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**LANCASTER BYPASS
WINTER 2000/2001**

Authors

S. J. Holloway & N. A. Clark

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The National Centre for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU
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EXECUTIVE SUMMARY

1. This study, commissioned by Lancashire County Council, updates baseline data previously gathered during Winter 1993/94 on the wintering avifauna along the corridor of the proposed Lancaster Western Bypass, and assesses the likely significance of the road upon it.
2. Outbreaks of Foot and Mouth Disease in parts of north-west England resulted in the cancellation of March fieldwork, following appropriate consultation with Lancaster County Council. We have carried out a thorough examination of the data and do not anticipate that the overall accuracy of the results have been compromised as a consequence of the cancellation.
3. The study areas were the intertidal habitat, saltmarsh and river at the proposed Salt Ayre crossing point, damp fields adjacent to the Lune and the hinterland fields along the proposed route corridor. These areas were monitored between December 2000 and March 2001.
4. The intertidal counts confirmed that relatively small numbers of waterfowl and waders present in the vicinity of the proposed Salt Ayre crossing point on the River Lune compared to the numbers known to use the estuary as a whole. The saltmarsh adjacent to Aldcliffe Marsh was important for feeding and roosting Mute Swans, with up to 60 individuals counted, representing a large proportion of the Lancaster and District population.
5. The terrestrial survey found no important areas for wintering wildfowl. The most important areas for waders were the damp fields and saltmarshes adjacent to the estuary, particularly around Conder Green, which held large numbers of Lapwing and, occasionally, Redshank. The pastures and hedgerows adjacent to the Lancaster Canal were used by small numbers of winter thrushes.

1. GENERAL INTRODUCTION

A Lancaster Western Bypass has been proposed to join the Morcambe-Heysham link road to the M6 motorway. The British Trust for Ornithology (BTO) previously carried out winter bird surveys in the study area during the 1993/94 winter, when the original project was considering four potential routes (Austin *et al.* 1994). There is now a single preferred route option running from junction 33 of the M6 motorway, through to Salt Ayre across the River Lune. This preferred route option is indicated in Figure 1.1.

Lancaster County Council is keen that the bird survey information previously gathered during winter 1993/94 is updated now that a single preferred route option exists. The results of this 2000/01 winter bird survey assess the likely impacts that the road will have on these populations.

The objectives of the survey work were:

1. To identify the importance of the Lune Estuary to bird populations around the proposed crossing point of the Lune.
2. To identify the importance of the coastal fields and marshes to bird populations of conservation importance.
3. To identify the use made of the hinterland fields within the survey area by winter flocking species of conservation importance.
4. To collate the information gained in order to assess the likely effect on these bird populations of building the Lancaster Western Bypass.

Currently all road building projects within the United Kingdom, whether involving the construction of totally new routes or the modification of existing routes, require an environmental impact assessment. Each assessment should take account of the likely impact during the construction phases of the proposed route as well as the interaction with the environment once traffic has begun to use the road. Traffic levels, the average speed of the vehicles and the type of habitat that the road traverses are all important factors for any assessment to consider. Roads may affect bird communities in several different ways. Habitats may be modified and fragmented creating habitat "islands" (*e.g.* Mader 1984). Other likely effects relate to noise and visual "pollution" resulting from fast moving traffic which are thought to be a major reason for depressed breeding success for species breeding in the vicinity of major roads (*e.g.* Reijnen *et al.* 1995a), chemical pollution, both airborne and run-off from the road surface (*e.g.* Smith 1971; Hofstra & Hall 1971), and human disturbance through facilitated access. Published studies have shown that these effects are detectable over surprisingly large distances (*e.g.* van der Zande *et al.* 1980). Reijnen *et al.* (1995a) showed that a measure of a species "sensitivity" to road disturbance can be obtained by a measure of the greatest effect distance *i.e.* the maximum distance from the road a species is deemed to be affected at. This is likely to vary between habitats, sites and species.

The distance over which three of the main traffic factors (noise, visual impact and air pollution) may operate to affect breeding densities is measurably different between woodland and open grassland habitats (Reijnen *et al.* 1995a). The greater the proportion of lorries in the traffic loading, the greater the noise effect distance, particularly in open agricultural areas. Air pollution is also measurable at greater distances in open, agricultural areas than in woodland (200 m versus 100 m).

The study area has three main areas of ornithological interest. These are: (a) the Lune Estuary, an integral part of the much larger Morecambe Bay ecosystem, with its internationally important mudflats (b) the damp coastal fields that are extensively used by various species of waterbirds (*e.g.* Marsh 1989) and (c) the fields of the hinterland.

This report details the results of winter survey work carried out between December 2000 and March 2001, which updated earlier survey work undertaken by the BTO between December 1993 and March 1994. The current fieldwork collected data of bird use of the Lune Estuary in the vicinity of the proposed river crossing from Salt Ayre to Aldcliffe Marsh, within the damp coastal fields around the estuary and from the hinterland fields.

2. METHODS

The methods followed those used for the earlier survey work carried out in the study area by the BTO during the winter 1993/94. However, the planned March fieldwork visit by BTO staff was cancelled after consultation with Lancaster County Council as a result of the Foot and Mouth outbreak, which was affecting parts of north-west England at the time. We have carried out a thorough examination of the data collected during the other three months and do not anticipate that the overall accuracy of the results have been compromised as a consequence of the cancellation.

The winter fieldwork comprised three distinct components:

- a) Intertidal counts on the Lune Estuary
- b) Terrestrial survey of the damp fields and saltmarsh adjacent to the Lune Estuary
- c) Terrestrial survey of the hinterland fields

2.1 Survey of intertidal habitat, saltmarsh and river adjacent to Aldcliffe Marsh

There are three main divisions of bird habitat in the study area at the proposed Salt Ayre crossing point. Intertidal habitats are those occurring between the low and high tide water lines and covered during most high tides. The principal intertidal habitat in the study area is mudflat although some rocky areas are also found. There are also well-developed expanses of saltmarsh surrounding the intertidal areas, which are only normally entirely flooded during the highest Spring Tides. The third habitat is the surface of the water itself. Each of these habitats is of particular importance to different bird species.

These three main habitats were sub-divided into smaller sections so as to facilitate counting and analyses, following those used in the earlier winter 1993/94 study (Austin *et al.* 1994). Figure 2.1.1 shows the recording sections and the three main types of habitat. All of the sections including the saltmarsh were counted from a single point on the west side of the Lune.

The number of birds using each section were counted on a by species basis and the number feeding and roosting were recorded separately. Each survey consisted of counts made at intervals of one hour and for a complete tidal cycle of twelve hours (low tide to the following low tide). The data collected during the tidal cycle counts were used to calculate three parameters:

1. the average exposure time per tidal cycle of each intertidal and saltmarsh count area;
2. the average number of feeding bird hours per tidal cycle (all day usage);
3. the average number of birds present at each hour of the tidal cycle and the proportion of these feeding

For further details on the formula for the calculations see Austin *et al.* (1994). Four monthly through-the-tidal-cycle counts were carried out between December 2000 and March 2001.

2.2 Terrestrial survey of the damp fields adjacent to the Lune

The damp fields, with some additional areas of saltmarsh, close to the Lune were individually numbered and checked for feeding and roosting waders and wildfowl over the high tide period (Figs. 2.2.1a – 2.2.1d). The usage of these areas is likely to vary during the course of the winter both in relation to the time of the day as well as the height of the tide. In order gain a better understanding of the use made of these areas, each field and piece of saltmarsh was checked on seven occasions during the winter, covering different points of the spring neap cycle. The majority of these areas were

checked on foot, with the remainder scanned from a vehicle. All of these visits were made within the period three hours before to three hours after high tide. During the winter each area was visited during a different part of the six-hour “slot” to determine differences in the of usage change over the high tide cycle. The activities of the waders and wildfowl were categorised as either feeding or roosting.

2.3 Terrestrial survey of the hinterland fields

Fields further away from the Lune and within the survey area were also individually numbered (Figs. 2.2.1a – 2.2.1d). The hinterland fields were visited four times during the course of the winter. Each visit concentrated on locating concentrations of flocking species such as Lapwings, Golden Plover and thrushes. Any species with special protection (*e.g.* Peregrine Falcon), or subject to a UK Biodiversity Action Plan (BAP) (*e.g.* Starling and Song Thrush) were also recorded. The crop and land use for each field, along with notes on any particularly interesting areas of habitat within them were also collected. Much of the survey work was conducted on foot, utilising the network of paths and roads in the area. During the first visit, an effort was made to survey every single field. However, during subsequent visits, those areas considered to be both unsuitable for the species concerned and to be particularly difficult to access were excluded.

2.4 Presentation of results

Accounts are given for each of the key species summarising the importance of the study area to the local populations, and giving details of the regional and national status of each. This enables the importance of the local population, both regionally and nationally, to be assessed.

The usage of the intertidal mudflats, water surface and saltmarsh in the vicinity of the Salt Ayre crossing and the use of the fields adjacent to the proposed route corridor are presented by means of distribution maps. The proportion of the birds feeding are only presented when sufficient were present for any one hour of the tidal cycle for this to be meaningful.

3. RESULTS

3.1 Accounts of key species recorded during both the intertidal and terrestrial surveys

In this section we use data from national surveys (e.g. Gibbons *et al* 1993, Pollit *et al* 2000, Stone *et al* 1997, Ogilvie *et al.* 2000 and Lack 1986) to provide the necessary background information to assess the national and regional importance of birds in the study area. This report compares the results of the earlier work carried out during winter 1993/94 (Austin *et al.* 1994) with those obtained during the present study. Austin *et al.* (1994) also reviewed the local status of each of the “key” species using regional bird reports, and this has not been repeated for the purposes of this report. Occasional reference is made to “Lancaster and District” in the species accounts. In this context, “Lancaster and District” refers to an area extending north from Lancaster to 20 km, east to 15 km, south to 10 km and including Morcambe Bay to the west (after Marsh 1989).

Species accounts follow the Voous (1973) order.

The usage by key species of the intertidal mudflats, water surface and saltmarsh in the vicinity of the Salt Ayre crossing and the use of fields adjacent to the proposed route are presented by means of distribution maps. On the intertidal maps, each dot represents the average number of bird hours per tidal cycle. On the terrestrial survey maps, each dot represents a single bird, and the dots are randomly placed within the survey sections, and therefore do not represent the actual distribution of the species within each recording section.

3.1.1 Cormorant

The Cormorant has an essentially coastal breeding distribution, but with an increasing number of inland colonies becoming established. The British breeding population is in the magnitude of about 7,000 pairs, with declines in recent years at some of the coastal colonies (Gibbons *et al.* 1993), whilst some of the newly formed inland colonies have increased (Wernham *et al.* 1999). The British wintering population is thought to be in the region of between 13,200 – 18,700 individuals depending on the methodology used to extrapolate the counts from the Wetland Bird Survey Data (Wernham *et al.* 1993).

During the present survey, Cormorants were occasionally recorded during the intertidal counts (Fig. 3.1.1). The maximum count during any single hour was of two feeding birds in January. Mudflat 2 was used as a feeding and roosting area at different stages of the tidal cycle, with sections 8 and 9 (comprising the main channel) used as the main feeding area. The results from the current intertidal survey and the previous intertidal survey (Austin *et al.* 1994) show little change, with perhaps slightly fewer bird hours recorded during the present study.

No Cormorants were recorded on the ground during the current terrestrial survey, but several birds were noted flying over fields adjacent to the estuary.

3.1.2 Grey Heron

Breeding and wintering populations of Grey Heron are widely distributed throughout the British Isles, with the wintering population perhaps supplemented by birds from colder Continental Europe. The current British breeding population is around 10,000 pairs (Stone *et al.* 1997). They feed principally on fish and amphibians, and are colonial breeders. Information on the location of local colonies is detailed in the earlier report. During the current survey, Grey Heron were occasionally recorded during the intertidal counts, feeding and roosting on the exposed mudflats of the Lune. The maximum number recorded during a single count was 3 individuals in section 3 (Fig. 2.2.1a). There appears to be little difference in the numbers recorded between the two surveys.

3.1.3 Mute Swan

Mute Swans are widely distributed throughout the British Isles throughout the year, with an estimated population of around 28,000 pairs (Stone *et al.* 1997). Outside the breeding season Mute Swans form herds as do the non-breeding birds throughout the year. It is thought that the wintering population in the Lancaster and District area is around 90 – 120 birds (Marsh 1989), with Aldcliffe Marsh and the Lune Estuary acting as the principal site for the species during the winter (Austin *et al.* 1994).

During the intertidal counts made during the present survey, Mute Swans made extensive use of parts the saltmarsh for grazing (Fig. 3.1.3.1). Odd birds also fed or roosted on the main channel and adjacent mudflat. The maximum count was of 38 birds in December, made on a falling tide. The numbers and distribution of the Mute Swan appeared broadly similar between the current and the 1993/94 surveys. However, section 7 adjacent to the municipal rubbish tip was extensively used as a feeding area by Mute swans during the previous survey, but not at all during the current survey. There are no obvious reasons for this.

During the present terrestrial survey, Mute Swans were recorded from most of the areas of saltmarsh bordering the Lune Estuary (Fig. 3.1.3.2), but mainly from the water treatment works northwards. The greatest numbers were present on the saltmarsh adjacent to Aldcliffe Marsh, with occasional individuals at Conder Green, and in fields by the Lancaster Canal. The maximum counts were of 60 birds on section 504 and 42 birds on section 506 (Figs. 2.2.1a & 3.1.3.2). The previous terrestrial survey showed a similar distribution, with the main concentrations of feeding swans on the saltmarshes adjacent to Aldcliffe Marsh, but with a lower maximum count of 22 individuals (Austin *et al.* 1994).

3.1.4 Greylag Goose

A recent survey has estimated the current breeding population of Greylag Geese in Britain as around 30,000 individuals (Rehfishch *et al.* In press). The population has continued to increase since the previous estimate of around 22,000 birds (Gibbons *et al.* 1993). The majority of the British population is derived from introduced feral breeding stock, with only a small population of truly wild breeding birds confined to north and west Scotland. Winter numbers in Scotland and parts of northern England are considerably increased by the arrival of most of the wild breeding population of Iceland. There is a feral population established in the Lancaster and District area (Marsh 1989), with continued introductions by the Morecambe Bay Wildfowling Association on to their refuge at Aldcliffe Marsh (pers. com. Marsh 2001).

During the current intertidal survey, Greylag Geese were regularly recorded in small numbers on the saltmarsh, with a peak count of 70 birds in section 5 in December (Fig. 2.1.1). The winter 1993/94 survey only recorded pairs of Greylag on a couple of occasions, suggesting that there has been an increase in the Aldcliffe marsh and Lune areas over the intervening years, increasing the importance of the study area as a wintering site for the species.

During the terrestrial survey Greylag Geese were recorded feeding and roosting on the areas of saltmarsh adjacent to the Lune, in particular Aldcliffe Marsh, and also in pastures west of the estuary (Fig. 3.1.4.1). The maximum count was of 69 individuals in recording areas 43 and 504 (Fig. 2.2.1a). The earlier terrestrial survey only recorded a single pair of Greylag Geese (on Aldcliffe Marsh), indicating a marked increase in population and use of the area in the vicinity of the proposed Salt Ayre crossing. It is likely that all the terrestrial records relate to feral birds introduced by the local wildfowling.

3.1.5 Shelduck

Shelduck are a widespread breeding species around much of the British coastline (Gibbons *et al.* 1993). The majority of the British population leaves our shore in the Autumn to moult in the German Wadden Sea, and return later in the year to winter on the coast. The principal food of Shelduck comprises of small snails, such as *Hydrobia ulvae*, polychaete worms and crustaceans (Lack 1986). Mudflats therefore provide an important feeding habitat for this species, and Morecambe Bay is the Forth most important wintering site for Shelduck in Britain, with over 8,000 birds present during the 1998/99 winter (Pollit *et al.* 2000). On the Lune, the greatest numbers occur further down the estuary, away from the study area and the proposed Salt Ayre crossing point. Aldcliffe Marsh holds one of the highest breeding densities of Shelduck in Britain (Allport *et al.* 1986).

During the present study, Shelduck were very occasionally recorded during the intertidal counts, and then only in very low numbers (Fig. 3.1.5.1). The highest counts were of five birds feeding on the saltmarsh in section 5, and 6 birds roosting on the main channel of the Lune in section 8 (Fig. 2.1.1). During the previous study of winter 1993/94, up to 22 Shelduck were counted, with birds present at all times during the intertidal counts, and present on more of the recording sections than during winter 2000/2001.

During the current terrestrial survey, generally low numbers of Shelduck were recorded, mostly feeding on the saltmarsh areas adjacent to the Lune Estuary (Fig. 3.1.5.2). Several individuals also fed in the flooded pasture on and around Aldcliffe Marsh. The maximum counts of Shelduck during the current terrestrial survey were made in February, with 26 and 22 individuals in sections 507 and 501 respectively (Fig. 2.2.1a & 2.2.1b). The previous terrestrial survey frequently encountered small numbers of Shelduck mostly in fields, but also on saltmarsh. The maximum count was of 35 birds near Conder Green (Austin *et al.* 1994). Overall, there were slightly fewer Shelduck recorded on pastures during the current survey, compared to the previous survey.

3.1.6 Wigeon

Wigeon are widely distributed in Britain as a winter visitor, with a small breeding population of between 300 to 500 pairs (Gibbons *et al.* 1993). It is principally a winter visitor to the Lancaster and District area, with Morecambe Bay holding nationally important numbers *e.g.* over 4,700 birds during winter 1998/99 (Pollit *et al.* 2000). A small but varying number of Wigeon are present all year on the Lune, although breeding has not been proved (Marsh 1989).

During the current intertidal survey, only small numbers of Wigeon were recorded on the Lune in the vicinity of the proposed Salt Ayre crossing during December (the maximum count was of 25 birds roosting on the main channel), but there was an increase during February when up to 150 birds were feeding and roosting on the saltmarsh area of section 5 (Fig. 2.1.1). None were recorded during the January intertidal counts. During the previous intertidal survey of winter 1993/94, Wigeon were only recorded occasionally and in small numbers during the intertidal counts, with a maximum record of 24 individuals.

During the current terrestrial survey, Wigeon were recorded from several areas of saltmarsh adjacent to the Lune Estuary (Fig. 3.1.6.1). The largest counts, all relating to feeding flocks on areas of saltmarsh, were of 111 birds in section 501 and 70 birds in section 507 (Figs. 2.2.1a & 2.2.1b). The previous terrestrial survey did not record any Wigeon at all, in contrast to the current survey in which Wigeon were regularly recorded in varying numbers around the Lune Estuary. This may primarily be as a result of a series of extremely high spring tides that totally flooded the saltmarsh, and made a lot of seeds and other vegetable matter more easily available to grazing species of duck such as Wigeon.

3.1.7 Mallard

The Mallard is a common and widespread species throughout Britain, with an estimated breeding population of between 100,000 and 130,000 pairs. There has been some suggestion of a decline in numbers over the last few years, particularly in the numbers recorded during the winter, although the situation is far from clear (Pollit *et al.* 2000). The wintering population on Morecambe Bay is of national importance, with mean numbers of around 3,600 birds (Pollit *et al.* 2000).

During the current intertidal survey, Mallard were widely recorded within the study area, with a maximum count of 47 birds in February (Fig. 3.1.7.1). Most of the birds appeared around the low tide period, tending to disappear at high tide. The intertidal survey of winter 1993/94 also suggested that there was more feeding activity around the low tide period than at other times. The peak count then was of 31 birds.

