



**Bedfordshire
Cambridgeshire
Northamptonshire**

Water Voles in the Middle Level

A repeat survey of Curf Fen and Ransonmoor

Prepared by

The Wildlife Trust for Bedfordshire, Cambridgeshire and
Northamptonshire

February 2016

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This work was undertaken through the Water for Wildlife project, a partnership project between the Wildlife Trust and Anglian Water



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Final report		
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2 Summary

This survey covered two drainage districts: Curf Fen and Ransonmoor. Drainage is maintained by Curf and Wimblington Combined Internal Drainage Board (Curf and Wimblington Combined IDB) and by Ransonmoor District Drainage Commissioners (Ransonmoor DDC) respectively. Both districts are in Cambridgeshire and form part of the Middle Level of the fens.

The survey checked all IDB / DDC maintained ditches and many private ditches for signs of water vole. The aim was to repeat a survey first carried out by the Wildlife Trust in 2005, and repeated in 2010 as part of a Masters' dissertation, to try to detect long term population trends.

This report has been produced by the Wildlife Trust and will be shared with the Middle Level Commissioners, Curf and Wimblington Combined IDB and Ransonmoor DDC. It will also be made available to any other interested parties.

Surveys were carried out on foot and by boat throughout Curf Fen and Ransonmoor in spring and autumn 2015, recording signs of water vole and using a GPS unit to produce an accurate map.

Results indicate no observable change in the number of water vole signs over the past 10 years, which is very encouraging against a background of national decline. Results support previous assertions that these drainage districts, collectively with many others in the Middle Level, are at least a regionally important stronghold for water vole.

Results also confirm that water voles prefer better habitat, or poorer habitat connected to other populations, and that "good habitat" generally means deeper water with good vegetation cover on the banks. As in previous surveys, Ransonmoor had a higher level of occupancy than Curf Fen, which is probably due to the better habitat (many of the Curf Fen ditches are shallow) and better connectivity (Curf Fen is divided into two by the A141 and is generally less compact).

Water voles at Curf Fen appear to move around the district from year to year, possibly following the best habitat, whereas at Ransonmoor there is a core area with consistent water vole occupation.

This survey supports the conclusions of previous surveys, that ditch maintenance (machine cleansing) does not have a significant effect on water vole populations in the short term, and seems to have a positive effect in the long term. Re-profiling ditches does have a negative effect on water vole presence, which can be mitigated by working on shorter sections and on one bank only. In general water voles seem to return after a period of between 2 and 5 years.

3 Introduction

The Cambridgeshire Fens have been identified as a stronghold for water vole, against a background of national decline. Surveys by Hillier & Baker (Hillier 2000, Hillier & Baker 2001) identified significant numbers of water voles in the Fens, and these were studied in more detail in two drainage districts in 2003, 2004 and 2005 (Ross 2006). These districts are Curf Fen and Ransonmoor, both within the operational area of the Middle Level Commissioners (MLC). The relevant drainage boards are Curf and Wimblington Combined Internal Drainage Board (Curf and Wimblington Combined IDB) and Ransonmoor District Drainage Commissioners (Ransonmoor DDC).

The districts were originally chosen because Ransonmoor DDC has a maintenance regime that the MLC consider to be more sympathetic to the needs of water vole as described by conservation best practice, whilst Curf and Wimblington Combined IDB uses a more intensive management regime. At Ransonmoor flail mowing is carried out in advance of both machine cleansing and side trimming works; mowing is confined to the bank-side from which the machine is working to afford better visibility. At Curf Fen the maintenance regime includes the flail mowing of most bank sides every year.

3.1 2005 results

Detailed surveys (Ross 2006) established strong populations of water vole in both districts, with the Ransonmoor DDC maintained ditches having 90% occupancy. Curf and Wimblington Combined IDB maintained ditches had 58% occupancy. Suggested reasons for the difference included the more sympathetic management regime at Ransonmoor, the consistently higher water levels in the main drains compared to Curf Fen, and the better connectivity between ditches at Ransonmoor due to differences in site layout. Water voles were less frequent in the side (farm) drains (31% at Ransonmoor and 42% at Curf Fen). Water levels are much lower in the side ditches, making them less suitable for water vole. Significantly fewer water vole signs were found in watercourses less than 30cm deep.

The study also found that de-silting (working from one side, over the winter, and placing removed material well away from the banks) has minimal impact on vole populations, although major re-profiling work can have a significant impact.

3.2 2010 results

Surveys of the same drainage districts were repeated in 2010 for a student masters' thesis at the University of East Anglia (Chen 2010). This found similar levels of water vole presence as the 2005 survey. It also showed no impact from construction of a wind farm at Ransonmoor. The study found that on the maintained ditches water depth and having banks steep enough and un-compacted enough for burrowing were key factors, whereas on the side ditches water presence and presence of common reed were critical for water vole presence.

Analysis of habitat quality in 2010 showed that water voles would prefer sub-optimal habitat linked to good habitat than isolated good habitat. Water voles live in large meta-populations and isolation makes them more vulnerable to predators and other unusual events. Connectivity is a key factor for persistence of water vole populations.

The 2010 study concluded that feeding remains are less associated with physical conditions (e.g. water depth and bank slope) and focussed instead on places where water voles can sit and eat comfortably. The number of feeding signs was also more dependent on the number of potential feeding stations with good cover. At sites in 2010 with comparable numbers of latrines and droppings, there was a much greater density of feeding remains at Ransonmoor than at Curf Fen, which was attributed to the better plant cover.

A 2010 “hotspot map” was created showing the areas with most water vole signs. Side ditches seemed to be more critical for these hotspots in Curf Fen than in Ransonmoor.

The 2010 survey suggested that re-profiling of ditches at Curf Fen had become more sympathetic since 2006, carried out on shorter sections of ditch, and that this work had not had a major impact on water vole populations, whereas the long stretches re-profiled in 2006 still had a reduced number of signs in 2010. It was not however possible to verify this claim with the available data.

3.3 Aims

The aims of this survey were to collect data from as many of the previously surveyed ditches as possible, and compare results with previous years to check for any long term trends.

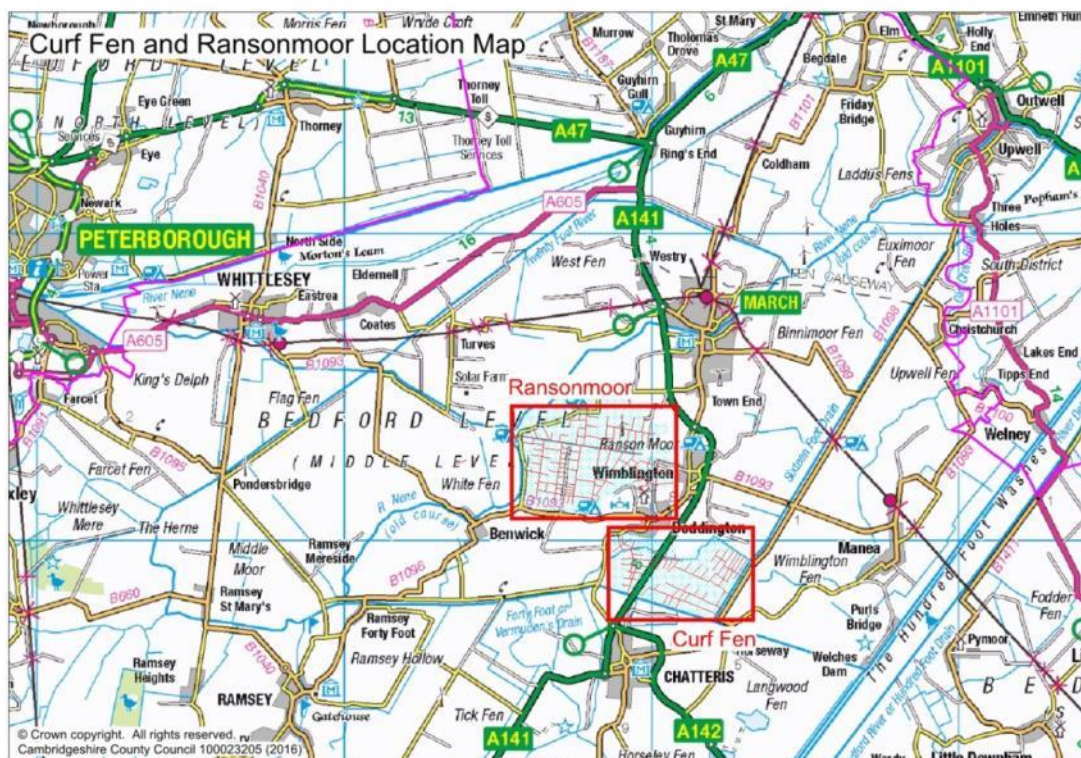
3.4 Limitations

Complete raw data is not available for all the previous surveys, which therefore limits the scope for comparisons.

3.5 Survey Location

Curf Fen and Ransonmoor lie between Peterborough and the Ouse Washes (see Map 1).

Map 1: Location of survey sites



4 Method

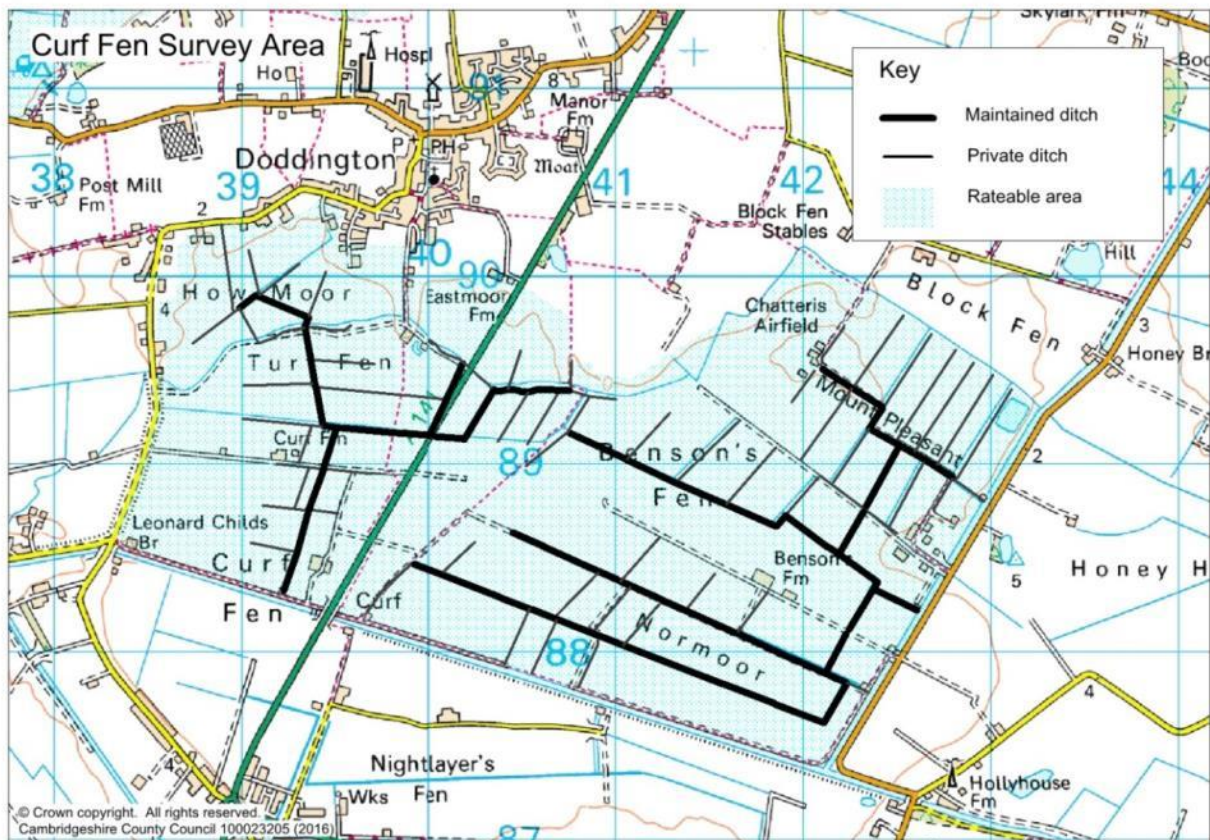
The methodology for this survey followed that of previous surveys as closely as possible, based in particular on the 2005 methods. This in turn followed the methodology of the Water Vole Conservation Handbook (Strachan 1998). Rather than survey a single bank of a 500m stretch, the decision was taken in previous surveys to cover both banks and whole ditch systems as this was felt to be more appropriate for complex ditch networks. This approach continued in 2015.

Larger ditches were surveyed by boat and smaller ones on foot, with one surveyor on each bank wherever possible. Banks, particularly at water level, were searched for latrines, droppings, feeding signs, prints, runs in vegetation, active and old burrows. Signs and sightings of other species including otter, mink, badger and rat were also noted. A handheld GPS unit was used to record signs and map them accurately. Surveys were carried out by Wildlife Trust staff and a range of volunteers, including some from the Cambridgeshire Mammal Group.

