



Eakring Meadows SSSI

Report on Ecohydrological Monitoring 2015-17

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1. Executive Summary

This report compiles and analyses data collected over a two year period (2015-2017) as part of the Floodplain Meadows Partnership Ambassadors programme, a programme which aims to pass on knowledge of ecohydrological monitoring. The study was undertaken on fields 2 and 3 of Eakring and Mapplebeck Meadows SSSI, Nottinghamshire, which is owned and managed by Nottinghamshire Wildlife Trust. This site was chosen due to the declining quality of the MG4 grassland over a period of many years, and followed on from previous studies commissioned by Natural England.

The fields contain MG4 *Alopecurus pratensis* – *Sanguisorba officinalis* grassland, but within this there are two distinct sub communities MG4b, the typical community albeit species poor and MG4c *Holcus lanatus* sub-community. This is likely to be due to poor drainage across the site providing hydrological regimes more typical of MG8 communities. It appears that the site had recovered slightly botanically between 2015 and 2016 when botanical transects were undertaken and this could be due to shorter periods of waterlogging.

During the period May 2015 to January 2017, various methods were employed to enable an assessment of the site, and likely beneficial management practices, to be made. These included – botanical quadrat transects, NVC botanical quadrats, dipwell installation with associated monthly monitoring, soil sampling, soil profiles and monitoring of site management.

Although the fields are still classified as MG4, they are of low diversity, and need to continue to receive annual hay cuts in July with aftermath grazing. Already field 3 has improved from being dominated by *Carex acuta* and *Carex acutiformis* as seen when the site was surveyed in 2008. The drainage pipe between the fields should be kept clear, and if this is not possible then a new drainage ditch/pipe/grip should be considered. The same applies to the ditch between fields 3 and 4.

Hydrological and botanical monitoring should continue and hydrological monitoring should be expanded with further dipwells installed to provide a wider understanding of the factors affecting the two fields.

2. Introduction

Eakring and Mapplebeck Meadows consist of 6 meadows bounded to the north by a small river called The Beck, a tributary of the River Trent, and with the southern boundary formed by a minor road. The meadows are owned (apart from field 1 – Penny Pasture Common) by Nottinghamshire Wildlife Trust. The meadows lie between 40m and 43m AOD and are underlain by heavy clay soils. The site lies at the bottom of the valley, with additional water being received from the surrounding arable fields to the south of the adjoining road. (See appendix 1 for location map).

All the meadows apart from Penny Pasture Common were designated as SSSI for their MG4 grassland in 1981. The meadows are managed by a combination of hay cuts in mid-late July and after mow grazing. In years where the ground is too wet to take a hay cut, grazing alone may be used. The hay cut and grazing is undertaken by a local farmer – Pat Moss.

This study is restricted to looking at fields 2 and 3. Field 3 has declined in diversity and has become dominated by rush and sedge, with a drop in finer herb species. Whilst field 4 has also suffered declines in diversity, it was decided to study fields 2 and 3 as they are starting to recover and it was felt that more impact could be made by studying them in depth. Fields 5 and 6 are in good condition botanically. Two previous studies have taken place on the site – an NVC botanical survey by the Floodplain Meadows Partnership in 2008 and a hydrological study in 2013 by Jonathon Hillman of Soil, Water and Catchment Management on behalf of Natural England.

The NVC survey in 2008 showed that the majority of fields 2 and 3 were classified as MG4 *Alopecurus pratensis* – *Sanguisorba officinalis* grassland. Whilst the MG4 sub-communities had not been officially defined at this time, field 2 was mainly classified as species poor MG4, and field 3 as MG4 *Carex acuta* / *acutiformis*.

The hydrology survey from 2013 was commissioned by Natural England with the following objectives in mind;

- Undertake a topographical survey of the site.
- Undertake monitoring and investigations to see how the site responds in relation to rainfall and flooding events e.g. water level monitoring using data loggers.
- Locate the drains, investigate their condition and identify areas of blockages
- Provide detailed costings and methodology to remediate the issue of the current drainage.
- Provide details on alternative methods of remediation if repairs to the existing drains are not feasible or likely to be successful. To include methodology and costings.
- Undertake conceptual modelling to aid decision making.

The hydrological monitoring took place over the winter of 2012/13, with regular dipwell readings over a period of 5 months. The conclusion from the range of factors studied was that the deep-drain running parallel to the road was blocked, significantly between fields 3 and 4 and also between fields 2 and 3.

The study period covered by this report is May 2015 until January 2017.

3. Methods

In order to assess the grassland and make recommendations on future management the following techniques were used.

3.1. Botanical and Habitat surveying

In May 2015 a map of the habitat extents was produced, which is shown as appendix 2.

On 18th June 2015, two botanical transects of four quadrats each were mapped on the site, appendix 3. All species within each quadrat, along with percentage abundance were recorded. The transects were across the two main habitat types with a hydrological gradient from the road through to the Beck.

On the 28th June 2016 the botanical transects were resurveyed, with percentage abundances recorded.