During the current terrestrial survey, Mallard were recorded regularly on and around Aldcliffe Marsh, including the adjacent saltmarsh (Fig. 3.1.7.2), with a maximum count of 24 individuals in section L58 (Fig. 2.2.1a). Smaller numbers of Mallard also fed in pastures just south of the sewage works, near Conder Green and by the Lancaster Canal near Hampson Green (Fig. 3.1.7.2). The previous survey recorded small numbers of Mallard, (usually one or two pairs), but with up to 16 birds on the saltmarsh adjacent to Aldcliffe Marsh (Austin *et al.* 1994). Overall, there are few differences between the results of the two surveys, with the exception that more Mallard appeared to feed on Aldcliffe Marsh itself rather than the adjacent saltmarsh areas during the current survey.

3.1.8 Goldeneye

Goldeneye are a widespread winter visitor to Britain with an estimated wintering population in the region of 17,000 individuals (Stone *et al.* 1997). They are found on both coastal and inland waters during the winter months, with a small breeding population mostly in Scotland in freshwater habitat. Morecambe Bay holds nationally important wintering populations of Goldeneye, with upwards of 300 birds regularly present (Pollit *et al.* 2000). The Lune Estuary as a whole holds the second largest concentration of Goldeneye in the Lancaster and district area, with between 70 – 120 birds present (Marsh 1989). Very few of these are normally found in the Aldcliffe Marsh intertidal survey area.

During the present intertidal survey, Goldeneye were recorded feeding in sections 8 and 9 (Figs. 3.1.8.1 & 2.1.1), with a maximum of seven individuals present in January. Goldeneye were recorded during every part of the tidal cycle, but with the greatest numbers present on rising tides and over high tide, with the numbers falling off during falling tides. The previous survey recorded higher numbers of Goldeneye (with a peak count of 17 individuals), but showed a similar pattern of occurrence, with the greatest activity on the rising tide, with the birds apparently moving elsewhere as the tides peaked and began to fall.

During the present terrestrial survey, up to three Goldeneye were recorded on the pools in sections 53 and 56 of Aldcliffe Marsh and on the Lancaster Canal adjacent to section 476, near Brantbeck Bridge (Figs. 2.2.1a & 2.2.1c). Austin *et al.* (1994) did not record any Goldeneye during the terrestrial survey work. During the current survey, some parts of Aldcliffe Marsh were flooded to a considerable depth as a result of above average winter rainfall, providing suitable feeding habitat for Goldeneye. Similar conditions were not present during the previous survey.

3.1.9 Goosander

During the last century, the Goosander has colonised much of Scotland and northern England and Wales as a breeding species (Gibbons *et al.* 1993). Since 1987, the increase in the breeding population along rivers has been running at an estimated 3% per annum. The greatest increase has occurred in Wales, with breeding pairs expanding into the adjacent counties of Gloucestershire and Shropshire (Wernham *et al.* 1999). During the winter, the numbers are supplemented by birds from the Northern

European breeding population, giving a total estimated British wintering population of 8,900 individuals (Stone *et al.* 1997), the majority of which are in Scotland and northern England (Lack 1986 & Pollit *et al.* 2000). Marsh (1989) suggested that up to 28 breeding pairs were present in the Lune catchment area.

During the present intertidal survey only a single Goosander was recorded, in section 9 on a rising tide during December (Fig. 2.1.1). This is in marked contrast to the previous study (Austin *et al.* 1994), when up to eight birds were regularly present in the study area on the estuary, mainly feeding in section 8 of the river.

The only records during the present terrestrial survey were of up to three birds on the Lancaster Canal between Galgate and Brantbeck Bridge, adjacent to sections 228, 239 and L248 (Fig. 2.2.1c). No Goosander were recorded during the previous terrestrial survey.

3.1.10 Oystercatcher

The Oystercatcher is a widespread breeding species within Scotland and northern England. Elsewhere in Britain it is more thinly distributed. The British breeding population is estimated as between 33,000 and 43,000 pairs, and comprises around 20% of the European breeding population (Gibbons *et al.* 1993). During the winter, the British population is swelled by large numbers of European Oystercatchers, increasing the British wintering population to 359,000 (Stone *et al.* 1997). During this period, they are chiefly coastal in their distribution. Morecambe Bay is the most important site in the British Isles with over 50,000 wintering Oystercatcher, giving it international importance. However, on the Lune during the winter months, most of the birds are further down the estuary towards the mouth. Within the Lancaster and District area, they are a common breeding species, particularly in the Lune catchment area and adjacent saltmarshes (Marsh 1984). Oystercatchers are generally present in the Aldcliffe Marsh area throughout the year (Austin *et al.* 1994). However, the numbers fall to just a few individuals by the mid-winter period, building up again by late winter/early spring.

Overall, the current survey recorded very few Oystercatcher in the vicinity of the proposed Salt Ayre crossing. There was only a single record during the December counts, none recorded at all in January and up to 22 Oystercatcher present during the February intertidal counts. During the present intertidal survey, the maximum number of Oystercatcher recorded was 28 birds roosting on saltmarsh sections 5 and 6 in December and the maximum number of feeding birds recorded was 3 in section 2 during February (Figs. 3.1.10.1 & 2.2.1). The majority of the birds recorded during the winter were not using the intertidal survey area for feeding but as a roosting area. Sections 2 and 3 were the most used (Fig. 3.1.10.1). The overall results from the current survey are very similar to those in Austin *et al.* (1994).

During the current terrestrial survey, Oystercatcher were mostly recorded from the saltmarshes adjacent to the Lune, particularly section 507 on the western side of the estuary (Figs. 2.2.1a & 3.1.10.2). The maximum count from here was of 26 individuals during February. A small number of Oystercatcher were also occasionally recorded from hinterland fields, with the highest count of nine feeding birds opposite the municipal tip (Figs. 3.1.10.2). The previous terrestrial survey recorded the greatest numbers of Oystercatcher from the saltmarsh section 508, adjacent to Aldcliffe Marsh, with up to 14 birds present. Occasional individuals were also noted on pasture at Conder Green and on Aldcliffe Marsh itself (Austin *et al.* 1994).

3.1.11 Golden Plover

The Golden Plover breeds in much of the upland habitat throughout Scotland and northern England, with an estimated breeding population of over 22,000 pairs (Gibbons *et al.* 1993). During the winter months, the birds move from the hills to lowland habitats such as permanent pasture, and increasingly during the last decade, also to intertidal areas. The winter population is swelled by the arrival of northern European birds, giving an estimated British wintering population of 250,000 birds (Stone *et al.* 1997). Morecambe Bay holds nationally important numbers of Golden Plover, with counts

regularly in excess of 4,000 individuals. Over recent years, up to 200 Golden Plover have been recorded using Aldcliffe Marsh during the late autumn period (Austin *et al.* 1994), with a decrease in numbers over the winter period.

During the present intertidal survey, Golden Plover were only recorded on a single occasion, when 8 birds roosted with Lapwing on Aldcliffe Marsh. This is broadly similar to the previous survey (Austin *et al.* 1994), when a single flock comprising 50 birds was recorded on Aldcliffe Marsh.

During the present terrestrial survey, Golden Plover were recorded on several occasions both on areas of saltmarsh and pasture. The greatest numbers were roosting flocks on the areas of saltmarsh adjacent to Aldcliffe Marsh, and on the western side of the Lune (Fig. 3.1.11.1). The maximum counts were of 400 in section 501 and 100 in section 503 (Figs. 3.1.11.1 and 2.2.1b). Small numbers of Golden Plover were also recorded feeding in recently manured fields near Conder Green, and in pasture adjacent to Aldcliffe Marsh (Fig. 3.1.11.1). The previous terrestrial survey also recorded flocks of up to 50 Golden Plover on the saltmarsh adjacent to Aldcliffe Marsh, and flocks of 70 and 80 birds on pasture between Galgate and Conder Green (Austin *et al.* 1994). Overall, the current survey recorded greater numbers of Golden Plover than the 1994 survey.

3.1.12 Lapwing

The Lapwing is widely distributed as a British breeding species, although it has shown some quite significant declines over parts of Britain. The current British breeding population is in the region of between 190,000 and 240,000 pairs (Stone *et al.* 1997). The British winter population is considerably increased by the arrival of large numbers of Lapwing from other parts of northern Europe, particularly Scandinavia, Denmark and northern Germany (Imboden 1974). These swell the wintering population to between 1,500,000 and 2,000,000 individuals (Stone *et al.* 1997). During the winter months, Morecambe Bay supports internationally important numbers of Lapwing, with recent mean counts of over 20,000 birds (Pollit *et al.* 2000). In the Lancaster and District area, Aldcliffe Marsh and areas of saltmarsh adjacent to the Lune are important throughout the year for both breeding and wintering Lapwing, with several thousand birds regularly present during the winter months (Austin *et al.* 1994).

During the current intertidal survey, Lapwing were generally present in large numbers, particularly on the saltmarsh of section 5, where up to 2,800 birds roosted over high tide in December (Fig. 3.1.12.1). When areas of mud were exposed around the edge of the river channel, some birds moved from the saltmarsh to bathe and roost, with only very small numbers actually feeding on the intertidal areas. The largest flocks on the intertidal mud of the estuary were 460 birds in section 1 and 200 individuals in section 2 during January and December respectively (Fig. 3.1.12.1 & 2.1.1). Only small, occasional flocks of Lapwing were recorded on the intertidal area at the point of the proposed Salt Ayre crossing (*i.e.* sections 3,4, and 9) (Fig. 2.1.1). The results obtained from the current intertidal survey are similar to those of the earlier survey, when Austin *et al.* (1994) found that large numbers of roosting Lapwing frequented the saltmarsh areas during the high tide, with some returning to the intertidal mudflats when they became exposed. Only small numbers of Lapwing were recorded actually feeding in the vicinity of the proposed Salt Ayre crossing. The maximum count from the earlier survey was of 1,500 individuals, lower than the maximum count of 2,800 individuals made during the current survey.

During the current terrestrial survey, the greatest concentrations of Lapwing were on the saltmarshes either side of the Lune in the vicinity of Aldcliffe Marsh (Fig. 3.1.12.2). The maximum counts were of flocks numbering 2,300 and 2,000 individuals on sections 501 and 504 respectively (Figs. 2.2.1a & 2.2.1b). Several flocks numbering up to 95 birds also frequented some of the old pastures comprising Aldcliffe Marsh. Lapwing also frequented newly manured permanent pasture north of Conder Green, and between Conder Green and Galgate (Fig. 3.1.12.2). Similarly, the previous survey found the greatest numbers of Lapwing on saltmarsh adjacent to Aldcliffe Marsh, (and close to the proposed Salt Ayre crossing), and in fields in the vicinity of Conder Green, and east of the Lancaster Canal (Austin *et al.* 1994). The current survey recorded higher numbers of Lapwing overall than the previous survey.

3.1.13 Dunlin

Within Britain, the Dunlin is a localised breeding species, confined to the peat bogs and high altitude moors of Northern England and Scotland, particularly the peat lands of Sutherland and Caithness and the Northern Isles (Gibbons *et al.* 1993). The current British breeding population is estimated as between 9,000 and 10,000 pairs (Stone *et al.* 1997), and represents more than 90% of the total European Community breeding population, affording Dunlin special protection under the EEC Wild Birds Directive. Outside of the breeding season, Dunlin frequent coastal mudflats. The British wintering population of Dunlin is increased by the arrival of thousands of birds from Northern Scandinavia and the former USSR, and is currently estimated as over 530,000 birds (Stone *et al.* 1997). The British breeding population winter well to the south of the British Isles. During the winter, Morecambe Bay holds internationally important numbers of Dunlin, with mean numbers in excess of 53,000 individuals, making it the second most important site in Britain (Pollit *et al.* 2000). The Lune Estuary is frequented by generally low numbers of Dunlin during the winter months, with the majority of the birds towards the mouth, and an apparent trend to decreasing numbers in the vicinity of Aldcliffe Marsh over recent winters (Bateman pers. comm. in Austin *et al.* 1994).

During the current survey, the only record of Dunlin during the intertidal survey was of five birds roosting on the saltmarsh of section 5 at high tide in January (Figs. 3.1.13.1 & 2.1.1). During the previous survey, up to 20 Dunlin were recorded on several occasions feeding on the intertidal area of section 1 and using the adjacent saltmarsh of section 5 (Austin *et al.* 1994).

During the current terrestrial survey, Dunlin were occasionally recorded feeding and roosting over high tide on the saltmarsh either side of the Lune in the vicinity of Aldcliffe Marsh (Fig. 3.1.13.2). The maximum count was of 22 individuals in section 501 (Fig. 2.2.1b). During the previous terrestrial survey, up to 20 Dunlin were recorded on the saltmarsh adjacent to Aldcliffe Marsh, but nowhere else within the study area (Austin *et al.* 1994). Thus overall, there were few differences both in the numbers and distribution of Dunlin between the two surveys.

3.1.14 Curlew

The main breeding habitat of the Curlew is moorland and areas of unimproved, rough grassland. They have also recently begun to extend their breeding range into some lowland agricultural habitats. However, the greatest breeding densities are in Wales and from the Pennines northwards covering much of Scotland (Gibbons *et al.* 1993). The current British breeding population is estimated as between 33,000 and 38,000 pairs (Gibbons *et al.* 1993). During the winter, the British birds move from the hills onto the coast, preferring muddy shores and estuaries. The wintering population is swelled by the arrival of birds from Scandinavia and other parts of northern Europe, giving an estimated total of around 115,000 individuals (Stone *et al.* 1997). Morecambe Bay is the most important wintering site for Curlew in Britain with an average of nearly 15,000 birds over recent winters (Pollit *et al.* 2000). The Curlew is a fairly widespread breeding species in Lancaster and District, with the Lune Valley holding one of the largest concentrations in the area (Austin *et al.* 1994). Although Curlew are present throughout much of the year on Aldcliffe Marsh, the numbers are generally low during the winter (Austin *et al.* 1994). During the current intertidal survey, Curlew were rarely recorded with the highest count being of five individuals roosting on the saltmarsh of section 5 towards high tide (Fig. 3.1.14.1).

The current intertidal survey rarely recorded Curlew, with the count of five individuals roosting on the saltmarsh of section 5 towards high tide (Fig. 3.1.14.1). The current intertidal survey recorded many fewer Curlews than the previous intertidal survey, when up to 18 Curlew were regularly recorded feeding in sections 1 and 3 of the intertidal area, and roosting on the saltmarsh of section 5 (Austin *et al.* 1994).

The current terrestrial survey recorded Curlews from two distinct areas, Aldcliffe Marsh and the adjacent areas of saltmarsh on either side of the Lune, and fields and saltmarsh around Conder Green

(Fig. 3.1.14.2). The maximum counts were of 97 individuals feeding on section 501 and 68 birds on section 451 (Figs. 2.2.1b & 2.2.1c). The numbers of Curlew using the fields around Conder Green increased markedly after farmyard manure was applied to several of the pastures. The previous terrestrial survey frequently recorded Curlew, with the largest flock (numbering 120 individuals) also in the vicinity of Conder Green (Austin *et al.* 1994). The numbers and distribution of Curlew recorded during the two surveys was broadly similar, revealing a preference for feeding and roosting in areas adjacent to the Lune Estuary.

3.1.15 Redshank

The Redshank is a widespread but declining breeding species in Britain, mainly due to the loss of breeding habitat, such as wet meadows (Gibbons *et al.* 1993; Noble *et al.* 2000). The greatest breeding densities are currently around parts of the east Anglian coast and from the Pennines northwards into Scotland and the Northern and Western Isles (Gibbons *et al.* 1993). The current estimates of the British breeding population are between 30,600 and 33,600 pairs (Stone *et al.* 1997). During the winter months, the Breeding birds move to the coastline, preferring muddy shores and estuaries. The British wintering population is joined by large numbers of northern European birds, principally those from the Icelandic breeding population. The current estimate of the total British wintering population is around 114,000 individuals (Stone *et al.* 1997). In Lancaster and District, Redshank are well distributed both as a breeding species and a winter visitor. One of the greatest breeding densities recorded anywhere in Britain was on Aldcliffe Marsh in 1985 (Allport *et al.* 1986). During the winter months, Morecambe Bay is the most important site for Redshank in Britain, with recent mean counts of nearly 7,000 individuals making it of international importance (Pollit *et al.* 2000).

During the current intertidal survey, Redshank favoured the muddy substrates of sections 1, 2 and 4 (Figs. 3.1.15.1 & 2.1.1), with the occasional individual also recorded from section 3 (Fig. 2.1.1). The greatest numbers were recorded from section 2, with up to 136 Redshank roosting on the rising tide during the February counts. The maximum count of feeding Redshank was of seven individuals on section 1 over low tide in January. The previous survey by Austin *et al.* (1994) showed a similar pattern, with small numbers of Redshank generally present through the intertidal counts, feeding on the intertidal flats in sections 1, 2 and, particularly, section 3. However, during the current survey, this section was rarely used. The current survey recorded far higher numbers of Redshank than Austin *et al.* (1994) (maximum counts of 136 versus 20 birds respectively). However, once the roosting birds were excluded, the maximum counts of feeding Redshank were fairly similar in both studies.

Redshank were regularly recorded during the current terrestrial survey in two main areas; the saltmarsh and wet pastures on and adjacent to Aldcliffe Marsh and around Conder Green (Fig. 3.1.15.2). The highest counts were of 243 birds on saltmarsh areas 460 and 461 and 140 individuals feeding and roosting on section 507 (Figs. 3.1.15.2 & 2.1.1). The highest counts of Redshank feeding on pasture were of 62 on freshly manured grassland by Conder Green, and a flock of 58 in wet pasture near Aldcliffe Marsh (Fig. 3.1.15.2). Redshank were only occasionally recorded on Aldcliffe Marsh itself. The largest numbers of Redshank were found on pastureland during the highest tides, when the majority of the saltmarsh was entirely flooded. The previous terrestrial survey only recorded single Redshanks on an occasional basis, all in fields and on areas of saltmarsh immediately adjacent to the Lune (Austin *et al.* 1994).

3.2 Accounts of key species recorded solely on the terrestrial surveys

3.2.1 Teal

Teal are a fairly common and widespread breeding species in Britain (Gibbons *et al.* 1993), although the breeding range and number of pairs appear to have been declining over recent years. The British breeding population is in the order of 1,500 to 2,600 pairs (Stone *et al.* 1997). During the winter months, the British population is increased by birds from northern Europe, and is estimated to be in

the region of 136,000 individuals (Stone *et al.* 1997). Morecambe Bay holds nationally important numbers of wintering Teal, with a recent average of over 1,800 individuals (Pollit *et al.* 2000), but numbers frequenting the Lune are small compared to elsewhere in the local district (Marsh 1989).

During the current terrestrial survey, Teal were only recorded from the saltmarsh at Conder Green, where a maximum of 76 individuals was recorded in February (Fig. 3.2.1.1). The previous terrestrial survey did not record Teal (Austin *et al.* 1994).

3.2.2 Snipe

Snipe are widely distributed over much of Britain, with the greatest densities from the Pennines northwards (Gibbons *et al.* 1993). Snipe breed in marshy and boggy areas from coastal grazing marshes to high altitude moorland. In parts of southern Britain, breeding numbers are declining as a result of the drainage of damp pastures and other agricultural improvements to previously suitable habitat. The current British breeding population is around 55,000 pairs (Stone *et al.* 1997). During the winter, many of the Snipe breeding in northern Britain move to the southern half of the country, with its milder weather. However, a proportion of the Snipe wintering in Britain originate from northern European populations (Lack 1986). The current British wintering population is estimated to be in excess of 100,000 individuals (Stone *et al.* 1997), but Snipe are an extremely difficult species to census during the winter. During the current terrestrial survey, small numbers of Snipe were present on the saltmarshes either side of the Lune in the vicinity of Aldcliffe Marsh, and around Conder Green (Fig. 3.2.2.1). The largest count was of 12 individuals on section 507 of the saltmarsh (Fig. 2.2.1a). Occasional single birds were also present on the flooded fields of Aldcliffe Marsh (Fig. 3.2.2.1). The previous terrestrial survey did not record Snipe.