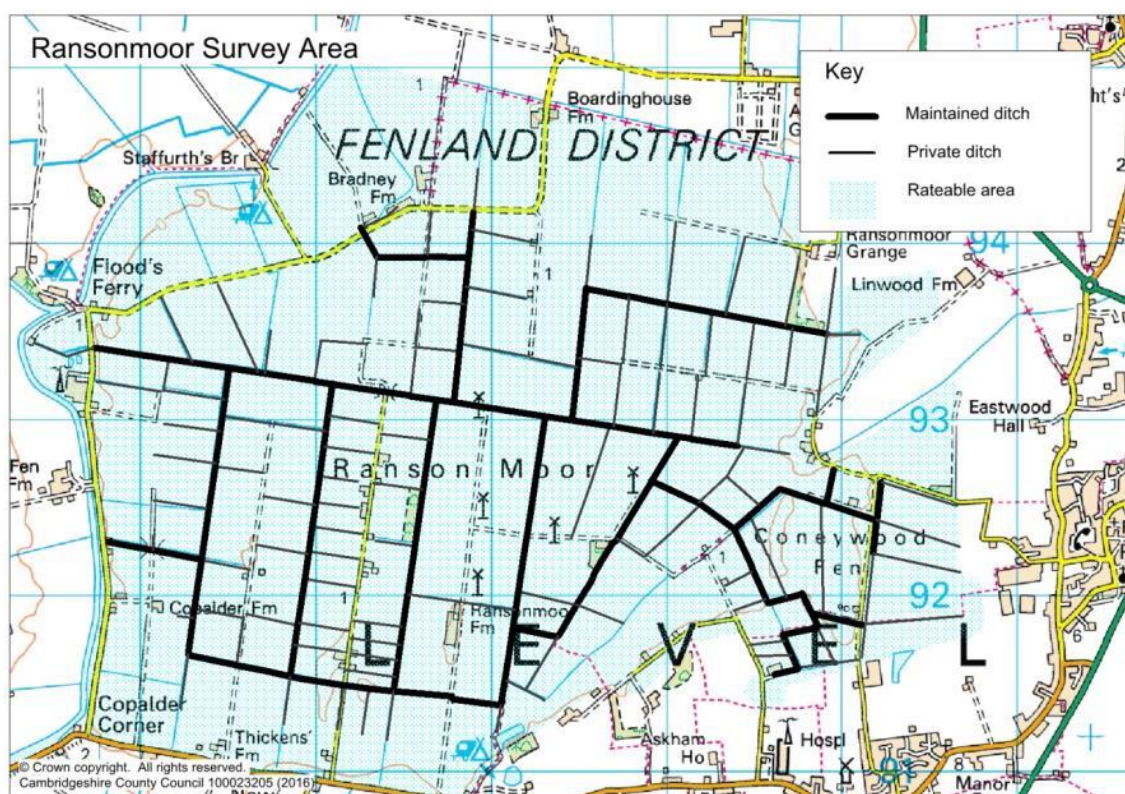
The intention was to carry out all surveys in April and May, but due to time limitations the work was completed in September and October 2015.

The survey area maps below show the survey ditches in black.

Map 2: Curf Fen Survey Area



Map 3: Ransonmoor Survey Area



4.1 Ditches surveyed

Note that this survey used the 2005 numbering system for ditch sections, in order to compare with previous surveys. This is different from the MLC numbering for maintained ditches. Ditches were divided into sections between ditch junctions, each section being approximately 250m in length.

Table 1: Number of ditches and lengths surveyed in 2015

	Curf Fen		Ransonmoor	
	No. ditch sections	Length (km)	No. ditch sections	Length (km)
IDB / DDC	57	12.45	83	21.81
Side	60	18.36	107	31.33
Total	117	30.81	190	53.14

Of these, 14 of the Curf Fen side ditches no longer exist, and 15 were dry at the time of survey and therefore not suitable for water vole. Similarly 22 of the Ransonmoor ditches no longer exist or are inaccessible (of which at least 13 were not surveyed in 2005) and 27 ditches were dry. This includes one main drain which was inaccessible (in a private garden) and a side ditch that did not lie in the survey area. It appeared on previous survey maps but was not surveyed at any time.

Table 2: Number of ditches with suitable habitat surveyed in 2015

	Curf Fen		Ransonmoor	
	No. ditch sections	Length (km)	No. ditch sections	Length (km)
IDB / DDC	57	12.45	82	21.67
Side	31	10.43	59	18.08
Total	88	22.88	141	39.75

A few dry ditches were surveyed but no water vole signs were found in any dry ditch, or even in dry sections of ditches with water vole signs. Previous surveys also checked dry ditches but did not find any water vole signs. The 2015 survey did find water vole signs in ditches with very little water, although generally results support the 2005 conclusion that water voles prefer at least 30cm water depth.

5 Results

Due to the large number of ditch sections surveyed, results are given in summarised form. Full results are available on request.

5.1 Curf Fen

5.1.1 Survey results 2015

A total of 117 ditch sections (57 IDB maintained and 60 side ditches) were surveyed, a length of approx. 31km. Of these, 29 sections were not suitable for water vole as they were either dry (15) or had disappeared altogether (14). The sections that no longer exist have been removed from the results table below. "Suitable" sections were those holding at least water in puddles. In some cases the survey timing was poor due to recent raising of water levels, which would have swamped signs.

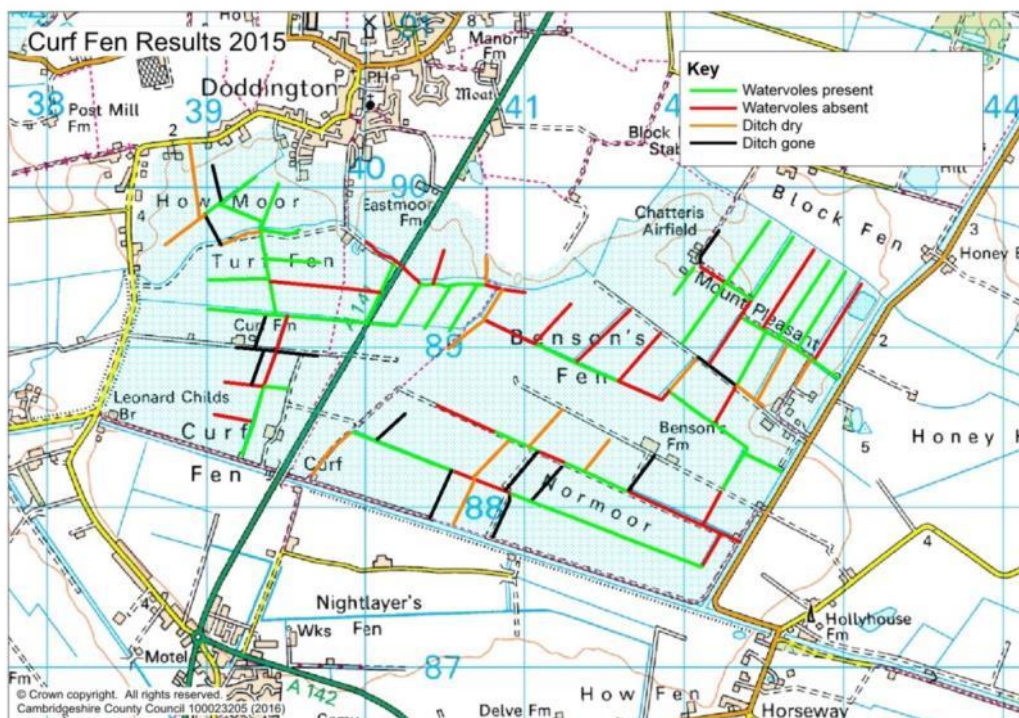
Table 3: Curf Fen Results Summary

	IDB	Side (private)	Overall
No. ditches surveyed	57	46	103
No. suitable ditches	57	31	88
No. positive (water vole signs found)	40	16	56
% positive	70	35	54
% positive of suitable sections	70	52	64

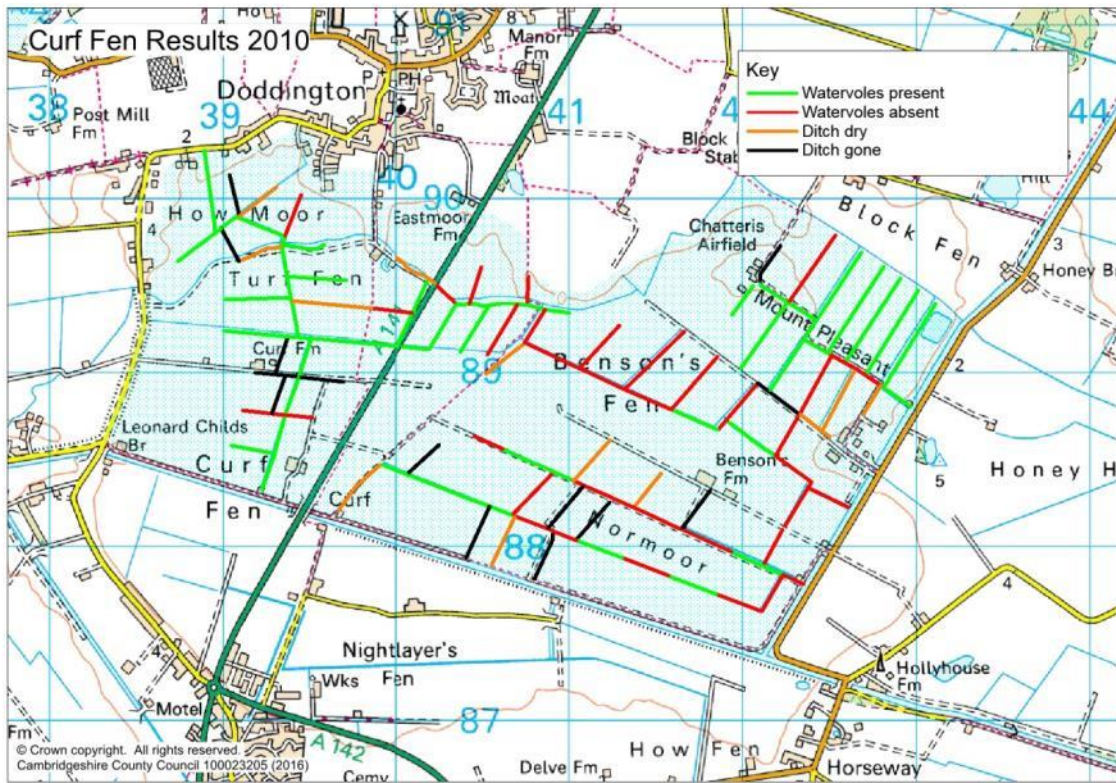
5.1.2 Curf Fen Results Map

These results are illustrated by Map 4. For comparison, maps are also shown for the 2010 (Map 5) and 2005 surveys (Map 6).

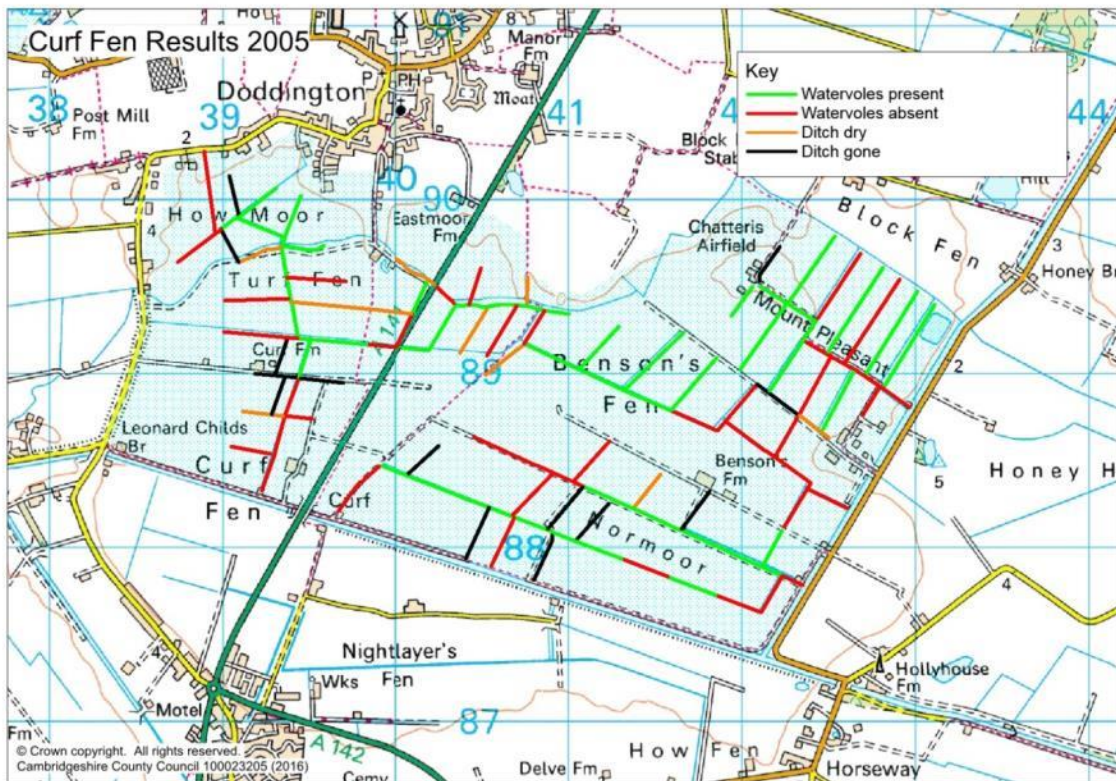
Map 4: Curf Fen Results 2015



Map 5: Curf Fen Results 2010



Map 6: Curf Fen results 2005



5.1.3 Summary

Overall, 54% of Curf Fen ditches had signs of water vole, or 64% of those which were not dry at the time of survey. This breaks down as 70% of IDB maintained ditches and 35% of side ditches (52% of side ditches holding water). A total of 16 ditches (11 main and 5 side) had good water vole habitat but no signs. Of these, 7 main ditches and 4 side ditches were surveyed very soon after water levels were raised, which is likely to have swamped any signs that were present.

