the 20 1x1 m sub-samples given in Appendix 2.

Species		2011	2017
		[ex 20]	[ex 20]
Fen Meadow species			
<i>Juncus subnodulosus</i>	Blunt-flowered Rush	19	20
<i>Agrostis stolonifera</i>	Creeping Bent	16	20
<i>Holcus lanatus</i>	Yorkshire Fog	13	20
<i>Calystegia sepium</i>	Hedge Bindweed	6	12
<i>Ranunculus repens</i>	Creeping Buttercup	9	11
<i>Persicaria amphibia</i>	Amphibious Bistort	7	9
<i>Lythrum salicaria</i>	Purple Loosestrife	5	7
<i>Persicaria maculosa</i>	Redshank	-	6
<i>Poa trivialis</i>	Rough Meadow-grass	15	5
<i>Lathyrus pratensis</i>	Meadow Vetchling	7	5
<i>Phragmites australis</i>	Common Reed	6	4
<i>Epilobium parviflorum</i>	Hoary Willowherb	-	4
<i>Silene flos-cuculi</i>	Ragged Robin	4	2
<i>Vicia cracca</i>	Tufted Vetch	3	2
<i>Juncus inflexus</i>	Hard Rush	2	2
<i>Ranunculus flammula</i>	Lesser Spearwort	-	2
<i>Juncus effusus</i>	Soft Rush	15	1
<i>Calliergonella cuspidata</i>	Pointed Spear-moss	1	1
<i>Schedonorus pratensis</i>	Meadow Fescue	-	1
<i>Filipendula ulmaria</i>	Meadowsweet	-	1
<i>Festuca rubra</i>	Red Fescue	13	-
<i>Equisetum palustre</i>	Marsh Willowherb	7	-
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort	5	-
<i>Sparganium erectum</i>	Branched Bur-reed	5	-
<i>Stachys palustris</i>	Marsh Woundwort	5	-
<i>Cerastium fontanum</i>	Common Mouse-ear	2	-
<i>Dactylis glomerata</i>	Cock's-foot	2	-
<i>Epilobium adenocaulon</i>	American Willowherb	2	-
<i>Eupatorium cannabinum</i>	Hemp Agrimony	1	-
Negative indicators			
<i>Arrhenatherum elatius</i>	False Oat-grass	20	2
<i>Rumex crispus</i>	Curled Dock	-	2
<i>Sonchus arvensis</i>	Perennial Sow-thistle	14	-
<i>Elytrigia repens</i>	Couch-grass	11	-
<i>Rumex conglomeratus</i>	Clustered Dock	3	-
<i>Geranium dissectum</i>	Dissected Cranes-bill	2	-

Floristic character	2011	2017
Fen Meadow species	24	20
Negative indicators	5	2

3.3 Monitoring Plot Report – W02 Fen Meadow-Tussock Grassland 2017

Plot code	W02 Fen Meadow-Tussock Grassland
Treatment type	Summary of preceding Monitoring Plot Report
Fen Meadow – Tussock Grassland	<p>In 2011, the sampled area was undisturbed by trampling with a thick plant litter layer mantling the ground surface. Rush tussocks were dominant, with a marked supra-canopy formed by grasses and scattered herbs; seedlings and bryophytes were absent.</p> <p>The plot was overwhelmingly dominated by False Oatgrass tussocks, with occasional Soft Rush tussocks and sprawling Hedge Bindweed. The thin ground layer was largely composed of trailing Couchgrass tillers. Fen Meadow species were no more than occasional, including Marsh Thistle, Tufted Vetch and Purple Loosestrife.</p>

Vegetation structure

- In 2017, the ground surface was typically wet, resolving into saturated hollows occasionally with shallow inundated patches with more extensive, slightly elevated areas of firmer, wet ground.
- The proportion of thick plant litter has greatly reduced to c.20 per cent, with occasional bryophytes and seedlings.
- The dominant plants are rushes, with Soft Rush and Blunt-flowered Rush occupying the raised areas and depressions respectively. Several grass species have spread between the rush tussocks.
- The supra-canopy of False Oat-grass is absent, as are woody seedlings and saplings.
- Multiple hoof-prints are evident with very little dunging; trampling of the sward was appeared to be largely restricted to trails through the plot, and several small short swards have developed beside them.

