SCOTTISH NATURAL HERITAGE

No 123 (Volume 2 of 3)

Sand dune vegetation survey of Scotland: Orkney
Volume 2: Site reports

T Dargie

1998

SCOTTISH NATURAL HERITAGE

Research, Survey and Monitoring

REPORT

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Sand dune vegetation survey of Scotland: Orkney
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T Dargie

1998

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The Sand Dune Vegetation Survey of Scotland has been in progress since 1994. The report on Orkney is part of a series of eight reports covering the whole coast of Scotland. It is split into three Volumes, as follows:

Volume 1: Main report
Volume 2: Site reports
Volume 3: NVC maps (These maps have been reduced to a scale of approximately 1:15,000 for production of this report. Sets of the original maps at 1:10,000 are located within the SNH Area Office in Shetland and the Maritime Group, Advisory Services).

In this report on Orkney, Rackwick has been spelt Rack Wick.

The complete series of reports for the Sand Dune Vegetation Survey of Scotland covers:

- Western Isles
- Orkney
- Shetland
- NW Scotland, mainland
- NE Scotland
- SE Scotland
- SW Scotland

Inner Hebrides

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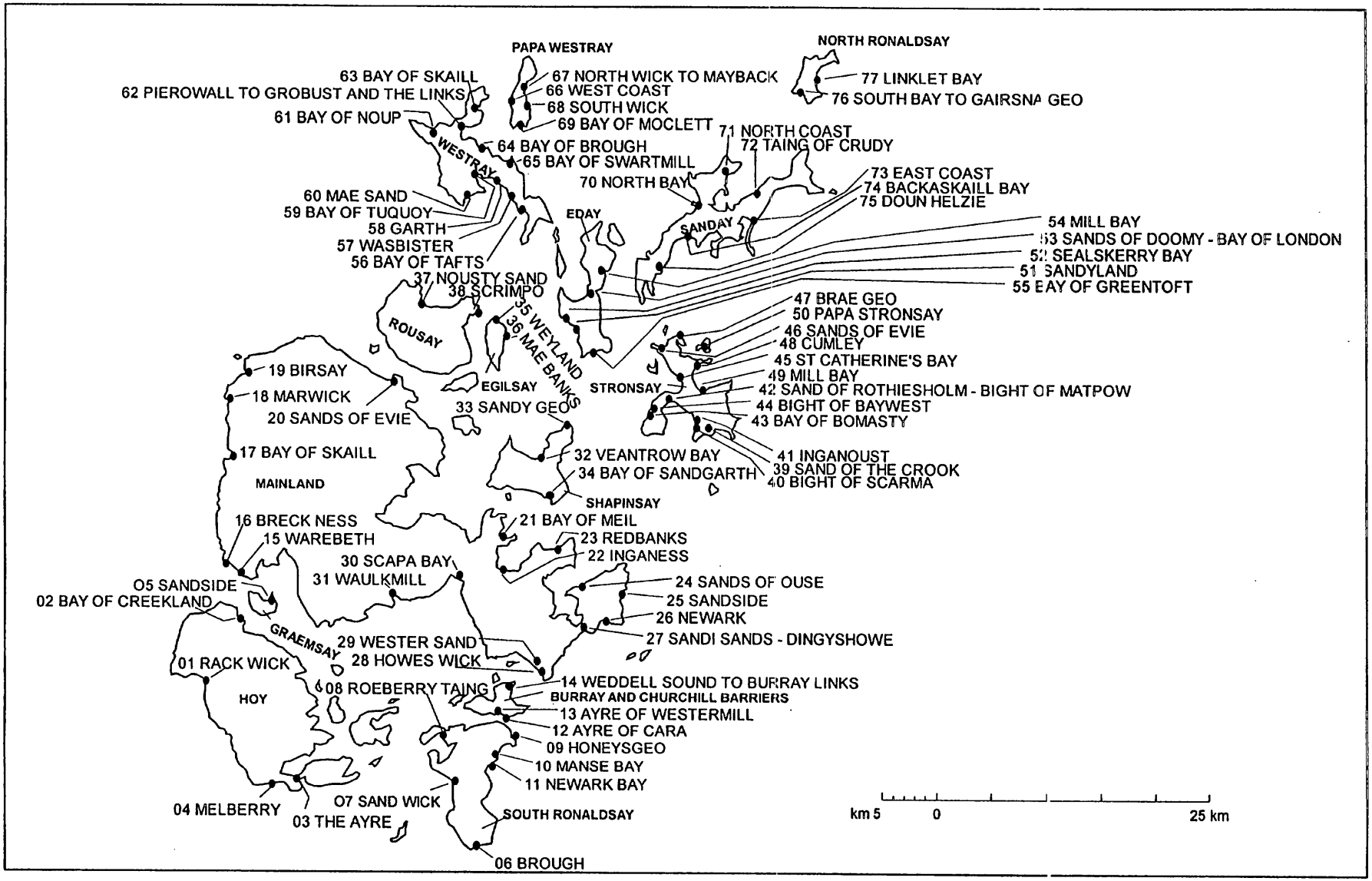
PREFACE

This volume covers the vegetation and other details of dune and links/machair sites in Orkney. A total of 77 site assemblages is covered (Map 1.1) and material is organised on the basis of island groupings of sites. Much information reported is derived from digital National Vegetation Classification (NVC) maps presented in Volume 3. A3 original maps at 1:10,000 scale are held in SNH Area Offices and Advisory Services (Edinburgh). A standard description format is used for each island grouping except for Graemsay which, with only one site, has the detail below in a different order.

Location and conservation status	Site assemblage names, grid references, location map; conservation status (SSSI, NSA - the only designations applicable to dune sites in Orkney) and boundaries of SSSIs superimposed on unlabelled NVC map boundaries
Previous surveys	Details on previous systematic studies of dune geomorphology or vegetation
Survey details	Date of survey, target note total, quadrat total, NVC map location.
Broad land cover	Area data (ha) for each site (Table 1) on beach extent, bare sand (within vegetated dune zone, excluding beach), vegetated sand, arable and fallow land, other land take, and total windblown sand extent (excluding and including the beach above MHWS). In addition, information on surveyed habitats not on blown sand is given. Each cell in Table 1 is based on GIS area data accurate to at least 10 decimal places, rounded to two decimal places. Rounding errors produce row totals which can differ very slightly from the sum of their constituent cells.
Dune habitats	Area (ha) data and shaded/hatched maps for each site (Table 2), covering a classification of dune habitats (see Volume 1, section 1.10). Each NVC polygon was allocated into one of twelve habitat classes, using a GIS to produce area data and habitat maps. Most maps are at 1:25,000 scale but large sites are occasionally at a slightly smaller scale. Scale is easily calculated from 1 km OS National Grid line spacing. Each cell in Table 2 is based on GIS area data accurate to at least 10 decimal places, rounded to two decimal places. Rounding errors produce column and row totals which can differ very slightly from the sum of their constituent cells.
Vegetation types	Area (ha) data and brief details of main NVC vegetation types present per island grouping of sites (Table 3). Each cell in Table 3 is based on GIS area data accurate to at least 10 decimal places, rounded to two decimal places. Rounding errors produce column and row totals which can differ very slightly from the sum of their constituent cells.
Site descriptions	Information on site location, dune types present, exposure, erosion or accretion of the coastal dune edge, major vegetation features and other significant detail (coastal protection, blowouts, tillage, stock and rabbit grazing, tipping, recreation impacts, etc.). Much of this detail is taken from target notes in Annex 2 of each island grouping. Dune management problems are discussed and an assessment of the nature conservation interest of site vegetation is made. This assessment does not use formal evaluation procedures (e.g. guidelines for selecting SSSIs), and is qualitative in character (based on size of site and vegetation diversity): very low, low, moderate, high, outstanding.
References	Listing of previous surveys
Annex 1 Target notes	Number, grid reference and detail collected when working across a site, plus map(s) of target note locations superimposed on unlabelled NVC vegetation polygon boundaries. Most maps are at 1:25,000 scale but large sites are occasionally at a slightly smaller scale. Scale is easily calculated from 1 km OS National Grid line spacing.
Annex 2 Quadrat data	Grid reference, structural information, and species details of 2m x 2m NVC quadrats used to identify or verify NVC types. For large collections, quadrats are aggregated into habitat groups (e.g. NVC mobile dune types). Maps of quadrat locations are given, superimposed on unlabelled NVC vegetation polygon boundaries. Most maps are at 1:25,000 scale but large sites are occasionally at a slightly smaller scale. Scale is easily calculated from 1 km OS National Grid line



Map 1.1 Location of dune and links/machair site assemblages in Orkney

1-4 HOY

Location and conservation status

Four areas of vegetated windblown sand are present:

01 Rack Wick	ND205987	02 Bay of Creekland	HY239040
03 The Ayre	ND288892	04 Melberry	ND265889

The locations of site assemblages are given in Map 1a-b.

No site is within an SSSI. Rack Wick and Bay of Creekland both fall within the Hoy and West Mainland Natural Scenic Area.

Previous surveys

Geomorphology Mather, Smith & Ritchie (1974)

Dune vegetation survey details

Date	September 1996
Target notes	22 (Annex 1)
Quadrats	2 (Annex 2) - recording effort curtailed by lack of time, concentrating on Hoy types which are uncommon in Orkney.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

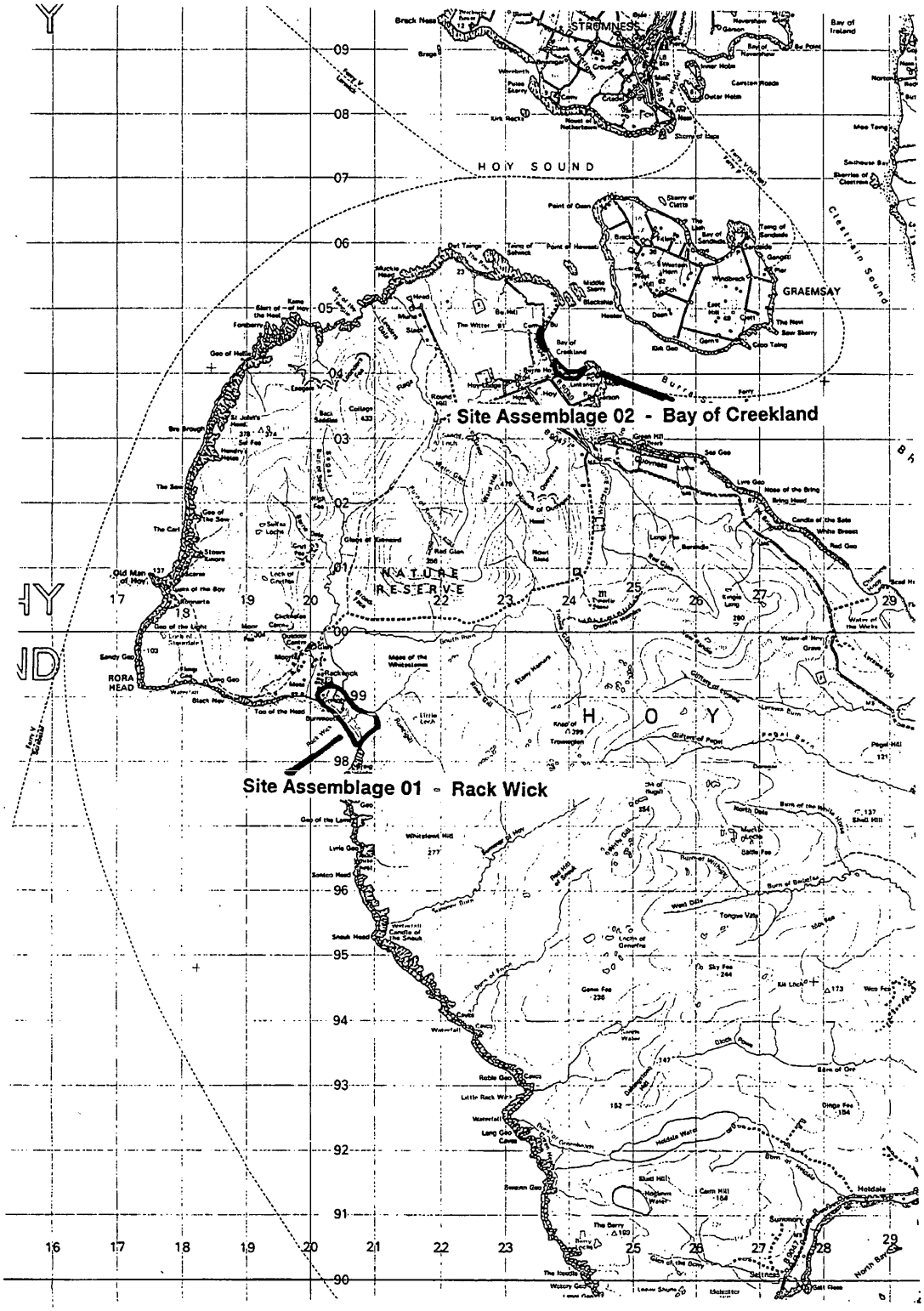
Broad land cover categories (Table 1)

Table 1 provides basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Rack Wick (16.9 ha) and Melberry (47.4 ha) are the largest sites in an island area of 70.6 ha of total windblown sand, excluding the beach zone (i.e. potential vegetated sand extent). Vegetated sand is dominant (61.9 ha), with modest amounts of bare sand, land take and arable/fallow ground.

Dune habitats (Table 2, Map 2a-c)

The total mapped area of Hoy (78.8 ha) is dominated by improved grassland (35.3 ha, 44.7% dune area). No other category approaches this extent, with only beach/strand (6.4 ha), dry dune heath (6.3 ha, all at Rack Wick), dune slack/wet grassland (6.2 ha) and other habitats (6.5 ha, mainly land take) exceeding 5 ha in extent.



Map 1a Site assemblage location: Rack Wick and Bay of Creekland, Hoy
See Volume 3 for NVC maps

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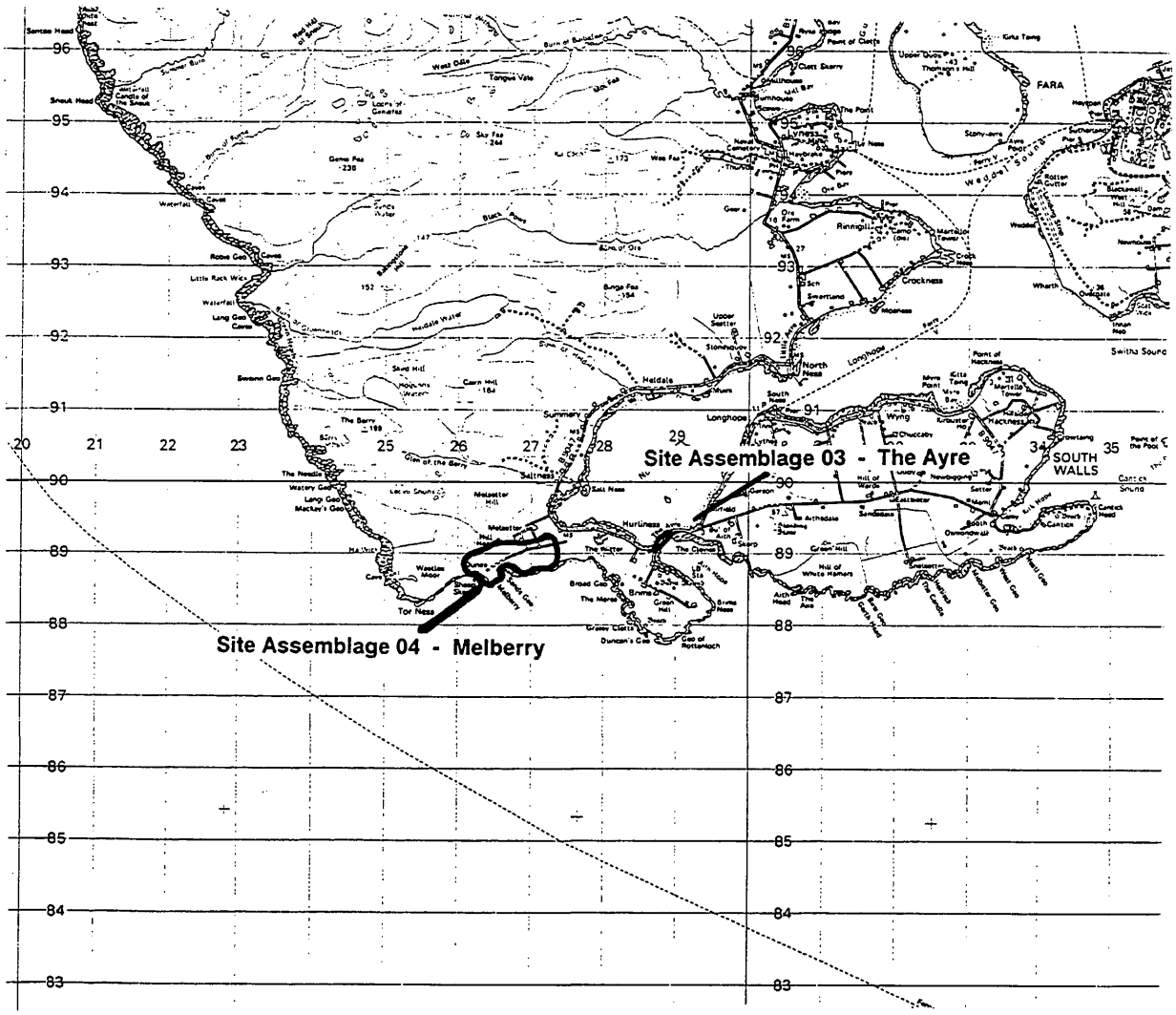

Map 1b Site assemblage location: The Ayre and Melberry, Hoy
See Volume 3 for NVC maps

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Table 1 Broad land cover extents (ha)

Sites 1 - 4

	01 Rack Wick	02 Bay of Creekland	03 The Ayre	04 Melberry	All Hoy sites
Windblown sand land cover					
Beach above MHWS	2.44	1.09	0.32	2.25	6.11
Bare sand				0.45	0.45
Vegetated sand (except fallows)	16.90	3.93	0.24	41.16	62.24
Arable and fallow				3.61	3.61
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.04	2.12		2.15	4.31
Total windblown sand excluding beach zone	16.94	6.05	0.24	47.38	70.62
Total windblown sand extent above MHWS	19.39	7.15	0.57	49.63	76.73
Surveyed but not on blown sand					
Bare rock					
Unvegetated maritime cliff		0.11		0.26	0.37
Saltmarsh					
Open water	1.73				1.73

Table 2 Extents (ha) of dune habitats and other ground

Sites 1 - 4

	01 Rack Wick	02 Bay of Creekland	03 The Ayre	04 Melberry	All Hoy sites
Habitat 1 - Beach and strand	2.44	1.13	0.57	2.25	6.39
Habitat 2 - Mobile dune	1.44	0.44		1.27	3.15
Habitat 3 - Semi-fixed dune	0.54			2.25	2.79
Habitat 4 - Fixed dry calcareous dune		2.02		0.50	2.52
Habitat 5 - Fixed acidic grassland	1.76				1.76
Habitat 6 - Dry dune heath	6.27				6.27
Habitat 7 - Wet dune heath	3.64				3.64
Habitat 8 - Dune slack and wet grassland	2.93	1.34		1.94	6.21
Habitat 9 - Mire and swamp	0.28	0.06		0.36	0.70
Habitat 10 - Arable and fallow				3.61	3.61
Habitat 11 - Improved grassland	0.05	0.03		35.25	35.34
Habitat 12 - Other habitats	1.77	2.23		2.46	6.46
TOTALS (ha)	21.12	7.25	0.57	49.89	78.83

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As indicated by dune habitat data, the most extensive types are MG7 *Lolium perenne* leys (34 ha) which dominate improved grassland, most notably at Melberry. The most notable vegetation type present, which is rare on sand in Orkney, is H11b *Carex arenaria - Calluna vulgaris* dry dune heath, *Empetrum nigrum* sub-community. This occurs at Rack Wick (4.9 ha), together with SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* acidic dune grassland (1.8 ha) and an H11b/SD12 intermediate (0.5 ha). *Festuca ovina* is not present and appears to be replaced by *F. vivipara*. Indicators of a good sand supply on the outer dune edge are uncommon and suggest little accretion or movement in the foredune zone: SD5 *Leymus arenarius* (0.4 ha) and SD6 *Ammophila arenaria* (2.2 ha) mobile dunes, plus only SD7 *Ammophila arenaria - Festuca rubra* semi-fixed dune (2.7 ha). Dune slack (SD17 *Potentilla anserina - Carex nigra* community) is particularly restricted (0.3 ha).

Site descriptions

01 Rack Wick (Map 2a)

This is a small - moderate sized (21.1 ha) bay dune system and the only site on the west coast of Hoy where it is exposed to a long SW fetch to the north coast of the Scottish mainland. The shingle beach is capped with vegetated sand in the south but is bare in the north, where all sand has been deflated and deposited inland. The southern sand edge is cliffed and eroding, with small blowouts. The foredunes here support SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community and SD7d *Ammophila arenaria - Festuca rubra* semi-fixed dune, *Tortula ruralis* ssp. *ruraliformis* sub-community. This area probably marks the best area of sand supply for the site.

The shingle impounds a winter loch (OW) in the south which has abundant *Littorella uniflora* and a surround of MxPp provisional *Carex nigra - Potentilla palustris* rich fen and M16 *Erica tetralix - Sphagnum compactum* wet dune heath. Most of the site interior is a mix of MG10 *Holcus lanatus - Juncus effusus* rush pasture, M16 wet heath (with *Empetrum nigrum*), SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* acidic dune grassland, and H11b *Carex arenaria - Calluna vulgaris* dry dune heath, *Empetrum nigrum* sub-community. The SD12 acidic dune grassland, H11 dry heath and M16 wet heath are good examples of their types and represent the main conservation interest of the site and also of the dunes of Hoy.

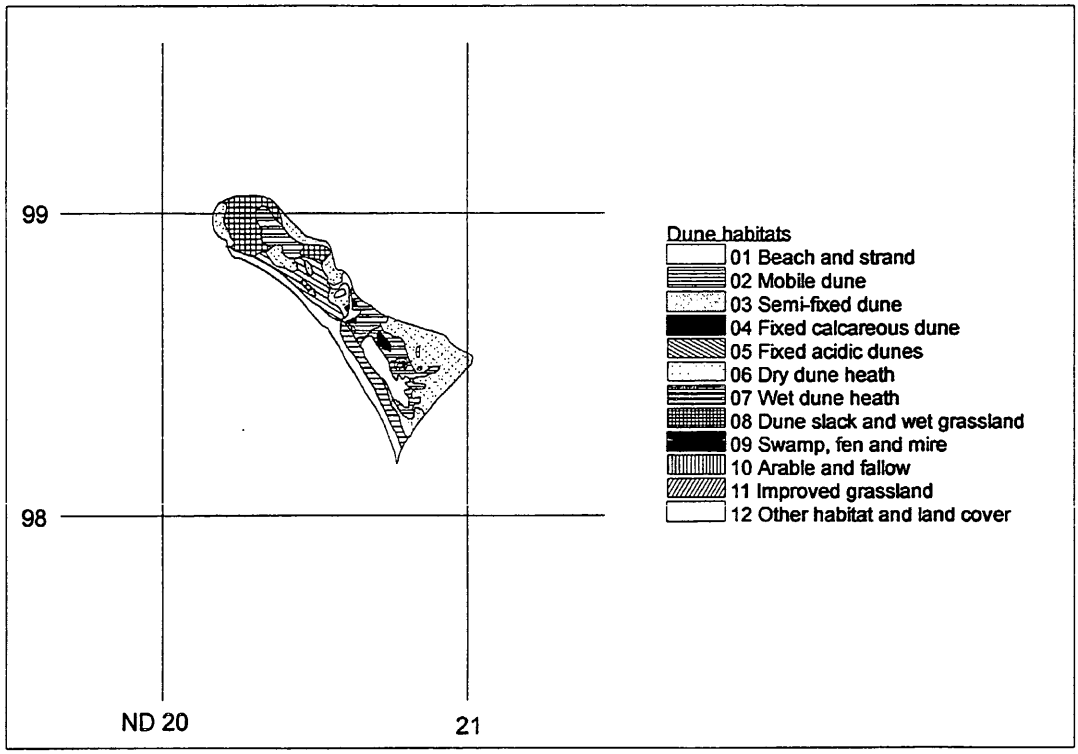
The site is used for extensive sheep grazing and has moderate rabbit numbers. Grazing pressure is not high. Camping takes place on improved grassland beside a bothy in the site centre but there is no significant damage.

02 Bay of Creekland (Map 2b)

This small (7.3 ha) bay dune site lies in the northeast of Hoy, opposite the island of Graemsay which acts as shelter, allowing only slight exposure to a short fetch across Scapa Flow. The site has two areas of sand: Sands of Klebreck in the north and Creekland *sensu stricto* further south. The northern sector is small and its increased shelter allows modest accretion, with a good strand and SD5 *Leymus arenarius* mobile dune. The southern sector is neutral or eroding slowly. SD8a *Festuca rubra - Galium verum* dune grassland, Typical sub-community is present at the outer dune edge, the absence of mobile or semi-fixed dune suggesting long-term erosion. A road passes through this sector and is protected by a 30 m stretch of stone gabion walling. Much of this vegetation is invaded by *Arrhenatherum elatius* (MG1/SD8a), the result of no stock grazing and low rabbit numbers. Southwest of the road there is damper ground with MG10 *Holcus lanatus - Juncus effusus* rush pasture. Overall nature conservation interest is low.

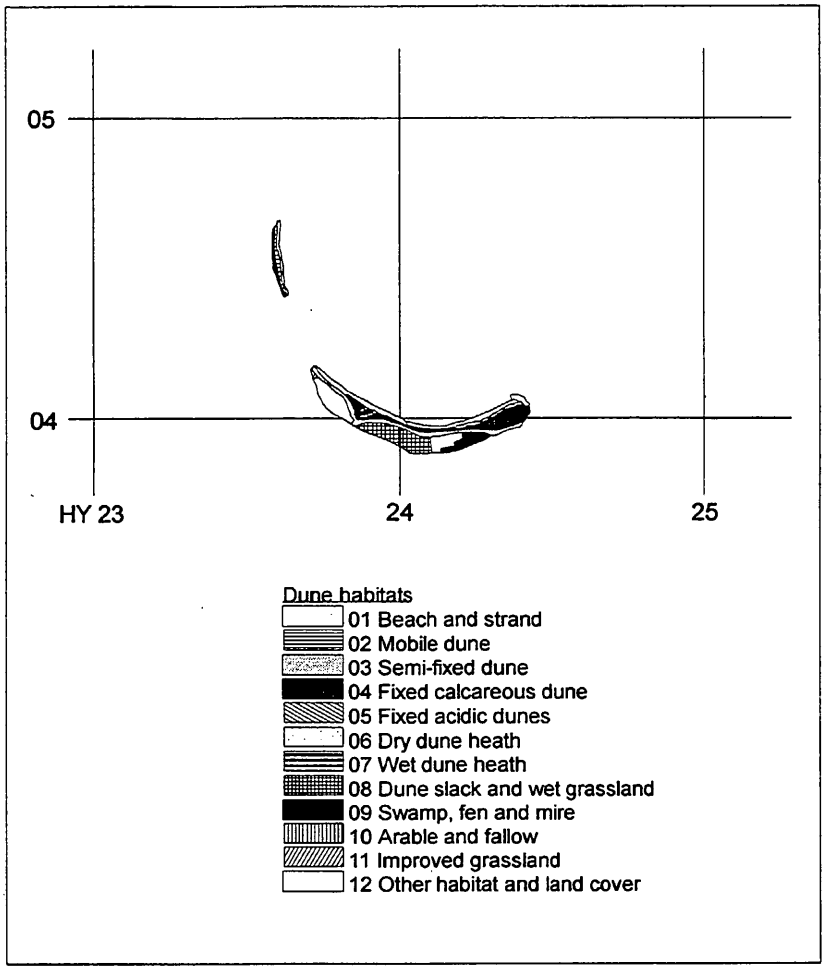
03 The Ayre (Map2c)

This very small (0.2 ha) bay dune site consists of a very small area of strandline with *Leymus arenarius*, on the south side of the road linking Hoy to South Walls. The vegetation is of virtually no nature conservation interest.



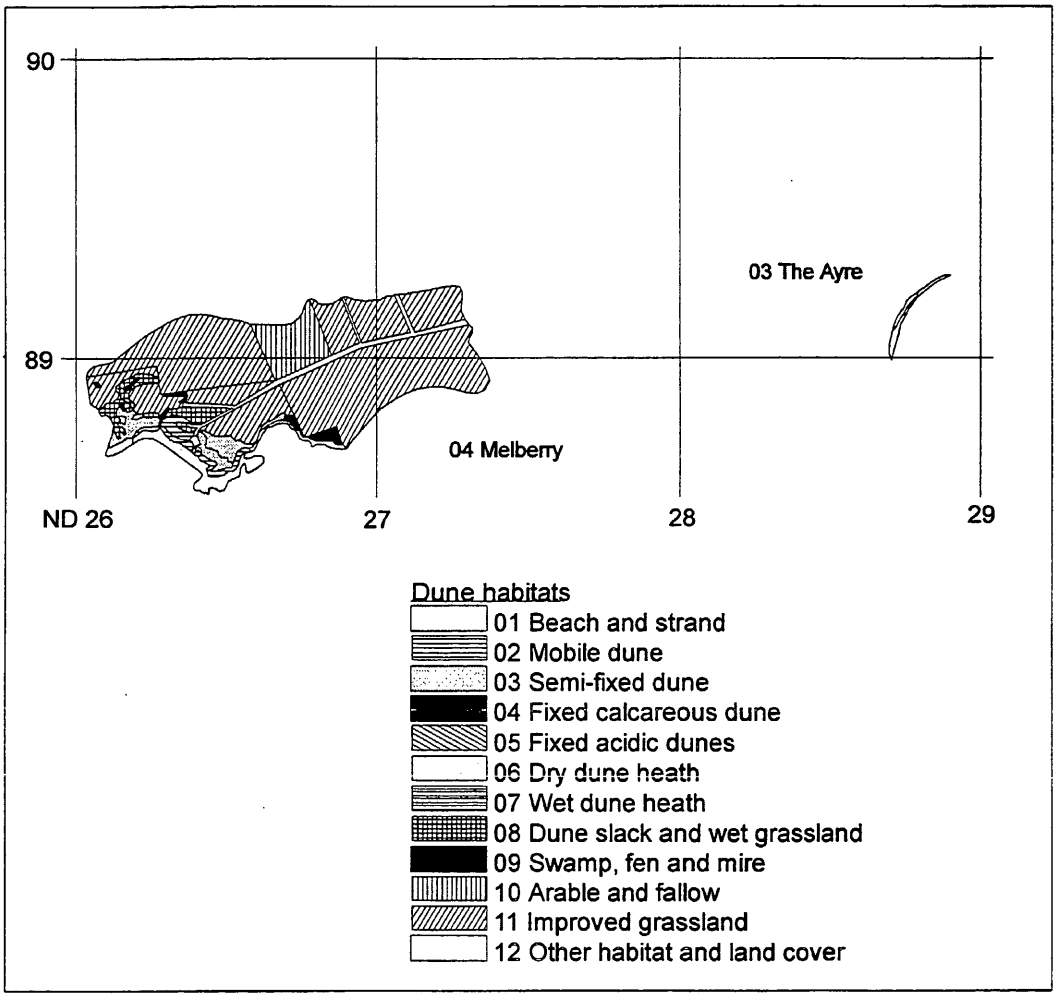
Map 2a Dune habitats of Rack Wick, Hoy

Grid lines spaced at 1 km intervals



Map 2b Dune habitats of Bay of Creekland, Hoy

Grid lines spaced at 1 km intervals



Map 2c Dune habitats of The Ayre and Melberry, Hoy

Grid lines spaced at 1 km intervals

04 Melberry (Map 2c)

This is the largest Hoy site (47.4 ha) and is exposed to a short 24 km SW fetch across the Pentland Firth to the north coast of the Scottish mainland. Two bays are present, facing SW and S, with sand blown over the intervening headland and inland. It is therefore a bay dune and climbing dune complex of moderate size.

The southwestern exposed shore is eroding, with 10 m high cliffs cut into semi-fixed dunes which have very active turf slumping. Rabbit numbers are high and the foredune zone supports large numbers of cattle which accelerate erosion on the coastal edge and maintain blowouts in the foredune crest. Sheep graze in paddocks inland. There are small areas of SD6 mobile dune and modest amounts of SD7 semi-fixed dune, both invaded by ruderals which are prolific in areas used for winter feeding of cattle in the lee of the foredune ridge. These foredunes, together with a small amount of SD8 fixed dune grassland and damp ground inland (with M28x *Iris pseudacorus* mire and MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland) represent the main conservation interest but this is modest due to heavy grazing pressure. Most of the interior is improved grassland, which dominates the site, plus some arable ground. Overall nature conservation interest is moderate to low.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

Sites 1 - 4

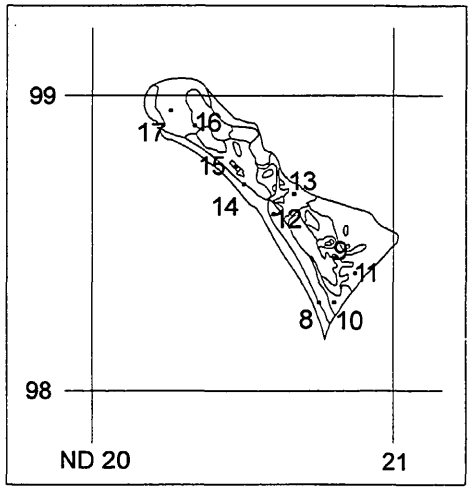
Map code	ORKNEY NVC VEGETATION AND LAND COVER TYPES	01 Rack Wick	02 Bay of Creekland	03 The Ayre	04 Melberry	All Hoy sites
ARB	Arable - barley				3.61	3.61
BBG	Buildings, bare ground and gardens	0.04	1.23			1.27
BBS	Bare beach sand (above MHWS, below vegetated dune zone)		0.60		1.82	2.42
BMC	Maritime cliff with little vegetation		0.11		0.26	0.37
BS	Bare sand (within vegetated sand zone)				0.45	0.45
BSH	Bare shingle	2.44	0.50	0.32	0.43	3.69
H11b	H11b *Carex arenaria - Calluna vulgaris* heath, *Empetrum nigrum* sub-community	4.91				4.91
H11b/ SD12	H11b/SD12 intermediate	0.48				0.48
M16	M16 *Erica tetralix - Sphagnum compactum* wet heath	4.03				4.03
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire		0.06			0.06
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)				0.47	0.47
MG1/ SD8a	MG1/SD8a intermediate		1.17			1.17
MG7	MG7 *Lolium perenne* leys	0.05	0.03		33.89	33.97
MG10	MG10 *Holcus lanatus - Juncus effusus* rush pasture	3.16	1.23			4.39
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland		0.11		1.84	1.95
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)	0.09				0.09
OW	Open water	1.73				1.73
PIT	Active sand pit or rock quarry				0.11	0.11
ROAD	Road and track		0.90		2.04	2.93
RUD	Ruderal-dominated vegetation				1.45	1.45
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community	0.09				0.09
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community	0.01				0.01
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community		0.22			0.22
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.22			0.22
SD6ae	SD6a/e intermediate				0.83	0.83
SD6d	SD6d *Ammophila arenaria* mobile dune, Typical sub-community				0.02	0.02
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community	1.44				1.44
SD7d	SD7d *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Tortula ruralis* ssp *ruraliformis* sub-community	0.54				0.54
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)				2.16	2.16
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community		0.85		0.50	1.35
SD12	SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* dune grassland	1.76				1.76
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community	0.05				0.05
SD17d	SD17d *Potentilla anserina-Carex nigra* slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community	0.29				0.29
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.04	0.08		0.12
SDy/SD5	SDy/SD5 intermediate			0.16		0.16
TOTALS (ha)		21.12	7.25	0.57	49.89	78.83

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

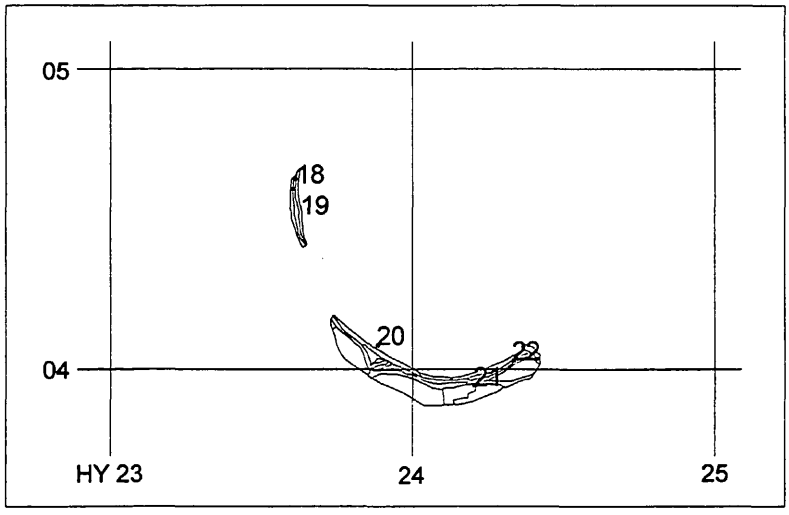
#	Grid Ref.	Site	Target Note Detail
1	ND26608878	04 Melberry	MG7 improved grassland with abundant patches of ruderals, especially *Urtica dioica*. Used as winter feeding ground for stock. *Ammophila arenaria* in east is restricted to cliff top zone, outside stock fence to south.
2	ND26508860	04 Melberry	SD6ae and SD7x dunes on top of 8 m cliffs developed in bedrock. Stock have created bare sand patches on steep slopes within fenced dune area, with ruderal patches taken well up towards summit of dunes.
3	ND26408865	04 Melberry	Dune cliffed (40 degree slope) to 10 m height, with SD7x turf collapse and turf gliding down long slope of cliff scarp. Sand beach at foot, no strand. Heavy stock trampling on cliff face and beach. Incipient blowout developing in cliff crest in one position.
4	ND26408870	04 Melberry	Sand pit (40 m x 30 m) still in use. Was originally behind foredune ridge but that has been broken by two blowouts, leaving a residual mobile dune. Vehicles use tracks here for land access.
5	ND26338870	04 Melberry	Poor MG11 slack with high ruderal content, especially *Plantago major* and *Poa annua*.
6	ND26168878	04 Melberry	Old sand pit, now used to bury dead stock. Size 20 m x 10 m, cut into back of SD7x foredune.
7	ND28758920	03 The Ayre	South shore has cobble shingle beach with intertidal sand. A very small amount of sand is deposited on the crest adjacent to road, with SD5/SDy strand, including small amounts of *Ammophila arenaria*. North shore has no sand deposition and is protected by concrete sea wall.
8	ND20759830	01 Rack Wick	Steep (15 degree) shingle beach with intertidal sand. No strand. Capped with 0.5-2.5 m sand at southeast end, but further north foredune ridge entirely deflated, with sand blown inland.
9	ND20809845	01 Rack Wick	*Littorella uniflora* in great quantity on floor of winter loch, dry at time of survey. Lowest depressions also have much *Ranunculus aquatilis*. Mapped as open water. Depressions on northeast side have MxPp poor fen or SD17d, surrounded by M16 wet heath containing invading *Empetrum nigrum*. Scattered individuals of *Salix repens* are present in M16.
10	ND20809830	01 Rack Wick	Foredunes in south are cliffed 0.5-2 m, with minimal summer accretion. Several small, very short blowouts present. SD6e along entire front, changing to SD7d inland, with more *Brachythecium albicans* than *Tortula ruralis* ssp *ruraliformis*.
11	ND20879840	01 Rack Wick	Fine H11b heath with abundant *Empetrum nigrum* developing abruptly from SD7d turf with much *Cladonia rangiformis* and *Hieracium pilosella*. Damper depressions have M16 wet heath.
12	ND20609860	01 Rack Wick	Exit for large burn blocked by shingle ridge and dams made by visitors. Creates a modest area of open water with S19a fragments in places.
13	ND20559866	01 Rack Wick	Dry (at time of survey) open water area with much *Gnapthalium uliginosum* and scattered *Callitriche stagnalis*. surrounding SD12 grasslands heavily invaded by *Empetrum nigrum* - mapped as SD12/H11b.

#	Grid Ref.	Site	Target Note Detail
14	ND20509870	01 Rack Wick	No SD6 or SD7 dunes behind shingle ridge north of burn. SD12 grassland dominant.
15	ND20409872	01 Rack Wick	Bothy and camping area, with small areas of bonfire/barbecue damage, plus burnt rubbish.
16	ND20339890	01 Rack Wick	Mature M16 heath being invaded by MG10 *Juncus effusus* and *Holcus lanatus* in wet depressions.
17	ND20259895	02 Bay of Creekland	MG10 on steep hillslope, scattered *Juncus effusus* but with *Holcus lanatus* and *Cirsium palustre*.
18	HY23580465	02 Bay of Creekland	Sands of Klebreck. Small but prograding bay dune system due to shelter and wide intertidal sand flats. SDy/SD2 strand changes rapidly to SDy/SD5b, then into SD5c. Little sand appears to have been blown inland beyond road. Cliffs to north and south.
19	HY23600460	02 Bay of Creekland	Small sand pit (5 m x 3 m, 1.5 m face) exploiting eroding face where water from small burn accumulates behind strandline.
20	HY23880408	02 Bay of Creekland	Creekland. Gently sloping shingle beach with scattered sand patches. Capped with 0.5-2 m sand. Ungrazed rank MG1/SD8a sward with ruderal patches, probably from previous casual tipping of garden refuse. Burn choked with M28 (good *Filipendula ulmaria* quantities present)
21	HY24200395	02 Bay of Creekland	Coastal edge in front of houses protected by 3 m wall of rock-filled gabions (30 m stretch).
22	HY24330403	02 Bay of Creekland	Gently sloping sandy beach with no strandline. Very thin line of SD5b dunes at foot of cliffed dunes with rank and weedy MG1/SD8a.



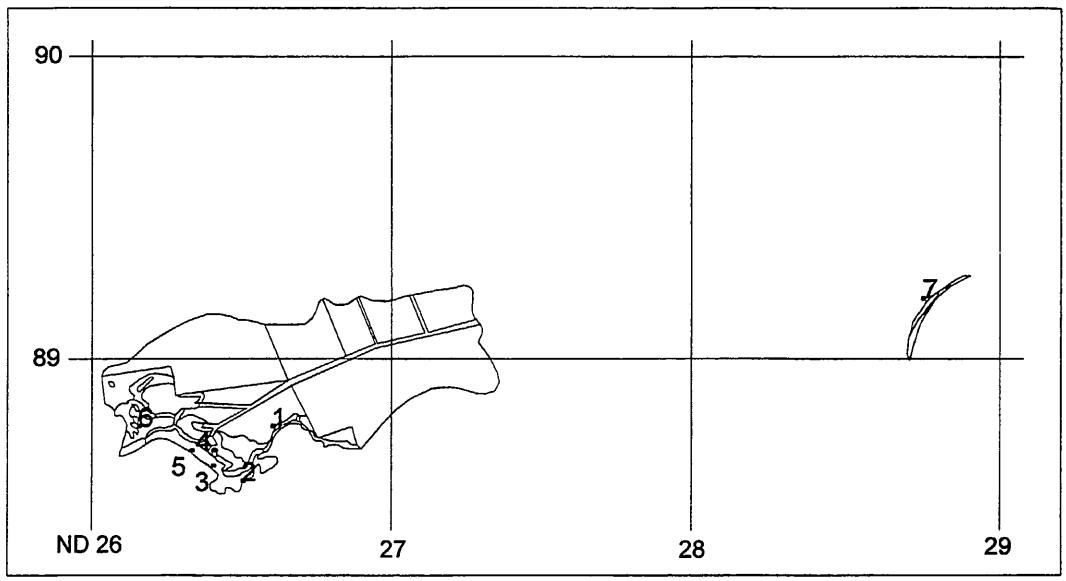
Map 3a Target note positions, Rack Wick (Hoy)

Grid lines spaced at 1 km intervals



Map 3b Target note positions at Bay of Creekland (Hoy)

Grid lines spaced at 1 km intervals



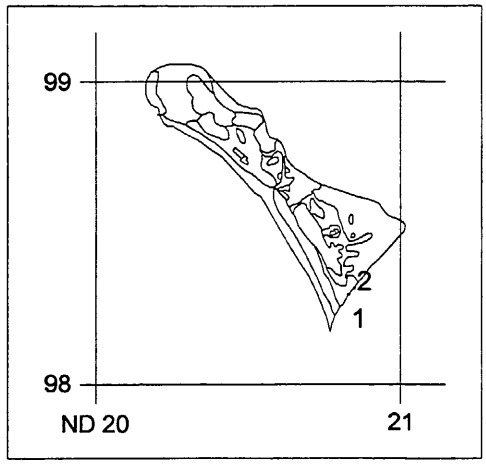
Map 3c Target note positions, The Ayre and Melberry (Hoy)

Grid lines spaced at 1 km intervals

Annex 2 Quadrat Data

Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

	Quadrat number	1	2
	NVC type	SD 7d	SD 7d
1	Grid reference 100km square	ND	ND
2	Grid reference easting	208	208
3	Grid reference northing	983	983
11	Herb height, centimetres	40	25
12	Moss height, centimetres	2	2
15	Herb cover, %	40	55
16	Moss cover, %	35	30
22	Bare soil/litter (incl.sand)	25	20
125	Aira praecox	3	3
159	Ammophila arenaria	6	5
167	Angelica sylvestris	1	2
304	Carex arenaria	3	3
383	Cerastium glomeratum	2	2
576	Festuca rubra	4	4
800	Lotus corniculatus	2	4
1510	Brachythecium albicans	6	4
1914	Pseudoscleropodium purum	2	5
2023	Tortula ruralis ssp ruraliform	4	4
230	Bellis perennis	-	4
786	Linum catharticum	-	3
973	Plantago lanceolata	-	3
988	Poa pratensis	-	3
1058	Primula vulgaris	-	4
1333	Thymus praecox arcticus	-	4
1422	Viola canina	-	2
1649	Ditrichum flexicaule	-	2
2381	Cladonia rangiformis	-	3
	Number of species per sample	10	19



Map 4 Quadrat positions, Rack Wick (Hoy)

Grid lines spaced at 1 km intervals

5 GRAEMSAY

Location and conservation status

One area of vegetated windblown sand is present: 01 Sandside HY265057

The location of the site assemblage is given in Map 1. The site is not an SSSI but lies within the Hoy and West Mainland Natural Scenic Area..