3.2.3 Fieldfare

Fieldfares are widespread winter visitors to much of Britain, with the greatest numbers in the southern parts of the country. The Fieldfare is also a very rare, but regular breeding species in Britain with less than seven pairs thought to have bred annually in each of the last five years (Ogilvie *et al.* 2000). The bulk of the birds that spent the winter in Britain come from Scandinavia and other parts of northern Europe. It is estimated that the British winter population is around 750,000 birds (Stone *et al.* 1997). Fieldfares are fairly widespread around Lancaster, mostly frequenting pastures with mature Hawthorn hedgerows with plenty of fruits. The current terrestrial survey regularly recorded scattered feeding flocks of Fieldfare, particularly along the Lancaster Canal, but also by Conder Green and on Aldcliffe Marsh (Fig. 3.2.3.1). Flocks were generally made up of less than 50 individuals, with the largest flock comprising 80 individuals in section 303 (Fig. 2.2.1d). The previous terrestrial survey only occasionally encountered small flocks of Fieldfare (Austin *et al.* 1994). Some of the feeding areas identified by the current survey are close to the proposed route of the road, particularly those in the vicinity of Galgate.

3.2.4 Redwing

Similarly to Fieldfare, Redwing are widespread winter visitors to much of Britain, with the greatest numbers in the southern parts of the country. The Redwing is also a very rare, but regular breeding species in Britain with less than seven pairs thought to have bred annually in each of the last five years (Ogilvie *et al.* 2000). The British winter population is mostly comprised of birds from the Icelandic, Finnish and Scandinavian populations (Lack 1986). The British overall winter population is around 750,000 (Stone *et al.* 1997). Redwing are fairly widespread in the Lancaster district, often frequenting the same habitats as Fieldfare, (pastures with mature Hawthorn hedgerows with plenty of berries). During the current terrestrial survey, mostly small flocks of Redwing (involving less than 20 individuals) were frequently recorded, particularly in the fields and hedgerows adjacent to the Lancaster Canal, and on Aldcliffe Marsh (Figs. 3.2.4.1). The largest flocks noted were of 100 Redwing in section 303 and 70 Redwing in section 181 (Figs. 2.2.1b & 2.2.1d). The latter section is

close to the proposed route. The previous terrestrial survey only occasionally encountered small, scattered flocks of Redwing (Austin *et al.* 1994).

3.3 Other species

Aside from those covered in the individual accounts, no other important species were encountered during the intertidal surveys. During the terrestrial surveys, four species of raptor were recorded, mostly hunting over the saltmarshes adjacent to the Lune. These were Sparrowhawk, Kestrel, Merlin and Peregrine Falcon. A single Little Egret was an unusual find in February, feeding in saltmarsh creeks at Conder Green. This species has recently colonised Britain from the near continent, but is still extremely rare as a breeding species in southern Britain, although it is more widespread as a non-breeding visitor. Song Thrushes were thinly scattered in the survey area, mostly in pastures around Galgate, Conder Green and Aldcliffe Marsh (Fig. 3.3.1). Most observations were of single birds but up to five frequented section 69 (Fig. 2.2.1a). The Song Thrush has declined dramatically over many parts of Britain, and is now subject to a UK Biodiversity Action Plan. Starlings were regularly recorded during the terrestrial surveys, with up to 300 feeding on the saltmarshes adjacent to the Lune. Smaller flocks fed in pastures at the southern end of the survey area, particularly between Conder Green and Galgate. Starlings are currently listed as being a species of Conservation Concern, following recent large declines in both the British breeding and wintering populations. Reed Bunting is another declining British breeding species now subject to a UK Biodiversity Action Plan. During the winter terrestrial survey, one or two Reed Buntings fed at the southern end of Aldcliffe Marsh and on the adjacent saltmarsh. The only other Reed Bunting recorded was at the southern end of the survey area by the M6.

4. SUMMARY OF ORNITHOLOGICAL IMPORTANCE OF STUDY AREA DURING WINTER

4.1 Intertidal survey

This survey confirmed the results of Austin *et al.* (1994), in that the numbers of wildfowl and waders frequenting the Lune Estuary in the vicinity of the proposed Salt Ayre crossing are generally small when compared to the numbers known to use the estuary as a whole. The numbers of Shelduck, Mallard, Goldeneye, Goosander, Oystercatcher, Dunlin, Curlew and Redshank recorded using the estuary were all relatively insignificant. The most abundant species of wader was Lapwing, which made extensive use of the areas of saltmarsh for roosting, and very limited feeding. Occasionally, small numbers of Lapwing fed and roosted on the intertidal areas of the estuary. The relatively small number of Golden Plovers recorded associated with the Lapwing flocks on the saltmarshes.

The overall numbers of both Oystercatcher and Redshank in the study area were generally low, the intertidal mudflats were important as a feeding area for both species. Sections 2 and 3 were the most important for Oystercatcher and section 3 for Redshank. Aldcliffe Marsh is an important breeding area for Redshank, and it is possible that the birds wintering in the intertidal study area included a large proportion of this breeding population, thus making the Aldcliffe mudflats locally important.

The areas of saltmarsh adjacent to Aldcliffe Marsh have previously been identified as important to the local wintering Mute Swan populations, with up to 50% of the Lancaster and District population sing them (Austin *et al.* 1994). The present survey also recorded large numbers of Mute Swan feeding and roosting on the saltmarshes, with up to 60 individuals present.

4.2 Terrestrial survey

As with the previous survey, no important areas for wintering wildfowl were identified during the current terrestrial survey. Similarly to the previous survey, the majority of the wildfowl records were concentrated on the saltmarshes and adjacent fields along the Lune. The distribution of waders was broadly similar to that of the wildfowl, with the greatest concentrations generally to be found on the saltmarshes and fields close to the estuary, particularly around Conder Green and Heaton Marsh, on the western side of the Lune Estuary. Feeding flocks of Golden Plover, Lapwing and Redshank were also attracted to fields that had been recently manured, especially in the vicinity of Conder Green. Pastures and hedgerows adjacent to the Lancaster Canal, including the Glasson Branch, were used by small flocks of winter thrushes, along with parts of Aldcliffe Marsh. Small numbers of Song Thrush were widely scattered in the survey area. There were few other important species regularly recorded in the survey area.

4.3 Summary of likely impact of the proposed route

Along the southern section of the proposed Lancaster Western Relief Road, the route avoids any areas of particular ornithological importance. It does however, traverse some tranquil areas, particularly by the Lancaster Canal, in which the bird communities would be affected by noise pollution both at the construction phase and once the road was in use. The majority of the terrestrial survey area was sheep-grazed pasture, with little or nothing in the way of mature hedgerow, and was consequently largely devoid of birds. Ornithologically, the richest part of the terrestrial survey area extended northwards from the water treatment works adjacent to the Lune to Aldcliffe Marsh. The pastures and saltmarsh adjacent to this section of the proposed route are locally important during the winter months for both feeding and roosting wildfowl and waders. Flocks of winter thrushes were also regularly recorded in these sections. It is inevitable that the construction and subsequent use of the proposed route would cause disturbance. This is likely to lead to an overall reduction in usage of these areas by many species, but particularly roosting wildfowl and waders.

The actual Salt Ayre crossing point of the Lune does not appear to be important for either wildfowl or waders, and the proposed route is unlikely to have a significant effect on the birds using the intertidal flats.

Glossary

Breeding population; That part of the population composed of adult breeding pairs. This is not the same as the number of birds present during the breeding season, which may also include non-breeding adults and immature birds.

Exposure; The length of time for which mudflats are exposed, and therefore offering feeding sites for birds, during the course of the tidal cycle.

Intertidal; Intertidal habitats are those found between the high and low water marks. Areas, which are covered by the majority of high tides, are typically mud or sand flats. Mudflats offer rich feeding for many species of wader and wildfowl. Areas, which are only covered by the highest of spring tides develop into saltmarsh, which are flat areas dominated by, salt tolerant vegetation.

Non-breeding Population; That part of the population present during the breeding season but not involved in breeding. These are often immature birds, which have not yet reached breeding age.

Passage; Passage birds are those on route between their breeding grounds and their winter grounds. Typically for British passage birds, breeding grounds will be in countries such as Iceland, Scandinavia and Siberia. Wintering grounds may be in Europe or Africa. British estuaries are important stop over sites for these birds, essential for feeding to put on fat reserves to enable them to continue their journeys.

Raptors; Birds of prey. Includes Eagles, Hawks, Falcons and Owls.

Resident population; Composed of individuals, which remain in the area throughout the year.

Roosting; In the context of this report, roosting birds are those that are not feeding or flying between sites. Many species of wader form roosts during high tides while the mudflats are covered making food unavailable. The presence of undisturbed roost sites may be important in determining the suitability of an area to many species.

Summer population; Used to refer to the overall breeding and non-breeding populations present during the breeding season.

Terrestrial; Within the context of this report, terrestrial habitats refer to agricultural land beyond the influence of estuarine waters. The principal terrestrial habitats within the study area are fields, hedgerows and woodland associated with pastoral farming.

Tidal cycle; In the context of this report refers to the rising and falling of the tide between one low tide to the following low tide.

Waders; Generally applied to the family of birds that includes plovers and sandpipers. The species of wader referred in this report include; Oystercatcher, Golden Plover, Lapwing, Dunlin, Snipe, Curlew and Redshank.

Wildfowl; The family of birds that includes swans, geese and ducks. The species of wildfowl referred to in this report include; Mute Swan, Greylag Goose, Shelduck, Wigeon, Mallard, Teal, Goldeneye and Goosander.

Winter population; Composed of both resident birds and those that over-winter in the area but breed elsewhere. Winter visiting birds may begin to arrive from as early as August and may remain through until March or April, although there is much variation between species. Weather conditions may have a considerable influence on the birds in a given area during the winter, and movements of birds as

result of hard weather commonly give rise to fluctuations in numbers. The winter population is potentially more mobile than breeding birds tied to their nests.

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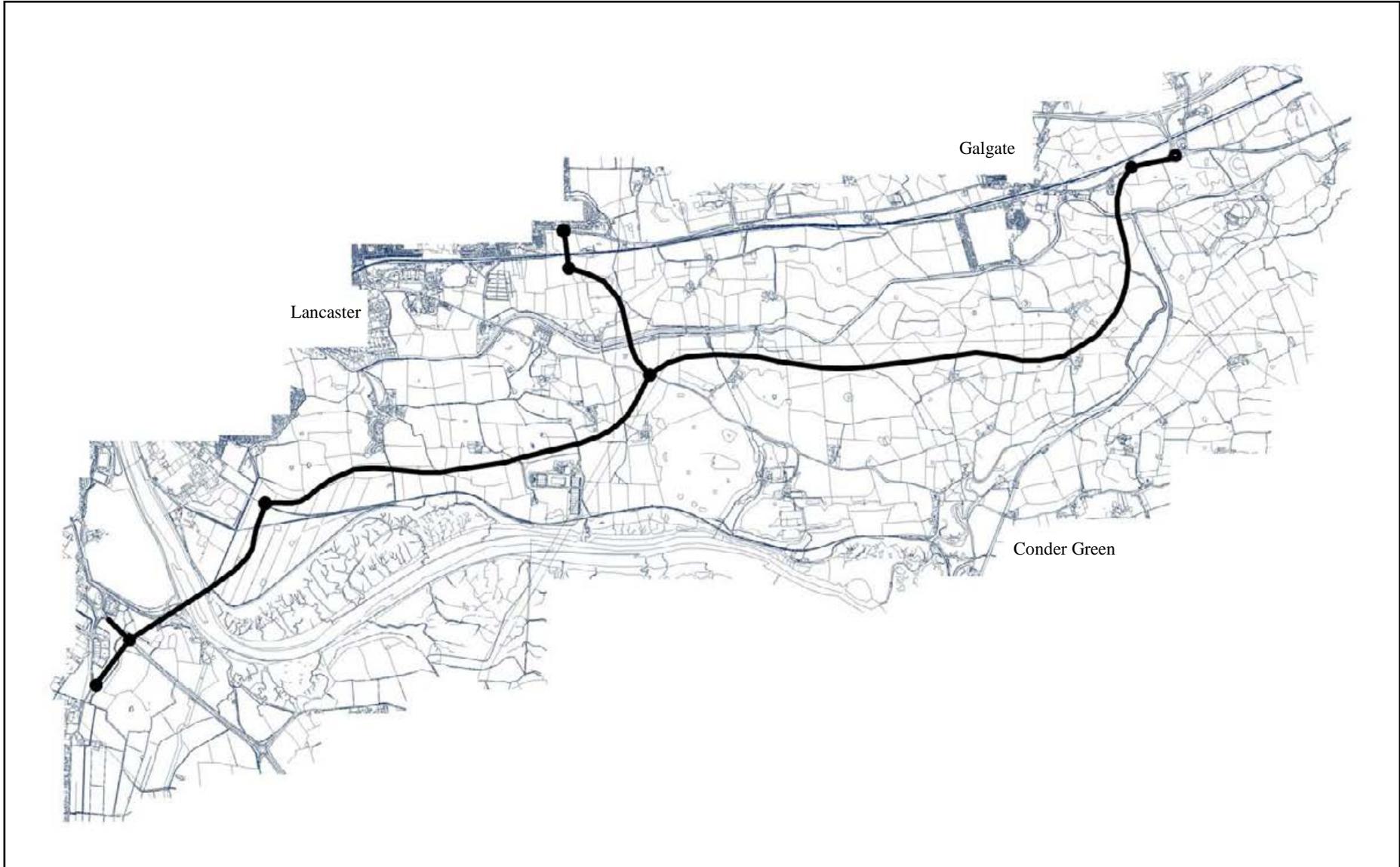


Figure 1.1 The preferred route option under consideration by Lancaster County Council for the proposed Lancaster Western Bypass (reproduced from plans supplied by LCC).

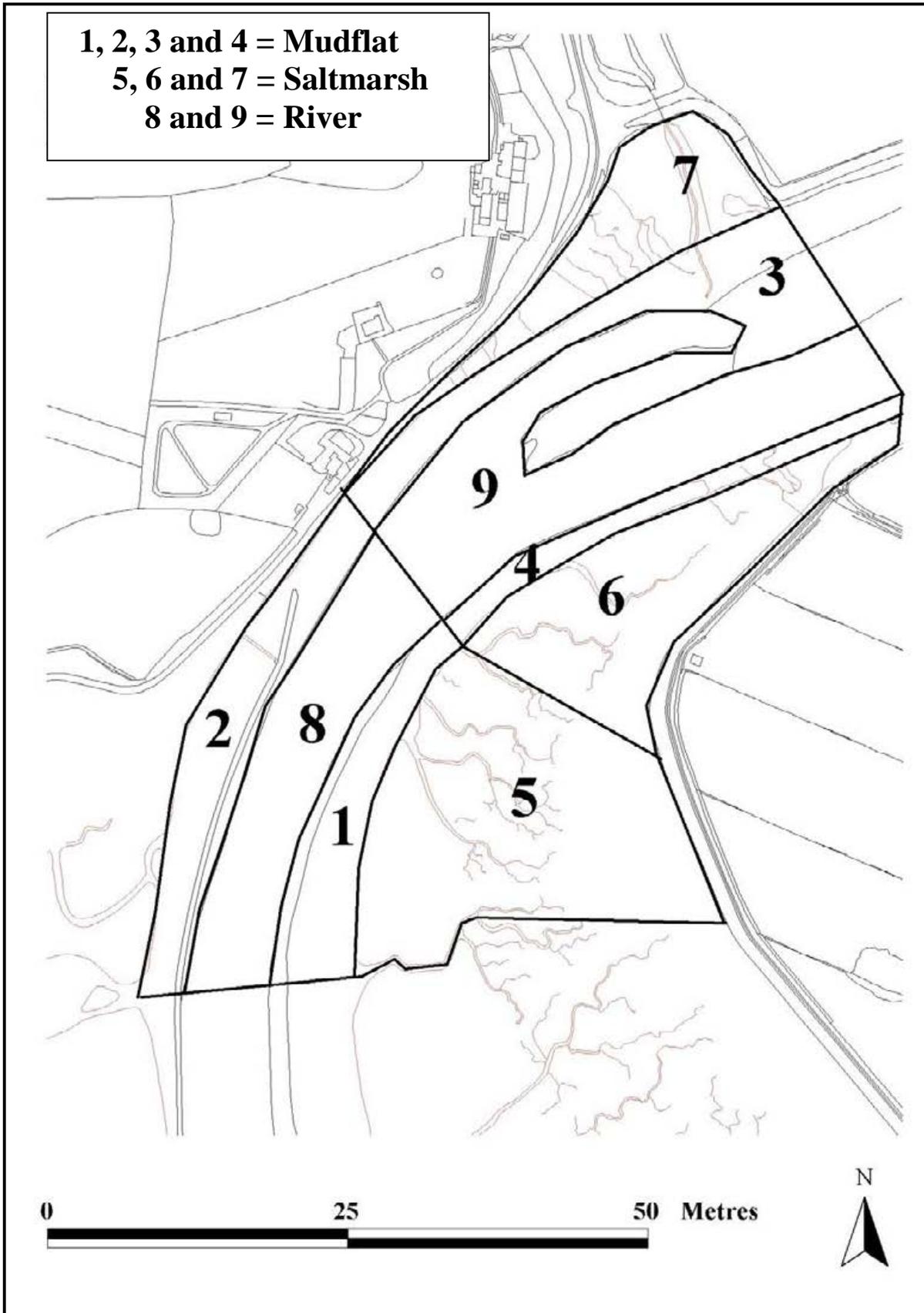


Figure 2.1.1 Study area for intertidal survey, in the vicinity of the proposed Salt Ayre river crossing, showing locations of count sections and habitats.



Figure 2.2.1 The overall terrestrial study area illustrating the sub-areas (a – d) used to show the location of the numbered fields and saltmarsh surveyed during the terrestrial winter bird surveys. The sections enclosed by the dotted line were the sections checked for feeding and roosting wildfowl and waders 3 hours either side of high tide.

