

NORTH EAST SCOTLAND WETLAND INVENTORY

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North East Scotland Local Biodiversity Action Plan Partnership

Summary

The North East Scotland wetland inventory examined the current wetland resources of Moray, Aberdeenshire and Aberdeen City. A principal aim was to identify sites with potential for restoration, expansion or creation.

Information of existing habitats was collated from a range of surveys and mapped using GIS software. Fen, reedbed and wet woodland habitats were then filtered by a number of constraints, to identify sites suitable for expansion. A map of flat areas was visually assessed, to identify areas of forest and grassland suitable for creating additional wetland habitats. These were then filtered by the same constraints as existing habitats, to prioritise sites.

This study estimates that the region holds c.153 ha of reedbed, c.1, 630* ha of fen and c.1, 490 ha of wet woodland. Five reedbeds and nine fens were found to be suitable for expansion. Four wet woodlands were also identified as suitable, although the potential expansion area for this habitat was relatively small. In addition, 73 ha of forest wetland and 772 ha of potential wet grassland sites were identified for habitat restoration.

The information collated in this study has formed the basis of the Local Biodiversity Action Plan for wetland habitats, translating national targets into effective action at the local level - that plan is presented as a separate document.

** includes 900 ha of "unclassified wetland – probably mostly fen"*

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1. North East Scotland Wetland Inventory

1.1 Introduction and overall purpose

Although Grampian is climatically a dry area of Scotland, many originally wet areas have been drained over centuries. Given the probable changes in wetland resource, there must have been large changes in flora, fauna and habitats – mostly detrimental. For this reason a Wetlands Action Plan is being produced to enable expansion and restoration of these important habitats. Wetland habitats include fen, reedbed, swamp, wet woodland, bog, forest wetland and wet grassland.

The overall purpose of this study was to collate information on wetlands in North East Scotland from existing reports and maps, as part of the development of the Local Biodiversity Action Plan for wetland habitats and to use this information to assess the conservation importance of sites, prioritise areas for expansion / creation, and produce the draft of a Wetlands Local Biodiversity Action Plan.

1.2 Justification for the expansion and creation of wetlands

There are a number of diverse benefits resulting from the expansion and creation of wetland habitats. Intensification of agriculture over the last fifty years has led to the drainage of large wetland areas, and those surviving are at risk from degradation. Wetlands are a vital component of the hydrological cycle, and a valuable element of the water environment. As well as being an important habitat for a wide range of wildlife species, many of which are in decline (and targets of specific Biodiversity Action Plans), wetlands play a role in improving water quality and managing flood risk. The biofiltration action of wetlands can take up nitrates and phosphates, reducing the nutrient load reaching watercourses and lochs.

Peatlands are important sources and sinks for greenhouse gases (Joosten, *et al.*, 2006.). They are also globally important stores of nitrogen and carbon. Although they cover just 3% of the Earth's land surface, they contain one third of all soil carbon and nitrogen. As a result of climate change, Scotland faces a long-term increased risk of flooding. This has resulted in the introduction of the Water Environment and Water Services (Scotland) Act 2003, which requires the promotion of sustainable flood management, such as restoration of rivers and floodplains. In addition to their environmental benefits, wetlands have a social and cultural value and therefore create tourism potential.

2. Assessment of current wetland resource

2.1 General Methods

To identify habitat suitable for expansion, existing wetland resources were mapped, along with potential expansion areas. This project focused on lowland habitats, below 350m. The relevant habitats were digitised using MapInfo GIS. Identification of existing wetland habitats required drawing together many different datasets, mainly in the form of GIS shapefiles. Datasets held at NESBReC were utilised heavily, where available. There was much overlap between these data, which meant that they had to be cut around each other, to omit any overlap. Overlapping habitat areas would lead to an overestimation of the habitat extents. Priorities were set to determine which data were “trimmed” and which remained intact.

These decisions were based upon the accuracy and date of the surveys. Therefore, the most recent NVC surveys were given top priority to remain intact. Following NVC surveys were the Integrated Habitat Survey, then Phase 1, with the oldest study of aerial photography being considered the least accurate. It was decided to allow overlap of wet woodland with the field layer habitats, as overlap naturally occurs.

Some surveys did not narrow down the habitat type to the required level, e.g. “mire” is mostly bog, but includes some fen habitat (Mackey, *et al.*, 1998; Rodwell, 1991a, 1991b, 1992, 1995). These were classed as “unclassified” wetlands. Bogs are defined as peatlands receiving water from rain only, and are nutrient poor (BSG, 1995). Upland blanket bogs are beyond the scope of this report. Lowland raised bogs have been identified, although the North East Scotland Local Habitat Action Plan has already been produced for this key habitat.

A wide range of existing, largely unpublished, datasets was also utilised, in addition to GIS shapefile data. These had already been compiled over a period of several years, and included SNH National Peatland Resource Inventory data, RSPB data on fens and reedbeds, Scottish Wildlife Trust peatland survey data and SNH SSSI habitat surveys. Many of these datasets were incomplete and sometimes overlapping. An attempt was made to integrate them as well as possible, but without a primary, field-based full survey that aims to visit all possible sites, it is recognised that the data assembled will still contain errors and misclassifications. However, the dataset used in this study is without doubt the most comprehensive that has ever been compiled on lowland wetland habitats in North East Scotland.

All data used in this inventory have provided on CD to all funding partners and are also held at the RSPB Office in Aberdeen. These include Excel spreadsheets, GIS shapefiles, site photographs and the full text of the Inventory and draft Wetlands LBAP.

Table 1 below shows the habitat survey codes and descriptions included within each habitat type adopted in this study.

Table 1 – habitat survey codes used

Habitat	WET WOODLAND	FEN	REEDBED	BOG	UNCLASSIFIED WETLANDS
Source					
NVC	W3 W4b W4c W7a W7b W7c Streamside Alder Alder Regen. Mire & Trees	Fen M7 M9 M14 M22 S28 M4 S9b Swamp	Reedbed Reedswamp S4b S26	M19a Bog	Mire Mire & Trees
IHS	WB34 WB341 WB342 WB34Z	EM3 EM31 EM3Z EM0 EM1 EM12 EM21 EM22	EM11	EO0 EO2 WB342	
Phase 1		E21 E3 E32 F1		E162 E17 E18	
GRWS	Broadleaf 80-90% Broadleaf Also flat & ≤ 350m altitude.				
LCS88	Wetland with Trees				Wetland Wetland with Trees
GNHS					Fen
LCC					Lowland Mire

The following were recorded within the attribute tables of the habitat shapefiles: Shape ID; Site Name; Notes, giving details of any site visits; Area (ha.); Perimeter (km); X & Y – central grid reference; Designation (SSSI, SPA, SAC, or NNR. Some sites had more than one designation, but only one was recorded, in order of priority as shown above); Source – survey from which the habitat extent was obtained, or initials of surveyor; Habitat – code or description of habitat type. Some secondary habitat characteristics were also included, when available.

These habitats were checked against the map of flat areas ≥ 10 ha (see appendix 1), to determine the accuracy of both sets of data. The vast majority of habitats were located within the flat areas, with many bogs being found outside of these areas, which is to be expected. Only three fens with areas over ten hectares were located outside these flat regions. All figures quoted are from this study, unless otherwise indicated.

Habitat Expansion

Constraints

Constraints were identified for sites; firstly, those that were visible from maps, or derived from a MapInfo query. Three protected airfields were identified in Grampian: two RAF bases (Lossiemouth and Kinloss), on the Moray coast, and Aberdeen City airport, in Dyce. Two unprotected sites were also identified (DfT, 2005; EA, 2005). These airfields were digitised, and a buffer with a 13km radius used, to identify any wetlands within the designated areas, using a MapInfo query.

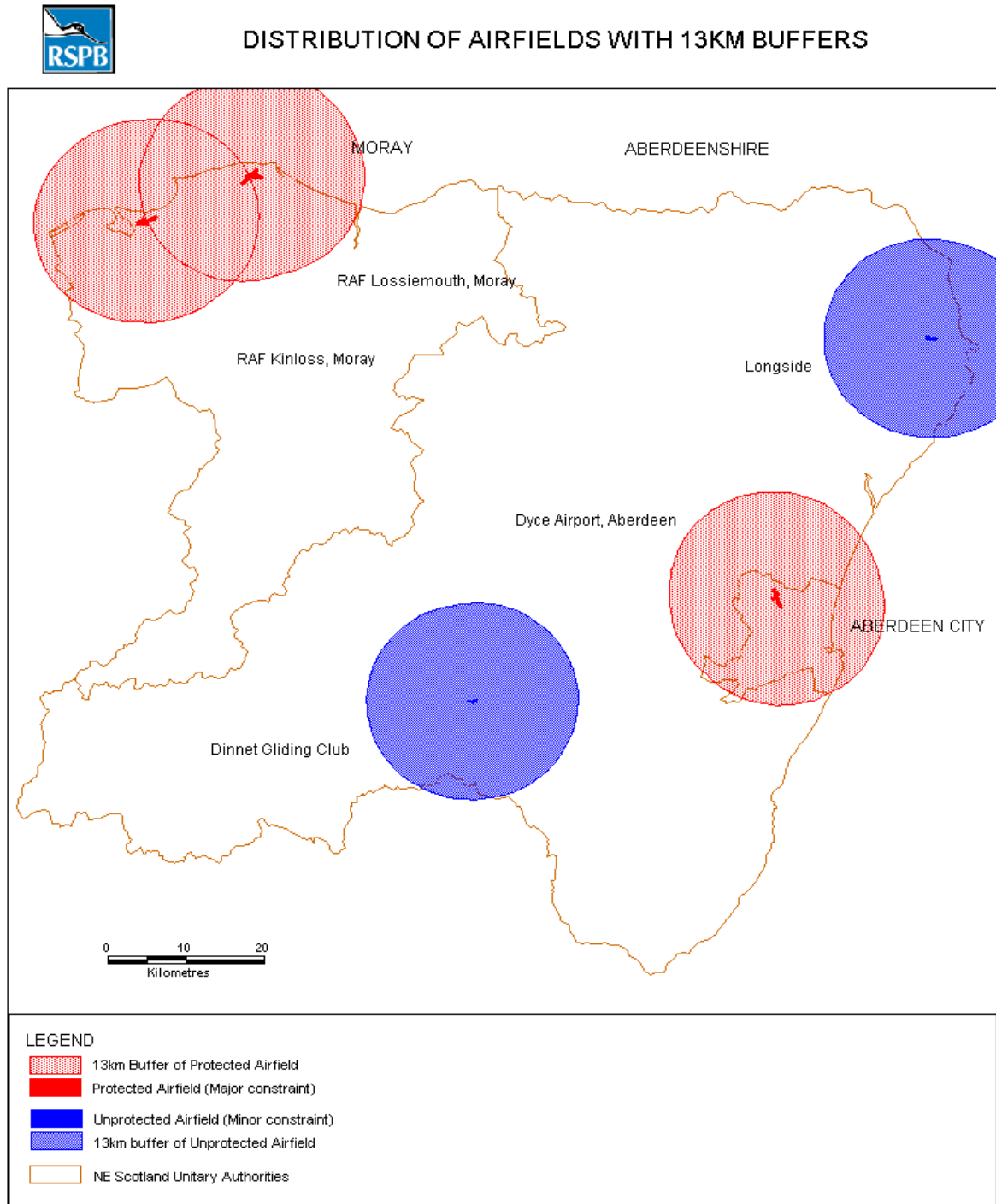
Five constraints were considered "major", in that sites were deemed wholly unsuitable for expansion. These were: small potential expansion area, or narrow, linear habitats; protected airfields, sites where expansion would affect urban areas; unsuitable topography (land not flat); and well draining soil. The protected (large active) airfields constraint is a significant one, as experience elsewhere in the UK has shown that any planning application for works to restore wetlands (therefore likely to increase potential bird strike risk to aircraft) would probably be objected to on air safety grounds. An eight mile (13 km) buffer radius is often used to safeguard such areas. Discussions with MoD officials in north Morayshire has confirmed that these issues are potentially very difficult to resolve.

Other "minor" constraints considered were: presence of power lines; effect of expansion on distant land, or on designated sites (e.g. SSSIs); and unprotected airfields. One further minor constraint was the presence of BAP priority species. One example is nesting corn buntings, which sufficient data was available to allow sites containing the species to be identified. All priority species should be considered during the final selection of wetland expansion and creation sites.

Each constraint was given a value in the attribute tables, of 0 (if not present) or 1 (if present). Any sites with major constraints were also given a binary value, and the total number of minor constraints was given. It was found that protected airfields filtered out a large proportion of potential habitats, particularly in Moray, where much flat land was located. The remaining sites were ordered by size, the largest of which were given priority for visits. Further constraints were noted during these visits, along with auditing habitat extents.

The map below shows the location of protected and unprotected airfields, with the 13 km buffers shown, indicating areas covered by these constraints.

Map 1: Protected and unprotected airfields with 13 km buffers



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2.2 Fens

Introduction

Fens are peatlands that receive water and nutrients from soil, rock and ground water as well as from rainfall (BSG, 1995). They are described as being either topogenous (vertical water movement, e.g. basin & floodplain fens), or soligenous (lateral water movement, e.g. valley mires, springs & flushes). Fens are also either base-rich (lowland mineral enriched) or base-poor (upland, or associated with lowland heath). They are generally found in lowland areas, often along low riverbanks and loch shores, on floodplains, waterlogged hollows and valley bottoms.

In this study, swamp was included within this habitat. Swamp is generally dominated by a single species, with the water table at or above the level of the substrate, for most of the year (Rodwell, 1995).

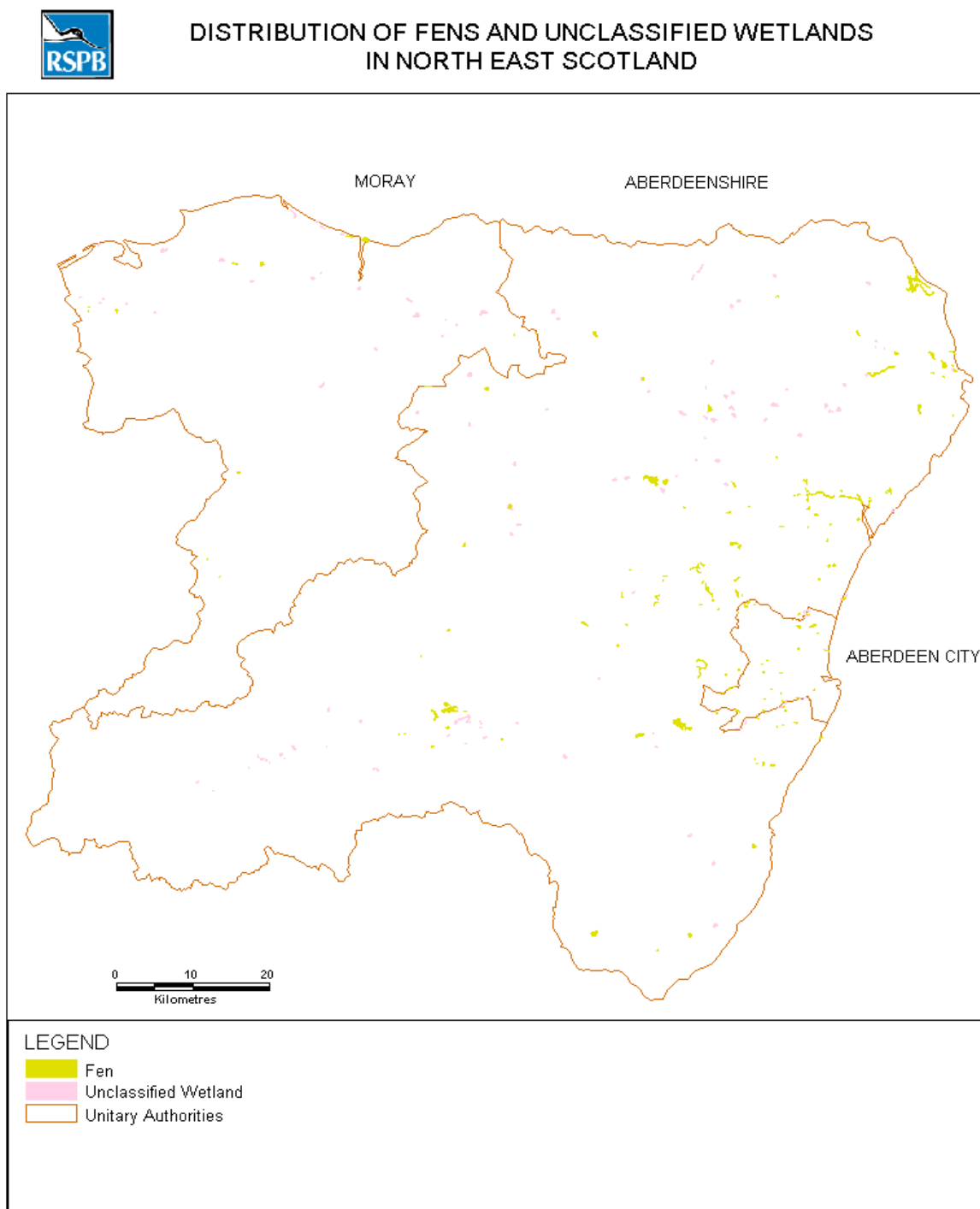


Wartle Moss fen. AMB 2007

There are c.115 fens in NE Scotland, with a total area of 900 ha. There are also c.106 unclassified wetlands, which are likely to be fens, totalling 730 ha. The largest known fens are found in Aberdeenshire, including Loch of Strathbeg, Cunnach Moss and Wartle Moss.

Map 2 shows the distribution of all fens and unclassified wetlands in North East Scotland.

Map 2. Distribution of fen and unclassified wetland habitats



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Fens are found mainly in Aberdeenshire, the largest being north and west of Aberdeen City. There are a number within the City, although most are small. Table 2 below lists the largest fens (over 10 ha) in the region.

Table 2. The largest fens (over 10 ha)

District	Site	Grid reference	Area (ha)
Moray	The Wards, Elgin	NJ211619	15.53
	Spey Bay	NJ344652	14.59
	Kingston Dune slack	NJ325656	10.20
Aberdeenshire	Loch of Strathbeg	NK056592	106.48
	Cunnach Moss	NO756993	96.02
	Wartle Moss	NJ724324	95.01
	Auchtydonald, Mintlaw	NK012471	38.37
	Black Moss, Ordie	NJ461013	38.20
	River Ythan	NJ944306	24.38
	Ordie Moss, Dinnet	NJ450011	23.11
	Burreldale Moss	NJ825239	23.05
	Greenford Moss	NJ738322	22.94
	Moss of Macterry	NJ796423	22.18
	Loch of Leys	NO704978	21.92
	Eslie Moss	NO644708	21.13
	Moss Gray	NK069423	21.12
	Green Moss, Ordie	NJ453020	16.38
	Kettlepool Moss	NJ646524	16.06
	Loch of Lumgair	NO852826	15.70
	Loch of Park	NO768987	14.07
	Loch Davan Mires	NJ439007	14.04
Moss of Kirkhill, Kennethmont	NJ535290	12.41	
Whitewater Moss, Tulloch	NO770706	12.33	
Mortlach Moss	NJ505449	11.98	

The North East Scotland Biodiversity Audit (Alexander, *et al.*, 1998) stated that fens covered 1,190 hectares. The reasons for the current figure being lower are that some sites have undergone natural succession into woodland. For example, Loch of Lumgair, considered one of the region's largest fens in 1998. Secondly, there is a large area of unclassified wetland in this study, some of which may have been classed as fen in previous work. If the unclassified habitat is surveyed, the total fen habitat may become much higher. The current figure is also likely to be an underestimate, since it was not possible to map the linear habitats, often found at the edges of watercourses.

Table 3 below lists unclassified wetlands over 10 ha, by district.

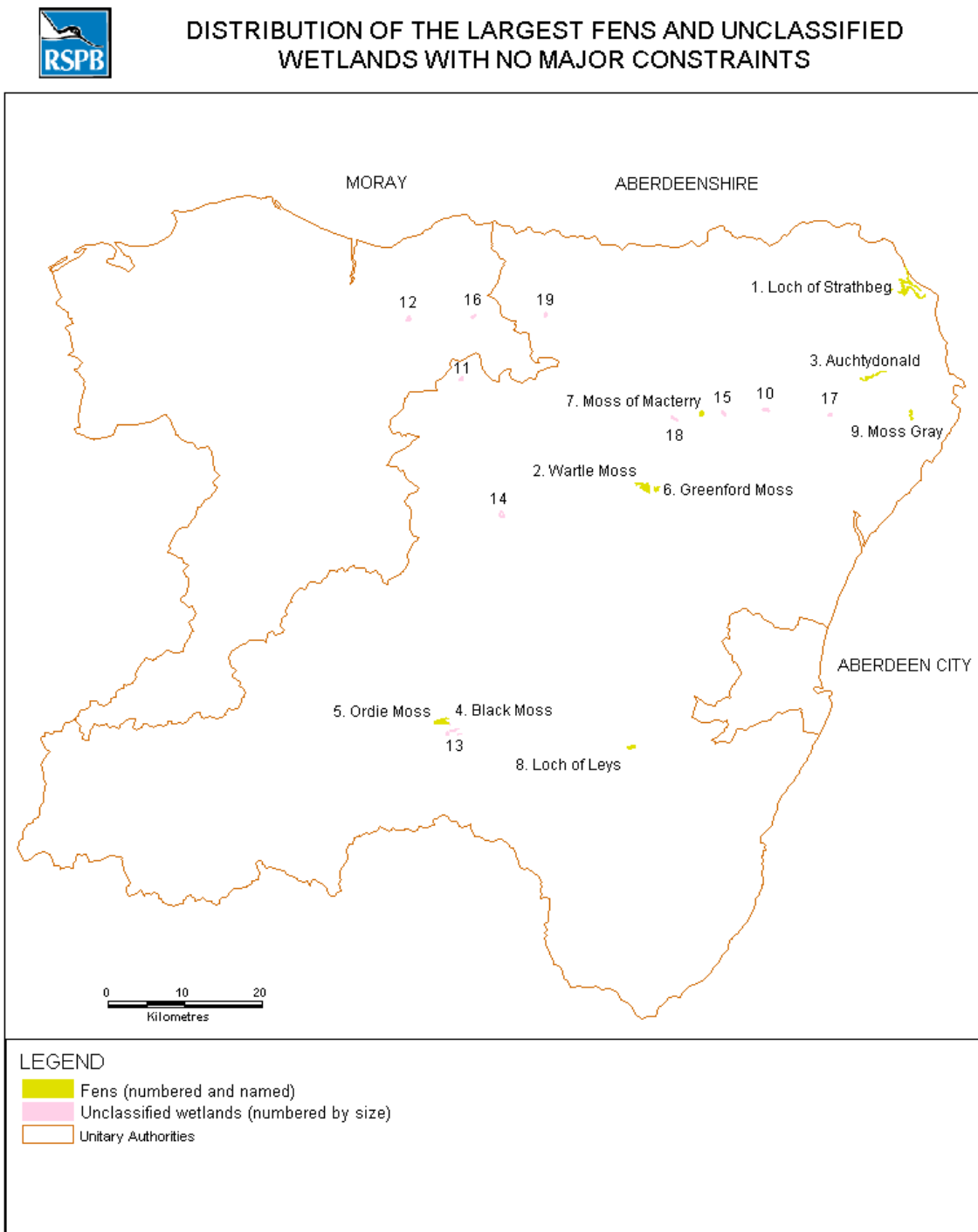
Table 3. The largest unclassified wetlands (over 10 ha)

District	Site	Grid Reference	Area (ha)
Moray	Auchinderran, Keith	NJ414550	19.17
	RAF Kinloss	NJ084637	18.94
	Lynesyde, Elgin	NJ159625	18.67
Aberdeenshire	Moss of Belnagoak, New Deer	NJ880428	29.78
	Foggy Moss, Huntly	NJ483469	20.17
	Clearfield	NJ473001	18.51
	Bog of Minnonie	NJ784613	17.50
	Moss of Kirkhill, Kennethmont	NJ533288	17.17
	Moss of Blackhillock north	NJ825423	15.52
	Crannach Moss	NJ499553	15.42
	Crichie Moss, Mintlaw	NJ964421	15.19
	Howe Moss, Fyvie	NJ761417	15.19
	Park Moss, Aberchirder	NJ592555	15.19
	Moss of Windyhill, Fyvie	NJ802407	14.29
	Anniston, Inverbervie	NO804719	13.94
	Leet Moss, Fyvie	NJ806352	13.45
	Roseseat, Rothienorman	NJ734311	13.20
	River Ythan, Ellon	NJ952303	13.05
	Moss of Blackhillock south	NJ827413	12.45
	Moss of Cairnhill, Rothienorman	NJ671326	11.45
	Moss of Blackpool	NJ816440	11.20
	Savoch, Methlick	NJ914386	10.68
	Little Blyth, New Pitsligo	NJ833569	10.21

There are many wetlands yet to be classified, from the sources utilised in this study. These make up a substantial part of the region's wetland resource, and it should be a priority to examine these sites further.