5.1.4 Comparison with previous surveys

Table 4 compares results from all three surveys. Note that the 2005 and 2010 results have been recalculated from the raw data to ensure a consistent definition of “suitable”. This involved some extrapolation for the 2010 results as there is limited information available about why ditches were labelled “unsuitable” in that year. The high number of IDB ditches with water vole signs found in 2015 is surprising given the sometimes less than ideal survey conditions. This is reflected in the fact that the total number of signs found in 2015 was considerably lower (see section 6.4).

Table 4: Curf Fen Results Comparison

Curf Fen	IDB			Side			Overall		
	2015	2010	2005	2015	2010	2005	2015	2010	2005
No. ditches surveyed	57	57	57	46	46	46	103	103	103
No. suitable ditches	57	57	57	31	25	36	88	82	93
No. positive for water vole	40	34	34	16	18	15	56	52	49
% positive for water vole	70	60	60	35	39	33	54	50	48
% positive of suitable sections	70	60	60	52	72	42	64	63	53

5.2 Ransonmoor

5.2.1 Survey results 2015

A total of 190 ditch sections (83 DDC maintained and 107 side ditches) were surveyed, a length of approx. 53km. Of these, one side ditch appeared to be outside the drainage district and was not visited, 48 further sections were not suitable for water vole as they were either dry (27) or were inaccessible or had disappeared altogether (21). The sections that no longer exist, were not in the district or could not be accessed have been removed from the results table below. “Suitable” sections were those holding water at least in puddles.

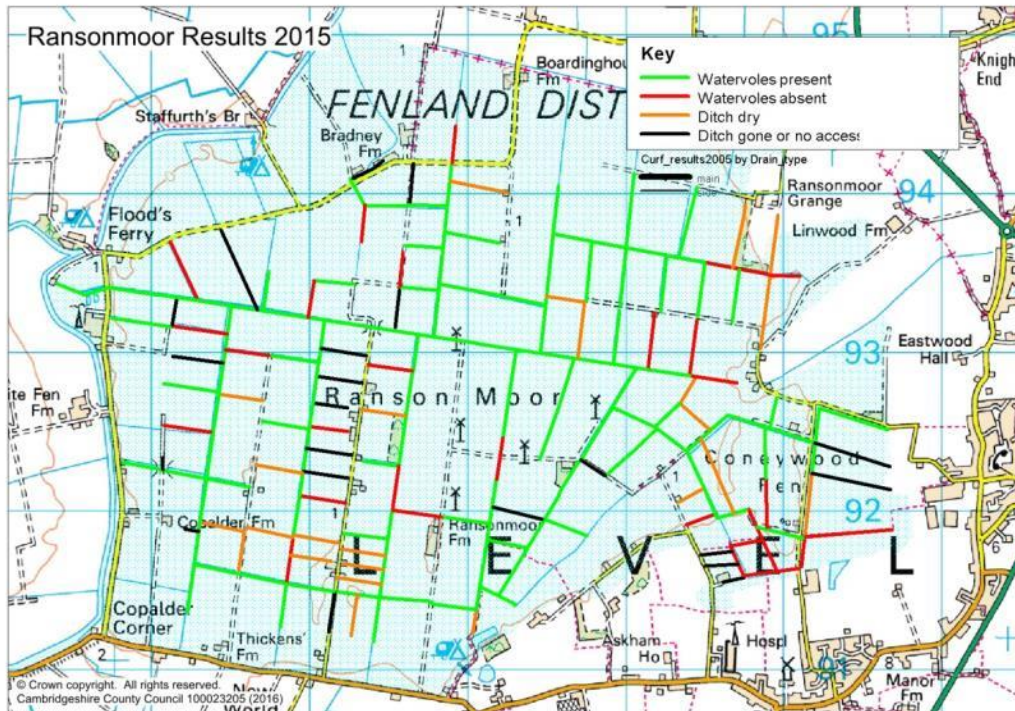
Table 5: Ransonmoor Results Summary

Ransonmoor	DDC	Side (private)	Overall
No. ditches surveyed	82	86	168
No. suitable ditches	82	59	141
No. positive	76	40	116
% positive	93	47	67
% positive of suitable sections	93	68	82

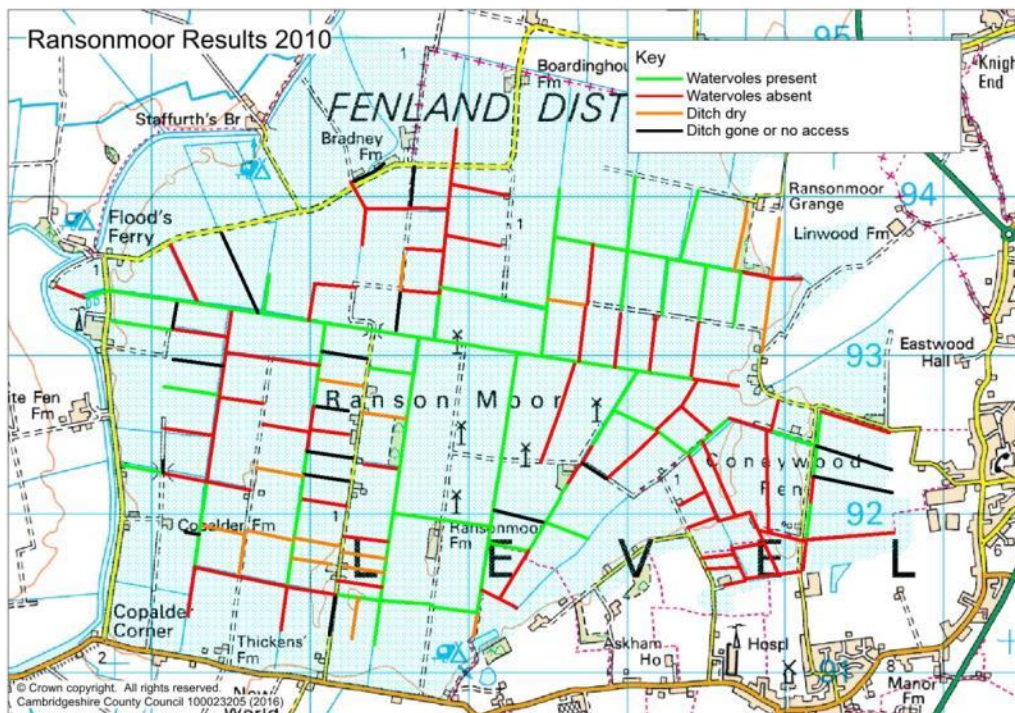
5.2.2 Ransonmoor Results Map

Maps 7, 8 and 9 show survey results from 2015, 2010 and 2005 respectively.

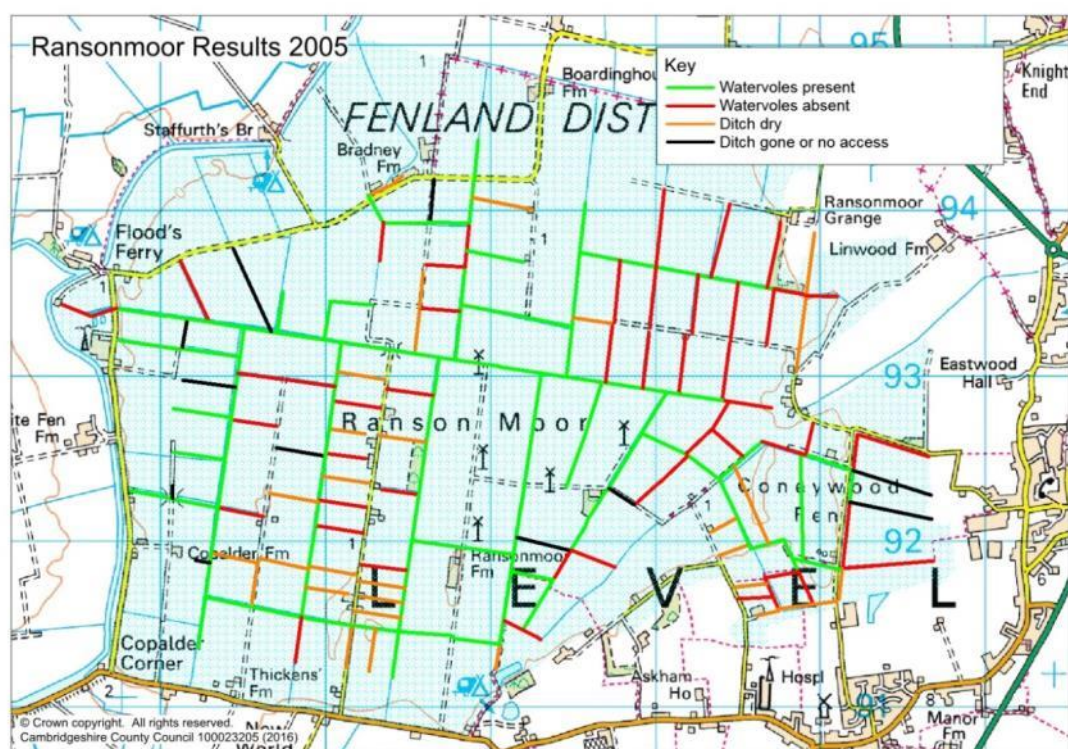
Map 7: Ransonmoor Results 2015



Map 8: Ransonmoor Results 2010



Map 9: Ransonmoor Results 2005



5.2.3 Summary

Overall, 67% of Ransonmoor ditches had signs of water vole, or 82% of those which were not dry at the time of survey. This breaks down as 47% of side ditches (68% of those holding water) and an impressive 93% of DDC maintained ditch sections. Seven ditches (3 DDC ditches and 4 side ditches) had good water vole habitat but no definite water vole signs were recorded.

5.2.4 Comparison with previous surveys

Table 6 compares results from all three surveys. Note that the 2005 and 2010 results have been recalculated from the raw data to ensure a consistent definition of “suitable”. This involved some extrapolation for the 2010 results as there is limited information available about why ditches were labelled “unsuitable” in that year. A higher number of ditches had water vole signs in 2015 than in previous years, significantly higher on the side ditches.

Table 6: Ransonmoor Results Comparison

Ransonmoor	DDC			Side			Overall		
	2015	2010	2005	2015	2010	2005	2015	2010	2005
No. ditches surveyed	82	82	83	86	88	95	168	170	178
No. suitable ditches	82	81	82	59	52	65	141	133	147
No. positive for water vole	76	57	74	40	19	20	116	76	94
% positive for water vole	93	70	89	47	22	21	67	45	53
% positive of suitable sections	93	70	90	68	37	31	82	57	64

6 Analysis of results

There are many factors that make analysis of the data complicated, particularly when comparing with previous surveys. Water vole populations are not stable on a year-to-year scale. While 2014 was a “good vole year”, with apparently high numbers of water voles throughout the county, 2015 seems to have been less good. It is not clear whether 2005 or 2010 were good vole years.

6.1 Historic weather records

The data from the Cambridge NIAB weather station via the Met Office website is presented below. Maximum and minimum temperatures are daytime temperatures. Sunshine hours are not available for 2015. The table shows that May 2005 and May 2015 were particularly wet survey months. Wet weather is not ideal for surveys as it can wash away water vole signs. It is also more difficult for surveyors to find and record signs, and they are likely to spend less time looking. By contrast it seems that 2010 was an ideal survey spring, being dry and sunny despite cold nights.

Table 7: Weather station data

	Max temp (°C)	Min temp (°C)	Air frost days	Rain (mm)	Sun (hours)
April 2005	14.2	4.3	4	27.7	130.6
May 2005	16.6	7.0	0	47.4	197.6
April 2010	14.9	3.7	3	12.5	212.1
May 2010	16.5	5.9	2	28.6	209.4
April 2015	15.0	4.1	0	20.2	-
May 2015	16.5	7.5	2	48.8	-
Sept 2015	18.2	8.7	0	33.1	-
Oct 2015	15.1	7.8	0	49.8	-

The 2015 survey season started well, with relatively settled weather, but at the end of April / beginning of May it turned colder and wetter. Water voles may have done better had the temperature stayed warm. Autumn surveys were conducted from late September and into October, which was mostly dry and settled.

6.2 Survey timing

The initial study (Ross 2006) showed that survey timing has a significant influence over the results, with April being the best month. From this perspective, results from Ransonmoor should be the most comparable across the three separate surveys as only a small number of ditches (18 ditches, 7 of which were dry) were surveyed in October 2015 and otherwise survey effort has been consistently in April and May. A larger proportion of the Curf Fen ditches (64% of ditches and 88% of suitable ditches) were surveyed in autumn 2015. However, the 2015 results appear to indicate that at least presence/absence results are similar in April and October (see Table 10).

Table 9: Survey months

	2003	2004	2005	2010	2015
Curf Fen	May/June	May/Oct	April	April	Apr/May/Sept/Oct
Ransonmoor	June/July	June/July	Apr/May	May	Apr/May/Oct

Table 10 shows the percentage of ditches surveyed which had water vole signs, divided by survey month. The percentage of ditches with latrines and droppings is shown in brackets for the 2015 survey.