Previous surveys

None New site - not covered by Mather, Smith & Ritchie (1974)

Dune vegetation survey details

Date	September 1996
Target notes	7 (Annex 1)
Quadrats	2 (Annex 2)
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

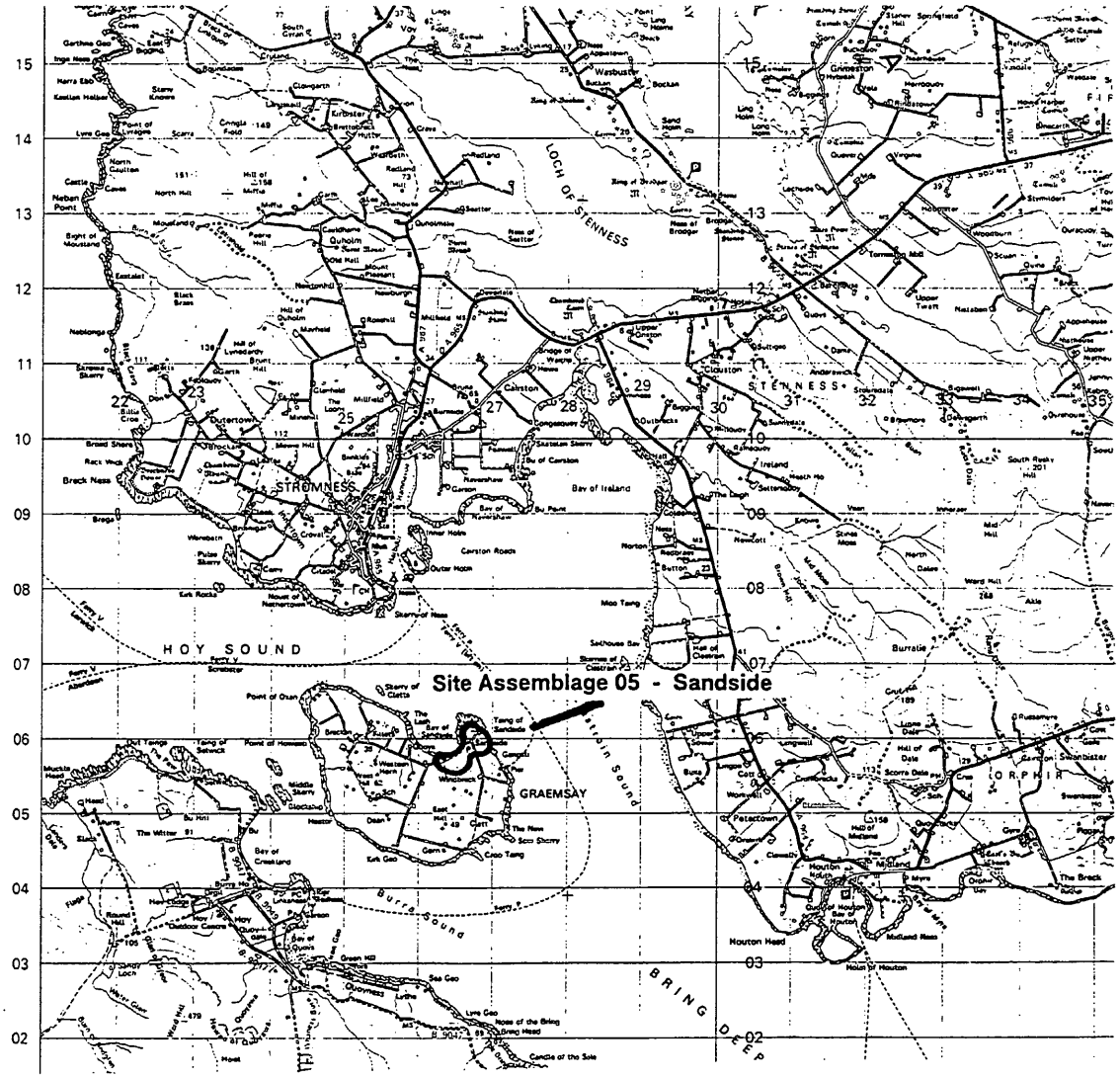
Site description

The Bay of Sandside lies on the north coast of Graemsay, in a sheltered position with a short 3 km fetch across Hoy Sound to Stromness (Mainland). It is a small site made up of a bay dune with a climbing dune interior. Sand exposures in coastal sections on the north side of the Bay of Sandside show evidence of waterlogging and the extent of the site has probably changed considerably since the time these deposits formed. All of the site interior is grazed by cattle. Rabbit numbers are low. The site is a good compact example of bay - climbing dune system but the vegetation is much altered. Good foredune vegetation is very restricted and invaded by rank grassland in the absence of grazing, wetland is already partly drained (but probably offers feeding and perhaps breeding ground for waders) and the site is dominated by improved grassland. Nature conservation interest is only modest.

Broad land cover categories (Table 1)

Table 1 provides basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Sandside is a small site with 11.2 ha of windblown sand above the beach zone. There is 2.6 ha of land take and the remainder is vegetated sand (8.6 ha). The beach zone above high water is restricted (0.5 ha).



Map 1 Site assemblage location: Sandside, Graemsay
See Volume 3 for NVC maps

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Table 1 Broad land cover extents (ha)

Site 5

	05 Sandside Graemsay
Windblown sand land cover	
Beach above MHWS	0.52
Bare sand	
Vegetated sand (except fallows)	9.20
Arable and fallow	
Buildings, roads, gardens, tips, pits, cemeteries, airfield	2.02
Total windblown sand excluding beach zone	11.23
Total windblown sand extent above MHWS	11.75
Surveyed but not on blown sand	
Bare rock	
Unvegetated maritime cliff	0.57
Saltmarsh	
Open water	

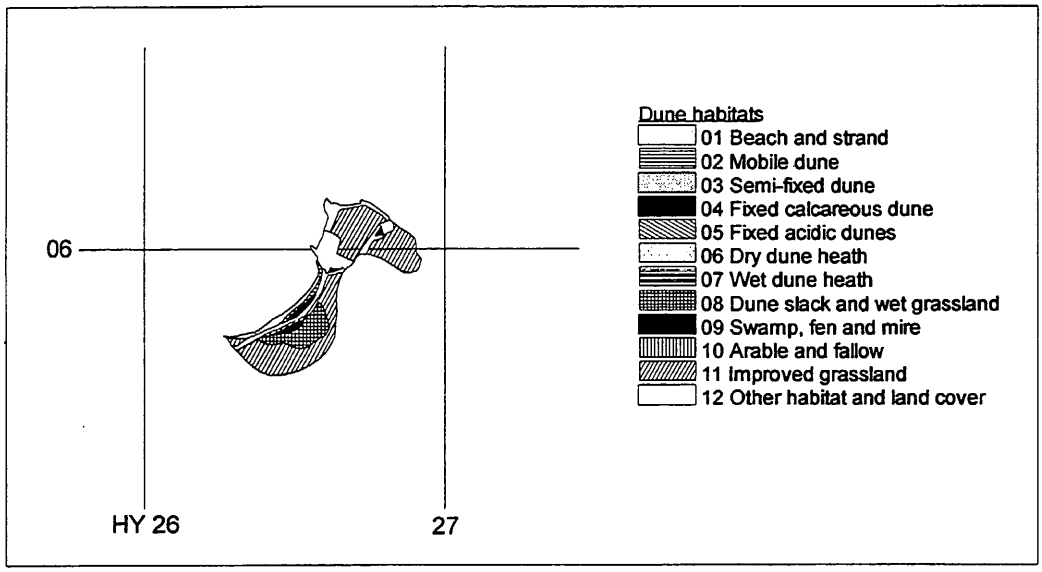
Dune habitats (Table 2, Map 2)

The total mapped area of Sandside (12.3 ha) is dominated by improved grassland (7.2 ha), with small extents of mobile dune (0.2 ha), fixed dune grassland (0.2 ha), wet grassland (1.4 ha) and swamp (0.2 ha). These habitats are part of a slowly eroding bay dune system with a single foredune ridge which provides shelter for a road running along its inner edge. The foredune disappears at the west end of the site and the road is protected by concrete slabs. The foredune zone impedes drainage from adjacent slopes, allowing wetland to develop. In the past deflation has carried sand east and northeast over bedrock, forming a climbing dune interior which extends as far as the east coast of Graemsay where 30 cm of sand is visible in cliff sections.

Table 2 Extents (ha) of dune habitats and other ground

Site 5

	05 Sandside Graemsay
Habitat 1 - Beach and strand	0.52
Habitat 2 - Mobile dune	0.21
Habitat 3 - Semi-fixed dune	
Habitat 4 - Fixed dry calcareous dune	0.23
Habitat 5 - Fixed acidic grassland	
Habitat 6 - Dry dune heath	
Habitat 7 - Wet dune heath	
Habitat 8 - Dune slack and wet grassland	1.43
Habitat 9 - Mire and swamp	0.16
Habitat 10 - Arable and fallow	
Habitat 11 - Improved grassland	7.17
Habitat 12 - Other habitats	2.59
TOTALS (ha)	12.32



Map 2 Dune habitats of Sandside, Graemsay

Grid lines spaced at 1 km intervals

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

The outer foredune ridge of the main bay has a narrow line of SD5 *Leymus arenarius* mobile dune (SD5a species-poor and SD5b *Elymus farctus* sub-communities). This is rapidly replaced inland by MG1 *Arrhenatherum elatius* rank grassland, the result of no grazing seaward of the road through this sector. The wet interior has S19c Eleocharis palustris swamp and, as a result of ditching at the foot of adjacent hillslopes, an intermediate between MG9 *Holcus lanatus - Deschampsia flexuosa* coarse wet grassland and S10 *Equisetum fluviatile* swamp. Further upslope this is replaced by MG7 *Lolium perenne* leys which also make up most of the northern part of the climbing dune area.

Table 3 Vegetation and other land cover (areas in ha)

Site 5

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	05 Sandside Graemsay
BBG	Buildings, bare ground and gardens	1.15
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.16
BMC	Maritime cliff with little vegetation	0.57
BSH	Bare shingle	0.37
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.23
MG7	MG7 *Lolium perenne* leys	7.17
MG9/ S10	MG9 *Holcus lanatus - Deschampsia cespitosa* coarse wet grassland /S10 *Equisetum fluviatile* intermediate	1.43
ROAD	Road and track	0.88
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community	0.16
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.06
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.15
TOTAL (ha)		12.32

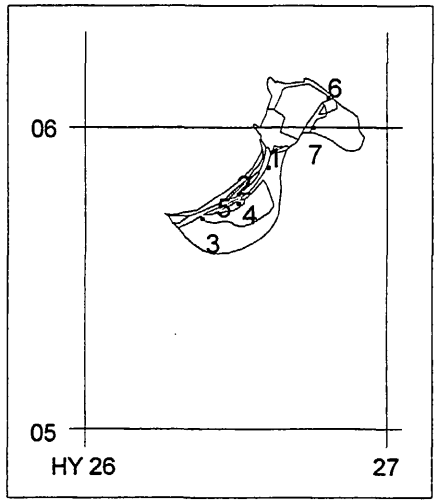
References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY26600587	05 Sandside	Northern end of beach cliffed to 3 m. Stone flags over bedrock at base. Grey organic sands thin rapidly to north over local area of head deposits close to pier - colour possibly due to waterlogging in past.
2	HY26500578	05 Sandside	Bay centre. Steep sand scarp 3 m above slab shingle upper beach. Strong summer accretion bank with SD5b mobile dune. No strand line. In winter dunes probably cliffed to 3 m height.
3	HY26380570	05 Sandside	Road immediately adjacent to beach protected by concrete slabs.
4	HY26500575	05 Sandside	Foredune ridge 1-15 m wide. MG1, with much *Carex arenaria, Arrhenatherum elatius* and *Elymus repens*. Back of ridge has small sand pit adjacent to road. *Bromus mollis* present in small quantity.
5	HY26500575	05 Sandside	*Equisetum fluviatile* swamp intermediate with MG9 wet neutral grassland (MG9/S10, Q1) created by drainage. Contains scattered *Potentilla palustris*. Edges have small patches of *Iris pseudacorus, Juncus effusus*.
6	HY26800610	05 Sandside	Low cliff above wave cut platform, capped with 30 cm sand. Very narrow edge of *Elymus repens*.
7	HY26750600	05 Sandside	Track to lighthouse being surfaced with shingle taken from shore.



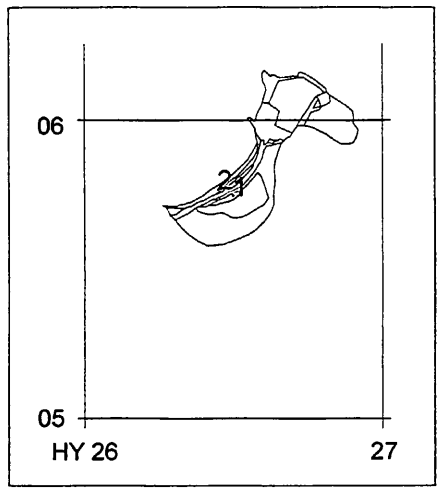
Map 3 Target note positions, Sandside (Graemsay)

Grid lines spaced at 1 km intervals

Annex 2 Quadrat Data

Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

	Quadrat number	1	2
	NVC type	MG9/ S10	S 19c
1	Grid reference 100km square	HY	HY
2	Grid reference easting	265	264
3	Grid reference northing	57	57
11	Herb height, centimetres	45	20
12	Moss height, centimetres	-	-
15	Herb cover, %	100	100
16	Moss cover, %	-	-
22	Bare soil/litter (incl.sand)	-	-
122	Agrostis stolonifera	5	8
533	Equisetum fluviatile	5	2
1089	Ranunculus flammula	2	4
1095	Ranunculus repens	5	4
279	Caltha palustris	-	2
333	Carex nigra	-	2
477	Deschampsia cespitosa cespitos	5	-
509	Eleocharis palustris	-	5
535	Equisetum palustre	-	3
576	Festuca rubra	4	-
680	Holcus lanatus	6	-
722	Juncus articulatus	-	3
990	Poa trivialis	2	-
1049	Potentilla palustris	2	-
1139	Rumex acetosa	2	-
1354	Triglochin palustris	-	2
	Number of species per sample	10	10



Map 4 Quadrat positions, Sandside (Graemsay)

Grid lines spaced at 1 km intervals

6 - 11 SOUTH RONALDSAY

Location and conservation status

South Ronaldsay has seven dune site assemblages, excluding sand which has accreted at Churchill Barrier No. 4 (Ayre of Cara) which extends from South Ronaldsay northwards to the island of Burray.

06 Brough	ND452832	07 Sand Wick	ND435893
08 Roeberry Taing (Bay of Wright)	ND424935	09 Honeysgeo	ND487935
10 Manse Bay	ND473914	11 Newark Bay	ND465905

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974), except 06 Brough (new site)

Survey details

Date	September 1996
Target notes	22 (Annex 1)
Quadrats	2 (Annex 2) - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

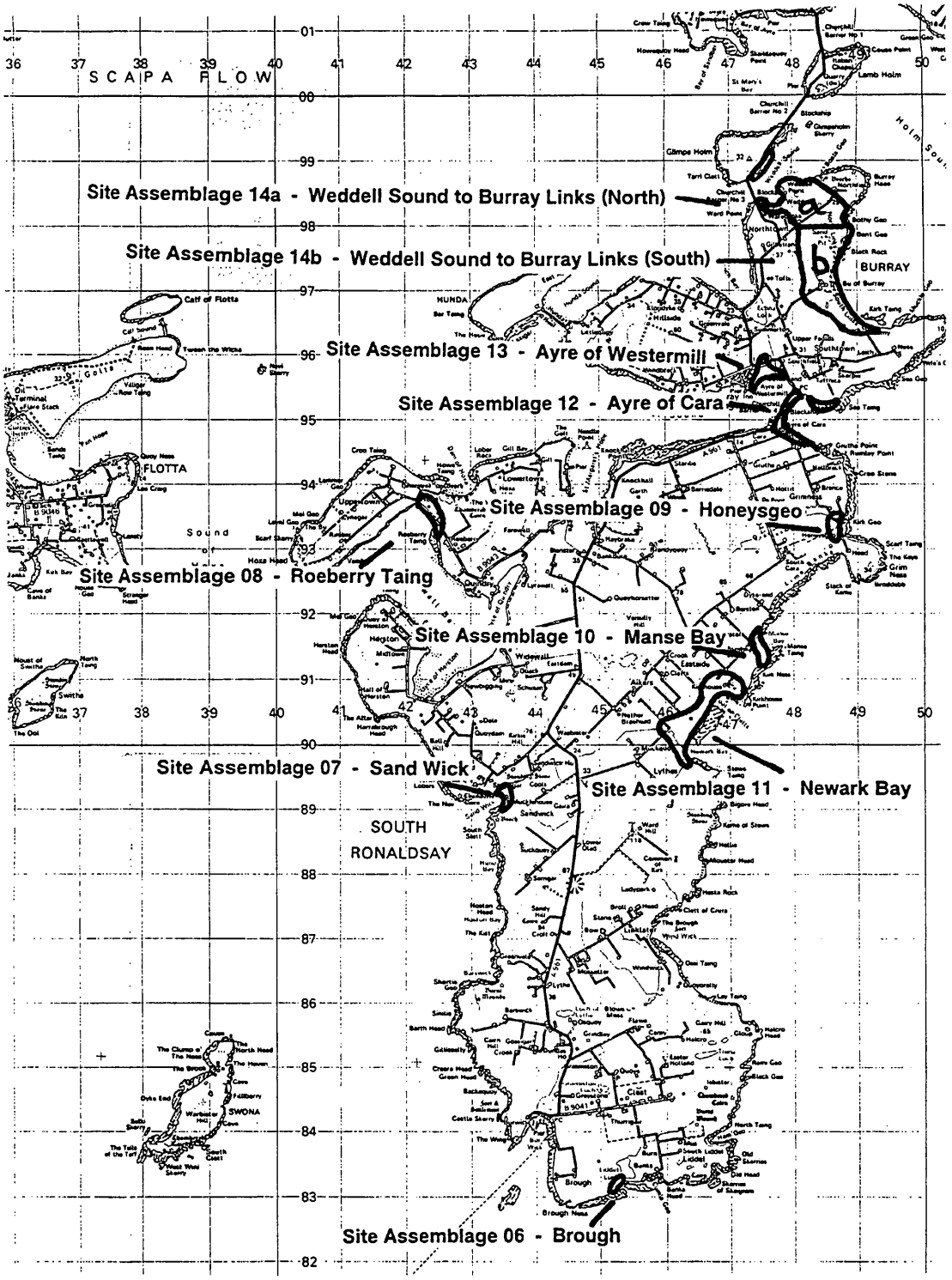
Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

The South Ronaldsay set ranges in size from 1.3 ha (Brough) to 44.8 ha (Newark Bay), although all but the latter can be considered small. Total windblown sand extent above the beach zone is 75.3 ha, most of it vegetation (66.4 ha) but also with bare sand (0.4 ha) and land take (7.3 ha) areas.

Dune habitats (Table 2, Map 2a-d)

The total mapped area of South Ronaldsay (84.3 ha) is dominated by improved grassland (38.4 ha) but there is also a large extent of fixed dry calcareous dune (24.1 ha). All other dune habitats have very low total extents: mobile dune (2.0 ha), semi-fixed dune (0.2 ha), dune slack/wet grassland (1.0 ha), mire/swamp (1.6 ha). Other habitats (mainly land take) make up 8.6 ha and the beach zone total is 8.4 ha.



Map 1 Site assemblage location, South Ronaldsay
(Map also includes sites on Burray and Churchill Barriers)
See Volume 3 for 1:10,000 NVC maps

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Table 1 Broad land cover extents (ha)

Sites 6 - 11

	06 Brough	07 Sand Wick	08 Roeberry Taing	09 Honeysgeo	10 Manse Bay	11 Newark Bay	All South Ronaldsay sites
Windblown sand land cover							
Beach above MHWS	0.48	0.71	0.86	0.90	1.09	3.73	7.77
Bare sand						0.36	0.36
Vegetated sand (except fallows)	1.25	2.49	11.23	8.97	2.78	40.94	66.66
Arable and fallow							
Buildings, roads, gardens, tips, pits, cemeteries, airfield		0.51	1.41	1.60	0.24	3.50	7.25
Total windblown sand excluding beach zone	1.25	2.99	12.64	10.57	3.02	44.8	75.28
Total windblown sand extent above MHWS	1.74	3.70	13.49	11.47	4.11	48.53	83.05
Surveyed but not on blown sand							
Bare rock							
Unvegetated maritime cliff	0.19		0.09	0.51	0.36	0.11	1.25
Saltmarsh							
Open water		0.02					0.02

Table 2 Extents (ha) of dune habitats and other ground

Sites 6 -11

	06 Brough	07 Sand Wick	08 Roeberry Taing	09 Honeysgeo	10 Manse Bay	11 Newark Bay	All South Ronaldsay sites
Habitat 1 - Beach and strand	0.54	0.77	0.95	0.94	1.09	4.16	8.44
Habitat 2 - Mobile dune		0.07		0.35		1.62	2.03
Habitat 3 - Semi-fixed dune			0.16			0.08	0.24
Habitat 4 - Fixed dry calcareous dune			2.17	0.26	2.24	19.38	24.05
Habitat 5 - Fixed acidic grassland							
Habitat 6 - Dry dune heath							
Habitat 7 - Wet dune heath							
Habitat 8 - Dune slack and wet grassland	0.70	0.09				0.21	1.00
Habitat 9 - Mire and swamp	0.11		1.28			0.21	1.60
Habitat 10 - Arable and fallow							
Habitat 11 - Improved grassland	0.40	2.26	7.53	8.27	0.55	19.39	38.39
Habitat 12 - Other habitats	0.19	0.53	1.49	2.16	0.60	3.61	8.57
TOTALS (ha)	1.92	3.72	13.58	11.98	4.47	48.64	84.31

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As indicated by dune habitat data, the most extensive types are MG7 *Lolium perenne* leys (34.8 ha) which dominate improved grassland, most notably at Roeberry Taing, Honeysgeo and Newark Bay.

Indicators of a good sand supply on the outer dune edge are uncommon and suggest little accretion or movement in the foredune zone, or even the absence of this zone. Vegetated strand is of very low extent, most of it at Newark Bay: SD2 *Cakile maritima - Honkenya peploides* strandline (0.3 ha), SD2/SDy provisional *Atriplex glabriuscula* strandline intermediate (0.2 ha), SD4 *Elymus farctus* embryo dune (0.1 ha). SD5 *Leymus arenarius* mobile dune sub-communities are similarly restricted: SD5b *Elymus farctus* (0.2 ha) and SD5c *Festuca rubra* (0.8 ha) are very restricted, SD6 *Ammophila arenaria* mobile dune (0.1 ha) is rare, as is SD7 *Ammophila arenaria - Festuca rubra* semi-fixed dune (0.2 ha).

Fixed dune grasslands are more extensive but good examples of well-managed (properly grazed), floristically-rich forms of the SD8 *Festuca rubra - Galium verum* community are almost absent. Most fixed dune grassland is invaded by *Arrhenatherum elatius* (MG1/SD8a intermediate 4.6 ha; MG1/SD8d intermediate 12.9 ha) and is rank and rather poor in species, the result of little or no grazing in recent time. Wetland habitats are also very restricted and most such habitat has probably been improved.

Site descriptions

06 Brough (Map 2a)

This is a very small open coast site (i.e. a bay dune forming only a slight coastal concavity) at the south end of South Ronaldsay, exposed to a long SE fetch across the North Sea to Denmark. Potential vegetated windblown sand is only 1.3 ha, with all mapping covering 1.9 ha. It is located on the coast east of Brough Ness and has a shingle beach laid on bedrock, with small quantities of sand blown ashore and inland for up to 40m. The strand has a good population of *Mertensia maritima* (the only feature of important nature conservation interest) and the dune zone is influenced by poor drainage, with wet habitats (MG9/MG11, M28x) which have been improved (MG7) along the inner edge of the site.

07 Sand Wick (Map 2b)

This is a very small 3.0 ha bay dune site on the west coast of South Ronaldsay, exposed to a long (35 km) WSW fetch across the Pentland Firth to the Scottish mainland. It has a boulder beach capped by sand. There is a good SDy *Atriplex glabriuscula* strand but all sand on higher ground is improved (MG7 leys) and the vegetation is of no nature conservation interest.

08 Roeberry Taing (Map 2c)

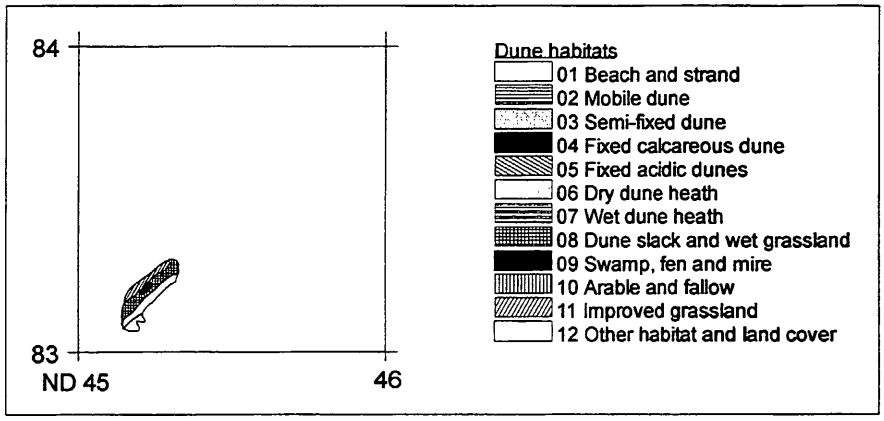
This is a small 12.6 ha bay dune site situated on the west coast of South Ronaldsay, within the comparative shelter of Widewall Bay. It has a narrow exposed SW fetch of 40 km across the Pentland Firth to the Scottish mainland. The beach is shingle, with a capping of sand and patches of SDy *Atriplex glabriuscula* and *A. prostrata* strand. Most of the interior is improved grassland but there are areas of fixed dune and good wetland (mire and swamp) in one location at the rear of the site (MxPp, S4, S28, S19c, SHv vegetation with good zonation patterns) - these habitats make up the nature conservation interest for vegetation which is only moderate. The coastal edge has an SD4/SD8c *Elymus farctus - Festuca rubra - Galium verum* intermediate, a type which might indicate former SD7x semi-fixed dune which has had *Ammophila arenaria* removed by grazing. The main block of fixed dune grassland is invaded by *Arrhenatherum elatius* (MG1/SD8a) and lacks sufficient grazing to maintain a species-rich SD8 sward. The site is a popular site for visitors and a car park and toilet block are provided. There are no serious recreational impacts.

09 Honeysgeo (Map 2d)

This is a small 10.6 ha bay and climbing dune site located in the northeast of South Ronaldsay, immediately north of the Grim Ness headland. It is exposed to long E and NE fetches extending across the North Sea to Norway. It has a mixed sand and shingle beach in the south, changing to shingle dominance in the north. In the south the main beach has a cliffed dune edge showing erosion at the present time. Blown sand extends for up to 300 m inland over adjacent slopes. There are very small quantities of both SD5 *Leymus arenarius* mobile dune, plus rank fixed dune (SD8a *Festuca rubra - Galium verum* community, Typical sub-community). These represent the only nature conservation interest which is minimal except for a patch of *Mertensia maritima* on the edge of the strand zone in one location. Most of the site inland is made up of MG7 improved grassland.

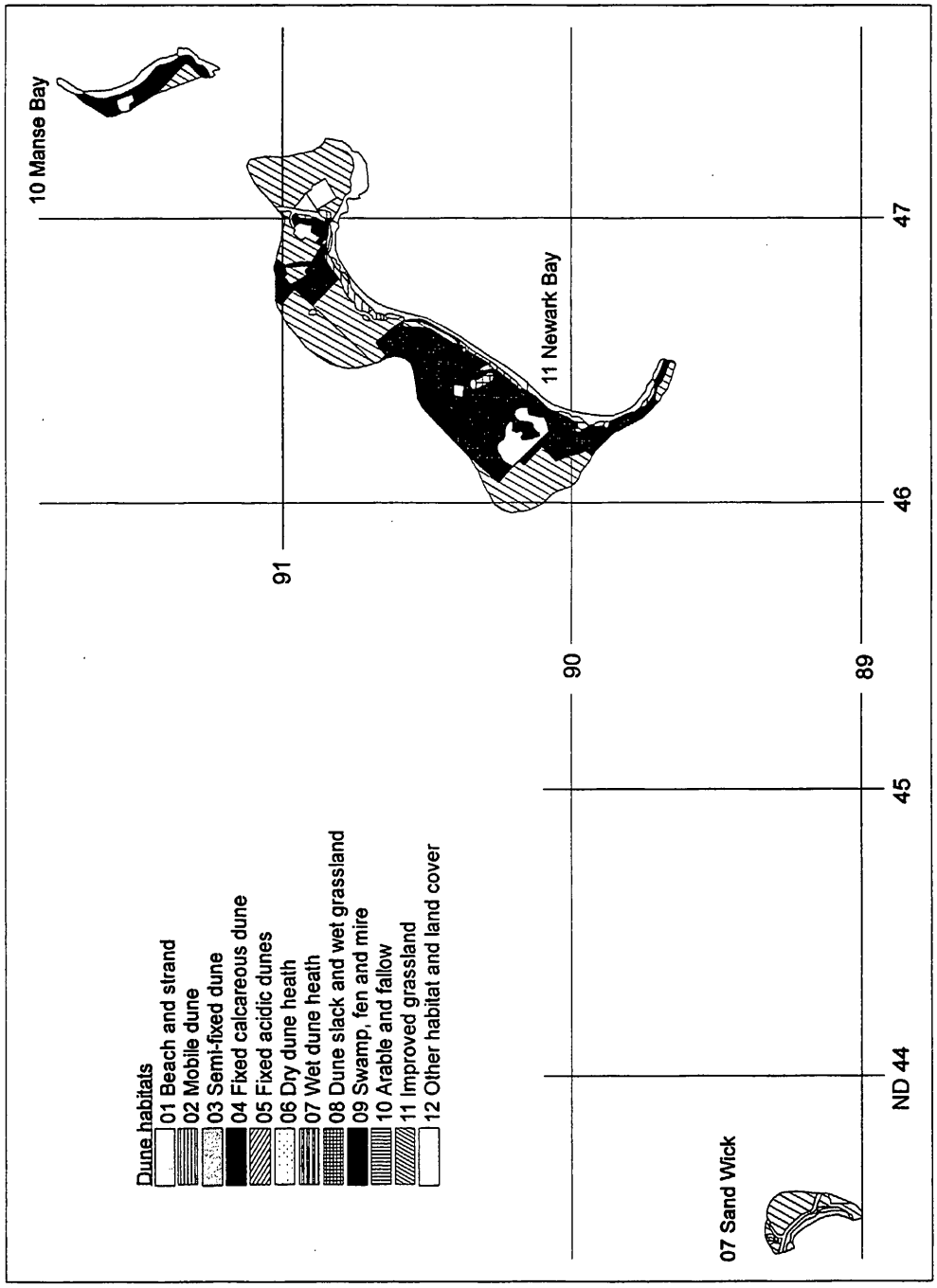
10 Manse Bay (Map 2b)

This a very small 3.0 ha bay dune site on the east coast of South Ronaldsay, with an exposed long fetch ENE across the North Sea to Norway. It has a shingle beach and current sand supply is derived from the intertidal zone. There is no foredune zone but most of the site is fixed calcareous dune grassland (SD8a *Festuca rubra - Galium verum* fixed dune, Typical sub-community), part of which is invaded by *Arrhenatherum elatius* (MG1/SD8a). This habitat is probably ungrazed or undergrazed, producing a rank and rather species-poor vegetation, representing low nature conservation interest. A small area of improved MG7 grassland is present in the south.

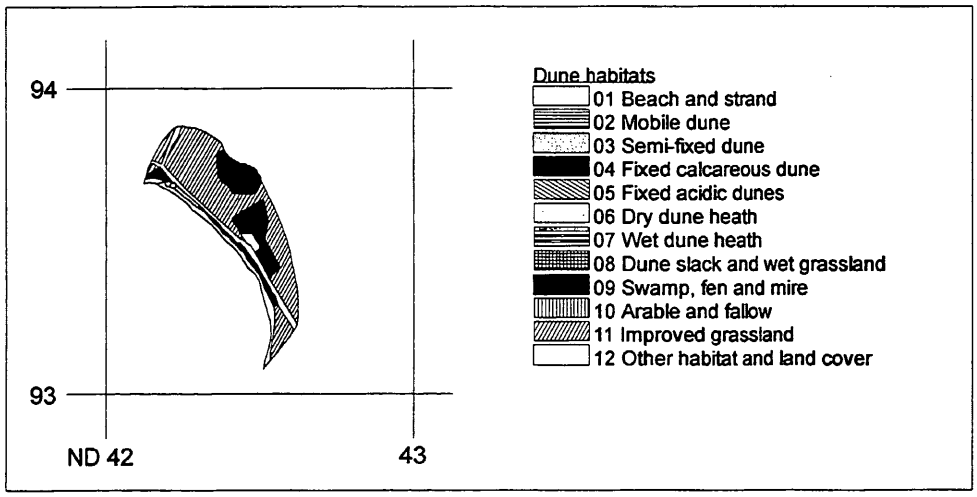


Map 2a Dune habitats of Brough, South Ronaldsay

Grid lines spaced at 1 km intervals

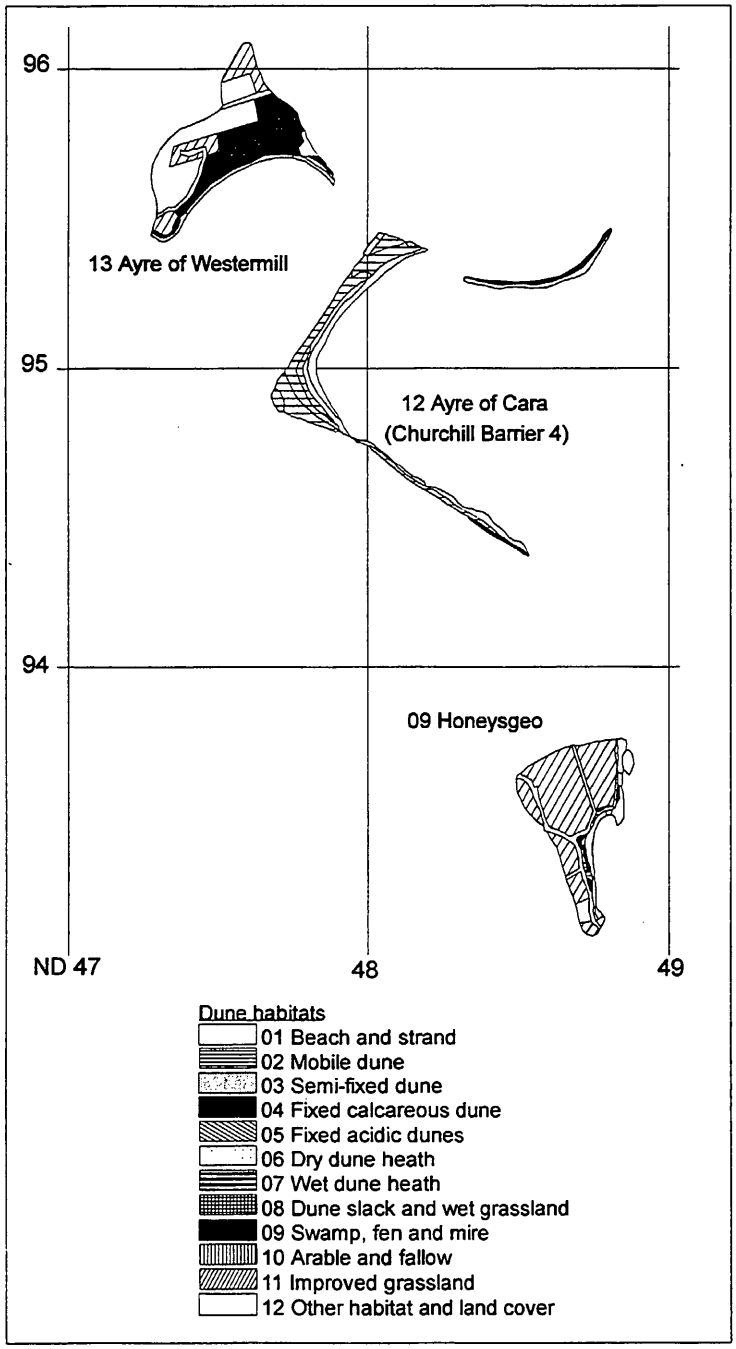


Map 2b Dune habitats of Sandwick, Manse Bay and Newark Bay (South Ronaldsay)



Map 2c Dune habitats of Roeberry Taing, South Ronaldsay

Grid lines spaced at 1 km intervals



Map 2d Dune habitats of 09 Honeysgeo, South Ronaldsay

(Map also includes 12 Ayre of Cara and 13 Ayre of Westermill, Burray)

Grid lines spaced at 1 km intervals

Table 3a Vegetation and other land cover (areas in ha)
Sites 6 - 9

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	06 Brough	07 Sand Wick	08 Roeberry Taing	09 Honeysgeo	All South Ronaldsay sites
BBG	Buildings, bare ground and gardens		0.13	0.18	0.33	1.63
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.05	0.39		0.55	3.67
BMC	Maritime cliff with little vegetation	0.19		0.09	0.51	1.25
BS	Bare sand (within vegetated sand zone)					0.36
BSH	Bare shingle	0.43	0.32	0.86	0.36	4.10
CMTY	Graveyard					0.62
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.11				0.11
MG1	MG1 *Arrhenatherum elatius* coarse grassland			0.10	0.07	2.34
MG1/ SD5c	MG1/SD5c intermediate					0.23
MG1/ SD8a	MG1/SD8a intermediate			1.19		4.63
MG1/ SD8d	MG1/SD8d intermediate					12.88
MG7	MG7 *Lolium perenne* leys	0.40	2.26	7.53	8.27	34.77
MG7/ SD8a	MG7/SD8a intermediate					0.31
MG7/SD9	MG7/SD9 intermediate					2.93
MG9/ MG11	MG9/MG11 intermediate	0.70				0.70
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland					0.21
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland		0.09			0.09
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)			0.64		0.64
OW	Open water		0.02			0.02
PIT	Active sand pit or rock quarry					1.76
ROAD	Road and track		0.38	1.20	1.26	3.17
RUD	Ruderal-dominated vegetation			0.40	0.06	0.95
S4	S4 *Phragmites australis* reedbed			0.08		0.08
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			0.35		0.35
S28	S28 *Phalaris arundinacea* fen			0.02		0.31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline	0.05				0.28
SD2/SDy	SD2/SDy intermediate					0.20
SD4	SD4 *Elymus farctus* foredune					0.12
SD4/SD8a	SD4/SD8a intermediate			0.10		0.44
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community				0.05	0.20
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.07		0.31	0.75
SD6ae	SD6a/e intermediate					0.09
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community					0.04
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			0.16		0.24
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community			0.39	0.19	2.82
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community					0.60
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.06	0.10	0.03	0.19
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)			0.19		0.19
TIP	Rubbish tip			0.03		0.07
TOTALS (ha)		1.92	3.72	13.58	11.98	84.31

Table 3b Vegetation and other land cover (areas in ha)
Sites 10 - 11

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	10 Manse Bay	11 Newark Bay	All South Ronaldsay sites
BBG	Buildings, bare ground and gardens	0.24	0.75	1.63
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.17	2.50	3.67
BMC	Maritime cliff with little vegetation	0.36	0.11	1.25
BS	Bare sand (within vegetated sand zone)		0.36	0.36
BSH	Bare shingle	0.91	1.23	4.10
CMTY	Graveyard		0.62	0.62
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)			0.11
MG1	MG1 *Arrhenatherum elatius* coarse grassland		2.17	2.34
MG1/ SD5c	MG1/SD5c intermediate		0.23	0.23
MG1/ SD8a	MG1/SD8a intermediate	0.29	3.15	4.63
MG1/ SD8d	MG1/SD8d intermediate		12.88	12.88
MG7	MG7 *Lolium perenne* leys	0.49	15.82	34.77
MG7/ SD8a	MG7/SD8a intermediate		0.31	0.31
MG7/SD9	MG7/SD9 intermediate		2.93	2.93
MG9/ MG11	MG9/MG11 intermediate			0.70
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland		0.21	0.21
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland			0.09
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)			0.64
OW	Open water			0.02
PIT	Active sand pit or rock quarry		1.76	1.76
ROAD	Road and track		0.32	3.17
RUD	Ruderal-dominated vegetation	0.05	0.45	0.95
S4	S4 *Phragmites australis* reedbed			0.08
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			0.35
S28	S28 *Phalaris arundinacea* fen		0.29	0.31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline		0.23	0.28
SD2/SDy	SD2/SDy intermediate		0.20	0.20
SD4	SD4 *Elymus farctus* foredune		0.12	0.12
SD4/SD8a	SD4/SD8a intermediate		0.34	0.44
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community		0.15	0.20
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.37	0.75
SD6ae	SD6a/e intermediate		0.09	0.09
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community		0.04	0.04
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)		0.08	0.24
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	1.95	0.30	2.82
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community		0.60	0.60
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)			0.19
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)			0.19
TIP	Rubbish tip		0.05	0.07
TOTALS (ha)		4.47	48.64	84.31

11 Newark Bay (Map 2b)

This is a small to moderate-sized 44.8 ha bay dune site located on the east coast of South Ronaldsay, exposed to long ESE and E fetches to Denmark. A shingle beach is dominant in the north of the site but is replaced by sand which is dominant for the remainder of the beach length. Strand vegetation (an SDy *Atriplex glabriuscula* - SD2 *Cakile maritima* - *Honkenya peploides* intermediate, with *Mertensia maritima*) is locally common in the north, with further SD2 occurrences in the south together with SD4 *Elymus farctus* embryo dunes which contain *Calystegia soldanella*. The good strand vegetation, MG7/SD9 vegetation inland in the north with *Ammophila arenaria*, and a dune edge vegetation of SD8c *Festuca rubra* - *Galium verum* community, *Tortula ruralis* ssp. *ruraliformis*) suggest a modest sand supply in front of a cliffed dune edge which is slowly receding in the north and south. Retreat is much faster in the centre of the bay, with 2 m high dune cliffs with turf slumping, a blowout in the dune cliff face, a collapsing fence line, and dumping of scrap as ineffective coastal protection.

Much of the site interior is MG7 improved grassland but there are moderately large tracts of fixed calcareous dune grassland in the north and centre, almost all of it invaded by *Arrhenatherum elatius* (MG1/SD8a, MG1/SD8d) and some is semi-improved (MG7/SD9 *Ammophila arenaria* - *Arrhenatherum elatius* intermediate). The abundance of *Arrhenatherum elatius* suggests a recent phase with little or no grazing, although most of the site is used for cattle grazing, with winter feeding impacts extensive (e.g. a high cover of ruderals and many black silage bags). There is little wetland apart from S28 *Phalaris arundinacea* tall-herb fen beside a stream in the north and MG11 wet grassland developed in the floor of a former sand pit.

One large and one small sand pit are present, together with a church and cemetery in the north of the site. The northern part of the site is used for recreation but impacts are very slight and there are none visible in the south.

This is the best dune site upon South Ronaldsay, its sand supply, size and management allowing a modest range of vegetation to be developed. The strand zone variety is good (and has *Mertensia maritima*) but fixed dune grasslands all show signs of semi-improvement or under-grazing in the past. Overall, the vegetation interest is only moderate.