Map 3 shows the distribution of the largest fens and unclassified wetlands with expansion potential, having no identified major constraints.

Map 3. The distribution of the largest sites without identified major constraints. *Fens are named and numbered in order of size; unclassified wetlands are numbered only, in order of their size. Key to sites is shown in the table following the map.*



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Table for Map 3, showing fens and unclassified wetlands, larger than 15 ha, with no identified major constraints. Sites are shown under ID or name in Map 3.

ID	Site Name	Fen Area (ha)	Total Wetland Area (ha)	Expansion Area (ha)	Expanded Area (ha)	Minor Constraints
	<i>Known Fens</i>					
1	Loch of Strathbeg	106.48	128.00	111.85	239.85	1
2	Wartle Moss	95.01	121.99	30.06	152.05	1
3	Auchtydonald	38.37	38.37	26.00	64.37	1
4	Black Moss	38.20	83.31	6.65	89.96	1
5	Ordie Moss	23.11	23.11	14.10	37.21	1
6	Greenford Moss	22.94	22.94	?	?	0
7	Moss of Macterry	22.18	22.18	5.71	27.89	0
8	Loch of Leys	21.92	25.69	3.16	28.85	0
9	Moss Gray	21.12	21.12	7.13	28.25	2
	<i>Unclassified Wetlands</i>					
10	Moss of Belnagoak	29.78	?	?	?	0
11	Foggy Moss	20.17	?	?	?	0
12	Auchinderran	19.17	?	?	?	0
13	Clearfield	18.51	?	?	?	1
14	Moss of Kirkhill	17.17	?	?	?	0
15	Moss of Blackhillock north	15.52	?	?	?	0
16	Crannach Moss	15.42	?	?	?	0
17	Crichie Moss	15.19	?	?	?	1
18	Howe Moss	15.19	?	?	?	0
19	Park Moss	15.19	?	?	?	0

Most suitable fens are situated in north east Aberdeenshire. The unclassified sites were not visited and may therefore have unidentified constraints. Detailed accounts of the nine fens with greatest expansion potential are given below; all sites were visited for checking.

2.2.1 Accounts of sites with potential for expansion

Loch of Strathbeg

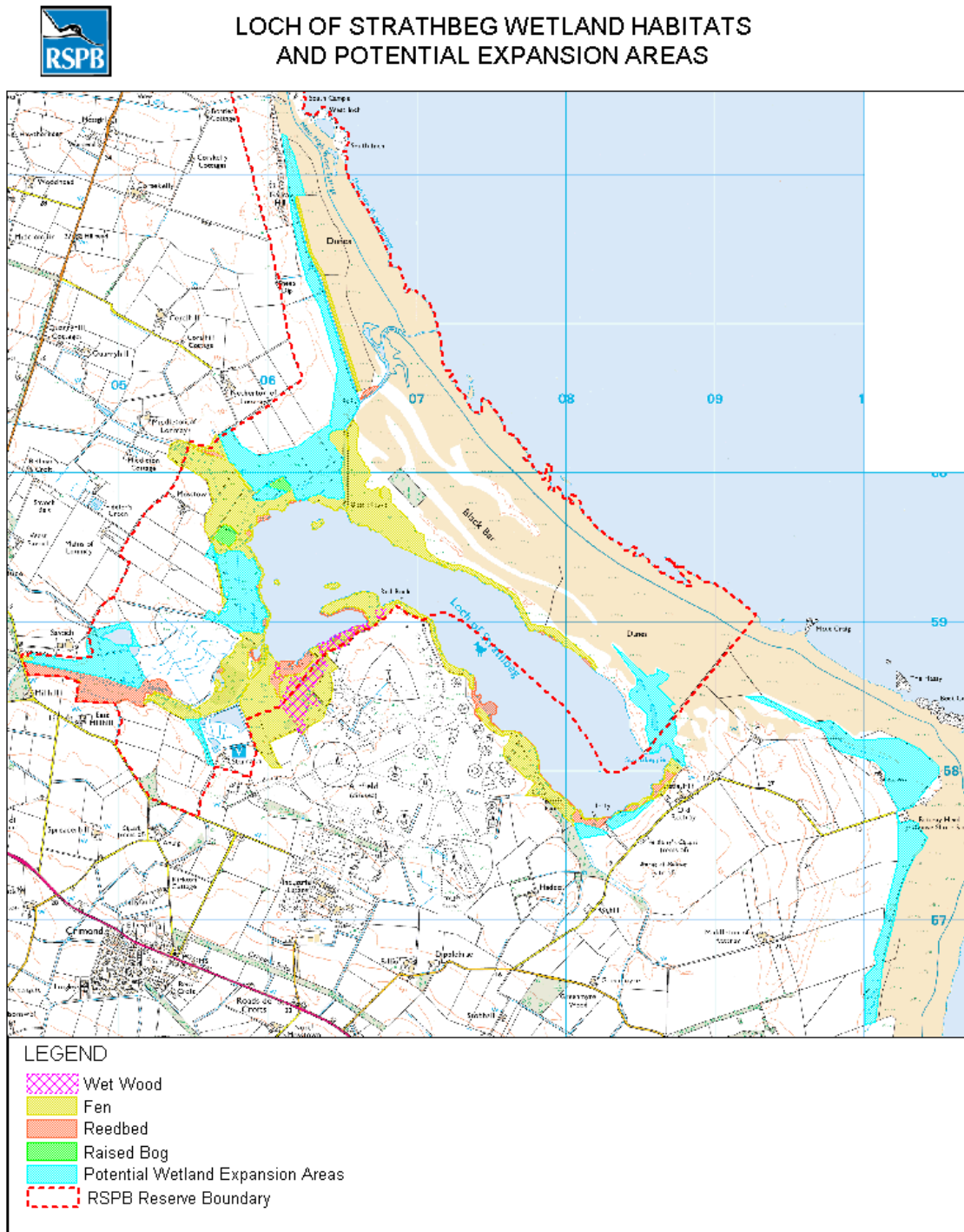


Loch of Strathbeg fen and wet woodland. AMB 2007

Loch of Strathbeg is one of the largest wetland sites in the region, and holds the greatest area of fen. Most of the site is managed as an RSPB nature reserve. Key bird species include wintering waders, wildfowl, and breeding waders and passerines, such as lapwing and reed bunting. Parts of the reserve are designated as Ramsar, SPA and SSSI.

Map 4 below shows existing wetland habitats, with potential expansion areas.

Map 4. Loch of Strathbeg wetland habitats and potential expansion areas



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Fen habitat forms a fringe around much of the loch shore, with a few more substantial areas. There is potential to double the area of fen on the site, although some areas should be used to expand reedbed or wet woodland. An area on the north side of the Savoich Burn, opposite Starnafin, is not highlighted, as it is managed for breeding waders, and is therefore of high conservation value (D. Funnell 2007, *pers. comm.*).

One minor constraint was identified at this site, which was the proximity to Longside (unprotected) airfield.

Wartle Moss and Greenford Moss



Wartle Moss fen. AMB 2007

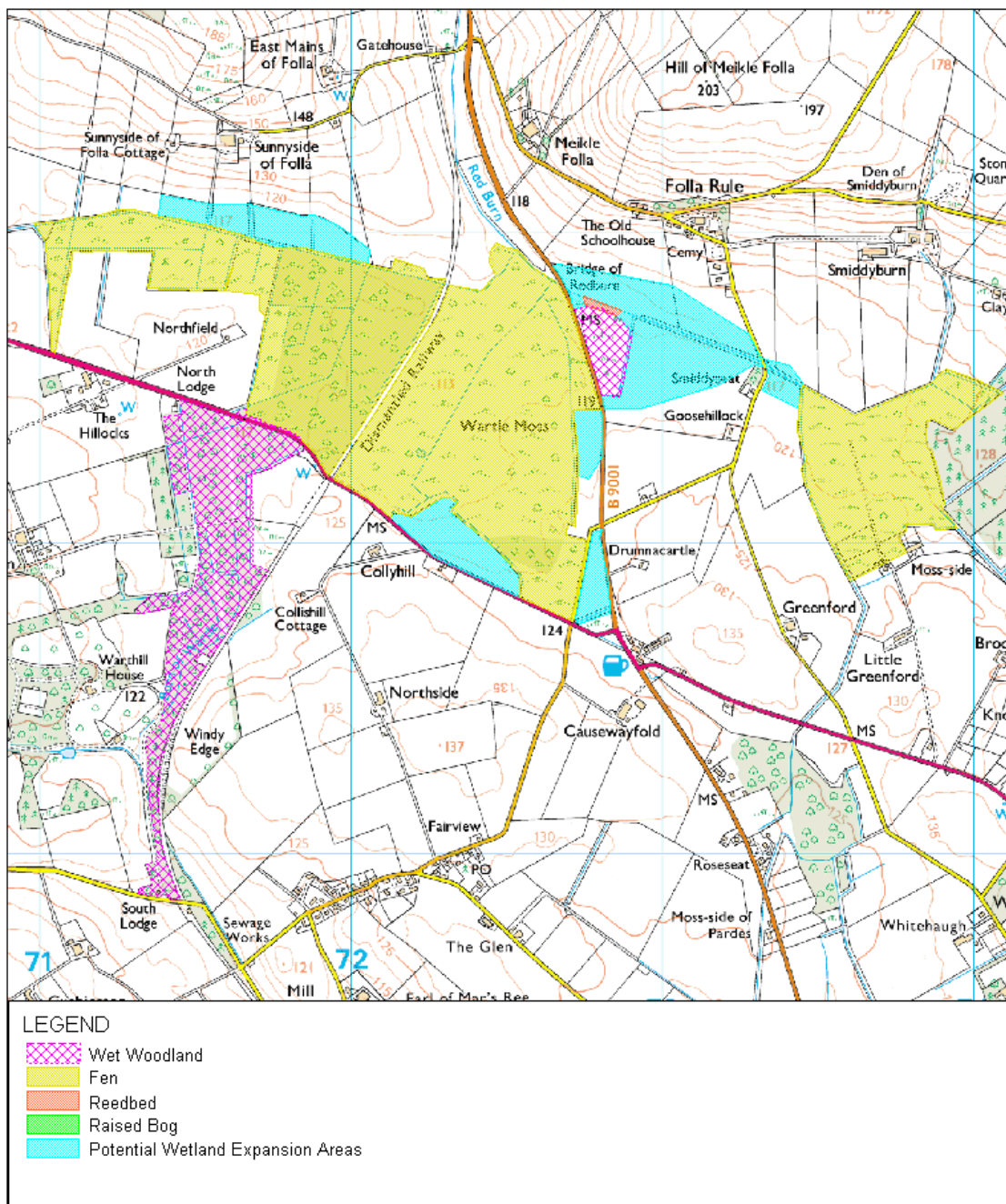
Wartle Moss is another large, relatively unspoilt site. Although it contains much scrub, the fen is still open in nature. Part of the site is a SSSI. Greenford Moss has not been visited specifically, but was identified as fen in passing. It may have once been a part of Wartle Moss.

Map 5 below shows the distribution of habitats on the sites, with potential expansion areas indicated.

Map 5.



WARTLE AND GREENFORD MOSSES WETLAND HABITATS AND POTENTIAL EXPANSION AREAS



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This map highlights the potential to create a substantial corridor, linking these two fens together, along with some expansion around the edges of Wattle Moss. Unfortunately, the topography at Northfield (the western edge of Wattle Moss) appeared unsuitable for expansion. This would have been ideal to widen the narrower edge of the fen. The

presence of power lines through the area linking the two fens was the only identified minor constraint at this site.



Wartle Moss small south eastern field potential expansion area. AMB 2007

Although surrounded by roads, the small south eastern expansion area, pictured above, was so wet that it could easily revert to wetland habitat. Reverting all of the highlighted areas to wetland would produce a habitat expanse of approximately 175 ha.

Auchtydonald

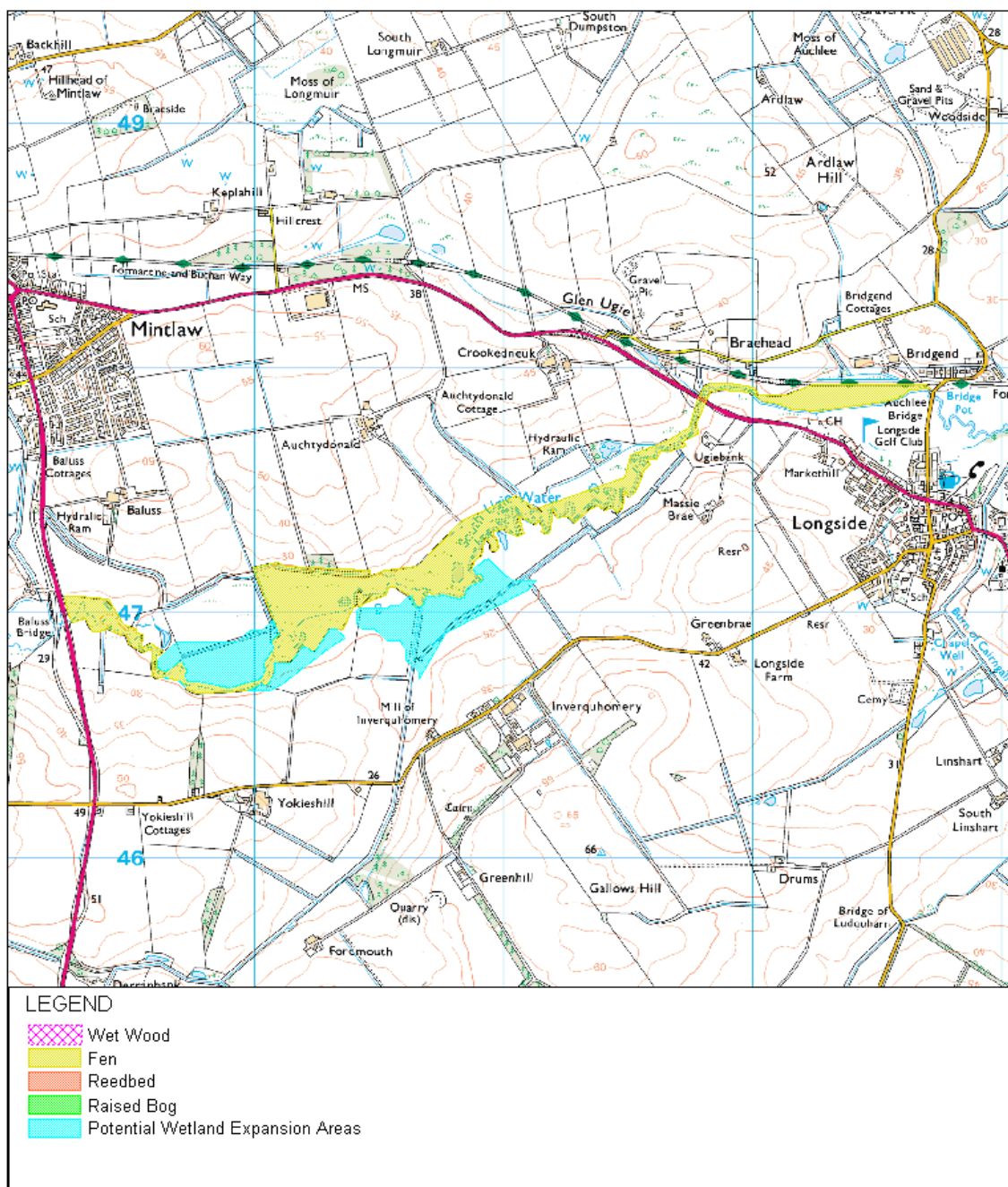
This site has not been thoroughly assessed. This section of fen follows the South Ugie Water, which holds much linear fen habitat. In the Auchtydonald area the fen is more substantial. Part of it is under the RSS creation and management of wetland option, and has held breeding redshank in recent years (A. Perkins 2007, *pers. comm.*). There are no designations on this site.

Map 6 below shows the existing habitat and the possible expansion area. The site is worthy of inspection, to assess the expansion area, as this may be larger than indicated by the SEPA data. Constraints will also need to be identified. The site is in close proximity to Longfield (unprotected) airfield, representing one identified minor constraint.

Map 6.



AUCHTYDONALD WETLAND HABITATS AND POTENTIAL EXPANSION AREAS



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Black Moss and Ordie Moss

Situated in the large wetland expanse of Muir of Dinnet, these two adjacent mosses, separated by a main road, are designated SAC and SSSI. Black Moss holds a large stand of wet woodland, surrounded by an open field layer of fen and reed. Ordie Moss is predominantly covered by wet woodland, with small areas of open wet fen.

The map below shows the variety of wetland habitats, with some potential expansion areas. There are potential forest wetlands at the southern sides of both sites, which could create significant additional wetland areas. These were assessed from the road only, and may require further investigation of topography. Another potential area is to the north of Black Moss. This area was not assessed, but has the potential to link the site up with Green Moss, which is shown on the map, north of Black Moss.

These sites have one identified minor constraint, being near to Dinnet gliding club.

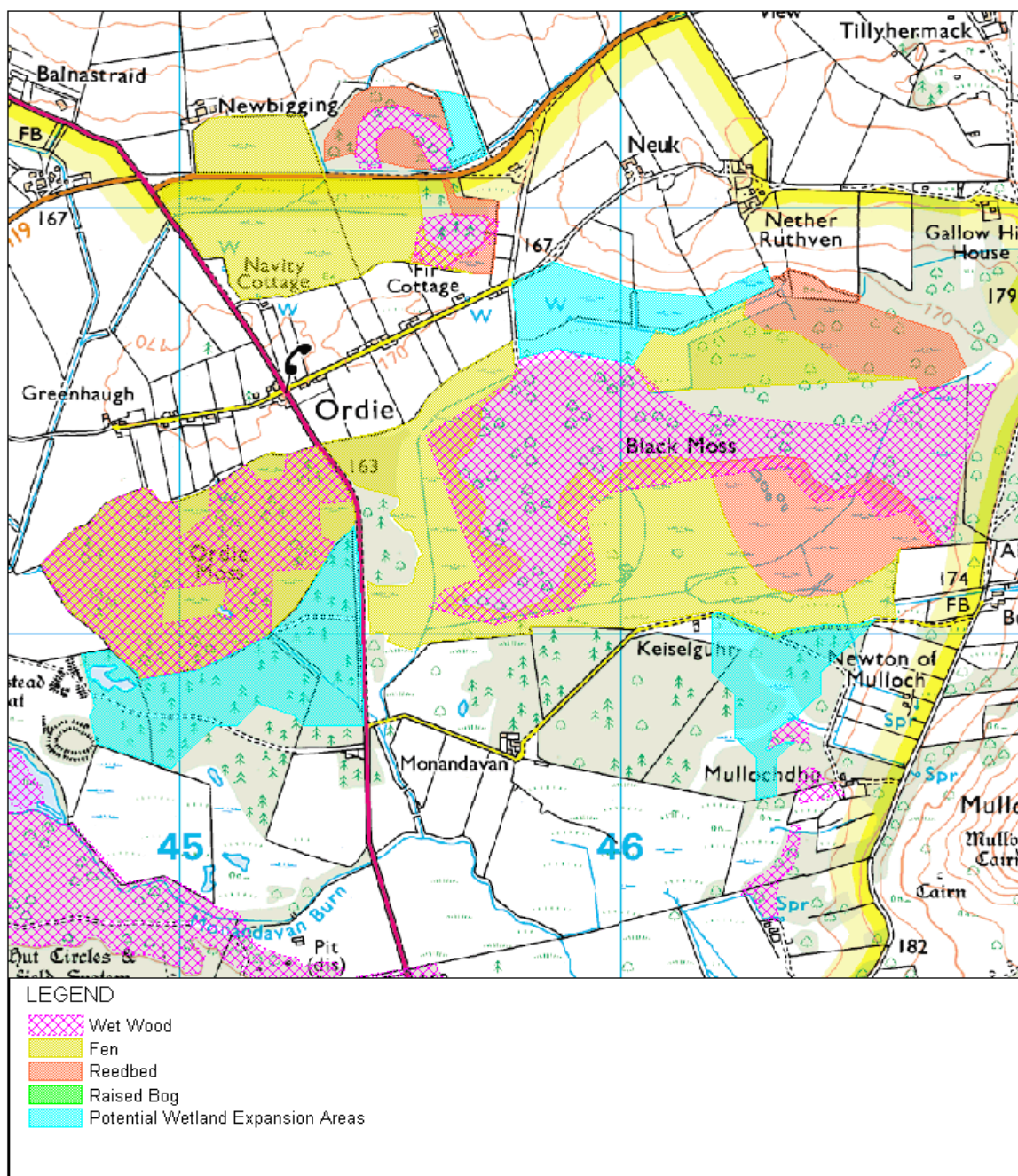


Ordie Moss, August 1999

Map 7.



**BLACK MOSS AND ORDIE MOSS WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Moss of Macterry

Moss of Macterry is an open fen with scattered scrub. It has no site designations.