The June 2016 quadrats spanned the different habitat types mapped in appendix 2 and will be used to determine NVC.

3.2. Soil Profiles

A soil profile was produced at the same time as the dipwell was installed, see appendix 5.

3.3. Hydrological Monitoring

On 31st October 2015 a dipwell was installed on site. A 5cm metal augur was used to create a hole to 110cm depth; a length of plastic drainage pipe with holes drilled at regular intervals was covered in a permeable stocking to prevent silting, and placed into the hole. A plastic cap and metal plate were placed on the top of the dipwell. An initial reading of water depth was made using a buzzing stick. Dipwell readings were taken on average once a month until January 2017. Readings for May and June 2016 were missed due to inability to locate the dipwell as the marker cane had been removed. A metal detector was purchased to aid with location in future visits. Whilst readings were taken once a month, these were not always evenly spaced. Map showing the dipwell location is Appendix 4.

3.4. Soil Nutrient

A soil sample was taken on the 31st October 2015, and after a week of drying was sent to the Open University for analysis. The analysis undertaken provided Olsens P and pH of the soil.

A sedimat was placed on the site on 23rd November 2015 and removed on 19th March 2016. No sediment was retrieved as the site had not flooded during the winter period.

3.5. Site Management

In both 2015 and 2016 estimates were made of hay yield and the date that stock were added to site were noted along with stocking numbers.

4. Results

4.1. Botanical and Habitat Monitoring

Ellenberg scores were used to assess changes in vegetation communities between 2015 and 2016. Charts 1 to 5 below show the relative changes in L (light), F (moisture), R (Reaction), N (nitrogen) and S (salt). In all of the quadrats the botanical composition indicated an

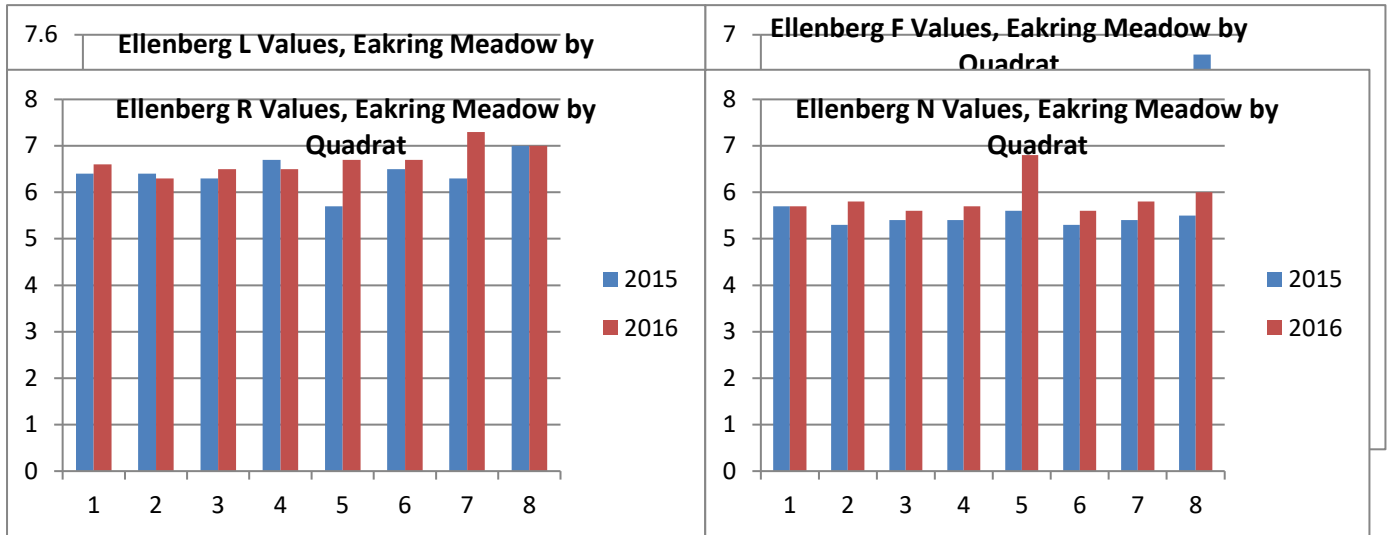


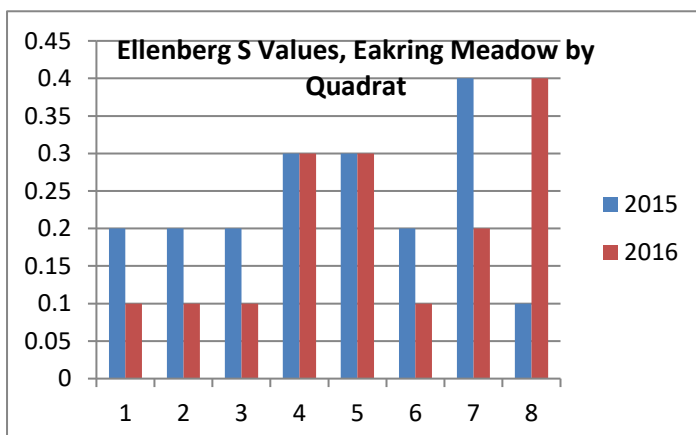
Chart 1

Chart 2

Chart 3

Chart 4

Chart 5



increase in light levels, or no change, from 2015 to 2016, apart from quadrat 8. F values dropped across all quadrats from 2015 to 2016 with the converse true for N values.