Table 10: Percentage of suitable ditches with water vole signs by survey month

Month	Curf Fen		Ransonmoor	
	Year	% waternole	Year	% waternole
April	2005	58%	2005	63%
	2015	63% (63%)	2015	88% (85%)
May	2003	30%	2005	71%
	2015	57% (32%)	2015	78% (75%)
June	2003	26%		
August			2003	12%
September	2015	54% (31%)		
October			2003	38%
	2015	80% (80%)	2015	73% (73%)

Data from 2004 and 2010 have been excluded as survey dates were not well recorded. This table supports the general advice not to survey between June and August.

Figures shown in brackets are ditches with latrines and droppings, illustrating the point noted in 2010 that at Ransonmoor ditches with water vole signs tend to have latrines and droppings whereas at Curf Fen there are more likely to be ditches with feeding signs but no droppings, particularly when vegetation is hard to search.

Autumn surveys in 2015 commenced very soon after water was lowered to winter levels on Curf Fen, meaning that water vole was most likely to be under-recorded in September.

In general, the larger maintained ditches were surveyed earlier in the year. These tend to have better habitat, which is likely to lead to better results in spring for non-seasonal reasons. The high number of Curf Fen ditches with water vole in October 2015 relies on signs that were hard to find, with relatively few latrines. More ditches were dry at this time, so it may be that water voles had moved into the smaller number of ditches with suitable habitat.

6.2.1 Vegetation growth

Ideal water vole survey timing is when the weather is warm enough for water voles to be active outside their burrows, but before (or after) the view of the bank toe is obscured by vegetation. Common reed is usually the main cause of difficulty and in 2015 dense growth of this species was found from early May. Autumn surveys commenced once plants had started to die back, but were slower to complete as most ditches still had thatch to search through. For this reason and the fact that water voles were probably no longer maintaining breeding territories, the number of signs recorded in autumn is probably less than would have been recorded in spring. However, there were relatively few wet ditches surveyed in autumn where no signs of water vole were found.

6.3 Consistency over 10 years

Maps 10 and 11 show the number of times water voles were found in each ditch section.

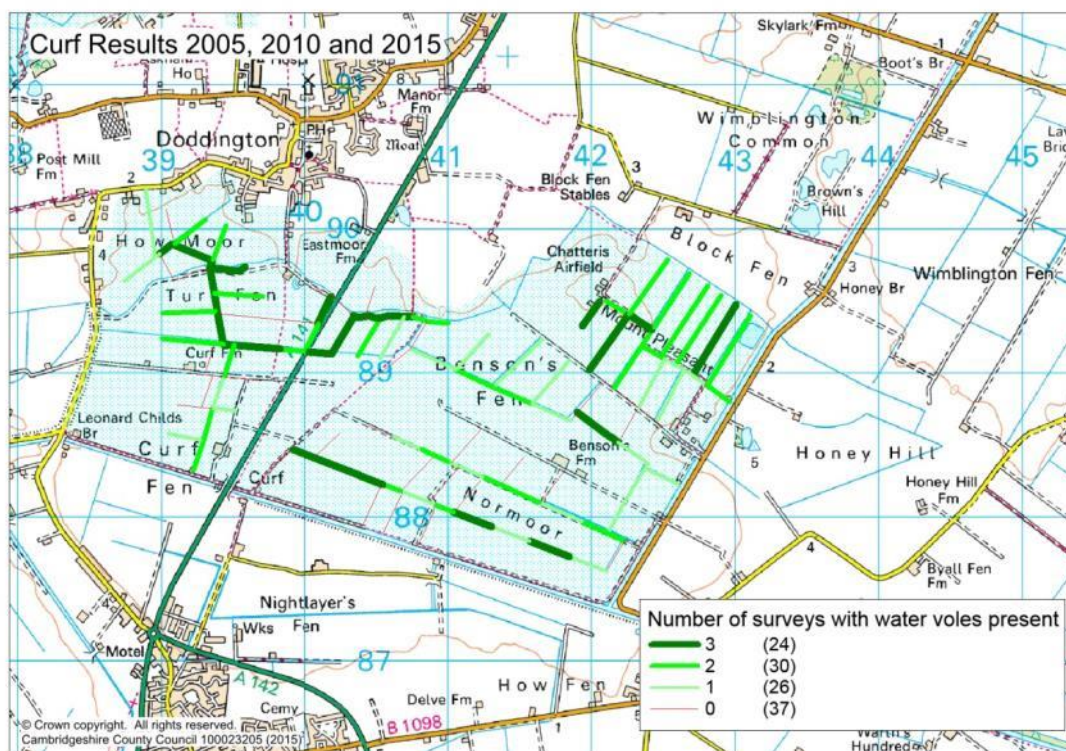
In Curf Fen, 20 ditches had water voles present in all three survey years, which is 23% of the 88 suitable ditches surveyed in 2015. Table 11 shows the frequency of signs. IDB ditches are much more likely to have signs in all years, whereas side ditches are more likely to have no signs in any year. This is largely due to the fact that many of the side ditches were dry, whereas the IDB ditches all held water. Many of the ditches had signs in 1 or 2 of the years, suggesting that water voles move around the drainage district, perhaps following optimal habitat.

There were 37 ditches where water voles were not found in any survey, and of these, 5 were noted to be dry and 14 were filled in in all three years. In 2015, 10 of the remaining ditches were dry, leaving only 8 ditches suitable for water voles in 2015 but with no signs in any survey year.

Table 11: Curf Fen consistency of survey signs

	IDB	Side	Total
Signs all 3 years	20 (35%)	4 (7%)	24 (21%)
Signs in 2 years	16 (28%)	14 (23%)	30 (26%)
Signs 1 year	17 (30%)	9 (15%)	26 (22%)
No signs	4 (7%)	33 (55%)	37 (32%)
Total	57	60	117

Map 10: Results over all surveys at Curf Fen



In Ransonmoor, 60 ditches had water vole signs present in all of the three surveys. This is 43% of the 141 ditches with suitable habitat in 2015. Table 12 shows that most ditches either had water vole signs in all 3 years, or no signs at all, indicating that there is a core

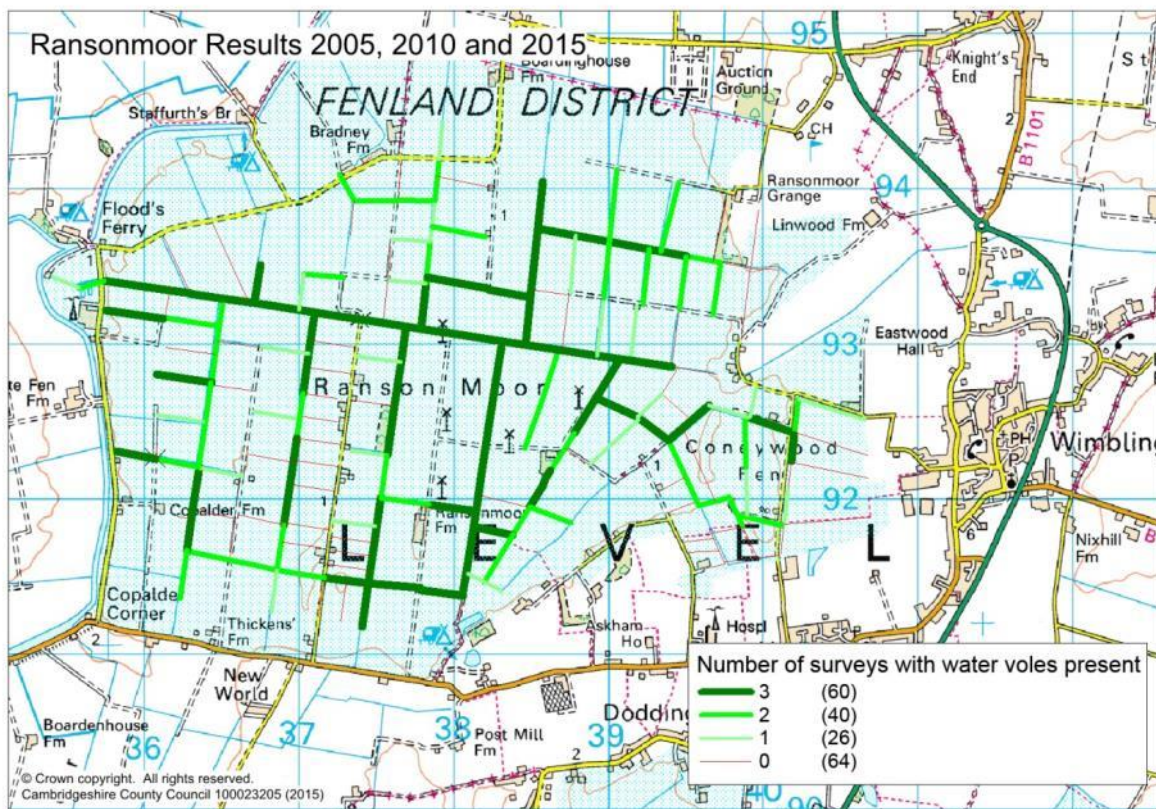
area with good habitat which is probably always occupied and a number of unoccupied ditches with poor habitat.

There were 64 ditches where water voles were not found in any survey, and of these, 17 were noted to be dry in all years and 18 were consistently recorded as unsuitable or filled in. In 2015, 9 of the remaining ditches were dry and 4 had been filled in since 2005. Only one of these 64 ditches had good water vole habitat in 2015. Only 3 of the ditches with no records in any year were DDC maintained (this includes the inaccessible one) and the others were private ditches.

Table 12: Ransonmoor consistency of survey signs

	DDC	Side	Total
Signs all 3 years	52 (63%)	8 (7%)	60 (32%)
Signs in 2 years	24 (29%)	16 (15%)	40 (21%)
Signs 1 year	3 (4%)	23 (21%)	26 (14%)
No signs	4 (5%)	60 (56%)	64 (34%)
Total	83	107	190

Map 11: Results over all surveys at Ransonmoor



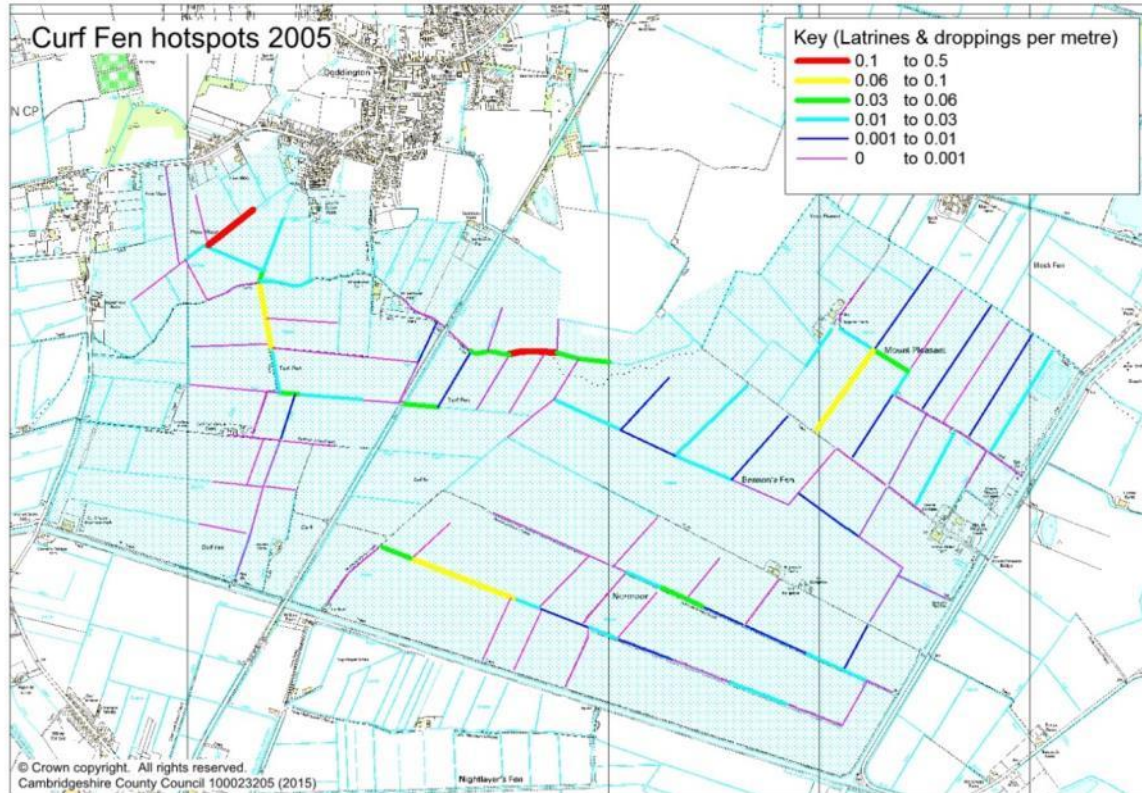
6.4 Hotspots

The 2010 study created “hotspot maps” to show where the most water vole signs were found, using the density of latrines and droppings found. Maps have been created for 2005 and 2015 using the same measure. This measure does not include feeding signs and so