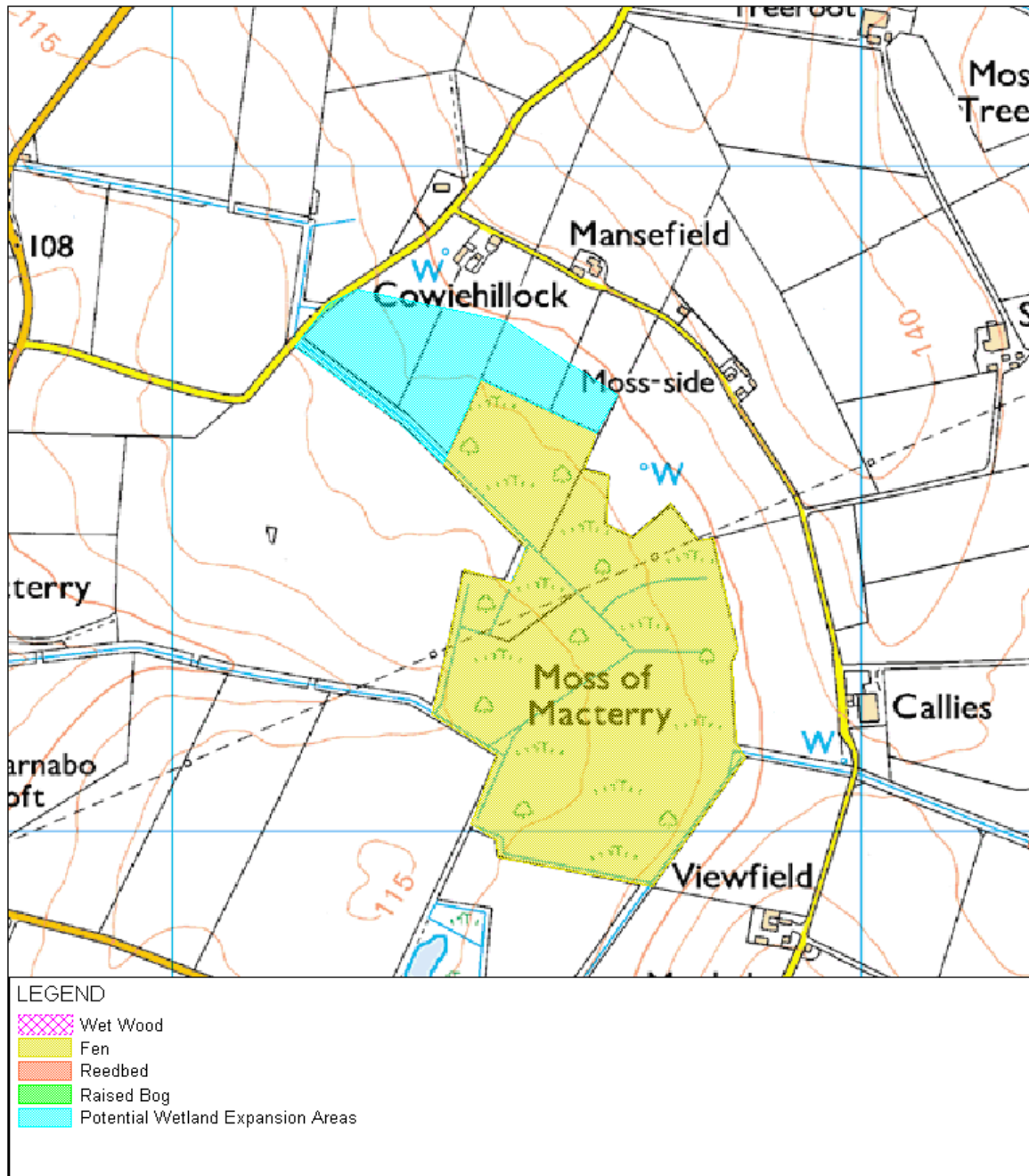
Moss of Macterry. AMB 2007

Most of the site is surrounded by gently sloping farmland, but, as can be seen from Map 8 below, there is a flatter area at the north edge of the habitat. There are no identified constraints at this site. Power lines and a pylon are situated on the existing fen, and are therefore not considered a constraint to expansion.

Map 8.



**MOSS OF MACTERRY WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Loch of Leys

This is a largely open site of fen, with substantial areas of reed. There are no designations on the site.

As can be seen from Map 9 below, the expansion area is limited to the western edge, the topography being unsuitable around much of the habitat. The highlighted expansion area was visited briefly, and consists of *Juncus*-dominated grassland, which would link the habitat to wetland at Lochhead of Leys, across a main road.

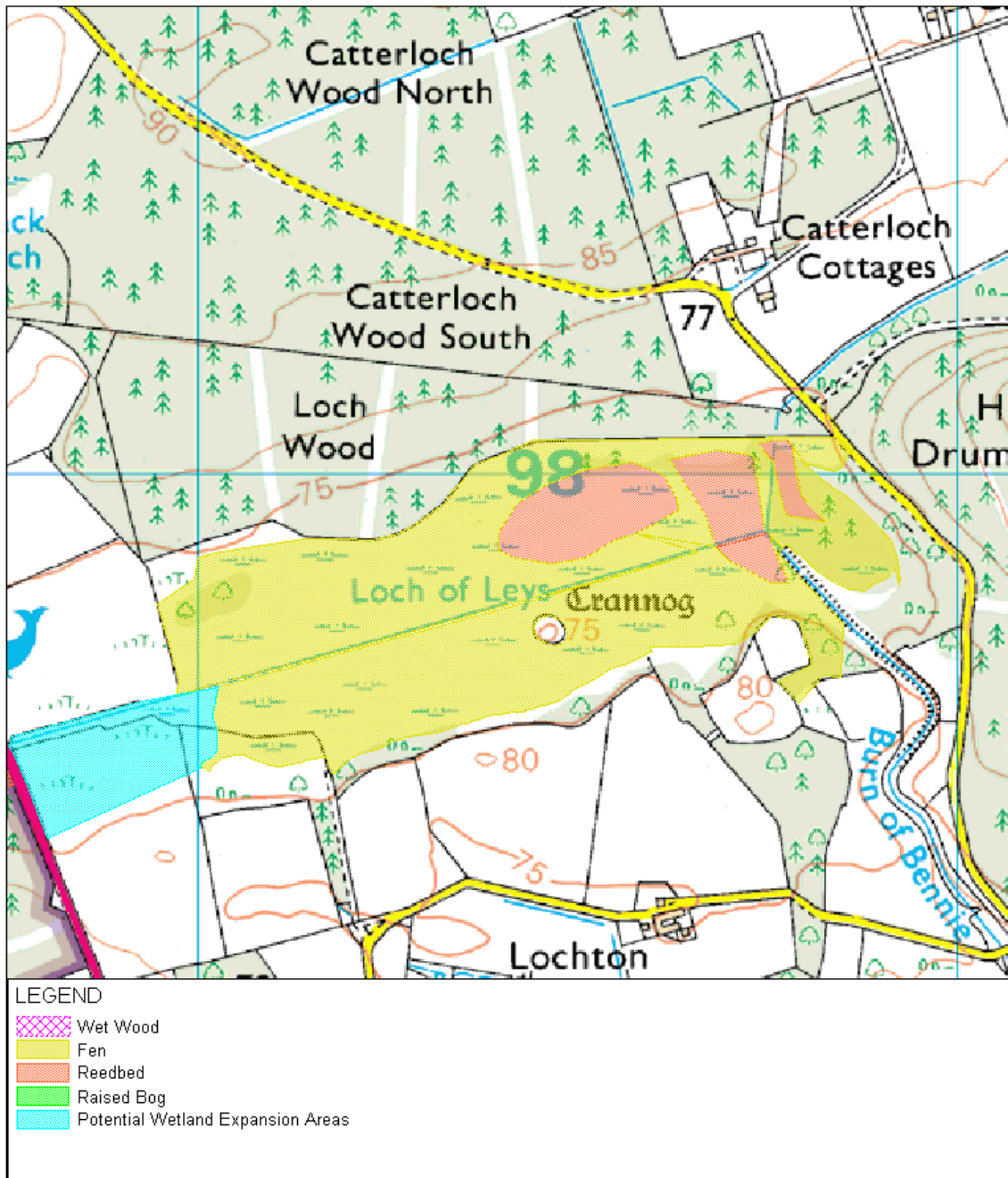


Loch of Leys, summer 2003

Map 9.



**LOCH OF LEYS WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Moss Gray

The North East Scotland Biodiversity Audit, 1998, states that this fen had been reclassified, when SWT conducted a survey of raised bogs. During this study, it was recorded as unclassified wetland, until it was prioritised for a visit, due to its large size.



Moss Gray. AMB 2007

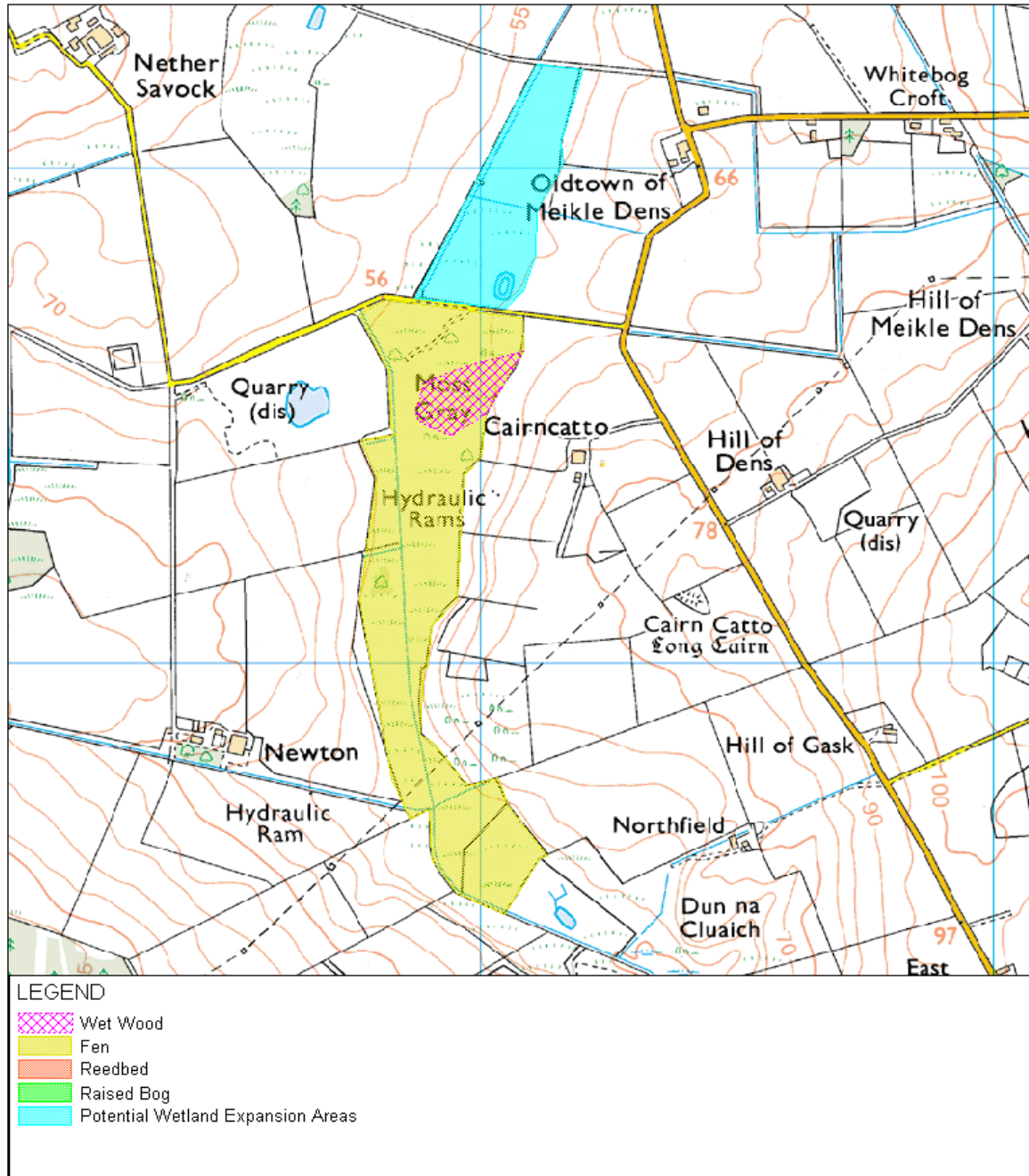
The wetland, which is not designated, is predominantly fen, with patches of scrub, and a small area of wet woodland. An area of *Calluna vulgaris* can be seen in the photograph above, although this is not substantial, it probably explains the earlier misclassification. The habitat sits in a rather steep-sided valley, and there is a landfill site at the southern edge. It was noted that lay-bys at the roadside had allowed easy dumping of waste onto the northern edge of the site.

Map 10 below shows the habitat extents and the suggested expansion area.

Map 10.



MOSS GRAY WETLAND HABITATS AND POTENTIAL EXPANSION AREAS



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Although the expansion area is on the opposite side of a road to the fen, the habitats are both below the level of the road. The expansion area, pictured below, consists of a small shooting pond and surrounding rush and wet grass. There are no identified constraints, although power lines cross the southern edge of the existing fen.



Moss Gray potential wetland expansion area. AMB 2007

2.3 Reedbeds

Reedbeds are fens or swamps dominated by the common reed, *Phragmites australis* (BSG, 1995).



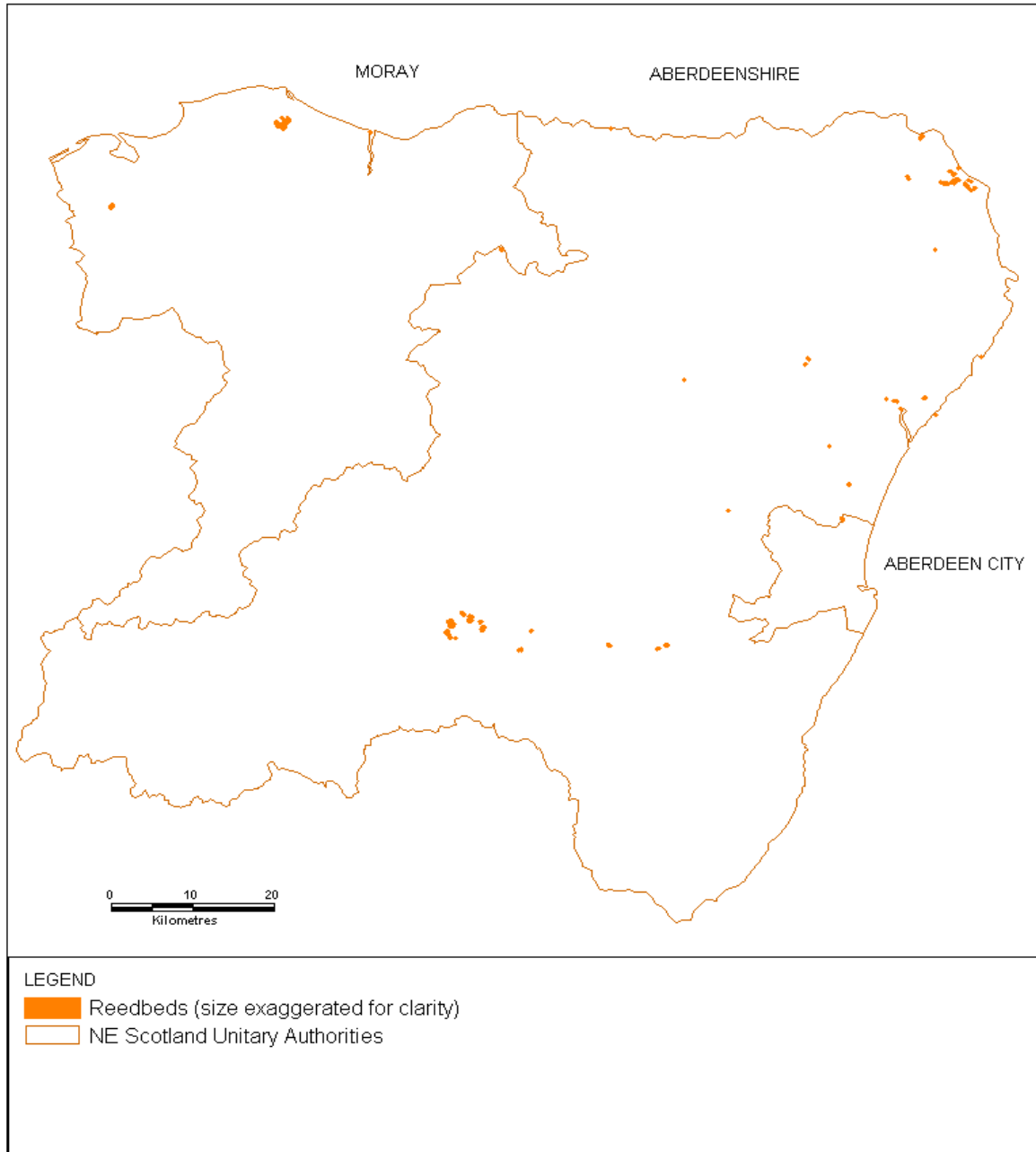
Loch Spynie reedbed. AMB 2007

There are c.32 reedbed sites in NE Scotland, with a total area of approximately 153 ha. Map 11 shows the distribution of reedbeds in North East Scotland.

Map 11. The distribution of all reedbed sites. Their sizes have been exaggerated for clarity.



DISTRIBUTION OF REEDBEDS IN NORTH EAST SCOTLAND



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The largest areas are found at Loch Spynie, near Lossiemouth, in Moray, and Loch of Strathbeg in Aberdeenshire. Most sites are small, being less than two ha. Sites of at least 0.5 ha are listed in Table 4 below.

Table 4. The largest areas (over 0.5 ha) of reedbed in NE Scotland

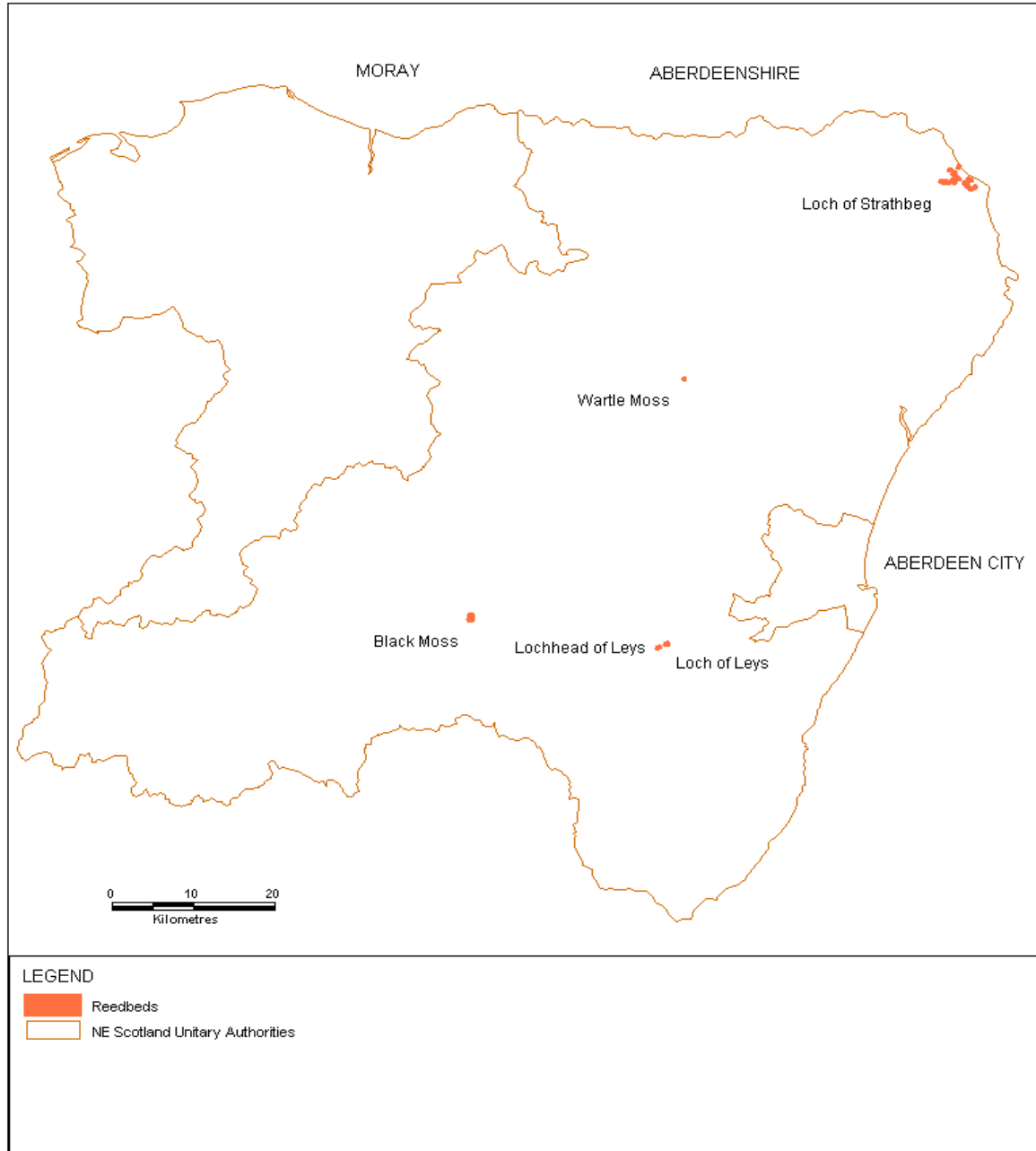
District	Site	Grid reference	Area (ha)
Moray	Loch Spynie	NJ236665	29.16
	Spynie Canal	NJ229662	22.03
	Loch of Blairs	NJ021553	1.76
	Speymouth	NJ341652	0.69
Aberdeenshire	Loch of Strathbeg	NK061587	21.02
	Black Moss, Dinnet	NJ464013	17.75
	Loch Davan	NJ442011	13.63
	Loch Kinord	NO437995	12.75
	Braeraddoch Loch	NJ481003	7.82
	Green Moss, Dinnet	NJ457019	3.81
	Loch of Leys	NO706980	3.77
	Logie Buchan, Ythan Estuary	NJ987300	3.40
	Clearfield, Dinnet	NJ477010	2.29
	Waters of Philorth	NK021646	2.16
	Lochhead of Leys	NO696976	2.05
	Bog Loch	NO637980	1.44
	Burn of Collieston	NK023304	1.19
	Birsemore Loch	NO527973	1.16
	Cortes Loch, Rathen	NK004593	1.00
	Rollomire, Kintore	NJ783156	0.82
	Harestone Moss	NJ932191	0.59
	Well of Auchindroin	NJ503498	0.57
	Aboyne Loch	NO539999	0.53

The 153ha total area of reedbed is an apparent increase of 37 ha since the Biodiversity in North East Scotland, 1998, which recorded 116 ha. However, many of the figures previously quoted were estimates, and complete mapping of the habitat in the region had not been previously carried out. Many areas were found to contain a far greater expanse of reed than previously thought, such as Black Moss. However, some sites previously recorded as containing *Phragmites* were found to contain none, e.g. Loch of Lumgair. It is believed that some swamp habitat was previously included with reed. In this study, swamp has been included with fen. Map 12 below shows the distribution of sites after major constraints have been filtered out.

Map 12. Reedbed sites with no major constraints and potential for expansion.



DISTRIBUTION OF REEDBEDS WITH NO MAJOR CONSTRAINTS



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From the original 32 sites, it can be seen that this filtering process has reduced the sites deemed suitable for expansion considerably, down to just five. These are all located in Aberdeenshire. Table 5 gives the areas and number of identified constraints for the candidate sites.

Table 5. Possible sites for reedbed expansion.

Site Name	Reed Area (ha)	Total Wetland Area (ha)	Expansion Area (ha)	Expanded Area (ha)	Minor Constraints
Loch of Strathbeg	21.02	134.00	111.85	245.85	2
Black Moss, Ordie	17.75	83.31	14.07	97.18	1
Loch of Leys	3.77	25.69	3.16	28.85	0
Lochhead of Leys	2.05	2.05	11.30	13.35	1
Wartle Moss	0.30	121.99	30.06	152.05	1

Three of the five sites contain less than five hectares of reedbed. However the expansion potential results in all sites being over 10 hectares. Detailed descriptions of the candidate sites can be seen below.

Accounts of sites with potential for reedbed expansion

Loch of Strathbeg

Loch of Strathbeg holds the largest reedbed in Aberdeenshire. Most of the site is managed as an RSPB nature reserve. Bittern have wintered at the site in recent years. Parts of the reserve are designated as Ramsar, SPA and SSSI.