In 2015, transect 1 had a total of 20 species, in 2016 it had 23. Transect 2 recorded 15 species in 2015 and 19 in 2016. The species data was put into constancy tables, to allow an assessment of NVC to be made.

Latin name	Common name	Const	Min	Max
Cynosurus cristatus	Crested dog's-tail	IV	10	25
Holcus lanatus	Yorkshire fog	IV	5	14
Lathyrus pratensis	Meadow vetchling	IV	5	15
Rumex acetosa	Common Sorrel	IV	1	3
Trifolium dubium	Lesser Trefoil	IV	3	10
Dactylis glomerata	Cock's-foot	III	3	5
Lolium perenne	Perennial rye-grass	III	2	2
Leontodon autumnalis	Autumn hawkbit	III	2	7
Ranunculus acris	Meadow buttercup	III	5	10
Sanguisorba officinalis	Great Burnet	III	45	70
Trifolium pratense	Red Clover	III	10	25
Alopecurus pratensis	Meadow foxtail	II	5	10
Cerastium fontanum	Common mouse-ear	II	1	2
Plantago lanceolata	Ribwort plantain	II	10	15
Arrhenatherum elatius	False oat-grass	I	5	5
Cirsium arvense	Creeping thistle	I	2	2
Filipendula ulmaria	Meadowsweet	I	5	5
Heracleum sphondylium	Hogweed	I	5	5
Ranunculus repens	Creeping buttercup	I	15	15
Geranium dissectum	Cut-leaved cranesbill	I	5	5

Table 1: Transect 1 constancy data 2015

Latin name	Common name	Const	Min	Max
Holcus lanatus	Yorkshire fog	IV	15	90
Lolium perenne	Perennial rye-grass	III	5	15
Filipendula ulmaria	Meadowsweet	III	5	10
Cynosurus cristatus	Crested dog's-tail	II	25	25
Lathyrus pratensis	Meadow vetchling	II	5	20
Dactylis glomerata	Cock's-foot	II	8	25
Ranunculus acris	Meadow buttercup	II	10	15
Trifolium pratense	Red Clover	II	8	10
Alopecurus pratensis	Meadow foxtail	II	5	10
Poa trivialis	Rough meadow-grass	II	10	10
Rumex acetosa	Common Sorrel	I	2	2
Sanguisorba officinalis	Great Burnet	I	8	8
Arrhenatherum elatius	False oat-grass	I	5	5
Elytrigia repens	Couch grass	I	20	20
Hordeum murinum	wall barley	I	10	10

Table 2: Transect 2, 2015

Latin name	Common name	Const	Min	Max
<i>Cynosurus cristatus</i>	Crested dog's-tail	IV	2	4
<i>Holcus lanatus</i>	Yorkshire fog	IV	4	40
<i>Sanguisorba officinalis</i>	Great Burnet	IV	3	60
<i>Poa trivialis</i>	Rough meadow-grass	III	4	10
<i>Lathyrus pratensis</i>	Meadow vetchling	III	3	5
<i>Leontodon autumnalis</i>	Autumn hawkbit	III	2	15
<i>Ranunculus repens</i>	Creeping buttercup	III	2	3
<i>Rumex acetosa</i>	Common Sorrel	III	1	2
<i>Trifolium dubium</i>	Lesser Trefoil	III	2	5
<i>Agrostis stolonifera</i>	Creeping bent	II	5	10
<i>Bromus commutatus</i>	Meadow brome	II	5	10
<i>Lolium perenne</i>	Perennial rye-grass	II	1	15
<i>Plantago lanceolata</i>	Ribwort plantain	II	7	10
<i>Ranunculus acris</i>	Meadow buttercup	II	2	8
<i>Trifolium pratense</i>	Red Clover	II	5	8
<i>Alopecurus pratensis</i>	Meadow foxtail	I	1	1
<i>Dactylis glomerata</i>	Cock's-foot	I	3	3
<i>Elytrigia repens</i>	Couch grass	I	10	10
<i>Phleum pratense</i>	Timothy	I	1	1
<i>Trisetum flavescens</i>	Yellow oat-grass	I	10	10
<i>Filipendula ulmaria</i>	Meadowsweet	I	25	25
<i>Heracleum sphondylium</i>	Hogweed	I	3	3
<i>Vicia cracca</i>	Tufted vetch	I	4	4