Floristics

- Yorkshire Fog is the most commonly recorded species, often growing with Creeping Bent, Creeping Buttercup and Cuckooflower in a rough, occasionally grazed sward between the rush tussocks.
- The separation is striking between Soft Rush (with occasional Hard Rush) and Blunt-flowered Rush (with some Jointed Rush). The latter is often accompanied by a small suite of fen species, including Purple Loosestrife and Hedge Bindweed.
- The group of 'negative indicators' has greatly reduced, with the near-loss of False Oat-grass and Couchgrass.
- A scatter of occasional fen species was not re-found in 2017, but these have been replaced by a number of colonists, including the fen species Lesser Pond-sedge and Marsh Willowherb.

Summary of records and events

- Not available at the time of reporting.
- Field evidence suggests that the plot vegetation has been periodically grazed, with patches of the grassy vegetation grazed short. Like the surroundings of this plot, it is the drier areas that have been targeted.

Relation to past and target conditions

- The baseline survey undertaken in 2011 provides a summary description of the monitoring plot as representing 'a transitional area between Fen Meadow vegetation (a rushy hollow) and Tussock Grassland

on drier ground dominated by False Oat-grass with a very thin scatter of fen meadow species’.

- Since 2011, initial site restoration has been undertaken and the plot vegetation has been subject to periodic stock grazing.

- This has largely removed the formerly abundant supra-canopy of False Oat-grass, several weedy ‘negative indicators’ and a number of grazing-sensitive reed-fen species.

- Colonisation by further fen meadow species has been limited, but the appearance of Marsh Willowherb is encouraging.

- The long-term target community is the M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow. As discussed in OHES (2011), such a target should be mediated by the degraded character of the peat, particularly in relation to available plant nutrients.



Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	W02 Fen Meadow-Tussock Grassland
Recorder	Jonny Stone
Survey Date	30th June 2017

Character of the ground surface

- The ground surface was uneven, grading from firm, slightly raised peat to a wetter hollow with soft, saturated peat.
- Stock hoof-prints were evident, but concentrated in trails across the plot.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
				II	III

ATTRIBUTE		SAMPLE from each plot quarter				AVERAGE
		1	2	3	4	
Layer height	Standing water (cm)	1	3	0	0	1 cm
	Plant litter (cm)	4	7	6	4	5.3 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	120	130	120	130	125 cm
	Reed-like grasses (cm)	0	0	0	0	0 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	1	5	0	0	1.5%
	Trampling (%)	20	15	5	5	11.3%
	Dunging (%)	5	0	1	1	1.8%
	Bare ground (%)	0	0	0	0	0%
	Plant litter (%)	20	10	20	20	17.5%
	Bryophytes (%)	0	1	1	2	1%
	Woody seedlings (%)	0	0	0	0	0%
	Large sedges / rushes (%)	100	90	95	85	92.5%
	Reed-like grasses (%)	0	0	0	0	0%
	Woody saplings (%)	0	0	0	0	0%

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot

W02 Fen Meadow-Tussock Grassland

Recorder

Jonny Stone

Survey Date

30th June 2017

This data is collated from the 20 1x1 m sub-samples given in Appendix 3.