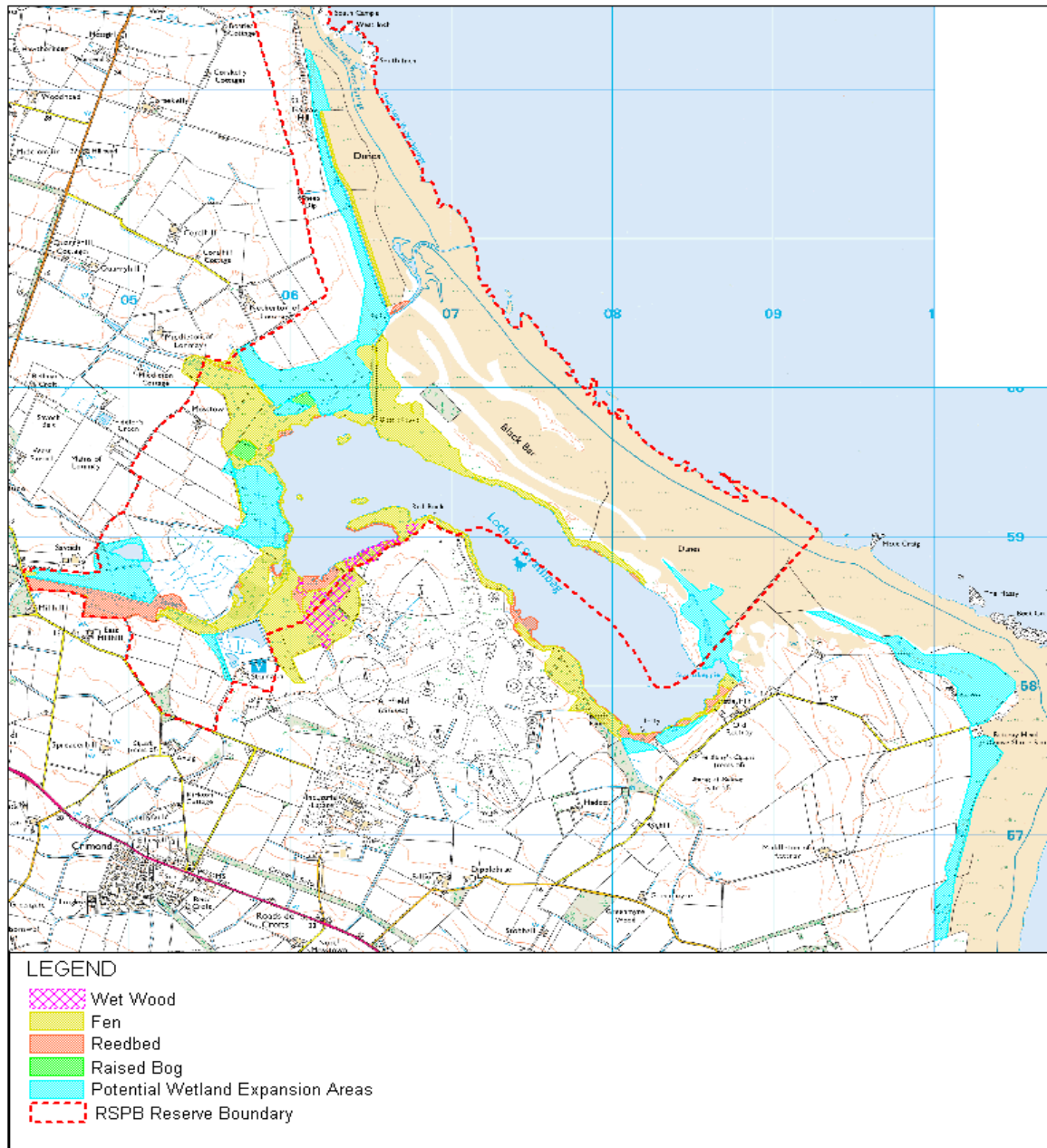
Savoch Burn reedbed, Loch of Strathbeg. AMB 2007

Much of the *Phragmites* is rather linear, with the most substantial part being along the Savoch Burn, pictured above. Map 13 below shows the extent of wetland habitats on the site, and highlights potential expansion areas at the location.

Map 13.



LOCH OF STRATHBEG WETLAND HABITATS AND POTENTIAL EXPANSION AREAS



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There appears to be much expansion potential for this already large site. There is an excellent opportunity to create a substantial area of *Phragmites* by expanding the Savocho Burn habitat to the north side of the water, illustrated by the photograph below. The RSPB is planning to plant reed in this area soon.



Potential reed expansion area on north side of Savocho Burn, Loch of Strathbeg. AMB 2007

As can be seen in the photograph, power lines run through this area. The site is also within 13 km of an unprotected airfield. These are the only two identified constraints.

The eastern-most expansion area is probably most suitable for fen habitat (D. Funnell, *pers. comm.*, 2007), and the other areas divided up between the two habitats. Creating large expanses of reedbed on the site may encourage the wintering bittern to stay and breed, along with marsh harriers and bearded tits, which occasionally visit the site.

Black Moss, Ordie

Black Moss was found to hold a much larger area of reed than previous records showed. However, as can be seen illustrated below, parts of the habitat are becoming encroached with wet woodland.



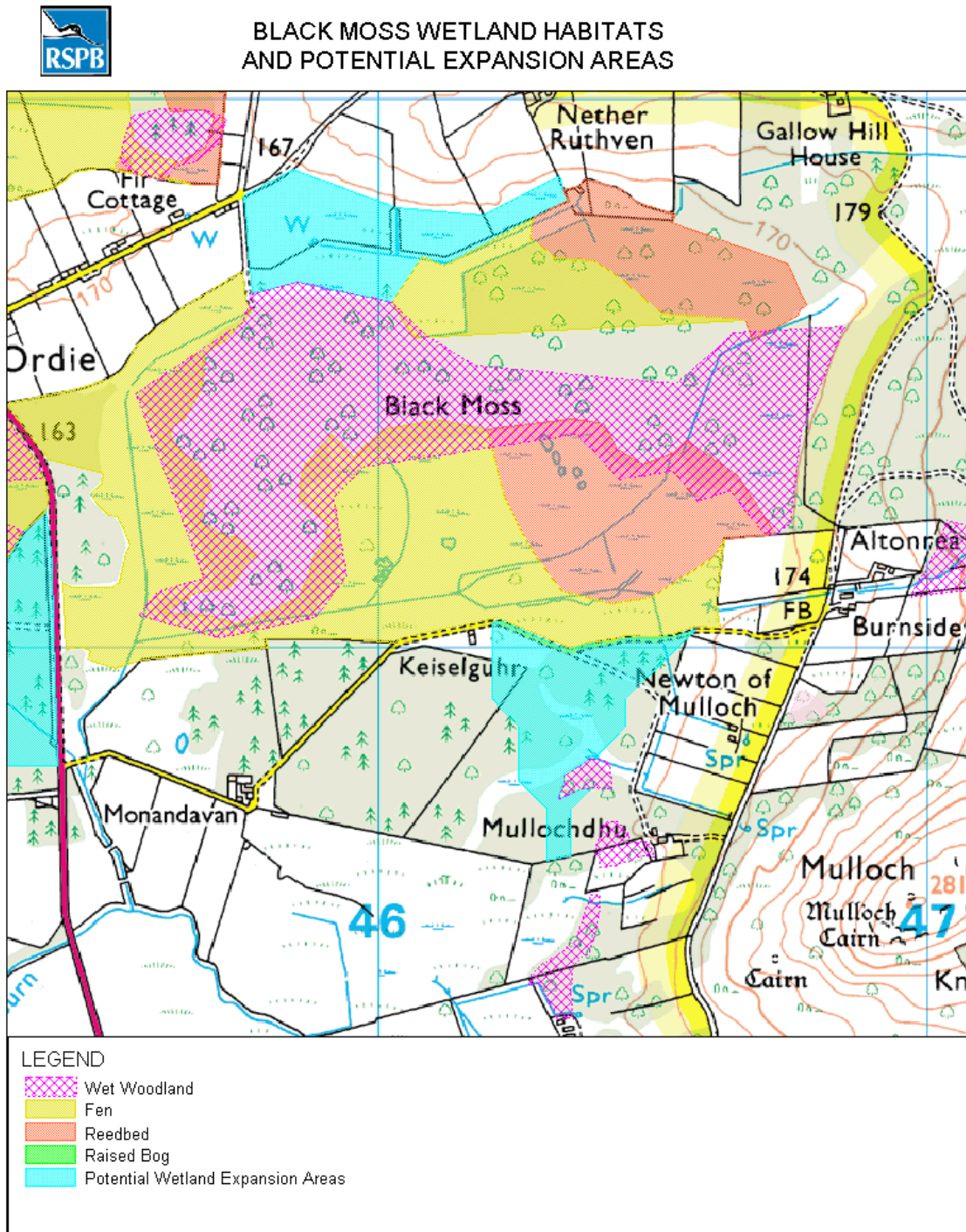
SE corner of Black Moss reedbed, Ordie. AMB 2006.

The map below shows the habitat extents and potential expansion areas at the site. The main area, to the south of the site, is a potential forest wetland. This was viewed from the edge only, and will require a more detailed study. There is a small patch of wet woodland within this area.

The stretch to the north of the site has not been visited, but appears to have the potential to create a corridor linking Black Moss reedbed to that of Green Moss, the edge of which can be seen to the north west.

The only identified constraint at this site is its proximity to an unprotected airfield (Dinnet Gliding Club).

Map 14. Habitats and expansion potential of Black Moss



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Loch of Leys / Lochhead of Leys

Loch of Leys is primarily open fen, but also holds substantial areas of reed. Across a main road lies the Lochhead of Leys reedbed, pictured below. This is situated on FCS land, and is surrounded by conifer plantations, with fishing ponds at one edge. The sites are not designated.



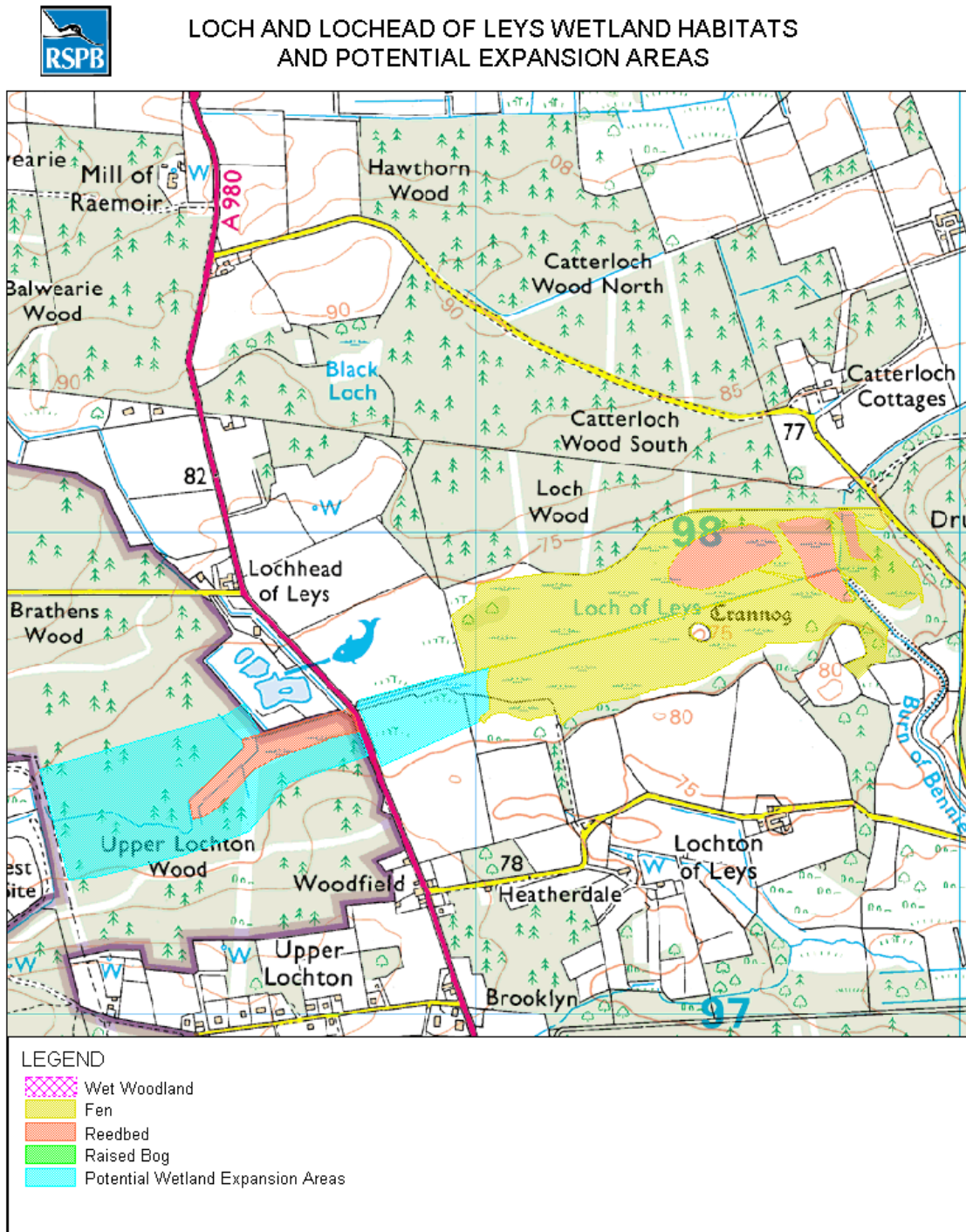
Lochhead of Leys reedbed, AMB 2006

Map 15 below illustrates the habitat extents and potential expansion areas for the two sites. The expansion area at Loch of Leys is rather small, but would link the habitat with that of Lochhead of Leys. The area is a stretch of rush-dominated grassland, with a ditch at the edge.

There is potential to expand the Lochhead of Leys reedbed into the surrounding plantation. This was viewed from the edge only, and therefore will require further assessment. If unsuitable for reed expansion, the area may hold wet woodland.

No constraints were identified for at Loch of Leys, although power lines run across the existing reedbed at Lochhead of Leys. The map below illustrates the habitats found at the sites, and the location of possible expansion areas.

Map 15. Distribution of habitats and potential expansion areas of Loch and Lochhead of Leys



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Wartle Moss

Wartle Moss is one of the largest fen sites in the region, and part is designated a SSSI. However, the reedbed is very small and is not within this designation. Its size is probably limited by the encroaching scrub, which can be seen in the photograph below.



Wartle Moss, showing small area of reed encroached by trees, with the edge of the main fen behind. AMB 2007

Map 16 below shows the extent of the wetland habitats and highlights areas deemed suitable for expansion. Although the reedbed is very small, there is a large potential expansion area around it. Scrub control would also enhance this. Expansion in this area would create a wetland corridor of fen and reed, linking the site to nearby Greenford Moss, also shown on the map, to the east of Wartle Moss.

The photograph below further illustrates this potential. The area comprises rush-dominated grassland and semi-improved grassland, and has a drain running through. The pictures also show that the area holds water and has one minor constraint: power lines.



Proposed expansion area adjacent to reedbed. AMB 2007

Most of the other expansion areas are probably most suitable for fen and wet woodland habitats, although more reeds could be established along the drain at the northern edge of the site.

2.4 Wet Woodlands

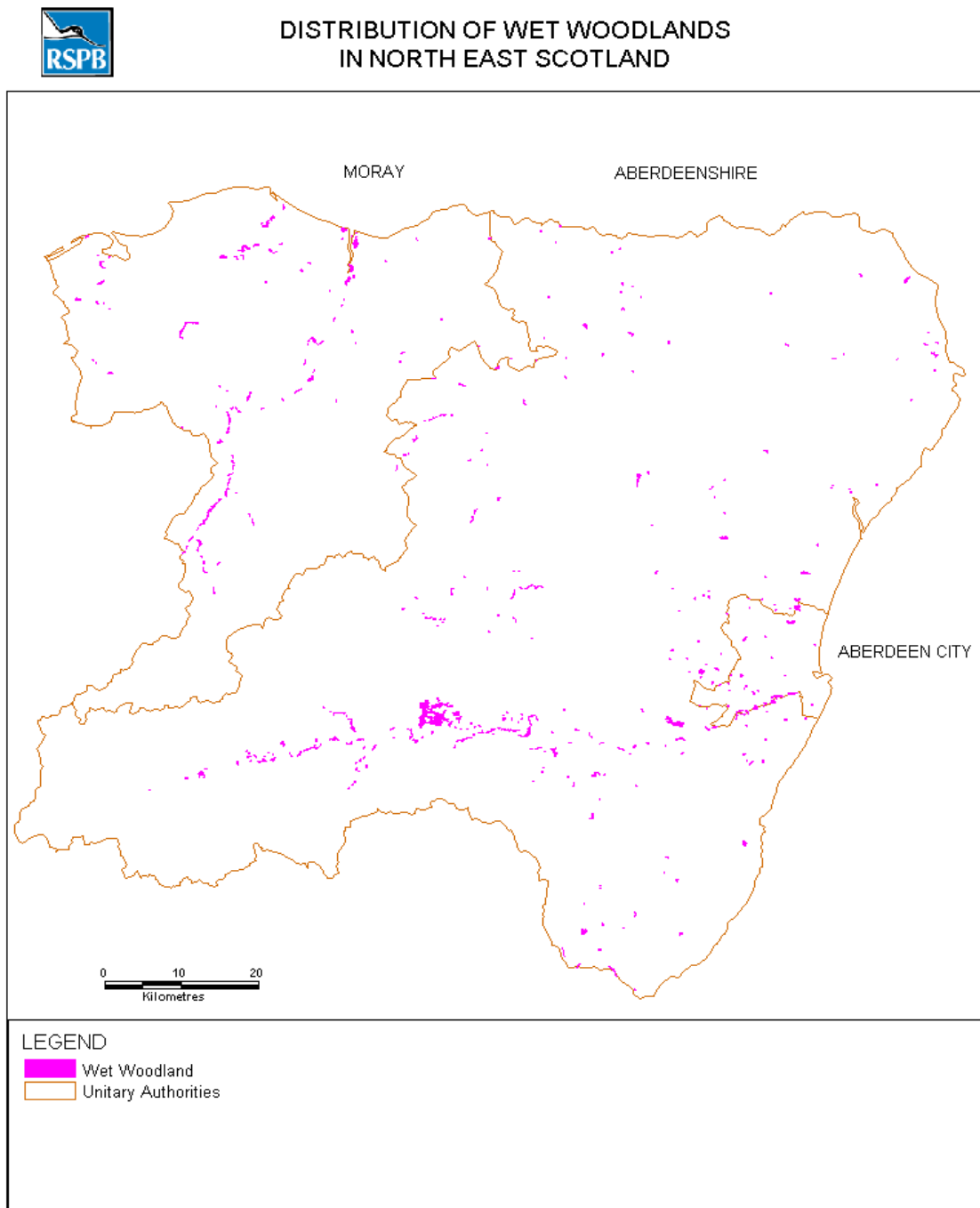
Wet woodland occurs on poorly drained or seasonally wet soils, usually with alder, birch and willows as the predominant tree species, but sometimes including ash, oak, pine and beech on the drier riparian areas. It is found on floodplains, as successional habitat on fens, mires and bogs, along streams and hillside flushes, and in peaty hollows (UK BAP 2). These woodlands occur on a range of soil types including nutrient-rich mineral and acid, nutrient-poor organic ones.



Culriach Wood, Speyside. Wet woodland created from forest wetland. AMB 2007

Map 17 below shows the distribution of wet woodlands throughout North East Scotland.

Map 17. Distribution of wet woodlands



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There were approximately 1490 ha of wet woodland identified within North East Scotland, from this study. There is a large expanse concentrated in the Muir of Dinnet area of Aberdeenshire. However, most of the sites are small and fragmented. Much of the habitat is linear riparian woodland. Table 6 below lists the largest sites, over 15 ha.

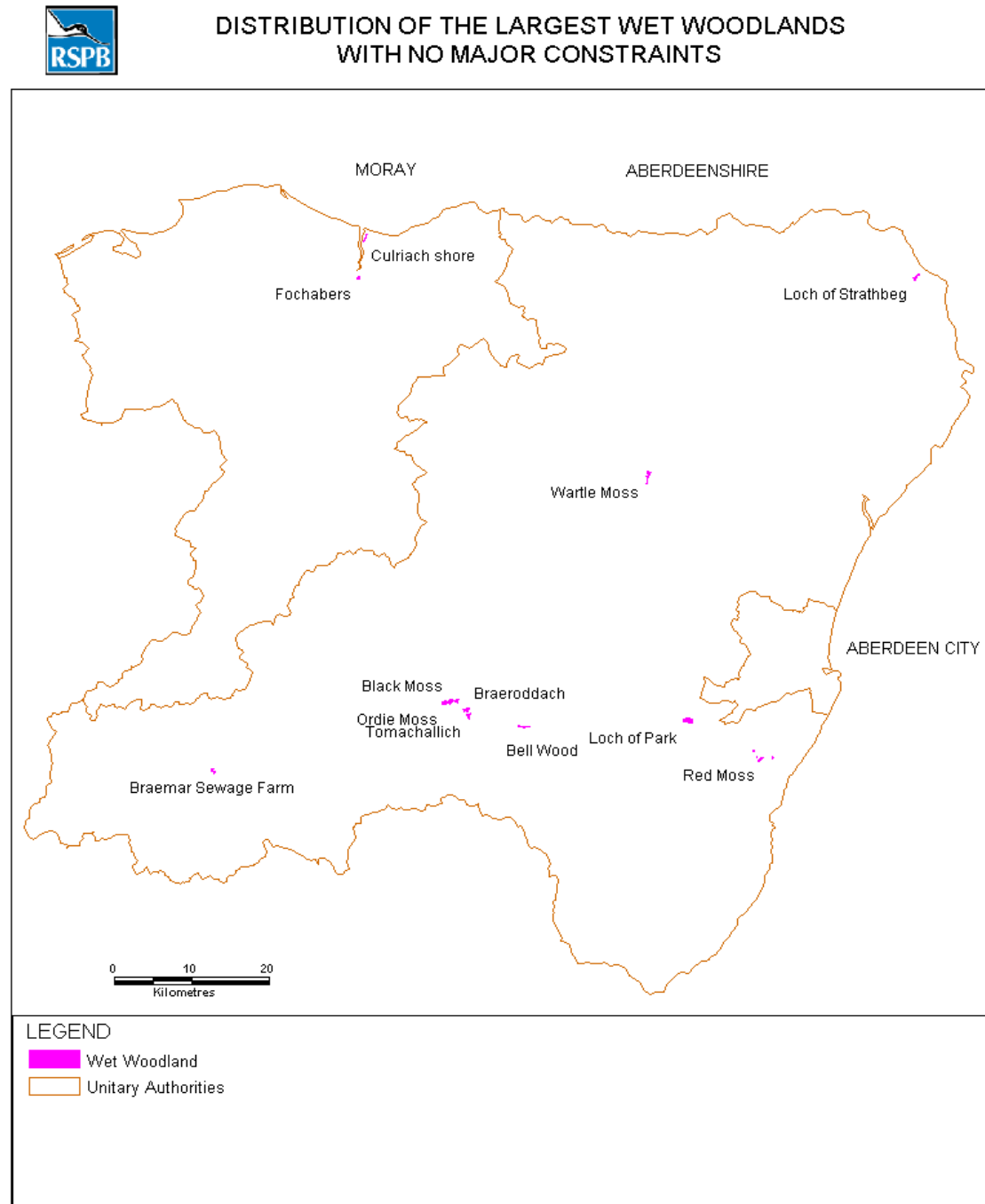
Table 6. The largest wet woodland sites – over 15 ha

District	Site	Grid Reference	Area (ha)
Moray	Culriach Wood	NJ349636	26.28
	Drainer Burn, Kingston	NJ333654	22.30
	Spynie Canal	NJ226661	21.02
	Mosstodloch	NJ343603	20.42
	Lochinver	NJ177618	17.94
Aberdeenshire	Muir of Dinnet	NJ457001	345.49
	Loch of Park	NO764988	39.00
	Black Moss, Dinnet	NJ458013	36.77
	Cunnach Moss	NO756993	35.54
	Garlogie Wood	NJ797058	26.12
	Wartle Moss	NJ715317	23.48
	Ordie Moss, Dinnet	NJ450011	19.56
	Burreldale Moss	NJ825239	17.24
	Loch of Lumgair	NO852826	17.16
	Kettlepool Moss	NJ646524	16.18
Shannel	NO607795	15.63	

There was little information on wet woodland within the 1998 Biodiversity in North East Scotland audit, as the national Action Plan was not available then. However, many sites classed as fen during that study, were found to have undergone natural succession into wet woodland, for example, Loch of Park, in Aberdeenshire.

Map 18 below shows sites with no major constraints and greatest potential for expansion.

Map 18. Wet woodland sites with greatest potential for expansion



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Filtering out sites with identified major constraints led to a low number of candidate sites over 10 ha, as can be seen from Table 7 below. Some sites of less than 10 ha have been included, as the potential expansion areas of unvisited are unknown.