Table 3: Transect 1, 2015

Latin name	Common name	Const	Min	Max
<i>Cynosurus cristatus</i>	Crested dog's-tail	II	2	10
<i>Holcus lanatus</i>	Yorkshire fog	IV	40	95
<i>Filipendula ulmaria</i>	Meadowsweet	III	2	6
<i>Carex acutiformis</i>	Lesser pond-sedge	III	3	10
<i>Sanguisorba officinalis</i>	Great Burnet	II	2	6
<i>Poa trivialis</i>	Rough meadow-grass	II	5	12
<i>Lathyrus pratensis</i>	Meadow vetchling	II	1	1
<i>Leontodon autumnalis</i>	Autumn hawkbit	II	1	1
<i>Rumex acetosa</i>	Common Sorrel	II	2	2
<i>Ranunculus acris</i>	Meadow buttercup	II	1	2
<i>Alopecurus pratensis</i>	Meadow foxtail	II	1	35
<i>Ranunculus repens</i>	Creeping buttercup	I	3	3
<i>Agrostis stolonifera</i>	Creeping bent	I	1	1

Lolium perenne	Perennial rye-grass	I	1	1
Phleum pratense	Timothy	I	1	1
Agrostis capillaris	Common bent	I	2	2
Deschampsia cespitosa	Tufted hair-grass	I	1	1
Cerastium fontanum	Common mouse-ear	I	1	1
Geranium dissectum	Cut-leaved cranesbill	I	1	1

Table 4: Transect 2, 2016

From the constancy tables both transects appear to be in the MG4 *Alopecurus pratensis* – *Sanguisorba officinalis* grassland.

All the quadrat data was run through MAVIS to confirm the NVC category. Transect 1, 2015 fit best with MG4b, Transect 2, 2015 with MG4c, Transect 1 in 2016 was showing as MG4c or Mg4b and Transect 2 in 2016 as MG4c.

4.2. Soil Profile

The full soil profile report obtained whilst installing the dipwell is contained in Appendix 5. It shows that the basic profile of the soil in that location was a layer of dark friable soil to about 7.5cm, followed by a band of clay over 1m thick (probably thicker in places). No gravel or mottling was experienced.



Photo 1: Soil profile (excluding the friable top zone)

4.3. Hydrological Monitoring

The dipwell data was plotted against date to show the trend across the year.

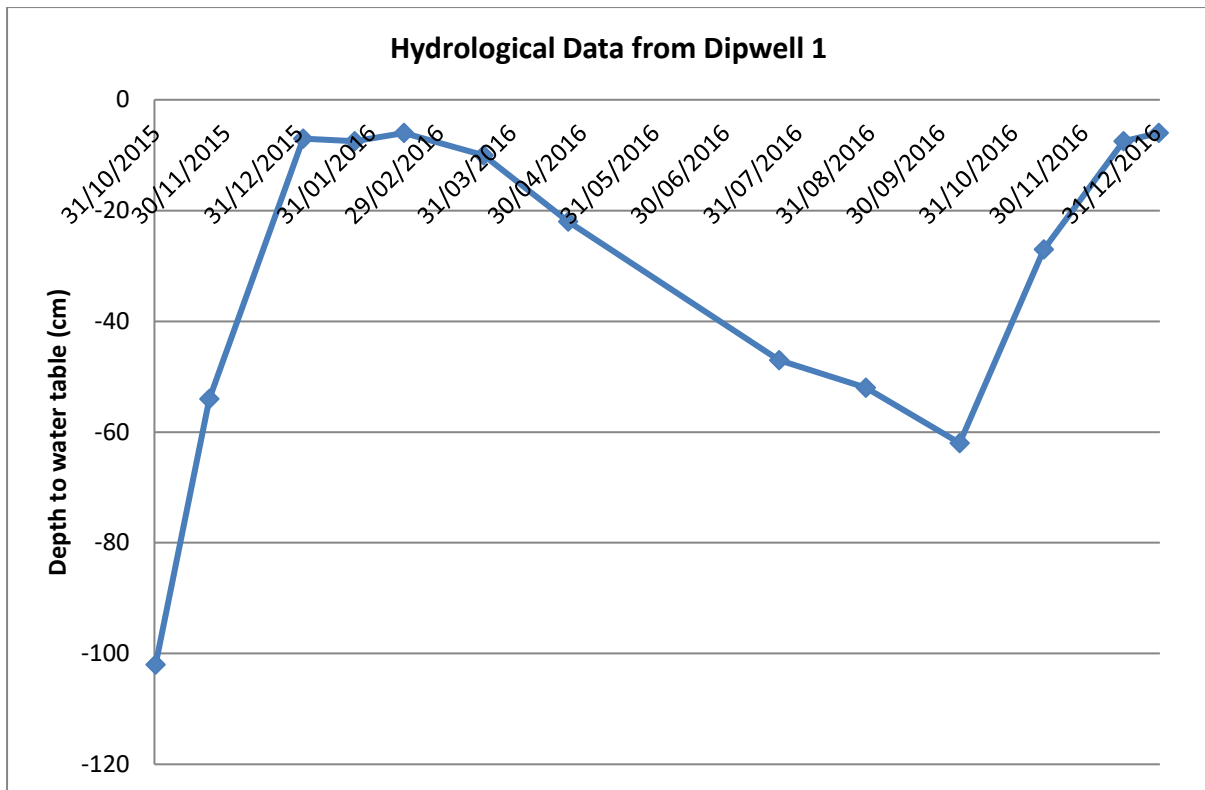


Chart 6: Dipwell trend

When the soil type is taken into account it is possible to work out the water depths at which the plants will experience drought and flood, which can help to determine the plant community composition. For Eakring Meadow it is likely that the wet threshold is **41cm** and the dry threshold **49cm** (i.e. if the water table is 41cm or less from ground level the plants will suffer waterlogging stress).