Species		2011	2017
		[ex 20]	[ex20]
Fen Meadow species			
<i>Holcus lanatus</i>	Yorkshire Fog	3	20
<i>Juncus effusus</i>	Soft Rush	8	15
<i>Juncus subnodulosus</i>	Blunt-flowered Rush	1	12
<i>Lythrum salicaria</i>	Purple Loosestrife	8	7
<i>Agrostis stolonifera</i>	Creeping Bent	5	7
<i>Calystegia sepium</i>	Hedge Bindweed	7	6
<i>Poa trivialis</i>	Rough Meadow-grass	5	6
<i>Epilobium parviflorum</i>	Hoary Willowherb	-	6
<i>Ranunculus repens</i>	Creeping Buttercup	1	5
<i>Cardamine pratensis</i>	Cuckoo-flower	-	5
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss	1	4
<i>Juncus articulatus</i>	Jointed Rush	-	4
<i>Carex acutiformis</i>	Lesser Pond-sedge	-	2
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort	-	2
<i>Juncus inflexus</i>	Hard Rush	-	2
<i>Epilobium palustre</i>	Marsh Willow-herb	-	1
<i>Dactylis glomerata</i>	Cock's-foot	8	-
<i>Alopecurus pratensis</i>	Meadow Foxtail	2	-
<i>Festuca rubra</i>	Red Fescue	1	-
<i>Cirsium palustre</i>	Marsh Thistle	1	-
<i>Phragmites australis</i>	Common Reed	1	-
<i>Vicia cracca</i>	Tufted Vetch	1	-
<i>Epilobium adenocaulon</i>	American Willowherb	1	-
Negative indicators			
<i>Arrhenatherum elatius</i>	False Oat-grass	20	4
<i>Urtica dioica</i>	Common Nettle	5	2
<i>Rumex conglomeratus</i>	Clustered Dock	-	2
<i>Rumex crispus</i>	Curled Dock	-	2
<i>Sonchus arvensis</i>	Perennial Sow-thistle	-	1
<i>Elytrigia repens</i>	Couch-grass	20	-
<i>Galium aparine</i>	Cleavers	2	-
<i>Lamium album</i>	White Dead-nettle	1	-
<i>Galeopsis tetrahit</i>	Common Hemp-nettle	1	-

Floristic character	2011	2017
Fen Meadow species	16	16
Negative indicators	6	5

3.4 Interpretation of the Monitoring Plot surveys

The two monitoring plots were originally established in locations intended to represent both the typical characters of each block of fen meadow and also an area that would be sensitive to some combination of management and hydrological influence.

The potential influence of near-surface groundwater is of particular significance on Webb's Fen as a flushed seepage track had been identified by OHES (2011) leading from near the terrace margin across the area sampled by the W01 Fen Meadow plot. Groundwater was also thought to have the potential to influence the shallow hollow picked out by the W02 Fen Meadow-Tussock Grassland plot. For both permanent plots, the maintenance and development of fen meadow vegetation was anticipated to be partly dependent upon groundwater influence.

One aspect of the target conditions for both plots is therefore likely to reflect the drift in species composition towards increasingly better-quality fen meadow, reflecting the persistence of near-surface groundwater flow. The quality of the fen is likely to reflect the proportion of the growing season with the watertable's capillary fringe within the topsoil, and the potential of fen species (positive indicators) to migrate from surrounding fens.

In the initial Fieldwork Report of 2011, the presence of ruderal plant species (classified as 'negative indicators' was assumed to be the result of the management history of Webb's Fen, which includes conversion to arable following drainage, and the subsequent management of the fen for sown grassland. This group of species, particularly False Oat-grass, is also likely to reflect the high nutrient availability typical of drained fen peats. These species are typically intolerant of prolonged waterlogging and repeated defoliation. They may therefore be expected to decline rapidly with improved hydrological conditions and/or a sufficient grazing intensity.

Following the initial site restoration, the fen has been periodically grazed and several facets of grazing behaviour are likely to affect sward growing conditions within the monitoring plot. In particular, defoliation, trampling, lodging of tussocks and dunging are each significant in the impact they can have on both physiognomy and sward floristics, with the effect of species composition tending to vary on the timing, intensity and duration of the stocking regime. Direct defoliation or trampling is most likely to affect grazing-sensitive species, which include many fen specialists as well as ruderal plant species. Notwithstanding, lodging of the rush tussocks may have an indirect impact on the sward by reducing light levels for both low-growing species and seedlings.

A second aspect of the target conditions for both plots is therefore likely to reflect the response of the sward to the pattern and intensity of grazing (and supplementary topping) on Webb's Fen. The quality of the grazed swards can be summarized as the potential for fenland species to establish and sustain populations favoured by an appropriate balance of grazing effects that tends to depress the vigour of competitive species and provides opportunities for seedling establishment and (largely) vegetative expansion.

The current sward characters of both plots are summarised below with reference to physiognomic and floristic changes since the baseline survey in 2011.