Table 7. Largest sites (over 5 ha) with no identified major constraints

Site	Wet Wood Area (ha)	Total Wetland Area (ha)	Expansion Area (ha)	Expanded Area (ha)	Minor Constraints
Loch of Park	39.00	46.05	4.78	50.83	0
Black Moss, Dinnet	36.77	83.31	6.65	89.96	1
Wartle Moss	23.48	122.00	30.58	152.58	0
Ordie Moss, Dinnet	19.56	23.11	14.10	37.21	1
Braeroddach	14.29	36.50	?	?	1
Loch of Strathbeg	8.98	128.00	80.00	208.00	1
Bell Wood	8.69	8.69	?	?	1
Red Moss, Netherley	7.31	74.08	?	?	0
Fochabers, Speyside	6.54	6.54	?	?	0
Braemar Sewage Farm	6.34	6.34	?	?	0
Tomachallich	6.18	9.40	?	?	1
Culriach shore, Speyside	5.75	5.75	?	?	0

Not all of the sites could be visited, but details of those that were are given below.

Accounts of sites with potential for wet woodland expansion

Loch of Park

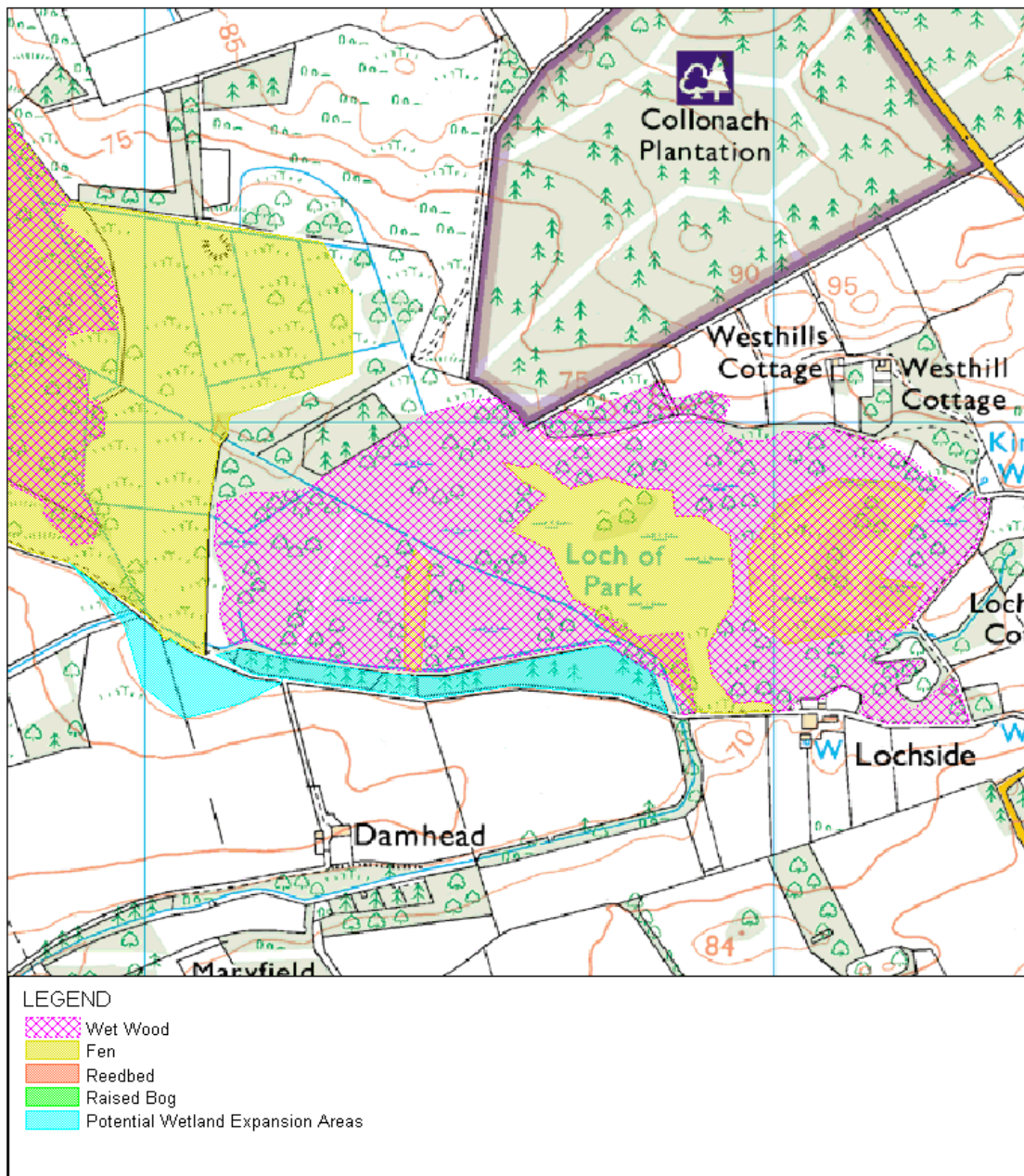
This entire site is designated a SSSI, and was a fen which has become predominantly wet woodland. It is adjacent to the more open wetland of Cunnach Moss. The site has a very small patch of reed at the southern edge, which is likely to be lost to woodland. Map 19 below shows the distribution of wetland habitats on the site and potential expansion areas.

The expansion area is rather small and narrow, and consists of potential forest wetland along the southern edge of the site. There is also some flat grassland beside this, on the opposite side of a track.

Map 19.



**LOCH OF PARK WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Black Moss and Ordie Moss

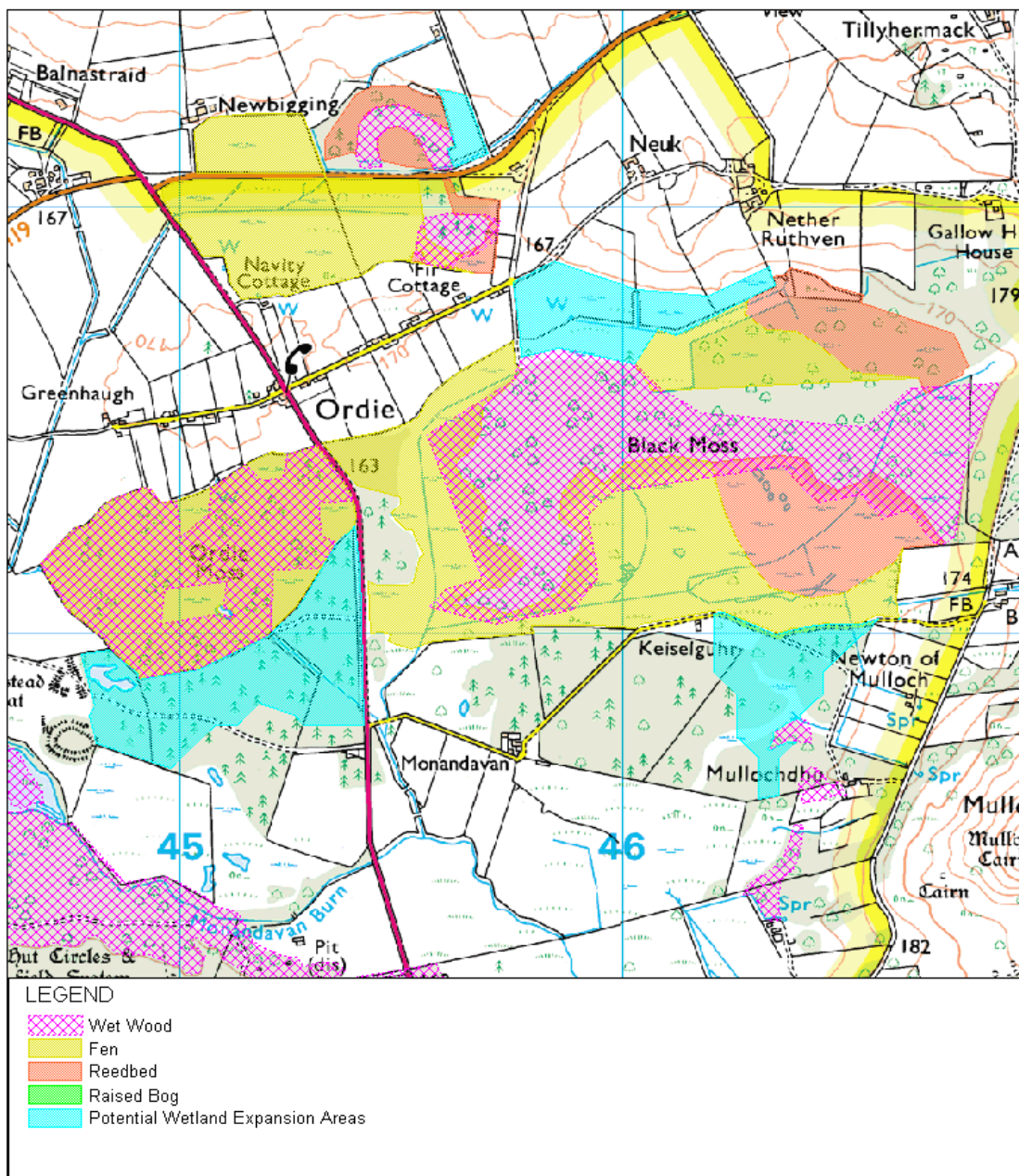
These adjacent wetlands are part of the Muir of Dinnet SSSI and SAC. They both contain large areas of wet woodland, although Black Moss also holds much open habitat.

Map 20 below shows the extent of wetland habitats and highlights their expansion potential.

Map 20.



**BLACK MOSS AND ORDIE MOSS WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Both areas have potential forest wetlands at their southern edges, which would be ideal to expand the wet woodland habitat. The area north of Black Moss, which is grassland, has not been visited, but is probably better suited to expansion of fen and reedbed.

Wartle Moss

Wartle Moss is predominantly open fen habitat, and part of the site is designated as a SSSI. Although there is much scrub present on the main fen, it was not considered dense enough to be classed as wet woodland, during this study.



Wartle Moss south wet woodland. AMB 2007

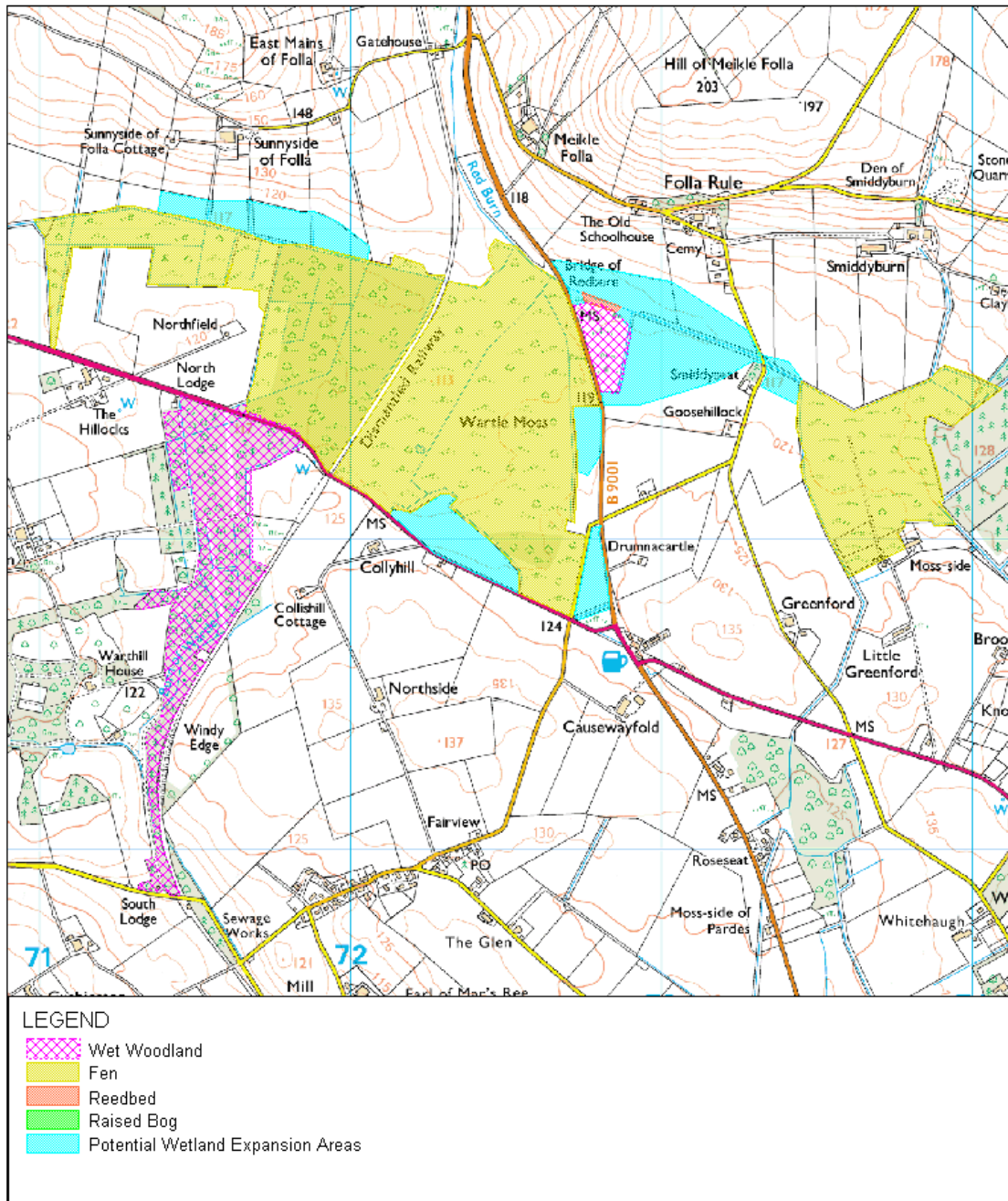
There are two areas of wet woodland identified at the site, neither within the SSSI boundary. They are separated from the main fen habitat by roads, although the smallest area, to the east, holds a small reedbed.

Map 21 below shows the habitat distribution of the site, and illustrates the expansion potential of the wetland. The largest wet woodland area, to the south appears to have little potential for expansion. Although the expansion area around the smaller wood is significant, this should also include some fen and reedbed habitat, linking this fen with the Greenford Moss habitat, also shown on the map below. This area contains power lines, and is the only identified constraint at the site.

Map 21.



**WARTLE AND GREENFORD MOSSES WETLAND HABITATS
AND POTENTIAL EXPANSION AREAS**



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Braeroddach

This loch-side wetland holds a large expanse of reed as well as wet woodland. The site has no designations.



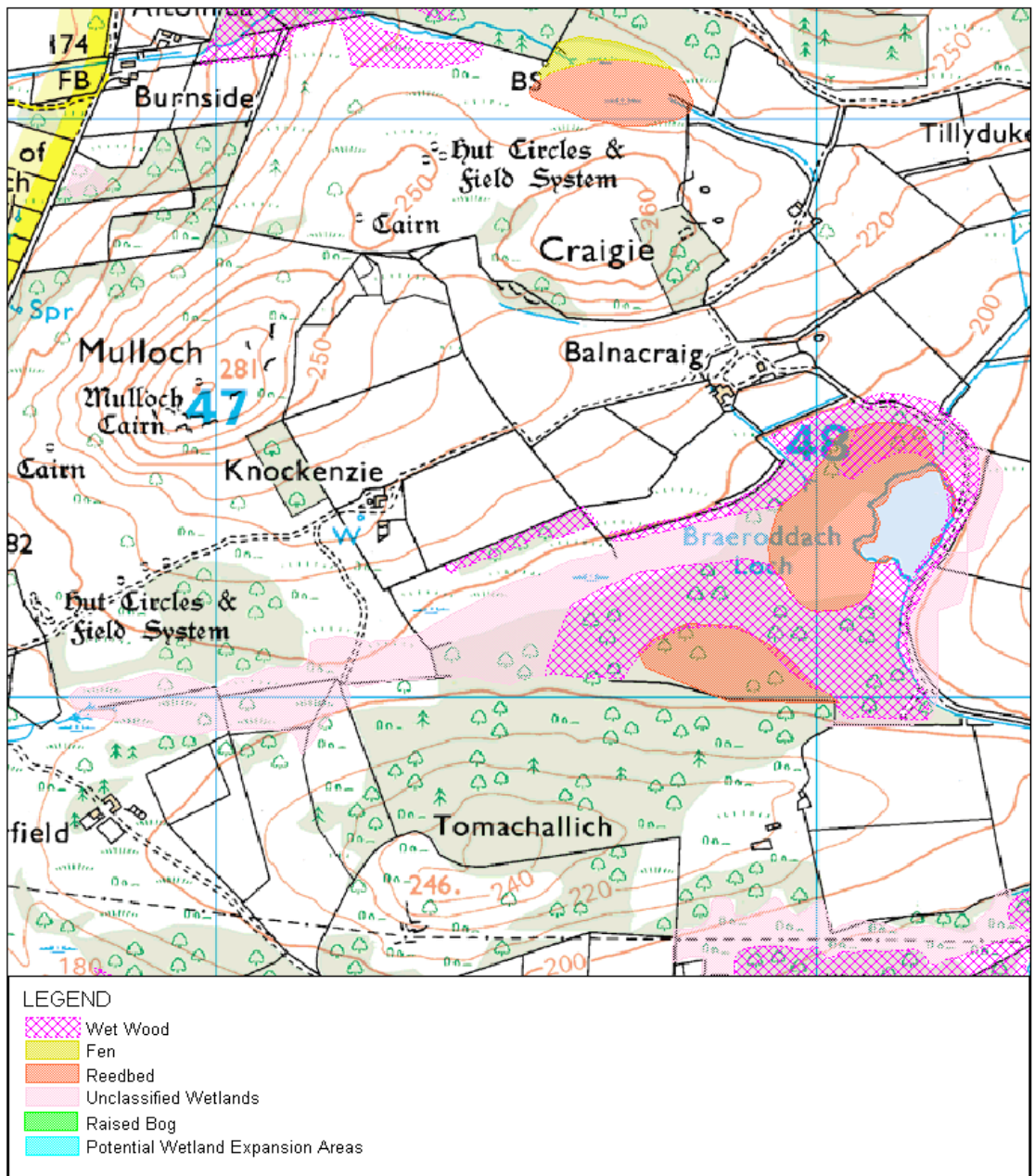
Braeroddach wet woodland. AMB 2006

Map 22 below shows the distribution of wetland habitats found on the site. No potential expansion areas were identified, although only a partial visit of the area was carried out. The proximity of the site to an unprotected airfield was the one minor constraint identified.

Map 22.



BRAERODDACH WETLAND HABITATS



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Loch of Strathbeg

Loch of Strathbeg is primarily open fen and parts of the site are designated Ramsar, SPA and SSSI.



Scrub removal at Loch of Strathbeg RSPB reserve. RSPB 2006

Much of the wet woodland and scrub on the site is being removed, to reverse encroachment into the field layer habitats (fen, swamp and reed) which are considered to be of higher conservation value. The areas due to be removed have not been included as woodland in the habitat map below.

Creation and restoration of wetlands

3.1 Introduction

As well as the expansion of existing wetland habitats, the total extent of these habitats can be increased by the creation of new areas, or restoration of drained sites. Historically, many wetlands have been drained for agriculture and forestry. Trees, particularly conifer plantations, may be planted in inappropriate places, such as raised bogs. 35% of Scotland's raised bogs and 13% of blanket bogs are forested (Pepper *et al.*, 2006). This section aims to identify areas of potential forest wetland and wet grassland, which are suitable for reversion to wetland habitats.

Elsewhere in the UK, there has been increasing attention paid to the concept of large-scale wetland restoration and creation. The entirety of England has been considered in this way, with a large-scale GIS-based study published in 2006 (RSPB *et al.* 2006) In Scotland, a similar exercise has been undertaken for the Borders, by the Macaulay Institute (Ball *et al.* 2006). These studies were more intensive and detailed than was possible in this inventory, but the general approach is similar.

There are two major methods of creating wetland habitat, following the raising of the water table. Firstly, vegetation can be allowed to develop naturally. However, it may take a long time for communities to become established, and the type of wetland cannot be decided using this method. Alternatively, suitable species may be planted, allowing a relatively fast conversion into a desired habitat. This is ideal for creating single species swamp, reedbed and wet woodland, but it is difficult to create diverse fen communities, for example.

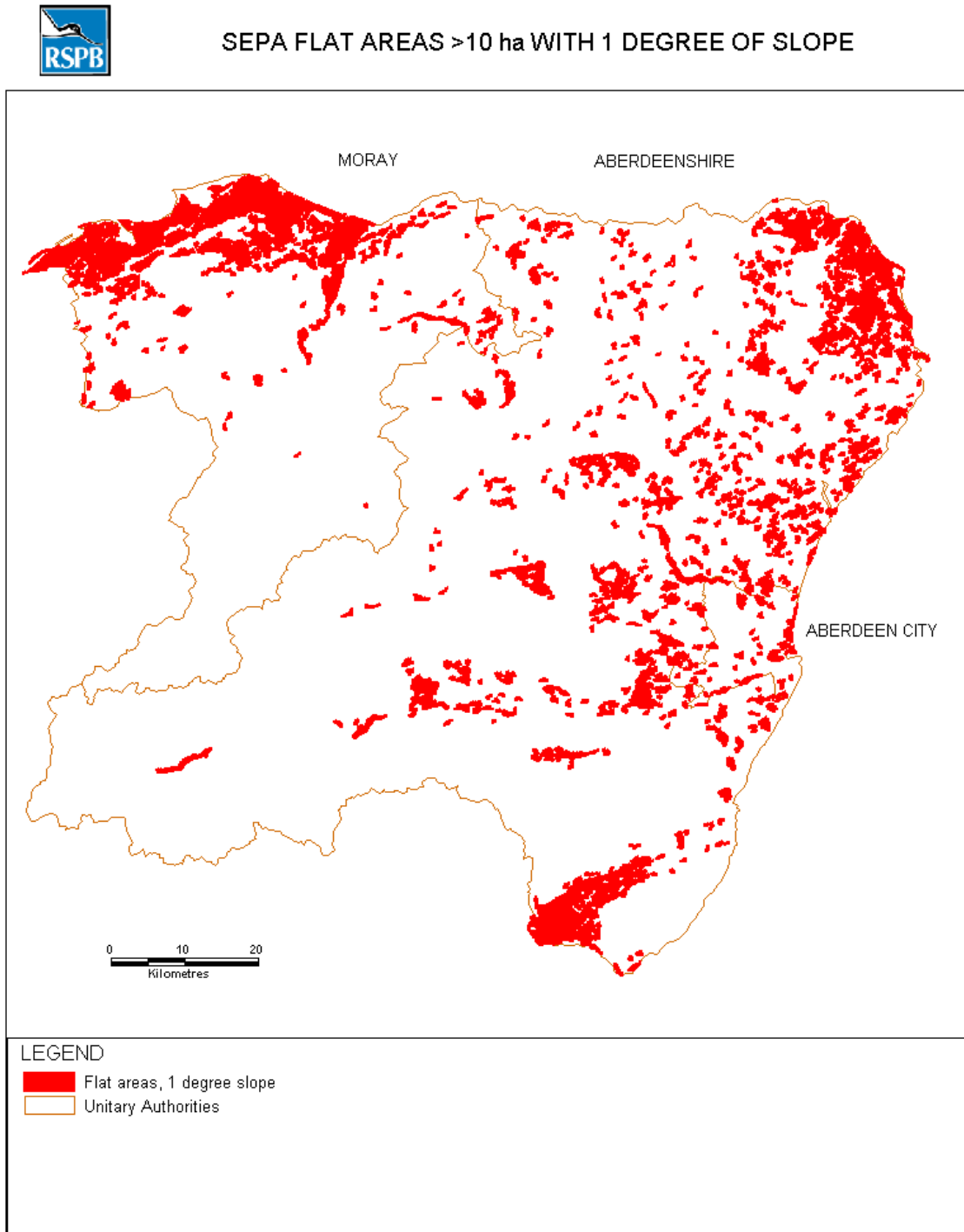
The methods used to identify suitable forest wetlands and wet grassland sites are laid out below.