This knowledge combined with the hydrological data from the dipwell it is possible to work out how many weeks the site spent with dry soil and how many with wet, which can be plotted onto a plant matrix to determine the likely NVC community based on the water stress of the site. When plotted this gives a predicted NVC community of MG8 *Cynosurus cristatus* - *Caltha palustris* grassland.

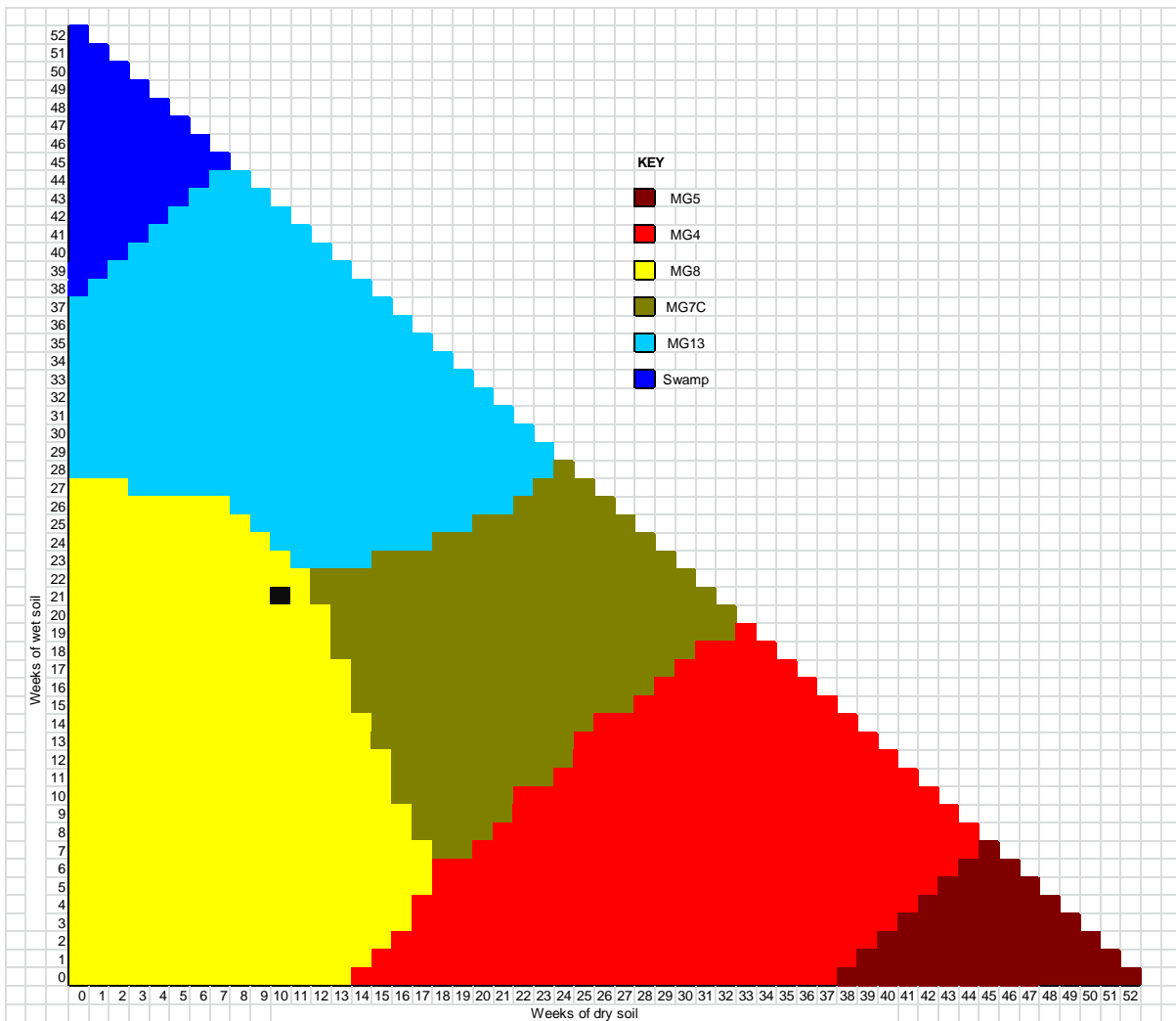


Chart 7: Plant matrix for Eakring Meadow, the black dot shows the predicted NVC for the site.

4.4. Soil Nutrients

The soil analysis conducted by the Open University from the sample sent in October 2015 showed Olsens P levels of 18.1 and pH of 6.51. There was no sediment sample analysis as the site did not flood during the study period.