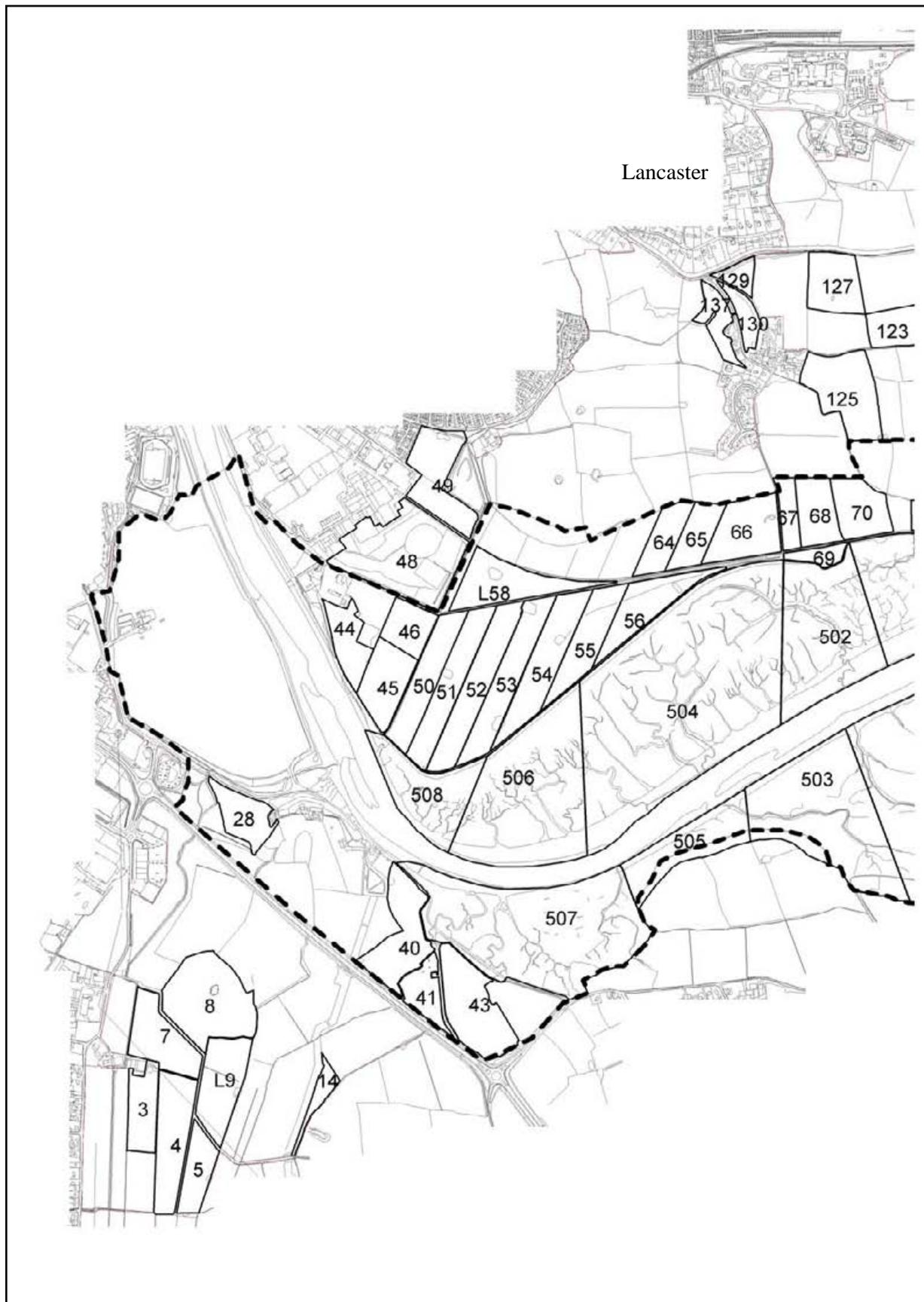


Figure 2.2.1a The terrestrial study area showing the location of the numbered fields and saltmarsh surveyed during the terrestrial winter bird surveys, in which key species were recorded. The sections enclosed by the dotted line were the sections checked for feeding and roosting wildfowl and waders 3 hours either side of high tide.

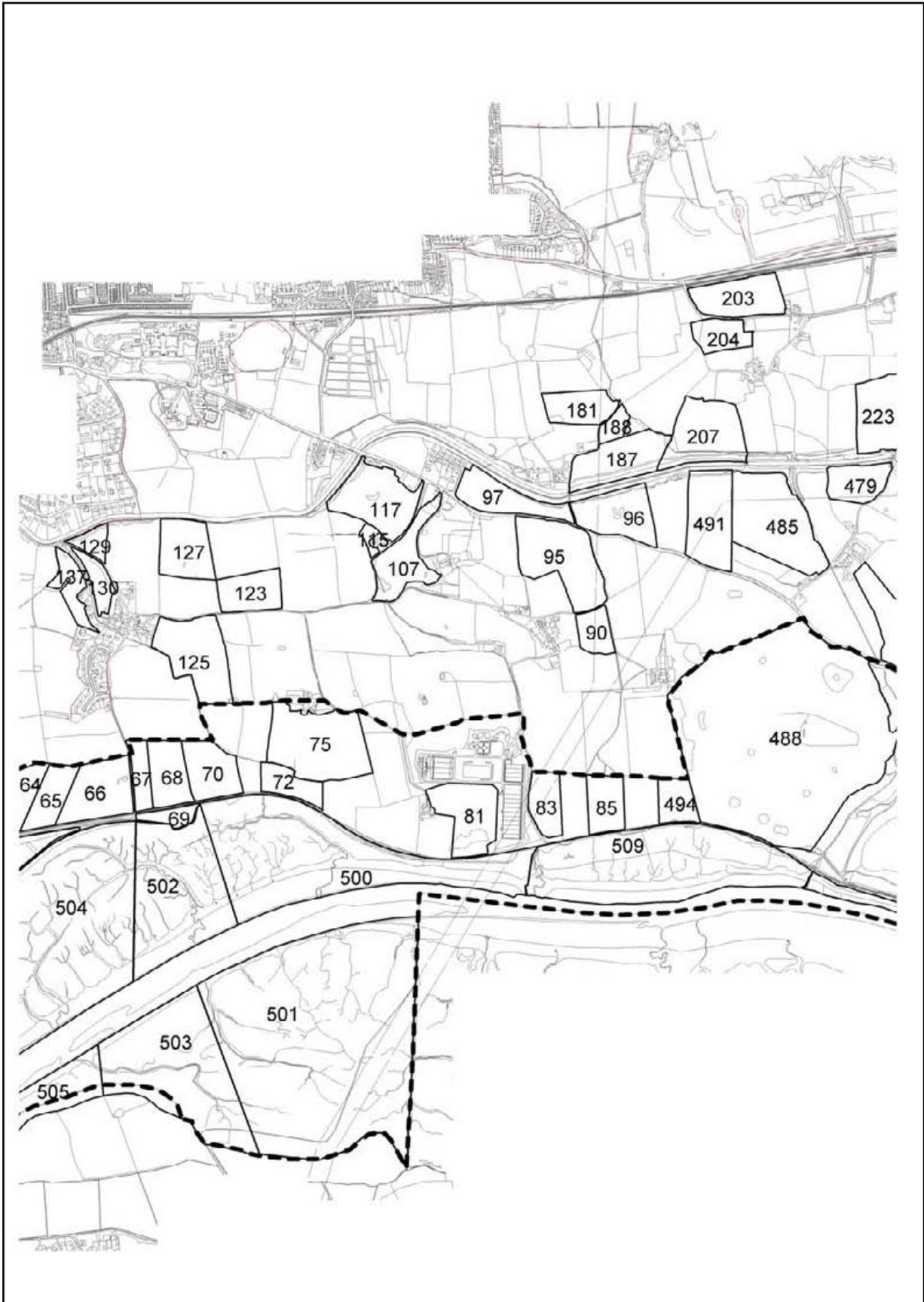


Figure 2.2.1b The terrestrial study area showing the location of the numbered fields and saltmarsh surveyed during the terrestrial winter bird surveys, in which key species were recorded. The sections enclosed by the dotted line were the sections checked for feeding and roosting wildfowl and waders 3 hours either side of high tide.

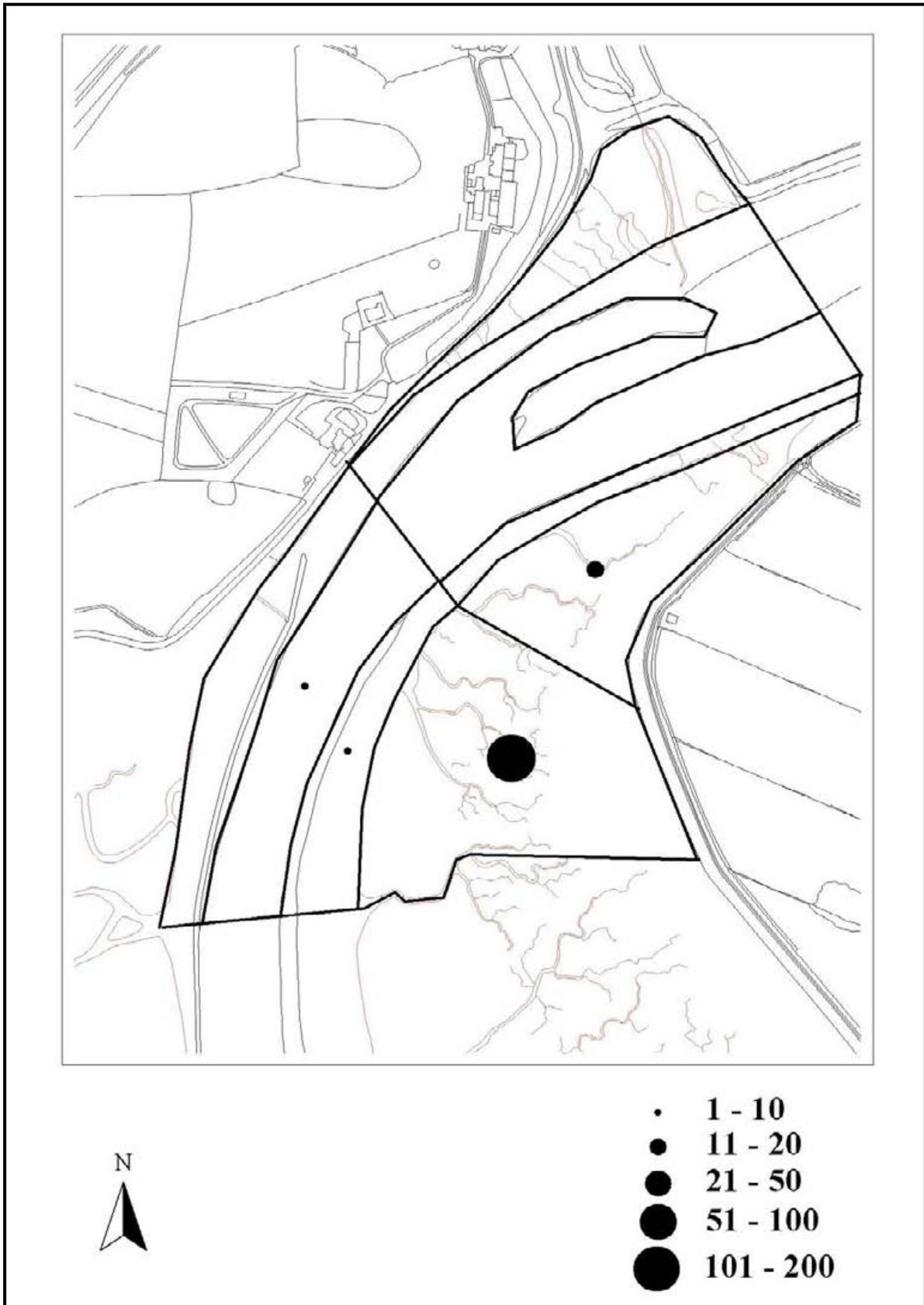


Figure 3.1.3.1 The distribution of feeding Mute Swan in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

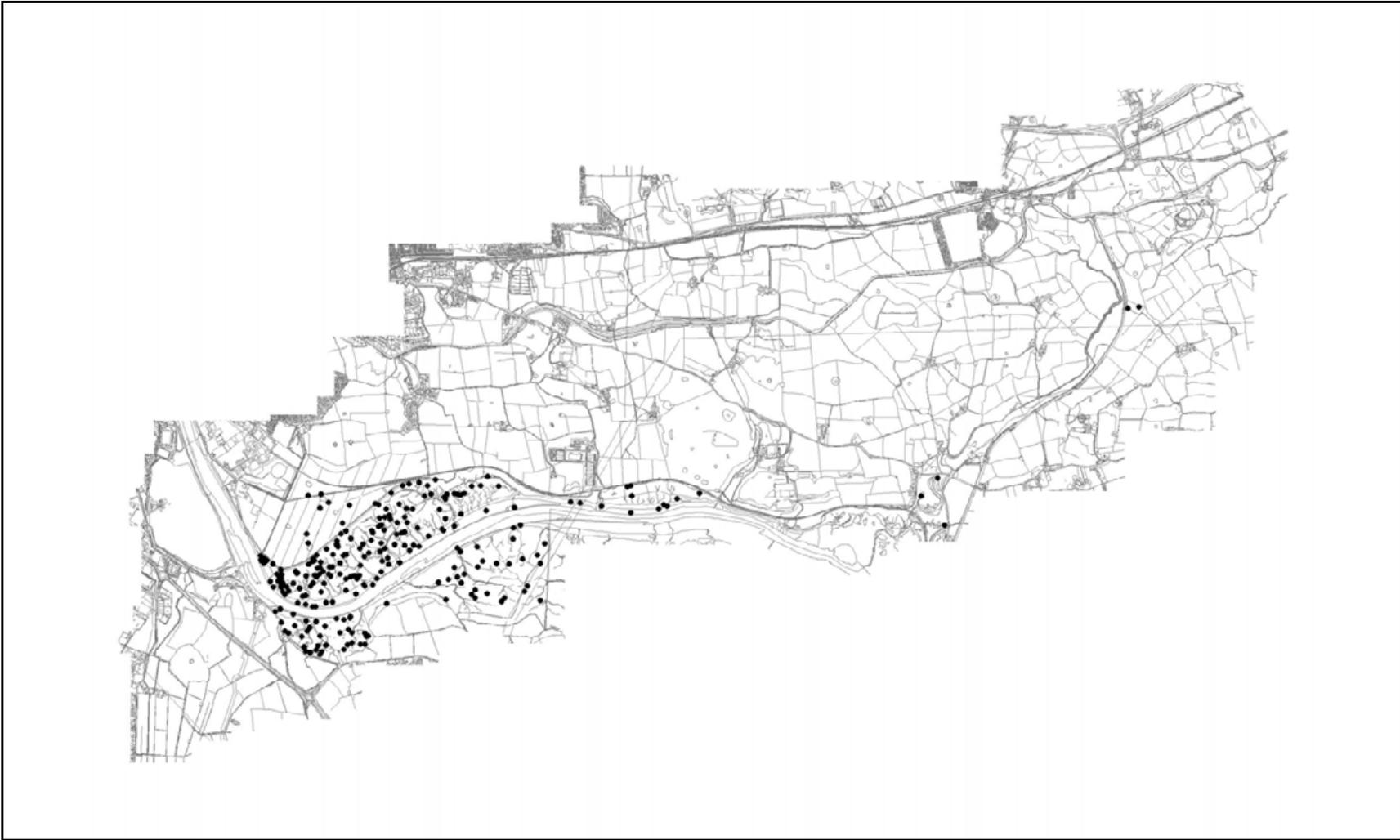


Figure 3.1.3.2 The distribution of Mute Swan recorded during the terrestrial survey. Each dot represents a single individual.

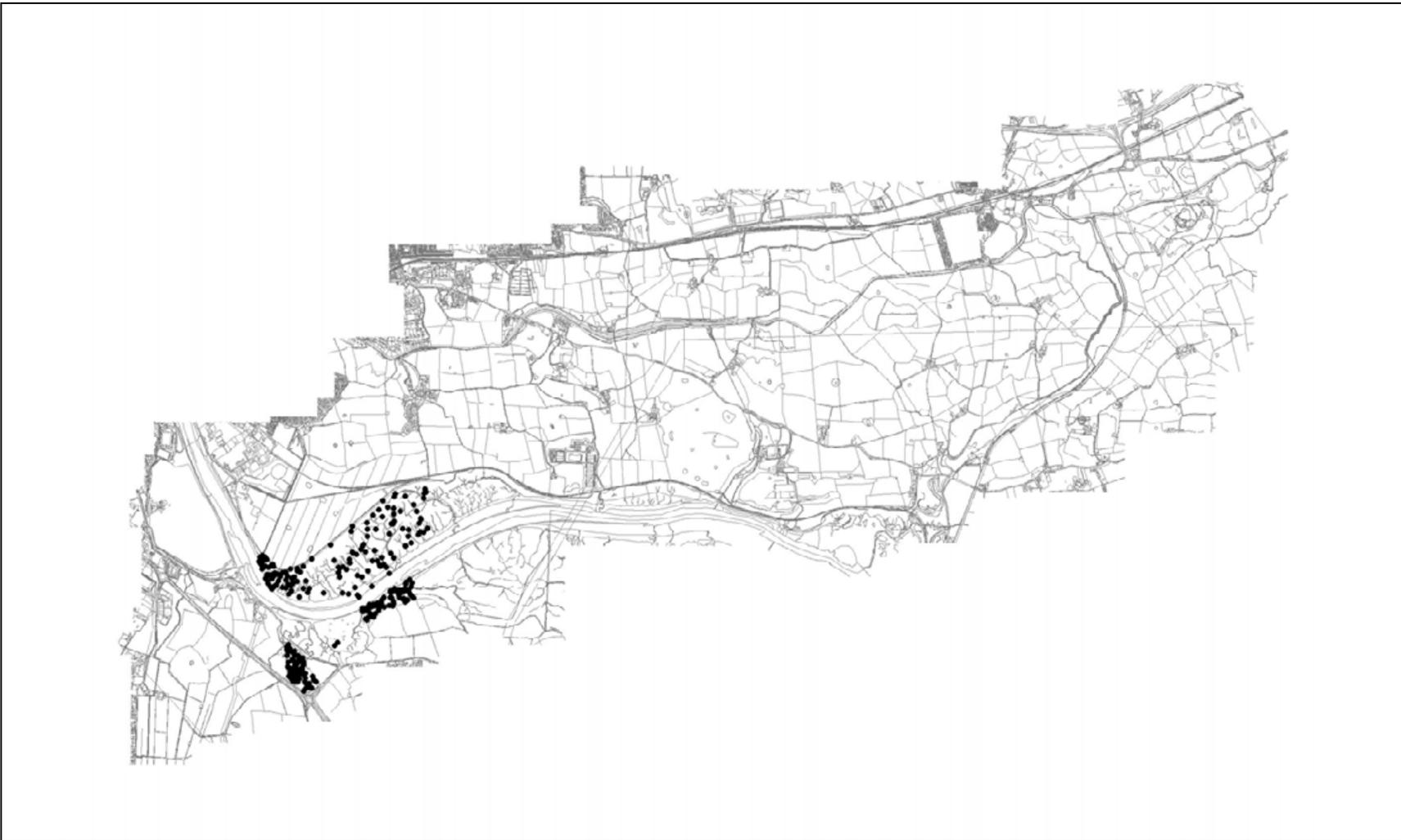


Figure 3.1.4.1 The distribution of Greylag recorded during the terrestrial survey. Each dot represents a single individual.