3.2 General Methods

For creation and restoration of wetland habitat, low-lying flat areas of land were identified, using two methods. Firstly, a visual assessment of 1:25000 Ordnance surveys was made, plotting areas of at least 1 ha, between 10m contours. It was decided that this method contained a large risk of human error, as several individual people undertaking earlier work on this project had carried out this task. The second method used a Landform Panorama DTM, supplied by SEPA. Details of how this was used can be seen in the technical report, in Appendix 1. Two datasets were produced from this, with different degrees of slope, for comparison.

The maps below show areas identified as having a slope of less than one degree, and less than half a degree, respectively.

Map 23. Areas of one degree of slope and at least 10 ha in size (SEPA data)



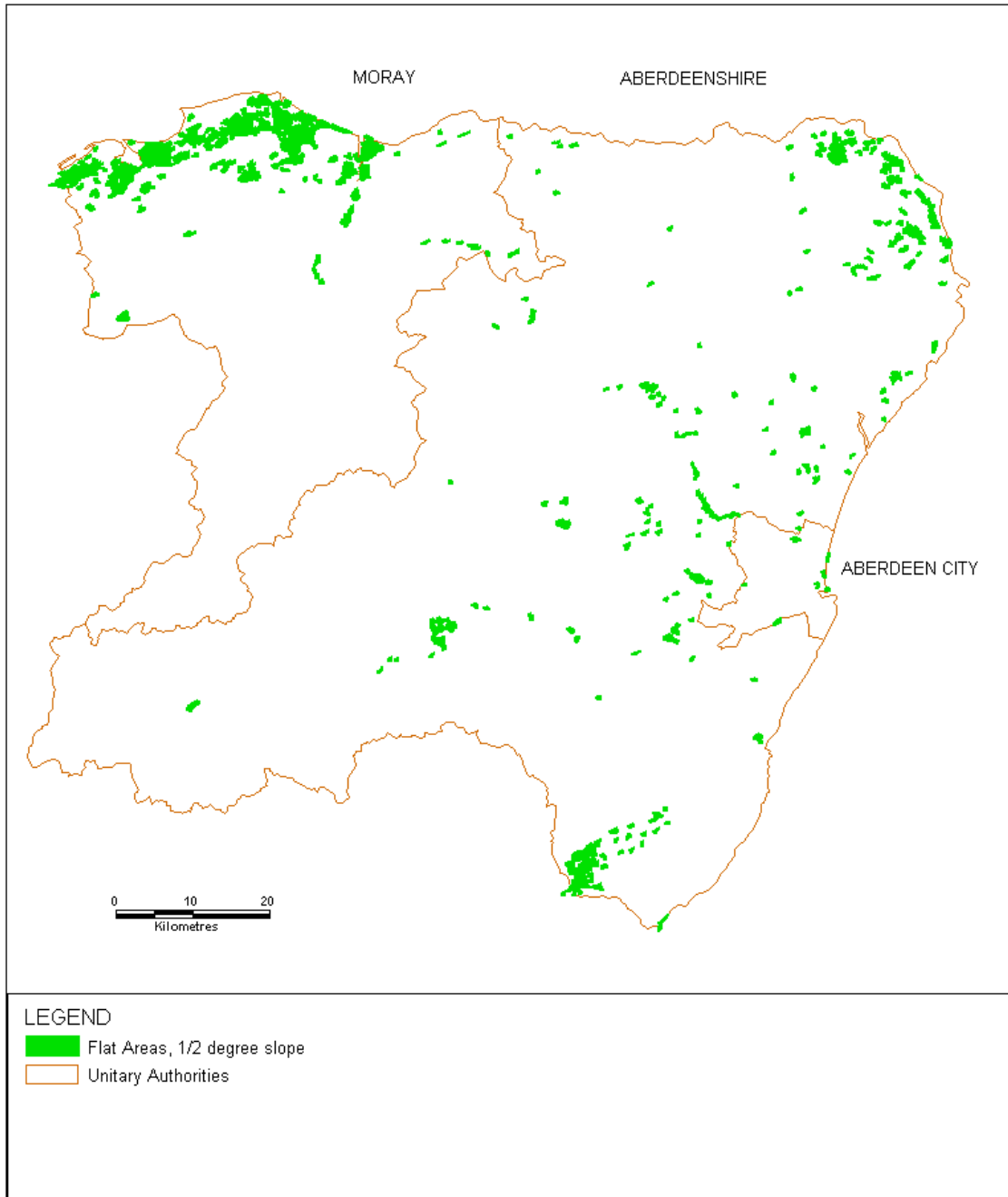
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When examined more critically, it was found that one degree slope produced too many areas to be utilised easily, thus half a degree of slope was preferred.

Map 24. Areas with half degree of slope and at least 10 ha in size (SEPA data)



SEPA FLAT AREAS >10 ha WITH 1/2 DEGREE OF SLOPE



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Within these areas, suitable grassland (including arable land) and forest plantation areas were identified, by visually assessing 1:25000 Ordnance Survey maps. Those areas crossed by ditches, streams, etc, were deemed suitable habitats. These sites were then examined for constraints and visited, in the same way as the previous habitats.

Although this method was deemed the most suitable, it was not without errors. It was found that some sites identified as being flat in this way, were topographically unsuitable when visited, and some of these areas crossed contours on the Ordnance Survey maps. This may be due to the 50m resolution of the original dataset, combined with the conversion of the data from height into slope (See discussion in Appendix 1 for full details).

However, this does not explain the fact that some flat areas had been missed, adjacent to some of these unsuitable sites. For this reason, areas were double-checked against the visually identified data, to minimise these errors. All potential sites need to be visited to pick out constraints, and any remaining errors should be picked up in the field.

3.3 Forest Wetlands

Introduction

Forest wetland is the term used here for areas created when plantations are cleared from suitable sites and the water table raised, by blocking drainage systems. This can allow natural reversion of an afforested wetland habitat, or the creation of new habitat, such as that undertaken at Culriach Wood, near Fochabers, illustrated below.

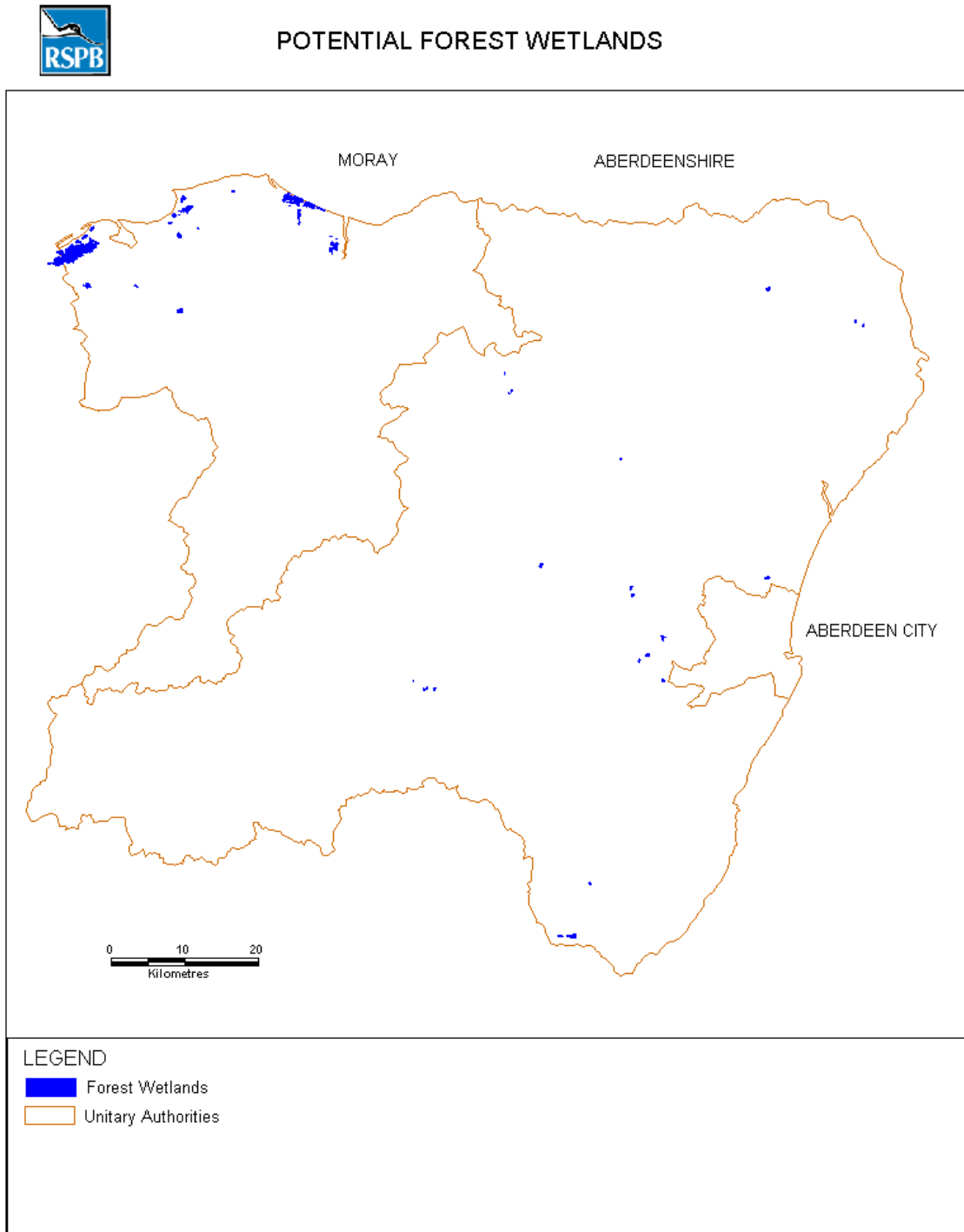


FCS information sign, Culriach Wood, Speyside. AMB 2007

Forestry Commission Scotland (FCS) is committed to increasing the area of native woodland and open habitats found within its estates (Pepper *et al.* 2006). Therefore, identifying potential forest wetlands on FCS estates is of particular value, since reluctance by land managers to create wetland habitat is a major constraint, and is beyond the scope of this project.

During this study, 1, 347 ha of potential forest wetlands were identified. Map 25 below shows the distribution of these.

Map 25. The distribution of potential forest wetlands in North East Scotland.



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The largest areas of forest were identified along the Moray coast, with many smaller stands throughout Aberdeenshire, reflected in the table below.

Table 8. Potential forest wetland restoration sites over 20 ha

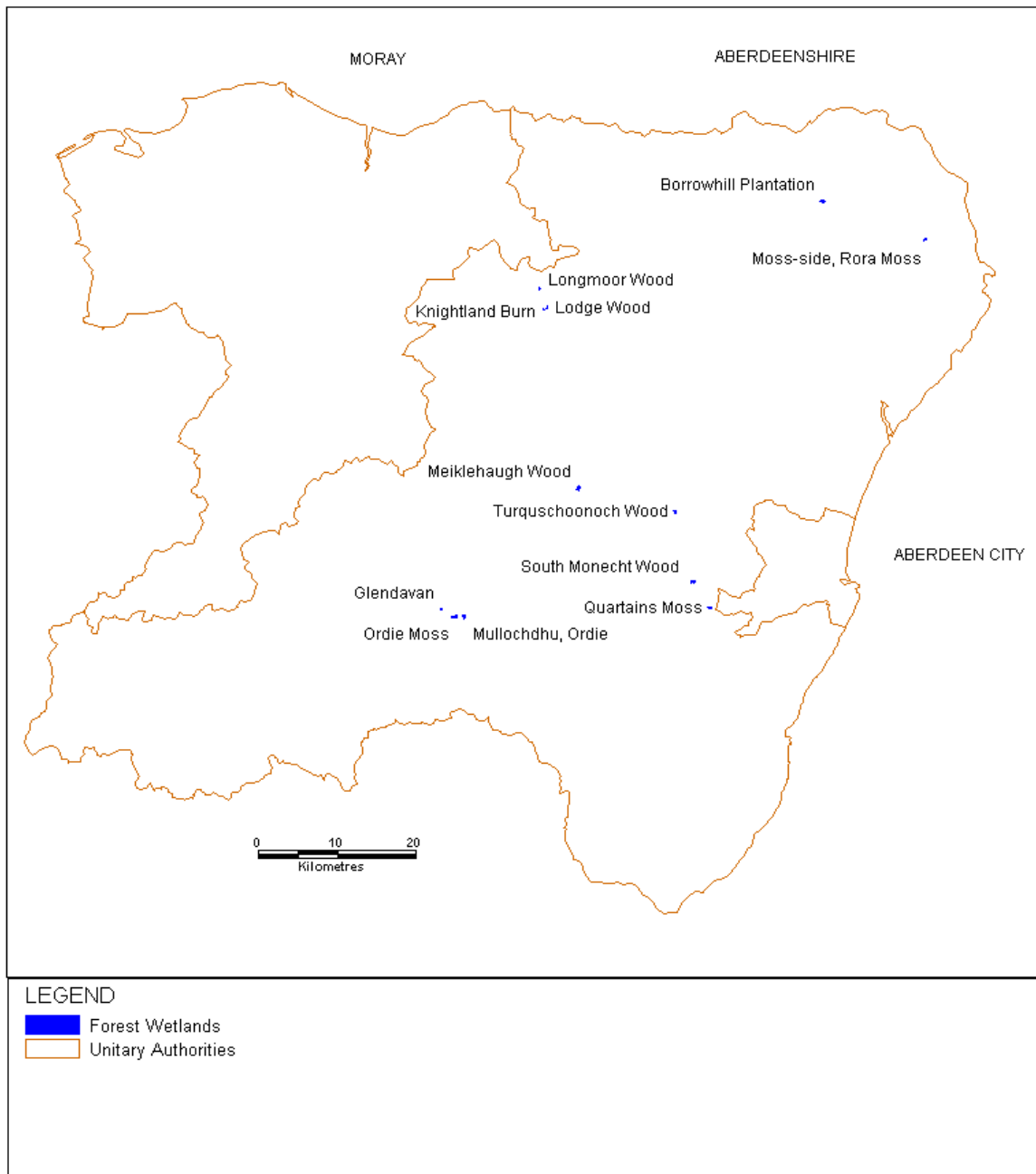
District	Site Name	Grid Reference	Area
Moray	Culbin Forest	NH935590	512.12
	Innes Links	NJ257676	130.10
	Culbin Forest Nature Reserve	NJ000616	31.71
	Innes House	NJ278656	29.65
	Muir of Stynie	NJ325617	27.62
	Innes Links	NJ288671	24.48
	Black Park	NJ111524	24.48
	Culbin Forest Nature Reserve	NH990618	24.24
	Roseisle Forest	NJ128665	23.74
	Innes Links	NJ261675	23.47
	Roseisle Forest	NJ119678	22.88
	Roseisle Forest	NJ114663	22.75
	Cloddymoss	NH970600	22.73
	Coltfield	NJ114629	22.73
	Innes Links	NJ290675	22.61
Muir of Stynie	NJ328612	21.58	
Aberdeenshire	Inverury Wood	NO649670	32.28

Unfortunately, the sites found on the Moray coast were within 13 km of the two RAF airfields, and were therefore discounted. The largest site in Aberdeenshire was visited and found to have unsuitable topography. Map 26 below shows the distribution of potential forest wetlands with no identified major constraints.

Map 26. Potential forest wetlands with no identified major constraints.



DISTRIBUTION OF FOREST WETLANDS WITH NO MAJOR CONSTRAINTS



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Eleven sites remained when those with major constraints were filtered out, covering an area of 73 ha. Of these, three sites were adjacent to known wetland habitats. The table below gives the areas of these forests.

Table 9. Potential forest wetland sites with no major constraints.

Site Name	Forest Area	Current Wetland Area	Expanded Area	Minor Constraints
Ordie Moss	11.17	23.11	34.28	1
South Monecht Wood	10.13	0.00	10.13	0
Borrowhill Plantation	9.66	211.30	220.96	0
Meiklehaugh Wood	8.48	0.00	8.48	0
Quartains Moss	7.66	0.00	7.66	0
Mullochdhu, Black Moss	6.65	83.31	89.96	1
Turquschoonoch Wood	5.34	0.00	5.34	0
Lodge Wood	4.71	0.00	4.71	0
Moss-side, Rora Moss	4.38	0.00	4.38	1
Knightland Burn	1.81	0.00	1.81	0
Longmoor Wood	1.43	0.00	1.43	0
Glendavan	1.42	0.00	1.42	1

Many of the remaining identified sites appear to be very small, but will need visiting to verify their potential size, as well as any constraints. Details of visited sites are given below.

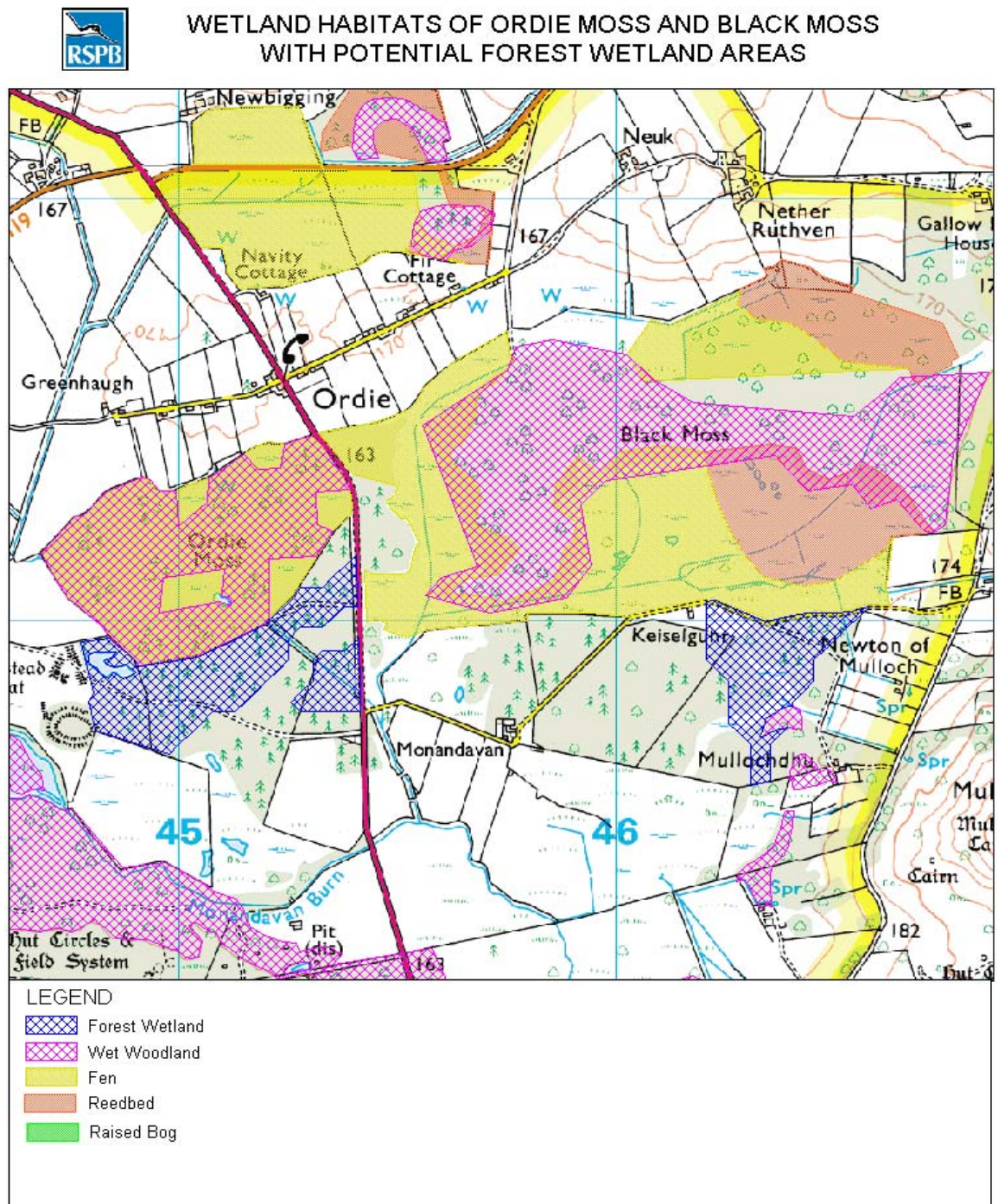
Accounts of sites with potential for forest wetland creation

Ordie Moss and Mullochdu

Ordie Moss and Mullochdu have been identified as expansion areas for Ordie Moss and Black Moss wetlands, respectively. The existing wetlands are designated SSSI and SAC. Although the forest area of Mullochdu outside these designations, the forest area of Ordie Moss is within the SSSI boundary. The sites are within 13 km of an unprotected airfield and this is the only identified constraint.

Map 27 below shows the existing habitats and potential forest wetlands.

Map 27. Habitats and potential forest wetlands at Ordie Moss and Mullochdu, Black Moss

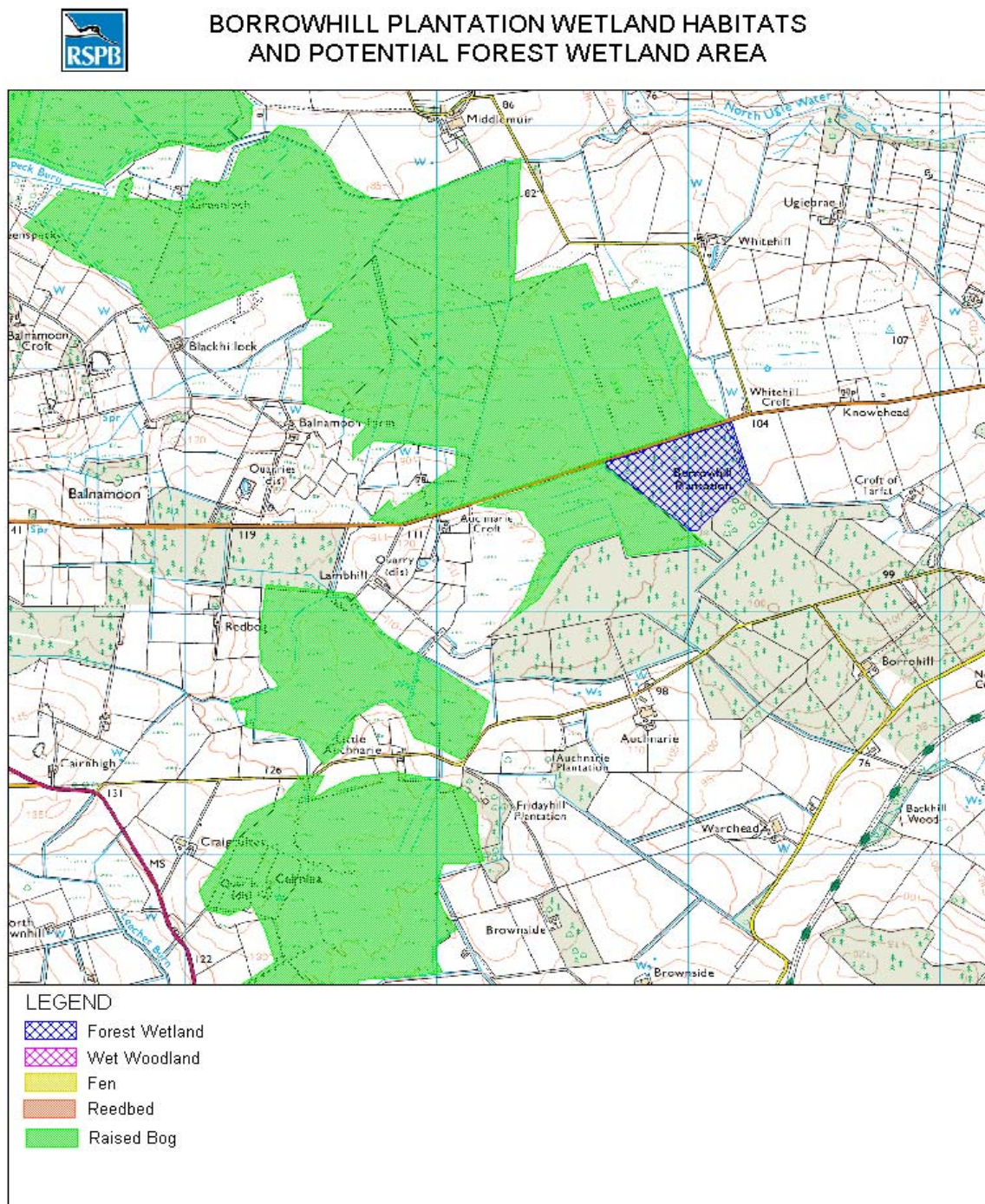


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Borrowhill Plantation

Borrowhill plantation is surrounded by over 200 ha of bog habitat, which is illustrated in Map 28 below. The area also contains other areas of bog habitat nearby.