4.5. Habitat Management

The site received a hay cut on both fields 2 and 3 in 2015 and 2016 with aftermath grazing both years. In 2015 the hay cut took place around the 24th of August and approximately 40 large round bales were removed. Cattle were observed on the site on the 28th August, with 8 animals seen, and they were removed by the 18th November, leaving a winter sward height of around 5cm. In 2016 the hay cut took place around the 15th July and approximately 42 large round bales were removed. Cattle were observed on the site on the 29th August, with 11 animals seen, and they were removed by the 30th November, leaving a winter sward height of around 5cm. It should be noted that the cattle also had access to Penny Pasture Common (adjacent) at the same time as grazing fields 2 and 3.

Discussion

From the botanical survey work, it is clear that the NVC community is species poor MG4, with two different sub-communities likely present. Transect 1 appears to be slightly better, with slightly drier conditions than Transect 2 and is within the MG4b typical subcommunity, although at the species poor end. Transect 2 is likely within the MG4c *Holcus lanatus* sub-community as evidenced by the dominance of Yorkshire Fog (*Holcus lanatus*) within the transect. Although the hydrological data points to the site being MG8, this is not backed up by the botanical data. There are two reasons this could be, the first is that dipwell monitoring was missed in May and June 2016, two of the likely drier months, which could have skewed the data to show that more weeks were spent wet than dry. The second reason could be that there is something amiss with the drainage on site, as highlighted by the previous botanical survey and hydrological reports, which is leading the site to be too wet. This would also partially explain the fact that both transects are particularly species poor compared to a typical MG4 grassland.

This conclusion with regards to NVC is comparable with previous surveys which determined that the fields were species poor MG4 grassland (Wallace et.al 2008). The management plan (2000) and its revision (2008) refer to the site as being designated for some of the best neutral grassland in Nottinghamshire, however they do not state an NVC. The first version from 2000 only briefly refers to the waterlogging and subsequent sedge issues in field 4. IN the 2008 revision it becomes clear that the drain running through fields 2 and 3 and which caused problems in the early 1980's, coupled with inconsistent hay cuts (every other year at the most frequent) had led to a spread in the sedge beds. However, comparing the current vegetation with the maps produced by Wallace (2008) there has been a significant reduction in the sedge cover in field 3.

The site is predominantly clay, which although it did not flood during the study period, does hold water well, draining slowly. This could also lead to an increase in water logging stress. The nutrient levels on site were as expected, and there was no call to recheck them as the fields did not receive any flood inputs.

The Ellenberg F values show a decrease in wetness across all quadrats from 2015 to 2016, which shows that perhaps the site has started to respond to drier conditions following from previous wet years. It is believed that the site may have flooded in December 2013 during a very wet winter locally. Apart from the Ellenberg S value increasing dramatically in 2016 at quadrat 8, which could be due to run-off from the adjacent road, the other Ellenberg values had not changed dramatically between years.

Whilst the dipwell data has shown no surprising trends, due to only being across 18 months, the lack of data from the summer months in 2016, and of ongoing monitoring can only tell us a small amount.

The site has been grazed for a number of years, however it is believed that hay cuts had been taken only on field 2 with any regularity – this was due to field 3 being too wet to take hay from.

Recommendations

- Continue monitoring the dipwell already installed.
- Install further dipwells to enable a picture of the site to be built up (4 further dipwells were installed on the 22nd April 2017 with assistance from Nottinghamshire Wildlife Trust who will take on the monitoring).
- Continue to take a hay cut every year from both fields 2 and 3, with aftermath grazing.

- Continue to monitor the botanical transects to allow changes in sward composition to be determined.
- Investigate the cost of rodding the drain between fields 2 and 3, to ensure that it is able to flow at periods of high water. This should ensure that field 2 remains suitable for MG4 grassland.
- Investigate the drain that runs from the road edge to the Beck along the hedgerow at the eastern edge of field 3.
- Investigate whether creating new drains will compensate for the blocked drains.

The **main risks** facing the site are inadequate drainage from blocked drains leading to a decrease in diversity and an increased likelihood that the vegetation community progresses to MG8. The other main risk is losing the farmer that takes the hay cut and grazes the site. Without access to this service it is a possibility that management may become more ad-hoc.

References

Jonathan Hillman, March 2013 Nottinghamshire SSSI Hydrological Study, 1. Eakring Meadows Final Report

Nottinghamshire Wildlife Trust, 2000. *Penny Pasture, Eakring Meadows and Hunt's Meadow Management Plan*