References

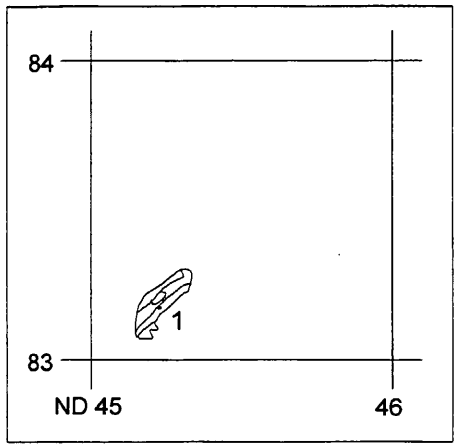
Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

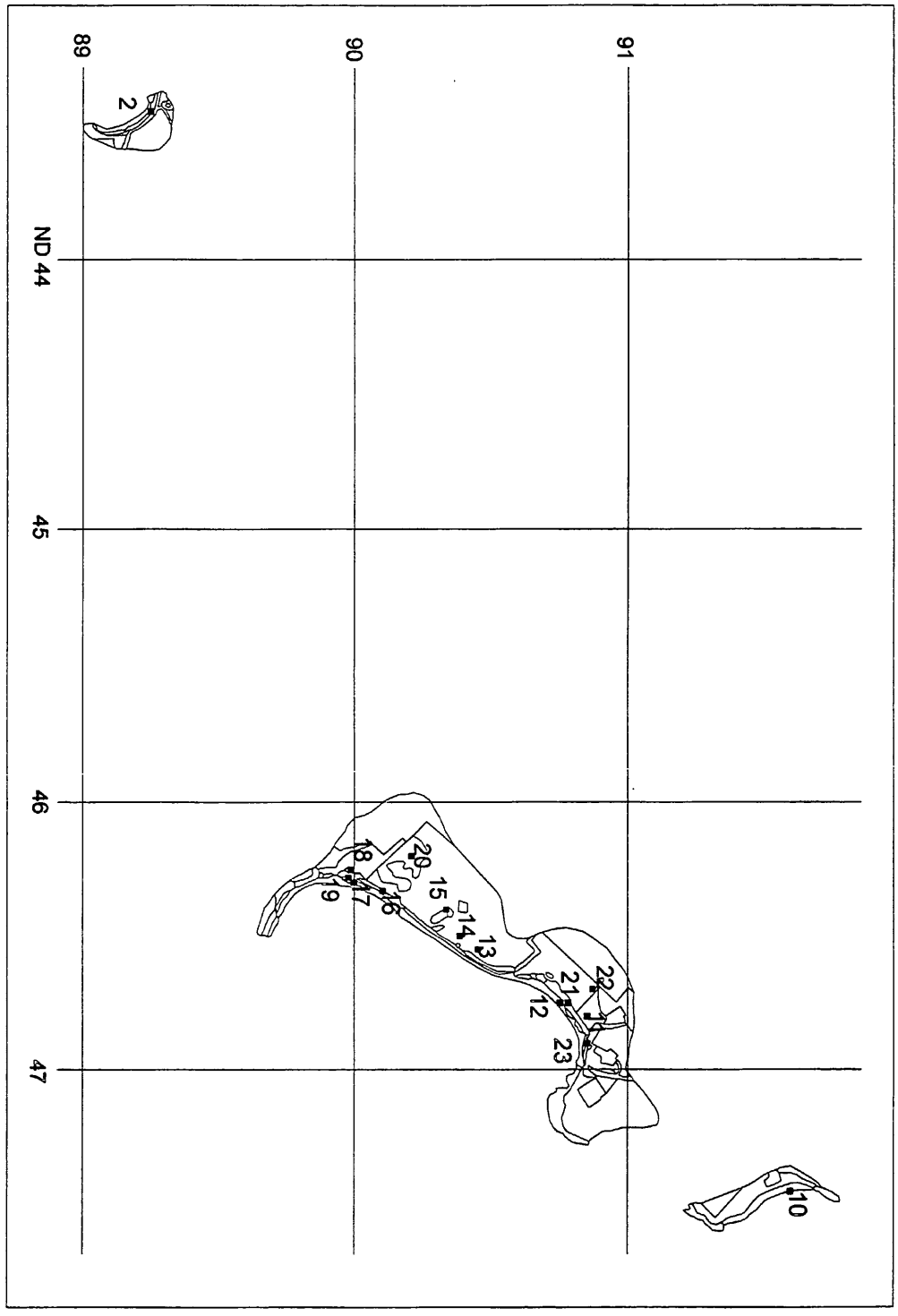
#	Grid Ref.	Site	Target Note Detail
1	ND45138317	06 Brough	Steep (10 degree) and long (20 m) shingle beach capped with thin sand which extends at least 30 m inland. Fence line encloses MG7 vegetation. *Cirsium vulgare* and *Urtica dioica* common around rabbit burrows. Thin layer of sand on top of shingle beach has a very good colony of *Mertensia maritima* (at least 50 plants, total area 15 sq m). One large patch of *Honkenya peploides*. Further west, ground behind shingle is damper (MG9/MG11) due to seepage from hill drainage.
2	ND43458925	07 Sand Wick	Boulder strewn beach above intertidal sand. Wide 4 m SDy strand line. Capped by 3-4 m sand, all enclosed by fence and converted to MG7 grassland.
3	ND42479348	08 Roeberry Taing	Hard surfaced car park and toilet block.
4	ND42449348	08 Roeberry Taing	Steep (10 degree) but short (10 m) shingle beach capped with 0.5-1 m sand. Patches of SDy strand present with *Atriplex glabriuscula* and *Atriplex prostrata*. Dunes edged with SD4/SD8a.
5	ND42229367	08 Roeberry Taing	Dump of rubble.
6	ND42379366	08 Roeberry Taing	Good dune wetland fenced from cattle. MxPp (*Carex nigra* - *Potentilla palustris* mire) with a small area of S4 *Phragmites australis* swamp. Wettest ground is S19c swamp with SHv *Hippuris vulgaris* in open standing water.
7	ND42452355	08 Roeberry Taing	Rank MG1/SD8a grassland with much *Heracleum sphondylium* plus ruderals, in an area formerly used for agricultural storage of machinery.
8	ND48759328	09 Honeysgeo	Dunes cliffed 1.5 m above shingle beach with thin cover of coarse shell sand. SD8a grassland with abundant *Heracleum sphondylium* on sand. No strandline.
9	ND48759330	09 Honeysgeo	1.5 sq m of *Mertensia maritima* growing on edge of SD5b strand. Scattered small individuals persist further north along whole beach, clinging to dune cliff face or at very top of sand beach.
10	ND47459160	10 Manse Bay	Steep shingle beach, no strand. Intertidal sand present. SD8a and MG1/SD8a turf extends inland to fenceline. MG7 inside fences.
11	ND46809085	11 Newark Bay	MG1/SD8a turf with patches of *Primula vulgaris*.
12	ND46759078	11 Newark Bay	Steep sandy beach, including coarse shell sand. Small fragments of SDy and SD2 (*Cakile maritima* strand) near to strand. Upper beach cliffed 0.5 m with very large accretion bank colonised by SD5b and one large mat of *Honkenya peploides*. Further southwest SDy/SD2 strand includes about 40 small *Mertensia maritima* individuals (area 4 sq m).
13	ND46559045	11 Newark Bay	Dunes cliffed to 2 m height, turf slumping active. Fragmented SDy/SD2 strand, with occasional small *Mertensia maritima* plants.
14	ND46509038	11 Newark Bay	Metal debris dumped in blowout to arrest erosion. Dune cliff edge has much SD4. Fence starting to collapse due to dune cliff retreat.
15	ND46409033	11 Newark Bay	Active sand pit 40 x 20 m, 2.5 m high face. Further south there are old fully recolonised faces, extending most of way to dune edge. These have an MG11 floor.

#	Grid Ref.	Site	Target Note Detail
16	ND46339010	11 Newark Bay	Head occasionally exposed in cliff section - most covered by summer accretion bank of sand.
17	ND46309000	11 Newark Bay	Impressive strand/embryo dune zonation, with SD2 *Honkenya peploides* monodominant, then mixing with SD4 *Elymus farctus* in a band 8 m wide.
18	ND46258999	11 Newark Bay	Dump (40 m x 20 m) of old cars and farm rubbish on side of stream.
19	ND46288998	11 Newark Bay	10 sq m of *Calystegia soldanella* just above large area of SD4 foredune on edge of SD4/SD8a turf.
20	ND46209020	11 Newark Bay	Large sand pit, still partly active. Floor partly recolonised by MG11 sward (50% area). Turf collapse extensive on old faces.
21	ND46759075	11 Newark Bay	*Urtica dioica* extensive in MG7/SD8d sward - result of winter feeding ground for stock. Black plastic bags litter the area.
22	ND46709087	11 Newark Bay	Sand pit (15 m x 10 m), still in use.

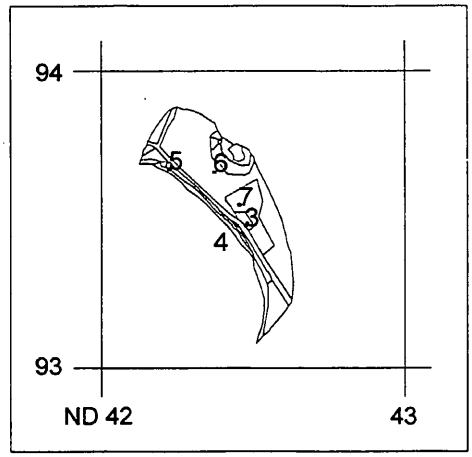


Map 3a Target note positions, Brough (South Ronaldsay)

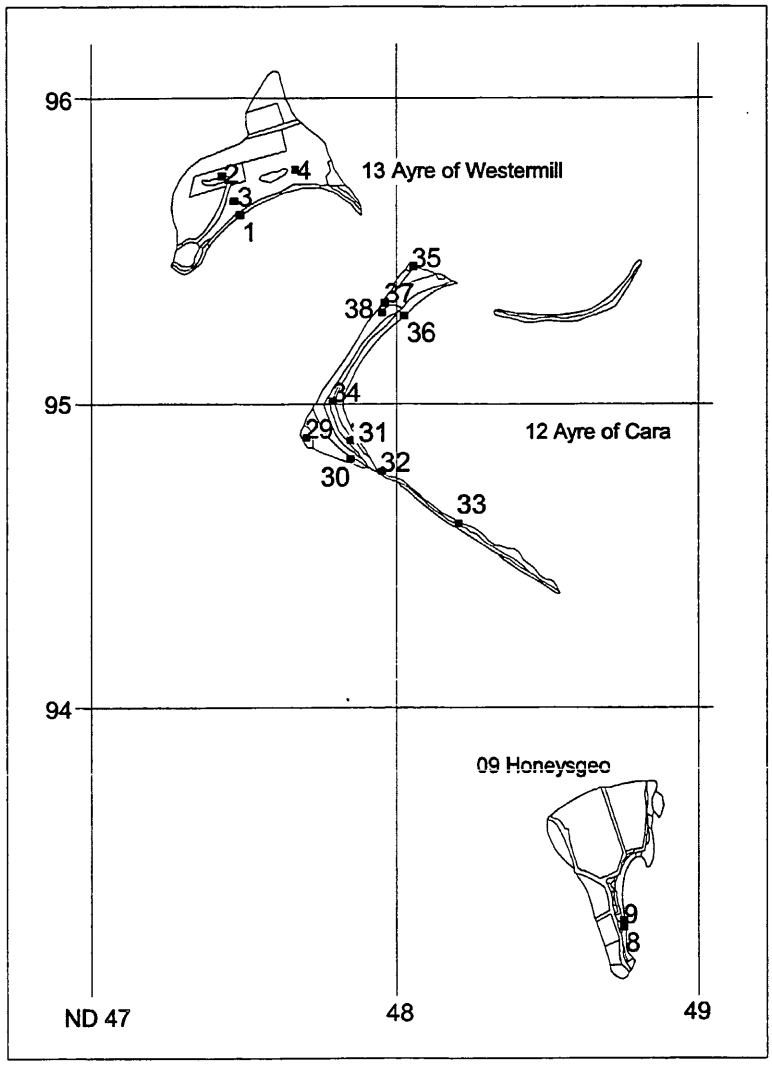
Grid lines spaced at 1 km intervals



Map 3b Target note positions: Sand Wick, Manse Bay and Newark Bay (South Ronaldsay)



Map 3c Target note positions, Roeberry Taing (South Ronaldsay)



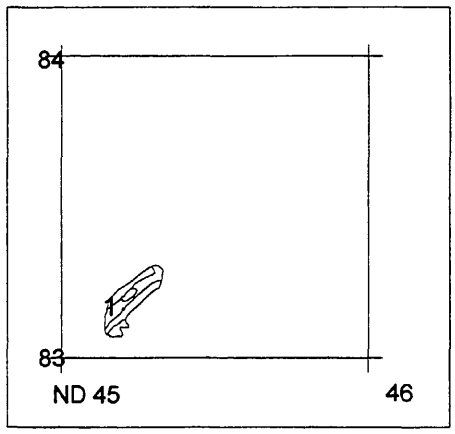
Map 3d Target note positions: Honeysgeo (South Ronaldsay)

(Map also has 12 Ayre of Cara, 13 Ayre of Westermill (Burray))

Annex 2 Quadrat Data

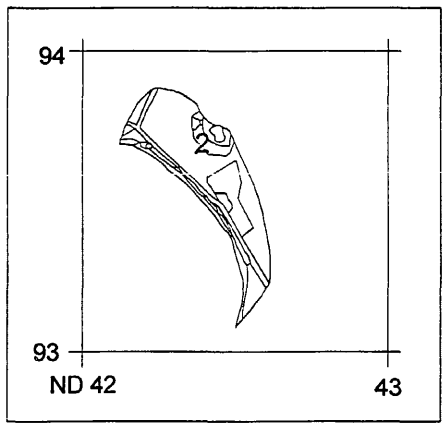
Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

	Quadrat number	1	2
	NVC type	SD 2	Mx Pp
1	Grid reference 100km square	ND	ND
2	Grid reference easting	451	423
3	Grid reference northing	831	936
11	Herb height, centimetres	8	40
12	Moss height, centimetres	-	2
15	Herb cover, %	20	100
16	Moss cover, %	-	40
22	Bare soil/litter (incl.sand)	20	-
122	Agrostis stolonifera	-	5
333	Carex nigra	-	5
509	Eleocharis palustris	-	4
525	Epilobium palustre	-	3
576	Festuca rubra	-	3
609	Galium palustre	-	3
680	Holcus lanatus	-	4
682	Honkenya peploides	3	-
690	Hydrocotyle vulgaris	-	4
813	Lychnis flos-cuculi	-	5
865	Mertensia maritima	5	-
990	Poa trivialis	-	2
1049	Potentilla palustris	-	5
1089	Ranunculus flammula	-	3
1095	Ranunculus repens	-	4
1106	Rhinanthus minor	-	4
1236	Senecio aquaticus	-	1
1445	Calliergon cuspidatum	-	7
	Number of species per sample	2	16



Map 4a Quadrat position, Brough (South Ronaldsay)

Grid lines spaced at 1 km intervals



Map 4b Quadrat position, Roeberry Taing (South Ronaldsay)

Grid lines spaced at 1 km intervals

12-14 BURRAY AND CHURCHILL BARRIERS

Location and conservation status

The island of Burray is linked to South Ronaldsay in the south by Churchill Barrier No. 4 (Ayre of Cara) and in the north to the islet of Glimps Holm by Churchill Barrier No. 3 (Weddell Sound). These barriers are boulder riprap structures built in the Second World War to protect Scapa Flow from submarine attack. An early defence measure was the scuttling of blockships, followed by the main barriers. Since construction the blockships and barriers have accumulated sand, particularly on the eastern side of Churchill Barrier No. 4 which probably represents the only major example of recent dune accretion in Orkney. Vegetated sand around the barriers is covered in this chapter, although both are also linked to islands other than Burray. Churchill Barriers No. 1 and No. 2, both further north, have no vegetated windblown sand deposits.

Three site assemblages are considered:

12	Ayre of Cara (Churchill Barrier No. 4)	ND478950
13	Ayre of Westermill	ND475957
14	Weddell Sound to Burray Links (including Churchill Barrier No. 3)	ND485980

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

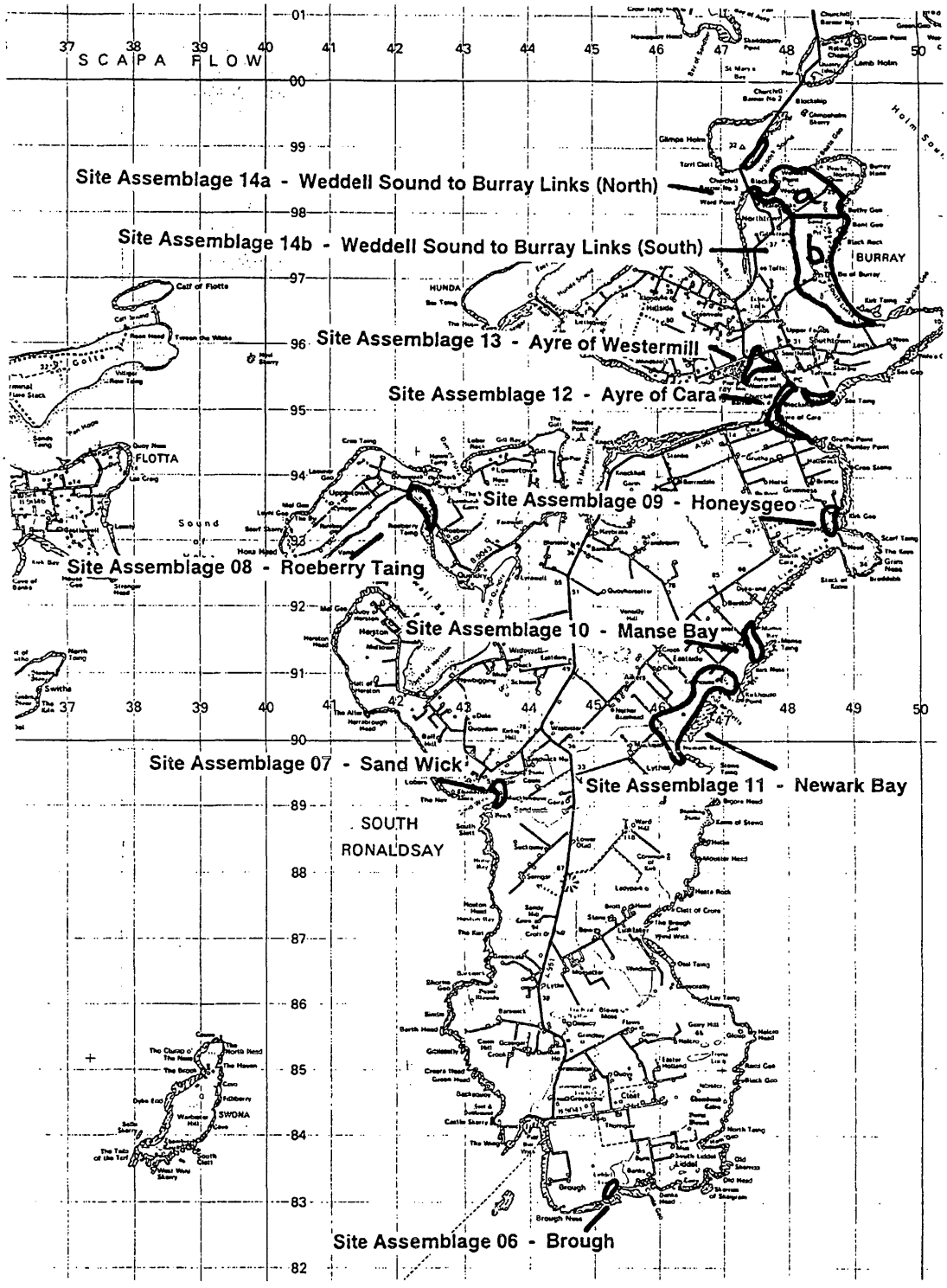
Survey details

Date	September 1996
Target notes	28 (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

The Burray and Churchill Barriers (Nos. 3 & 4) set covers two small sites (Ayre of Cara, 7.1 ha; Ayre of Westermill, 14.2 ha) and one large site (Weddell Sound to Burray Links (or Bu of Burray, 131.8 ha). Total windblown sand extent above the beach zone is 145.9 ha, most of it vegetation (111.7 ha) but also with bare sand (1.2 ha), arable and fallow ground (6.2 ha) and land take (26.2 ha) areas.



Map 1 Site assemblage location, Burray and Churchill Barriers
(Map also includes sites on South Ronaldsay)
See Volume 3 for NVC maps

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Table 1 Broad land cover extents (ha)

Sites 12-14

	12 Ayre of Cara	13 Ayre of Westermill	14 Weddell Sound to Burray Links	All Burray and Churchill Barrier sites
Windblown sand land cover				
Beach above MHWS	2.97	0.80	5.01	5.81
Bare sand	0.12	0.43	0.81	1.24
Vegetated sand (except fallows)	6.84	7.72	104.61	112.33
Arable and fallow			6.15	6.15
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.14	6.01	20.17	26.18
Total windblown sand excluding beach zone	7.10	14.16	131.75	145.91
Total windblown sand extent above MHWS	10.07	14.96	136.76	151.72
Surveyed but not on blown sand				
Bare rock				
Unvegetated maritime cliff			0.60	0.60
Saltmarsh				
Open water			0.25	0.25

Table 2 Extents (ha) of dune habitats and other ground

Sites 12-14

	12 Ayre of Cara	13 Ayre of Westermill	14 Weddell Sound to Burray Links	All Burray and Churchill Barrier sites
Habitat 1 - Beach and strand	4.00	0.94	5.24	6.18
Habitat 2 - Mobile dune	5.17		2.51	2.51
Habitat 3 - Semi-fixed dune			6.53	6.53
Habitat 4 - Fixed dry calcareous dune	0.81	5.58	68.16	73.74
Habitat 5 - Fixed acidic grassland				
Habitat 6 - Dry dune heath				
Habitat 7 - Wet dune heath				
Habitat 8 - Dune slack and wet grassland			3.32	3.32
Habitat 9 - Mire and swamp			5.63	5.63
Habitat 10 - Arable and fallow			6.15	6.15
Habitat 11 - Improved grassland		2.42	12.71	15.13
Habitat 12 - Other habitats	0.08	6.01	27.36	33.37
TOTALS (ha)	10.07	14.96	137.61	152.57

Dune habitats (Table 2, Maps 2a-b)

There are striking contrasts between sites in terms of dune habitats. Despite its small size, the Ayre of Cara has the largest extent of mobile dune (5.2 ha) and a large beach/strand zone (4.0 ha). Dune succession is, however, attenuated and the only other habitat present is land take. The absence of mobile or semi-fixed dune is in sharp contrast to the Ayre of Westermill on the other side of Churchill Barrier No. 4 and is probably due to absence of sand supply since barrier construction. The Ayre of Westermill has only fixed calcareous dune and residential land above the beach zone. The large size of the Weddell Sound to Burray Links site allows a wide range of dune habitats, with only acidic types missing (these are restricted to sites on Hoy and Eday). There is a particularly large extent of fixed calcareous dune (68.2 ha) and some slack/wet grassland (3.3 ha) and mire/swamp (5.6 ha).

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As indicated by dune habitat data, the most extensive vegetation type is SD8a *Festuca rubra - Galium verum* fixed dune, Typical sub-community (62.9 ha), followed by MG7 *Lolium perenne* leys (14.7 ha) which dominate improved grassland. Indicators of a good sand supply on the outer dune edge are extensive at Ayre of Cara. SD5 *Leymus arenarius* and SD6 *Ammophila arenaria* mobile dune (also at Weddell Sound in smaller quantity), especially the SD6b *Leymus arenarius - Elymus farctus* sub-community (2.8 ha at Ayre of Cara) form the main strand and foredune vegetation types. Typical strand types (mainly SD2 *Cakile maritima - Honkenya peploides* strandline, 0.2 ha) are uncommon (0.3 ha). Fixed dune grasslands are extensive (69.6 ha for all SD8 *Festuca rubra - Galium verum* types) but good examples of well-managed (properly grazed), floristically-rich forms (SD8d *Ranunculus acris - Bellis perennis* and SD8e *Prunella vulgaris* sub-communities) are uncommon. Instead, the SD8a Typical sub-community is dominant (62.9 ha) and, together with the SD8x provisional *Centaurea nigra - Daucus carota* type (2.0 ha), might indicate undergrazing of the sward, producing a tall and often rank sward with relatively low numbers of species. A further clue to undergrazing is the presence of SD8 swards with *Arrhenatherum elatius* (MG1/SD8 types, 6.3 ha), plus a little MG1 *Arrhenatherum elatius* coarse neutral grassland (0.5 ha). Wetland habitats are also restricted, with small amounts of MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland (3.4 ha) and an M28/S28 *Iris pseudacorus* mire - *Phalaris arundinacea* tall-herb fen intermediate (5.6 ha).

Land take for buildings/gardens (6.7 ha), arable land (6.2 ha) and sand pits (16.2 ha) is quite large, particularly at Weddell Sound to Burray Links.

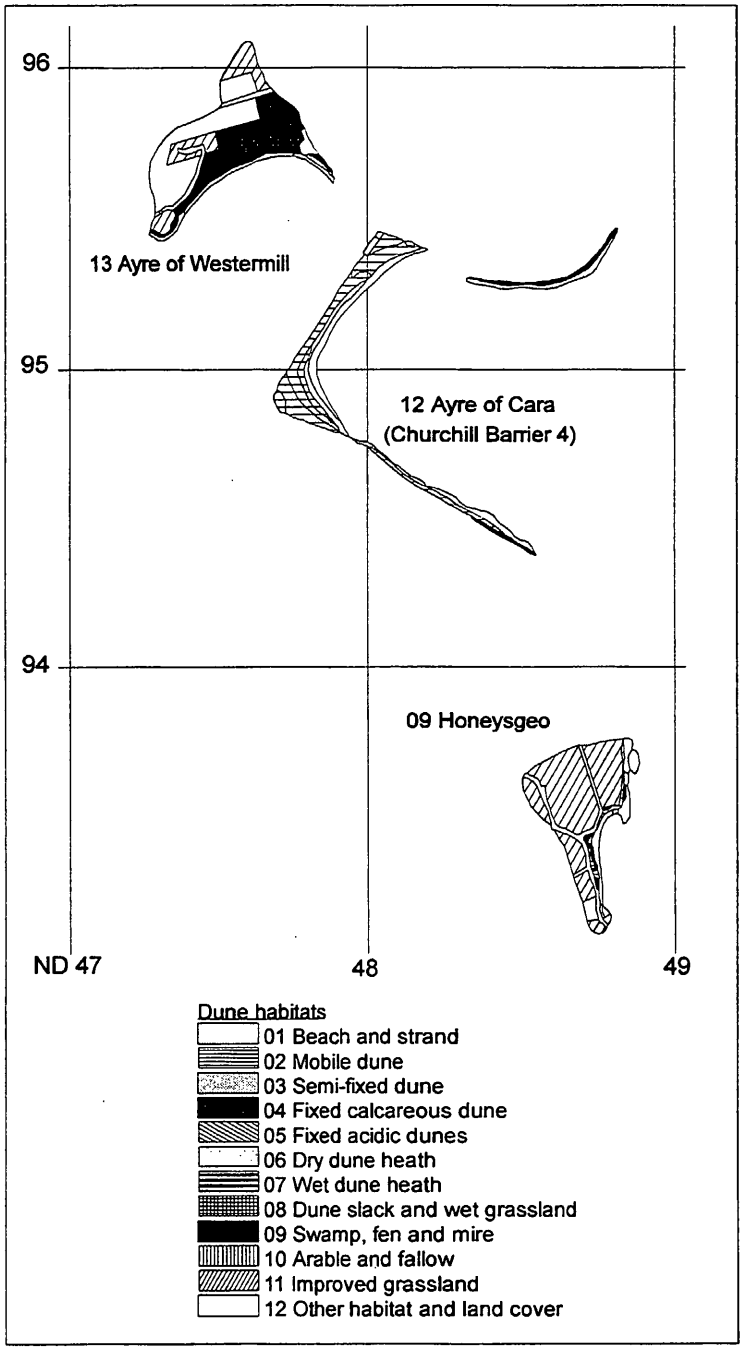
Site descriptions

12 Ayre of Cara (Map 2a)

This bay dune system is located east of Churchill Barrier No. 4 and has accreted since barrier completion in the Second World War. The total area of vegetated sand (7.1 ha) for a 50+ - year period of time is not large and accretion rates are probably relatively modest. Strand and mobile dune vegetation types are dominant, with SDy/SD2 forming the main strand and SD6b occupying most of the interior. Sand blow is weakest in the southwest and SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community is present here with no *Ammophila arenaria* in the sward. It is important to stress that though SD6b *Ammophila arenaria* mobile dune is extensively mapped, *Leymus arenarius* is the dominant sand-trapping species at the Ayre of Cara, including within the SD6b type. Recreational pressure is heavy at the site, mainly at the north end close to the car park - better management is desirable, including preventing vehicles passing beyond the car park. Small amounts of sand extraction already seem to take place and at present there is a threat of major extraction. This would destroy much of the geomorphological and ecological interest of a site which is unique in Orkney and perhaps in Britain in terms of origin and known accretionary history. Despite its small size the site is of great interest, as well as being an important recreational resource.

13 Ayre of Westermill (Map 2a)

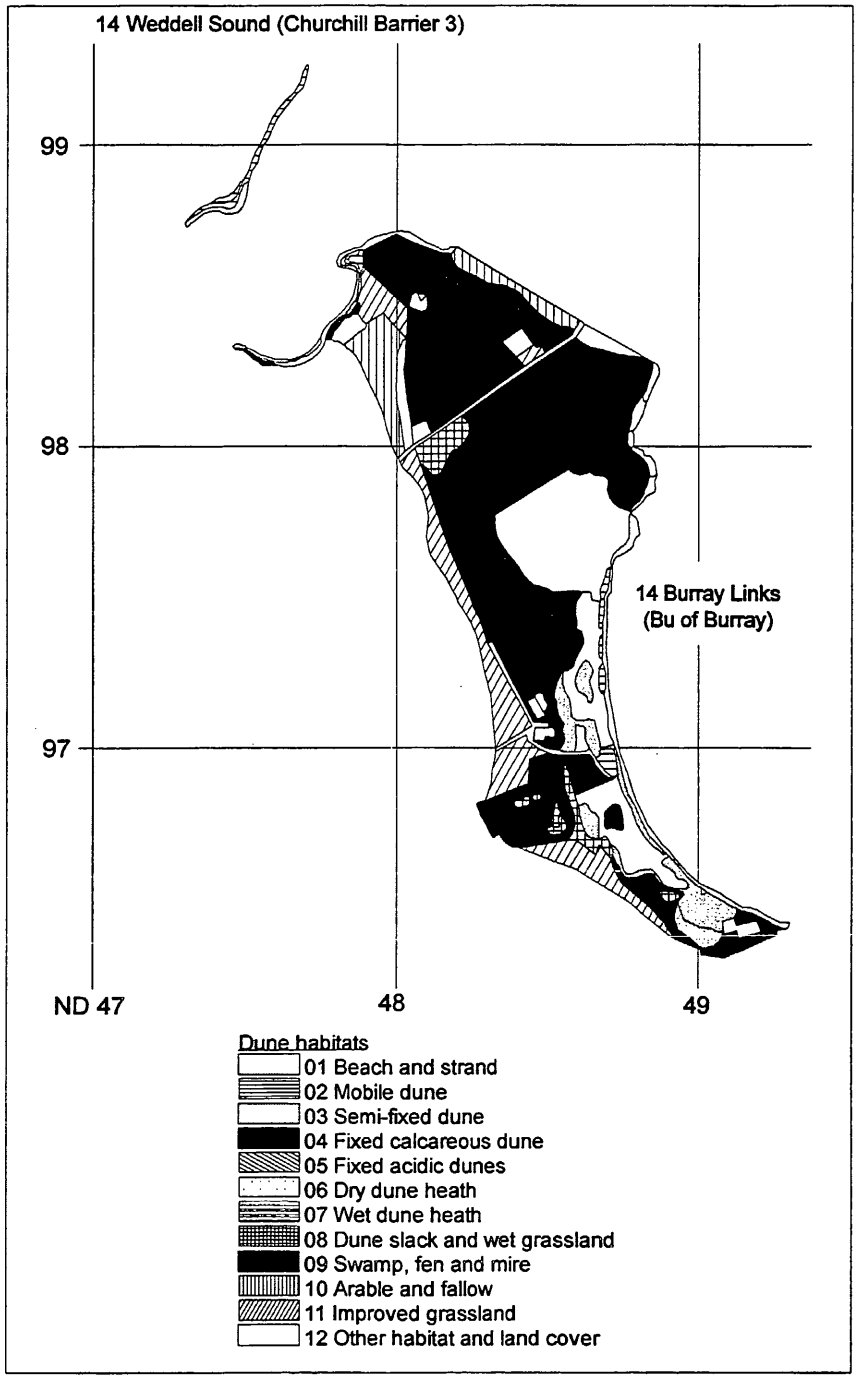
This bay and climbing dune site is located to the west of Churchill Barrier No. 4, on the south coast of Burray. It was formerly exposed to a narrow SE fetch across the North Sea but barrier construction has since created great shelter, as well as cutting off sand supply. The present beach is entirely shingle and there is no sand, even in the intertidal zone. A short sector of the dune edge is eroding in the centre of the bay but is probably stable elsewhere. Sand has been blown up to 500 m inland, with a thin covering over hillslopes to the north. The western sector has been lost to houses and gardens, but further east an intermediate MG1/SD8a sward occupies the largest part of the site, which does not appear to be grazed by stock at present. Rabbit grazing in one small sector is sufficient to maintain an SD8d sward. Other ground in the north has been improved (MG7 ley) and a former sand pit is present, currently used for storing heavy vehicles. Part of this ground has been restored with an MG7 seed mix. The site is a good example of the long-term effects of no sand supply under sheltered conditions, resulting in loss of mobile and semi-fixed dune types. The vegetation of the site has low to moderate nature conservation interest because the SD8d and MG1/SD8a types present are extensive elsewhere.



Map 2a Dune habitats of 12 Ayre of Cara and 13 Ayre of Westermill, Burray

(Map includes 09 Honeysgeo, South Ronaldsay)

Grid lines spaced at 1 km intervals



Map 2b Dune habitats of Weddell Sound to Burray Links, Burray

Grid lines spaced at 1 km intervals

14 Weddell Sound to Burray Links (Map 2b)

This is a large bay and climbing dune site (total extent of mapping 137.6 ha) which extends from the main area of sand supply, Burray Links (The Bu of Burray) on the east coast of Burray, northwards to Weddell Sound where there are small amounts of sand deposited on the east side of Churchill Barrier No. 3. Burray Links is exposed to a long E - ENE fetch to the coast of southern Norway and the headland to the south, Burray Ness, is low and offers little shelter from southerly winds which in the past have driven mobile sand 600 m NNW to Weddell Point.

Sand extraction has destroyed virtually all of the former foredune zone on the east coast at Burray Links. The present sand pit even extends beyond the probable outer edge of the foredune and shingle is taken from the back of the main beach ridge, risking a major breach and realignment of much of the upper beach (perhaps 20 - 30 m inland of the present shingle ridge). The present beach is largely of shingle. Fragments of SD6ae vegetation are still present and some outer dune ridges are probably artificial, produced by machine. There are high-quality SD7x semi-fixed dunes (*Ammophila arenaria - Festuca rubra* community, provisional *Galium verum* sub-community) at the south end of the site, including a thick mat of tall bryophytes and occasional plants of *Ligusticum scoticum*. This grades inland into rank SD8a fixed dune grassland, with rabbit grazing producing an SD8d sward over large areas.

Dune wetland is present along the inland edge of Burray Links (mainly as M28/S28 *Iris pseudacorus - Phalaris arundinacea* mire, with MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland in a few places and MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* grassland on higher ground. Most other wetland is further north on the floors of older sandpits which are rarely worked, a thin sand cover over flushed bedrock producing young but species-rich and interesting SD8e swards which have a good bryophyte cover.

The northern interior of the site is dominated by extensive SD8a fixed dune grassland, much of which is only lightly grazed by cattle. A road runs through the centre of this block and to the south there is a motorcycle scrambling circuit with extensive tracks and heavily disturbed ground. The edges of this large block are converted to MG7 improved grassland or arable land.

The dune edge of Weddell Sound has only limited interest, with a narrow fringe of SD5b Leymus arenarius mobile dune patchily present above SDy and SD2 strandlines. Sand supply here is much poorer than in the Ayre of Cara.

Sand extraction has destroyed much of the mobile and semi-fixed dune vegetation interest of this site. Dune sandstone (aeolinite) was reported by Mather *et al.* (1974) but was not seen in 1996 survey and this too has probably been removed, leaving the Sands of Evie (Mainland) as the only Orkney site with a major exposure. Most extraction takes place adjacent to Burray Links but other pits are present in the north of the site. A former stone quarry is also present, with small fish cages placed in open water occupying the base of the former extraction area. It seems likely that sand extraction cannot continue in the long term and there are probably opportunities for restoring a foredune component. Equally interesting would be restoration of pit floors inland where there is a high moisture and flushing component to the environment - SD8e swards are already locally of interest. The present quarries lack grazing except by rabbits and stock would help to diversify the vegetation mosaic, although fencing should be used to keep animals off the outer foredune zone.

Despite the effects of sand extraction the site has much of interest and it is the most diverse site on Burray and South Ronaldsay. The vegetation of the site has locally high nature conservation value but the scale of disturbance reduces overall interest to a moderate level. Restoration could greatly improve the conservation value with detailed design and sympathetic modification of sand pits to create dune-type relief.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

Sites 12 - 14

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	12 Ayre of Cara	13 Ayre of Westermill	14 Weddell Sound to Burray Links	All Burray and Churchill Barrier sites
ARB	Arable - barley			6.15	6.15
BBG	Buildings, bare ground and gardens	0.04	5.25	1.45	6.70
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	2.08	0.18	0.66	0.84
BMC	Maritime cliff with little vegetation			0.60	0.60
BS	Bare sand (within vegetated sand zone)	0.12	0.43	0.81	1.24
BSH	Bare shingle	0.89	0.62	4.35	4.97
CMTY	Graveyard			0.50	0.50
M28/S28	M28/S28 intermediate			5.63	5.63
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.81		0.48	0.48
MG1/SD8	MG1/SD8 intermediate			0.09	0.09
MG1/ SD8a	MG1/SD8a intermediate		5.18	1.06	6.24
MG7	MG7 *Lolium perenne* leys		1.99	12.71	14.70
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland			3.36	3.36
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland			0.30	0.30
OW	Open water			0.25	0.25
PIT	Active sand pit or rock quarry	0.04		16.22	16.22
ROAD	Road and track		0.76	2.00	2.76
RUD	Ruderal-dominated vegetation	0.03		0.40	0.40
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline			0.18	0.18
SD5/ SM28	SD5/SM28 intermediate		0.12		0.12
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.45		1.04	1.04
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	1.70		0.18	0.18
SD6ae	SD6a/e intermediate			0.58	0.58
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community	2.81		0.06	0.06
SD6c	SD6c *Ammophila arenaria* mobile dune, *Leymus arenarius* sub-community			0.19	0.19
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			8.70	8.70
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community		0.20	62.72	62.91
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community		0.21	1.92	2.12
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community			2.66	2.66
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)			1.95	1.95
SD9a	SD9 *Ammophila arenaria - Arrhenatherum elatius* grassland, *Festuca rubra* sub-community			0.37	0.37
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)			0.05	0.05
SDy/SD5	SDy/SD5 intermediate		0.02		0.02
TOTALS (ha)		10.07	14.96	137.61	152.57

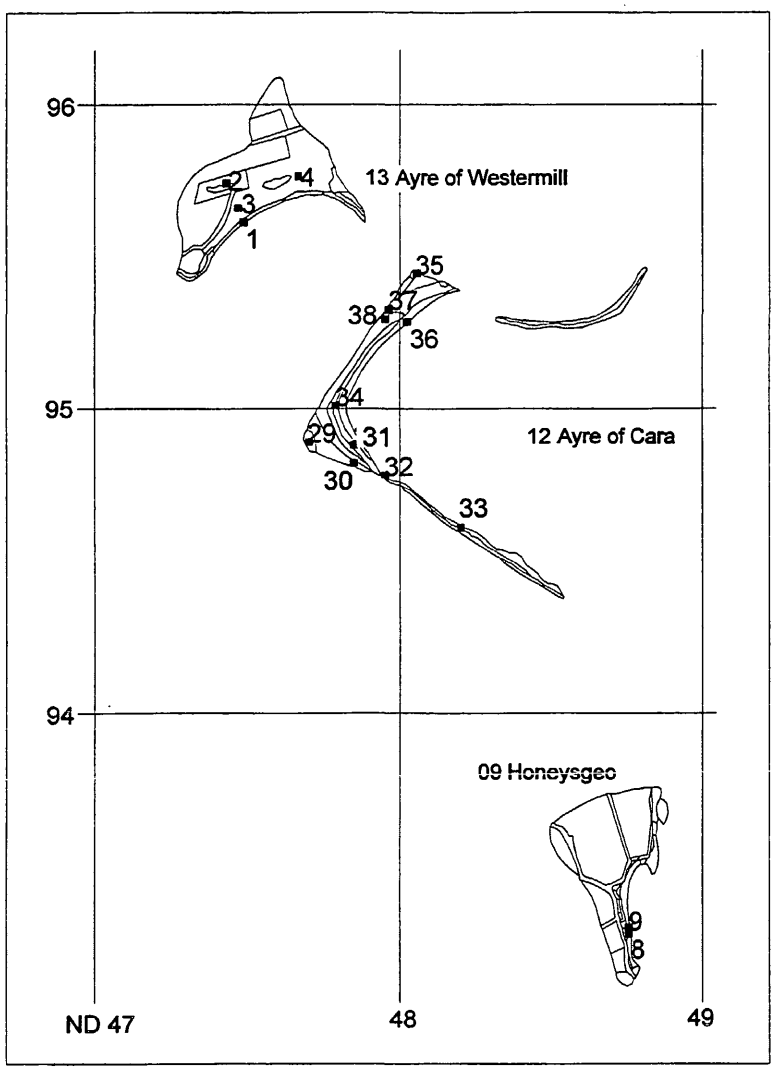
Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	ND47509560	13 Ayre of Westermill (West Links)	Gently sloping shingle beach with no sand even in intertidal zone. Shingle has 0.5-2 m sand cap, probably derived from sediment sources now obstructed by Churchill Causeway No. 4 to southeast. Dune edge in centre of bay is cliffed to 1.5 m with recent turf collapse. Edge elsewhere is stable.
2	ND47459566	13 Ayre of Westermill (West Links)	Old sand pit now used as car park for mobile crane. Small piles of rubble dumped in base. Part restored with MG7 sward (50% bare ground).
3	ND47499563	13 Ayre of Westermill (West Links)	Dump of old cars and rubble.
4	ND47609566	13 Ayre of Westermill (West Links)	Bulk of West Links is rank 40 cm tall MG1/SD8a grassland, the result of lack of stock grazing. Scattered *Urtica dioica, Heracleum sphondylium, Centaurea nigra* point to steady change to MG1 vegetation. Only a small area on a steep south-facing bank remains as SD8d, probably due to rabbits.
5	ND48809665	14 Weddell Sound to Burray Links (Bu of Burray)	Large active sand pit (1-2.5 m face), all excavated since 1987 aerial photography. Foredune ridge breached in one place.
6	ND49029655	14 Weddell Sound to Burray Links (Bu of Burray)	Fine SD7x dunes with thick deep bryophyte mat (*Rhytidiadelphus triquetrus, Rhytidiadelphus squarrosus*) and scattered *Angelica sylvestris, Primula vulgaris*.
7	ND49009656	14 Weddell Sound to Burray Links (Bu of Burray)	Gently sloping shingle beach with patchy thin sand cover. Small fragments of SD2 (*Cakile maritima*) strand. Backed by impressive 8 m high steep (30 degree) dune scarp, with slow turf slumping in lower parts where foot of dune is cliffed 0.5-1.5 m.
8	ND48409675	14 Weddell Sound to Burray Links (Bu of Burray)	Large stand of M28/S28 with wettest areas occupied by tussocky MG11 and MG13 vegetation (including *Polygonum hydropiper* and *Menyanthes trifoliata*).
9	ND48669685	14 Weddell Sound to Burray Links (Bu of Burray)	Deep drain to shingle ridge - scattered *Hippuris vulgaris* in floor. Little interest.
10	ND48609690	14 Weddell Sound to Burray Links (Bu of Burray)	Old sand pit floor with patchy cover (60%) of SD8a, including much *Agrostis stolonifera*.
11	ND48709695	14 Weddell Sound to Burray Links (Bu of Burray)	Recently abandoned sand pit floor with 30% ruderal cover, including *Cakile maritima*. Much of area spread with straw animal bedding and nutriphiles prominent (*Stellaria media, Urtica dioica, Sonchus arvensis Cirsium vulgare*).
12	ND48709710	14 Weddell Sound to Burray Links (Bu of Burray)	Foredune zone destroyed and shingle immediately behind main ridge excavated and sorted from sand. Major threat of sea breaking through in this area and forcing shingle ridge to develop 20-30 m inland, with consequent readjustment to whole shoreline in bay.
13	ND48759700	14 Weddell Sound to Burray Links (Bu of Burray)	*Ligusticum scoticum* in SD7x turf between sand pits.
14	ND48609733	14 Weddell Sound to Burray Links (Bu of Burray)	Old sand pit floor excavated close to water table. Hollows developing MG11 (perhaps MG13) slack, with tussock SD8a on higher ground. Shows potential for wetland development if proper landscaping and ecological design pursued.