Plot W01 Fen Meadow

In 2011, the character of the plot was summarised as a "young, rushy fen meadow overstood by False Oat-grass but with the potential to stabilise and diversify through management". The appearance of the plot in comparison with the 2017 survey is shown in **Figure 3. Plot W01 physiognomy – comparison between 2011 and 2017.**

Figure 3. Plot W01 physiognomy – comparison between 2011 and 2017



Note that the oblique photos were taken from different points along the plot baseline

The oblique photos demonstrate that management has removed the supra-canopy of the grazing-sensitive False Oat-grass and reduced the average height of the rush canopy from 90 cm to 75 cm. This canopy height is of the same order as many rush beds in East Anglia.

The vertical photos show a small but representative area of the plot. In 2011, grasses were dominant and rush stems frequent. A thick litter layer is very evident. In 2017, the grassy canopy is essentially absent and many rush stems over-stand a thin sprawl of creeping grasses. Here, litter is a minor component, and dunging and defoliation are very apparent. Purple Loosestrife seedlings are scattered over this part of the plot.

These physical changes have had a major impact on the physiognomy of the sward, and they are coupled by an increase in standing water (at the end of June) and stock hoof-prints.

Plot floristics partly reflect the impact of a change in management since 2011, as there has been a high species turnover. Of the original 29 species recorded in 2011, only 55 per cent were re-recorded in 2017 (16 species). The most frequently occurring species to disappear from the sward are Red Fescue (which may have been sown) and a small suite of grazing-sensitive fen species such as Square-stemmed St John's-wort and Branched Bur-reed. Other species that have declined markedly are Rough Meadow-grass, Soft Rush and False Oat-grass. The meadow-grass is particularly sensitive to repeated trampling, and False Oat-grass to defoliation (presumably by grazing). The near-loss of Soft Rush, however - when Blunt-flowered Rush has sustained its frequency of occurrence - is more

likely to be evidence of near-surface groundwater, perhaps coupled with the impact of trampling in reducing the detention of mildly acidic rainwater on the soil surface.

There has also been a marked reduction in the frequency of the group of 'negative indicators'. Though largely represented by False Oat-grass, the loss of Perennial Sow-thistle and Couch-grass is also very evident.

A comparison of the floristics between 2011 and 2016 also reveals a number of colonists. The appearance of Lesser Spearwort is of some note in this context, though there has clearly not been an influx of fen species as might be expected. Potential colonists may either not be producing viable propagules, the mechanisms for transfer may not be functioning with sufficient vigour, or the receptor conditions may not have been suitable during and after the potential transfer periods between the two surveys.

Overall, plot floristic-richness has declined slightly, from 29 to 22 species, with a proportionately greater decline in the number of 'negative indicators'. The frequency of occurrence of this group has declined by over 90 per cent.

Plot W02 – Fen Meadow – Tussock Grassland

In 2011, the character of the plot was summarised as a “transitional area between Fen Meadow vegetation and Tussock Grassland Here, the plot is deliberately adjacent to one of the rushy hollows, but on notably drier ground dominated by False Oat-grass with a very thin scatter of fen meadow species”. The appearance of the plot in comparison with the 2017 survey is shown in **Figure 4. Plot W02 physiognomy – comparison between 2011 and 2017.**

As in W01, the oblique photos demonstrate that management has removed the supra-canopy of the grazing-sensitive False Oat-grass, though the height of the sub-tending rush canopy has increased from an average height of 107 cm to one of 125 cm. This is typically the outcome of higher light levels being matched by nutrient availability, though the actual fertility of the peat topsoil has not been demonstrated. Nonetheless, there has been a marked increase in rush cover, increasing from an average of 10 per cent in 2011 to 92.5 per cent in 2017. Over the same period, the cover of plant litter has greatly declined, with increases in the proportion of trampled ground and the occurrence of mosses.

It should also be noted that the peat surface was wet to saturated in the current survey.

Plot floristics partly reflect the impact of a change in management since 2011, as there has been a high species turnover. Of the 22 species recorded in 2011, 50 per cent (11 species) were not re-found. The greatest declines were amongst grass species, particularly Couch-grass and Cock's-foot. The decline in the 'negative indicator' Couch-grass was nearly matched in the reduction of False Oat-grass. Overall, there has been a marked decline in these non-target species.

As noted above, the greatest increases have been amongst the rushes, with Blunt-flowered and Jointed Rush expanding into the shallow hollow, and Soft Rush and Hard Rush over the slightly elevated area. As the tussock structure has developed, a distinct ground cover of grasses, with scattered Cuckooflower and occasional docks, has assembled between them, and these have formed the locus for cattle trampling and grazing.