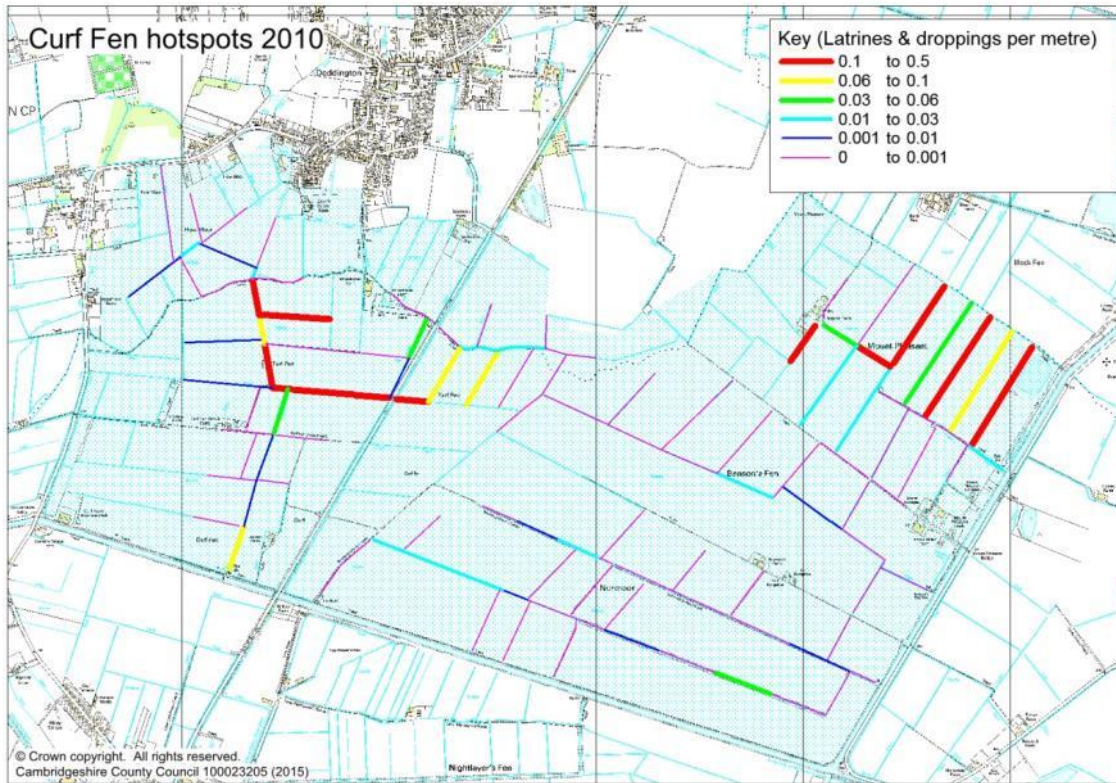
gives a particularly low 2015 score to the IDB ditches in the south-east of Curf Fen, which were surveyed soon after a reduction in water levels.