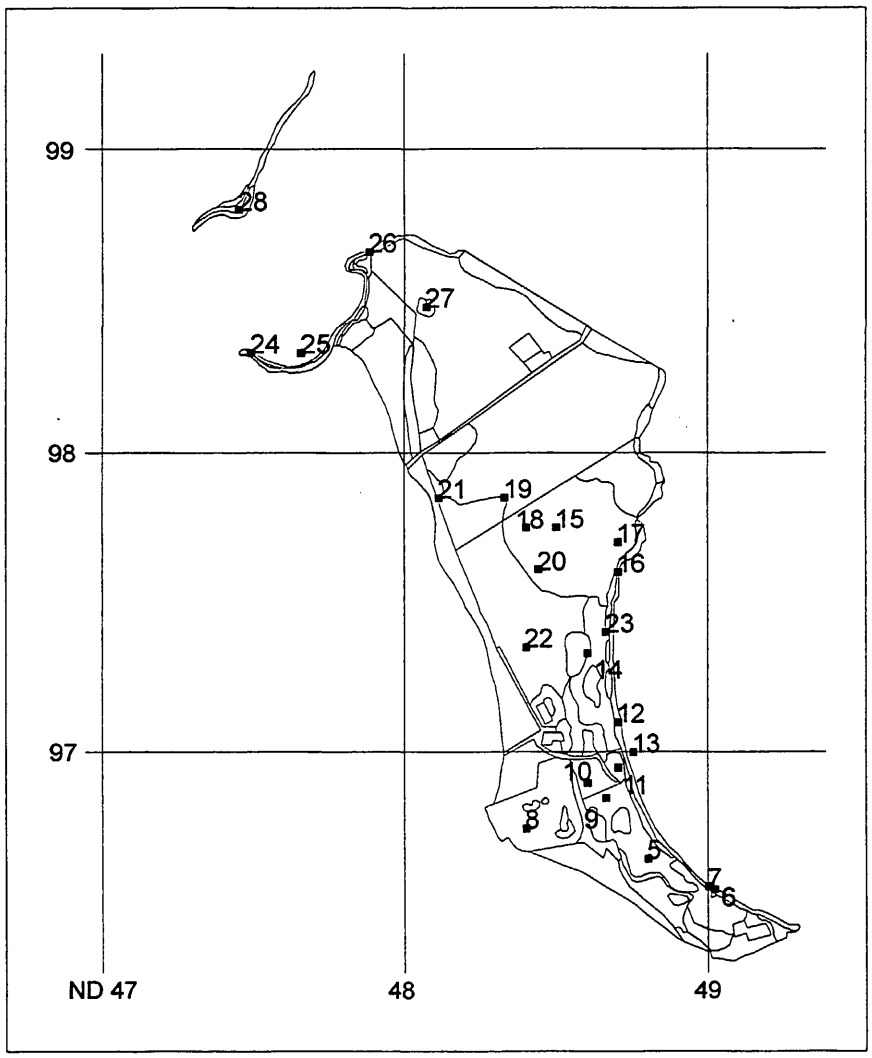
#	Grid Ref.	Site	Target Note Detail
15	ND48509775	14 Weddell Sound to Burray Links (Bu of Burray)	Old sand pit floor, stripped down to bedrock on 5-8 degree slope. Only 10% colonisation by patches of *Agrostis stolonifera, Festuca rubra, Sagina nodosa, Plantago coronopus, Ceratodon purpureus*. A very slow succession - would have been aided by a thin skin of sand, allowed to develop small dune relief naturally. Mapped as pit due to extent of bare ground.
16	ND48709760	14 Weddell Sound to Burray Links (Bu of Burray)	Cobble beach and thin sand over bedrock ledges. No strand.
17	ND48709770	14 Weddell Sound to Burray Links (Bu of Burray)	Flushed area over bedrock with fully vegetated sand. - good SD8e vegetation. Shows potential for sensitive habitat creation.
18	ND48409775	14 Weddell Sound to Burray Links (Bu of Burray)	Stream draining upper parts of old pit. Large quantities of *Drepanocladus aduncus* and *Philonotis fontana* on sides.
19	ND48339785	14 Weddell Sound to Burray Links (Bu of Burray)	Turf destroyed along marked track 0 m wide - probably large motorcycle scrambling circuit. Tracks extend as far north as ND48339815
20	ND48449761	14 Weddell Sound to Burray Links (Bu of Burray)	Good SD8e sward in area close to water table. Patches of *Selaginella selaginoides* are locally common in turf.
21	ND48119785	14 Weddell Sound to Burray Links (Bu of Burray)	Field used as sand pit, MG7 regrowth. Pit extends down eastern side, excavated to boundary fence (1-2 m face, still being worked).
22	ND48409735	14 Weddell Sound to Burray Links (Bu of Burray)	Old quarry with part wet floor. One cluster of *Eleocharis palustris*. Little interest.
23	ND48669740	14 Weddell Sound to Burray Links (Bu of Burray)	Sand pit floor, excavating south to fence. Small scale extraction.
24	ND47509833	14 Weddell Sound to Burray Links (Bu of Burray)	SD5c and SD6b edge to sandy beach. SD8e inland for 10 m.
25	ND47669833	14 Weddell Sound to Burray Links (Bu of Burray)	Dune edge cliffed to 1.5 m with SD5b on summer accretion bank.
26	ND47889866	14 Weddell Sound to Burray Links (Bu of Burray)	Eroding coast - fresh cliffing exposing sand and shingle mix, with loss of SD6b dunes.
27	ND48079848	14 Weddell Sound to Burray Links (Bu of Burray)	Old quarry with open water base - used for fish farming (three cages).
28	ND47469880	14 Weddell Sound to Burray Links (Bu of Burray)	Good example of local dune development arising from barrier construction. Narrow 1 m SDy strand backed by 5-15 m wide SD5b, then SD5c vegetation on oldest accretion ground. SD5b zone continues along coast beneath steep cliffs for 500 m to northeast.

#	Grid Ref.	Site	Target Note Detail
29	ND47709489	12 Ayre of Cara (Churchill Barrier No. 4)	Dump for rubble, sand and animal bedding.
30	ND47859482	12 Ayre of Cara (Churchill Barrier No. 4)	Striking contrast either side of fence passing through SD6b vegetation. Grazed (southern) side has much-suppressed growth of *Leymus arenarius, Festuca rubra* and *Elymus farctus*. These are much more abundant in terms of cover and height to the north, acting as a much more efficient sand trap (sand is 40 cm higher on northern side of fence).
31	ND47859488	12 Ayre of Cara (Churchill Barrier No. 4)	20 m wide SDy/SD2 (*Cakile maritima* only) strand with scattered *Leymus arenarius, Elymus farctus*. Could develop rapidly into SD5b with slight increase in sand supply to this zone.
32	ND47959478	12 Ayre of Cara (Churchill Barrier No. 4)	Former gun emplacement protected from coastal erosion by rock-filled gabion baskets.
33	ND48209466	12 Ayre of Cara (Churchill Barrier No. 4)	Steep shingle beach with sand patches below cliffed till covered with thin sand and MG1 vegetation.
34	ND47799501	12 Ayre of Cara (Churchill Barrier No. 4)	Bow of former blockship, now in SDy/SD2 strandline zone.
35	ND48059545	12 Ayre of Cara (Churchill Barrier No. 4)	Hard-surfaced car park and toilet block. 1-2 m wide bare sand patches developed to SE on routes to beach, with timber steps constructed in one place. Vehicles can drive beyond end of car park and have caused erosion. About 10% of ground at north end can be considered seriously damaged by visitor pressure. Ruderals also present, (*Urtica dioica*, patches of *Petasites hybridus*). Sand appears to have been extracted from some areas.
36	48029529	12 Ayre of Cara (Churchill Barrier No. 4)	Superstructure of blockship only part now not buried by sand. Forms part of SDy/SD2 strandline, but heavy trampling by visitors probably prevents vegetation development and slows down burial.
37	ND47969533	12 Ayre of Cara (Churchill Barrier No. 4)	Many small *Mertensia maritima* plants adjacent to road and in SD6b vegetation. *Honkenya peploides* also common close to road. Sand on road edge possible extracted from strandline area.
38	ND47959530	12 Ayre of Cara (Churchill Barrier No. 4)	Good simple zonation from 5 m wide SDy/SD2 strandline (with much scattered *Leymus arenarius, Elymus farctus*) to SD6b which continues inland to road. Lowest parts dominated by *Elymus farctus, Leymus arenarius* increasing on higher ground. Roadside is disturbed over a 5 m wide zone.



Map 3a Target note positions: Ayre of Cara and Ayre of Westermill (Burray)

(Map also has 09 Honeysgeo, South Ronaldsay)



Map 3b Target note positions: 14 Weddell Sound to Burray Links (Bu of Burray), Burray

Grid lines spaced at 1 km intervals

15-31 MAINLAND

Location and conservation status

Seventeen site assemblages are scattered around the coast of Mainland:

15	Warebeth	HY237085	16	Breck Ness	HY225096
17	Bay of Skaill	HY239192	18	Marwick	HY229244
19	Birsay	HY248272	20	Sands of Evie	HY378262
21	Bay of Meil	HY476118	22	Inganess	HY475087
23	Redbanks	HY527097	24	Sands of Ouse	HY550072
25	Sandside	HY589070	26	Newark	HY572045
27	Sandi Sand and Dingyshowe	HY550034	28	Howes Wick	HY512005
29	Wester Sand	HY508008	30	Scapa Bay	HY440088
31	Waulkmill	HY377065			

The locations of site assemblages are given in Map 1a-e.

The following sites have overlaps with SSSI boundaries, although no SSSI is designated primarily for its dune vegetation interest: Warebeth, Breck Ness and Bay of Skaill (Stromness Heaths and Coast SSSI/cSAC and Bay of Skaill SSSI, Map 1f); Waulkmill (Waulkmill SSSI, Map 1g). Sites at Warebeth and Breck Ness also fall within the Hoy and West Mainland National Scenic Area.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

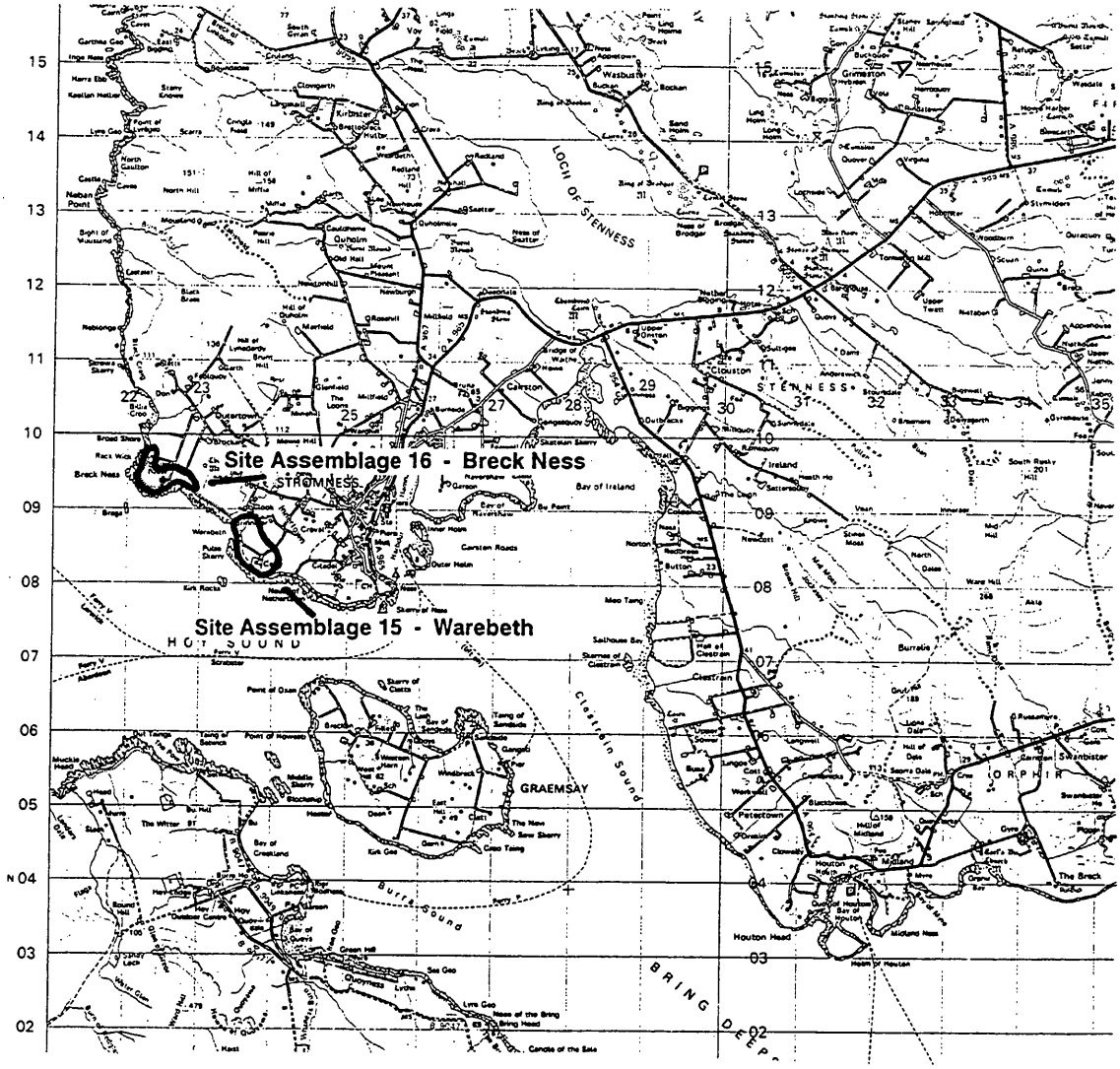
Survey details

Date	September 1996
Target notes	85 (Annex 1)
Quadrats	11 (Annex 2) - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc..

Total windblown sand area above the beach zone is 528.7 ha, most of it vegetated (444.3 ha) and with bare sand (2.1 ha), arable/fallow (38.8 ha), plus land take (41.5 ha). Many sites are very small (<5 ha: Marwick, Inganess, Redbanks, Howes Wick, Wester Sand, Waulkmill) or small (>5 ha - <10 ha: Bay of Meil, Sands of Ouse, Scapa Bay). All remaining sites are <50 ha except for Bay of Skaill which, by far, is the largest area of blown sand on Mainland (294.2 ha).



Map 1a Site assemblage location,
See Volume 3 for NVC maps

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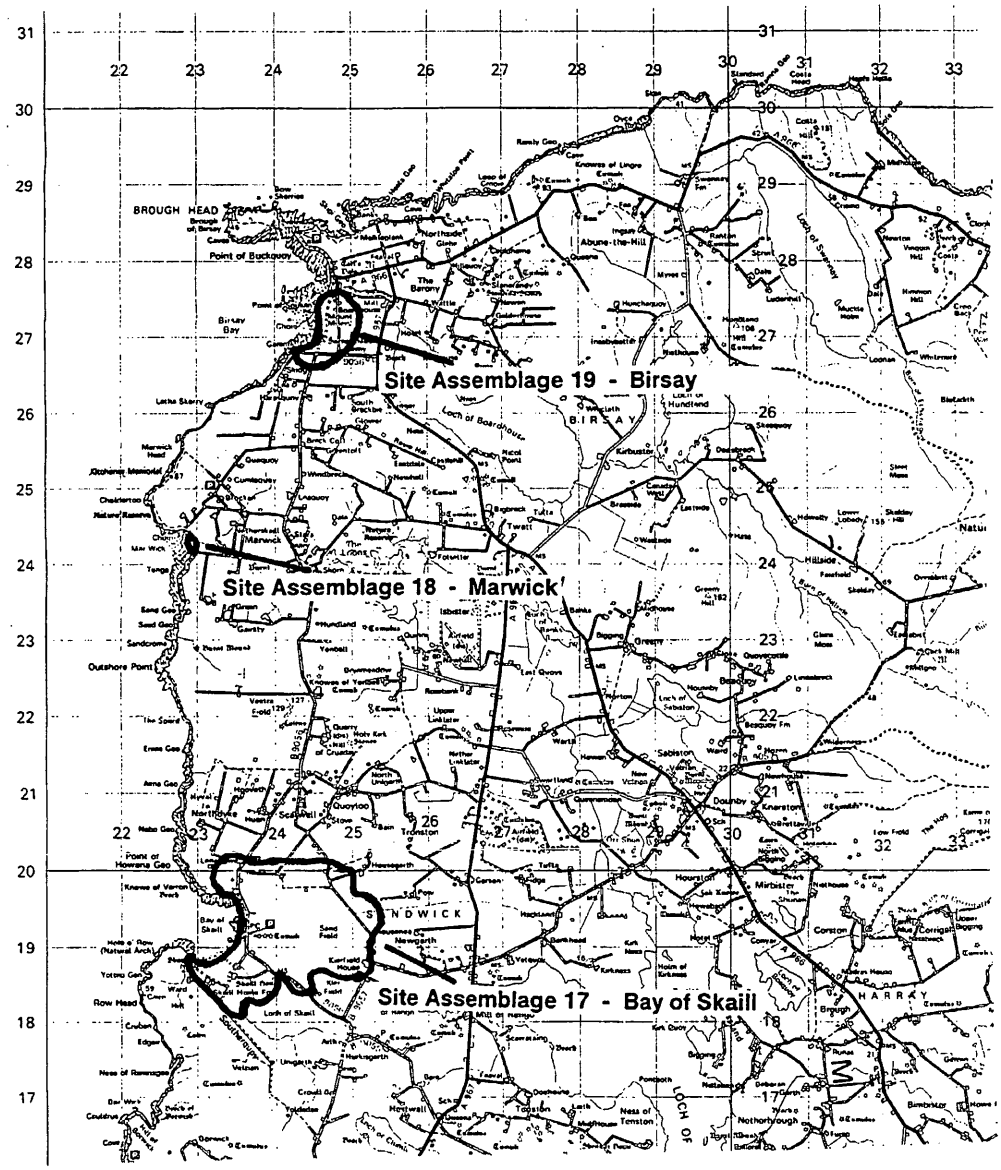

Map 1b Site assemblage location,
See Volume 3 for NVC maps

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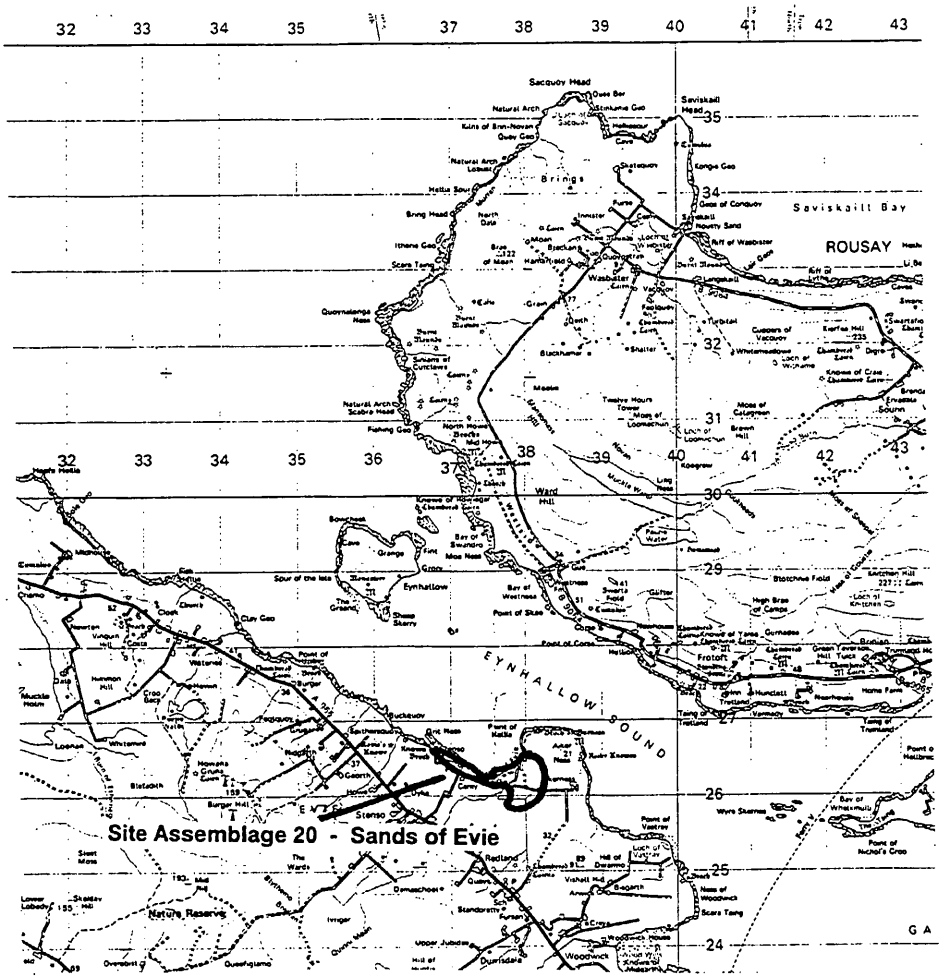

Map 1c Site assemblage location,
See Volume 3 for NVC maps

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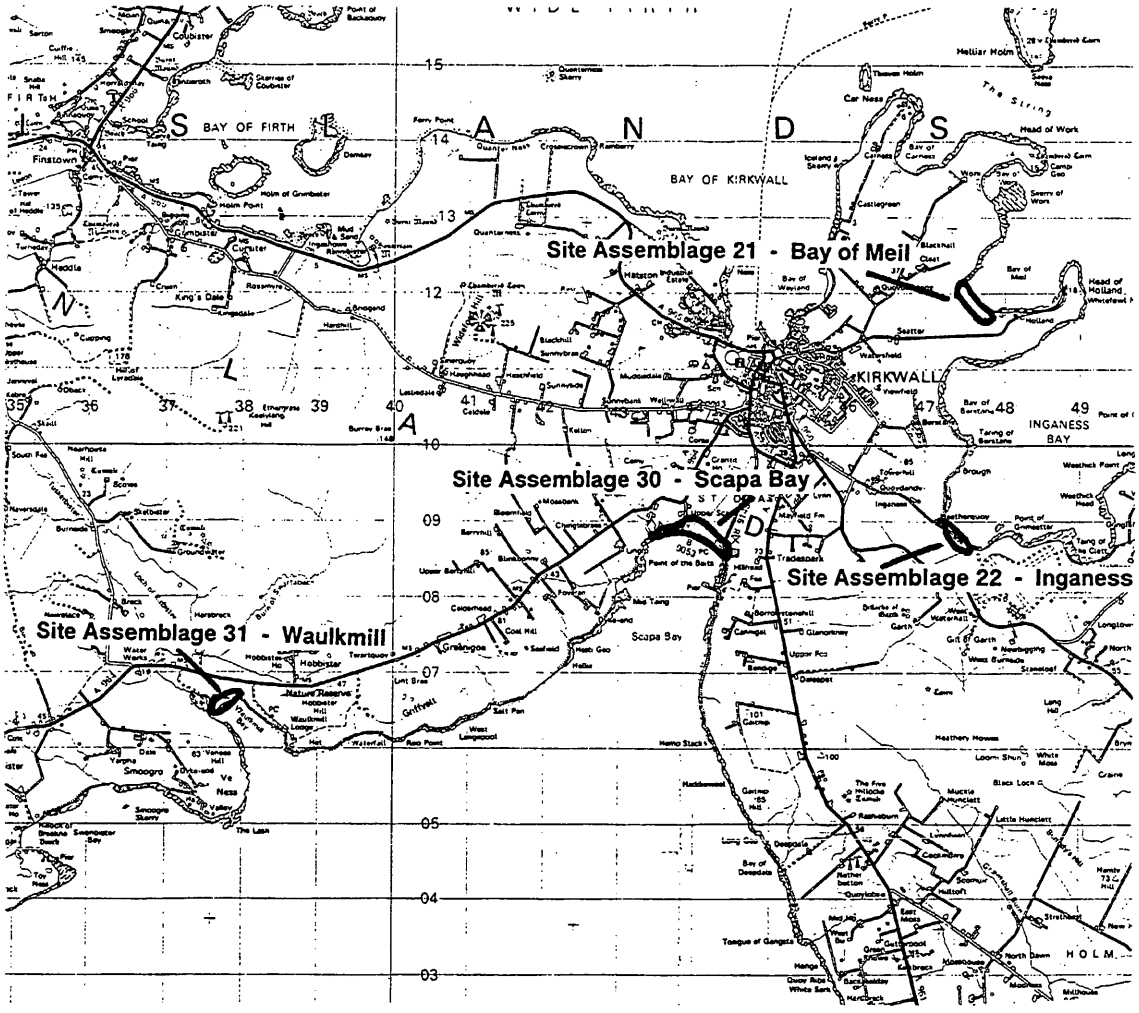

Map 1d Site assemblage location,
See Volume 3 for NVC maps

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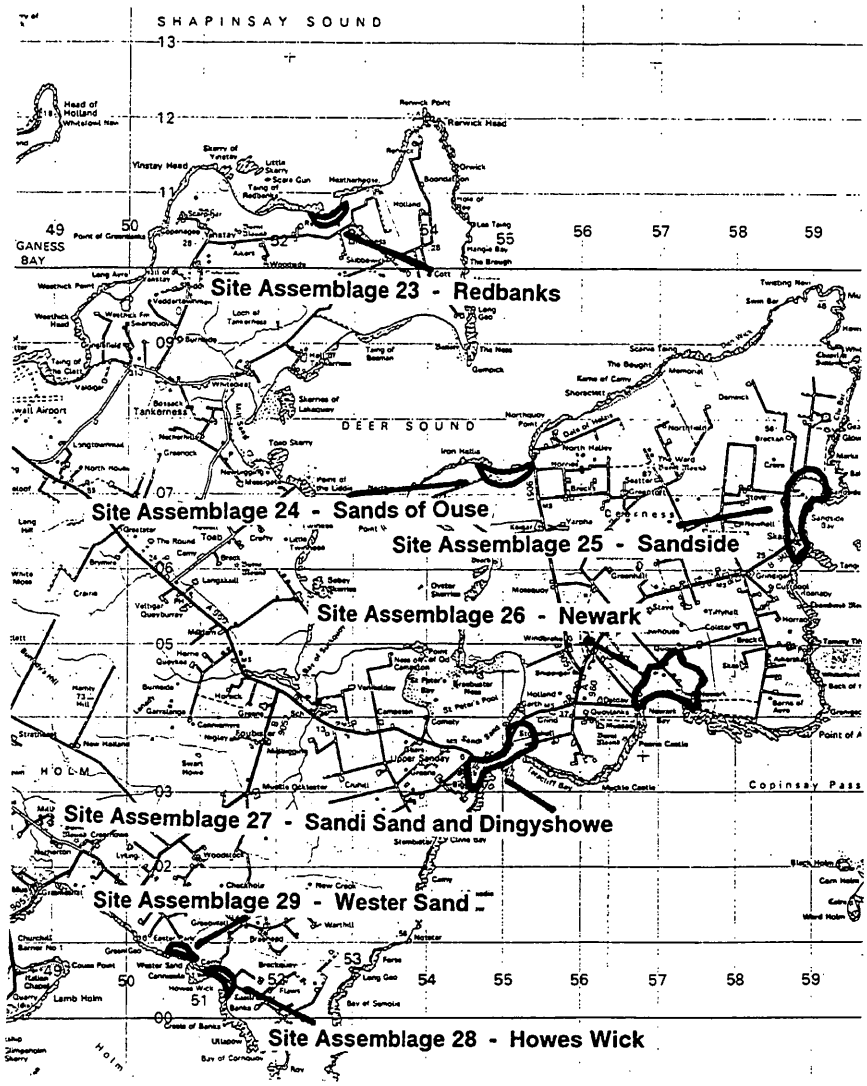

Map 1e Site assemblage location,
See Volume 3 for NVC maps

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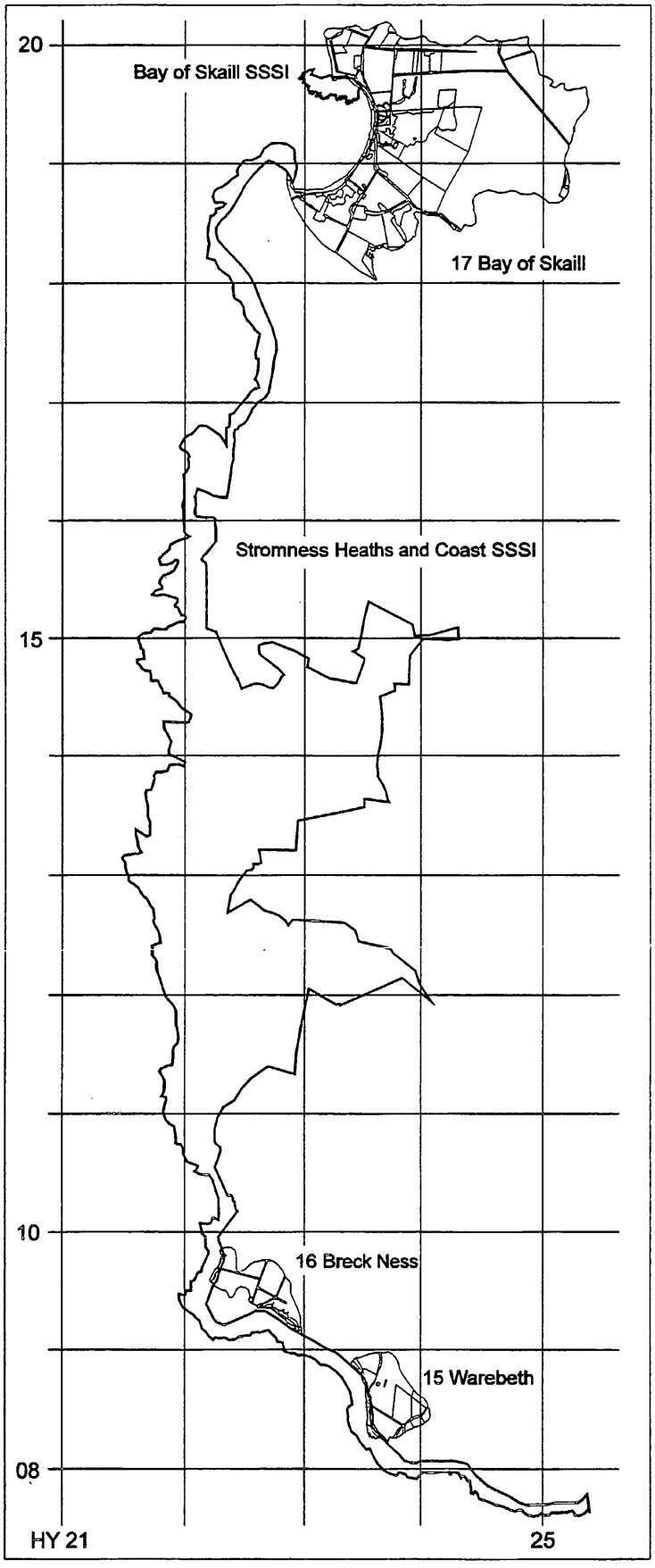
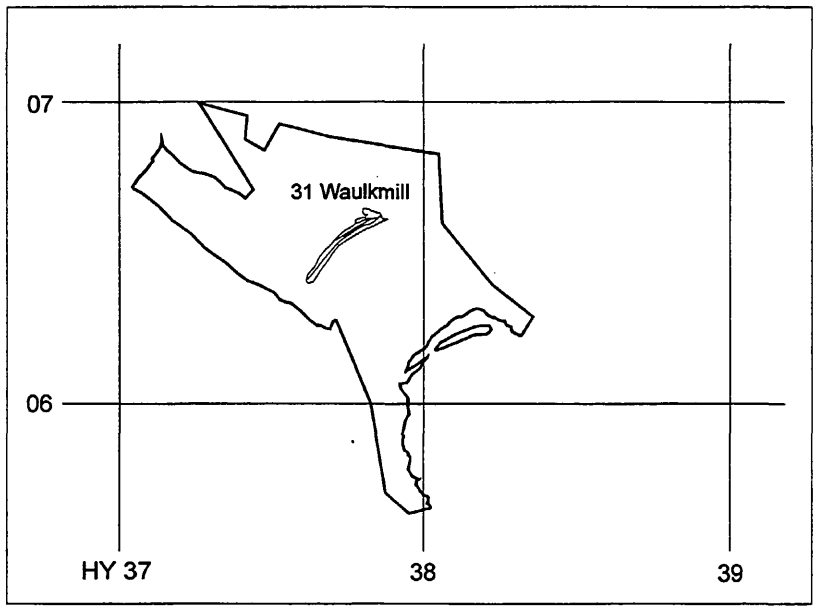


Map 1f Stromness Heaths and Coast SSSI (bold border, south and centre) and Bay of Skaill SSSI (bold border, north) in relation to Warebeth, Breck Ness and Bay of Skaill dune site assemblages



Map 1g Waulkmill SSSI in relation to Waulkmill dune site assemblage

Table 1a Broad land cover extents (ha)

Sites 15 - 19

	15 Warebeth	16 Breck Ness	17 Bay of Skaill	18 Marwick	19 Birsay	All Mainland sites 15-31
Windblown sand land cover						
Beach above MHWS	1.15	0.61	3.69	0.04	1.94	17.32
Bare sand	0.06	0.04	0.28		1.63	2.13
Vegetated sand (except fallows)	20.68	20.49	253.57	0.09	40.06	446.29
Arable and fallow	6.87		20.79			38.76
Buildings, roads, gardens, tips, pits, cemeteries, airfield	1.46	1.37	19.56		3.55	41.52
Total windblown sand excluding beach zone	29.08	21.89	294.2	0.09	45.24	528.92
Total windblown sand extent above MHWS	30.23	22.5	297.89	0.13	47.18	546.24
Surveyed but not on blown sand						
Bare rock						0.06
Unvegetated maritime cliff	0.48	0.64	0.39		0.53	2.15
Saltmarsh						0.22
Open water						0.32

Table 1b Broad land cover extents (ha)

Sites 20 - 24

	20 Sands of Evie	21 Bay of Meil	22 Inganess	23 Redbanks	24 Sands of Ouse	All Mainland sites 15-31
Windblown sand land cover						
Beach above MHWS	2.52	0.61	0.35	0.60	0.61	17.32
Bare sand						2.13
Vegetated sand (except fallows)	16.92	4.82	0.23	1.69	5.11	446.29
Arable and fallow	7.74	1.49				38.76
Buildings, roads, gardens, tips, pits, cemeteries, airfield	1.87				0.09	41.52
Total windblown sand excluding beach zone	26.53	6.31	0.23	1.69	5.24	528.92
Total windblown sand extent above MHWS	29.05	6.92	0.57	2.28	5.85	546.24
Surveyed but not on blown sand						
Bare rock	0.06					0.06
Unvegetated maritime cliff					0.04	2.15
Saltmarsh						0.22
Open water	0.32					0.32

Table 1c Broad land cover extents (ha)

Sites 25 - 29

	25 Sandside	26 Newark	27 Sandi Sand and Dingyshowe	28 Howes Wick	29 Wester Sand	All Mainland sites 15-31
Windblown sand land cover						
Beach above MHWS	1.23	0.91	0.98	0.57	0.18	17.32
Bare sand	0.10		0.03			2.13
Vegetated sand (except fallows)	28.88	32.32	13.73	1.27	0.51	446.29
Arable and fallow	0.32		1.55			38.76
Buildings, roads, gardens, tips, pits, cemeteries, airfield	4.39	2.37	1.53	0.41	0.17	41.52
Total windblown sand excluding beach zone	33.69	34.69	17.05	1.69	0.68	528.92
Total windblown sand extent above MHWS	34.92	35.60	18.03	2.26	0.86	546.24
Surveyed but not on blown sand						
Bare rock						0.06
Unvegetated maritime cliff			0.06			2.15
Saltmarsh			0.22			0.22
Open water						0.32

Table 1d Broad land cover extents (ha)

Sites 30 - 31

	30 Scapa Bay	31 Waulkmill	All Mainland sites 15-31
Windblown sand land cover			
Beach above MHWS	0.95	0.39	17.32
Bare sand			2.13
Vegetated sand (except fallows)	5.21	0.67	446.29
Arable and fallow			38.76
Buildings, roads, gardens, tips, pits, cemeteries, airfield	4.73		41.52
Total windblown sand excluding beach zone	9.94	0.67	528.92
Total windblown sand extent above MHWS	10.89	1.06	546.24
Surveyed but not on blown sand			
Bare rock			0.06
Unvegetated maritime cliff			2.15
Saltmarsh			0.22
Open water			0.32

Dune habitats (Table 2, Maps 2a-h)

The total mapped area of habitats in dune sites (548.8 ha) is dominated by improved grassland (332.0 ha). No other category approaches this extent, with only fixed dry calcareous dune grassland >50 ha (71.5 ha). Mobile (10.2 ha) and semi-fixed dune (2.7 ha) areas are low and suggest poor sand supply. There are modest extents of dune wetlands, with slack/wet grassland (18.7 ha) and mire/swamp (10.3 ha) totalling 29.0 ha. Arable and fallow ground (38.6 ha) is quite extensive and further confirms the great impact of more-intensive agriculture on Mainland dunes. Other habitats are largely made up of land take and this too is high (45.4 ha).

Table 2a Extents (ha) of dune habitats and other ground

Sites 15 - 20

	15 Warebeth	16 Breck Ness	17 Bay of Skaill	18 Marwick	19 Birsay	20 Sands of Evie	All Mainland sites 15-31
Habitat 1 - Beach and strand	1.15	0.68	3.83	0.04	2.21	3.21	19.48
Habitat 2 - Mobile dune	0.89	0.04	0.05		3.69	3.18	10.24
Habitat 3 - Semi-fixed dune			1.54				2.66
Habitat 4 - Fixed dry calcareous dune	4.46	0.95	30.14	0.09	20.33	0.45	71.48
Habitat 5 - Fixed acidic grassland							
Habitat 6 - Dry dune heath							
Habitat 7 - Wet dune heath							
Habitat 8 - Dune slack and wet grassland			14.63			0.89	18.70
Habitat 9 - Mire and swamp			7.77			0.06	10.29
Habitat 10 - Arable and fallow	6.87		20.79			7.74	38.55
Habitat 11 - Improved grassland	15.33	19.47	199.49		17.54	11.35	331.96
Habitat 12 - Other habitats	2.00	2.01	20.04		3.94	2.54	45.40
TOTALS (ha)	30.71	23.14	298.29	0.13	47.71	29.43	548.77

Table 2b Extents (ha) of dune habitats and other ground

Sites 21 - 26

	21 Bay of Meil	22 Inganess	23 Redbanks	24 Sands of Ouse	25 Sandside	26 Newark	All Mainland sites 15-31
Habitat 1 - Beach and strand	0.61	0.39	0.66	0.67	2.08	1.08	19.48
Habitat 2 - Mobile dune				0.60	0.12	0.66	10.24
Habitat 3 - Semi-fixed dune					0.44		2.66
Habitat 4 - Fixed dry calcareous dune	0.84	0.19		0.82	6.06	2.01	71.48
Habitat 5 - Fixed acidic grassland							
Habitat 6 - Dry dune heath							
Habitat 7 - Wet dune heath							
Habitat 8 - Dune slack and wet grassland				1.00	0.89	1.28	18.70
Habitat 9 - Mire and swamp				0.56	1.00	0.52	10.29
Habitat 10 - Arable and fallow	1.49				0.32		38.55
Habitat 11 - Improved grassland	3.98		1.62	2.10	19.61	27.68	331.96
Habitat 12 - Other habitats				0.13	4.39	2.37	45.40
TOTALS (ha)	6.92	0.57	2.28	5.89	34.92	35.60	548.77

Table 2c Extents (ha) of dune habitats and other ground

Sites 27 - 31

	27 Sandi Sand and Dingyshowe	28 Howes Wick	29 Wester Sand	30 Scapa Bay	31 Waulkmill	All Mainland sites 15-31
Habitat 1 - Beach and strand	1.60	0.64	0.20	0.00	0.43	19.48
Habitat 2 - Mobile dune	0.77			0.23		10.24
Habitat 3 - Semi-fixed dune	0.68					2.66
Habitat 4 - Fixed dry calcareous dune	3.56	0.45	0.14	0.54	0.45	71.48
Habitat 5 - Fixed acidic grassland						
Habitat 6 - Dry dune heath						
Habitat 7 - Wet dune heath						
Habitat 8 - Dune slack and wet grassland						18.70
Habitat 9 - Mire and swamp				0.20	0.17	10.29
Habitat 10 - Arable and fallow	1.33					38.55
Habitat 11 - Improved grassland	8.55	0.76	0.36	4.12		331.96
Habitat 12 - Other habitats	1.59	0.41	0.17	5.79		45.40
TOTALS (ha)	18.09	2.26	0.86	10.89	1.06	548.77

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As suggested by dune habitat results, Mainland dunes are dominated by MG7 *Lolium perenne* leys (316.8 ha), plus small amounts of intermediates with SD8 *Festuca rubra - Galium verum* fixed dune. Strand and embryo dune (SD2 *Cakile maritima - Honkenya peploides*, SDy provisional *Atriplex glabriuscula*, SD4 *Elymus farctus* communities plus a distinctive SD5/SM28 *Elymus repens* saltmarsh intermediate) conditions are all very low (<1 ha) in extent and mobile dune (SD5 *Leymus arenarius*, SD6 *Ammophila arenaria*) and semi-fixed dune (SD7 *Ammophila arenaria - Festuca rubra*) conditions are likewise rare (each <5 ha). Such low quantities suggest a combination of poor sand supply and conversion of much vegetation in the inner foredune zone into improved grassland. SD8 fixed dune sub-communities are the most common typical dune habitats: SD8a Typical (12.0 ha), SD8d *Ranunculus acris - Bellis perennis* (39.5 ha) are the most widespread. An important additional area of such swards is invaded by *Arrhenatherum elatius*, suggesting undergrazing is common (MG1/SD8 types: MG1/SD8 1.6 ha; MG1/SD8a 4.5 ha). Wetlands are largely represented by MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland (21.0 ha), but MG13 *Agrostis stolonifera - Alopecurus geniculatus* (0.3 ha), dune slack (SD17 *Potentilla anserina - Carex nigra* 0.3 ha) and mires (M28 *Iris pseudacorus - Filipendula ulmaria* 7.6 ha; provisional MxPp *Carex nigra - Potentilla palustris* 0.4 ha; provisional MxTm *Carex nigra - Triglochin maritima* 1.3 ha) and swamp (S10 *Equisetum fluviatile* 0.1 ha; S19 *Eleocharis palustris* 0.4 ha; S28 *Phalaris arundinacea* tall-herb fen 0.1 ha) contribute to overall wetland diversity.

Site descriptions

15 Warebeth (Map 2a)

This bay and climbing dune site lies in the southwest of Mainland, with a long exposed W fetch across the Atlantic. Most of the site interior is MG7 improved ley or arable land. The outer edge has low to modest nature conservation interest, with SD8d fixed dune grassland present in one large block and with MC8/SD8, SD4/SD8c and SD8d intermediates marking a spray zone with sand deposition along the present dune edge. Aeolinite is present in coastal sections on top of shingle. The Stromness Heaths and Coast SSSI/cSAC overlaps with coastal edge of the site but most dune vegetation lies just outside the SSSI boundary.

16 Breck Ness (Map 2a)

This bay and climbing dune site is located on the Breck Ness headland of SW Mainland, with two beaches with exposed fetches SW to the Scottish mainland and W across the Atlantic. Aeolinite is exposed in coastal sections along the south shore. Apart from a restricted area of spray-influenced fixed dune (MC8/SD8a) on the south shore and a very small amount of SD8a on the west, there is no nature conservation interest in terms of vegetation. The site interior is entirely improved (MG7 leys). The Stromness Heaths and Coast SSSI/cSAC runs close to coastal edge of the site but all dune vegetation lies just outside the SSSI boundary.

17 Bay of Skaill (Map 2b)

This bay and climbing dune site lies on the west coast of Mainland, with a long and very exposed fetch west across the Atlantic. The beach is made up of steeply sloping shingle, with erosion in places and attempts to control retreat have been made using anti-submarine thick wire netting to hold material in place. The western end of the site contains the famous Skara Brae historical settlement which was formerly buried in sand. Erosion around the site is controlled by a vertical concrete sea wall and long-term protection with offshore defence structures is currently planned.

There is little nature conservation interest in the site. The bulk of the interior, a very large expanse of climbing dune extending 1.5 km inland, is improved grassland for cattle and a few sheep, and parts have also been used as sand pits. One large block of SD8a and SD8d fixed dune grassland remains but parts have seen sand extraction and MG11 inundation grassland is developed in former sand pit floors. A small area of SD7x semi-fixed dune, provisional *Galium verum* sub-community is present at the western end of this block and is the only large occurrence on Mainland. Other smaller SD8 blocks are present further north and there is a heavily-trampled SD8 fringe along the top edge of the beach, adjacent to paths leading from parking areas to the Skara Brae site. The edge here is in poor condition in several places and reinstatement is probably required, including fencing to keep the public from the dune edge. Good wetland is developed in the south of the site, mainly as large M28 *Iris pseudacorus* mire, but also with a good example of MxTm mire.

18 Marwick (Map 2c)

This bay dune site on the west coast of Mainland has an exposed long WSW fetch to the Scottish mainland and across the Atlantic. It is very small and consists only of a thin sand cover upon a shingle system, with dune vegetation confined to the shingle crest. A rank SD8a sward is present but the turf includes *Ligusticum scoticum*. There is almost no nature conservation interest.

19 Birsay (Map 2c)

This bay dune site on the west coast of Mainland has an exposed long W fetch across the Atlantic. It is one of the most poorly managed sites in Orkney. Natural coastal erosion due to exposure is greatly exacerbated by stock trampling and sheltering effects, mainly during the winter when the area is used as feeding ground. There is also trampling by visitors. Part of the former foredune zone has been used for sand extraction and stock access here is mobilising sand on steep pit faces. The outer dune edge is cliffed in many places, often with turf slumping. Blowouts are present and relict old dune surfaces are present as mesa-like landforms (tallards). Unsightly dumping of rubble and shingle is used in several places to reduce erosion of the outer dunes and blowouts. Despite management problems there are large areas with SD8 fixed dune and MG11 inundation grassland is developed in the floor of the former sand pit. Much of the rear of the site is improved (MG7 leys). Nature conservation interest is low to moderate, with *Mertensia maritima* (nationally scarce) and *Polygonum raii* on the strand. Wet ground inland is infested with *Petasites hybridus* and there is a threat that this could spread and reduce the quality of wetter grasslands.

20 Sands of Evie (Map 2d)

This bay and climbing dune site lies on the north coast of Mainland, to the south of the island of Rousay and with a moderately exposed NW fetch up Eynhallow Sound and into the Atlantic. The main beach is sand and there are signs of moderate accretion, with some of the largest extents of strand (SD2 and SDy/SD2 intermediate) and SD5 *Leymus arenarius* mobile dune (SD5b *Elymus farctus* and SD5c *Festuca rubra* sub-communities) present in moderate quantities. A burn enters the sea through the foredunes and is deflected to the north, giving the accreting beach zone a slight resemblance to a spit. Sand is blown inland and this climbing dune component is mainly improved (MG7 ley) or arable. A small patch of SD8a fixed dune is present in a fenced area which encloses a good aeolinite exposure. Nature conservation interest is moderate, based on a good but small case of accretionary vegetation conditions, plus the aeolinite outcrop.