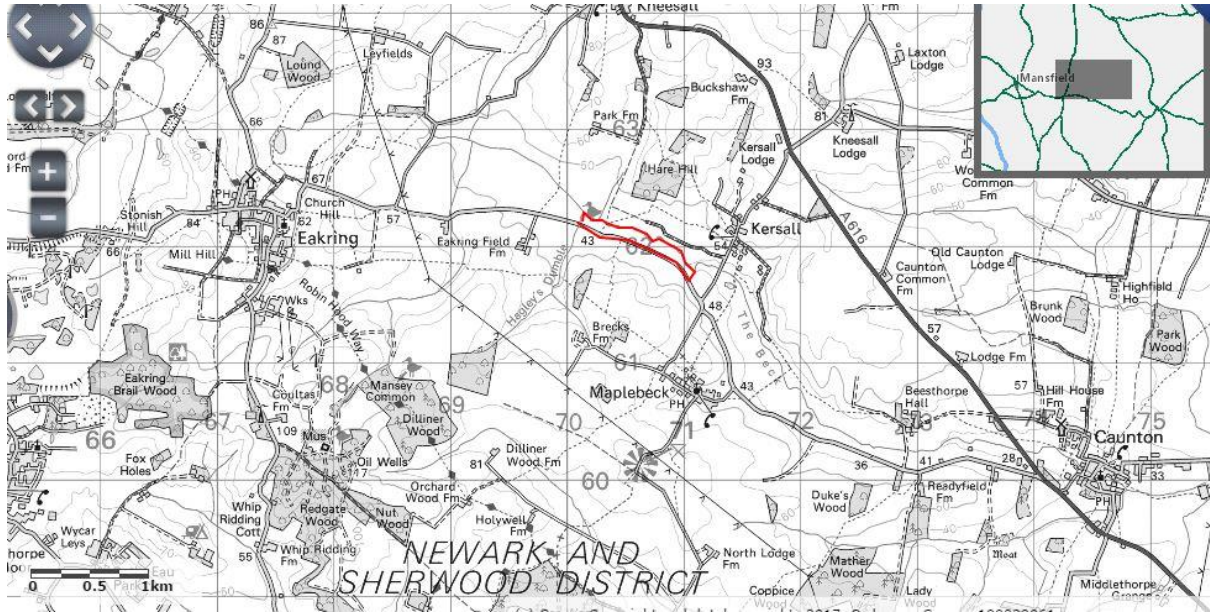
Nottinghamshire Wildlife Trust, 2008. *Update to Penny Pasture, Eakring Meadows and Hunt's Meadow Management Plan*

Wallace, H and Prosser, M. 2008 *NVC Survey of Eakring and Besthorpe Meadows Floodplain Meadows Partnership.*