6.4.1 Curf Fen Hotspot maps

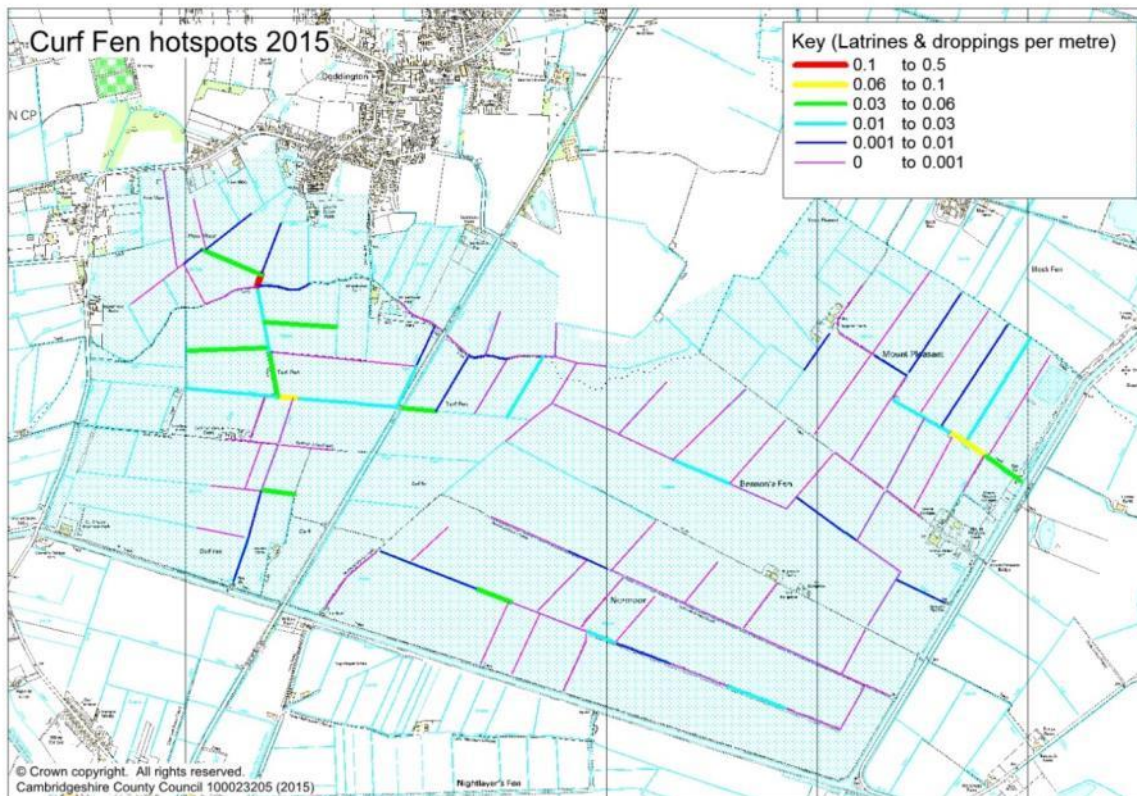
Map 12



Map 13

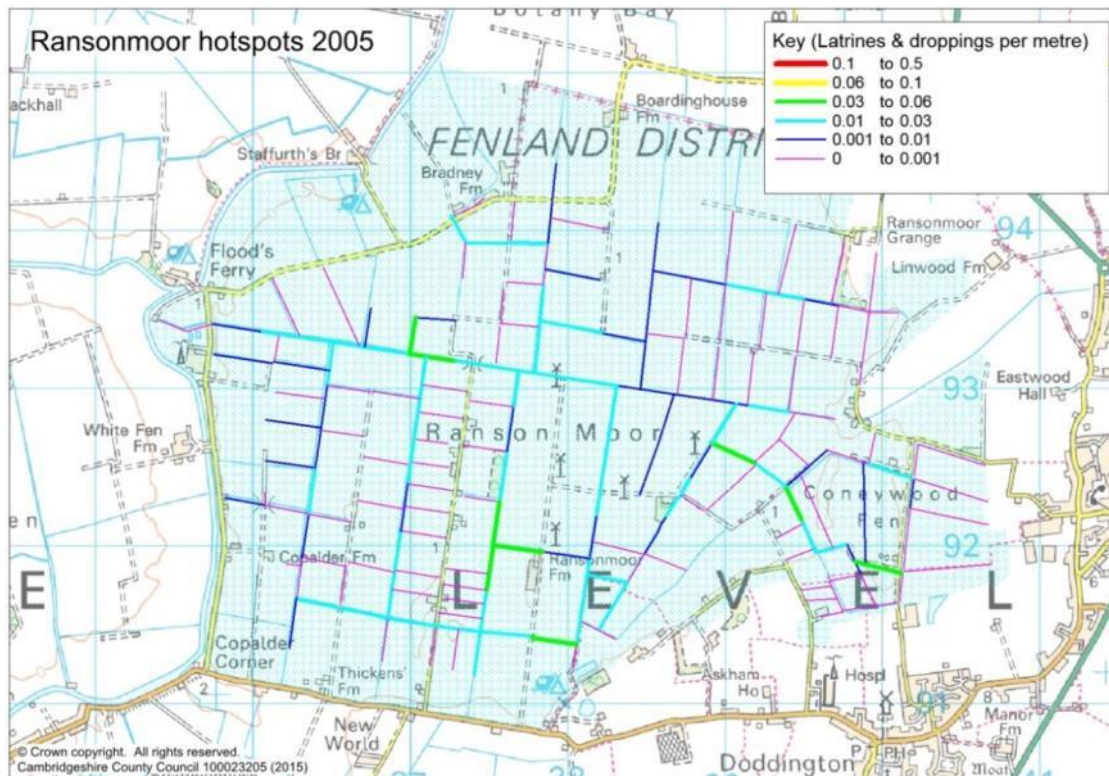


Map 14

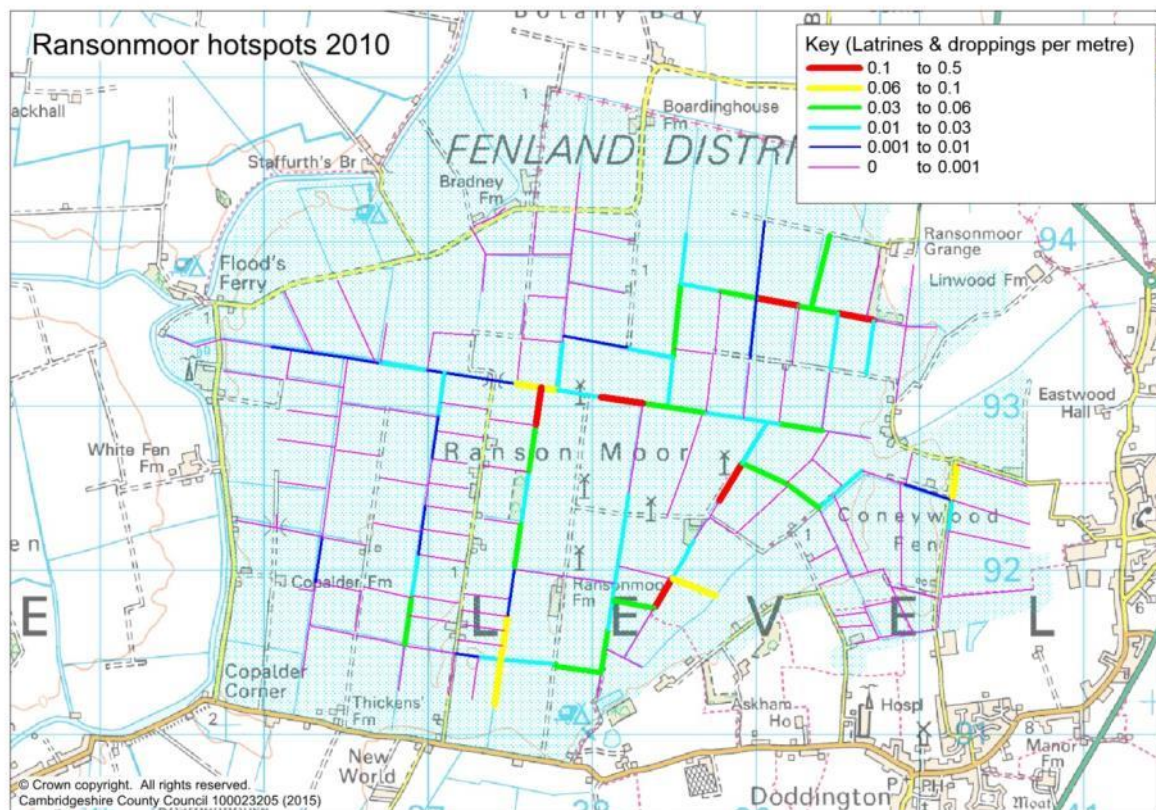


6.4.2 Ransonmoor hotspot maps

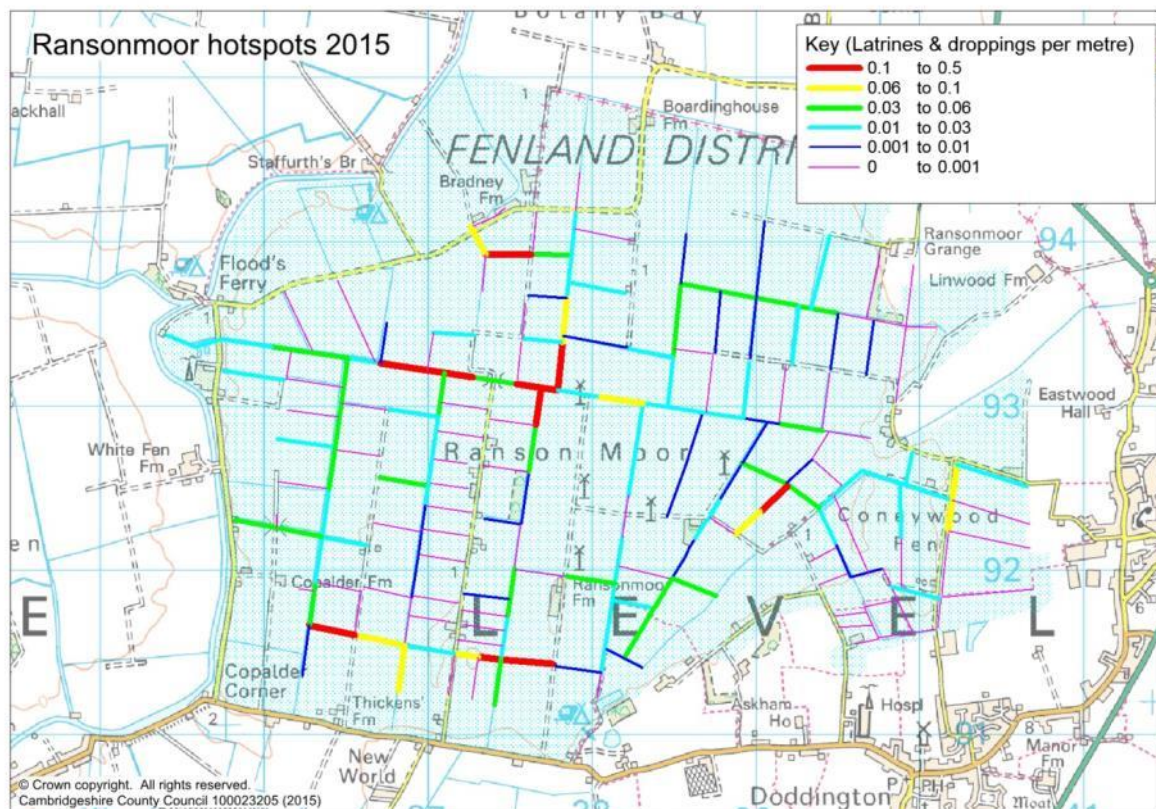
Map 15



Map 16



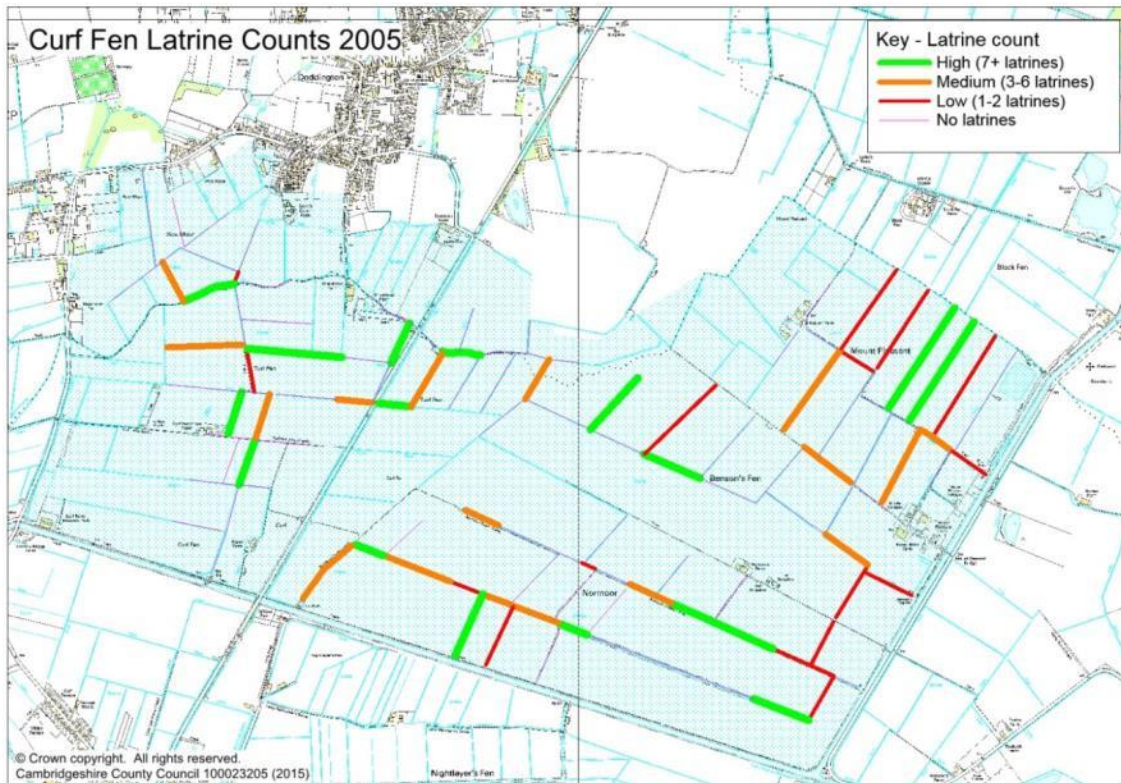
Map 17



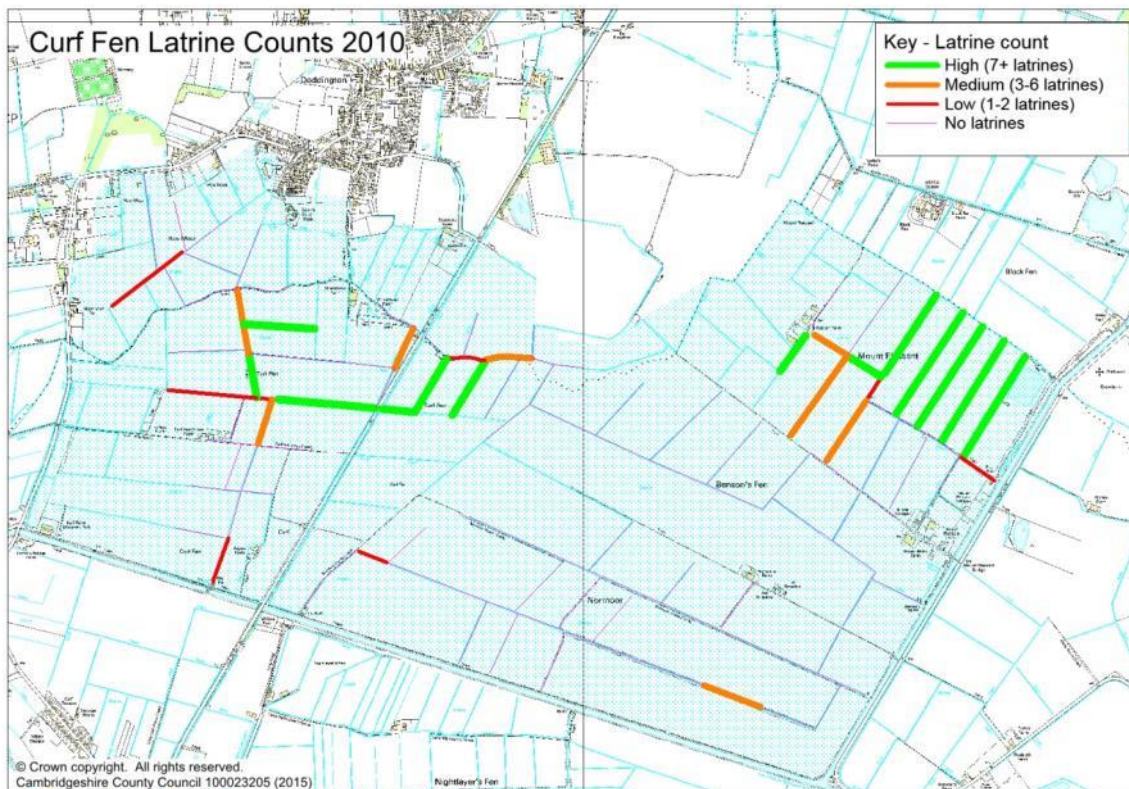
These maps make the 2005 survey look poor, but this may relate to different survey priorities in the field. The latrine count measure used in 2005 turns this around (see below). The difference may be in part because the 2005 focus on latrines meant a small pile of droppings was more likely to be recorded as a latrine in 2005 and more likely as dropping pile in 2015. The 2010 maps do not include counts of latrines or droppings found on rafts, as this data is not available. Rafts were not used in 2005 or 2015.