21 Bay of Meil (Map 2e)

This is a very small bay dune system on the north coast of Mainland, 3 km northeast of Kirkwall. The site is quite sheltered, with a short 6 km fetch NE to Shapinsay. The beach is largely shingle (intertidal sand is present) and the sand edge is cliffed and slowly eroding. Sand only extends 150 m inland and there is a narrow rank and weedy SD8a fixed dune zone along part of the outer blown sand area. Most of the interior is improved (MG7) or arable, but an MG7/SD8 intermediate is present. The vegetation of the site has virtually no nature conservation interest.

22 Inganess (Map 2f)

This is a very small bay dune system on the north coast of Mainland, in the centre of Inganess Bay. It is quite sheltered, with a 9 km fetch NE to Shapinsay. Very little blown sand is present. The beach is shingle with an SDy strand and a very small area of SD8a fixed dune is present immediately adjacent to the beach. The vegetation of the site has virtually no nature conservation interest.

23 Redbanks (Map 2e)

This is a very small bay dune system on the north coast of Mainland, lying between Yinstay Head and Rerwick Head. It is quite sheltered, with a 4 km fetch north to Shapinsay. Very little blown sand is present, extending only 40 m inland. The beach is sand, changing abruptly to improved grassland inland at the dune edge. *Lolium perenne* is present on the strand. The vegetation of the site has virtually no nature conservation interest.

24 Sands of Ouse (Map 2g)

This is a very small bay dune system on the north coast of Mainland, lying on the outer edge of Deer Sound. It is moderately exposed, with a limited fetch of 9 km north to Shapinsay. Sand supply is poor and windblown sand is only present for 60 m inland, although there is sufficient blow to maintain a 6 m high foredune ridge which has small cauldron blowouts present. SD5 *Leymus arenarius* mobile dune (SD5b and SD5c sub-communities) are present as a narrow foredune, with SD8a fixed dune grassland inland in the centre of the site and a transition to wetland with MG11 inundation grassland and M27/M28 *Iris pseudacorus - Filipendula ulmaria - Angelica sylvestris* fen/mire. To the west and east most of the site interior is improved. A burn enters the sea from the Loch of Ouse inland and there are SD2 strand fragments at its mouth. Site vegetation is of low nature conservation interest due to low extent and lack of outstanding features.

25 Sandside (Map 2g)

This is a moderately-sized bay and climbing dune site (34.9 ha) on the east coast of Mainland, the most easterly of this island set. It is exposed to a long ESE fetch across the North Sea to Denmark. The beach is mainly shingle, but with sufficient sand to develop a clear low foredune zone with mobile dune vegetation (SD6c) and a wide strand belt with SD5/SM28 *Leymus arenarius - Elymus repens* vegetation. The rear of the foredune has SD7x semi-fixed dune in the bay centre. In the past sand has been blown inland for up to 350 m and poorly-drained areas with bedrock or till close to the surface support dune wetland (MG11 inundation grassland, M28x mire, S10 swamp), surrounded by ungrazed fixed dune grassland which is invaded by *Arrhenatherum elatius* (MG1/SD8a). Most of the climbing dune interior is *Lolium perenne* improved (MG7). A track leads through the centre of the site to a car and boat park behind the foredune zone. The nature conservation interest of the site is only moderate due to the limited size of the site and the scale of improvement but it does provide typical examples of foredune development under limited sand supply and varied moisture conditions in the unimproved climbing dune sector.

26 Newark (Map 2g)

This is a moderately-sized bay and climbing dune site (35.6 ha) on the south side of the Deerness Peninsula of Mainland. It is exposed to a southerly fetch across the Pentland Firth to the Scottish mainland. The beach is a mix of sand and shingle, with sufficient sand to develop a low but very narrow foredune zone with mobile dune vegetation (SD6c) and a strand (SDy) belt. Fixed dune grasslands are present in a small part of the southeast of the site and MG7/SD8 intermediates are extensive, though most of the blown sand area is improved (MG7 leys). A former blowout complex in the southeast has MG11 and MG13 inundation grassland present in depressions, but wetland is otherwise rare. The nature conservation interest of the site is low due to the scale of improvement and restricted areas of typical dune vegetation types.

27 Sandi Sand and Dingyshowe (Map 2g)

This site covers the isthmus between western Mainland and the Deerness Peninsula at the east end of the island and is therefore a tombolo with bay dune conditions on both sides of the structure. The northern side (Sandi Sand) is sheltered and has a limited 5 km NNW fetch across Deer Sound. The southern bay (Dingyshowe) is exposed, with a long SE fetch across the North Sea to Denmark. Sand has also been blown on to adjacent hillslopes to the west and especially the east, extending inland for 200 m. The Sandi Sand shore has a wide SDy strand forming mosaics with SM28 *Elymus repens* saltmarsh and SD4 embryo dunes. The western beach edge is close to the main road and a shoreline track and is protected by a stone wall *Ammophila arenaria* is present inland but the area is ungrazed and invaded by *Arrhenatherum elatius*, producing a good example of SD9 *Ammophila arenaria - Arrhenatherum elatius* rank dune grassland from what was probably an earlier SD7x sward. The Dingyshowe shore has a fragmented SD2 strand on a sand beach (*Ligusticum scoticum* is present), with a tall but narrow foredune with several small incipient blowouts. The beach is heavily trampled by visitors who have access via a small car park and a stepped wooden walkway. There is a rapid change inland to SD7x semi-fixed dune and SD4/SD8c in the west (marking a narrow zone of heavier sand inputs) or, more extensively in the east, to SD8a and SD9 fixed dune vegetation. Cars have access to the eastern part of the tombolo and there is some erosion of the turf in SD8a areas. The climbing dune sides of the site are largely improved (MG7 leys and arable land). The nature conservation interest of the site is moderate to good, with interesting geomorphological contrasts and a good range of mobile, semi-fixed and dry fixed dune conditions compressed into a small area. High visitor numbers have created some impacts and localised erosion but these could be controlled by restricting vehicle access to the dune turf and improving access points to the Dingyshowe shore which is by far the most popular.

28 Howes Wick (Map 2h)

This is a very small bay dune site on the south side of Mainland, with a short 3 km but exposed SW fetch to Burray. The beach is shingle with an SDy strand, changing to a narrow belt of SD8 fixed dune on the outer of a road which separates the shore from a small area of improved grassland inland. Site vegetation has virtually no nature conservation interest.

29 Wester Sand (Map 2h)

This is a very small bay dune site on the south side of Mainland, 500 m NW of Howes Wick and with a similar fetch SW to Burray. It has the same vegetation zonation but is eroding more rapidly, with rubble tipped at its eastern end. Old fencing has also been dumped on the shore. Site vegetation has virtually no nature conservation interest.

30 Scapa Bay (Map 2f)

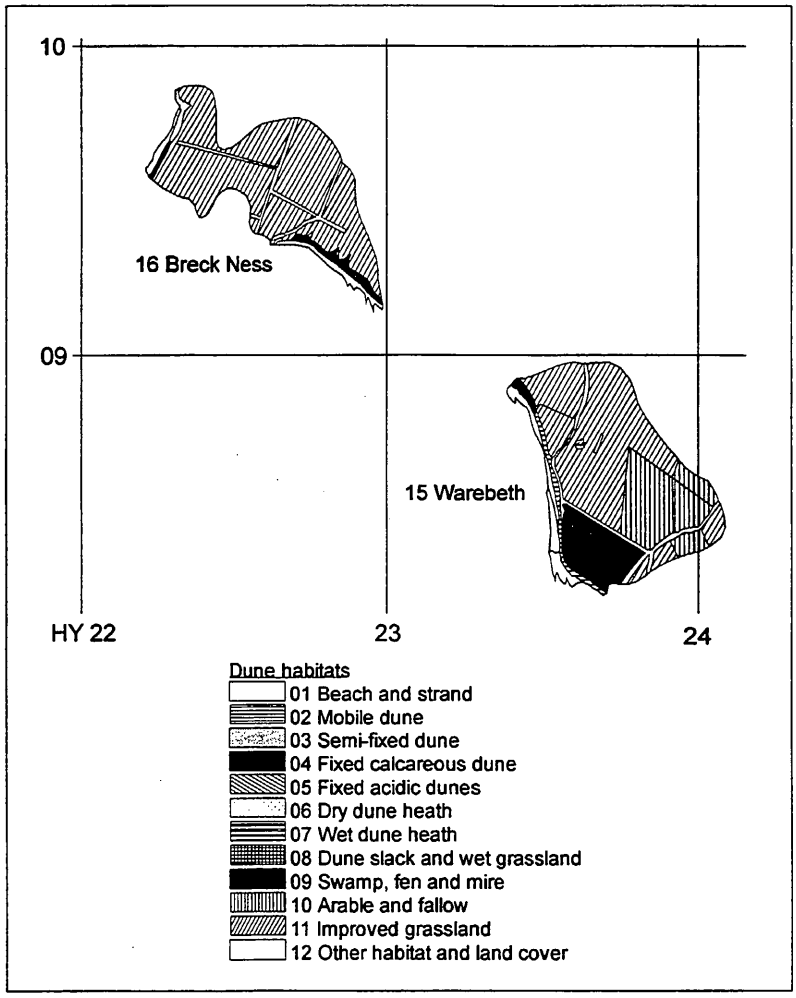
This bay dune site lies at the head of Scapa Bay, 2 km SW of Kirkwall and with a an exposed SSW fetch across Scapa Flow to Flotta. The upper beach is entirely protected by a low concrete sea wall, with the main road running along inside its inner edge. There is a near-continuous SDy/SD2 strand (with small amounts of SD5b which were not mapped) on a sand beach which is popular with visitors and well-trampled. Sand is blown over the seawall and SD5c *Leymus arenarius* mobile dune is present beside the road in the bay centre. The eastern half of the site is developed as buildings and gardens. The western interior is largely improved (MG7), with M28x *Iris pseudacorus* in a streambed. The site has minimal nature conservation interest due to coastal protection and the developed/improved interior. It is however an important recreational resource and should be managed as such.

31 Waulkmill (Map 2f)

This is a shingle spit site with a thin cover of sand on the top of the main shingle spit in Waulkmill Bay on the south coast of Mainland. The bay has 15 km fetch SE across Scapa Flow to Burray. The shingle spit encloses a small area of saltmarsh and the intertidal zone to seaward has pronounced bare sand ridges of geomorphological interest. The dune vegetation is ungrazed and forms an MG1/U4 sward at the eastern (older and more acidic) end, changing to MG1/SD8a further west. The site lies within Waulkmill SSSI which is important for its shingle and saltmarsh habitats. The dune component adds to the habitat range but extent is so restricted that it is not a major component of overall interest.

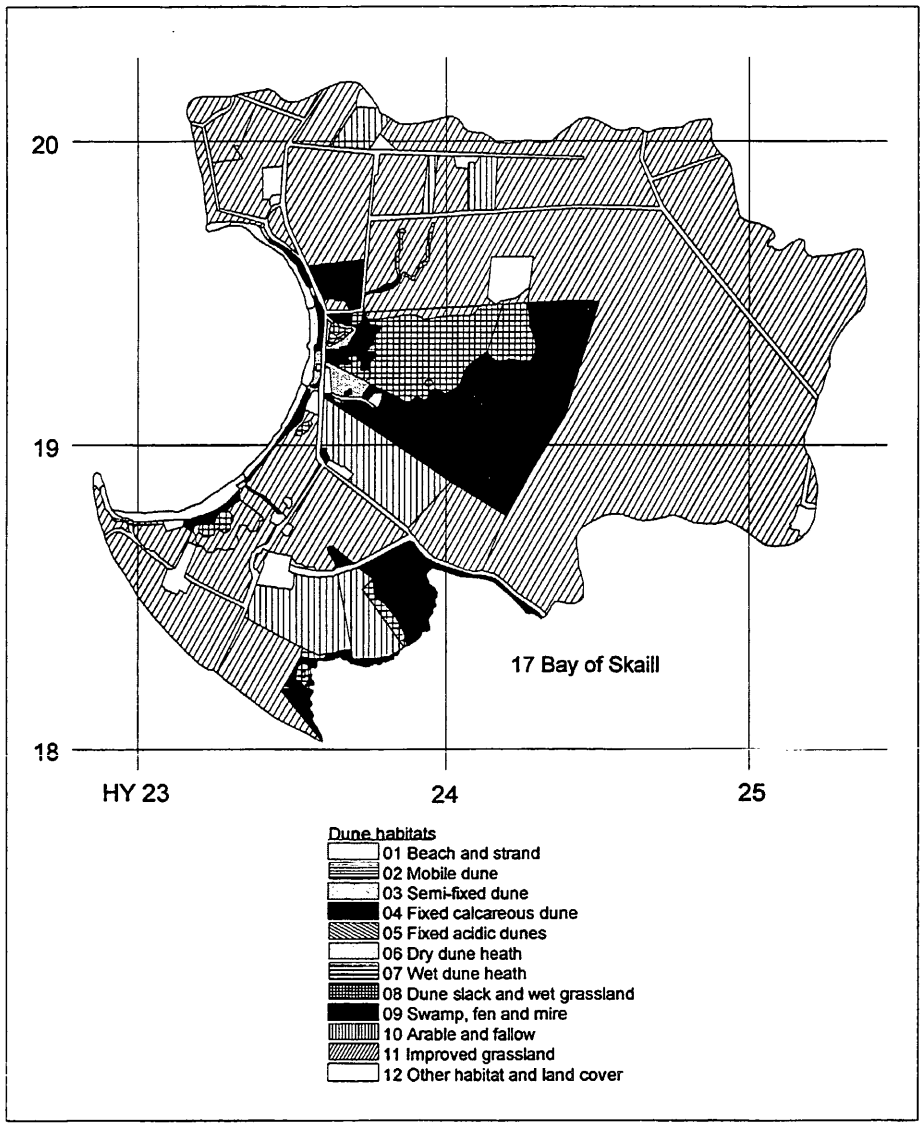
References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.



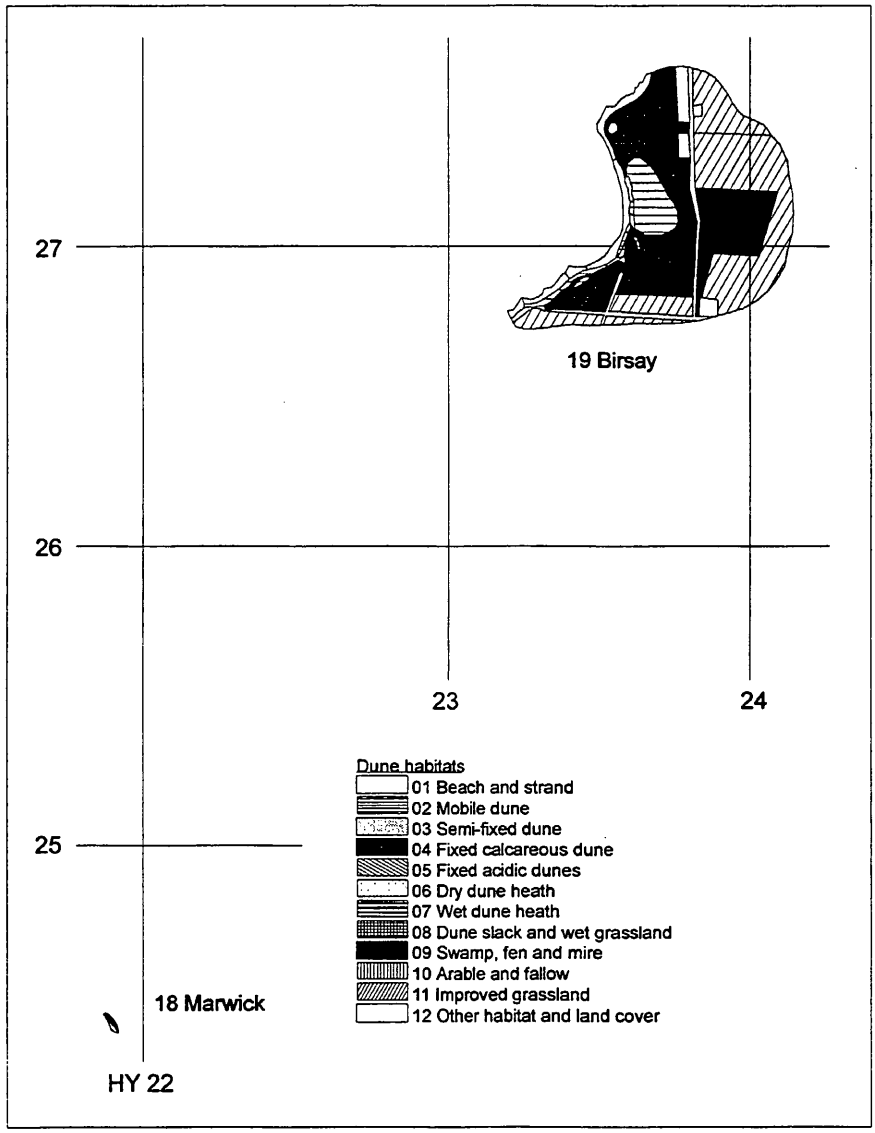
Map 2a Dune habitats of Warebeth and Breck Ness (Mainland)

Grid lines spaced at 1 km intervals



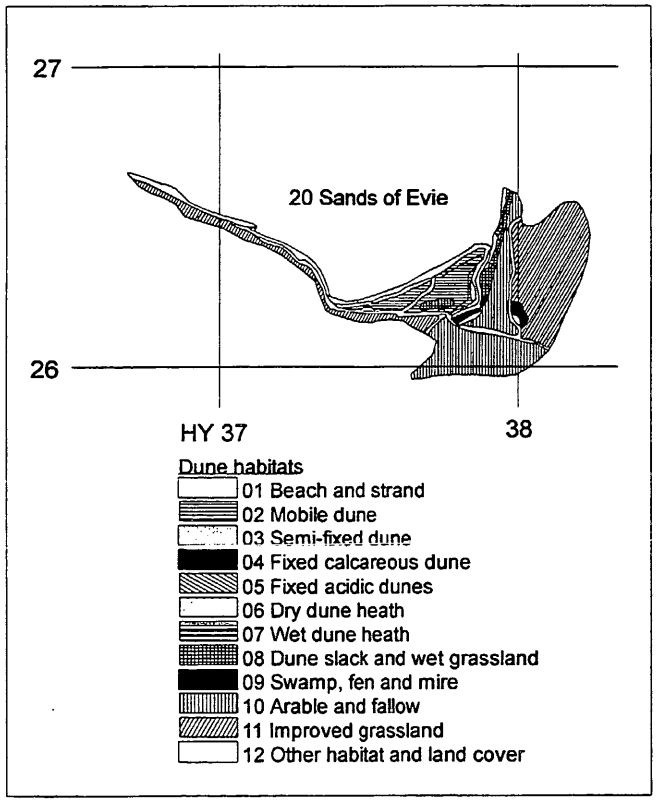
Map 2b Dune Habitats of Bay of Skaill (Mainland)

Grid lines spaced at 1 km intervals



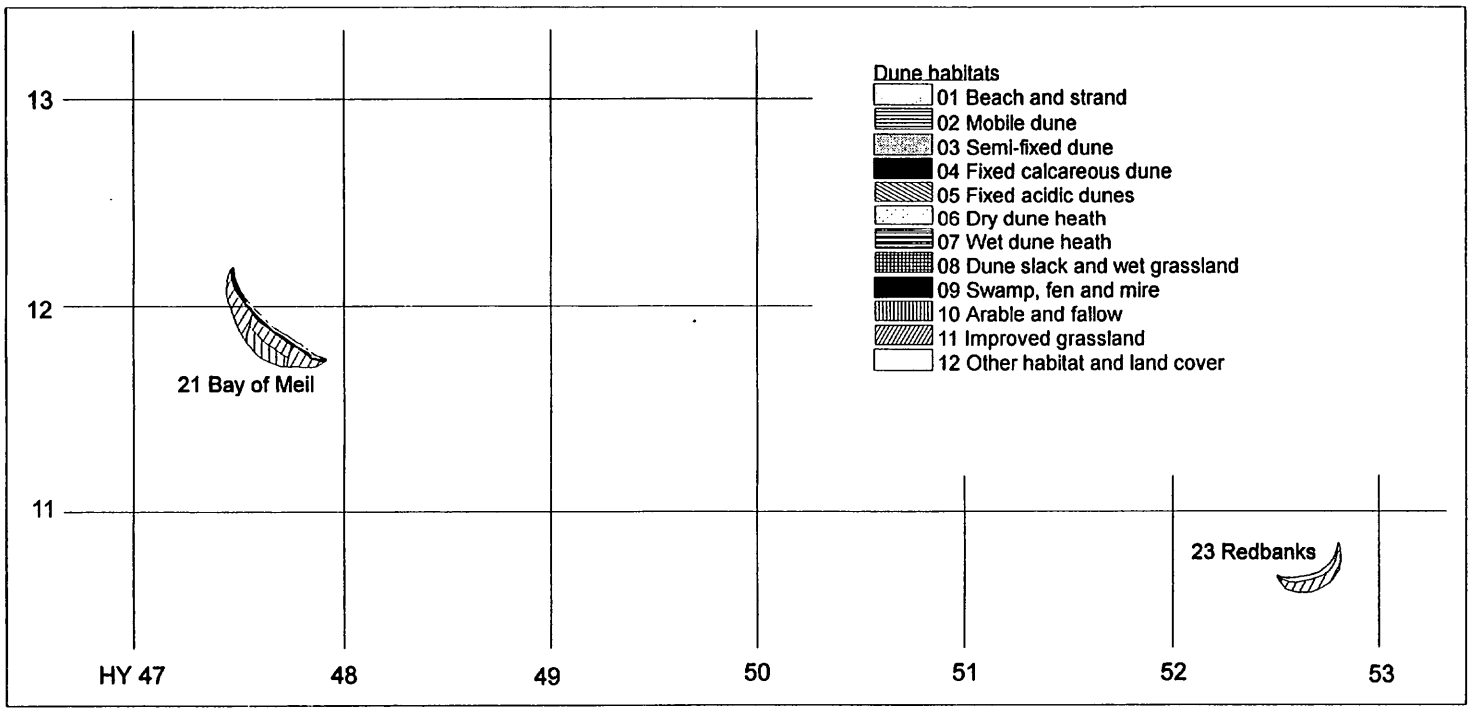
Map 2c Dune habitats of Marwick and Birsay (Mainland)

Grid lines spaced at 1 km intervals



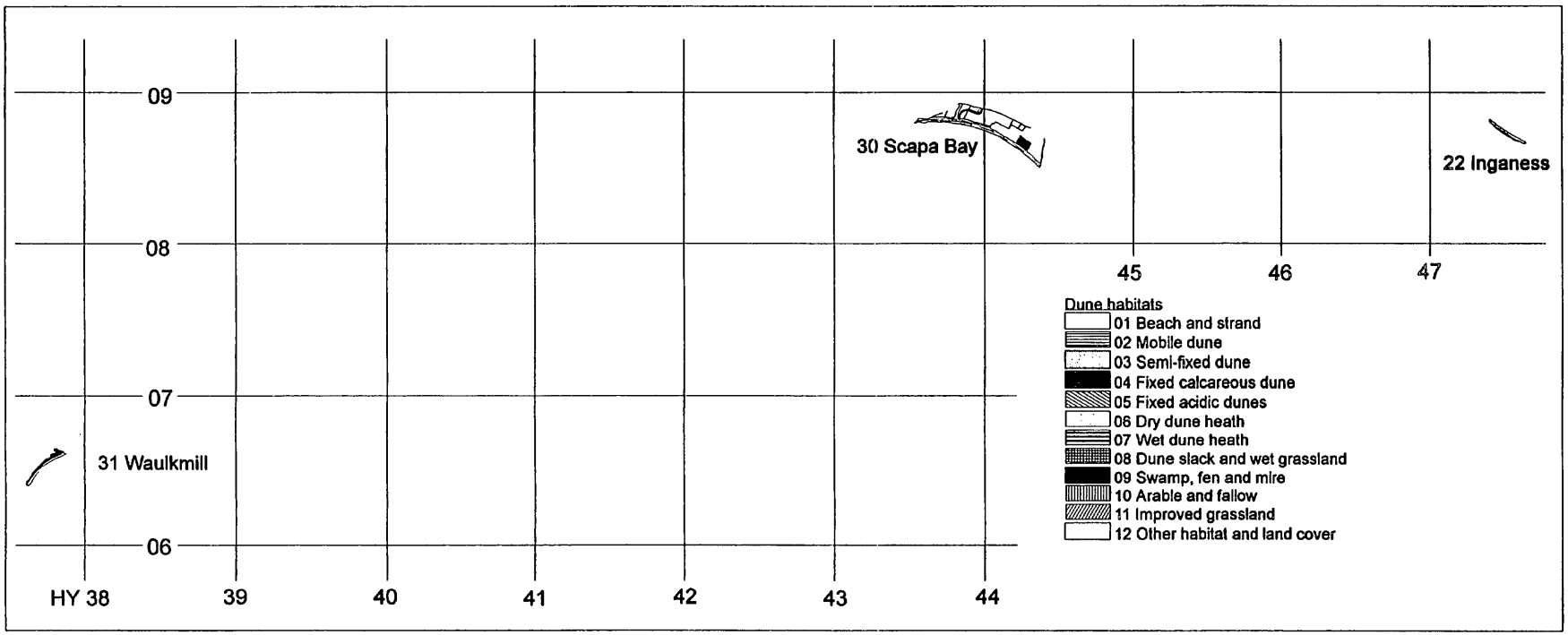
Map 2d Dune habitats of Sands of Evie (Mainland)

Grid lines spaced at 1 km intervals



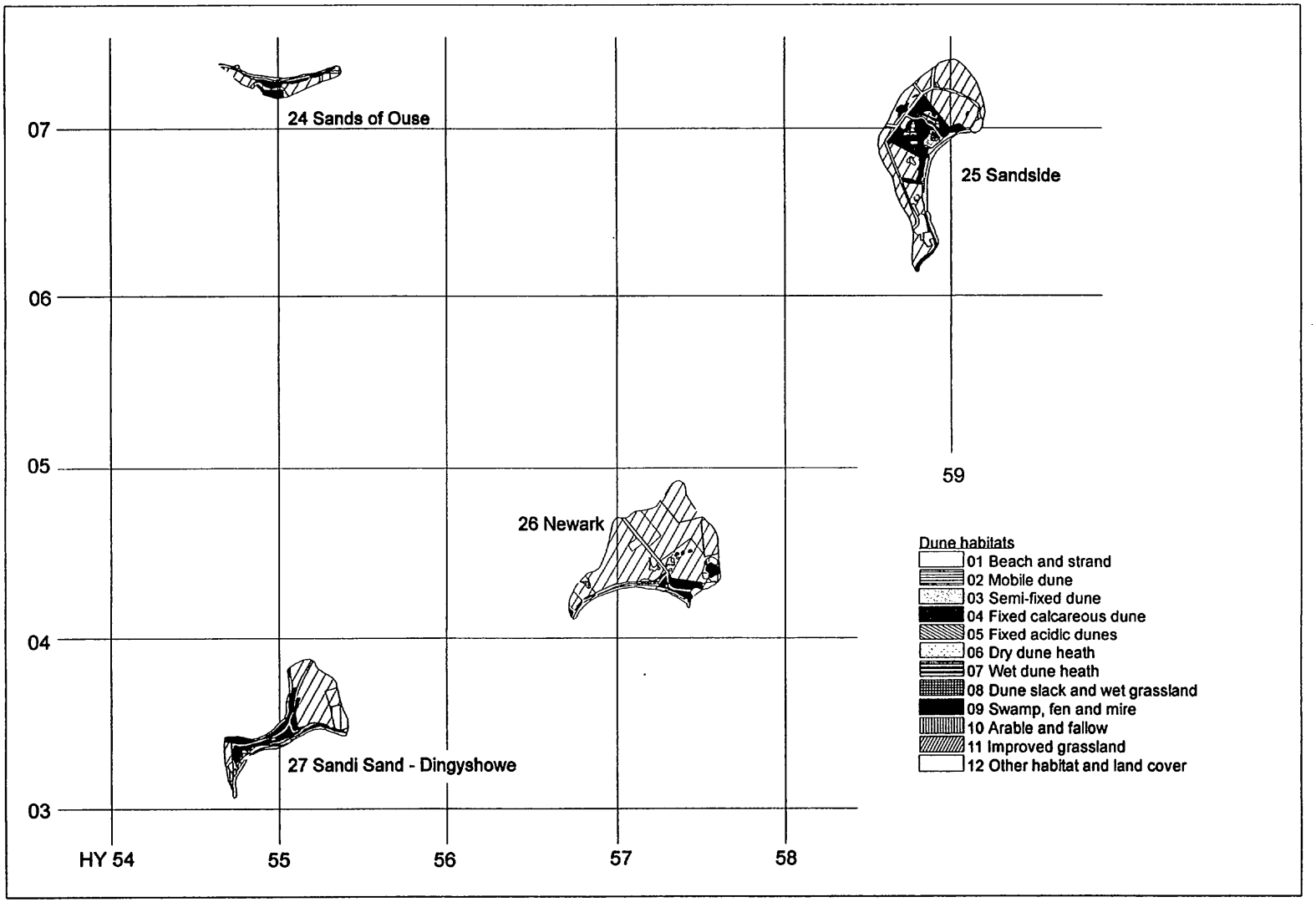
Map 2e Dune habitats of Bay of Meil and Redbanks (Mainland)

Grid lines spaced at 1 km intervals



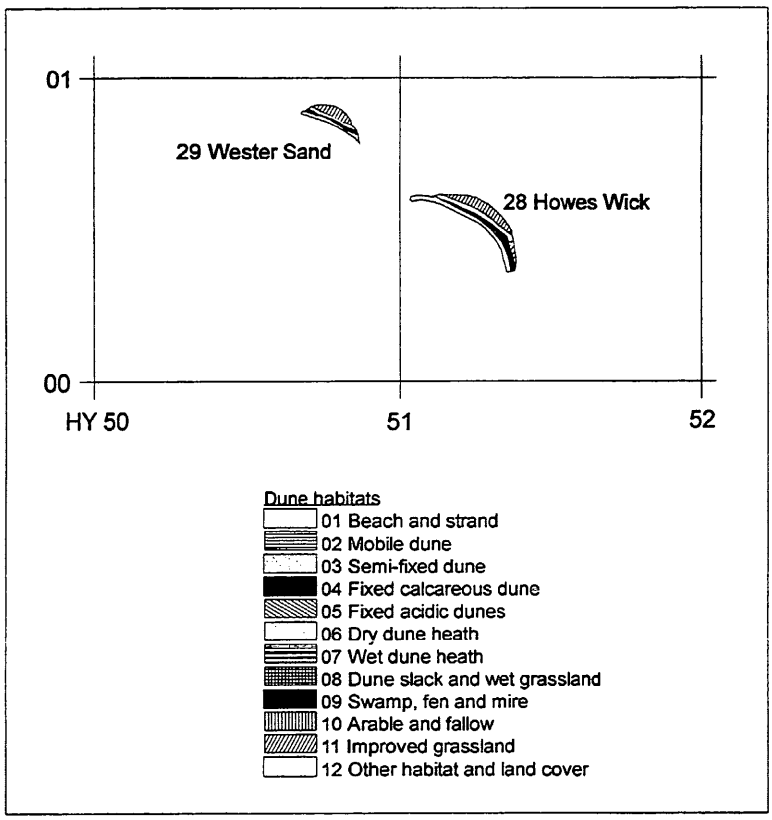
Map 2f Dune habitats of Inganess, Scapa Bay and Waulkmill (Mainland)

Grid lines spaced at 1 km intervals



Map 2g Dune habitats of Sands of Ouse, Sandside, Newark and Sandi Sand - Dingyshowe

Grid lines spaced at 1 km intervals



Map 2h Dune habitats of Howes Wick and Wester Sand

Grid lines spaced at 1 km intervals

Table 3a Vegetation and other land cover (areas in ha)

Sites 15 - 18

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	15 Warebeth	16 Breck Ness	17 Bay of Skaill	18 Marwick	All Mainland sites 15-31
AP	Arable - potatoes					0.12
ARB	Arable - barley	5.57		17.50		32.30
ARTUR	Arable - turnips	1.31		3.28		6.13
BBG	Buildings, bare ground and gardens			4.88		11.52
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.22				5.79
BMC	Maritime cliff with little vegetation	0.48	0.64	0.39		2.15
BR	Bare rock outcrop					0.06
BS	Bare sand (within vegetated sand zone)	0.06	0.04	0.28		2.13
BSH	Bare shingle	0.93	0.61	3.69	0.04	11.53
CMTY	Graveyard			0.62		1.35
M27/M28	M27 *Filipendula ulmaria - Angelica sylvestris* tall-herb fen/M28 intermediate					0.56
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire			4.45		4.63
M28/S28	M28/S28 intermediate			0.29		0.29
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)			1.43		2.67
MC8/SD8	MC8 *Festuca rubra - Armeria maritima* maritime grassland/SD8 dune grassland intermediate	0.31				0.31
MC8/ SD8a	MC8/SD8 intermediate		0.95			0.95
MG1	MG1 *Arrhenatherum elatius* coarse grassland					1.39
MG1/SD8	MG1/SD8 intermediate					1.61
MG1/ SD8a	MG1/SD8a intermediate					4.48
MG1/U4	MG1/U4 intermediate					0.12
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community			0.10		0.10
MG7	MG7 *Lolium perenne* leys	14.16	19.47	195.41		316.76
MG7/SD8	MG7/SD8 intermediate					3.94
MG7/ SD8a	MG7/SD8a intermediate	1.17				1.20
MG7/ SD8d	MG7/SD8d intermediate			1.49		1.49
MG7/ SD8e	MG7/SD8e intermediate			1.38		1.38
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland			15.50		20.96
MG11/ MG13	MG11/MG13 intermediate			0.16		0.16
MG11/ RUD	MG11/RUD intermediate			0.37		0.37
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland			0.17		0.33
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)					0.39
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)			1.22		1.33
OW	Open water					0.32
PIT	Active sand pit or rock quarry			1.84		1.84
ROAD	Road and track	1.45	1.37	12.19		26.40
RUD	Ruderal-dominated vegetation	0.78		6.21		12.60
RUDPh	Ruderal vegetation dominated by *Petasites hybridus*					0.29
S10	S10 *Equisetum fluviatile* swamp					0.09
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community.			0.03		0.03
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			0.34		0.34
S28	S28 *Phalaris arundinacea* fen					0.06

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 15 - 18

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	15 Warebeth	16 Breck Ness	17 Bay of Skaill	18 Marwick	All Mainland sites 15-31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline			0.08		0.24
SD2/SDy	SD2/SDy intermediate					0.11
SD4	SD4 *Elymus farctus* foredune					0.18
SD4/SD8a	SD4/SD8a intermediate			0.61		0.61
SD4/SD8c	SD4/SD8c intermediate	0.83		0.11		1.67
SD4/SD8d	SD4/SD8d intermediate	0.53				0.53
SD5/ SM28	SD5/SM28 intermediate					0.64
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community					0.89
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community					3.94
SD6ae	SD6a/e intermediate					0.63
SD6c	SD6c *Ammophila arenaria* mobile dune, *Leymus arenarius* sub-community					0.03
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			1.54		2.45
SD8	SD8 *Festuca rubra-Galium verum* fixed dune grassland		0.07			0.07
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community			4.21	0.09	11.98
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	2.90		18.20		39.52
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW					0.22
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)					0.24
SD9	SD9 *Ammophila arenaria - Arrhenatherum elatius* grassland					2.66
SD17	SD17 *Potentilla anserina-Carex nigra* dune-slack			0.04		0.04
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community			0.21		0.21
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)				0.01	0.60
SDy/SD2	SDy/SD2 intermediate					0.23
SM28	SM28 *Elymus repens* saltmarsh					0.22
TIP	Rubbish tip	0.01		0.03		0.41
TOTALS (ha)		30.71	23.14	298.29	0.13	548.77

Table 3b Vegetation and other land cover (areas in ha)

Sites 19 - 22

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	19 Birsay	20 Sands of Evie	21 Bay of Meil	22 Inganess	All Mainland sites 15-31
AP	Arable - potatoes					0.12
ARB	Arable - barley		7.74	1.49		32.30
ARTUR	Arable - turnips					6.13
BBG	Buildings, bare ground and gardens	1.15				11.52
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.79	1.66			5.79
BMC	Maritime cliff with little vegetation	0.53				2.15
BR	Bare rock outcrop		0.06			0.06
BS	Bare sand (within vegetated sand zone)	1.63				2.13
BSH	Bare shingle	1.15	0.86	0.61	0.35	11.53
CMTY	Graveyard	0.36				1.35
M27/M28	M27 *Filipendula ulmaria - Angelica sylvestris* tall-herb fen/M28 intermediate					0.56
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire					4.63
M28/S28	M28/S28 intermediate					0.29
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)					2.67
MC8/SD8	MC8 *Festuca rubra - Armeria maritima* maritime grassland/SD8 dune grassland intermediate					0.31
MC8/ SD8a	MC8/SD8 intermediate					0.95
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.33		0.40		1.39
MG1/SD8	MG1/SD8 intermediate					1.61
MG1/ SD8a	MG1/SD8a intermediate					4.48
MG1/U4	MG1/U4 intermediate					0.12
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community					0.10
MG7	MG7 *Lolium perenne* leys	16.43	11.35	2.61		316.76
MG7/SD8	MG7/SD8 intermediate			1.37		3.94
MG7/ SD8a	MG7/SD8a intermediate					1.20
MG7/ SD8d	MG7/SD8d intermediate					1.49
MG7/ SD8e	MG7/SD8e intermediate					1.38
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	1.44	0.89			20.96
MG11/ MG13	MG11/MG13 intermediate					0.16
MG11/ RUD	MG11/RUD intermediate					0.37
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland					0.33
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)					0.39
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)					1.33
OW	Open water		0.32			0.32
PIT	Active sand pit or rock quarry					1.84
ROAD	Road and track	2.01	1.87			26.40
RUD	Ruderal-dominated vegetation	2.37	0.23			12.60
RUDPh	Ruderal vegetation dominated by *Petasites hybridus*		0.29			0.29
S10	S10 *Equisetum fluviatile* swamp					0.09
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community					0.03
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community					0.34
S28	S28 *Phalaris arundinacea* fen		0.06			0.06

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 19 - 22

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	19 Birsay	20 Sands of Evie	21 Bay of Meil	22 Inganess	All Mainland sites 15-31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline		0.09			0.24
SD2/SDy	SD2/SDy intermediate					0.11
SD4	SD4 *Elymus farctus* foredune	0.06				0.18
SD4/SD8a	SD4/SD8a intermediate					0.61
SD4/SD8c	SD4/SD8c intermediate	0.61				1.67
SD4/SD8d	SD4/SD8d intermediate					0.53
SD5/ SM28	SD5/SM28 intermediate					0.64
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community		0.83			0.89
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		2.55			3.94
SD6ae	SD6a/e intermediate					0.63
SD6c	SD6c *Ammophila arenaria* mobile dune, *Leymus arenarius* sub-community					0.03
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)					2.45
SD8	SD8 *Festuca rubra-Galium verum* fixed dune grassland					0.07
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.60	0.40	0.45	0.19	11.98
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	18.24				39.52
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW					0.22
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)					0.24
SD9	SD9 *Ammophila arenaria - Arrhenatherum elatius* grassland					2.66
SD17	SD17 *Potentilla anserina-Carex nigra* dune-slack					0.04
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community					0.21
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)				0.04	0.60
SDy/SD2	SDy/SD2 intermediate		0.23			0.23
SM28	SM28 *Elymus repens* saltmarsh					0.22
TIP	Rubbish tip	0.03				0.41
TOTALS (ha)		47.71	29.43	6.92	0.57	548.77

Table 3c Vegetation and other land cover (areas in ha)

Sites 23 - 26

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	23 Redbanks	24 Sands of Ouse	25 Sandside	26 Newark	All Mainland sites 15-31
AP	Arable - potatoes			0.12		0.12
ARB	Arable - barley					32.30
ARTUR	Arable - turnips			0.21		6.13
BBG	Buildings, bare ground and gardens		0.09	1.18	0.53	11.52
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.60	0.34	0.22	0.39	5.79
BMC	Maritime cliff with little vegetation		0.04			2.15
BR	Bare rock outcrop					0.06
BS	Bare sand (within vegetated sand zone)			0.10		2.13
BSH	Bare shingle		0.27	1.01	0.52	11.53
CMTY	Graveyard			0.36		1.35
M27/M28	M27 *Filipendula ulmaria - Angelica sylvestris* tall-herb fen/M28 intermediate		0.56			0.56
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire					4.63
M28/S28	M28/S28 intermediate					0.29
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)		0.10	0.91	0.02	2.67
MC8/SD8	MC8 *Festuca rubra - Armeria maritima* maritime grassland/SD8 dune grassland intermediate					0.31
MC8/ SD8a	MC8/SD8 intermediate					0.95
MG1	MG1 *Arrhenatherum elatius* coarse grassland			0.27	0.30	1.39
MG1/SD8	MG1/SD8 intermediate			1.61		1.61
MG1/ SD8a	MG1/SD8a intermediate			3.22		4.48
MG1/U4	MG1/U4 intermediate					0.12
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community					0.10
MG7	MG7 *Lolium perenne* leys	1.69	2.10	18.64	21.83	316.76
MG7/SD8	MG7/SD8 intermediate				2.57	3.94
MG7/ SD8a	MG7/SD8a intermediate				0.03	1.20
MG7/ SD8d	MG7/SD8d intermediate					1.49
MG7/ SD8e	MG7/SD8e intermediate					1.38
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland		0.75	1.26	1.12	20.96
MG11/ MG13	MG11/MG13 intermediate					0.16
MG11/ RUD	MG11/RUD intermediate					0.37
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland				0.16	0.33
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)				0.39	0.39
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)				0.11	1.33
OW	Open water					0.32
PIT	Active sand pit or rock quarry					1.84
ROAD	Road and track			2.57	1.78	26.40
RUD	Ruderal-dominated vegetation		0.15	0.60	1.54	12.60
RUDPh	Ruderal vegetation dominated by *Petasites hybridus*					0.29
S10	S10 *Equisetum fluviatile* swamp			0.09		0.09
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community					0.03
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community					0.34
S28	S28 *Phalaris arundinacea* fen					0.06

Table 3c (continued) Vegetation and other land cover (areas in ha)

Sites 23 - 26

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	23 Redbanks	24 Sands of Ouse	25 Sandside	26 Newark	All Mainland sites 15-31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline				0.01	0.24
SD2/SDy	SD2/SDy intermediate					0.11
SD4	SD4 *Elymus farctus* foredune					0.18
SD4/SD8a	SD4/SD8a intermediate					0.61
SD4/SD8c	SD4/SD8c intermediate					1.67
SD4/SD8d	SD4/SD8d intermediate					0.53
SD5/ SM28	SD5/SM28 intermediate			0.64		0.64
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community		0.05			0.89
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.55	0.16	0.45	3.94
SD6ae	SD6a/e intermediate					0.63
SD6c	SD6c *Ammophila arenaria* mobile dune, *Leymus arenarius* sub-community			0.03		0.03
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			0.22		2.45
SD8	SD8 *Festuca rubra-Galium verum* fixed dune grassland					0.07
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community		0.64	0.78	3.63	11.98
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community		0.18			39.52
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW					0.22
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)			0.24		0.24
SD9	SD9 *Ammophila arenaria - Arrhenatherum elatius* grassland					2.66
SD17	SD17 *Potentilla anserina-Carex nigra* dune-slack					0.04
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community					0.21
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.06	0.22	0.16	0.60
SDy/SD2	SDy/SD2 intermediate					0.23
SM28	SM28 *Elymus repens* saltmarsh					0.22
TIP	Rubbish tip			0.28	0.06	0.41
TOTALS (ha)		2.28	5.89	34.92	35.60	548.77

Table 3d Vegetation and other land cover (areas in ha)

Sites 27 - 31

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	27 Sandi Sand and Dingys-howe	28 Howes Wick	29 Wester Sand	30 Scapa Bay	31 Waulkmill	All Mainland sites 15-31
AP	Arable - potatoes						0.12
ARB	Arable - barley						32.30
ARTUR	Arable - turnips	1.33					6.13
BBG	Buildings, bare ground and gardens	0.19			3.49		11.52
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.58			0.95	0.04	5.79
BMC	Maritime cliff with little vegetation	0.06					2.15
BR	Bare rock outcrop						0.06
BS	Bare sand (within vegetated sand zone)	0.03					2.13
BSH	Bare shingle	0.40	0.57	0.18		0.35	11.53
CMTY	Graveyard						1.35
M27/M28	M27 *Filipendula ulmaria - Angelica sylvestris* tall-herb fen/M28 intermediate						0.56
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire					0.17	4.63
M28/S28	M28/S28 intermediate						0.29
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)				0.20		2.67
MC8/SD8	MC8 *Festuca rubra - Armeria maritima* maritime grassland/SD8 dune grassland intermediate						0.31
MC8/SD8a	MC8/SD8 intermediate						0.95
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.09					1.39
MG1/SD8	MG1/SD8 intermediate						1.61
MG1/SD8a	MG1/SD8a intermediate	0.39			0.54	0.33	4.48
MG1/U4	MG1/U4 intermediate					0.12	0.12
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community						0.10
MG7	MG7 *Lolium perenne* leys	7.83	0.76	0.36	4.12		316.76
MG7/SD8	MG7/SD8 intermediate						3.94
MG7/SD8a	MG7/SD8a intermediate						1.20
MG7/SD8d	MG7/SD8d intermediate						1.49
MG7/SD8e	MG7/SD8e intermediate						1.38
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland						20.96
MG11/MG 13	MG11/MG13 intermediate						0.16
MG11/ RUD	MG11/RUD intermediate						0.37
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland						0.33
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)						0.39
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)						1.33
OW	Open water						0.32
PIT	Active sand pit or rock quarry						1.84
ROAD	Road and track	1.35	0.41	0.17	1.24		26.40
RUD	Ruderal-dominated vegetation	0.72					12.60
RUDPh	Ruderal vegetation dominated by *Petasites hybridus*						0.29
S10	S10 *Equisetum fluviatile* swamp						0.09
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community						0.03
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community						0.34
S28	S28 *Phalaris arundinacea* fen						0.06

Table 3d (continued) Vegetation and other land cover (areas in ha)

Sites 27 - 31

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	27 Sandi Sand and Dingys-howe	28 Howes Wick	29 Wester Sand	30 Scapa Bay	31 Waulkmill	All Mainland sites 15-31
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline	0.06					0.24
SD2/SDy	SD2/SDy intermediate				0.11		0.11
SD4	SD4 *Elymus farctus* foredune	0.12					0.18
SD4/SD8a	SD4/SD8a intermediate						0.61
SD4/SD8c	SD4/SD8c intermediate	0.12					1.67
SD4/SD8d	SD4/SD8d intermediate						0.53
SD5/SM28	SD5/SM28 intermediate						0.64
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community						0.89
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community				0.23		3.94
SD6ae	SD6a/e intermediate	0.63					0.63
SD6c	SD6c *Ammophila arenaria* mobile dune, *Leymus arenarius* sub-community						0.03
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)	0.68					2.45
SD8	SD8 *Festuca rubra-Galium verum* fixed dune grassland						0.07
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.42	0.45	0.14			11.98
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community						39.52
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW	0.22					0.22
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)						0.24
SD9	SD9 *Ammophila arenaria - Arrhenatherum elatius* grassland	2.66					2.66
SD17	SD17 *Potentilla anserina-Carex nigra* dune-slack						0.04
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community						0.21
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.06	0.02		0.04	0.60
SDy/SD2	SDy/SD2 intermediate						0.23
SM28	SM28 *Elymus repens* saltmarsh	0.22					0.22
TIP	Rubbish tip						0.41
TOTALS (ha)		18.09	2.26	0.86	10.89	1.06	548.77

Annex 1 Target Notes

Target note locations are given in Maps 3a-h, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY23601922	17 Bay of Skaill	Gravel surfaced car park for Skara Brae. Toilet block on opposite side of road.
2	HY23551920	17 Bay of Skaill	Footpath to Skara Brae. An SD8 sward in places (close to SD8d) with patches of *Bellis perennis* and *Poa annua*. Other areas have *Lolium perenne* indicating re-seeding and very worn sections have flat stones laid. Mapped as SD8d.
3	HY23551902	17 Bay of Skaill	MG7 *Lolium perenne* ley which close to Skara Brae footpath is rich in *Festuca rubra*. Further inland there is much more *Agrostis stolonifera*, with extensive patches of *Cirsium arvense* marking winter feeding areas for cattle, also rich in *Plantago major, Poa annua, Polygonum aviculare, Stellaria media*. High cover of *Agrostis stolonifera* might indicate heavy salt spray deposition on free draining soil.
4	HY23401902	17 Bay of Skaill	Very steep (12 degree) and long (125 m) shingle beach formed of slab boulders and cobbles, indicating a very high energy beach. Blown sand forms only 0.5-2 m thick layer on top of shingle. Dune edge cliffed, with turf slumping. Much *Elymus farctus* on edge, with scattered *Tortula ruralis* ssp. *ruraliformis*.
5	HY23371885	17 Bay of Skaill	Fast flowing stream entering shingle. Little interest - left bank has M28x, a line of *Sparganium erectum* and a small patch of *Petasites hybridus*.
6	HY23351887	17 Bay of Skaill	Foundations of old corn mill used as picnic area. Seaward side damaged by coastal erosion, boulders and broken concrete held in place by a net of large wire rope rings anchored in concrete. Much *Atriplex glabriuscula* and *Galium aparine* in this sector of shingle, unlike elsewhere. Suggests this is held stable but shingle storm beach either side is much more dynamic and moving inland.
7	HY23331875	17 Bay of Skaill	Large depression with abundant *Potentilla anserina* and much *Plantago major*. Probably used as feeding ground. Heavily grazed *Phalaris arundinacea* also present, plus *Alopecurus geniculatus*.
8	HY23151875	17 Bay of Skaill	Skara Brae archaeological site. Sown and mown *Festuca rubra-Trifolium repens* sward. Seaward side protected by 4 m solid stonewall built on concrete foundations.
9	HY23011875	17 Bay of Skaill	1.5-4 m sand over bedrock outcrops, with slight seepage from adjacent fields. *Agrostis stolonifera-Elymus repens* sward of low interest.