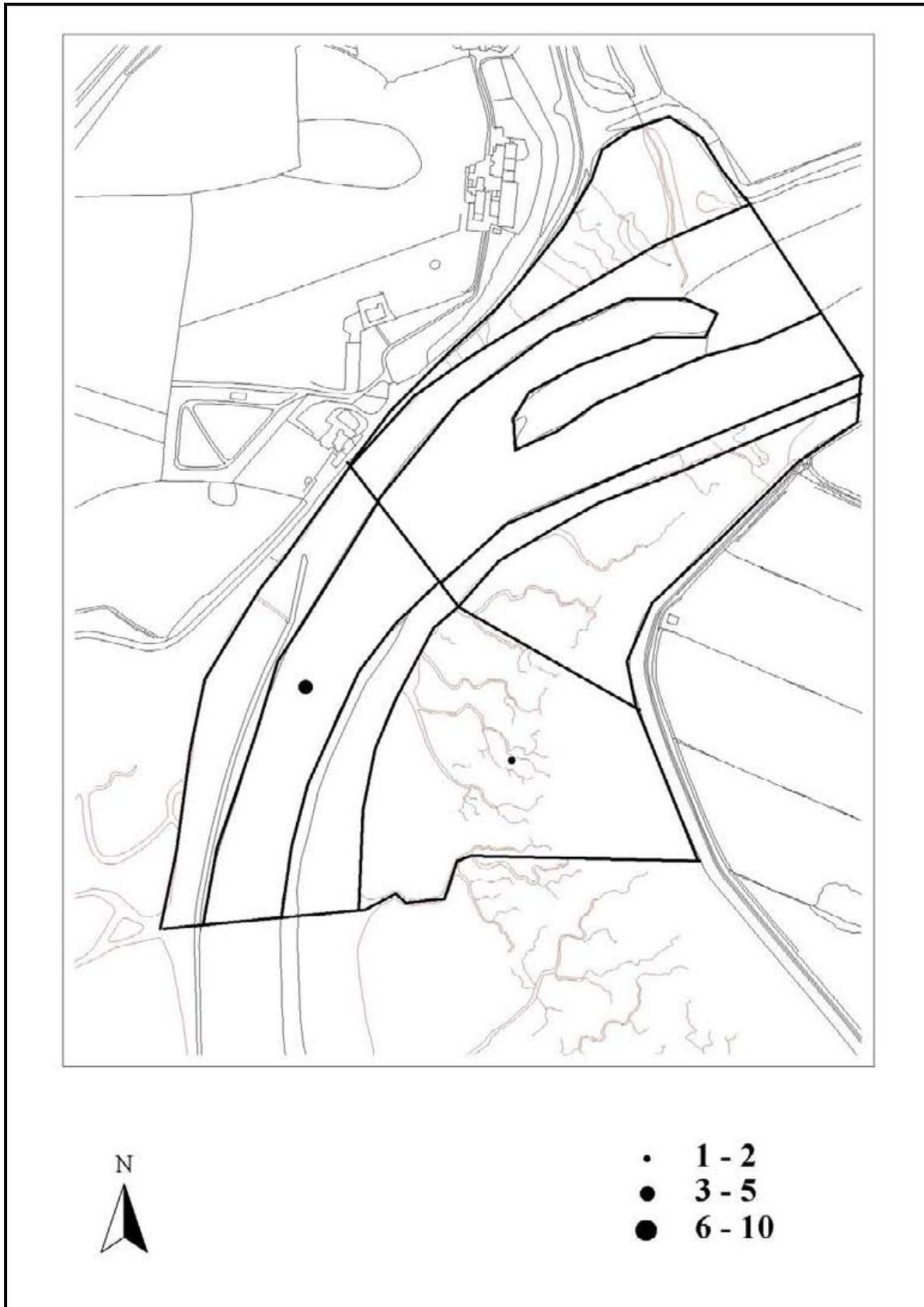


Figure 3.1.5.1 The distribution of feeding Shelduck in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

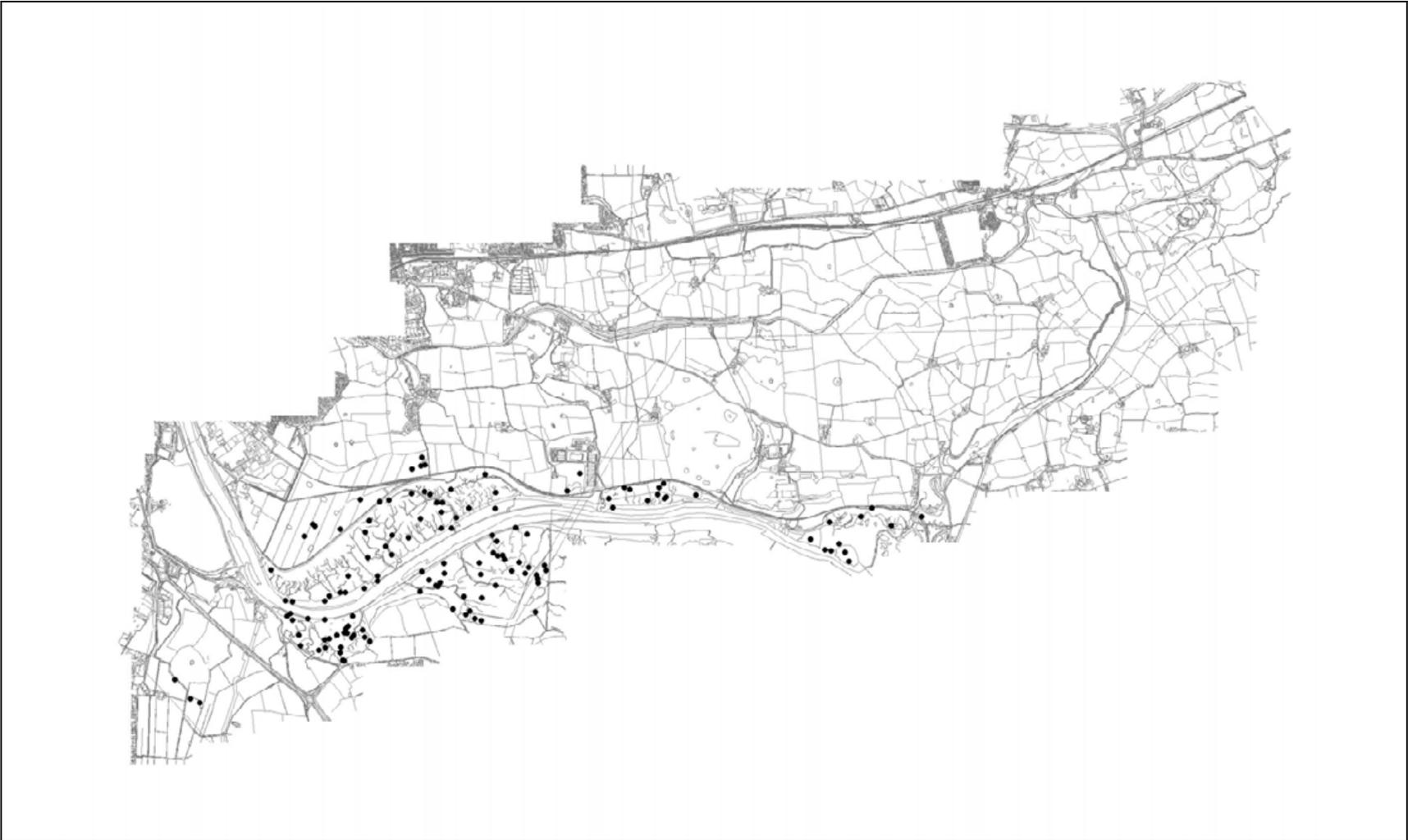


Figure 3.1.5.2 The distribution of Shelduck recorded during the terrestrial survey. Each dot represents a single individual.

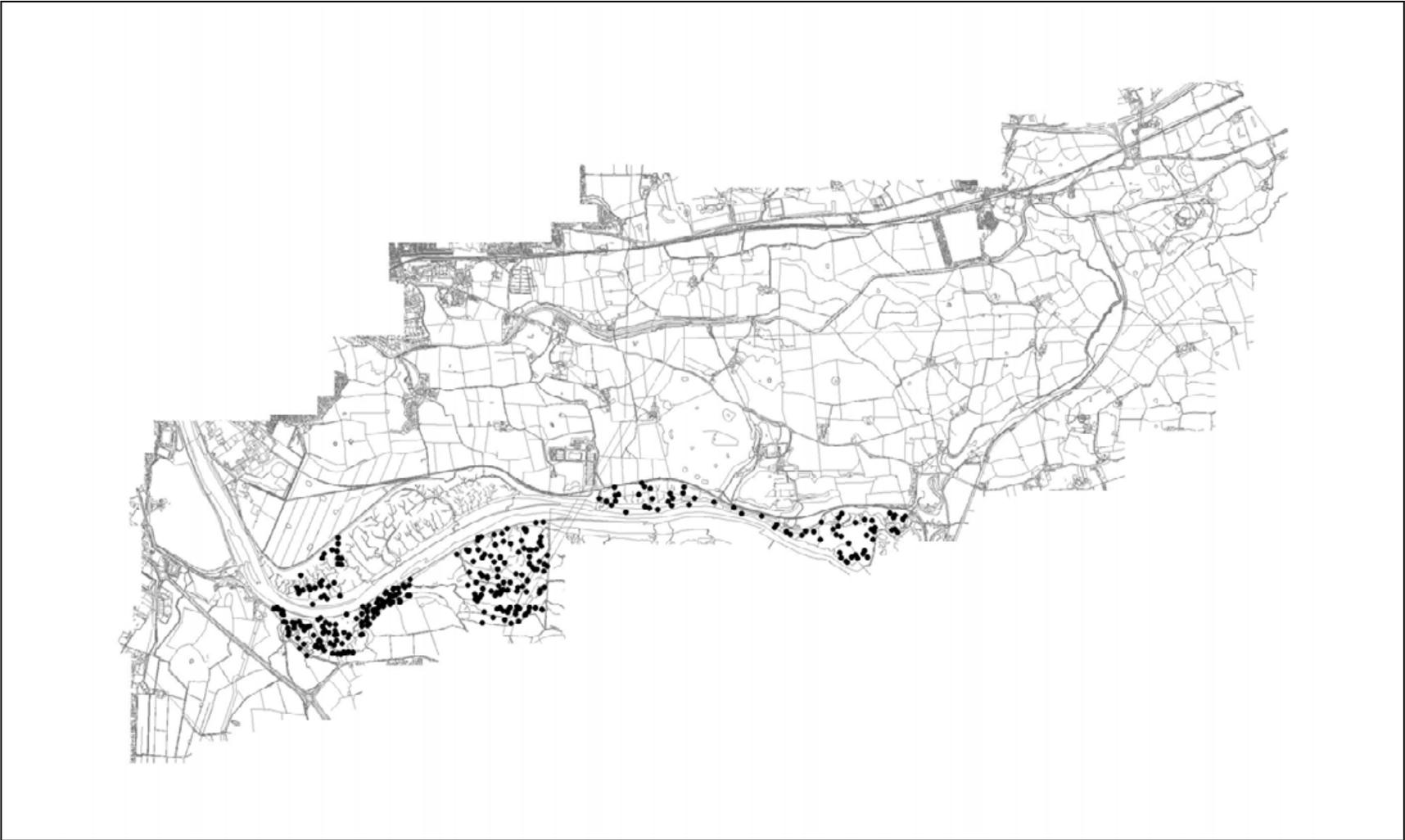


Figure 3.1.6.1 The distribution of Wigeon recorded during the terrestrial survey. Each dot represents a single individual.

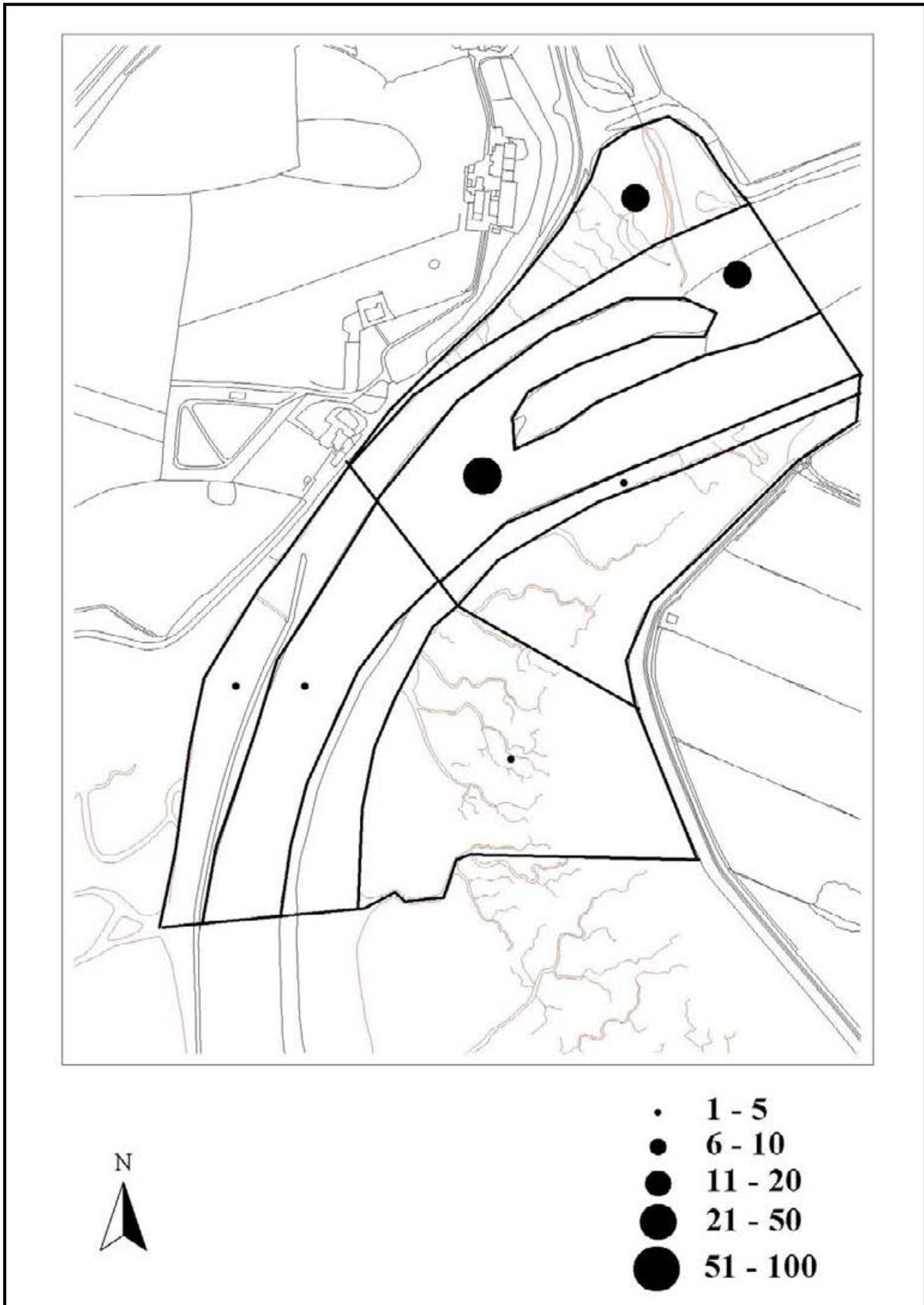


Figure 3.1.7.1 The distribution of feeding Mallard in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.



Figure 3.1.7.2 The distribution of Mallard recorded during the terrestrial survey. Each dot represents a single individual.

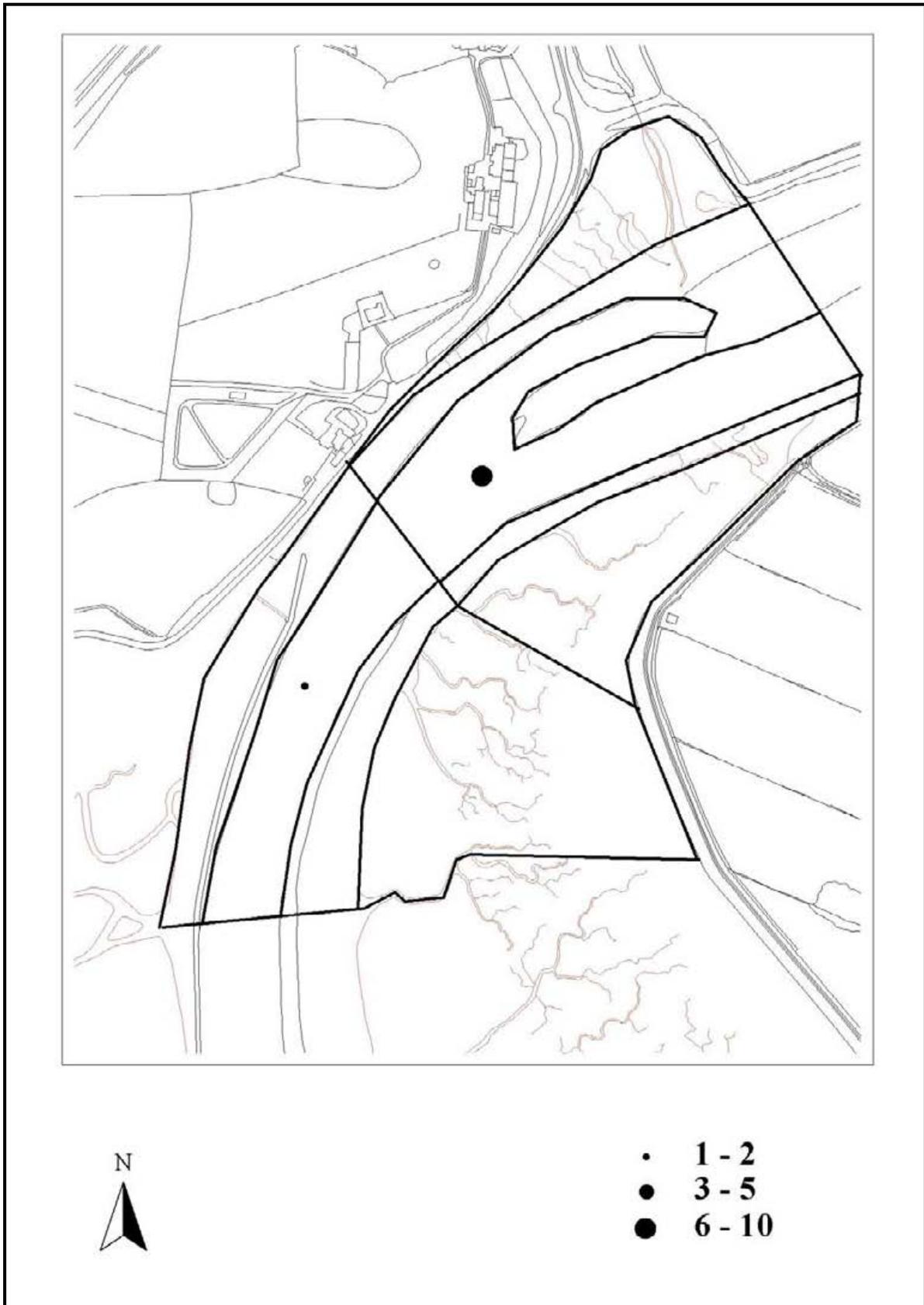


Figure 3.1.8.1 The distribution of feeding Goldeneye in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

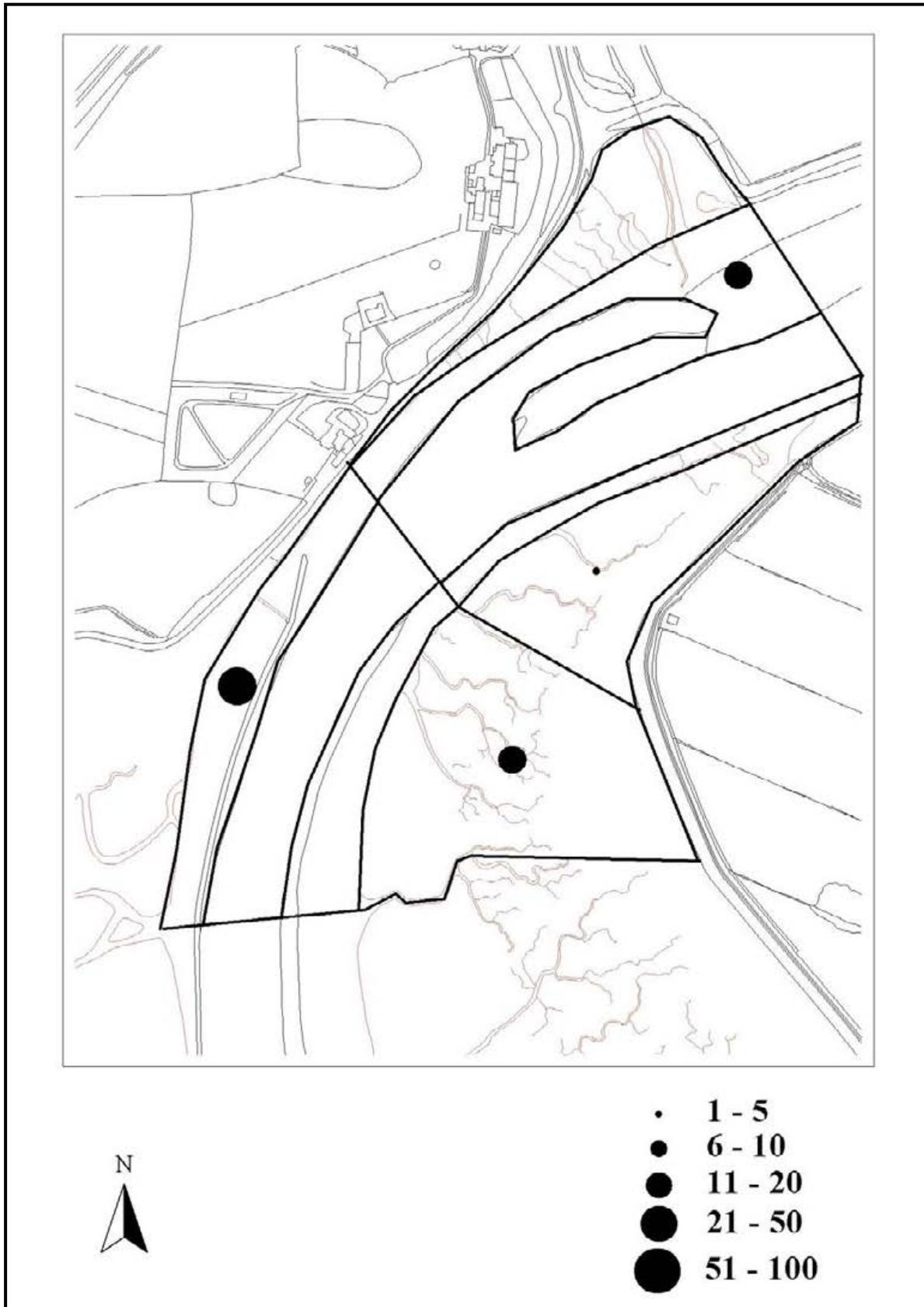


Figure 3.1.10.1 The distribution of feeding Oystercatcher in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