6.4.3 Curf Fen Latrine Count Maps

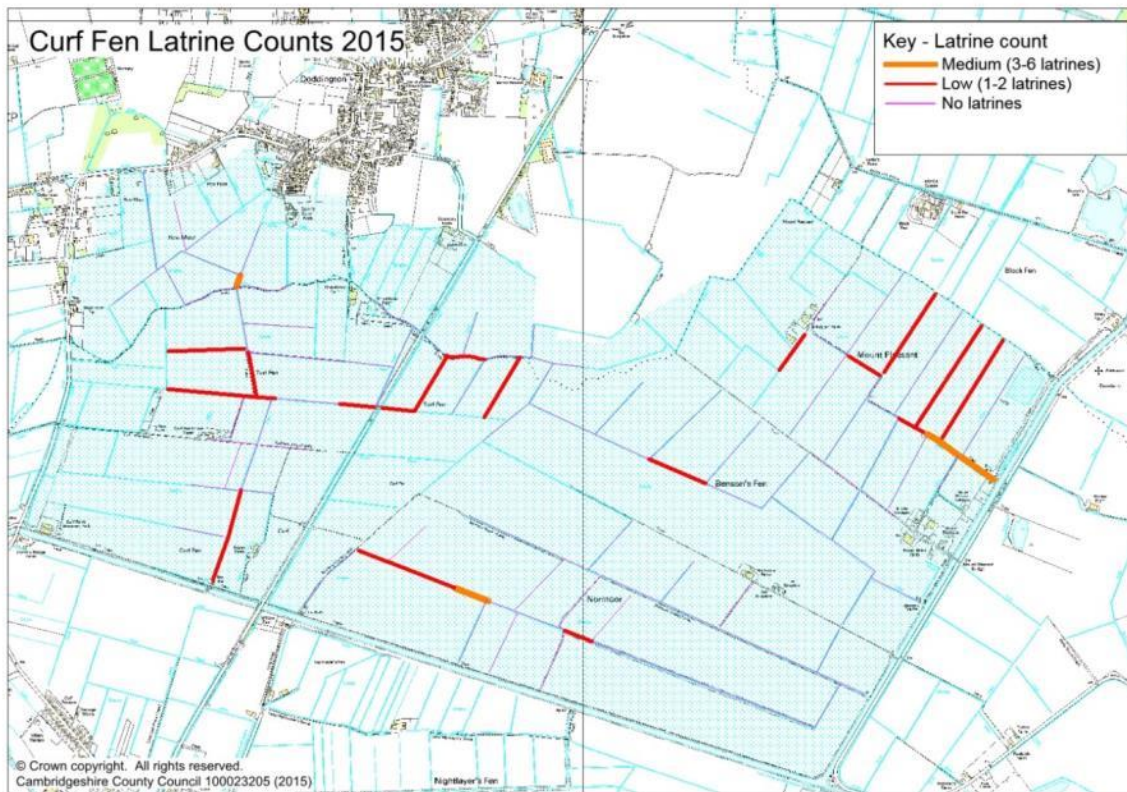
Map 18



Map 19



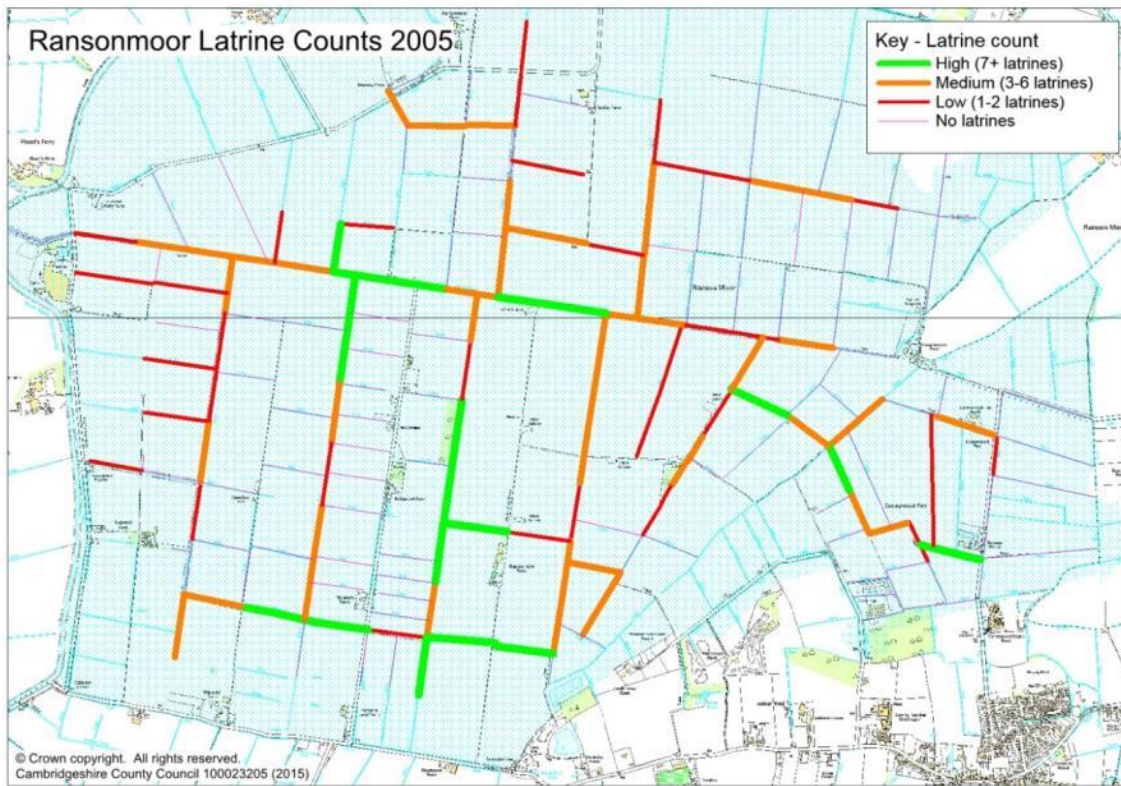
Map 20



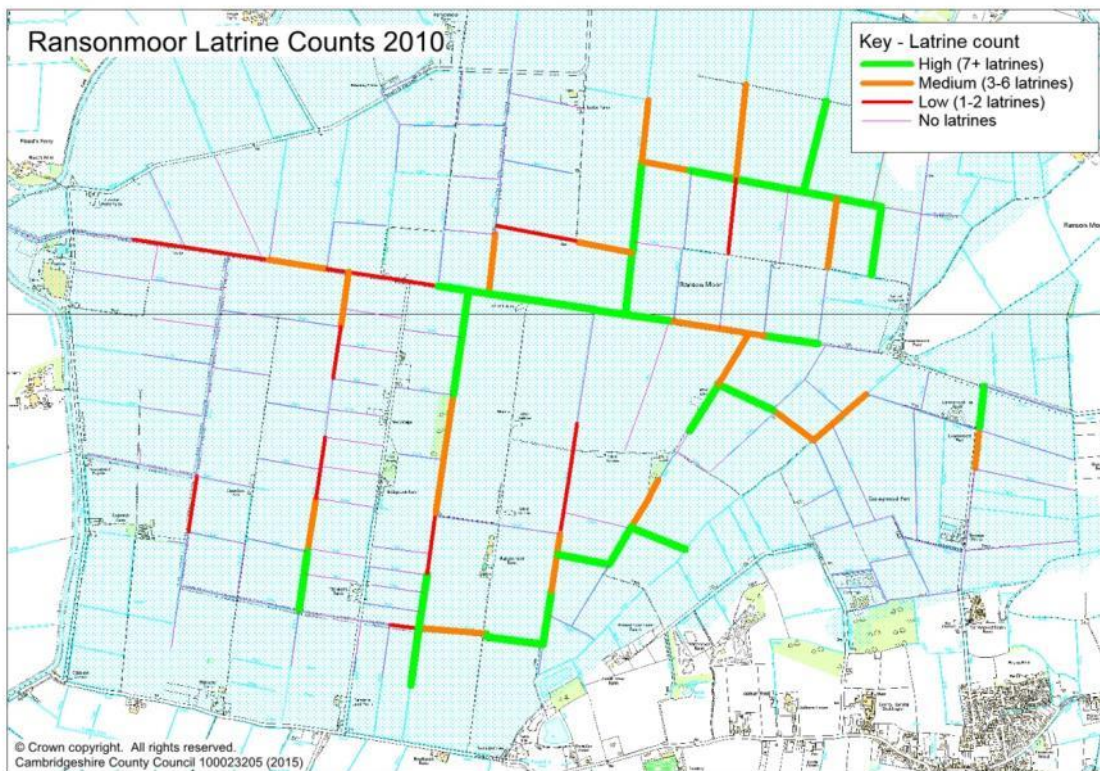
The survey timing at Curf Fen in 2015 meant few latrines were found, even though there was evidence of water vole occupation. This map looks poor although water vole signs were found on more ditches than in previous surveys.

6.4.4 Ransonmoor Latrine Count Maps

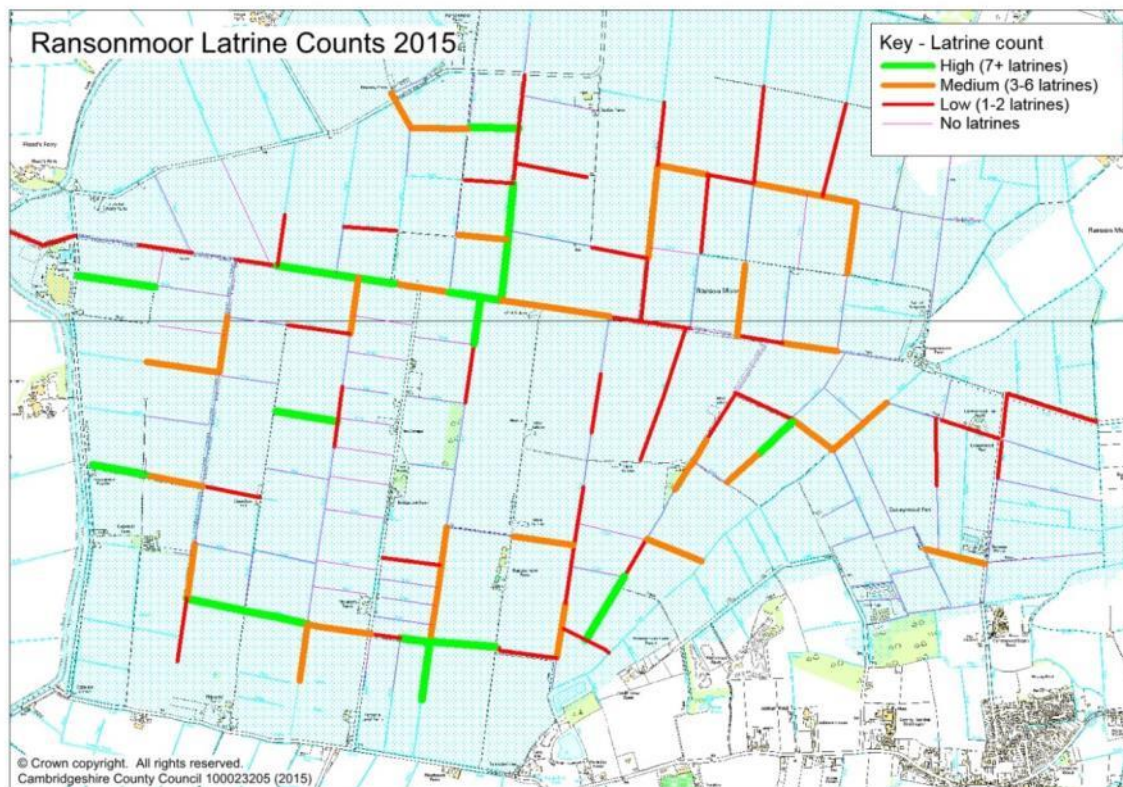
Map 21



Map 22



Map 23



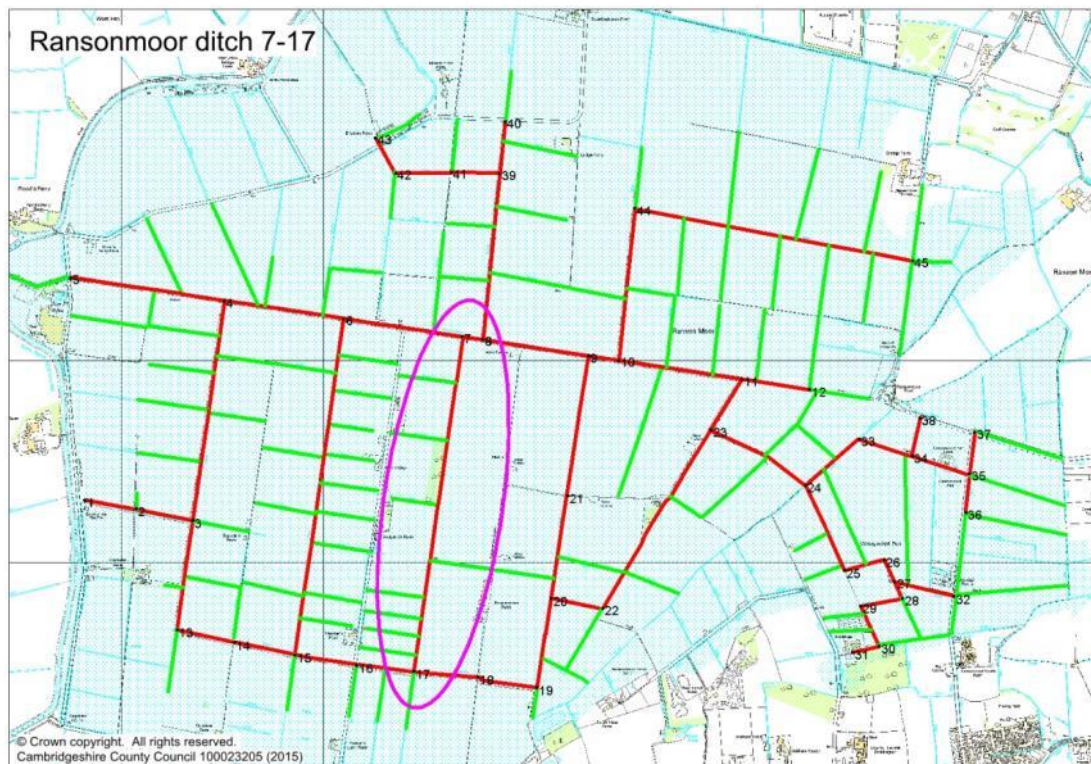
These maps show a slight fall in the number of ditches with “high” and “medium” latrine count and slightly more with a “low” count between 2005 and 2015 at Ransonmoor. The difference is probably largely due to survey and recording differences, though it does seem to show an overall small shift of the best ditches towards the west of the district over 10 years. The largest number of latrines found on a single ditch section at Ransonmoor in 2005 was 16. In 2015 the largest number was 26. The areas with most latrines appear to be more fragmented in 2015 than in 2005.

6.5 Impacts of management

6.5.1 Re-profiling work 2006

Previous studies have found that regular ditch maintenance (“slubbing”) work has little impact on water voles, but some concerns have been raised about re-profiling. The 2005 study (Ross 2006) showed water voles moving away from a re-profiled section but then recolonising 2 years later. The report also notes a section of Ransonmoor (MLC numbers 7 – 17) which had a good population of water vole in spring 2005, but was found in 2006 to be occupied by rats following re-profiling, which had removed all water vole habitat from the working side. Map 22 shows the location of the ditch (DDC ditches are in red, side ditches in green and the stretch in question circled in pink).

Map 24

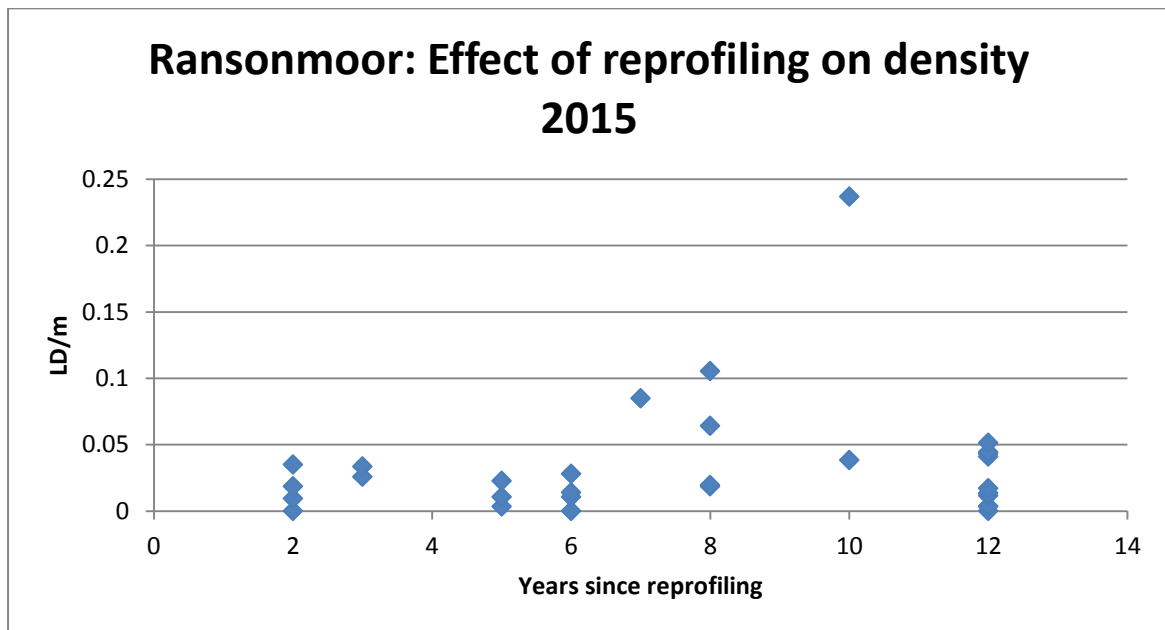


Water voles were found here in 2010 and 2015 in good numbers, although the “best” part of the ditch appears to have changed. Where in 2005 most water vole signs were found in a central section of this stretch, in 2010 and 2015 more signs were at the ends. The northern end of this section had the best water vole population found in 2015. This suggests that even where rats displace water voles, the water voles can move back within 5 years.

6.5.2 Effect of re-profiling on latrine / dropping density

No ditches were re-profiled in 2014 so immediate impacts could not be recorded, but it is possible to compare the number of latrines and droppings per metre to the number of years since re-profiling. Figure 1 shows relatively little impact of re-profiling 2 years later, but that the best ditches for water vole were re-profiled more than 6 years ago (Figure 1 excludes ditches with no record of re-profiling).

Figure 1



The Curf Fen results cannot be used to draw conclusions about re-profiling / side trimming as it has been carried out in too few cases. 7 ditch sections were re-profiled 12 years before survey (prior to 2005). Water vole signs were found on 3 of these in 2005 and 4 in 2010 and 2015. All of them had water vole in at least one survey, and only one had water vole signs recorded in 2005 only. One ditch section had hard revetment installed 5 years before survey; in this case water vole signs were recorded before revetment but not after. This reflects the established understanding that hard revetment does not provide good water vole habitat.

The 2010 survey suggested that bank re-profiling is a “major influence” at Curf Fen, but no such work was undertaken in that district since 2003 up until the 2010 survey. It is possible this should have referred to machine cleansing, or “slubbing”.