#	Grid Ref.	Site	Target Note Detail
10	HY23251875	17 Bay of Skaill	Junction of Skara Brae seawall and dunes in very poor condition. Stock rubbed edge, visitor erosion breaking turf edge, dumped stone and coastal erosion combine to produce a very unsightly short (200 m) stretch of dune edge. Needs radical approach to new management. A fence to exclude stock and visitors is required and the dune edge should be regraded and probably planted with the typical vegetation of this type of edge - SD5/SM28 *Leymus arenarius-Elymus repens* or *Ammophila arenaria* as this is present as fragments on the northern bay side.
11	HY23551825	17 Bay of Skaill	Locally high density of *Triglochin palustris* in MG13 and SD17b wet hollow within extensive M28x *Iris pseudacorus* mire.
12	HY23701830	17 Bay of Skaill	Fine stand of M28 with *Filipendula ulmaria*, plus scattered *Phalaris arundinacea* and *Festuca arundinacea*.
13	HY23551933	17 Bay of Skaill	More gentle slope to shingle beach (probable excavation area). Mats of *Honkenya peploides* prominent, mixing with *Elymus farctus* upslope. SD8c turf on sand cap is SD4/SD8c type, with SD4/SD8a type also present and containing much *Honkenya peploides*. Suggests strong occasional spray soaking.
14	HY23661938	17 Bay of Skaill	Former sand pit, now used as storage area for large quantities of sand/shingle probably taken from lower beach (path to beach directly opposite pit track). Small dumps of top soil and rubble also present. Floor partly covered in MG11 with much *Equisetum arvense*. Sides have SD7x.
15	HY23901925	17 Bay of Skaill	Irregular hummocky ground, probably restored floor to old sand pits. Sward has very high ruderal content due to use as winter feeding ground, with heavy sheep grazing in summer. Mapped as MG11/RUD due to high cover for *Agrostis stolonifera* and *Potentilla anserina*.
16	HY24231946	17 Bay of Skaill	Former sand pit in climbing dunes. Much stock trampling and rabbit burrowing maintains bare sand and high ruderal content. Floor with abundant *Agrostis stolonifera*, possibly restored ground.
17	HY24221953	17 Bay of Skaill	Former sand pit in early stages of restoration. Steeper hillslope sector regraded, largely bare sand with small amounts of *Cirsium vulgare, Stellaria media, Agrostis stolonifera*. One 40 m long, 2 m high face remains at base. Mapped as pit.
18	HY23751953	17 Bay of Skaill	S19c *Eleocharis palustris* swamp with high density of *Triglochin palustris*. Located in confined channel of Burn of Snusgar.

#	Grid Ref.	Site	Target Note Detail
19	HY23571950	17 Bay of Skaill	Steep (10 degree) and long (25 m) shingle beach with much SD2 *Honkenya peploides* in upper 5 m. Capped with thin sand (SD4/SD8a, with *Honkenya peploides*). Shingle in front of house to north is stabilised artificially by anchored wire rope hoop netting. Slope on either side has advanced inland by 3-4 m.
20	HY23451960	17 Bay of Skaill	Track adjacent to shore temporarily protected by dumped earth.
21	HY23691934	17 Bay of Skaill	Old sand pit floor now fully revegetated with MG11 cover, mainly *Agrostis stolonifera*. Old working face was 1.5 m high, now with SD7x cover.
22	HY23841922	17 Bay of Skaill	Edge of former sand pit with bare organic sand. Was formerly graded to smooth slope but now being excavated and removed. Old pit floor elsewhere now largely covered in MG11 (mostly *Agrostis stolonifera*) with one deeper hollow with SD17 and MG13x and much *Plantago major*. Area used as sheep grazing and winter feeding area for cattle. With deeper excavation the hollows could be developed into slacks.
23	HY47661180	21 Bay of Meil	Sand exposed in sheep rubs and around rabbit burrows. Sward of uncertain status - no *Carex arenaria* or *Galium verum*. *Festuca rubra, Agrostis capillaris, Holcus lanatus* and *Rumex acetosa* are dominant, with scattered *Lolium perenne*. Mapped as MG7/SD8 intermediate.
24	HY47661184	21 Bay of Meil	Gently sloping mixed sand and shingle beach. Dunes cliffed 0.5-1 m with fragmented SDy strand at foot. Rank SD8a grassland on top of dunes to fence, with much *Elymus repens* and *Heracleum sphondylium*.
25	HY47450875	22 Inganess	Virtually no sand. Shingle beach with 1 m wide SDy strand, sand in intertidal zone. Shingle crest has rutted track with concrete blocks to stop erosion in several places. Rear of crest in west now industrial land. A very small amount of SD8a present in centre of bay.
26	HY52671062	23 Redbanks	Steep beach of thin sand over shingle with dunes cliffed 0.5-1.5 m. No vegetated strand. Turf collapse in several places. Dune cliff front has patches of *Sonchus arvensis* and *Elymus repens*. Cliff top is narrow, rank and weedy MG7. Fence line marks abrupt change to MG7 ley.
27	HY51501066	23 Redbanks	No vegetated wind blown sand. Coast cliffed 2-6 m with shingle beach at foot. No strand.
28	HY55250730	24 Sands of Ouse	Blown sand over till in cliffed sections (1-3 m height). Shingle beach with intertidal sand. 1-2 m wide SDy strand at eastern end of site.
29	HY55250727	24 Sands of Ouse	Small paddock with patches of M28x in MG11 grassland, but also large cover of ruderals (*Urtica dioica, Cirsium arvense, Plantago major, Polygonum aviculare, Poa annua*) due to winter feeding.

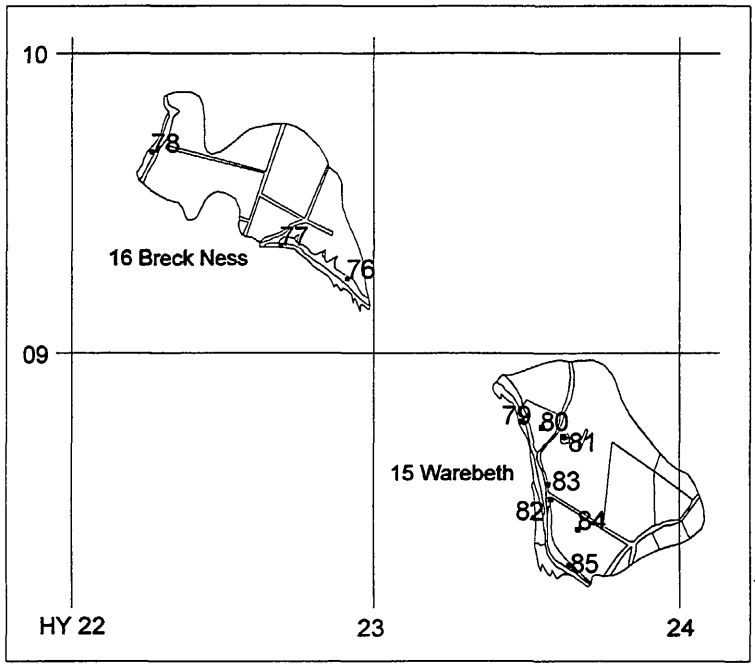
#	Grid Ref.	Site	Target Note Detail
30	HY55150725	24 Sands of Ouse	Foredune ridge rises to 6 m height and contains several small (10-30 sq. m) saucer-shaped blowouts maintained by stock trampling and rubbing. A narrow fringe of SD8d turf is present inside the coastal fence. The remainder is MG7 improved grassland.
31	HY55000723	24 Sands of Ouse	Extensive stand of *Filipendula ulmaria* east of Loch of Ouse, with scattered *Angelica sylvestris* and patches of *Iris pseudacorus*. Mapped as M27/M28.
32	HY54880727	24 Sands of Ouse	4 m wide channel for water leaving Loch of Ouse. Choked with blown sand. Fragments of SD2 (*Cakile maritima*) strand. Beach in this sector gently sloping thin sand over shingle with SD5b and SD5c zonation on dunes cliffed to 70 cm.
33	HY56750422	26 Newark	Steep, short shingle beach above sand. SDy strand covers much of shingle. Track on top of shingle has altered foredune which forms a SD8a bank up to fences, rich in *Elymus repens* and *Heracleum sphondylium*.
34	HY57330445	26 Newark	Very hummocky ground, possibly started as a blowout complex. Has since been used for scattered rubble dumping. Hollows MG11, hummocks a mix of SD8a and MG7/SD8.
35	HY57250430	26 Newark	Hard surfaced car park (20 m x 5 m) at end of Newark Road.
36	HY57250433	26 Newark	Sand caps cliffed till, with much seaweed on strand. SD5c cover to sand.
37	HY58850678	25 Sandside	Shingle beach with wide (5 m) fragmented SDy strand, backed by 4-5 m wide SD5/SM28 *Leymus arenarius* strandline. Signs of old shingle extraction from beach close to track through dune.
38	HY58890690	25 Sandside	Old, overgrown dump of farm machinery.
39	HY58820683	25 Sandside	Rank and unusual form of S10 *Equisetum fluviatile* swamp with tufts of *Arrhenatherum elatius*, groups of *Angelica sylvestris* and much *Mentha aquatica*, *Tussilago farfara*. Developed at end of stream from M28x inland. Set in area of hummocky ungrazed dunes with very rank SD8a containing large amounts of *Arrhenatherum elatius*. Mapped as MG1/SD8a.
40	HY58750701	25 Sandside	Dump for animal bedding and rubble in old sand pit. Edge also used as store for bagged silage.
41	HY58930733	25 Sandside	Former sand pit, re-seeded with MG7 sward.
42	HY58950693	25 Sandside	Landing area and storage for boats and boat trades.
43	HY54970339	27 Sandi Sand to Dingyshowe	Dingyshowe Bay. Sandy beach of varying thickness over shingle. Fragmented SD2 strand (*Cakile maritima* and *Honkenya peploides*). SD6ae dunes cliffed 1-1.5 m with strong summer accretion bank. *Ligusticum scoticum* present as a few individuals at dune foot. Path north to car park and toilet block lacks steps until dune crest, where there is a stepped wooden walkway. Chestnut paling fence positioned to minimise windblow and avoid blowout. All of beach is heavily trampled.

#	Grid Ref.	Site	Target Note Detail
44	HY54950340	27 Sandi Sand to Dingyshowe	Small car park and toilet block.
45	HY54750333	27 Sandi Sand to Dingyshowe	Sudden loss of SD7x sward, replaced by SD4/SD8c rich in *Honkenya peploides* and *Thalictrum minus*. Large quantities of *Honkenya peploides* seed probably thrown inland by winter gales.
46	HY54720335	27 Sandi Sand to Dingyshowe	Rank SD8a with much *Heracleum sphondylium* and *Arrhenatherum elatius*. Mapped as MG1/SD8a. Clusters of *Silene dioica* around old rabbit burrows.
47	HY54750340	27 Sandi Sand to Dingyshowe	SD9 *Ammophila arenaria-Arrhenatherum elatius* rank dune due to lack of grazing. Beyond dunes to north is young SM13 saltmarsh. Dune foot to west protected by stone wall and concrete blocks as defence for track along shoreline.
48	HY54850340	27 Sandi Sand to Dingyshowe	Rubble tipped on shoreline/dune edge, close to track from main road.
49	HY54900343	27 Sandi Sand to Dingyshowe	SDy strand and 2 m wide band of SM28 *Elymus repens* along shoreline.
50	HY54920344	27 Sandi Sand to Dingyshowe	Planted or dumped *Rosa rugosa* (8 m x 4 m) adjacent to northern side of road.
51	HY55080347	27 Sandi Sand to Dingyshowe	Fly tipping along track through dunes.
52	HY55100345	27 Sandi Sand to Dingyshowe	Turf trampling and erosion by vehicles, probably due to use of dunes when small car park full. Area affected is not large. Incipient small blowout in low foredune nearby probably due to visitor trampling.
53	HY55000340	27 Sandi Sand to Dingyshowe	5 m diameter area of bare sand used for driftwood fires and barbecues. Further small fire area immediately behind foredune to south. Given popularity of area, this amount of damage is probably acceptable but it creates a fire risk to adjacent areas of mossy SD9 coarse dune grassland. Interior of SD9 dunes broken by vehicle tracks which maintain a short SD8a sward.
54	HY51250055	28 Howes Wick	Steep slab shingle beach with 3 m wide SDy strand. Cliffed section in middle of Howes Wick shows 50 cm of blown sand intercalated with shingle layer. Weedy (*Cirsium arvense, Elymus repens, Heracleum sphondylium*) SD8a sward on slope up to road.
55	HY50750083	29 Wester Sand	Steep slab shingle beach with fragmented SDy strand. Cliffed section at eastern side of bay shows 50 cm of blown sand intercalated with shingle layers. Narrow weedy SD8a between cliff and road. Eastern end of beach protected from erosion by dumped rubble. Old fencing wire dumped on beach in bay centre.
56	HY38000660	31 Waulkmill	Access via narrow track from road to northeast. Well constructed - gravel surface, water bars on steep sections, boardwalk over burns.

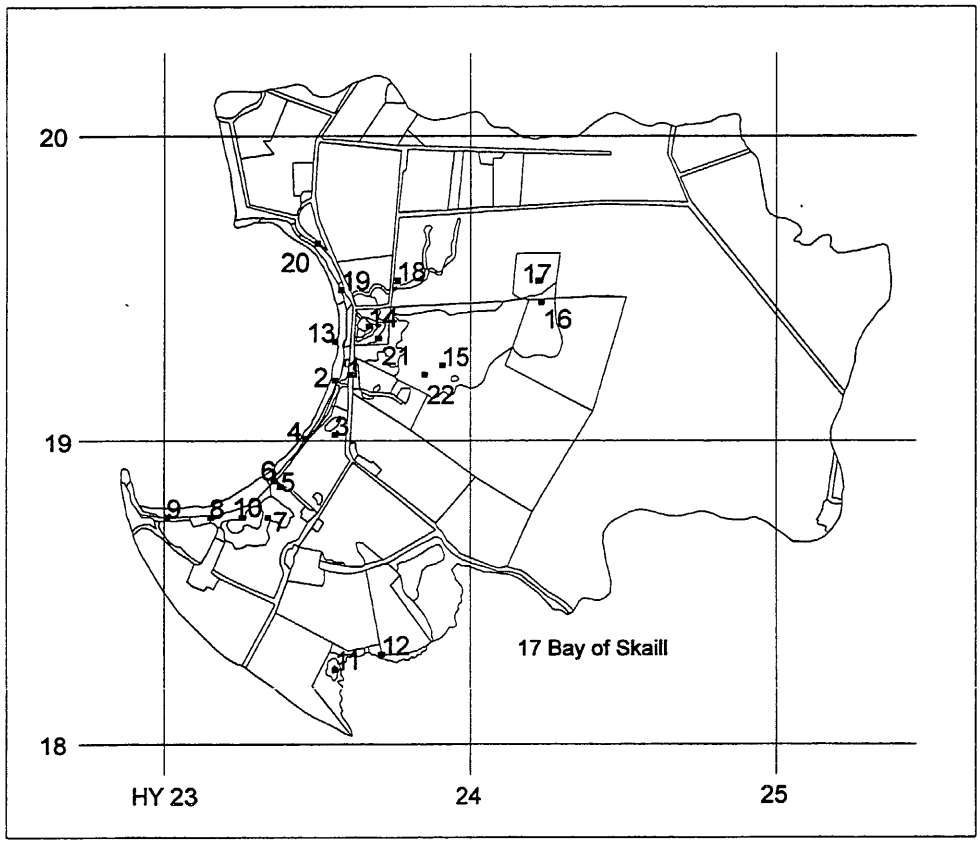
#	Grid Ref.	Site	Target Note Detail
57	HY37750660	31 Waulkmill	Gently sloping shingle beach with patches of sand plus intertidal sand with marked ridges. SDy strand on thick seaweed deposit, backed by narrow band of *Elymus repens*. Dune front and crest is rank MG9/SD8a with much *Arrhenatherum elatius* and scattered *Angelica sylvestris*. Further inland this becomes rank MG1/U4 with *Agrostis capillaris, Potentilla anserina, Succisa pratensis* and *Rumex acetosa* as good acidic grassland indicators. No *Carex arenaria* in sward. Sand probably has little carbonate content.
58	HY44000875	30 Scapa Bay	Sea wall extends across complete width of bay east from Lower Scapa (HY43750878) to protect road immediately inland. Gently sloping sandy beach with good summer accretion bank and in places wide SDy/SD2 strand. No other dune vegetation south of seawall.
59	HY44250866	30 Scapa Bay	Eastern half of blown sand occupied by houses, garden and navigation control centre. Very little dune vegetation remains.
60	HY43950880	30 Scapa Bay	Dune vegetation now restricted to fragments behind a sea wall and a 4 m band north of road, with fenced MG7 grassland on inner edge. Much sand blows over sea wall and road probably needs regular clearance.
61	HY37752630	20 Sands of Evie	Beach of mixed sand and shingle, much seaweed deposition. Recent removal of c. 5 cu m of material from hole on upper beach. Diverse strand - a mixture of SDy, SD2 (*Cakile maritima*) and SD5b in a band 10 m wide. Foredune ridge is only 1-1.5 m high, suggesting poor sand supply. SD5c very extensive inland.
62	HY37712625	20 Sands of Evie	Old sand pit fully recolonised with SD5c cover.
63	HY37762625	20 Sands of Evie	Small (5 m x 4 m) dump of animal bedding and dung.
64	HY37752620	20 Sands of Evie	Banks of stream and adjacent dune slopes infested with *Petasites hybridus* (RUDPh).
65	HY37332640	20 Sands of Evie	Track beside coast protected by boulder riprap for 200 m. SDy strand fragments.
66	HY37802630	20 Sands of Evie	Fine outcrops of aeolinite with SD8a turf. Surrounded by MG7 improved grassland, but fenced in triangular exclosure with 80 m sides.
67	HY24552755	19 Birsay	Beach zone of bedrock outcrops with patches of sand and slab shingle. Cliffed head deposits 1-3 m high, with 30 cm of stony sand in section. SD8d turf inland.
68	HY24662720	19 Birsay	Very large former sand pit with stock trampling and rabbit damage to edges. 0.5-1 m vertical faces, some with turf slumping. Floor partly recolonised with MG11 (*Agrostis stolonifera* in main). Sand piles covered in slab shingle also present, perhaps to act as stock shelters. Sand excavated to shingle ridge on west. Foredunes largely lost over 250 m stretch - relict SD4/SD8c mesa dunes left upstanding. Gaps have thin sand over shingle with sparse SD4 development.

#	Grid Ref.	Site	Target Note Detail
69	HY24552717	19 Birsay	Moderately steep (7 degrees) shingle beach with thin sand cover. Fragments of SDy strand with much *Polygonum raii*. One small *Mertensia maritima* found.
70	HY24522701	19 Birsay	Foredunes in very poor condition. Cliffed to 4 m height with massive turf slumping, aided by visitor and stock trampling. SD4 on face and SD4/SD8c turf on top edge. Retreat here will threaten Saevar House immediately inland.
71	HY24752712	19 Birsay	Winter feeding ground for cattle - two feeding stances with much trampling in close vicinity. Patches of ruderals elsewhere suggesting old position.
72	HY24502695	19 Birsay	Rubble dump (20 m x 20 m) at head of developing blowout. Rubble also dumped over edge of cliffed dunes immediately to southwest, providing a very ugly 30 m section.
73	HY24402690	19 Birsay	Cliffs above bedrock platform developed in head and 0.5-2 m sand. The sand thins gradually to southwest. One long (40 m) and narrow (3-5 m) blowout developed in top of cliff - much stock trampling.
74	HY24662675	19 Birsay	Ditch beside road infested with *Petasites hybridus* for 250 m.
75	HY22902440	18 Marwick	Steep very exposed shingle beach with blown sand restricted to 5-50 cm depth above intertidal sand at north end of system. Vegetation confined to shingle crest. Very rank SD8a mix of *Festuca rubra, Elymus repens, Heracleum sphondylium, Rumex obtusifolius, Sonchus arvensis*. A few clusters of *Honkenya peploides* and *Ligusticum scoticum* present at top of beach in area with most intertidal sand.
76	HY22910925	16 Breck Ness	Blown sand on cliffs above steep shingle beach. Very good outcrops of aeolinite in section. Turf with scattered *Armeria maritima* tufts - a MC8/SD8a intermediate.
77	HY22690936	16 Breck Ness	Shingle beach with small amounts of intertidal sand. Dunes developed above cliffs which include 1-2 m thick layered aeolinite.
78	HY22260967	16 Breck Ness	Steep (12 degree) and long (30 m) shingle beach (boulder size) - very exposed. Very little sand in intertidal zone which is dominated by rock platforms. Coastal edge entirely improved apart from very small MC8/SD8a at very top of shingle, with *Rumex crispus* and *Sonchus arvensis*.
79	HY23480877	15 Warebeth	Steep (12 degree) shingle beach with large extent of intertidal sand. Dunes cap shingle. Turf to north and south ends above rock platforms and has much *Armeria maritima* due to local spray effect - MC8/SD8a. Dunes on top of shingle cliffed 0.5-1.5 m, showing much intercalated shingle.
80	HY23550875	15 Warebeth	Semi-improved (MG7/SD8a) dune pasture used as winter feeding ground for stock.

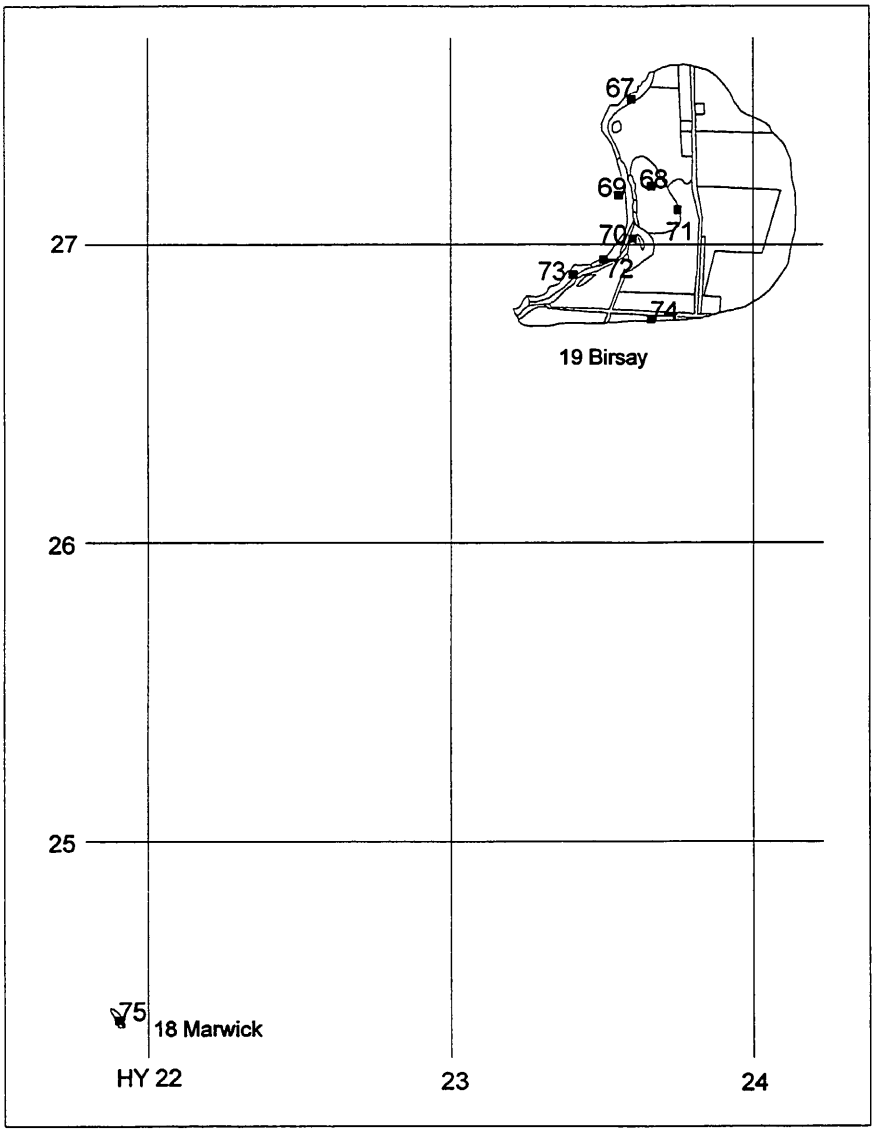
#	Grid Ref.	Site	Target Note Detail
81	HY23620872	15 Warebeth	Dump for rubble and old farm equipment.
82	HY23580851	15 Warebeth	Area developed for car parking behind shingle ridge. Much spray generated from beach - SD8c turf rich in *Honkenya peploides, Elymus farctus* and *Armeria maritima*. A major compression of NVC types (MC8, SD2, SD4, SD8) into one local type. Mapped as SD4/SD8c.
83	HY23570856	15 Warebeth	Aeolinite outcrops very prominent on top of shingle in bay centre. Largely bare upper surface has patches of *Plantago coronopus* and *Cerastium glomeratum* (a very local occurrence of MC10). Tangle tables common in this area.
84	HY23670841	15 Warebeth	Many small hollows suggesting old sand pits. All fully revegetated apart from a few animal rubs and rabbit burrows. Winter feeding ground, also used as dump for animal bedding. Ruderal content high (20% area) in SD8d sward.
85	HY23640829	15 Warebeth	0.5-1 m sand over bedrock wave-cut platform. SD4/SD8d turf with much *Armeria maritima*.



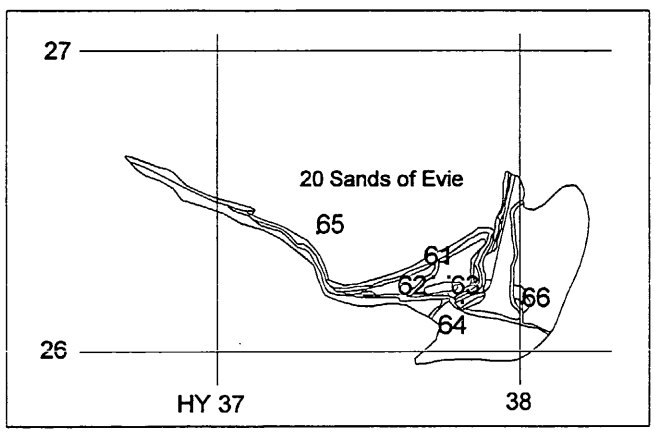
Map 3a Target note positions: Warebeth and Breck Ness (Mainland)



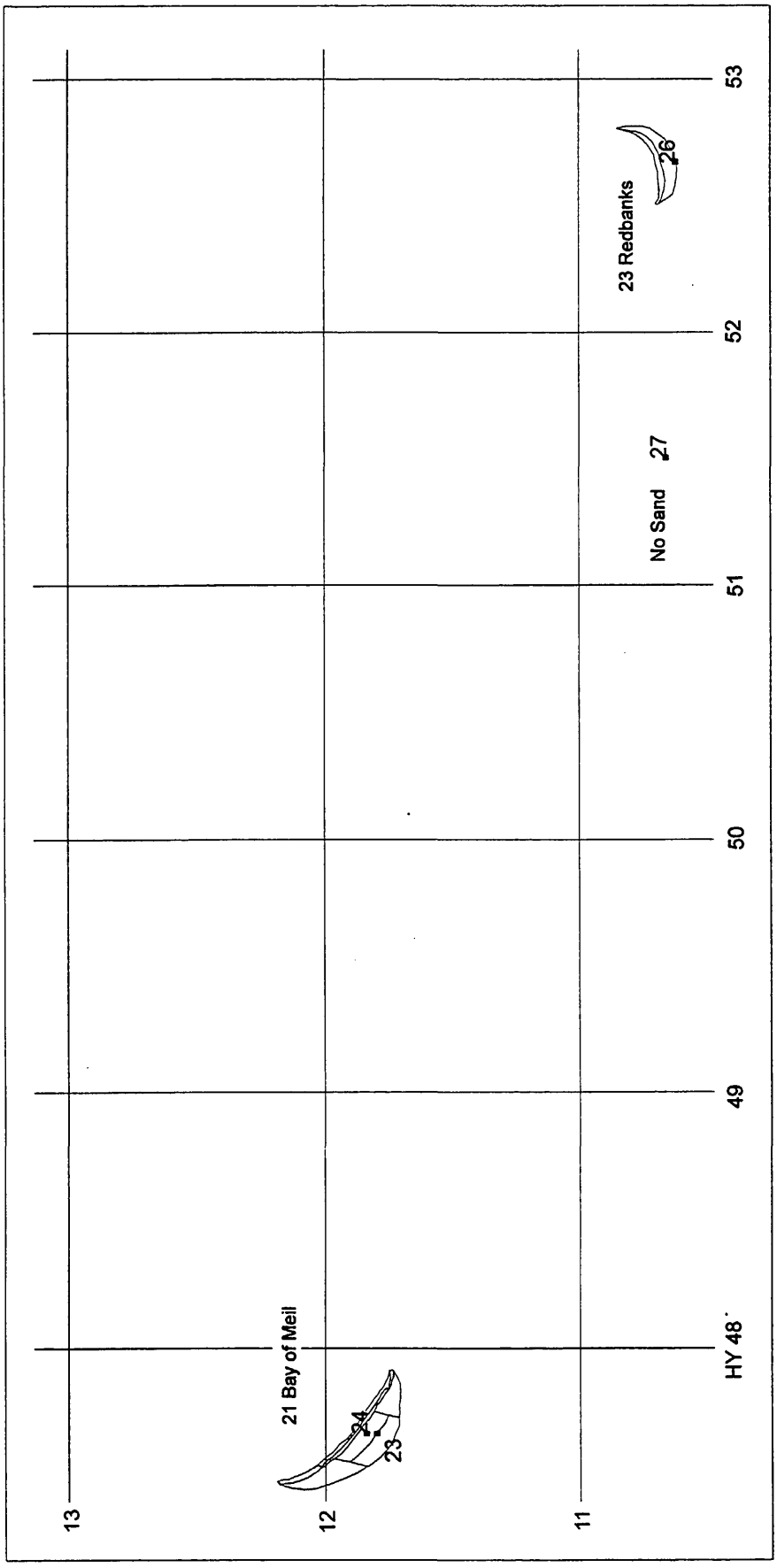
Map 3b Target note positions: Bay of Skaill (Mainland)



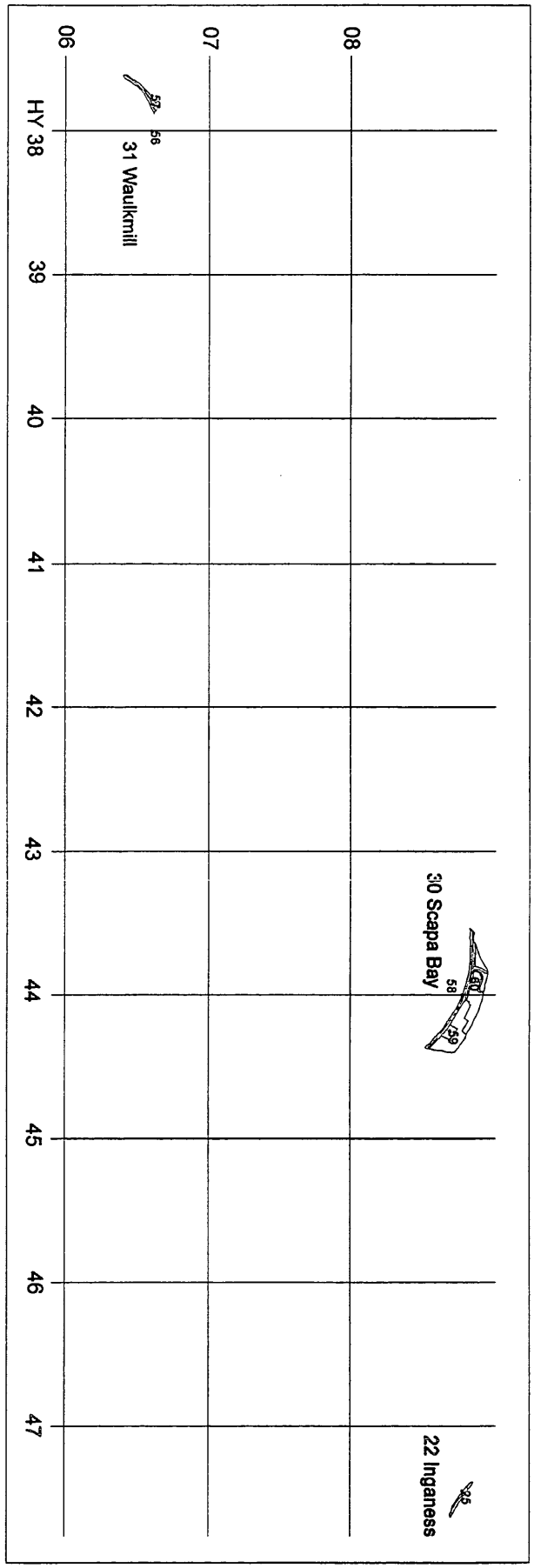
Map 3c Target note positions: Marwick and Birsay (Mainland)



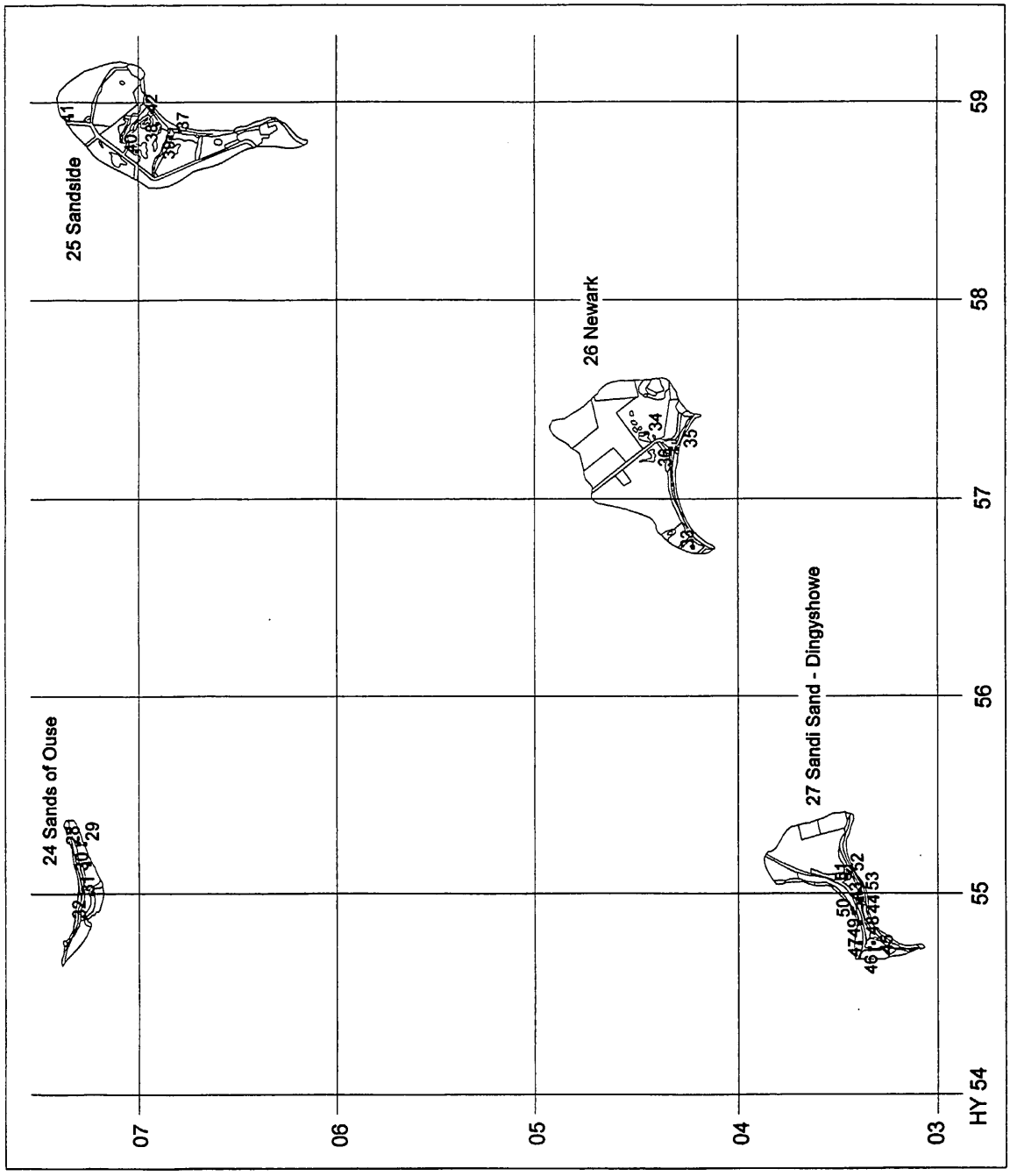
Map 3d Target note positions: Sands of Evie (Mainland)



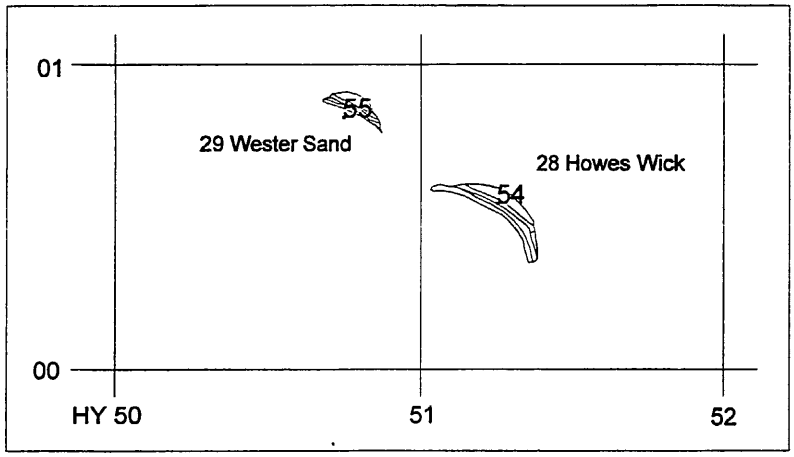
Map 3e Target note positions: Bay of Meil and Redbanks (Mainland)



Map 3f Target note positions: Inganess, Scapa Bay and Waulkmill (Mainland)



Map 3g Target note positions: Sands of Ouse, Sandside, Newark and Sandi Sand - Dingyshowe (Mainland)



Map 3h Target note positions: Howes Wick and Wester Sand (Mainland)

Annex 2 Quadrat Data

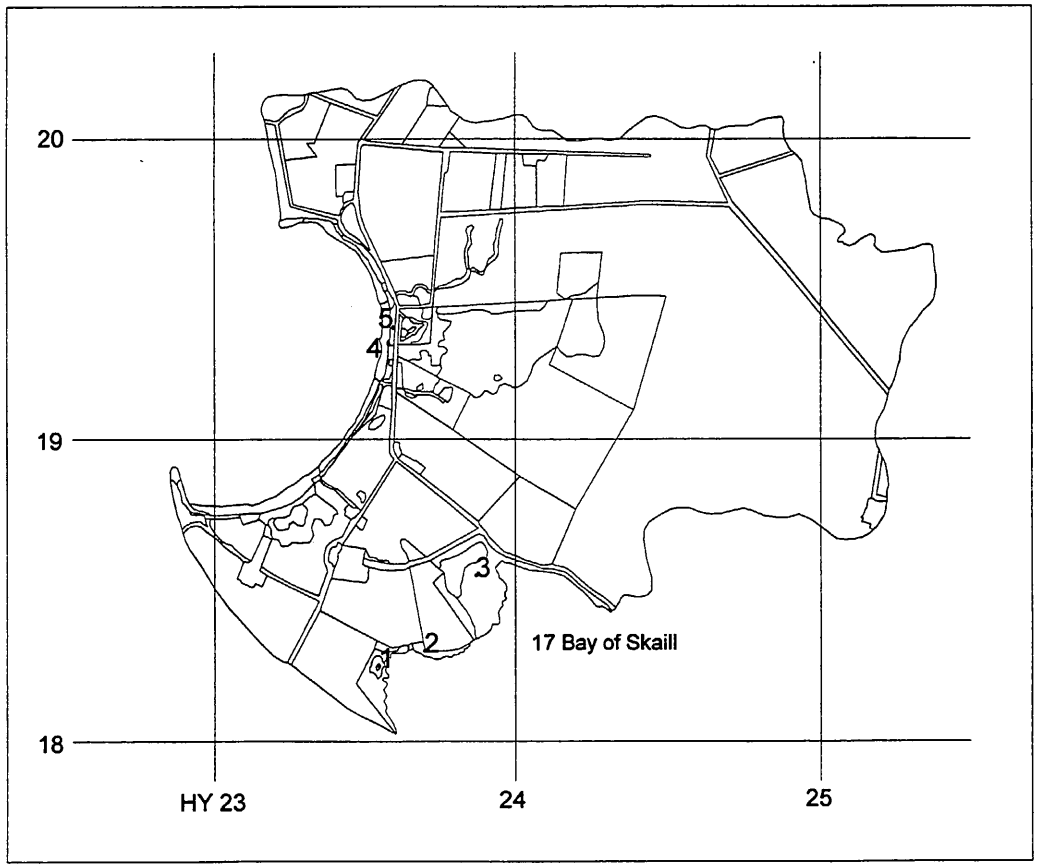
Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