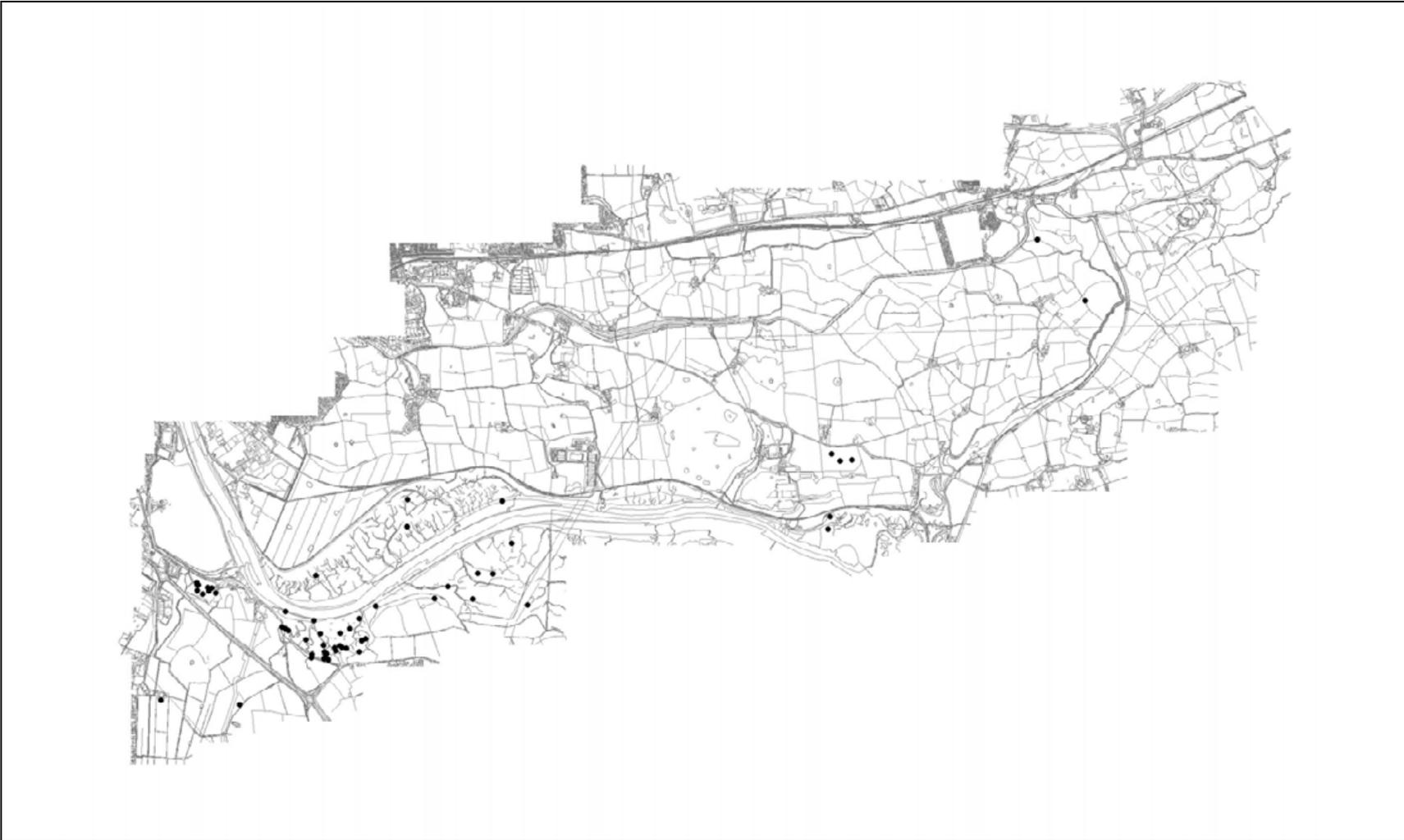


Figure 3.1.10.2 The distribution of Oystercatcher recorded during the terrestrial survey. Each dot represents a single individual.

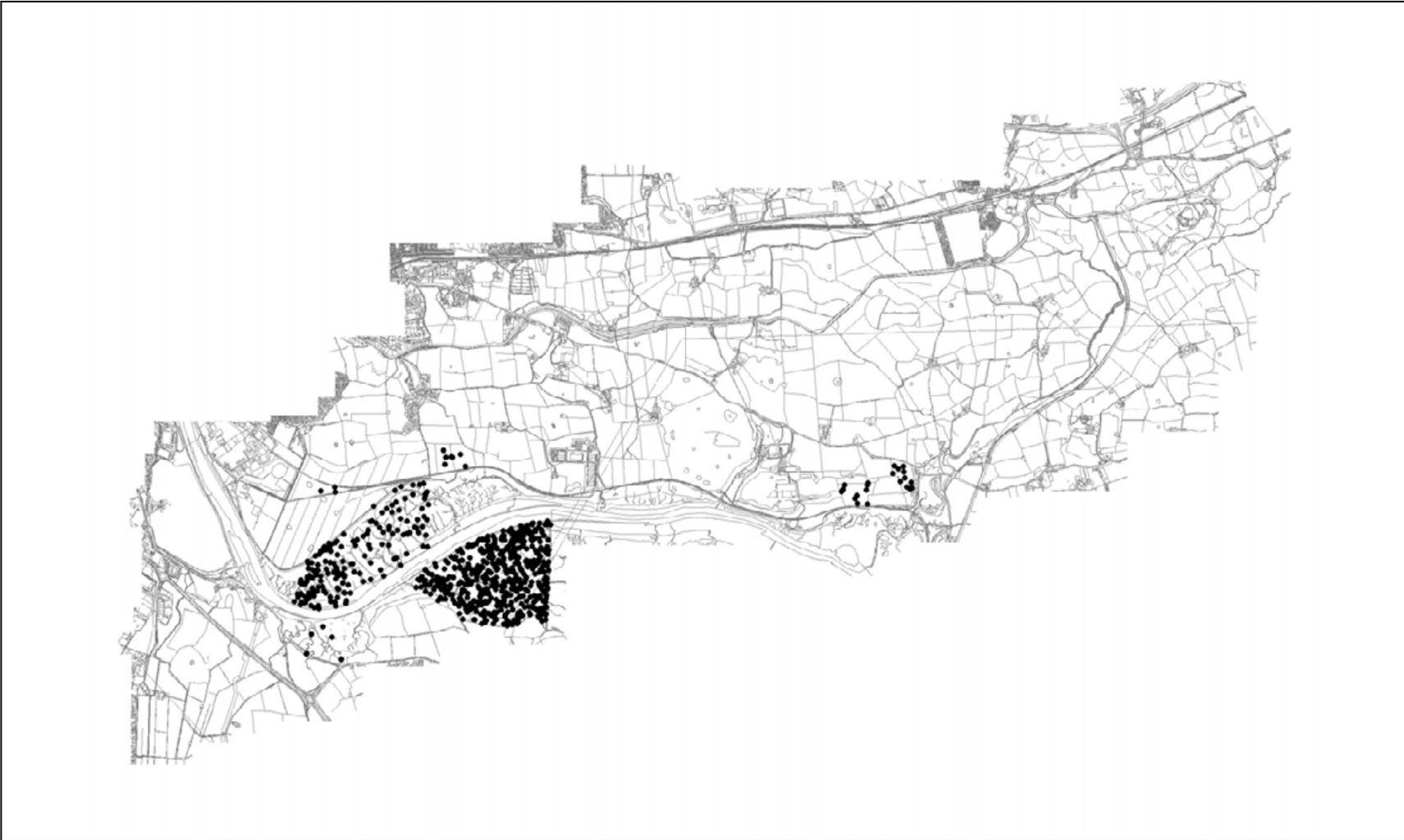


Figure 3.1.11.1 The distribution of Golden Plover recorded during the terrestrial survey. Each dot represents a single individual.

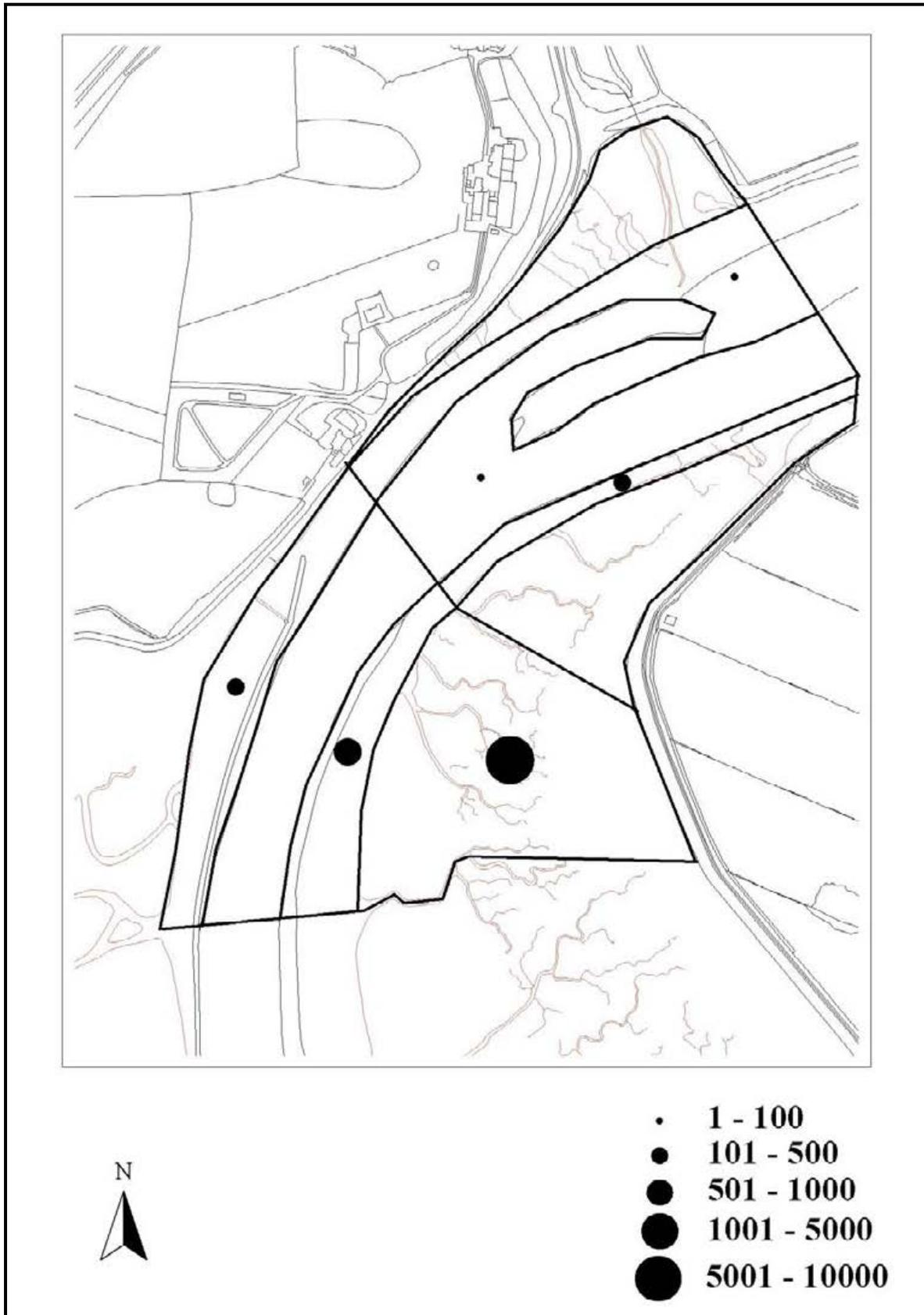


Figure 3.1.12.1 The distribution of feeding Lapwing in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

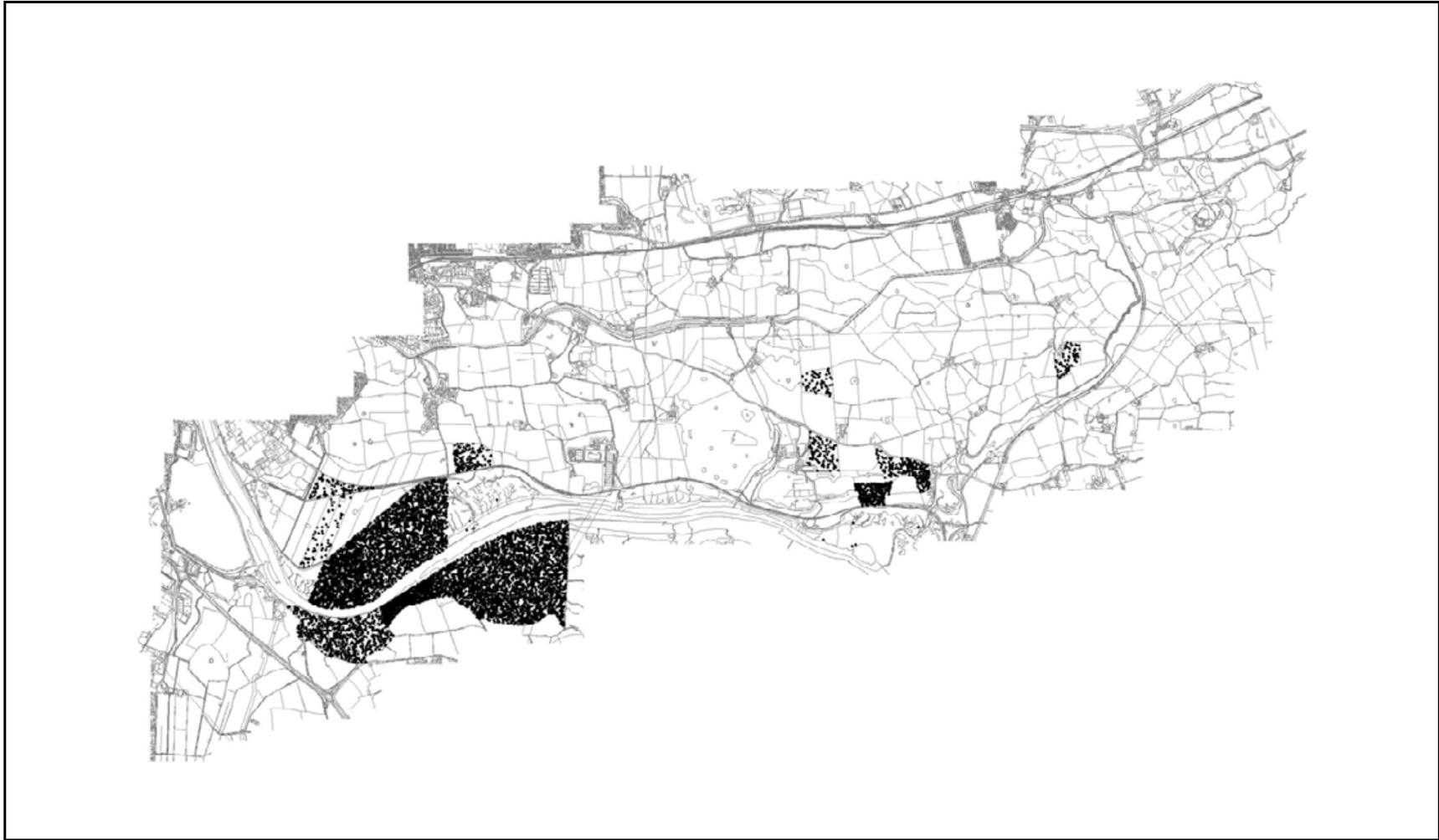


Figure 3.1.12.2 The distribution of Lapwing recorded during the terrestrial survey. Each dot represents a single individual.

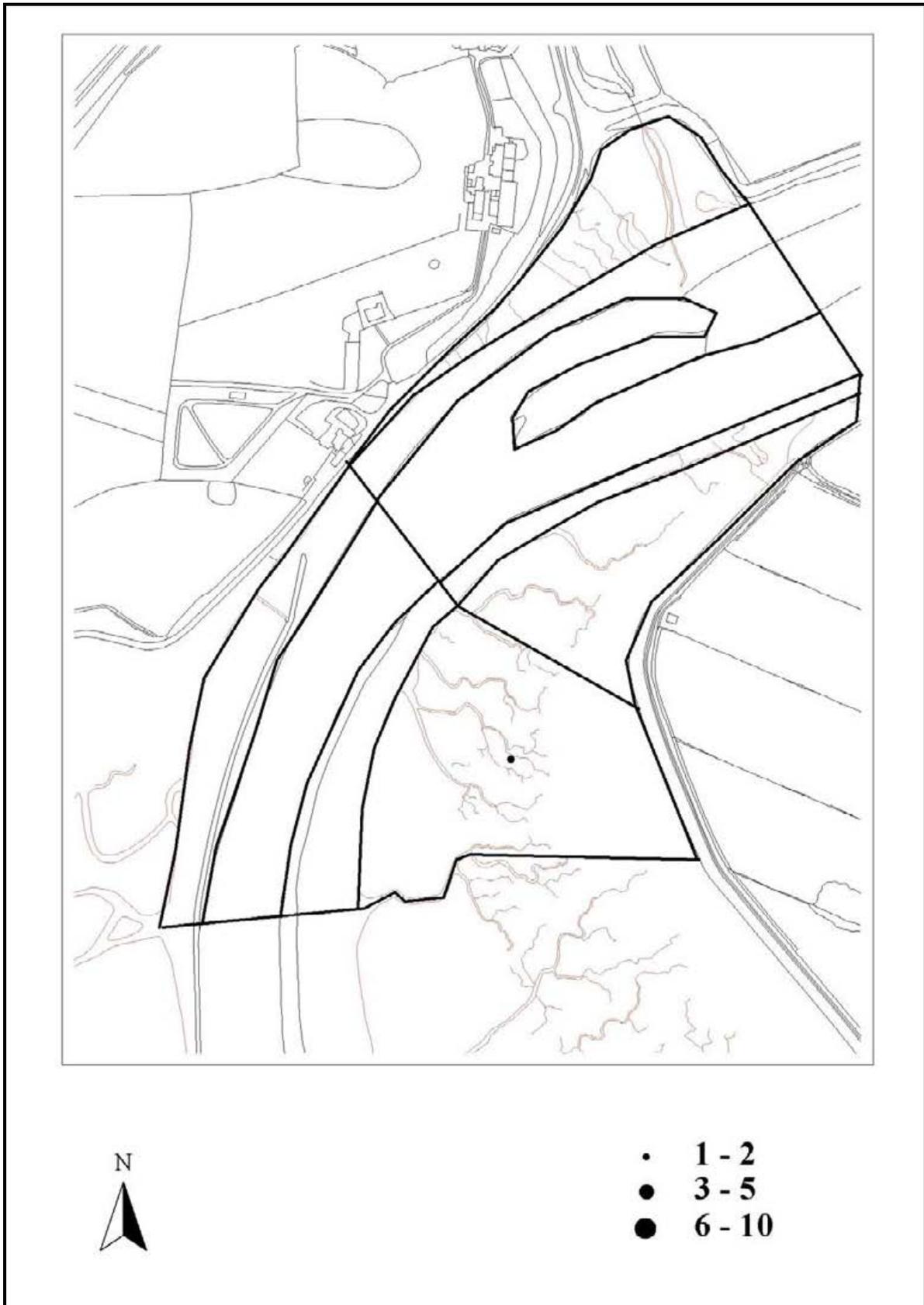


Figure 3.1.13.1 The distribution of feeding Dunlin in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