6.5.3 Recovery after slubbing

Slubbing is routine machine cleansing to remove accumulated silt, and takes place every year on rotation in some part of each drainage district. Larger ditches are cleaned more regularly than smaller ones (every 4-6 years), and the smaller IDB / DDC ditches are cleaned at least every 10-12 years.

The figures below show how the latrine and dropping density is distributed according to years since maintenance. Each district has two figures, the first showing latrine and dropping density according to number of years since maintenance and the second highlighting where points accumulate at zero. There is no obvious trend, but the figures do show that slubbing has no noticeable impact on water vole populations the following year. They also indicate that slubbing benefits water voles, as the best ditches were cleansed within the past 4 years.

Figure 2

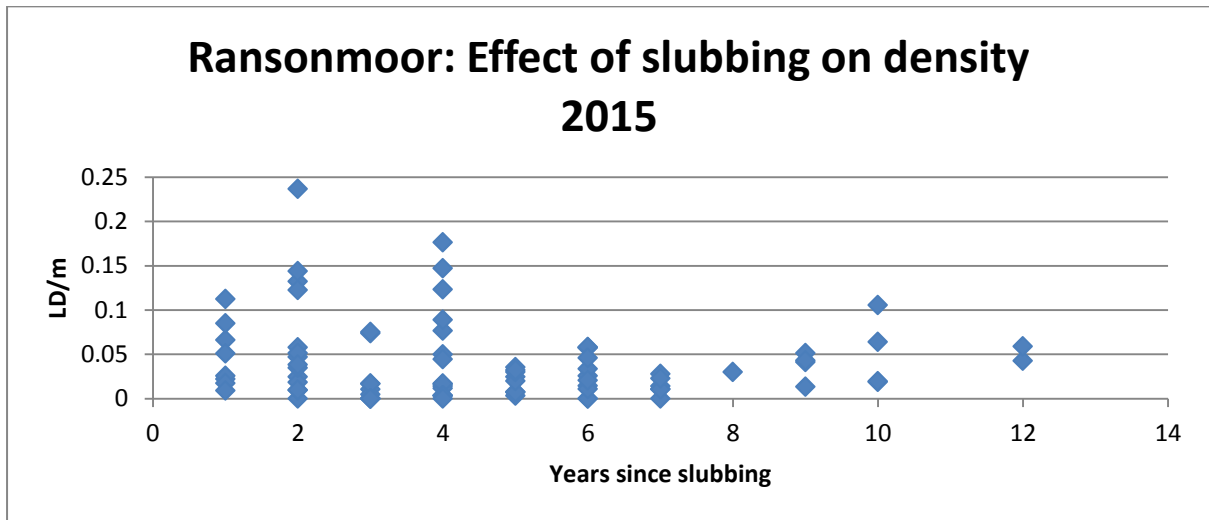


Figure 3

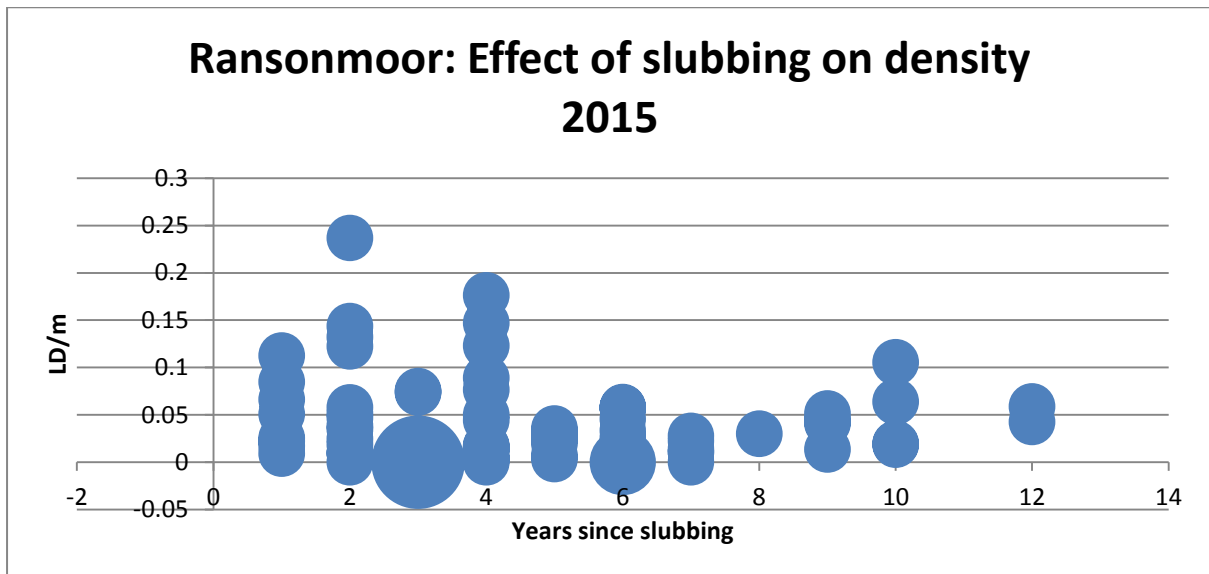


Figure 4

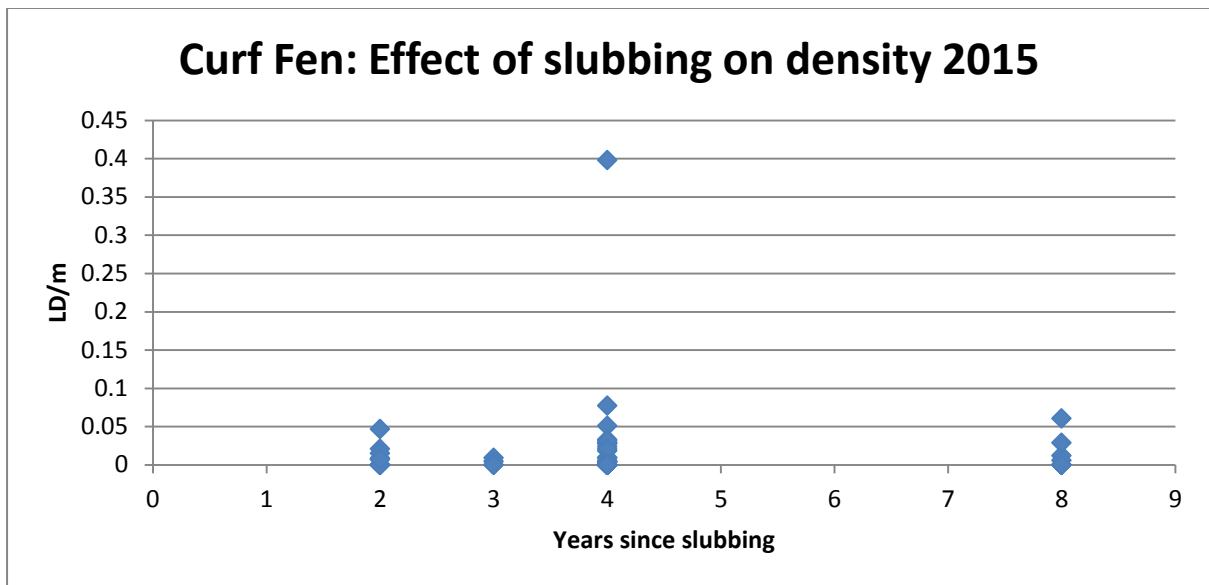
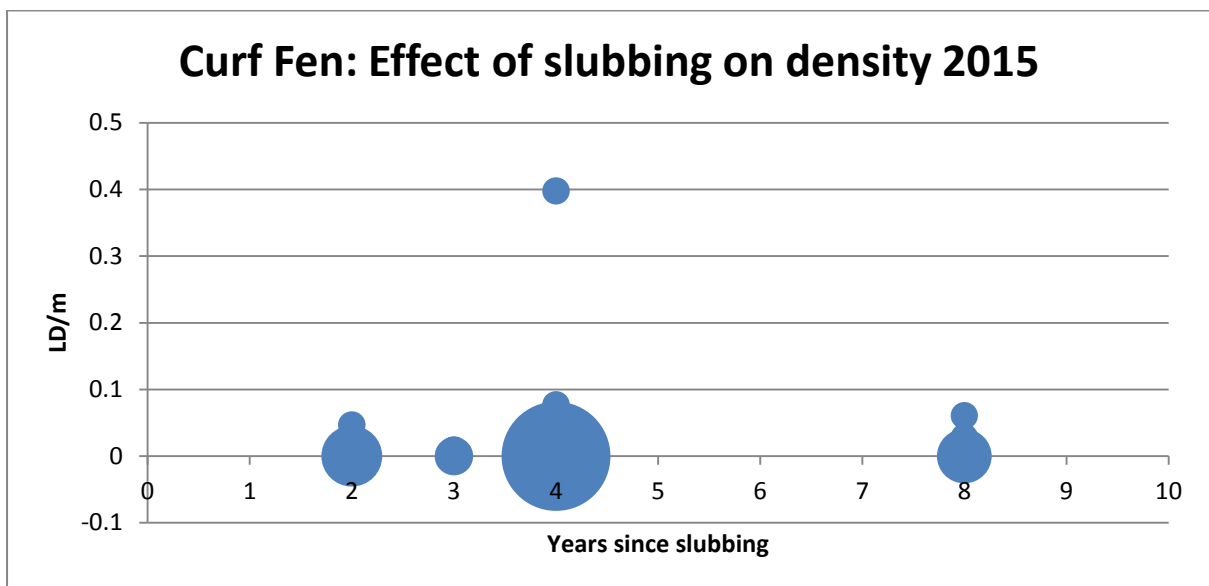


Figure 5



7 Conclusions

- Water vole populations in these two drainage districts appear to be stable with no noticeable declines over the last 10 years.
- The surveys of Curf Fen and Ransonmoor suggest that these drainage districts (collectively with many others in the Middle Level, which have similar habitat and maintenance regimes) are important as a regional, and possibly national, stronghold for water vole.
- Water voles appear to prefer the IDB or DDC maintained ditches, probably because these have more diverse vegetation and deeper water.
- As noted in previous surveys, the better connectivity of Ransonmoor makes it better for water voles, and is probably a key reason for the very high and consistent occupancy there.
- Water voles at Curf Fen appear to move around, potentially following optimal habitat. At Ransonmoor there is a core area with consistent occupation, although the “best” water vole ditches change within this.
- Water voles were present in the majority of ditches with suitable habitat.
- Ditch maintenance does not have a significant effect on water vole populations, and in fact the best ditches were cleansed within the past 4 years.
- Re-profiling ditches does have a negative effect. Re-profiling shorter sections (one bank only) can mitigate this, and in general water voles return after 2 – 5 years.

8 Discussion

The three surveys are slightly different, for example due to survey timing and recording priorities, but they are sufficiently similar to be comparable. The 2005 and 2015 surveys undertaken by the Wildlife Trust in particular are easy to compare.

Overall, it appears that all three surveys found a good population of water voles in both drainage districts and that the populations are stable with no noticeable decline.

“Stable / no noticeable decline” is a very positive result against a background of national decline. In Surrey, water voles have been declared “functionally extinct” (Independent 2016 and SWT 2016). In other counties water voles are relying on extensive programmes of mink trapping. It is not clear how many mink are present in the area, but there is no known trapping here, so it may be that the complexity of the habitat is providing some degree of protection. Even if a mink devastates the water vole population there is likely to be a remnant that survives and can recolonise, unlike on many linear watercourses.

Ditch maintenance by the IDB and DDC maintains the ditches in a good condition for water voles, as well as maintaining drainage function. This management has been consistent for many years creating a very stable habitat.

9 Recommendations

- Ditch management (particularly of IDB / DDC maintained ditches) should continue as it has been, to maintain a stable water vole habitat as well as effective land drainage.
- Re-profiling should only be carried out on one bank at a time, and in lengths as short as is practical.
- This survey should be repeated in 5 years' time to continue monitoring the success of water voles in the fens.

10 Acknowledgements

This survey would not have been possible without assistance from the Middle Level Commissioners, Environmental Officer Cliff Carson, Curf and Wimblington Combined IDB, Ransonmoor DDC, landowners and volunteer surveyors.

Thanks to the Middle Level Commissioners, Curf and Wimblington Combined IDB and Ransonmoor DDC for contributions to survey travel expenses.

Thanks also to volunteer surveyors Alistair Taylor, Elizabeth Bannister, Georgette Taylor, Glenn Hadley, Jenny Mackay, Jo Garrad, Kevin Hand, Leo Schlesinger, Lucy Roberts, Mark Ricketts, Paul Wyer, Peter Pilbeam, Pippa Keynes, Roger Featherstone, Ruth Angrave, Sarah Koets, Sharon Erzinclioglu, Siân Williams and Simon Bleet. Thanks to everyone who allowed us access to their land, particularly those who did not get notice that we were coming.

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12 Appendix 1

Water vole survey form 2015

Location:		Recorders:			Date:		Foot / boat
Drain No	Bank height	Water depth	Channel width	Bank Profile	Phrag. abundance	Other species / comments	Water vole signs
							Latrines Droppings Feeding signs Runs Prints Sightings Active holes Old holes
							Latrines Droppings Feeding signs Runs Prints Sightings Active holes Old holes
							Latrines Droppings Feeding signs Runs Prints Sightings Active holes Old holes
							Latrines Droppings Feeding signs Runs Prints Sightings Active holes Old holes