Fixed dune grasslands

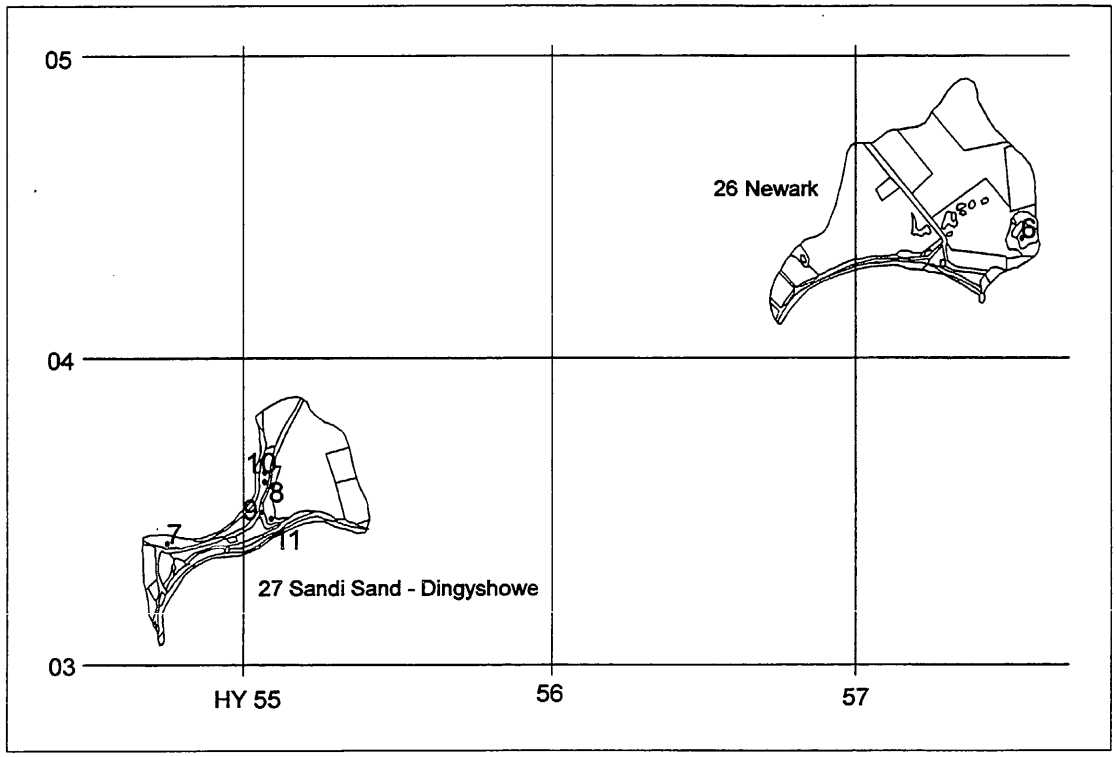
	Quadrat number	4	5	7	8	9	10	11
	NVC type	SD4/SD8c	SD4/SD8a	SD9	SD9	SD9	SD9	SD9
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	235	235	547	550	550	550	550
3	Grid reference northing	193	193	034	036	035	036	034
11	Herb height, centimetres	2	20	60	65	65	70	65
12	Moss height, centimetres	1	-	15	20	20	20	20
15	Herb cover, %	60	100	95	60	60	90	65
16	Moss cover, %	20	-	60	100	70	45	100
22	Bare soil/litter (incl.sand)	20	-	-	-	-	-	-
576	Festuca rubra	5	7	4	3	3	4	3
613	Galium verum	2	3	3	3	3	2	2
122	Agrostis stolonifera	3	6	-	-	-	-	-
159	Ammophila arenaria	-	-	5	5	5	4	5
197	Arrhenatherum elatius	-	-	6	6	6	7	7
1940	Rhytidiadelphus squarrosus	-	-	8	9	6	7	7
167	Angelica sylvestris	-	-	4	-	4	5	4
1058	Primula vulgaris	-	-	4	4	4	2	-
1941	Rhytidiadelphus triquetrus	-	-	-	4	7	2	7
415	Cirsium arvense	-	-	4	-	-	5	2
988	Poa pratensis	3	4	4	-	-	-	-
1239	Senecio jacobaea	2	2	2	-	-	-	-
116	Elymus farctus boreali-atlanti	4	4	-	-	-	-	-
973	Plantago lanceolata	4	2	-	-	-	-	-
1043	Potentilla anserina	-	-	-	-	-	2	-
1350	Trifolium repens	4	4	-	-	-	-	-
2486	Peltigera canina	-	-	-	4	-	4	-
104	Achillea millefolium	4	-	-	-	-	-	-
125	Aira praecox	3	-	-	-	-	-	-
304	Carex arenaria	-	3	-	-	-	-	-
368	Desmazeria marina	2	-	-	-	-	-	-
383	Cerastium glomeratum	4	-	-	-	-	-	-
385	Cerastium semidecandrum	2	-	-	-	-	-	-
532	Equisetum arvense	-	-	-	-	-	2	-
661	Heracleum sphondylium	-	-	5	-	-	-	-
682	Honkenya peploides	-	5	-	-	-	-	-
758	Lathyrus pratensis	-	-	-	2	-	-	-
981	Poa annua	2	-	-	-	-	-	-
1254	Silene dioica	-	-	2	-	-	-	-
1271	Sonchus arvensis	-	-	-	-	-	4	-
2023	Tortula ruralis ssp ruraliform	5	-	-	-	-	-	-
	Number of species per sample	15	10	12	9	8	13	8

Dune wetland

	Quadrat number	1	2	6	3
	NVC type	MG 13	M 28	Mx Pp	Mx Tm
1	Grid reference 100km square	HY	HY	HY	HY
2	Grid reference easting	235	237	575	238
3	Grid reference northing	182	183	044	185
11	Herb height, centimetres	20	100	50	35
12	Moss height, centimetres	-	-	-	5
15	Herb cover, %	100	100	100	80
16	Moss cover, %	-	-	-	60
576	Festuca rubra	-	-	4	4
122	Agrostis stolonifera	7	7	5	4
279	Caltha palustris	2	-	2	4
333	Carex nigra	2	-	4	5
509	Eleocharis palustris	3	-	5	3
533	Equisetum fluviatile	3	-	4	2
680	Holcus lanatus	-	3	4	4
862	Menyanthes trifoliata	4	-	2	5
1004	Polygonum hydropiper	4	2	5	-
583	Filipendula ulmaria	-	7	-	2
715	Iris pseudacorus	-	5	-	2
722	Juncus articulatus	3	-	-	3
855	Mentha aquatica	-	-	5	5
990	Poa trivialis	3	3	-	-
1043	Potentilla anserina	2	-	-	-
1095	Ranunculus repens	5	-	4	-
105	Achillea ptarmica	-	1	-	-
156	Alopecurus geniculatus	5	-	-	-
323	Carex flacca	-	-	-	3
535	Equisetum palustre	-	-	-	3
546	Eriophorum angustifolium	-	-	-	3
572	Festuca arundinacea	-	2	-	-
813	Lychnis flos-cuculi	-	-	2	-
890	Myosotis secunda	2	-	-	-
907	Odontites verna	1	-	-	-
944	Parnassia palustris	-	-	-	1
946	Pedicularis palustris	-	-	-	2
955	Phalaris arundinacea	-	4	-	-
1049	Potentilla palustris	-	-	5	-
1086	Ranunculus bulbosus	-	1	-	-
1106	Rhinanthus minor	3	-	-	-
1139	Rumex acetosa	-	-	2	-
1236	Senecio aquaticus	1	-	-	-
1353	Triglochin maritima	-	-	-	3
1354	Triglochin palustris	3	-	-	-
1445	Calliergon cuspidatum	-	-	-	8
1847	Philonotis fontana	-	-	-	2
2167	Lophocolea bidentata	-	-	-	3
2256	Aneura pinguis	-	-	-	2
	Number of species per quadrat	17	10	14	22



Map 4a Quadrat Positions: Bay of Skaill (Mainland)



Map 4b Quadrat positions: Newark and Sandi Sand - Dingyshowe

32-34 SHAPINSAY

Location and conservation status

Three areas of windblown sand are present:

32 Veantrow Bay	HY510191	33 Sandy Geo	HY537224
34 Bay of Sandgarth	HY520158		

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

Survey details

Date	September 1996
Target notes	10 (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

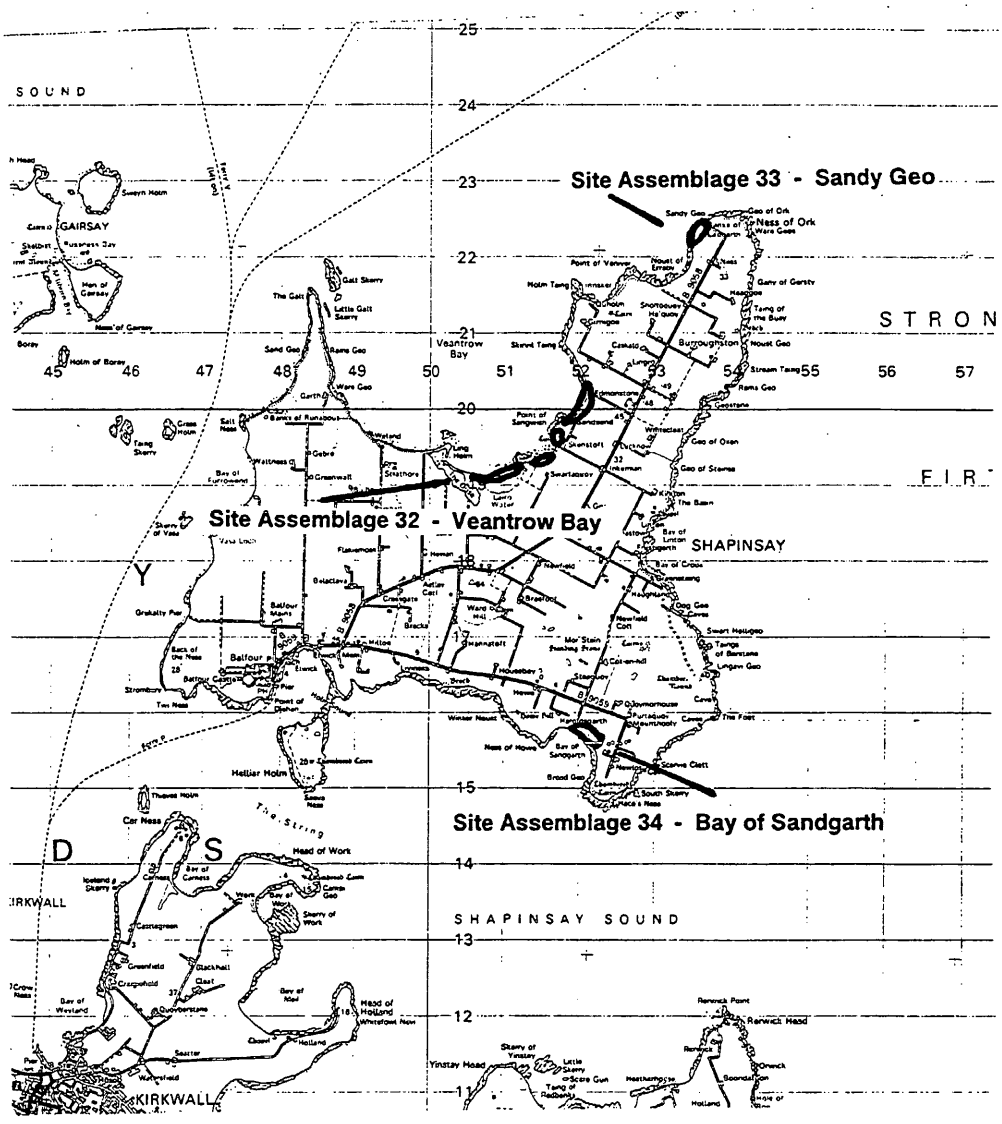
Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Shapinsay has only 5.3 ha of windblown sand above the beach sand, distributed between three sites. All are therefore very small, with the Bay of Sandgarth largest overall (2.5 ha). Most windblown sand is vegetated (4.8 ha), with further quantities of arable/fallow land (0.3 ha) and land take (0.2 ha). The beach zone occupies 2.7 ha.

Dune habitats (Table 2, Map 2)

The small size of all Shapinsay sites greatly restricts their habitat diversity. The beach and strand zone only supply sufficient sand to create mobile dunes at Veantrow Bay (0.7 ha). The most common habitat is improved grassland (2.6 ha), followed by fixed calcareous dune (total 1.0 ha).



Map 1 Site assemblage location,
See Volume 3 for NVC maps
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Table 1 Broad land cover extents (ha)

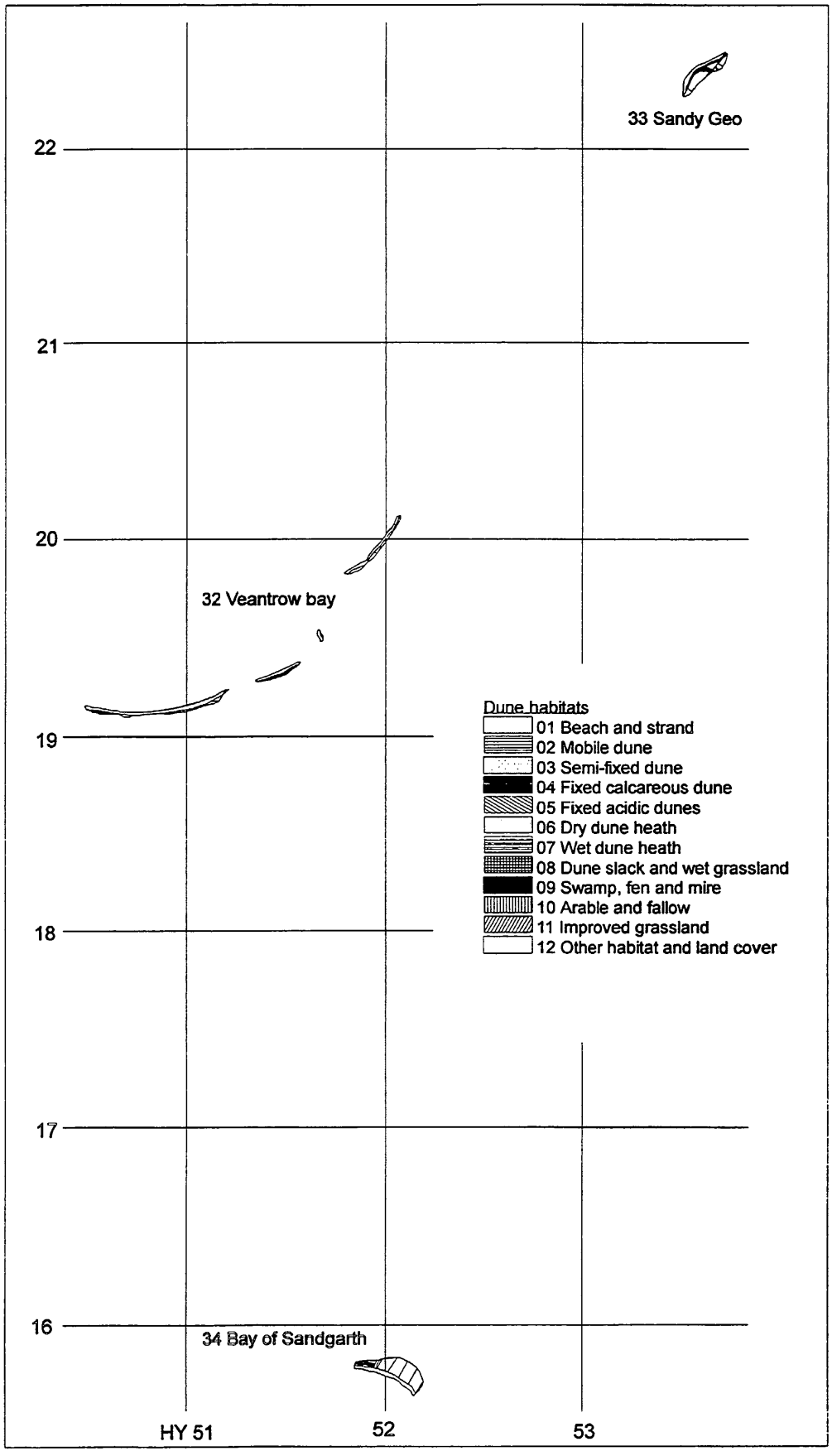
Sites 32 - 34

	32 Veantrow Bay	33 Sandy Geo	34 Bay of Sandgarth	All Shapinsay sites
Windblown sand land cover				
Beach above MHWS	1.68	0.42	0.56	2.65
Bare sand				
Vegetated sand (except fallows)	1.46	0.94	2.38	4.79
Arable and fallow		0.31		0.31
Buildings, roads, gardens, tips, pits, cemeteries, airfield		0.12	0.08	0.20
Total windblown sand excluding beach zone	1.46	1.37	2.46	5.30
Total windblown sand extent above MHWS	3.14	1.79	3.02	7.95
Surveyed but not on blown sand				
Bare rock				
Unvegetated maritime cliff				
Saltmarsh				
Open water				

Table 2 Extents (ha) of dune habitats and other ground

Sites 32 - 34

	32 Veantrow Bay	33 Sandy Geo	34 Bay of Sandgarth	All Shapinsay sites
Habitat 1 - Beach and strand	1.97	0.46	0.62	3.05
Habitat 2 - Mobile dune	0.72			0.72
Habitat 3 - Semi-fixed dune				
Habitat 4 - Fixed dry calcareous dune	0.45	0.38	0.21	1.04
Habitat 5 - Fixed acidic grassland				
Habitat 6 - Dry dune heath				
Habitat 7 - Wet dune heath				
Habitat 8 - Dune slack and wet grassland				
Habitat 9 - Mire and swamp				
Habitat 10 - Arable and fallow		0.31		0.31
Habitat 11 - Improved grassland		0.51	2.11	2.62
Habitat 12 - Other habitats		0.12	0.08	0.20
TOTALS (ha)	3.14	1.79	3.02	7.95



Map 2 Dune habitats of Veantrow Bay, Sandy Geo and Bay of Sandgarth (Shapinsay)

Vegetation and other land cover types (Table 3; Volume 3 - NVC maps)

Small areas of strand (SDy provisional *Atriplex glabriuscula* community, 0.4 ha) and SD5 *Leymus arenarius* mobile dune (SD5b *Elymus farctus* and SD5c *Festuca rubra* sub-communities, total area 0.7 ha, all at Veantrow Bay) are the only cases of beach and foredune conditions on Shapinsay. Fixed dune communities are found at all sites (total area 0.4 ha): SD8a *Festuca rubra - Galium verum* grassland, Typical sub-community is present at Veantrow Bay and Bay of Sandgarth; stands invaded by *Arrhenatherum elatius* (MG1/SD8 intermediate) are found at Veantrow Bay and Sandy Geo (0.8 ha). The interior of Sandy Geo and Bay of Sandgarth is improved (MG7 *Lolium perenne* leys, 2.6 ha) and this is the most extensive vegetation type.

Site descriptions

32 Veantrow Bay

This bay dune site lies on the north coast of Shapinsay, exposed to a long northerly fetch from the North Atlantic but with some shelter in the north from Eday. It is made up of four separate blocks of thin sand above shingle beaches which have an SDy strand. Small amounts of sand are sufficient to produce SD5 mobile dune as a very narrow band on the top of the shingle beach, and some SD8a and MG1/SD8 fixed dune in the bay centre. The nature conservation interest of the site is very low due to small extent and a very restricted range of vegetation types.

33 Sandy Geo

This is a very small bay and climbing dune site on the tip of the northeastern coast of Shapinsay, exposed to a long NNW fetch from the North Atlantic but also with some shelter in the north from Eday. The beach is largely shingle with a thin patchy sand cover, with sand blown inland over cliffs. A thin sand covering on till-covered bedrock slopes supports MG1/SD8 fixed dune grassland but the land inland of the cliffs is either improved (MG7 ley) or is used for arable farming. The nature conservation interest of the site is very low due to small extent, a very restricted range of vegetation types and improvement.

34 Bay of Sandgarth

This bay dune site lies on the south coast of Shapinsay, with a short 5 km SW fetch to Mainland. Sand is blown inland for 90 m beyond the shingle beach. There is a small area of SD8a fixed dune grassland, heavily infested with ruderals but most of the site is improved grassland (MG7). The nature conservation interest of the site is very low due to small extent, poor vegetation range and improvement.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

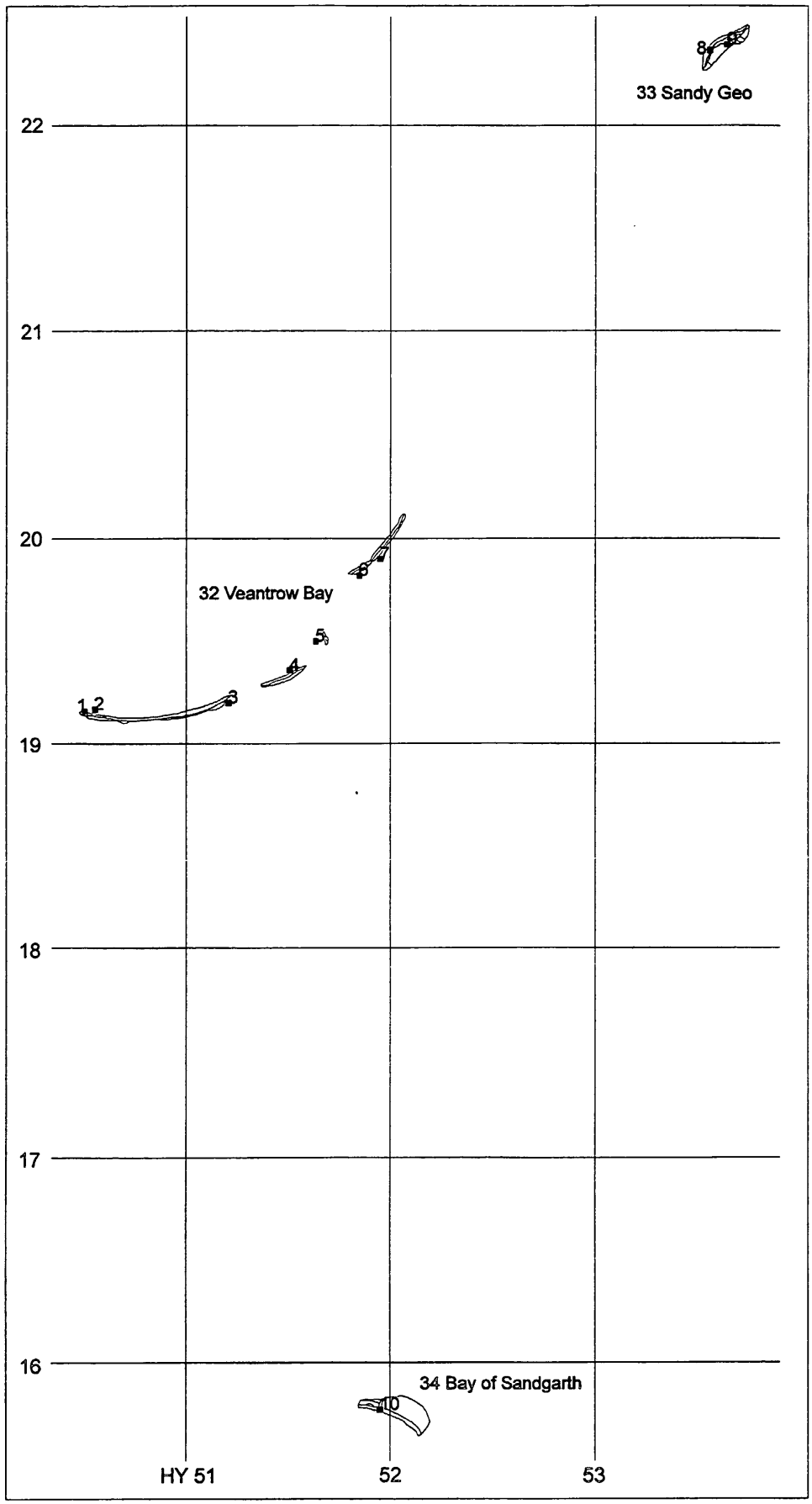
Sites 32 - 34

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	32 Veantrow Bay	33 Sandy Geo	34 Bay of Sandgarth	All Shapinsay sites
ARB	Arable - barley		0.24		0.24
ARTUR	Arable - turnips		0.07		0.07
BBG	Buildings, bare ground and gardens		0.12		0.12
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.18	0.14		0.32
BSH	Bare shingle	1.49	0.28	0.56	2.33
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.16			0.16
MG1/SD8	MG1/SD8 intermediate	0.03	0.38		0.41
MG7	MG7 *Lolium perenne* leys		0.51	2.11	2.62
ROAD	Road and track			0.05	0.05
RUD	Ruderal-dominated vegetation			0.04	0.04
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.38			0.38
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.35			0.35
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.25		0.17	0.42
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.29	0.05	0.06	0.40
TIP	Rubbish tip			0.02	0.02
TOTALS (ha)		3.14	1.79	3.02	7.95

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY50501916	32 Veantrow Bay	Intertidal sand supplies a thin layer (10-20 cm) of stony blown sand, lying on top of cliffed till (1.5 m) in section, above shingle beach with SDy strand.
2	HY50551917	32 Veantrow Bay	Intertidal sand supplies thin layer (10-20 cm) of stony blown sand on top of shingle beach with 3 m wide SDy strand. SD5c vegetation present. *Silene maritima, Cochlearia officinalis* present on boundary between SDy and SD5c.
3	HY51201920	32 Veantrow Bay	15 m long cliff section, with 10-30 cm cap of very recent blown sand on top of head deposit with good palaeosol (showing waterlogging detail). Sand derived from intertidal source.
4	HY51501936	32 Veantrow Bay	Low cliffed till (0.5-1.5 m) with 5-15 cm blown sand from intertidal source. Cobble beach present with 1 m wide SDy strand.
5	HY51631950	32 Veantrow Bay	20 m cliffed till section with 5-15 m blown sand derived from intertidal sands. Boulder and cobble beach, 1 m wide SDy strand. MG1/SD8a as narrow band on cliff top.
6	HY51851982	32 Veantrow Bay	Very small sand beach (thin, over shingle) in southern corner of bay. 1-3 m cliffed head forms southern edge (5-30 cm blown sand in section) with SD5b stretching for 50 m to north.
7	HY51951990	32 Veantrow Bay	Sand-capped (5-15 cm) shingle ridge with SD5c cover. Wetland to rear probably not based on sand - not mapped.
8	HY53502240	33 Sandy Geo	Beach thin sand patches over cobble and boulder sized shingle. Most of coast cliffed (2-4 m head over bedrock) with MG1/SD8a sward on face and top outside of agricultural fields.
9	HY53632240	33 Sandy Geo	Store for straw and bagged silage. Pile of sand excavated from beach (5 cu m). Also small piles of dumped rubble.
10	HY51951577	34 Bay of Sandgarth	Shingle beach with intertidal sand. 2 m wide SDy strand at upper edge. Sand excavated from intertidal beach and piled at southern end of track to beach (15 cu m). Large fish cages (40 m diameter) stored in rank SD8 grassland to right of track. This field is also used as a rubble tip.



Map 3 Target note positions: Veantrow Bay, Sandy Geo and Bay of Sandgarth (Shapinsay)

35-36 EGILSAY

Location and conservation status

Two areas of windblown sand are present:

35 Weyland HY479312
36 Mae Banks HY478303

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

Survey details

Date	September 1996
Target notes	6 (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

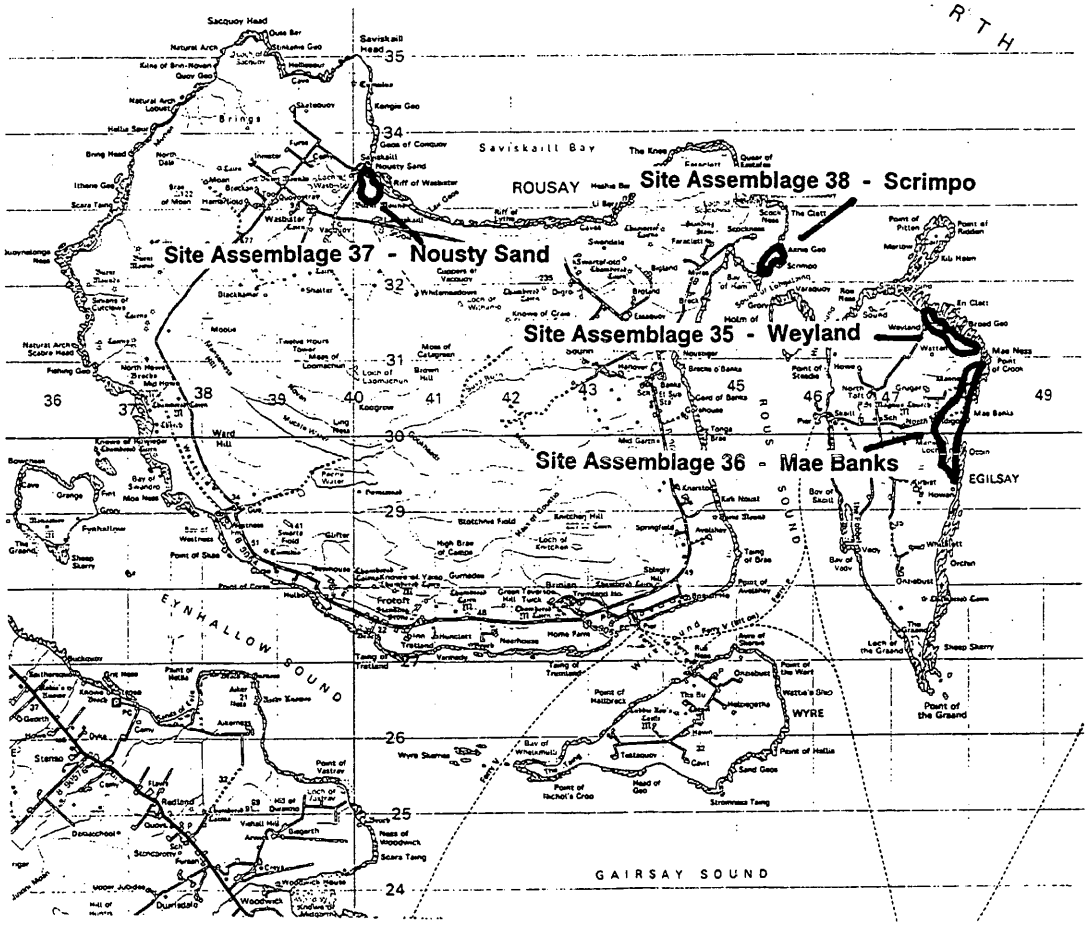
Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Egilsay has a modest 26.2 ha of windblown sand, excluding the beach zone. Most of this area is vegetated (21.9 ha). There are small areas of bare sand (0.3 ha), arable/fallow ground (1.9 ha), and land take (1.2 ha). Mae Banks is the larger site (20.5 ha), with Weyland occupying 5.7 ha.

Dune habitats (Table 2, Map 2)

A total of 30.8 ha was surveyed and habitats present span the full range of Orkney dune conditions except for the absence of acidic dune grassland, dry dune heath and wet dune heath which are restricted to Hoy and Eday. The small size of the Weyland site and poor sand supply attenuates its range and it lacks mobile and semi-fixed dunes. Sand supply is better at Mae Banks and there is a small area of mobile dune, much of it formed from moss-rich fixed dune vegetation which indicates low but regular blown sand input (SD8c *Festuca rubra - Galium verum* community, *Tortula ruralis* ssp. *ruraliformis* sub-community). Dry fixed dune grassland is also present in modest quantity (5.2 ha) but an important characteristic of both sites is the high amount of dune wetland which dominates the site interiors, with 7.1 ha of slack/wet grassland and 3.3 ha of mire/swamp for all of Egilsay blown sand. The dune wetland probably forms the largest area of all remaining wetland on Egilsay. Improved grassland is also present (3.9 ha), much of it formed from semi-improved fixed dune.



Map 1 Site assemblage location,
(Map also includes sites on Rousay)
See Volume 3 for NVC maps

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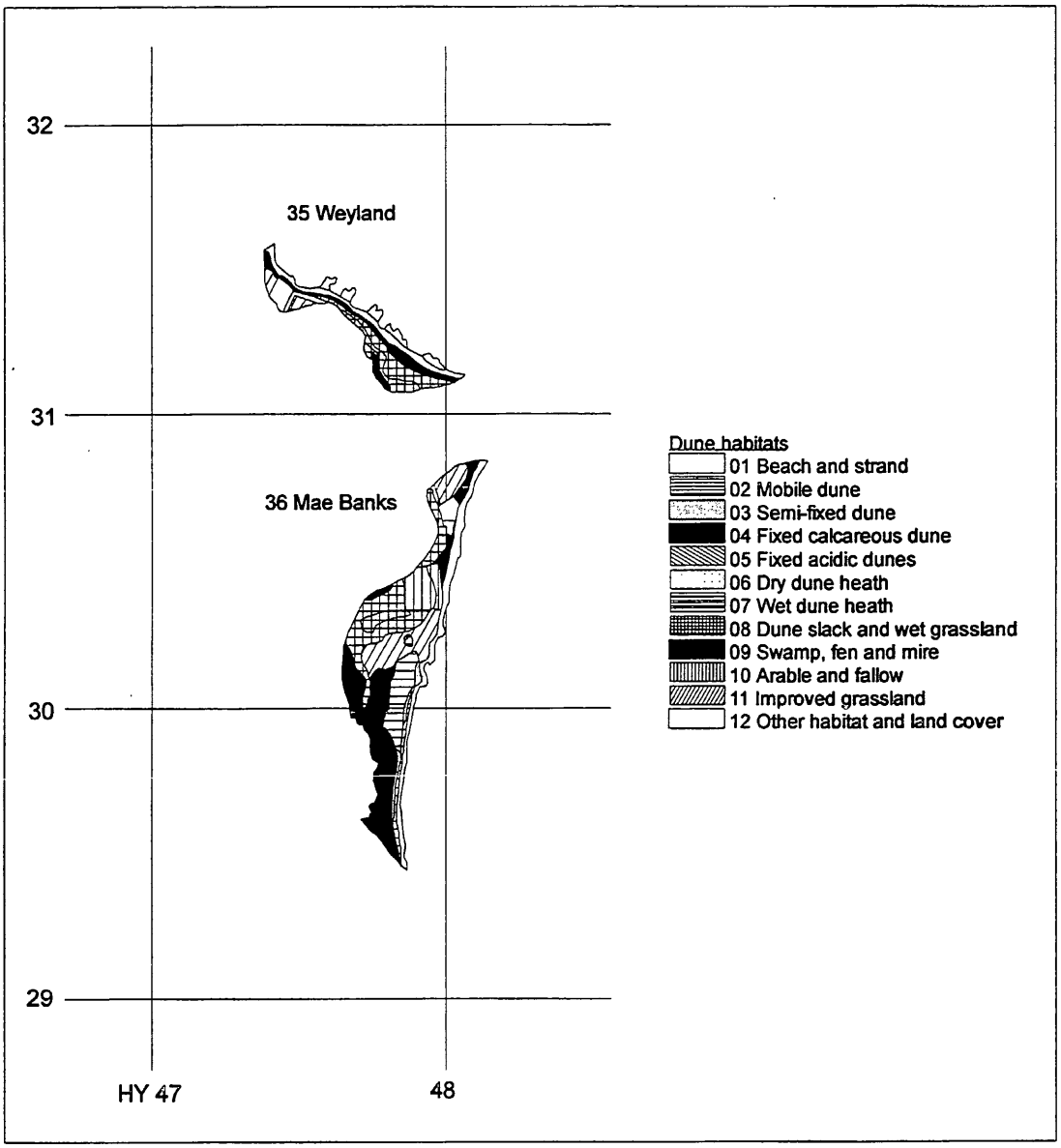
Table 1 Broad land cover extents (ha)

	35 Weyland	36 Mae Banks	All Egilsay sites
Windblown sand land cover			
Beach above MHWS	1.37	2.39	3.76
Bare sand		0.31	0.31
Vegetated sand (except fallows)	4.85	17.88	22.74
Arable and fallow		1.89	1.89
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.81	0.41	1.22
Total windblown sand excluding beach zone	5.67	20.49	26.16
Total windblown sand extent above MHWS	7.03	22.89	29.92
Surveyed but not on blown sand			
Bare rock			
Unvegetated maritime cliff	0.84		0.84
Saltmarsh			
Open water			

Table 2 Extents (ha) of dune habitats and other ground

	35 Weyland	36 Mae Banks	All Egilsay sites
Habitat 1 - Beach and strand	1.52	2.66	4.18
Habitat 2 - Mobile dune		2.51	2.51
Habitat 3 - Semi-fixed dune		0.43	0.43
Habitat 4 - Fixed dry calcareous dune	1.41	3.83	5.24
Habitat 5 - Fixed acidic grassland			
Habitat 6 - Dry dune heath			
Habitat 7 - Wet dune heath			
Habitat 8 - Dune slack and wet grassland	2.50	4.63	7.13
Habitat 9 - Mire and swamp	0.30	2.96	3.26
Habitat 10 - Arable and fallow		1.89	1.89
Habitat 11 - Improved grassland	0.49	3.43	3.92
Habitat 12 - Other habitats	1.65	0.55	2.20
TOTALS (ha)	7.87	22.89	30.76



Map 2 Dune habitats of Weyland and Mae Banks (Egilsay)

Vegetation and other land cover types (Table 3; Volume 3 - NVC maps)

A total of 27 vegetation and other land cover types is present on Egilsay, with no single type dominating extent. This shows considerable diversity is a relatively small total area. Almost half of all categories are wetland types, with MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland forming the largest single area of any type (5.7 ha). Despite some improvement from MG7 *Lolium perenne* leys there are good zonations present from dry conditions close to the coastal edge to damp and then very wet ground along the inner site edge.

Site descriptions

35 Weyland

This site is located on the northeastern coast of Egilsay, immediately west of the Mae Ness headland. It is exposed to a short 7 km fetch NE to the island of Faray. Egilsay is sheltered by larger Orkney islands and seas are unlikely to be extremely rough except in exceptional conditions. Nevertheless, the dune edge is cliffed to 0.75 m along one sector of the beach, providing evidence of slow erosion. Sand is 0.5 - 1 m thick on the coastal edge, laid on top of slab shingle with outcrops of bedrock present. The northwestern part of the site is largely improved but the eastern side has a good simple zonation from SD8a *Festuca rubra - Galium verum* fixed dune, Typical sub-community to MG11 inundation grassland and then M28x *Iris pseudacorus* beds and the provisional MxPp *Carex nigra - Potentilla palustris* rich fen community. This zonation is common in Orkney. The nature conservation interest of the vegetation is only moderate, especially given the small size of the site.

36 Mae Banks

Mae Banks is positioned on the eastern coast of Egilsay, immediately south of the Mae Ness headland. It is exposed to a short 7 km fetch east to Eday and, like Weyland, is comparatively sheltered by surrounding larger islands. Exposure is still sufficient to induce steady coastal retreat at present, with cliffed dune edges rising to 1.5 m and fence collapse occurring. The northern end of the site is partly improved and used for winter feeding of cattle. The southern part of the site has very good zonations inland from mobile and semi-fixed dunes (SD6ae, SD7x and SD8c types) to fixed dry (SD8d) and damp (SD8e) calcareous grassland, and then to dune wetland (MG11 inundation grassland and then MxTm and MxPp rich fen) on the lowest ground which surrounds an area of occasional open water named Manse Loch. The MxPp rich fen extends beyond the blown sand boundary. These zonations are common in Orkney but this site has one of the better examples. The vegetation of the southern sectors is of good nature conservation interest. The wet ground conditions are also probably good for waders.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

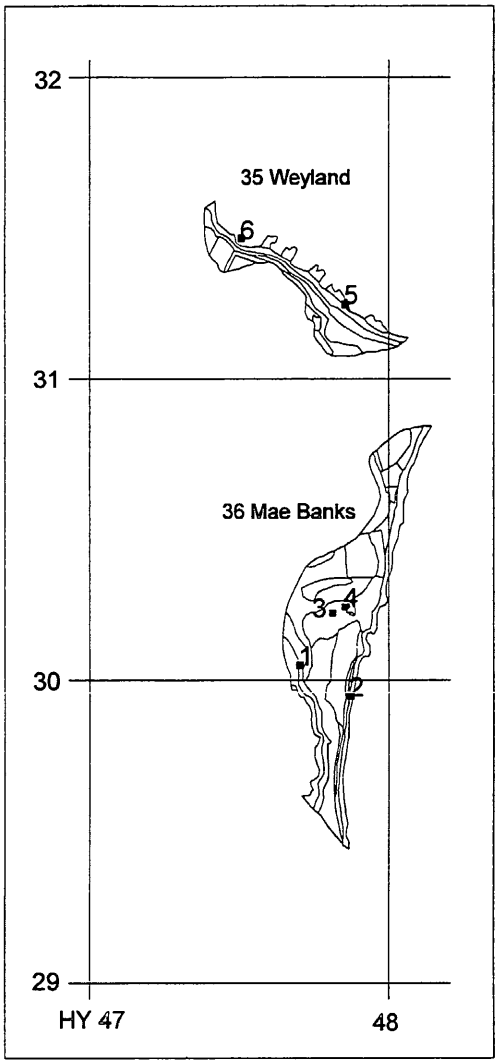
Sites

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	35 Weyland	36 Mae Banks	All Egilsay sites
ARO	Arable - oats		0.09	0.09
BBG	Buildings, bare ground and gardens	0.55	0.41	0.96
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.61	0.80	1.41
BMC	Maritime cliff with little vegetation	0.84		0.84
BS	Bare sand (within vegetated sand zone)		0.31	0.31
BSH	Bare shingle	0.76	1.60	2.36
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.11	0.17	0.27
MG7	MG7 *Lolium perenne* leys	0.49	0.89	1.38
MG7/SD8	MG7/SD8 intermediate		2.54	2.54
MG9/ MG11	MG9/MG11 intermediate	0.80		0.80
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	1.58	4.10	5.68
MG11F	MG11F *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland - FALLOW		1.33	1.33
MG13/ S19c	MG13/S19c intermediate	0.13		0.13
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)	0.19	1.31	1.50
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)		1.46	1.46
ROAD	Road and track	0.26		0.26
RUD	Ruderal-dominated vegetation		0.13	0.13
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community		0.03	0.03
SD6ae	SD6a/e intermediate		0.29	0.29
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)		1.00	1.00
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	1.41	0.80	2.21
SD8c	SD8c *Festuca rubra-Galium verum* grassland, *Tortula ruralis* ssp. *ruraliformis* sub-community		1.37	1.37
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community		1.50	1.50
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community		1.50	1.50
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW		0.47	0.47
SD17d	SD17d *Potentilla anserina-Carex nigra* slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community		0.53	0.53
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.15	0.27	0.42
TOTALS (ha)		7.87	22.89	30.76

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY47703005	36 Mae Banks	East side and north of Manse Loch occupied by MxTm, changing to acidic MxPp in more extensive wetland to north. The MxPp extends around the western side of the loch and is probably developed extensively on non-sand parent material.
2	HY47872995	36 Mae Banks	Gently shelving shingle beach with thin cover of sand and continuous SDy strand. Dune edge cliffed to 1.5 m, with fence collapse in places. SD6ae cover developing rapidly inland into SD7x.
3	HY47813022	36 Mae Banks	Winter feeding ground for cattle. Extensive patches of ruderals (*Urtica dioica, Cirsium arvense*) and much *Lolium perenne*, in turf dominated by *Festuca rubra* (no *Galium verum*).
4	HY47853024	36 Mae Banks	Former sand pit. Now entirely recolonised with MG11 floors.
5	HY47853125	35 Weyland	Slab shingle beach overlain with very thin sand, SDy strand. Dune vegetation developed on 0.5-1 m blown sand above shingle, rank SD8a vegetation.
6	HY47503147	35 Weyland	Slab shingle beach with thin cover of sand. SDy strand present. Dune edge cliffed to 0.75 m.