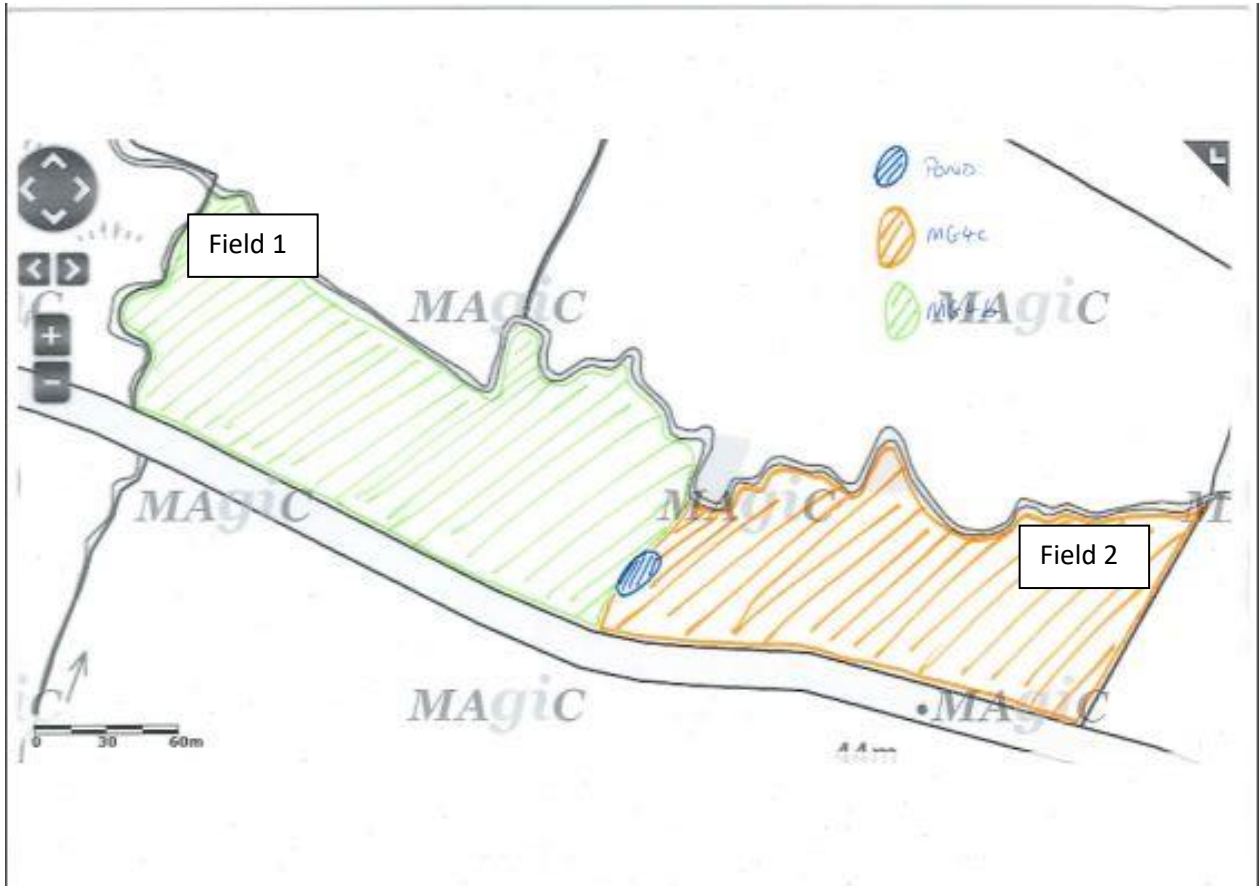
Appendices

Appendix 1: Location map of site

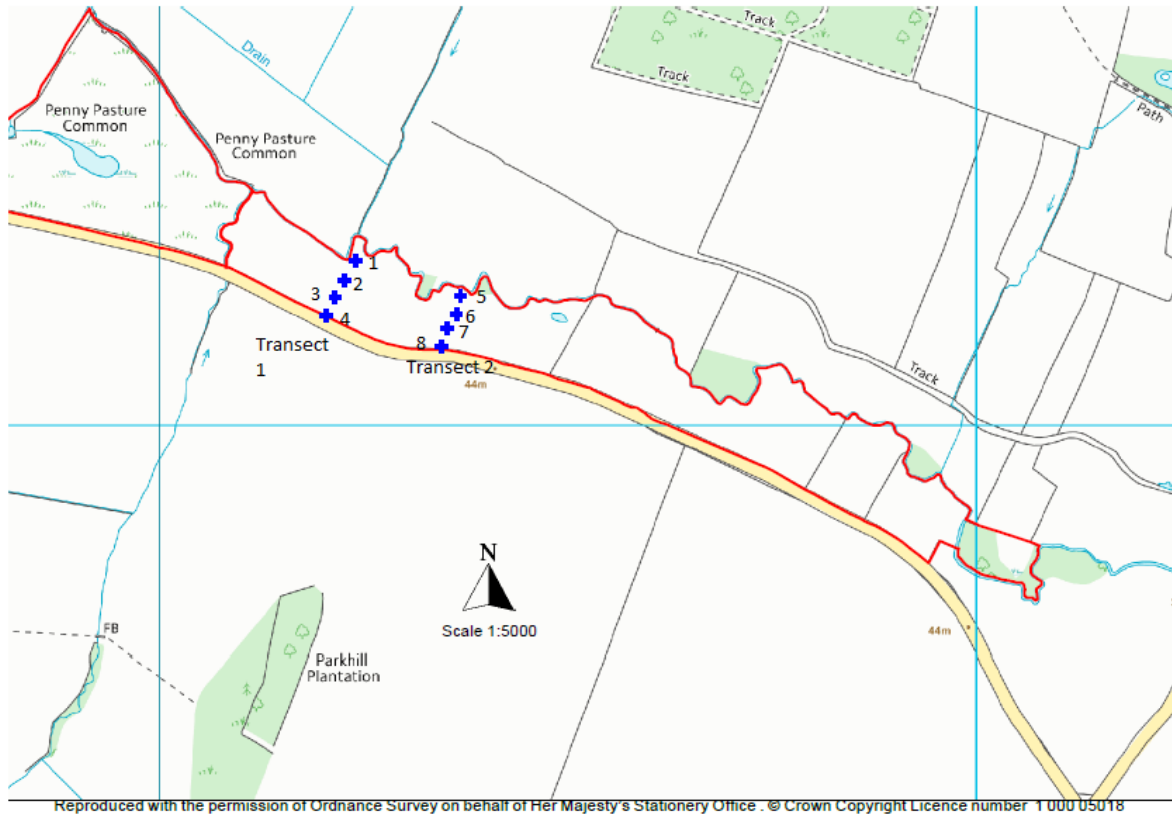
Eaking Meadow SSSI – Hydrological Monitoring Report



Appendix 2: Map showing habitat types



Appendix 3: Map showing botanical transects



Appendix 4: Map showing dipwell location



Appendix 5: Soil Profile Report

Survey of the soil profile at Eakring Meadow

The soil profile was investigated at Eakring Meadow SSSI on 31st August 2015 using a 1.2m auger. One sample point was used.

In the profile the depth of the darker surface horizon was measured, as was the depth to sand and/or gravel, and any mottling of grey/brown. At some points water was visible at the bottom of the hole.

The river level was fairly normal.



ID	Location	Core number	Description
1	SK70366212	1	Dark and friable, with roots, won't roll into ball, no sand
		2	Dark and friable to half way, then turns to reddish clay.
		3-9	Reddish Clay – no mottling.
		10-12	Grey clay, no mottling. Does not hit gravel.

Interpretation

The basic profile of the soil from this augur is a layer of dark friable soil to about 7.5cm, followed by a band of clay over 1m thick (probably thicker in places). No gravel or mottling was experienced.

Photos

1



missing friable top soil

2



Showing friable soil to left of picture.