Map 28.



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Borrowhill Plantation. AMB 2007

The photograph above shows the edge of the plantation surrounded by rush habitat, indicating the site has great potential as a wetland habitat. Behind this plantation is another, which may also be potential wetland.

Below, the photograph shows the adjacent land, on which peat has been cut.



Peat cutting at edge of Borrowhill Plantation. AMB 2007

Below, the photograph illustrates an undisturbed part of the bog, opposite the plantation.

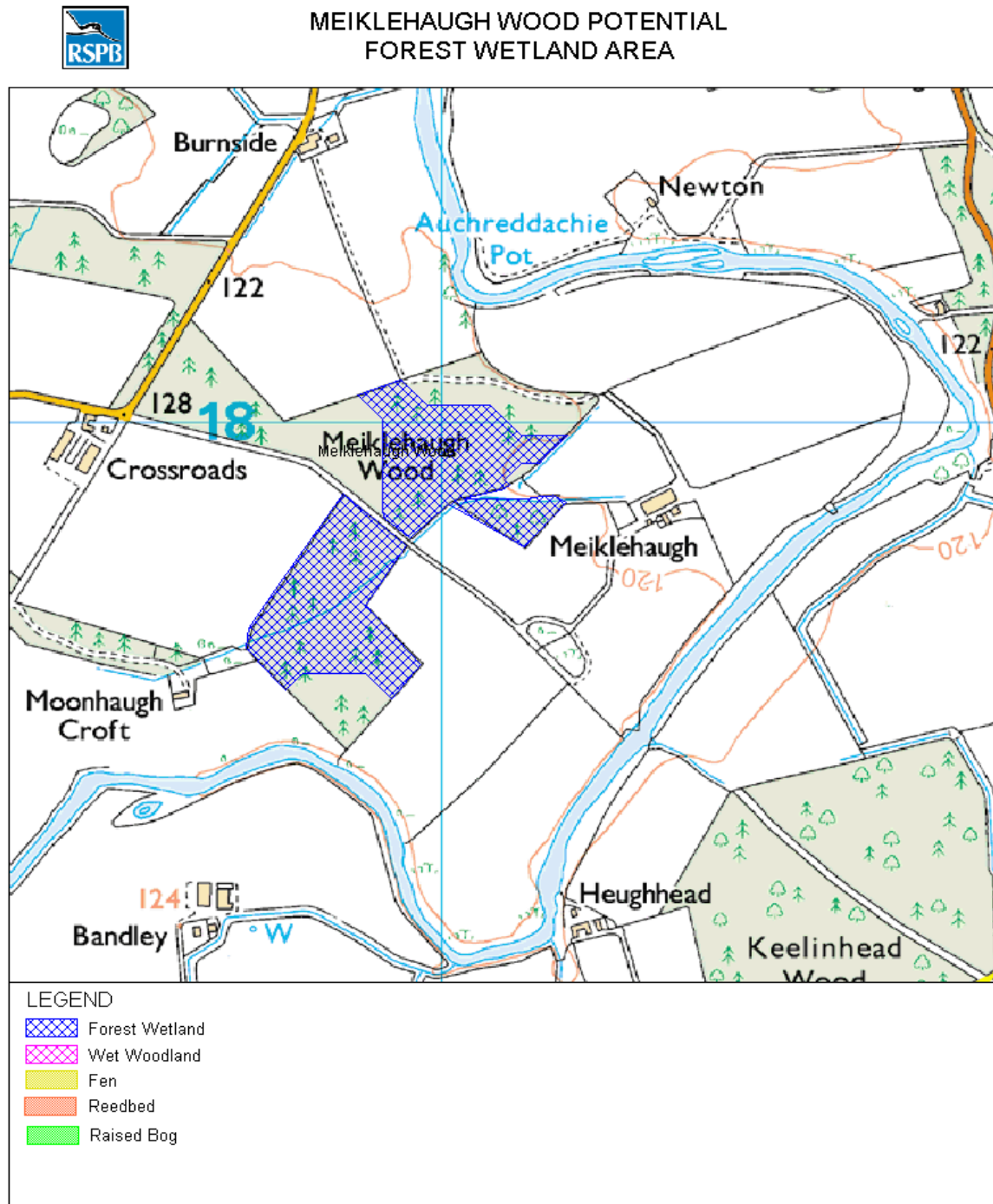


Raised Bog opposite Borrowhill Plantation. AMB 2007

Clearly, this site shows great potential. The forest itself is a fair size and it could help to restore and expand the important bog habitat surrounding it, or perhaps add diversity by the creation of a fen.

Meiklehaugh Wood

Map 29 below shows the potential forest wetland extent of Meiklehaugh Wood.



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The identified site lies either side of a track, which is higher than the forest, and has ditches along both sides. When visited, it was found that the trees had recently been felled. No constraints were identified, and it was thought the expanse was greater than that indicated by the map. Further investigation will be required to fully determine the site's potential. The photograph below shows the current habitat at the site.



Meiklehaugh potential forest wetland. AMB 2007

3.4 Wet Grassland

Low-lying wet grassland allows the further creation of habitats such as reedbed and wet woodland, but is also important in its own right, for example as habitat for breeding waders. The photographs below illustrate the potential of a wet grassland site, which was created recently at a sewage treatment works near Tarland.



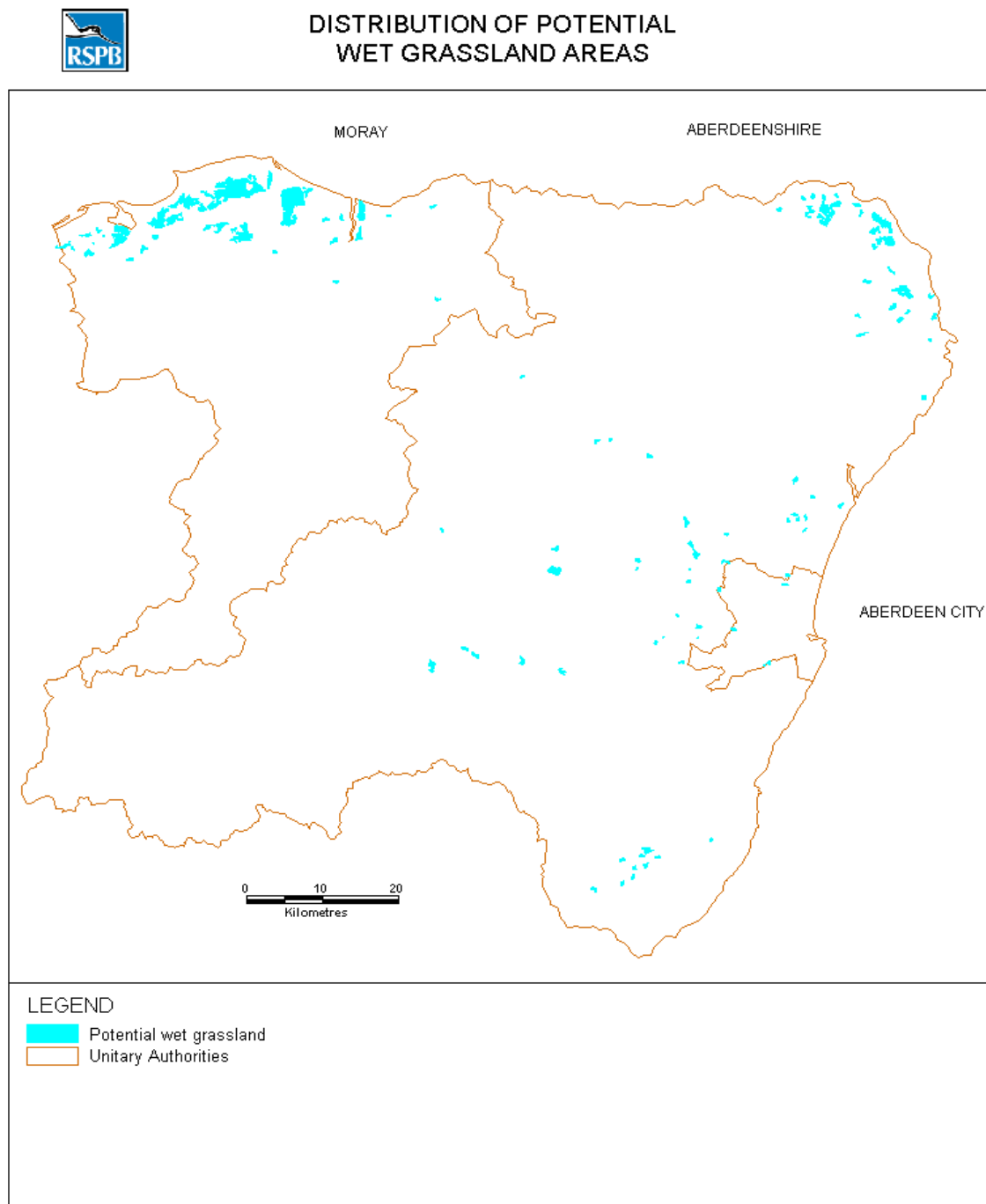
Tarland Burn wastewater treatment wet grassland. AMB 2007



Information sign for Tarland Burn wet grassland. AMB 2007

Over 5, 000 hectares of potential wet grassland was identified during this study. Map 30 below shows the distribution of these sites. Concentrations of potential habitat are found on the Moray coast and the north east coast of Aberdeenshire.

Map 30.



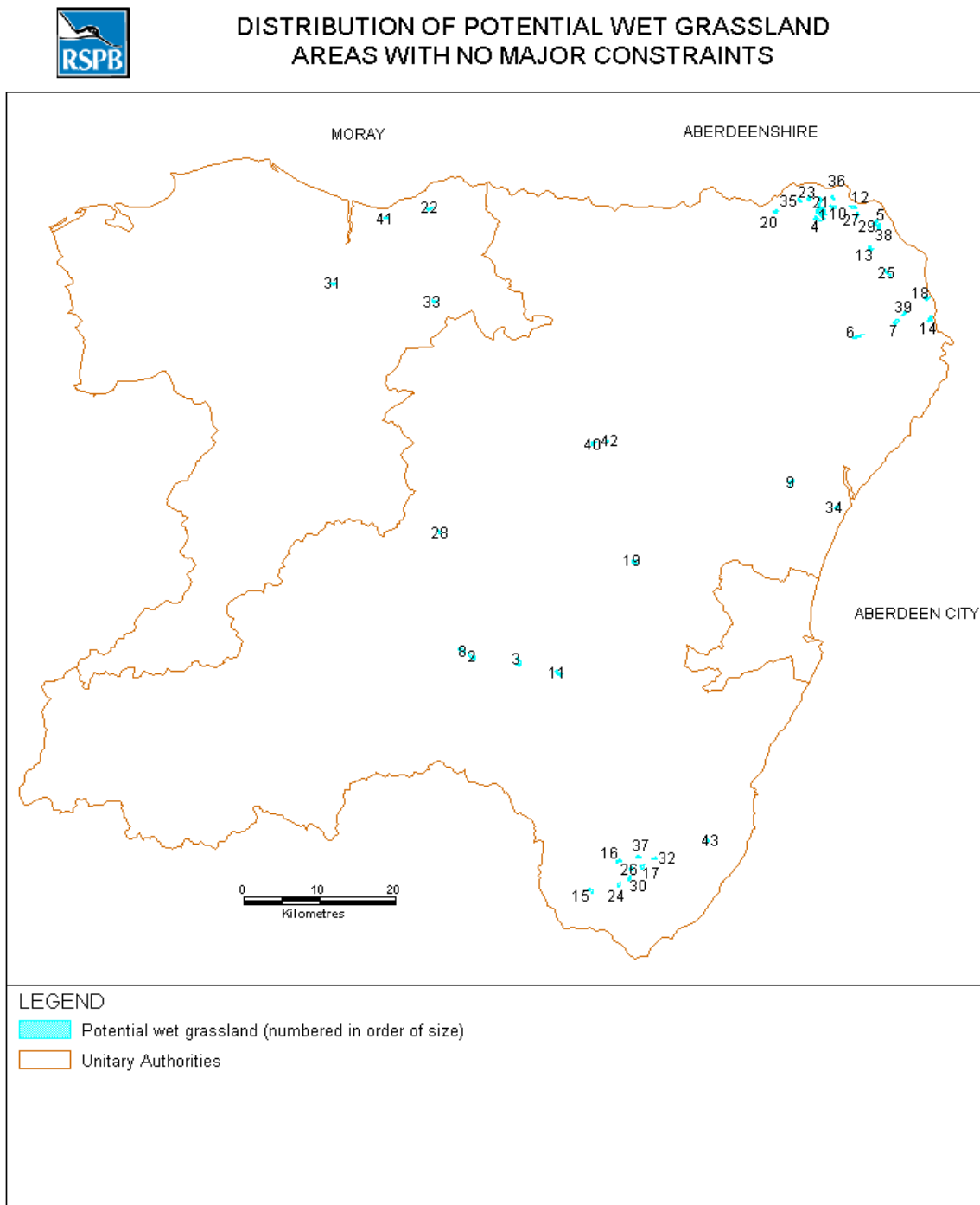
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Table 10. The largest areas of potential wet grassland, over 50 ha

District	Site Name	Grid Reference	X	Y	Area
Moray	Duffus	NJ188668	318753	866831	715.87
	Milltown Airfield	NJ263652	326298	865156	617.30
	Kilcluan	NJ258628	325799	862777	160.43
	Bogmoor, Spey Bay	NJ353636	335296	863631	121.14
	Middlefield	NJ025606	302506	860606	84.16
	Woodside Farm, Kinloss	NJ077622	307745	862240	79.25
	Bruntland	NJ128652	312752	865158	71.15
	Greenside, Spynie	NJ233658	323305	868531	66.67
	Miltonhill	NJ097626	309656	862556	62.23
	Gilston	NJ202664	320206	866356	53.79
	Earnside	NJ097619	309656	861856	52.62
	Warren Wood	NJ350602	335029	860171	50.02
Aberdeenshire	Mosstown, Strathbeg	NK034598	403409	859781	106.62
	Wester Cardno, Fraserburgh	NJ958638	395756	863856	92.91
	Whitehouse, Alford	NJ608147	360828	814681	92.10
	St. Fergus Moss	NK068531	406808	853081	81.45
	Corsekelly	NK041625	404056	862456	68.28
	Nethermill, Fraserburgh	NJ960624	396040	862431	53.08
	Kintore	NJ788181	378756	818082	51.12

From the table above, it can be seen that many large areas have been identified. Many of these sites were found to have major constraints, ruling them out from further consideration. Map 31 below shows the distribution of potential sites with no identified major constraints.

Map 31. The distribution of potential wet grassland habitat with no identified major constraints. Sites are numbered in order of their size.



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Although the identified areas are widely dispersed, six of the ten largest sites are found on the north east coast of Aberdeenshire. Table 11 below shows the areas of these sites. The ID numbers in the table correspond to those on the map.

Table 11. Potential wet grassland sites with no major constraints

ID	Site Name	Grass Area	Current Wetland Area	Expanded Area	Minor Constraints
1	Wester Cardno, Fraserburgh	92.91	0.00	92.91	1
2	Bog More, Tarland Burn	37.38	0.00	37.38	2
3	Auchlossan	35.99	0.00	35.99	1
4	Bodychell, Fraserburgh	28.02	0.00	28.02	1
5	Whitecairns	26.68	0.00	26.68	0
6	Auchtydonald	26.00	38.37	64.37	2
7	Haughs of Rora	23.55	1.33	24.88	1
8	Tarland Burn	23.53	0.00	23.53	1
9	Logierieve	22.16	0.00	22.16	0
10	Pitblae, Fraserburgh	20.04	0.00	20.04	2
11	Dubbieford	18.91	0.00	18.91	2
12	Kirktown	18.49	0.00	18.49	0
13	Crimonmogate	17.57	0.00	17.57	1
14	Lunderton	16.97	0.00	16.97	1
15	Gourdon	16.33	0.00	16.33	0
16	Howe of the Mearns	15.74	0.00	15.74	0
17	Conveth, Howe of the Mearns	15.42	0.00	15.42	0
18	Annachie Burn, St Fergus	15.23	0.00	15.23	1
19	Nether Coullie	15.11	0.00	15.11	0
20	New Aberdour	14.92	0.00	14.92	0
21	Percyhorner, Fraserburgh	14.23	0.00	14.23	0
22	Bogside, Moray	14.18	0.00	14.18	0
23	Knowehead	13.89	0.00	13.89	0
24	Blackiemuir, Laurencekirk	13.51	0.00	13.51	0
25	Moss-side, St. Fergus Moss	13.22	0.00	13.22	1
26	Wyndford, Howe of the Mearns	12.26	0.00	12.26	0
27	Water of Philorth	12.20	0.00	12.20	0
28	Muirend	12.14	0.00	12.14	0
29	Mosstown, Inverallochy	12.08	0.00	12.08	0
30	Haulkerton, Laurencekirk	11.99	1.64	13.63	0
31	St Mary's, Speyside, Moray	11.75	0.00	11.75	0
32	Fordoun	11.58	0.00	11.58	0
33	Montgrew, Moray	11.40	0.00	11.40	0
34	Pitscaff	11.25	0.00	11.25	0
35	Broadmoss, Fraserburgh	11.01	0.00	11.01	1
36	Merryhillock, Fraserburgh	10.93	0.00	10.93	0
37	Pittarrow, Howe of the Mearns	10.55	0.00	10.55	0
38	The Shieling, Inverallochy	10.55	0.00	10.55	0
39	Artlaw	10.41	0.00	10.41	2
40	Moss of Cairnhill	10.38	11.45	21.83	0
41	Core Burn, Moray	10.37	0.00	10.37	0
42	Moss of Rothmaise	10.15	9.21	19.36	0
43	Greendend	10.12	0.00	10.12	0

Many potential sites were identified. Details of the largest visited areas are presented below.

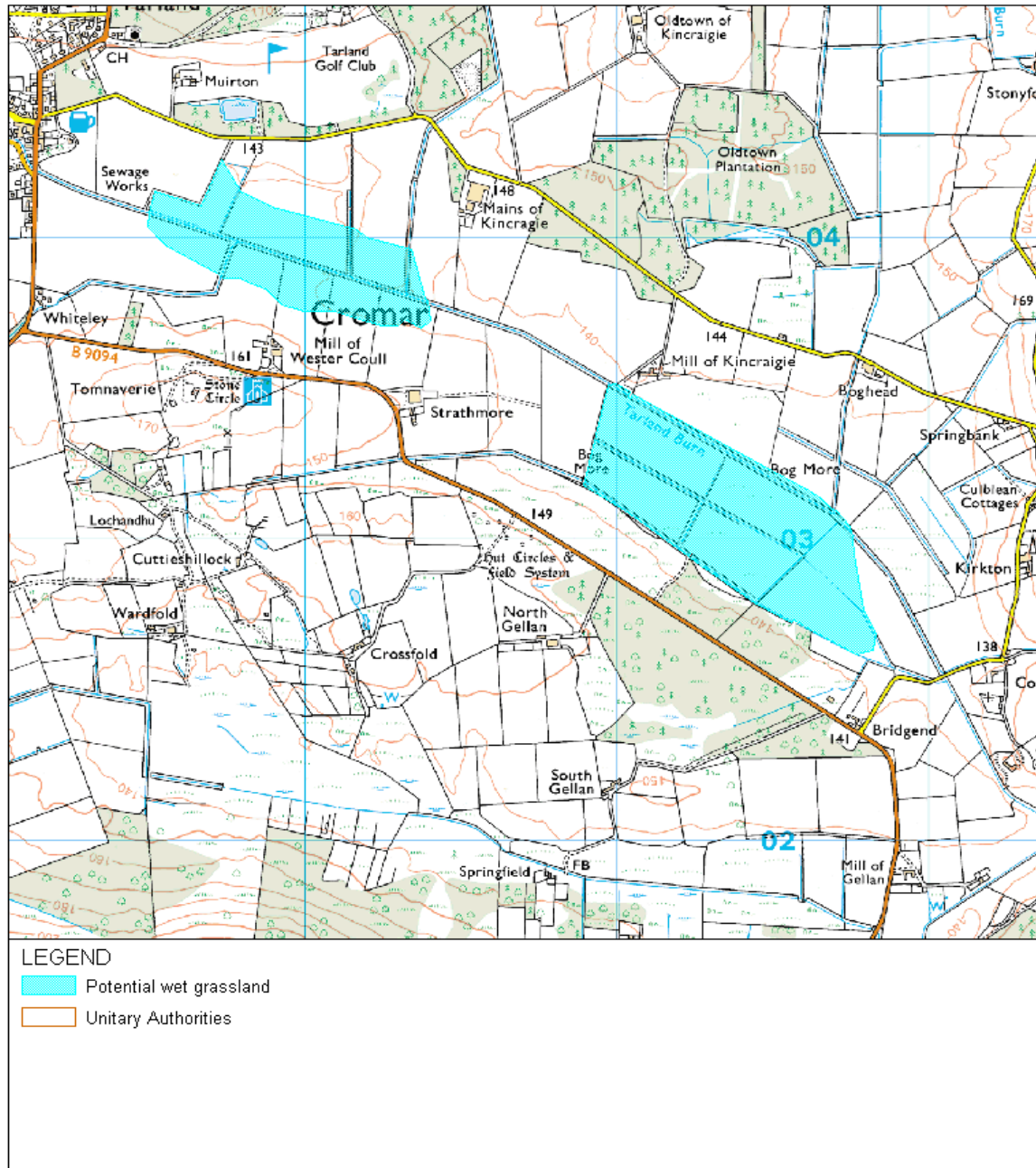
Accounts of sites with potential for wet grassland creation

Bog More and Tarland Burn

Map 32 showing Bog More (SE) and Tarland Burn (NW) candidate wet grassland sites



BOG MORE AND TARLAND BURN POTENTIAL WET GRASSLANDS



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These sites are situated to the north east of Muir of Dinnet. The Tarland Burn itself is part of the River Dee SAC. The surrounding land is not designated.

The Tarland Burn site contains the wastewater treatment site, where an area of wet grassland was recently created. The map above shows the potential for expansion of this site into the surrounding flat land. Although Bog More is a separate flat area, the sites are relatively close together, with the potential to create a combined wetland habitat of over sixty hectares. Below, the photograph shows the flat land at Bog More.



Bog More potential wet grassland, Tarland Burn. AMB 2007

This was the largest verified area of potential wet grassland identified, estimated to be over 37 ha. There were two minor constraints at the site: power lines, which can be seen in the photograph, and the area is within 13 km of an unprotected airfield.