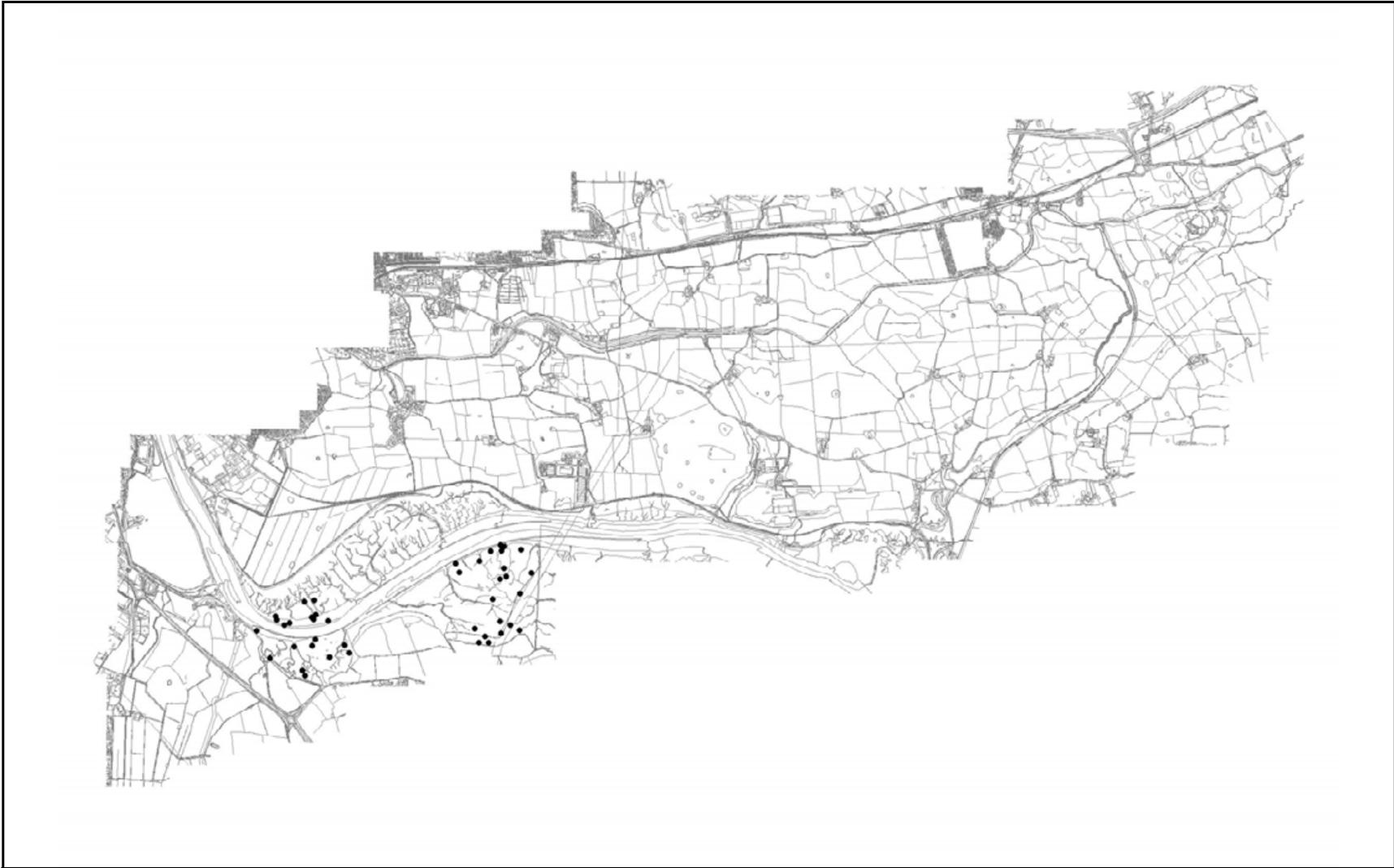


Figure3.1.13.2 The distribution of Dunlin recorded during the terrestrial survey. Each dot represents a single individual.

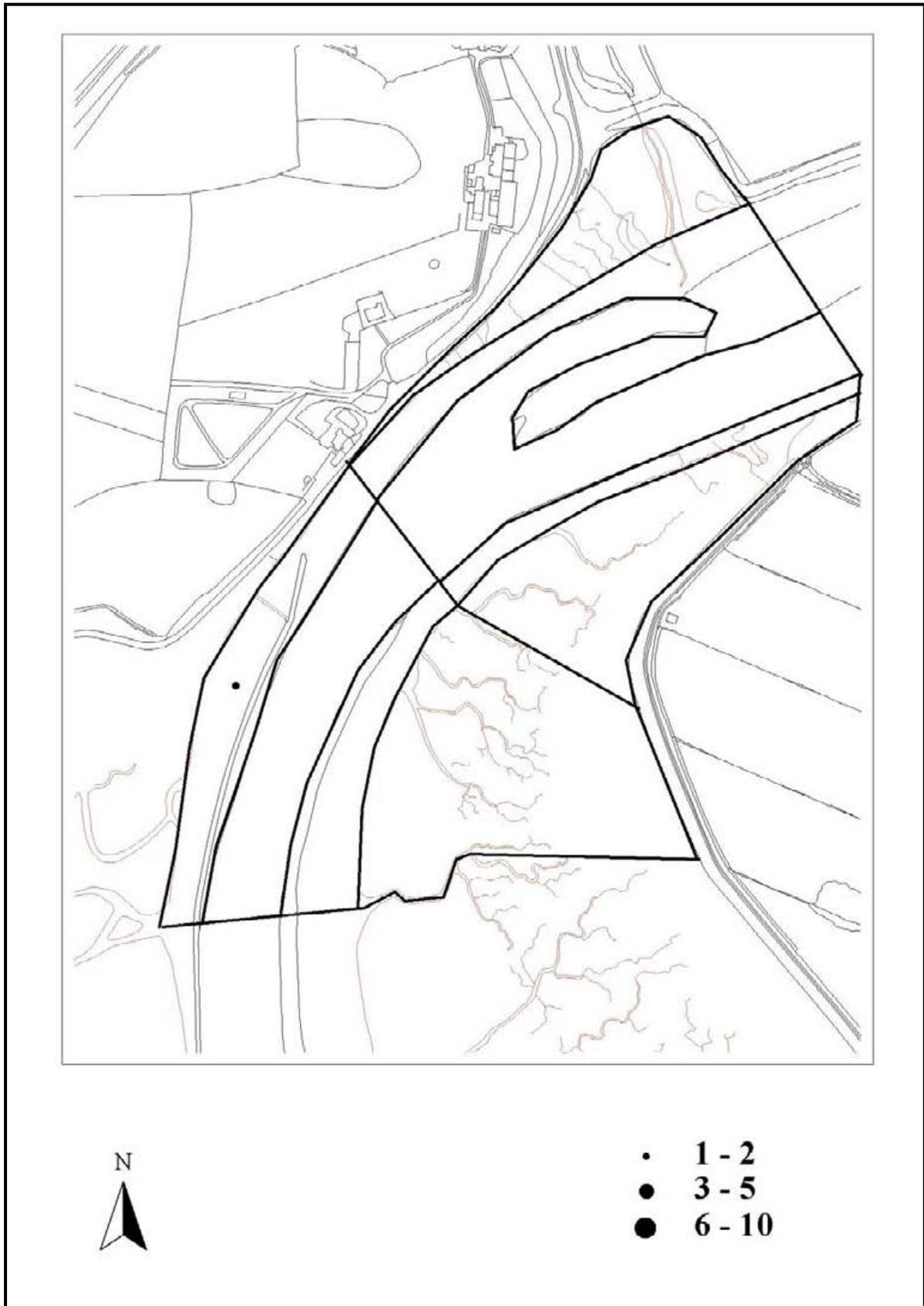


Figure 3.1.14.1 The distribution of feeding Curlew in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

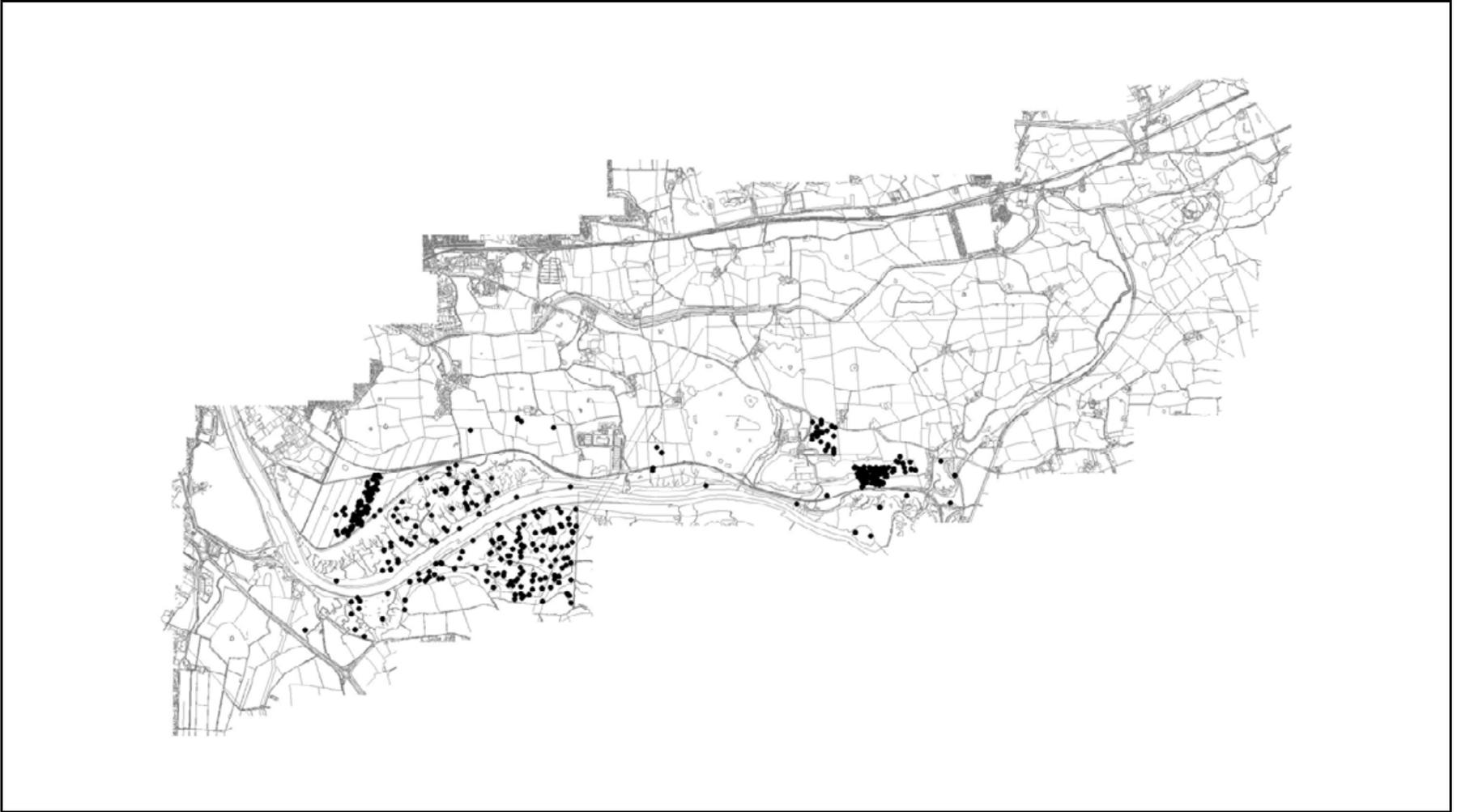


Figure3.1.14.2 The distribution of Curlew recorded during the terrestrial survey. Each dot represents a single individual.

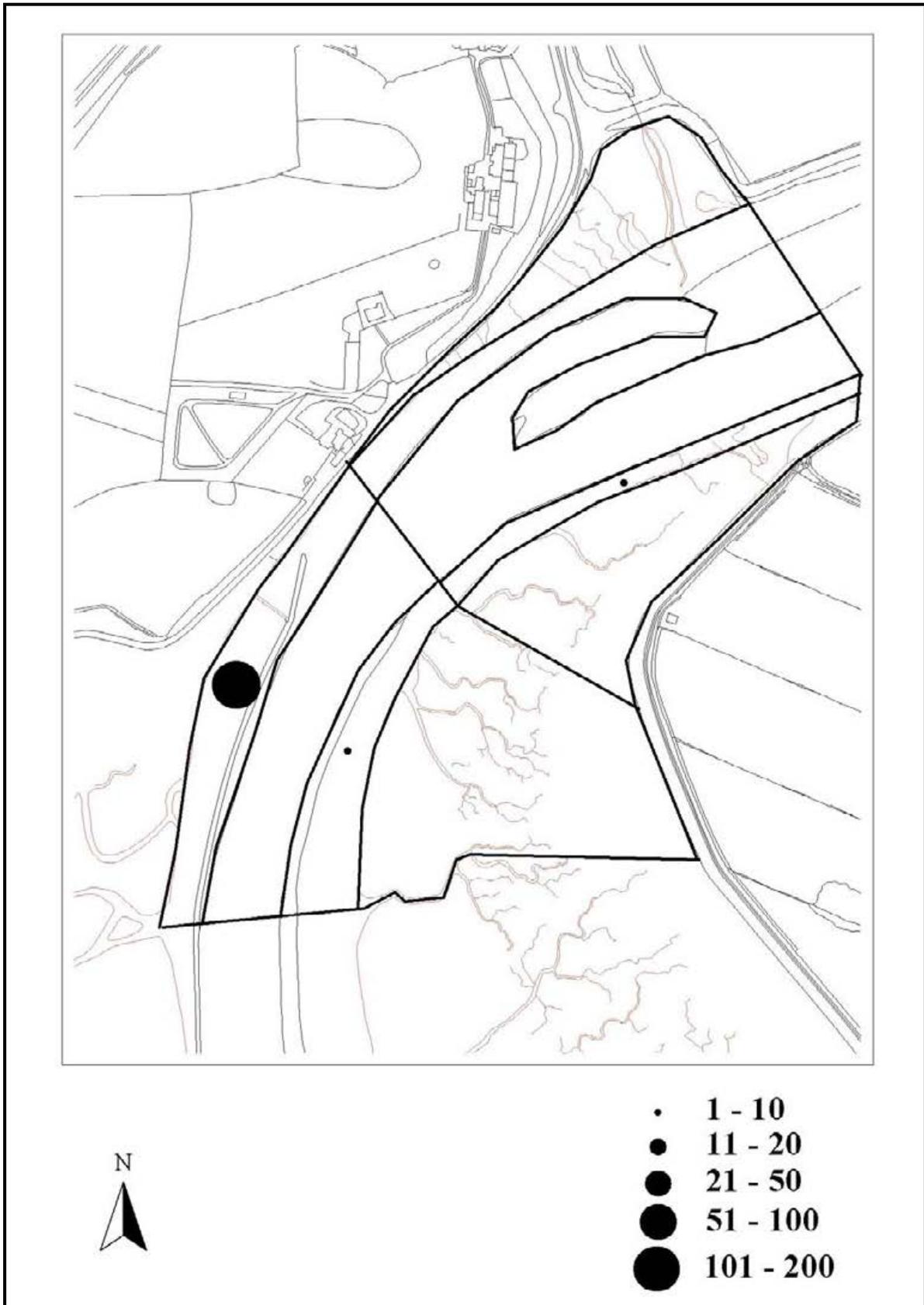


Figure 3.1.15.1 The distribution of feeding Redshank in the vicinity of the proposed Salt Ayre crossing. The average number of bird hours per tidal cycle is depicted.

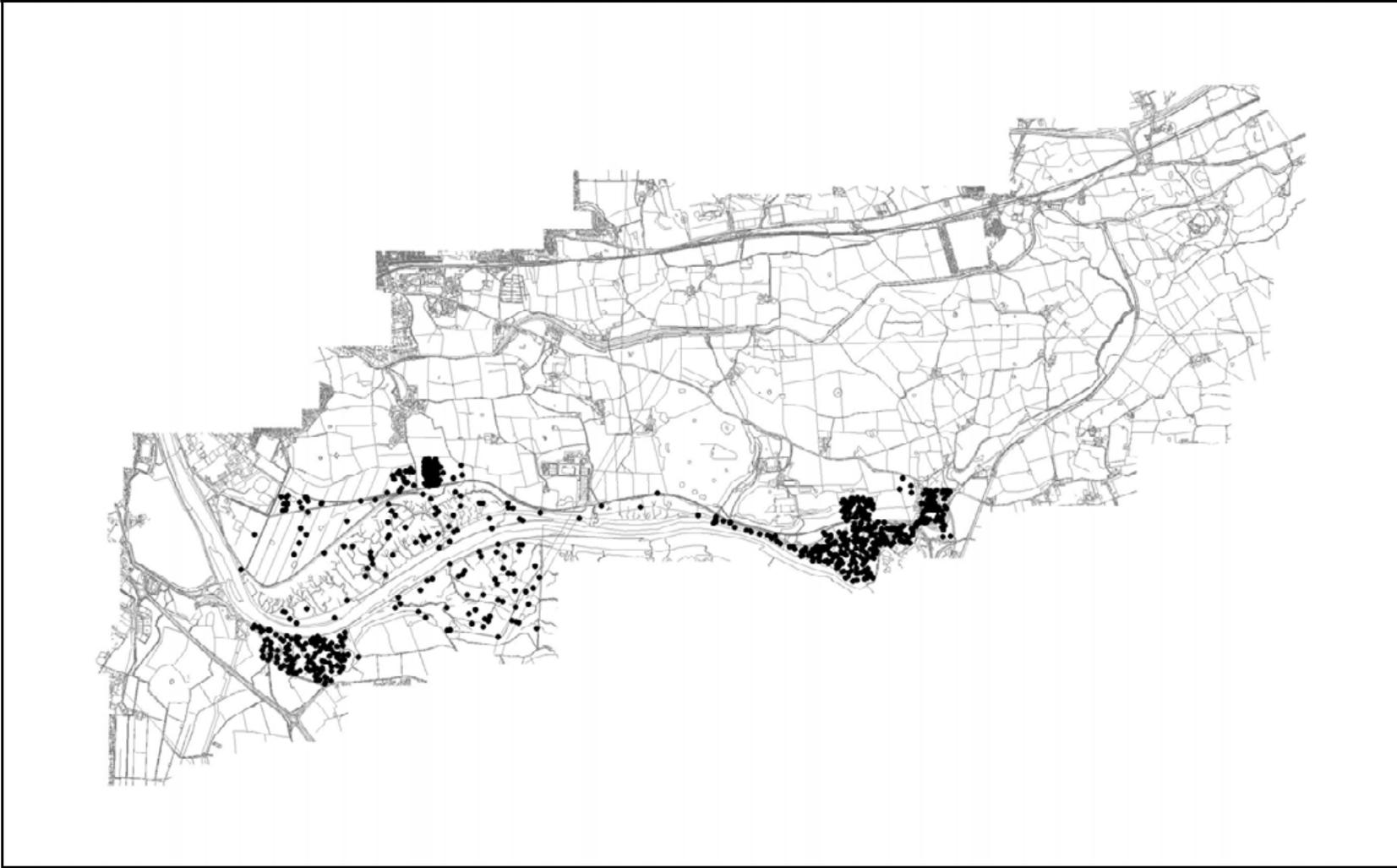


Figure 3.1.15.2 The distribution of Redshank recorded during the terrestrial survey. Each dot represents a single individual.