Overall, plot floristic-richness has remained at the same level (22 species in 2011 and 21 species in 2017). The frequency of occurrence of the 'negative indicators' has declined by nearly 80 per cent.

Figure 4. Plot W02 physiognomy – comparison between 2011 and 2017



Note that the oblique photos were taken from different points along the plot baseline

3.5 Recommendations of the Vegetation Monitoring Programme

It is recommended that:

1. ***The Vegetation Monitoring Programme is maintained*** at Webb Fen by those responsible for ensuring appropriate management of the grasslands. This second Fieldwork Report successfully repeated the permanent plot surveys using the ‘full’ survey method (photographs, physiognomy and floristics). The Monitoring Plan (OHES 2010) proposes several means to integrate vegetation monitoring as a management decision-making tool.
2. ***The means of achieving target conditions for each sward should be reviewed***, based on the comments made in the previous section. Although it is evident that considerable progress has been made in diverting the overall structural and floristic characters towards a ‘fen meadow’ target there are two over-arching issues that could be addressed.
 - a) The first is the degree of control over stocking intensity and regime that would be needed to prevent continued dominance by rushes and the prevalence of trampling and lodging. Both impacts are likely to affect successful colonization.
 - b) The second issue is the paucity of evidence for successful colonization by fen species. If greater control can be exerted over achieving early-, mid- and late-season targets for sward height and rush cover, then natural ecological processes are likely to be

successful. It may also be appropriate to enhance natural processes by strewing green hay from carefully selected local sites.

3. **Monitoring surveys should be repeated regularly**, and the results incorporated into management decision-making. As recommended in the Monitoring Plan, the 'rapid survey' technique (plot photographs) is a useful annual device to assess gross changes in the sward. This should ideally be supplemented by a rapid walkover survey to identify the presence of colonising plant species, particularly when these can be interpreted as indicators of positive (or negative) change. The 'full survey' should provide a summative statement of the floristic and physiognomic changes that have occurred over a period of several years, and should be integrated into a periodic review of restoration progress.

4. REFERENCES

- Hill M.O., Blackstock T.H., Long D.G. and Rothero G.P. (2008) A Checklist and Census Catalogue of British and Irish Bryophytes. British Bryological Society, Middlewich.
- OHES (2010) Fen restoration vegetation monitoring programme for Parker's Piece and Bleyswyck's bank. Monitoring Plan 2010. Unpublished report to Little Ouse Headwaters Project.
- OHES (2011) Fieldwork to Support Habitat Restoration Work at Webb's Fen, Thelnetham. Unpublished report to Little Ouse Headwaters Project.
- Stace C.A. (2010) New Flora of the British Isles. Third Edition. Cambridge University Press, Cambridge.

Appendix 1. SPECIES RECORDED IN MONITORING PLOTS

<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alopecurus pratensis</i>	Meadow Foxtail
<i>Angelica sylvestris</i>	Wild Angelica
<i>Arrhenatherum elatius</i>	False Oat-grass
<i>Calystegia sepium</i>	Hedge Bindweed
<i>Cardamine pratensis</i>	Cuckooflower
<i>Carex acutiformis</i>	Lesser Pond-sedge
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Cirsium palustre</i>	Marsh Thistle
<i>Dactylis glomerata</i>	Cock's-foot
<i>Elytrigia repens</i>	Common Couch
<i>Epilobium adenocaulon</i>	American Willow-herb
<i>Epilobium palustre</i>	Marsh Willow-herb
<i>Epilobium parviflorum</i>	Hoary Willow-herb
<i>Equisetum palustre</i>	Marsh Horsetail
<i>Eupatorium cannabinum</i>	Hemp Agrimony
<i>Festuca rubra</i>	Red Fescue
<i>Filipendula ulmaria</i>	Meadow-sweet
<i>Galeopsis tetrahit</i>	Common Hemp-nettle
<i>Galium aparine</i>	Cleavers
<i>Geranium dissectum</i>	Cut-leaved Cranes-bill
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort
<i>Juncus articulatus</i>	Jointed Rush
<i>Juncus effusus</i>	Soft Rush
<i>Juncus inflexus</i>	Hard Rush
<i>Juncus subnodulosus</i>	Blunt-flowered Rush
<i>Lamium album</i>	White Dead-nettle
<i>Lathyrus pratensis</i>	Meadow Vetchling
<i>Lythrum salicaria</i>	Purple Loosestrife
<i>Persicaria amphibia emersa</i>	Amphibious Bistort (land form)
<i>Persicaria maculosa</i>	Redshank
<i>Phragmites australis</i>	Common Reed
<i>Poa trivialis</i>	Rough Meadow-grass
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Rumex conglomeratus</i>	Clustered Dock
<i>Rumex crispus</i>	Curled Dock
<i>Schedonorus pratensis</i>	Meadow Fescue
<i>Silene flos-cuculi</i>	Ragged Robin
<i>Sonchus arvensis</i>	Perennial Sow-thistle
<i>Sparganium erectum</i>	Branched Bur-reed
<i>Stachys palustris</i>	Marsh Woundwort
<i>Urtica dioica</i>	Common Nettle
<i>Vicia cracca</i>	Tufted Vetch
Bryophytes	
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss
<i>Calliergona cuspidata</i>	Pointed Spear-moss