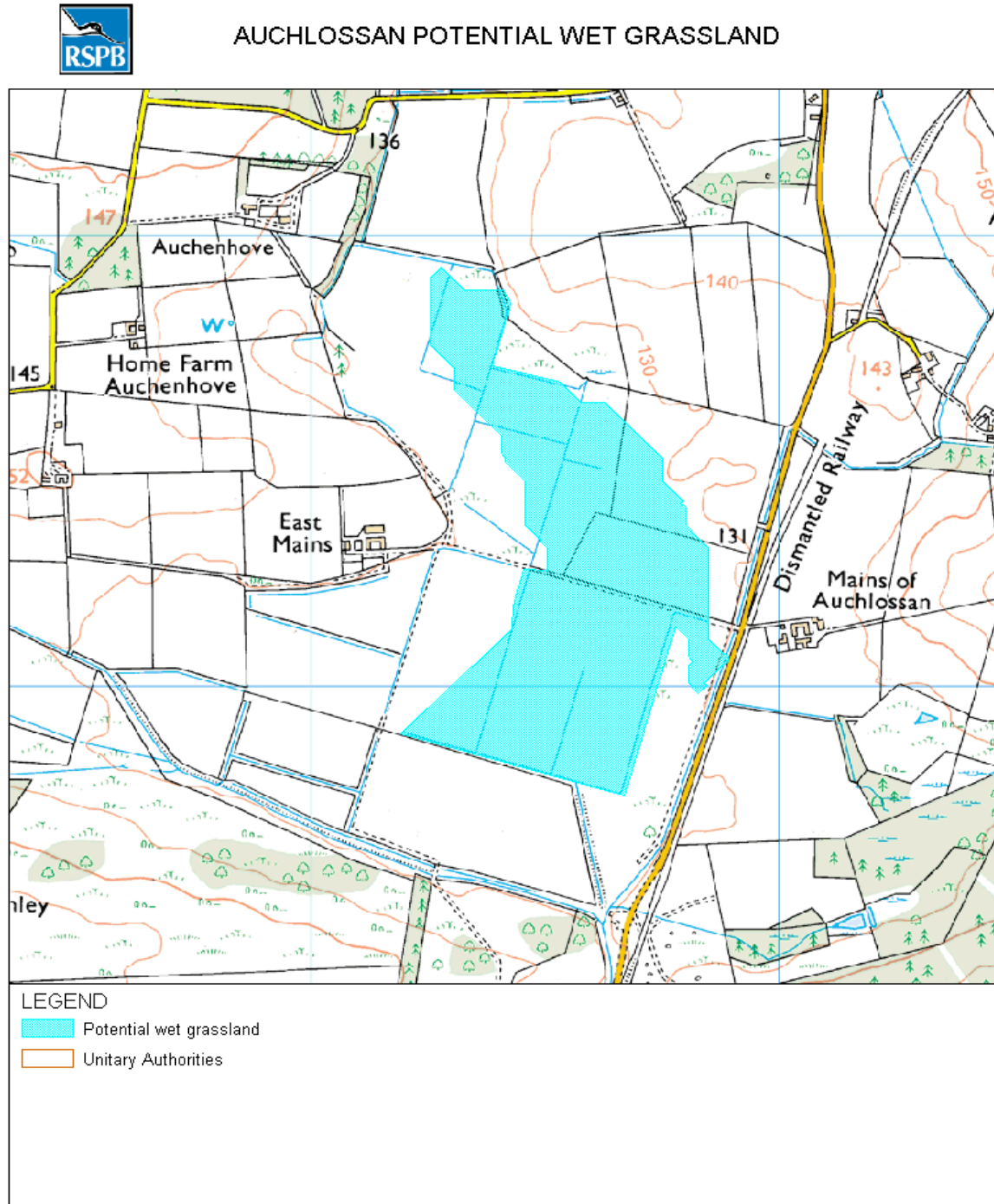
The photograph below shows the Tarland Burn site, with the previously created wet grassland to the left, above the ploughed field. It can be seen that there is great potential to expand this site. The area is within 13 km of an unprotected airfield, but had no other identified constraints.



Tarland Burn, showing wastewater treatment wet grass and potential expansion area. AMB 2007

Auchlossan

Map 33 showing Auchlossan candidate wet grassland site.



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Auchlossan lies 6 km west of Tarland Burn and has no designations. The area is within 13 km of Dinnet Gliding Club, an unprotected airfield, which is the only identified constraint. The photograph below shows the layout of the site, much of it holding water.



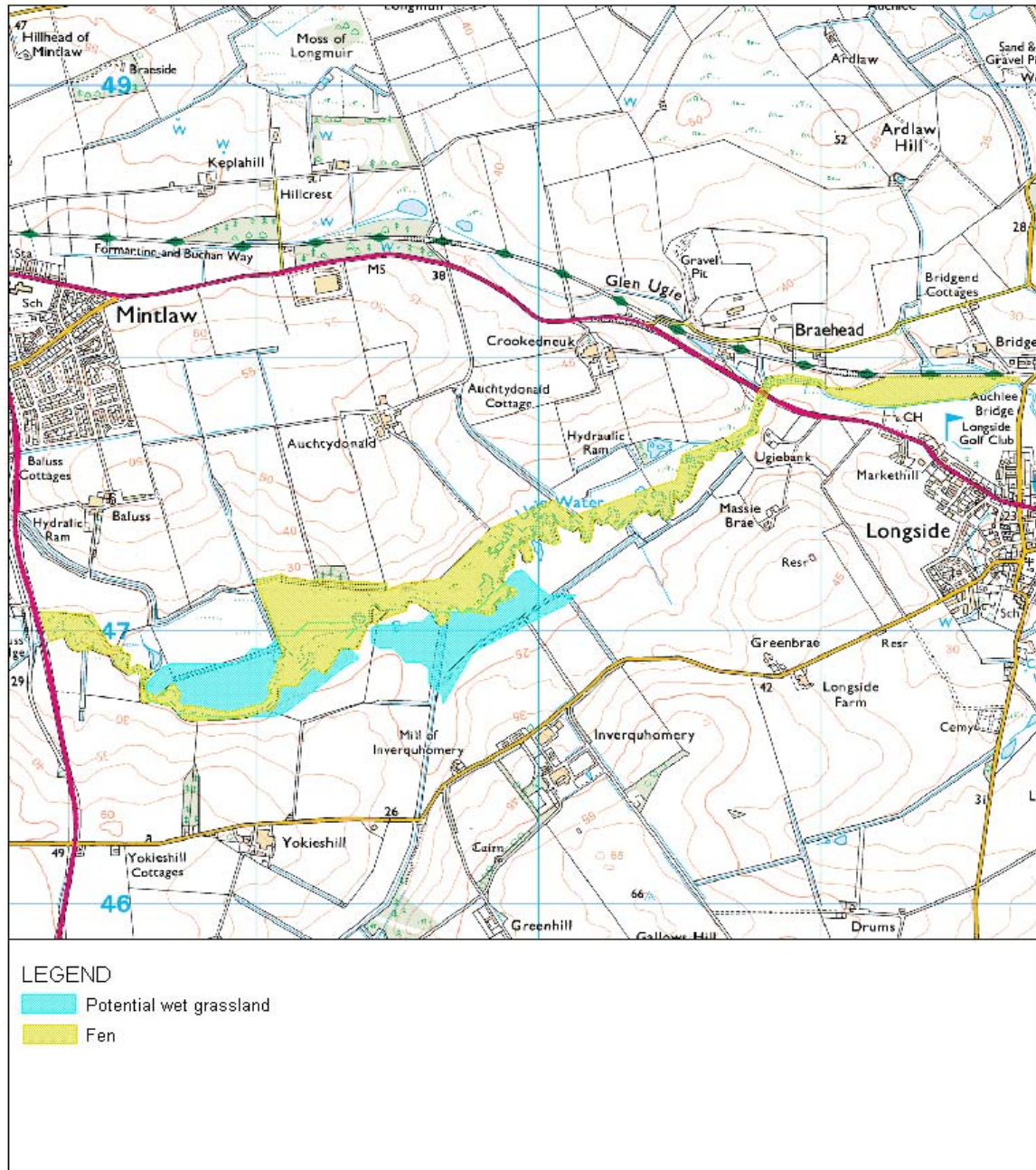
Auchlossan potential wet grassland. AMB 2006

Auchtydonald

Map 34 showing Auchtydonald fen and potential wet grassland



AUCHTYDONALD POTENTIAL WET GRASSLAND



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Auchtydonald was identified while investigating a potential fen expansion area. It will require a more detailed visit to determine its potential. The site has two identified minor constraints: it is located within 13 km of an unprotected airfield, and there are breeding corn buntings on the farm. There are no designations, and part of the fen is under RSS wetland management option.

Haughs of Rora

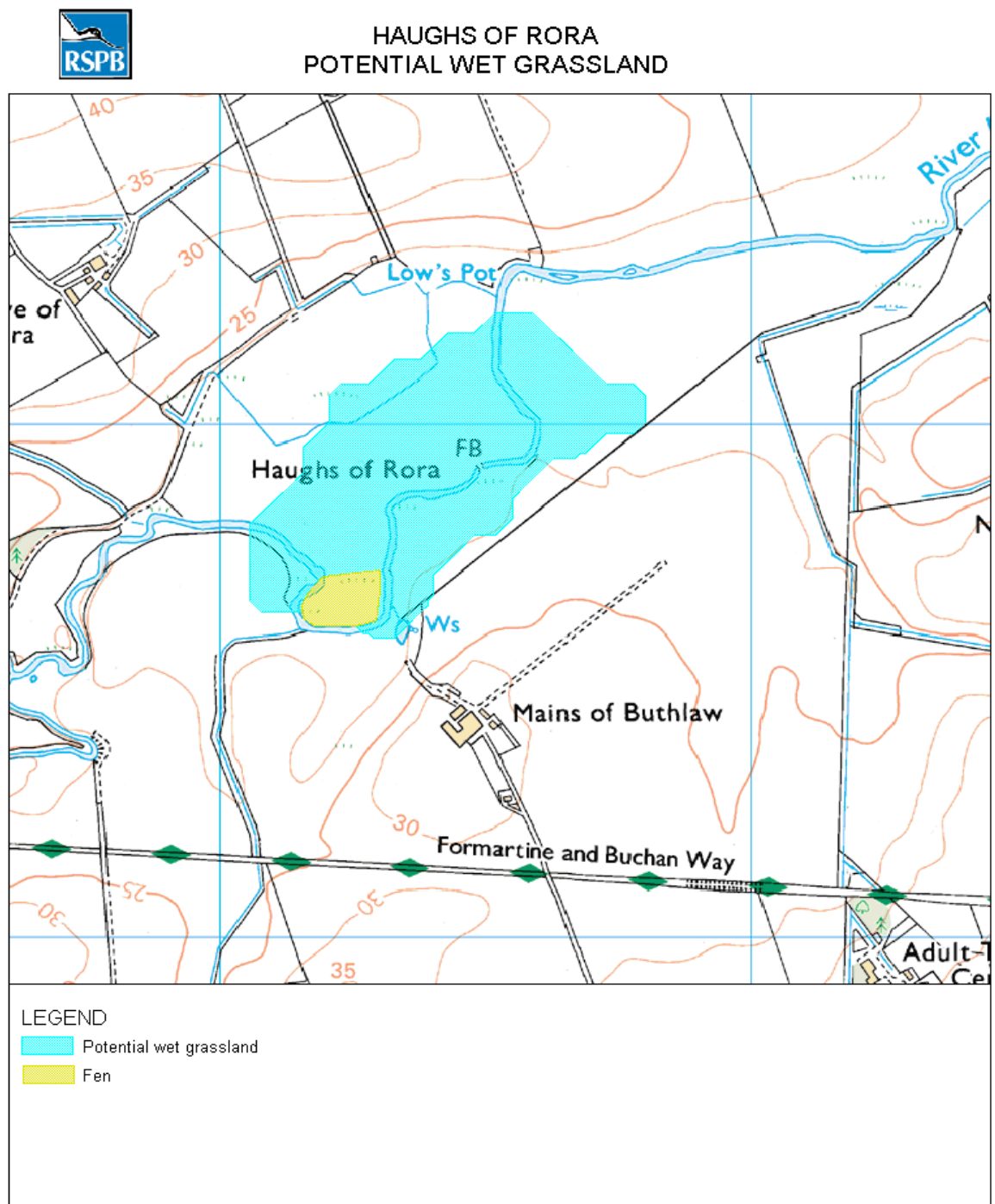
This is another site containing an area of fen habitat, covering less than 2 ha. The site is located on the River Ugie and has no designations. There is one identified minor constraint, the site being within 13 km of an unprotected airfield. The photograph below shows the potential of the site for restoration of wetland habitat.



Haughs of Rora fen and potential wet grassland. AMB 2007

Map 35 below shows this habitat and the identified potential wet grassland surrounding it.

Map 34. Haughs of Rora fen and potential wet grassland habitats.



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4. General conclusions

Map 36 below shows the distribution of all identified lowland wetland habitats (below 350m) in the region, including raised bogs (not considered in this inventory). The majority of these can be found in north east Aberdeenshire, whilst most wet woodland occurs along the edges of the Rivers Spey and Dee.

This study has found that the region supports a total of approximately 6040 hectares of lowland wetland habitats, comprising 2,850 ha of bog, 900 ha of fen, 153 ha of reedbed and 730 unclassified wetlands (probably mostly fens). A total of 1490 ha of wet woodland was also recorded, with 80 ha of this overlapping with the field layer habitats above.

Some of the larger sites were highlighted for expansion of a number of different habitats, for example Loch of Strathbeg, Wartle Moss, and Black Moss. This indicates the importance of these diverse areas, and the potential to extend some already large sites.

Map 37 below shows sites considered to have the greatest potential for wetland expansion and creation. Since many sites could not be visited during this study, there are many areas, particularly unclassified wetlands and potential wet grassland, which may possess major constraints, and will therefore be discounted upon detailed investigation. Nevertheless, this assessment provides the first indication of where action targeted towards achievement of habitat action plan objectives could be directed.

It was found that Aberdeen City holds no potential for significant wetland expansion or creation; the presence of the protected major airport at Dyce discounted almost the entire region from consideration, if any restoration or creation works involve planning permissions. This was also the case in much of Moray, due to the presence of the RAF bases at Lossiemouth and Kinloss, although a few unvisited sites are highlighted in the north east area.

This project represents a preliminary study of potential wetland habitats, to prioritise sites for further investigation. Many constraints were outside the scope of the project, and in particular, no approaches were made to landowners, since this would have been premature for a study such as this, with a primary purpose of identifying sites for future investigation.

The information collated and analysed in this study has been used as a basis for drafting an action plan for wetlands in North East Scotland, under the auspices of the North East Scotland Local Biodiversity Action Plan. That plan will be developed separately and will form part of the overall suite of action plans for the area, in support of the Scottish Biodiversity Strategy.

5. Acknowledgements

This study was funded by SEPA, SNH, Aberdeenshire Council and the North East Scotland LBAP; Justin Prigmore (LBAP Officer until 2006) played an important part in initiating the work. Thanks to Dominic Habron of SEPA, for providing the original digital topographic data and to Lucy Arnold and Paul Britten at RSPB Data Unit, for converting this data into a useable form, and their guidance on GIS matters throughout the study. We are grateful too to Judith Cox (Aberdeenshire Council) and Ewan Lawrie (SNH) for their help.

The following individuals contributed habitat data for inclusion in this report: Nick Littlewood and Iain Lawrie (NESBReC) and Mike Smedley (SNH).

Thanks to Andy Tharme (Scottish Borders Council) for providing a copy of Borders Wetland Vision. Thanks to Anne Porteous, Jane Nightingale and RSPB volunteers for carrying out the groundwork for this study. Also to Dominic Funnell and Simon Busuttil (RSPB), for information on Loch of Strathbeg, and to Allan Perkins (RSPB) for details of nesting corn buntings in potential wet grassland areas.

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Appendix 1

Geographic Information Systems Technical Report for the North East Scotland Wetlands Project

Lucy Arnold (RSPB, Sandy)

Objective

To ascertain the areas within the Grampian region that are suitable for creation of wetlands. The criteria to determine this were the slope and height above sea level. Sites were then ranked based on the size of contiguous area.

Datasets

Name	Description	Format	Source	Restrictions	Date
Landform Panorma DTM	Height data for the NE area of Scotland	Raster ESRI grid with a resolution of 50 metres	Scottish Environmental Protection Agency (SEPA)	Unknown, presumed single project licence only	Survey date 1988
Scotland Coastline	High water mark of the Scottish coastline	MapInfo Vector Polyline	Ordnance Survey Great Britain	None	May 2006

Software

ArcGIS Desktop 9.0
MapInfo 6.0 and 7.8
MapInfo Vertical Mapper

Methodology

Preparation of the Data

The Landform Panorama DTM data was obtained from SEPA in the ESRI grid format. In order to analyse the data it was first converted to allow it to be opened in MapInfo Vertical Mapper. This was achieved by conversion of the ESRI grid from Raster to ASCII using ArcGIS 9.0. The ASCII file was then imported into MapInfo using the import grid option in Vertical Mapper, setting the projection to British National Grid and the units to metres.

The Scottish coastline was converted from a polyline to a polygon by creation of a new polygon dataset and then tracing round the polyline boundary using the bulk snapping feature. This method was used rather than straight conversion as errors occurred with the conversion of polyline to polygon that prevented its successful completion.

Selection of flat areas below 350m

Suitable areas for re-creation of wetland were defined as those areas below 350m with a slope of either 1 degree or 0.5 degrees. A summary of the steps taken in this procedure is detailed in Figure 1.

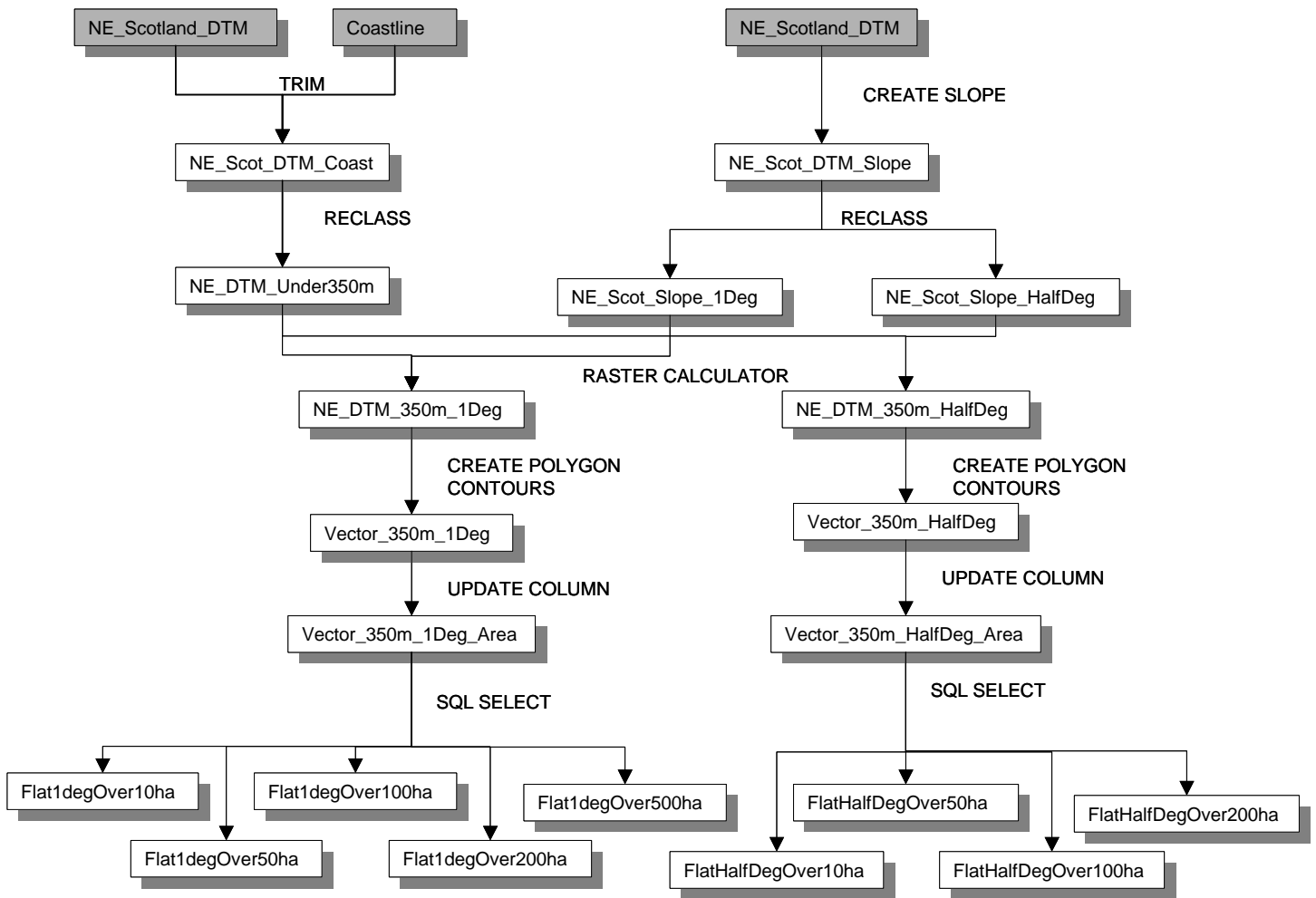
The first stage was to clip the DTM to the coastline. This was performed as the significant parts of the sea were included in the DTM and, due to their inherently flat

nature, would be included in the resultant output. This was achieved by using the Trim option in Vertical Mapper, the result output is the DTM that includes only those area of “land” above the high water mark. This dataset was then reclassified such that all values below 350 were assigned the value one. This effectively cuts out all higher altitude areas and prepares the dataset for the overlay using the raster calculator at the next stage.

The next stage was the conversion of the DTM height data to slope data. Create slope was used for this conversion, choosing the option for the output to be expressed in degrees. Two reclassification were then performed on this resultant slope dataset; one for areas with a slope of 1 degree or lower (assigned the value one) and one for areas with a slope of 0.5 degrees or lower (assigned the value 0.5). The raster calculator was used to multiply the land under 350m dataset gained in the first stage with each of the slope datasets.

The final stage was the calculation of the contiguous area of the patches of flat land and selection of the largest one. Both the resultant datasets from the previous stage were converted to vector data with the use of the create polygon contours option. A new field called Area of data type float was added and the Area updated as the spherical area calculated in hectares. SQL select was then used to create separate datasets for those sites with 10ha or above, 50ha or above, 100ha or above and 200ha or above. In addition a selection of 500ha or above for the dataset based on a one degree slope was also performed. Each of the selections were saved as a new dataset.

Summary of selection of flat areas below 350m



Discussion

Sources of Error

In common with all GIS analysis, the greater the number of steps undertaken, in any analysis, the more likely that any unknown errors may creep into the resultant data. Translation to and from different formats was an unfortunate but necessary step as the Landform Panorama DTM data was only available in ESRI grid raster format and this needed to be translated into a format that MapInfo Vertical Mapper could read. Care was taken, therefore to minimise the number of steps in the rest of the process, thus reducing the effect of this phenomenon.

There were, unfortunately, difficulties arising from the Scottish coastline high water mark polyline. Due, most likely, to the complexity of this dataset a straight conversion from polyline to polygon was not possible and as such a completely new polygon dataset had to be created that traced the polyline coastline. This is not the most accurate solution, but it is unlikely to have had a major effect on the overall accuracy of the resultant datasets, and indeed can only potentially effect the accuracy of those sites on the coast.

Whilst temporal discrepancies would normally be of concern it is unlikely that the difference in the dates between the two dataset used is a cause of concern due to the relatively unchanging nature of this type of data.

The quoted accuracy of Landform panorama data is better than one half the interval range between the contours, which at 10m means that it is better than 5m. In addition, there are potentially errors that arise due to the resolution of the dataset of 50m. Conversion of the data from height to slope, which will account for distance between and difference in height, will, inevitably, compound any errors. The degree to which this has occurred is not known. This aside the application of this method, with these possibly inaccuracies, is perfectly acceptable as a first and region-wide analysis of the possible location of sites for creation of wetlands.

Recommendations

The main suggestion to improve the accuracy of the output of this analysis is to obtain height data of a greater accuracy than the 50m resolution offered by the Landform Panorama DTM data. As this data would be potentially very large for the whole Grampian area it is suggested that selection of a few sites is based on this first analysis and greater detailed analysis can be performed on those selected target areas with any more accurate data that is acquired.