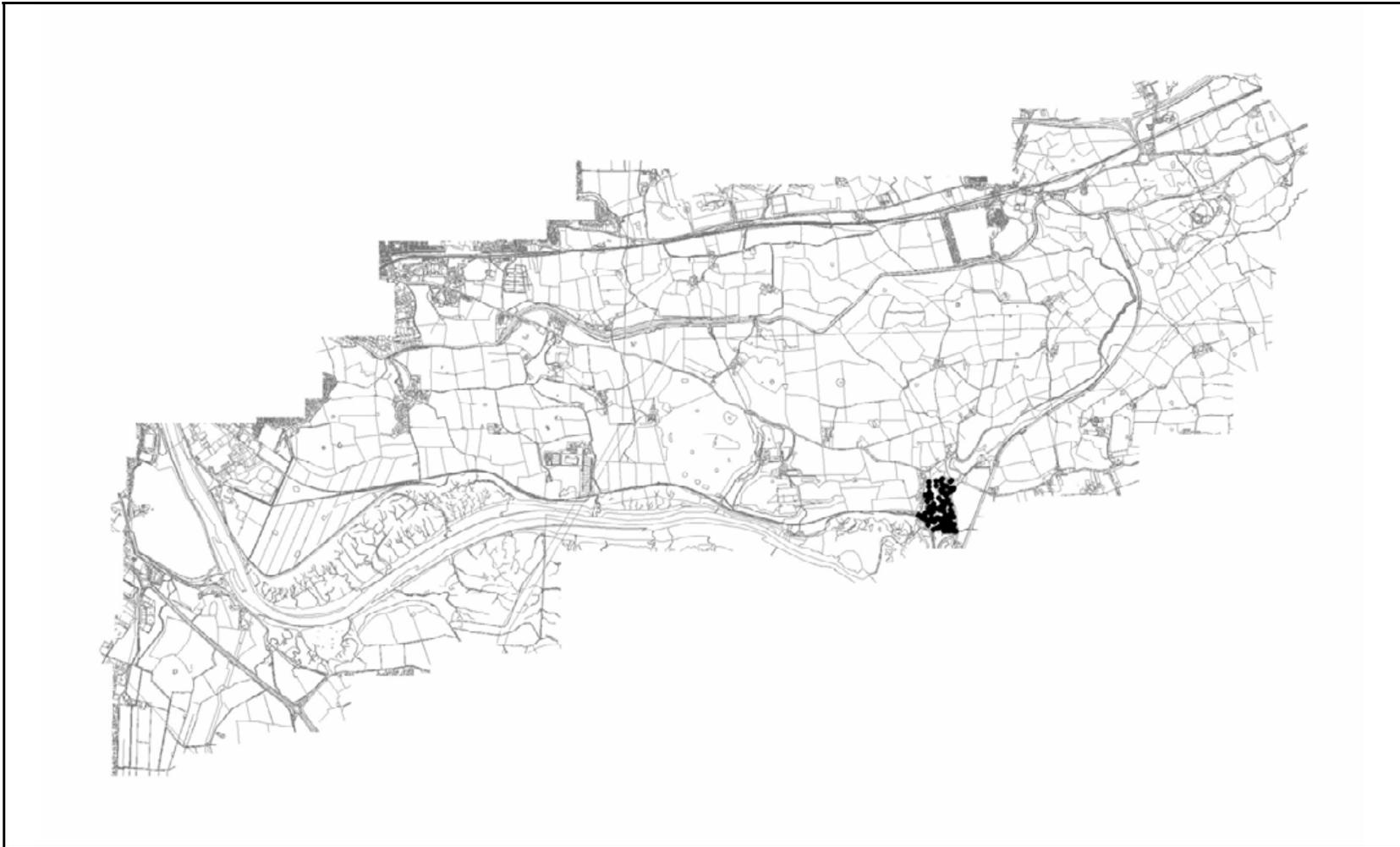


Figure 3.2.1.1 The distribution of Teal recorded during the terrestrial survey. Each dot represents a single individual.

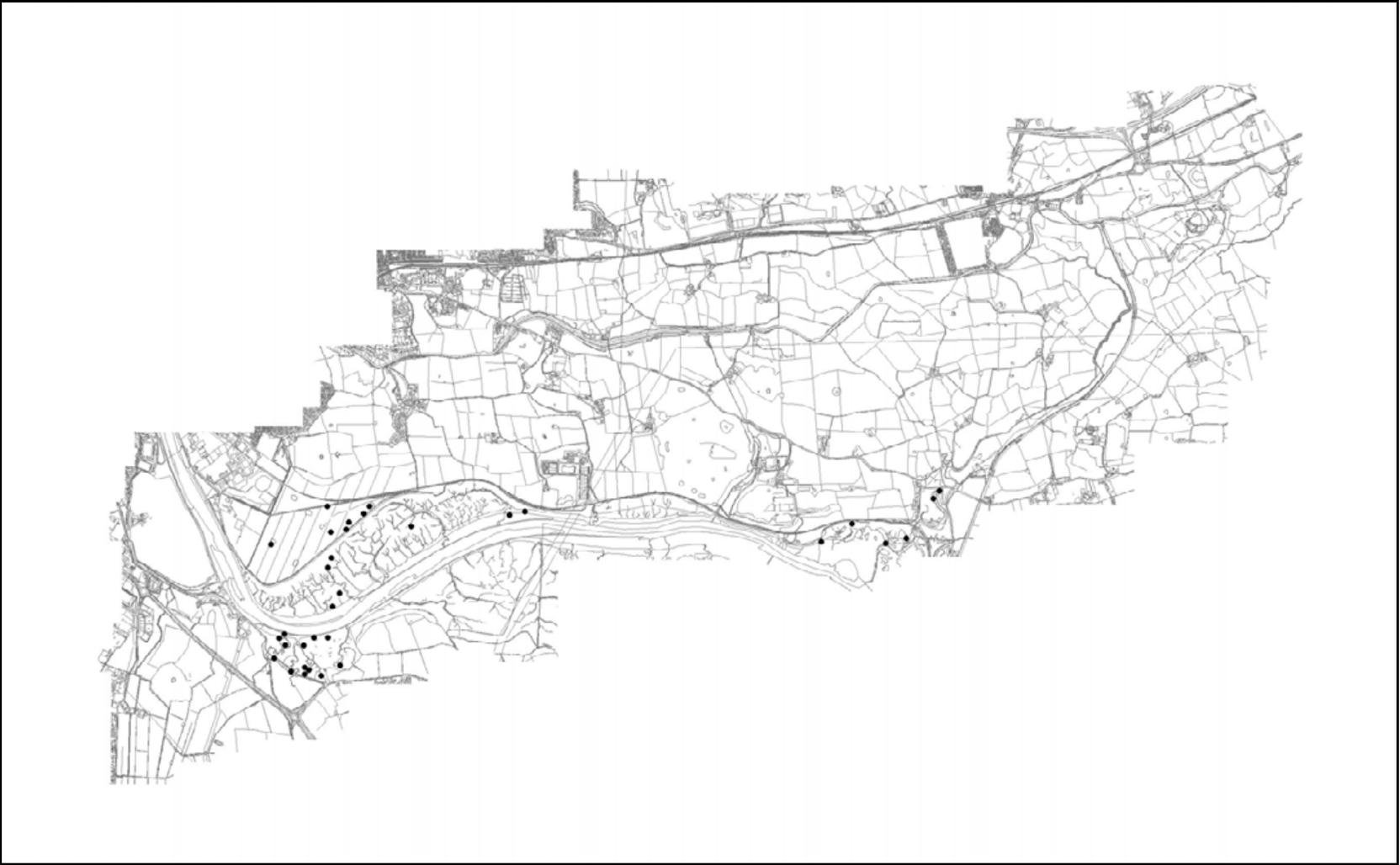


Figure 3.2.2.1 The distribution of Snipe recorded during the terrestrial survey. Each dot represents a single individual.

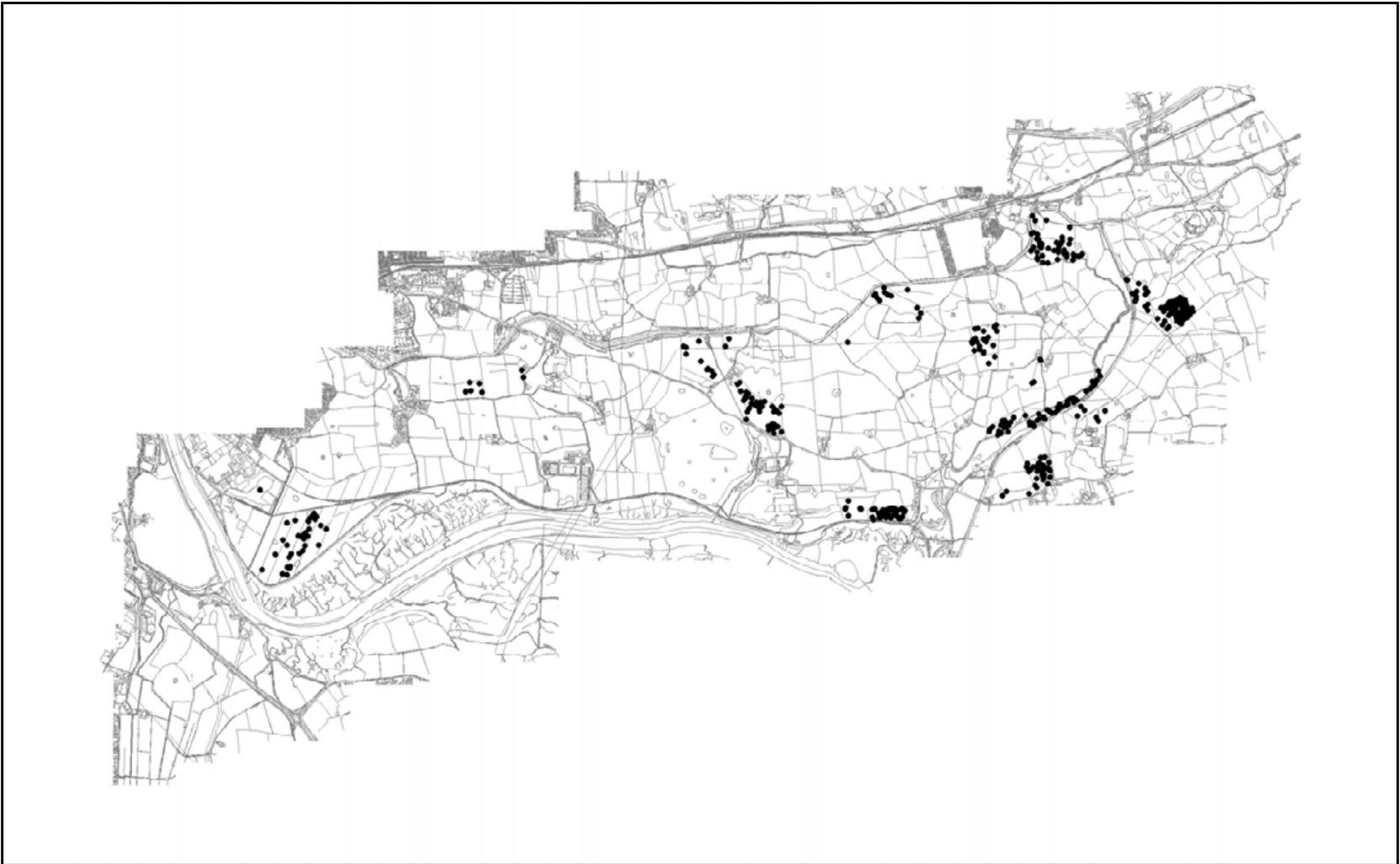


Figure 3.2.3.1 The distribution of Fieldfare recorded during the terrestrial survey. Each dot represents a single individual.

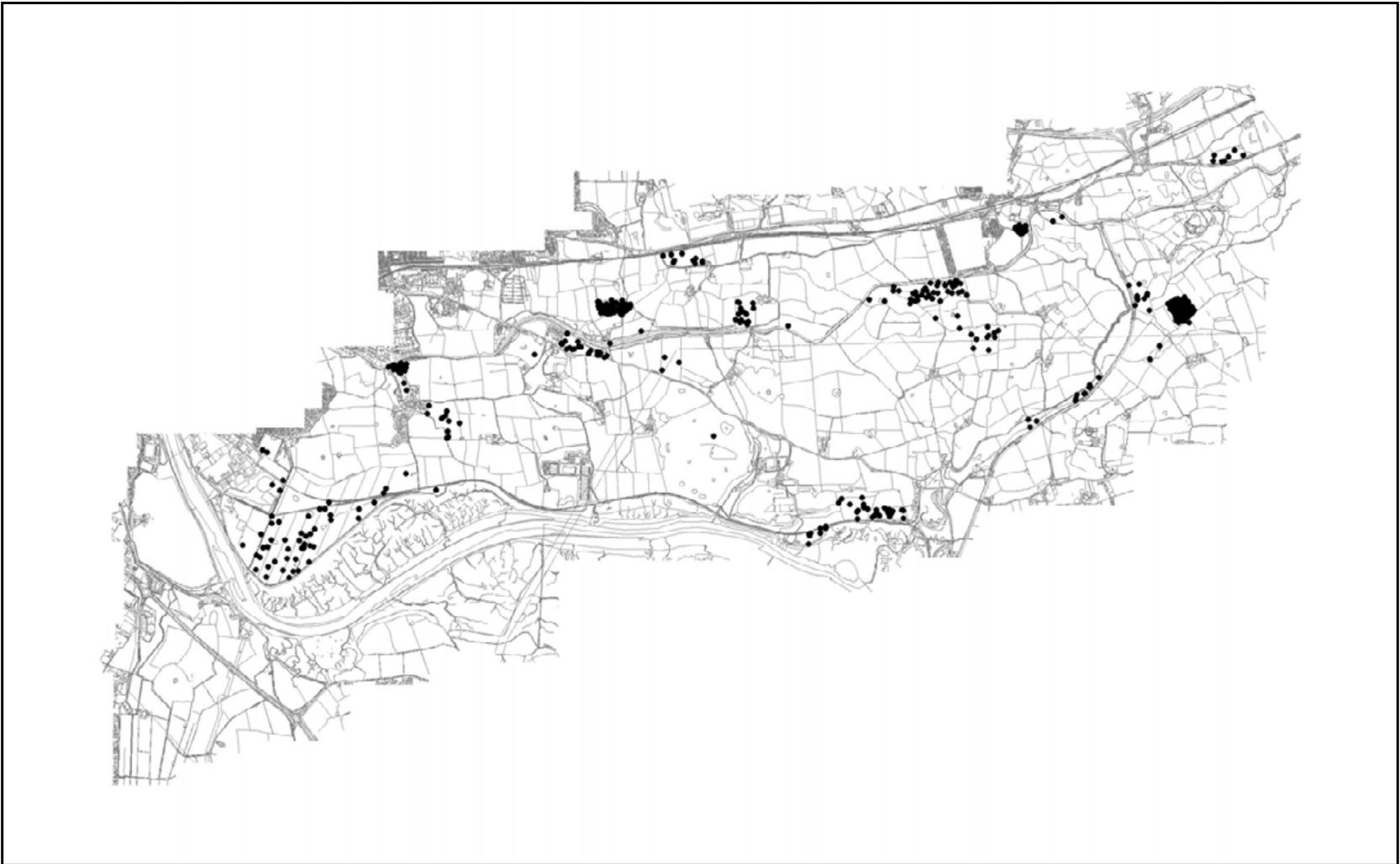


Figure 3.2.4.1 The distribution of Redwing recorded during the terrestrial survey. Each dot represents a single individual.

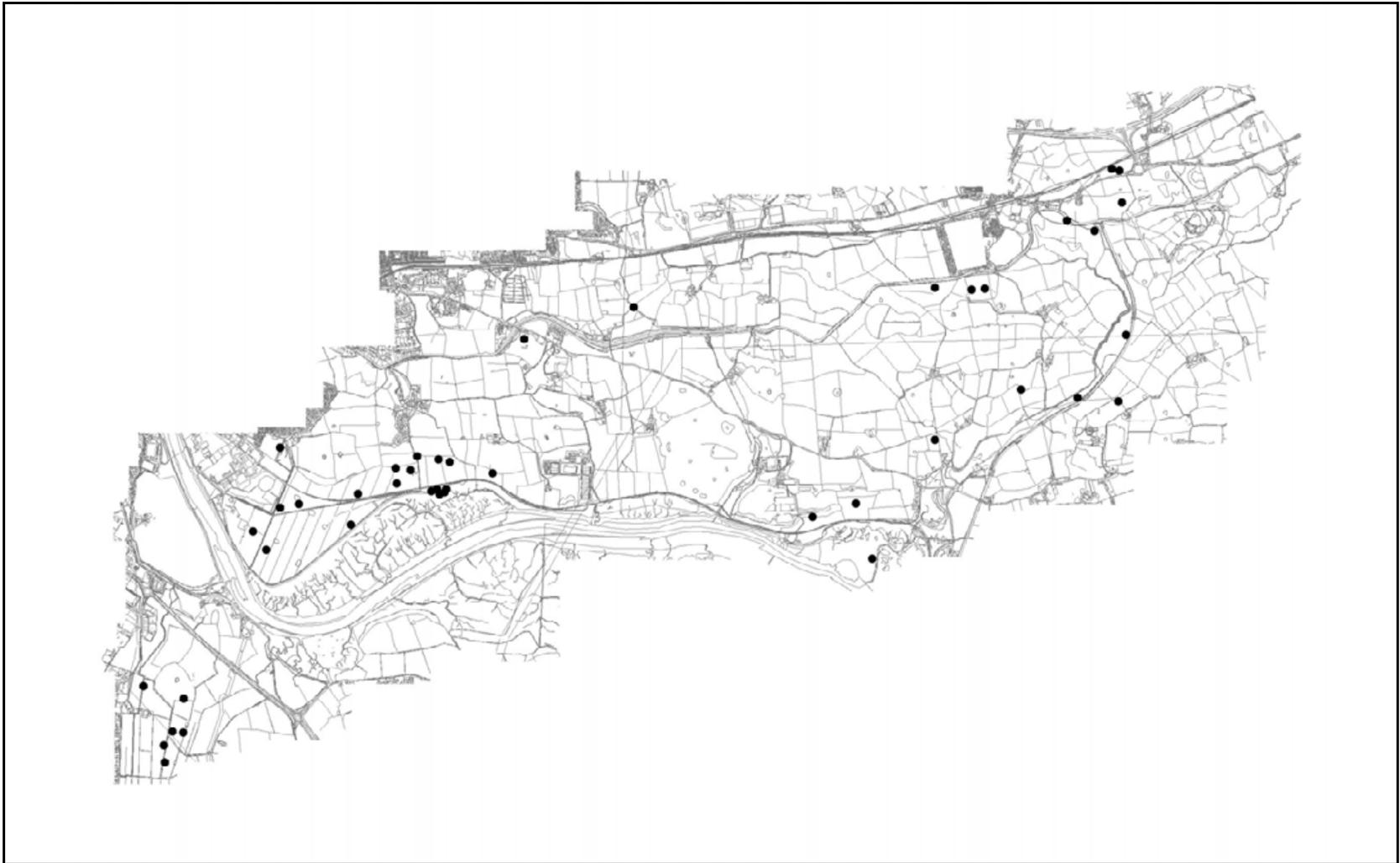


Figure 3.3.1 The distribution of Song Thrush recorded during the terrestrial survey. Each dot represents a single individual.