Appendix 2. FIELD RECORD FOR W01 FEN MEADOW MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Juncus subnodulosus</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Agrostis stolonifera</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Holcus lanatus</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Calystegia sepium</i>	P	P	P				P	P					P	P	P	P		P	P	P	12
<i>Ranunculus repens</i>				P	P	P		P	P	P	P	P	P				P	P			11
<i>Persicaria amphibia</i>			P	P				P	P		P		P			P	P	P			9
<i>Lythrum salicaria</i>		P	P	P				P				P	P				P				7
<i>Persicaria maculosa</i>				P				P	P		P	P				P					6
<i>Poa trivialis</i>	P						P					P		P				P			5
<i>Lathyrus pratensis</i>	P				P	P													P	P	5
<i>Phragmites australis</i>	P				P	P													P		4
<i>Epilobium parviflorum</i>	P				P	P														P	4
<i>Silene flos-cuculi</i>			P						P												2
<i>Vicia cracca</i>					P	P															2
<i>Juncus inflexus</i>						P									P						2
<i>Ranunculus flammula</i>					P					P											2
<i>Arrhenatherum elatius</i>					P	P															2
<i>Rumex crispus</i>								P					P								2
<i>Juncus effusus</i>		P												P							1
<i>Calliergonella cuspidata</i>									P												1
<i>Schedonorus pratensis</i>	P																				1
<i>Filipendula ulmaria</i>			P																		1
No. of species	9	6	8	7	10	10	5	9	8	5	6	7	8	6	5	6	6	7	6	6	Av. 7.0

Appendix 3. FIELD RECORD FOR W02 FEN MEADOW-TUSsock GRASSLAND MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Holcus lanatus</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Juncus effusus</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P						15
<i>Juncus subnodulosus</i>								P	P		P	P	P	P	P	P	P	P	P	P	12
<i>Lythrum salicaria</i>								P		P		P		P			P	P	P		7
<i>Agrostis stolonifera</i>		P		P	P	P	P		P	P											7
<i>Calystegia sepium</i>													P			P	P	P	P	P	6
<i>Poa trivialis</i>		P		P	P		P			P								P			6
<i>Epilobium parviflorum</i>														P		P	P	P	P	P	6
<i>Ranunculus repens</i>		P		P			P			P		P									5
<i>Cardamine pratensis</i>		P		P			P			P		P									5
<i>Brachytecium rutabulum</i>			P			P			P		P										4
<i>Juncus articulatus</i>															P						4
<i>Arrhenatherum elatius</i>	P		P		P			P													4
<i>Carex acutiformis</i>											P									P	2
<i>Hypericum tetrapterum</i>	P					P															2
<i>Juncus inflexus</i>								P					P								2
<i>Urtica dioica</i>	P			P																	2
<i>Rumex conglomeratus</i>		P					P														2
<i>Rumex crispus</i>					P			P													2
<i>Epilobium palustre</i>															P						1
<i>Sonchus arvensis</i>	P																				1
No. of species	6	7	4	7	6	5	7	7	5	7	5	6	5	5	5	5	5	7	6	5	Av. 5.8