Map 3 Target note positions: Weyland and Mae Banks (Egilsay)

37-38 ROUSAY

Location and conservation status

Two sites are present with vegetated windblown sand:

37 Nousty Sand	HY402332
38 Scrimpo	HY454323

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

Survey details

Date	September 1996
Target notes	5 (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

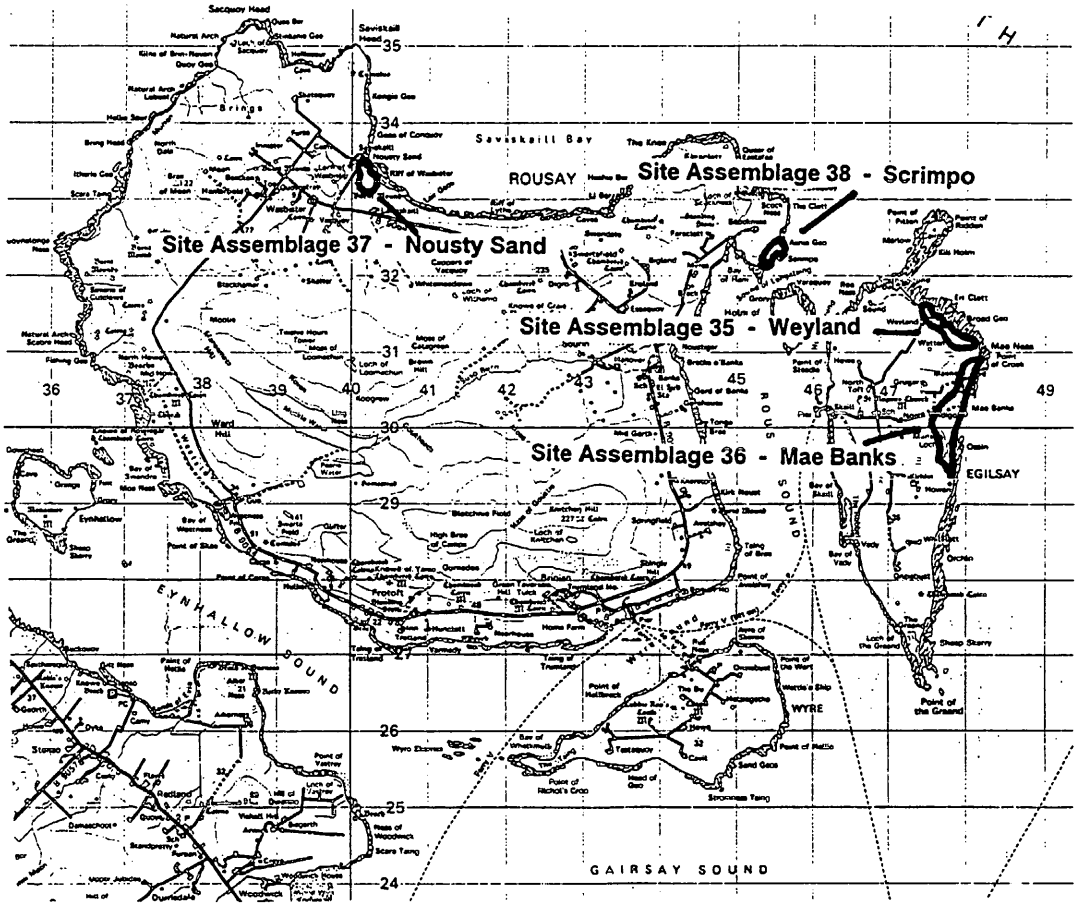
Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Despite its size, Rousay has little windblown sand, the two sites present only totalling 11.7 ha excluding the beach zone. Of this 11.2 ha is vegetated, with a further 0.4 ha of land taken for buildings, gardens and roads (all at Nousty Sand). Much of the coastal edge of both sites is made up of cliff and bedrock outcrops, giving an additional area of 1.2 ha to mapped extent. Storm waves generate spray from such exposures and support vegetation types intermediate with maritime cliff vegetation, and these are present in low quantity at Scrimpo (see site descriptions).

Dune habitats (Table 2, Map 2)

More than half of the surveyed area of Rousay (13.7 ha) is dominated by improved grassland (7.0 ha). The only dune habitat of significant extent is fixed dry calcareous dune grassland (2.6 ha) which is restricted to the Scrimpo site. No mobile or semi-fixed dune conditions are present and vegetated strand is almost absent, suggesting poor sand supply at both sites. There are small amounts of wetland on poorly-drained parts of the inner edge of sites, as well as in the floor of a former blowout at Scrimpo.



Map 1 Site assemblage location,
(Map includes sites on Egilsay)
See Volume 3 for NVC maps

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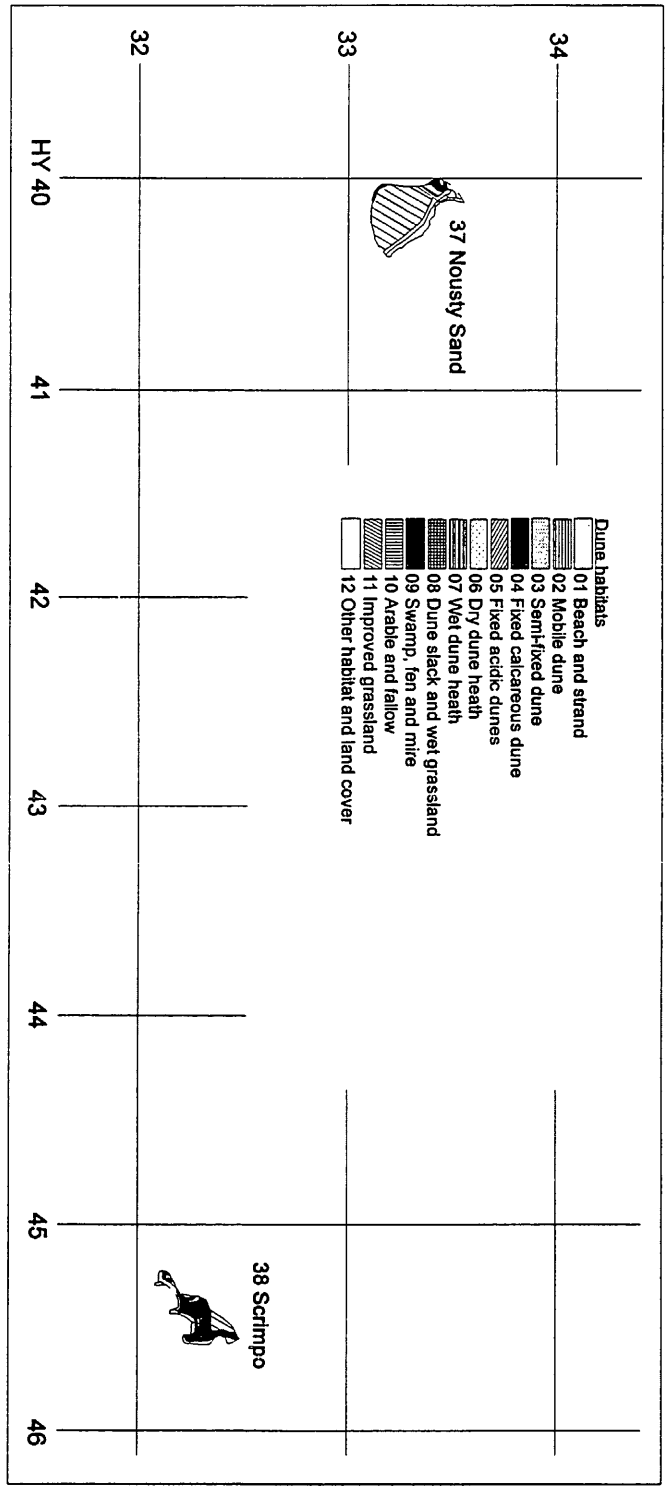
Table 1 Broad land cover extents (ha)

	37 Nousty Sand	38 Scrimpo	All Rousay sites
Windblown sand land cover			
Beach above MHWS	0.15	0.61	0.76
Bare sand			
Vegetated sand (except fallows)	7.57	3.66	11.22
Arable and fallow			
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.42		0.42
Total windblown sand excluding beach zone	7.98	3.72	11.70
Total windblown sand extent above MHWS	8.14	4.33	12.46
Surveyed but not on blown sand			
Bare rock			
Unvegetated maritime cliff	0.76	0.43	1.18
Saltmarsh		0.06	0.06
Open water			

Table 2 Extents (ha) of dune habitats and other ground

	37 Nousty Sand	38 Scrimpo	All Rousay sites
Habitat 1 - Beach and strand	0.17	0.61	0.78
Habitat 2 - Mobile dune			
Habitat 3 - Semi-fixed dune			
Habitat 4 - Fixed dry calcareous dune		2.58	2.58
Habitat 5 - Fixed acidic grassland			
Habitat 6 - Dry dune heath			
Habitat 7 - Wet dune heath			
Habitat 8 - Dune slack and wet grassland	0.05	0.28	0.33
Habitat 9 - Mire and swamp	0.43	0.12	0.55
Habitat 10 - Arable and fallow			
Habitat 11 - Improved grassland	6.30	0.67	6.98
Habitat 12 - Other habitats	1.94	0.49	2.43
TOTALS (ha)	8.89	4.75	13.65



Map 2 Dune habitats of Nousty Sand and Scrimpo (Rousay)

Vegetation and other land cover types (Table 3; Volume 3 - NVC maps)

The small size of the sites, poor sand supply and low extent of wet ground greatly reduce the range of vegetation types and other types of land cover. Only fourteen categories were mapped, nine of them covering vegetation. MG7 *Lolium perenne* leys are dominant at Nousty Sand, together with a high cover of ruderal vegetation associated with stock feeding, rabbit burrows and seaweed blown inland from the shore. SD8 *Festuca rubra - Galium verum* Typical sub-community fixed dune grassland is dominant at Scrimpo and along much of its eastern edge there is an intermediate with MC8 *Festuca rubra - Armeria maritima* maritime grassland in areas receiving spray deposition.

Site descriptions

37 Nousty Sand

This bay dune site is named Saviskaill by Mather *et al.* (1974). It is located at the western end of Saviskaill Bay on the north coast of Rousay and is exposed to an 11 km fetch NE to Westray. The coastal edge shows very slow retreat at present, with 0.5 - 1 m thin sand overlying shingle cliffed along its entire length. Most of the interior is improved and the only vegetation of nature conservation interest consists of very small extents of MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland and M28x *Iris pseudacorus* marsh on the inner edge of the site. Overall the nature conservation interest of site vegetation is very low.

38 Scrimpo

This bay and climbing dune site occupies the southeastern parts of a small headland on the northeastern coast of Rousay, opposite the small island of Holm of Scockness. Three small bays are present, one facing east, the remaining two oriented to the south. Blown sand has accumulated inland and forms a continuous but small area of climbing dune. The coastal edge is either neutral (static) or retreating very slowly, with only small amounts of cliffed dune edge. The site interior is dominated by SD8 *Festuca rubra - Galium verum* Typical sub-community fixed dune grassland which also has a spray-influenced intermediate with MC8 *Festuca rubra - Armeria maritima* maritime grassland along its eastern edge. Some improvement to MG7 *Lolium perenne* ley has occurred in the north. Wet grassland (MG11, MG9/MG11 intermediate with *Holcus lanatus - Deschampsia cespitosa*) and M28x *Iris pseudacorus* mire are present inland. The MG11 grassland behind the central beach is in a depression which was probably a blowout but could also be an old sandpit. Overall nature conservation interest is low to moderate, given the small size and limited diversity of the site vegetation. Mather et al. (1974) describe the beaches as attractive and suitable for casual recreation - no visitor impacts were noted and much of the site is probably unchanged from conditions observed in the early 1970s.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

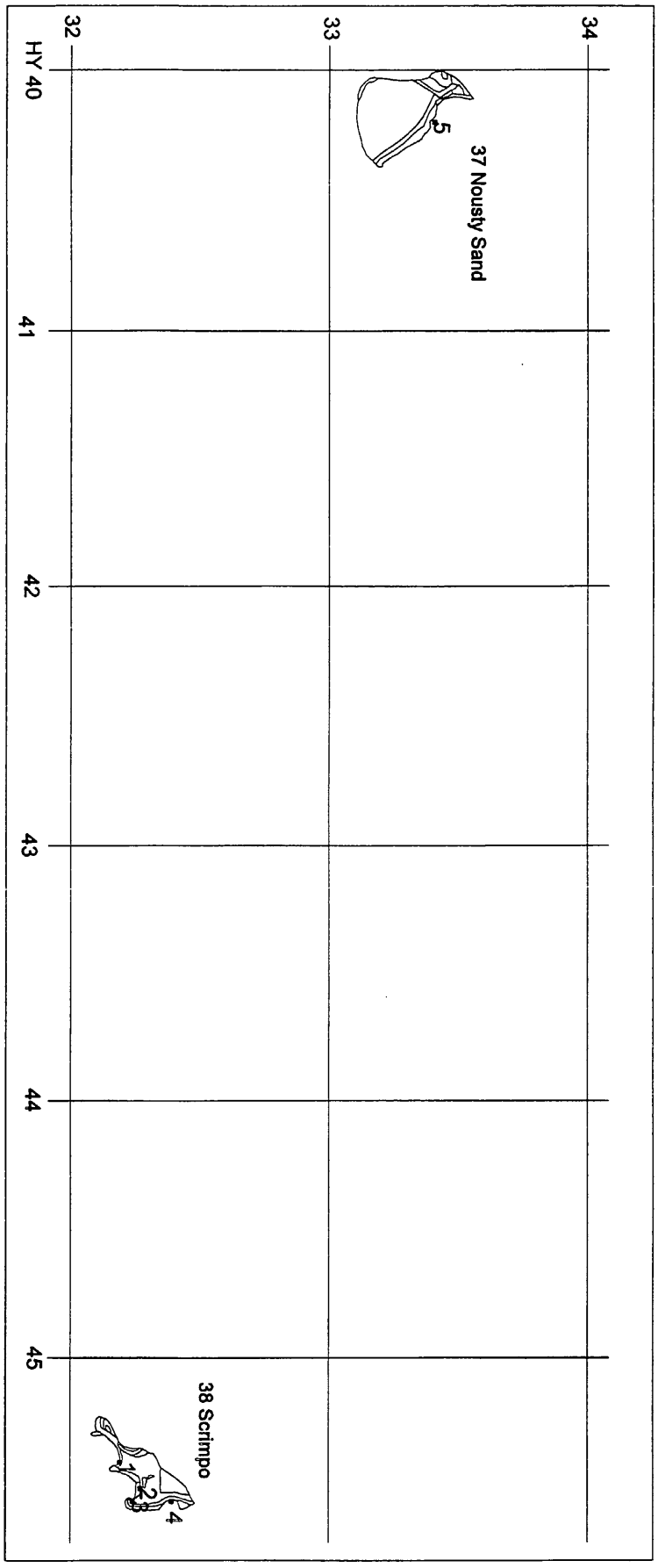
Sites 37 - 38

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	37 Nousty Sand	38 Scrimpo	All Rousay sites
BBG	Buildings, bare ground and gardens	0.15		0.15
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.07	0.10	0.16
BMC	Maritime cliff with little vegetation	0.76	0.43	1.18
BSH	Bare shingle	0.08	0.51	0.59
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.43	0.12	0.55
MC8/SD8	MC8 *Festuca rubra - Armeria maritima* maritime grassland/SD8 dune grassland intermediate		0.15	0.15
MG7	MG7 *Lolium perenne* leys	6.30	0.67	6.98
MG9/ MG11	MG9/MG11 intermediate		0.08	0.08
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	0.05	0.20	0.25
ROAD	Road and track	0.27		0.27
RUD	Ruderal-dominated vegetation	0.63		0.63
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.13	2.44	2.57
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.02		0.02
SM16	SM16 *Festuca rubra* saltmarsh		0.06	0.06
TOTALS (ha)		8.89	4.75	13.65

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY45403220	38 Scrimpo	Short shingle beach in front of bedrock outcrop, capped with 0.5-3 m sand. Fairly rank (25 cm height) SD8a sward present, with a few rabbit holes and a small flock of goats.
2	HY45503228	38 Scrimpo	Short, steep slab shingle beach with a sand covering in the eastern half of the bay. Capped with sand (0.5 m thick), edge cliffed with some turf collapse.
3	HY45553225	38 Scrimpo	Gently dipping sandstone rock ledges with thin vegetated sand extending into splash zone. Small amounts of MC8/SD8 vegetation present.
4	HY45553240	38 Scrimpo	Short, steep shingle beach capped with little sand. Thicker material inland, with moderate number of rabbit burrows, plus patches of *Urtica dioica*.
5	HY40203340	37 Nousty Sand	Steep, short slab shingle beach with fragmented SDy strand. Sand 0.5-1 m thick on crest, cliffed throughout coastal length, especially along eastern side. Small amounts of SD8a present but largely dominated by ruderals (*Heracleum sphondylium, Elymus repens, Cirsium vulgare, Urtica dioica*) derived from inblown seaweed and use of area for storing hay bales.



Map 3 Target note positions: Nousty Sand and Scrimpo (Rousay)

39-50 STRONSAY AND PAPA STRONSAY

Location and conservation status

Eleven areas of vegetated windblown sand are present on Stronsay, together with an additional site on Papa Stronsay:

39 Sand of the Crook	HY667214	40 Bight of Scarma	HY655215
41 Inganoust	HY657225	42 Sand of Rothiesholm and Bight of Matpow	HY630245
43 Bay of Bomasty	HY616236	44 Bight of Baywest	HY618240
45 St Catherine's Bay	HY645262	46 Sands of Odie	HY625296
47 Brae Geo	HY642303	48 Cumley	HY654280
49 Mill Bay	HY658257		
50 Papa Stronsay	HY660297		

The locations of site assemblages are given in Map 1a.

Only one site has a nature conservation or landscape designation: Mill Bay SSSI (1.9 ha, Map 1b, HY665254) is notified for its geomorphological interest, having the best available exposures of shelly till in Orkney which provide evidence for Early Devensian glaciation. The SSSI covers only a small part of the windblown sand area at Mill Bay (*c.* 1.7 ha) and the nature conservation interest of vegetation within its boundary is only modest.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

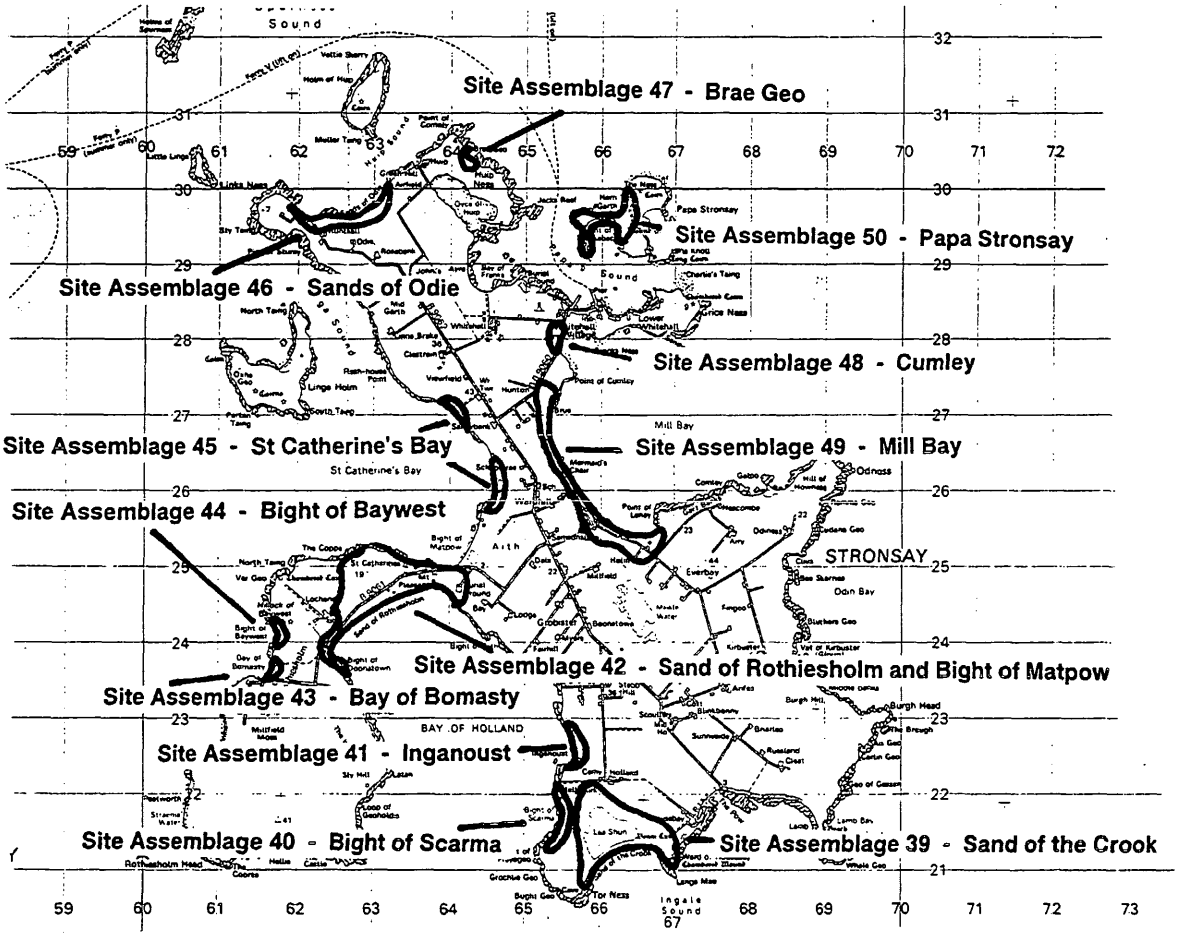
Survey details

Date	September 1996
Target notes	37 Stronsay, 4 Papa Stronsay (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

The total area of windblown sand excluding the beach zone on Stronsay is 211.6 ha, 183.2 ha of which consists of vegetated sand and a remainder made up of bare sand (2.1 ha), arable and fallow (14.2 ha), and land take for buildings, gardens, roads etc. (10.5 ha). Additional surveyed land includes 25.3 ha of open water, dominated by Lea Shun loch which occupies the centre of the site at Sand of the Crook. Papa Stronsay has a windblown sand area of 11.7 ha, most of it vegetated (11.0 ha) but also with some blown sand (0.7 ha).



Map 1a Site assemblage location
See Volume 3 for NVC maps

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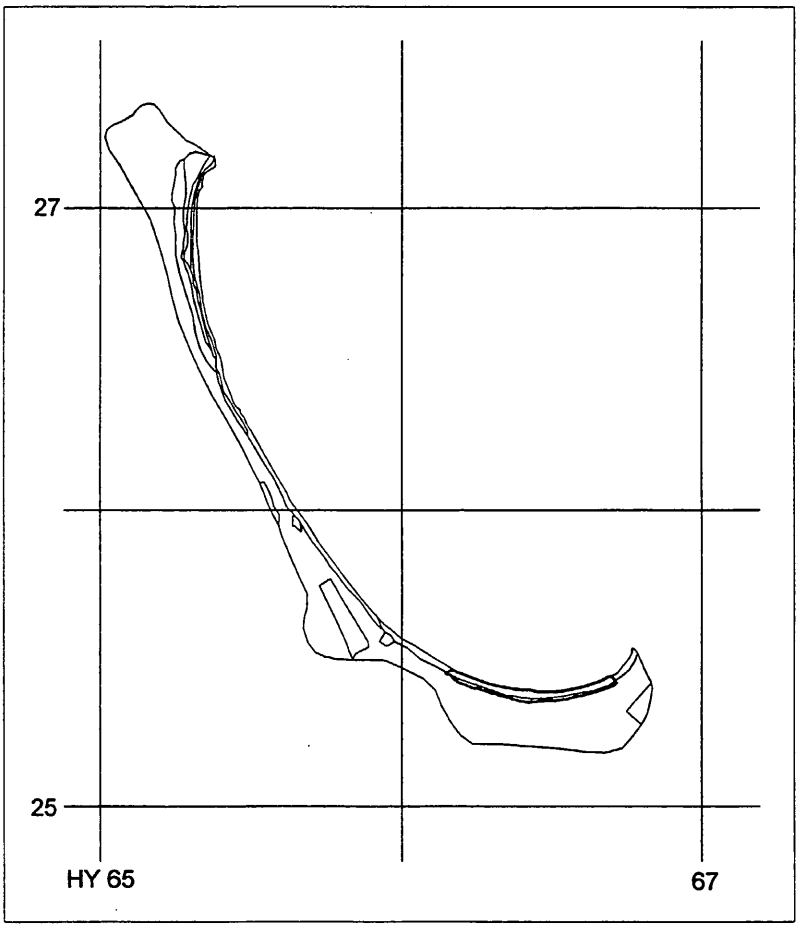


Map 1b Mill Bay SSSI, Stronsay

SSSI boundary with thick black line

Table 1 Broad land cover extents (ha)

	39 Sand of the Crook	40 Bight of Scarma	41 Inganoust	42 Sand of Rothiesholm and Bight of Matpow	43 Bay of Bomasty	All Stronsay sites
Windblown sand land cover						
Beach above MHWS	2.74	0.81	0.77	3.76	0.12	15.01
Bare sand	1.11			0.91		2.12
Vegetated sand (except fallows)	46.90	2.83	4.93	70.50	0.39	184.79
Arable and fallow	0.31	0.81		10.87		14.15
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.02	0.75	0.15	7.46		10.50
Total windblown sand excluding beach zone	48.34	4.39	5.07	89.75	0.39	211.57
Total windblown sand extent above MHWS	51.08	5.19	5.84	93.52	0.51	226.58
Surveyed but not on blown sand						
Bare rock						
Unvegetated maritime cliff				0.31		1.58
Saltmarsh						
Open water	23.88			0.35		25.28

	44 Bight of Baywest	45 St Catherine's Bay	46 Sands of Odie	47 Brae Geo	48 Cumley	49 Mill Bay	All Stronsay sites
Windblown sand land cover							
Beach above MHWS	0.46	1.74	1.61	0.23	0.40	2.35	15.01
Bare sand		0.05		0.05			2.12
Vegetated sand (except fallows)	0.47	10.92	8.67	0.33	2.64	36.21	184.79
Arable and fallow		0.36	0.67	0.36		0.78	14.15
Buildings, roads, gardens, tips, pits, cemeteries, airfield			0.03		0.46	1.63	10.50
Total windblown sand excluding beach zone	0.47	11.33	9.37	0.73	3.10	38.61	211.57
Total windblown sand extent above MHWS	0.93	13.07	10.99	0.97	3.50	40.97	226.58
Surveyed but not on blown sand							
Bare rock							
Unvegetated maritime cliff						1.27	1.58
Saltmarsh							
Open water		0.97			0.08		25.28

	50 Papa Stronsay
Windblown sand land cover	
Beach above MHWS	2.50
Bare sand	0.68
Vegetated sand (except fallows)	10.99
Arable and fallow	
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.01
Total windblown sand excluding beach zone	11.69
Total windblown sand extent above MHWS	14.19
Surveyed but not on blown sand	
Bare rock	
Unvegetated maritime cliff	
Saltmarsh	
Open water	

Dune habitats (Table 2, Map 2a-b)

Total surveyed area is 253.4 ha for Stronsay, with almost half of this made up of improved grassland (113.4 ha). Mobile dune extent (10.7 ha) suggests modest sand supply but it is important to note that most of this category is not made up of the normal habitat dominated by lyme grass *Leymus arenarius* or marram *Ammophila arenaria*. Instead, short-turf grasslands with a high cover of the moss *Tortula ruralis* ssp. *ruraliformis* are dominant and indicate areas receiving sand blow, often derived from an eroding dune edge or marking areas from which the normal large mobile dune grasses have been removed by grazing. Dry fixed dune extent is low (13.1 ha) but dune wetland is reasonably extensive, with 35.3 ha of slack/wet grassland and 8.4 ha of mire/swamp. Much of this wetland is close to the coastal edge, in depressions at the rear of shingle ridges which underlie blown sand deposits. An exception is present at the Sand of the Crook where it extends inland for a considerable distance around the edge of Lea Shun loch.

The Papa Stronsay site has a total area of 14.2 ha, most of which is improved grassland (10.4 ha).

Vegetation and other land cover types (Table 3; Volume 3 - NVC maps)

As indicated by habitat data, Stronsay is dominated by MG7 *Lolium perenne* leys (109.9 ha). No other vegetation type approaches this extent and the second highest area is represented by SD17b *Potentilla anserina - Carex nigra* slack, *Carex flacca* sub-community (10.6 ha). A total of 30 vegetation and 13 land cover types is present and represents reasonable diversity, especially for wetland categories of vegetation which total 16. Dry dune conditions are also reasonably diverse but extents are generally low, especially for mobile (SD5 *Leymus arenarius*, SD6 *Ammophila arenaria*) and semi-fixed (SD7 *Ammophila arenaria - Festuca rubra*) dunes which total only 4.4 ha. SD8 *Festuca rubra - Galium verum* fixed dune (18.1 ha) is more extensive and includes the SD8a Typical, SD8c *Tortula ruralis* ssp. *ruraliformis*, SD8d *Ranunculus acris - Bellis perennis*, and SD8e *Prunella vulgaris* sub-communities. Much of the large improved MG7 ley area would probably have been dry dune conditions in the past. The balance of losses between mobile, semi-fixed and fixed dune conditions is uncertain.

Papa Stronsay has only a small sand area and this is dominated by MG7 improved grassland and semi-improved (MG7/SD8) types. There is a small additional area of dune wetlands (M28x *Iris pseudacorus* beds, MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grasslands).

Site descriptions

39 Sand of the Crook (Map 2a)

This site lies on the south coast of Stronsay, exposed to a long fetch SSE across the North Sea to the Netherlands. It is a bay and climbing dune site, with sand capping an impressive shingle ridge on its seaward edge and a large loch (Lea Shun, 23.9 ha) forming the centre of the site. It has a blown sand area of 48.3 ha excluding the beach zone, the second largest site on Stronsay. There is no sand on the seaward side and only a thin capping on the shingle crest (0.2 - 0.5 m), but sand thickens on the shingle backslope where there is a high density of rabbit burrows and ground infested with ruderals. The poor sand cover associated with shingle is in contrast to thicker sand on climbing dunes which extend almost 1 km inland. Sand probably lies under Lea Shun. The northeastern side of the site has MG7 improved grassland, part of which has been used to restore a former large sand pit, with a small area still in use for sand extraction. Heavy cattle grazing and winter feeding in this area has produced a large infestation of ruderal vegetation and a very unkempt appearance. The western slopes and immediate margins of Lea Shun have good wetland, with transitions from MG9/MG11 to MG11/SD17 and SD17b on the west and at the head of Lea Shun an excellent area of SD17b merging into MxTm *Carex nigra - Triglochin maritima* rich fen on wetter, lower ground. The southern and northeastern shores have a wide belt of S19a *Eleocharis palustris* swamp.

Despite improvement and past sand extraction (plus a little shingle extraction too) the site retains much interest, particularly the wetlands around Lea Shun. The range of vegetation types is good and the transitional sequences are excellent. The breeding bird interest is also likely to be high - snipe were plentiful at the time of survey.

Table 2 Extents (ha) of dune habitats and other ground

	39 Sand of the Crook	40 Bight of Scarma	41 Inganoust	42 Sand of Rothiesholm and Bight of Matpow	43 Bay of Bomasty	44 Bight of Baywest	All Stronsay sites
Habitat 1 - Beach and strand	2.53	0.81	1.31	4.35	0.19	0.52	16.95
Habitat 2 - Mobile dune	6.68			2.49			10.66
Habitat 3 - Semi-fixed dune	0.02						0.67
Habitat 4 - Fixed dry calcareous dune	0.54	0.53		9.24		0.42	13.06
Habitat 5 - Fixed acidic grassland							
Habitat 6 - Dry dune heath							
Habitat 7 - Wet dune heath							
Habitat 8 - Dune slack and wet grassland	16.00			12.66			35.29
Habitat 9 - Mire and swamp	5.00			0.63			8.35
Habitat 10 - Arable and fallow	0.31	0.81		10.87			14.15
Habitat 11 - Improved grassland	18.66	2.30	4.37	44.98	0.33		113.41
Habitat 12 - Other habitats	25.23	0.75	0.17	8.95			40.47
TOTALS (ha)	74.96	5.19	5.84	94.18	0.51	0.93	253.44

	45 St Catherine's Bay	46 Sands of Odie	47 Brae Geo	48 Cumley	49 Mill Bay	All Stronsay sites
Habitat 1 - Beach and strand	2.03	2.02	0.23	0.62	2.35	16.95
Habitat 2 - Mobile dune	0.63	0.06	0.12		0.69	10.66
Habitat 3 - Semi-fixed dune	0.10				0.56	0.67
Habitat 4 - Fixed dry calcareous dune	0.69	0.15	0.26		1.23	13.06
Habitat 5 - Fixed acidic grassland						
Habitat 6 - Dry dune heath						
Habitat 7 - Wet dune heath						
Habitat 8 - Dune slack and wet grassland	1.49	2.83		0.42	1.88	35.29
Habitat 9 - Mire and swamp	0.40	1.50		0.82		8.35
Habitat 10 - Arable and fallow	0.36	0.67	0.36		0.78	14.15
Habitat 11 - Improved grassland	7.36	3.73		1.19	30.92	113.41
Habitat 12 - Other habitats	0.97	0.03		0.55	3.83	40.47
TOTALS (ha)	14.03	10.99	0.97	3.59	42.24	253.44

	50 Papa Stronsay
Habitat 1 - Beach and strand	2.50
Habitat 2 - Mobile dune	0.82
Habitat 3 - Semi-fixed dune	
Habitat 4 - Fixed dry calcareous dune	
Habitat 5 - Fixed acidic grassland	
Habitat 6 - Dry dune heath	
Habitat 7 - Wet dune heath	
Habitat 8 - Dune slack and wet grassland	0.15
Habitat 9 - Mire and swamp	0.36
Habitat 10 - Arable and fallow	
Habitat 11 - Improved grassland	10.36
Habitat 12 - Other habitats	0.01
TOTALS (ha)	14.19

40 Bight of Scarma (Map 2a)

This site is a small bay dune (4.4 ha excluding beach) developed in a slight coastal inflexion on the east side of the Bay of Holland, SW Stronsay. It is exposed to a very short 3 km WNW fetch across the Bay of Holland to the Rothiesholm peninsula. The site is narrow, with blown sand extending only 120 m inland. The interior is MG7 improved ley or arable (oats) and the only nature conservation interest is a narrow band of SD8a fixed dune grassland between the shingle beach and road which runs the length of the site. The coastal edge, despite a short fetch, is cliffed 0.5 - 1 m, showing slow coastal retreat of sand which is 1 - 3 m thick over shingle.

41 Inganoust (Map 2a)

This bay dune site lies 250 m north of Bight of Scarma on the east side of the Bay of Holland. It is small (5.1 ha excluding beach) and developed in a shallow coastal inflexion, extending for 800 m as a thin 80 - 100 m wide area of blown sand. It is exposed to a very short 3 km NW fetch across the Bay of Holland to Sand of Rothiesholm, though this is sufficient to develop low dune cliffs along much of the dune edge. The interior is entirely improved and the very low nature conservation interest of the site is based on strand vegetation: SD5/SM28 *Leymus arenarius - Elymus repens* and a small amount of SDy *Atriplex glabriuscula* strand.

42 Sand of Rothiesholm and Bight of Matpow (Map 2a)

This is a complex site which forms the largest individual area of windblown sand on Stronsay (89.8 ha). It is developed from two bay dune systems, Sand of Rothiesholm at the head of Bay of Holland (with a 3 km fetch SE to Inganoust), and Bight of Matpow on the southern edge of St Catherine's Bay (with a 6 km fetch NNW to Links Ness). The blown sand is developed upon shingle which probably forms a tombolo linking the Rothiesholm peninsula to the remainder of Stronsay. At its narrowest the north-south distance between the two shores is 275 m. Climbing dunes are also developed behind the Sand of Rothiesholm and rise to about 19 m OD.

Most of the site interior is MG7 improved grassland or arable land but the centre of the site, immediately west of the narrow neck, has a good area of dune wetland developed in low ground between the two sets of underlying shingle ridges. There are gradations here from dry conditions (SD8d *Festuca rubra - Galium verum* grassland, *Ranunculus acris - Bellis perennis* sub-community) through damp and wet grassland (SD8e *Prunella vulgaris* sub-community and MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland) to dune slack, swamp and open water in the lowest areas (SD17b *Potentilla anserina - Carex nigra* slack, *Carex flacca* sub-community; SD17 - S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community). Leaves of *Ranunculus baudotii* were noted on the dried out floor of open water areas. Further west there is a large area of rabbit-infested SD8d fixed dune grassland which has a coastal edge facing the Bay of Holland with the SD8c *Tortula ruralis* ssp. *ruraliformis* sub-community and an SD4 *Elymus farctus* embryo dune - SD8c intermediate. These might indicate former narrow zones of mobile dune which have had their normal tall grasses replaced with these forms of SD8 fixed dune which are good evidence for sand deposition. Small blowouts are frequent along this sector of shore and inland there is a marked dry depression suggesting a former sand pit, with metal dumps in three locations. At the western end of Sand of Rothiesholm the shingle impounds a large waterbody (Loch of Rothiesholm), and there is further dune wetland developed mainly on its western side.

The wetland areas of the site form the major nature conservation interest, though cattle poaching is heavy on all soft ground. Breeding wader interest here is probably quite good. Elsewhere much dry fixed dune grassland seems altered and most of the site interior has lost dune habitat to improved grassland and arable. Overall interest is therefore only moderate, but with some good local interest.

43 Bay of Bomasty and 44 Bight of Baywest (Map 2a)

These two sites are very small bay dunes (0.4 ha and 0.5 ha respectively), developed as very narrow systems on the western side of the Rothiesholm peninsula, SW Stronsay. Both have fetches of 22 km west to Mainland in Orkney. Blown sand is present as a very thin capping (30 cm) to shingle, above shingle beaches with intertidal sand. Neither site has any significant nature conservation interest. The interior of Bay of Bomasty is MG7 improved grassland and there are very small quantities of SD5/SM28 and SDy strand, mainly developed on shingle rather than sand. A thin line of SD8a fixed dune is present at Bight of Baywest above a shingle beach with a patchy SDy strand.

45 St Catherine's Bay (Map 2b)

Blown sand is present in two areas within the centre of St Catherine's Bay on the west coast of Stronsay. Both sub-sites are bay dunes, with sand extending up to 120 m inland, and with a common fetch of 18 km WNW to Egilsay. Total blown sand area is 11.3 ha. The northern sub-site is almost entirely improved with MG7 leys inland from a shingle beach with patches of SD5/SM28 and SDy strand. The southern sub-site is much more diverse. MG7 leys and arable land are present at the northern and southern extremities but between these there is a sand beach with an outer narrow fringe of dry conditions (SD6ae *Ammophila arenaria* mobile dune, *Elymus farctus - Festuca rubra* intermediate sub-community, SD7x *Ammophila arenaria - Festuca rubra* semi-fixed dune *Galium verum* sub-community and SD8a *Festuca rubra - Galium verum* fixed dune Typical sub-community) changing rapidly inland to MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland and S19c *Eleocharis palustris* swamp *Agrostis stolonifera* sub-community around a small area of open water. Such transitions and wet/dry contrasts are common in Orkney and the nature conservation interest of the southern bay dune sub-site is low given its small size and limited range of typical conditions.

46 Sands of Odie (Map 2b)

This bay dune site is located on the north coast of Stronsay and is exposed to an 8 km fetch NW to Eday. The site is small (9.4 ha) and much of the western interior is MG7 improved grassland. Dune wetland of good quality is well developed in the eastern sector, with mosaics of M28x *Iris pseudacorus* - S28 *Phalaris arundinacea* intermediate mire/tall-herb fen, MG11 inundation grassland, MG9 *Holcus lanatus - Deschampsia cespitosa* coarse wet grassland - MG11 intermediate community and an MG11 - MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland intermediate. There is little dry dune vegetation and the coastal dry edge is very narrow inside a shingle beach with fragments of SD5/SM28 strand. A small tip for household refuse and animal bedding is present. Overall nature conservation interest is low to moderate due to small site size tempered by good wetland variation.

47 Brae Geo (Map 2b)

This very small (0.7 ha) bay dune site is located on the northeast coast of Stronsay, about 1 km east of Sands of Odie. It is exposed to a long fetch NE across the North Sea to Norway. Blown sand extends only 40 m inland and only dry dune vegetation is present, with small areas of SD4 embryo dune, SD5b mobile dune and SD8a fixed dune present above a beach with mixed sand and shingle. A fence separates this zone of dune vegetation from arable land inland. Small numbers of visitors use the site and the eastern side of the beach is trampled and slightly degraded. Nature conservation interest is very low due to the very small size and limited vegetational range.

48 Cumley (Map 2b)

This very small (3.1 ha) bay dune site is located on the east coast of Stronsay in the northwest of Mill Bay, immediately south of Whitehall Village, the principal settlement. It is exposed to a very short 3 km fetch SE to the other side of Mill Bay. A surfaced road crosses the site on a slight embankment and this impedes drainage, leading to small areas of MG11/MG13 inundation grassland, M28x *Iris pseudacorus* beds and S19c *Eleocharis palustris* swamp. The coastal edge on the east of the road has an SD5/SM28 strand. The remainder of the site is MG7 improved grassland apart from two tips, the most northern being the council refuse tip with many old cars. Nature conservation interest is low due to small site size and restricted range of wetland conditions.

49 Mill Bay (Map 2b)

This is a small to moderately-sized bay dune site (38.6 ha) located in the centre of Mill bay on the eastern coast of Stronsay. It is exposed to a long ENE fetch across the North Sea to Norway. The southern shore comprises bedrock outcrop with 1 - 6 m tall cliffs of till and a thin sand cover (a sector containing Mill Bay SSSI). A mixed sand and shingle beach is present in the north of the site and sand supply is sufficient to support very narrow zones of SD5c *Leymus arenarius* (*Festuca rubra* sub-community) and SD6ae *Ammophila arenaria* mobile dune (*Elymus farctus - Festuca rubra* intermediate sub-community), plus some SD8a *Festuca rubra - Galium verum* fixed dune Typical sub-community inland. This foredune zone has a backslope transition to MG11 inundation grassland but the remainder of the site interior is MG7 improved grassland or arable land. The nature conservation interest of the site is low due to the scale of grassland improvement and limited range of dune vegetation types.

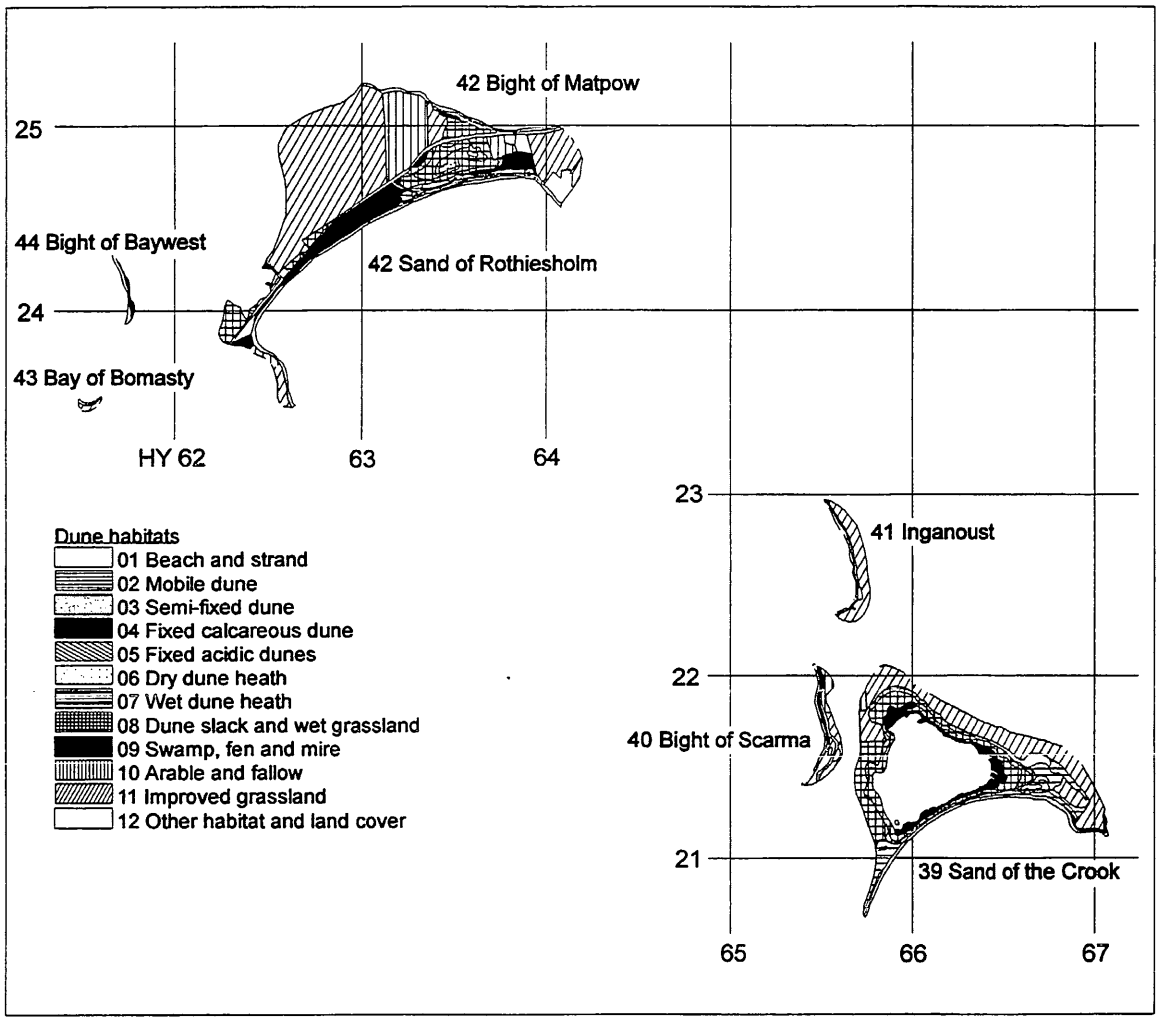
50 Papa Stronsay (Map 2b)

The island of Papa Stronsay lies 1 km offshore from the northeast shore of Stronsay. The site is complex. Dune vegetation developed upon a very narrow shingle tombolo separating the northern beach of Harri Garth from a sheltered bay (Bight of Stackaback), extending also west and east of the tombolo as more extensive areas of blown sand (total area 11.7 ha excluding beach). The western side of the Bight of Stackaback has a small shingle spit. Harri Garth is exposed to a 9 km fetch N to Sanday and the site east of the tombolo has a series of small active blowouts, one long (200 m) blowout scar and a semi-improved MG7 - SD8c *Festuca rubra - Galium verum* fixed dune *Tortula ruralis* ssp. *ruraliformis* sward indicating regular inundation with small sand quantities. The tombolo neck is threatened with breaching and the sand cover has been lost at the east end, with metal dumped in the breach zone. A sea wall 1.2 m high has been constructed to reduce erosional loss. There is a small area of climbing dune at the eastern end of the site. Sheep grazing pressure on the site is heavy and stock feeding has converted most vegetation to semi-improved dry (MG7/SD8c, MG7/SD8d) and wet (MG7/MG11) types, with *Lolium perenne* omnipresent. Stock rubbing and sheltering have exacerbated blowout erosion.

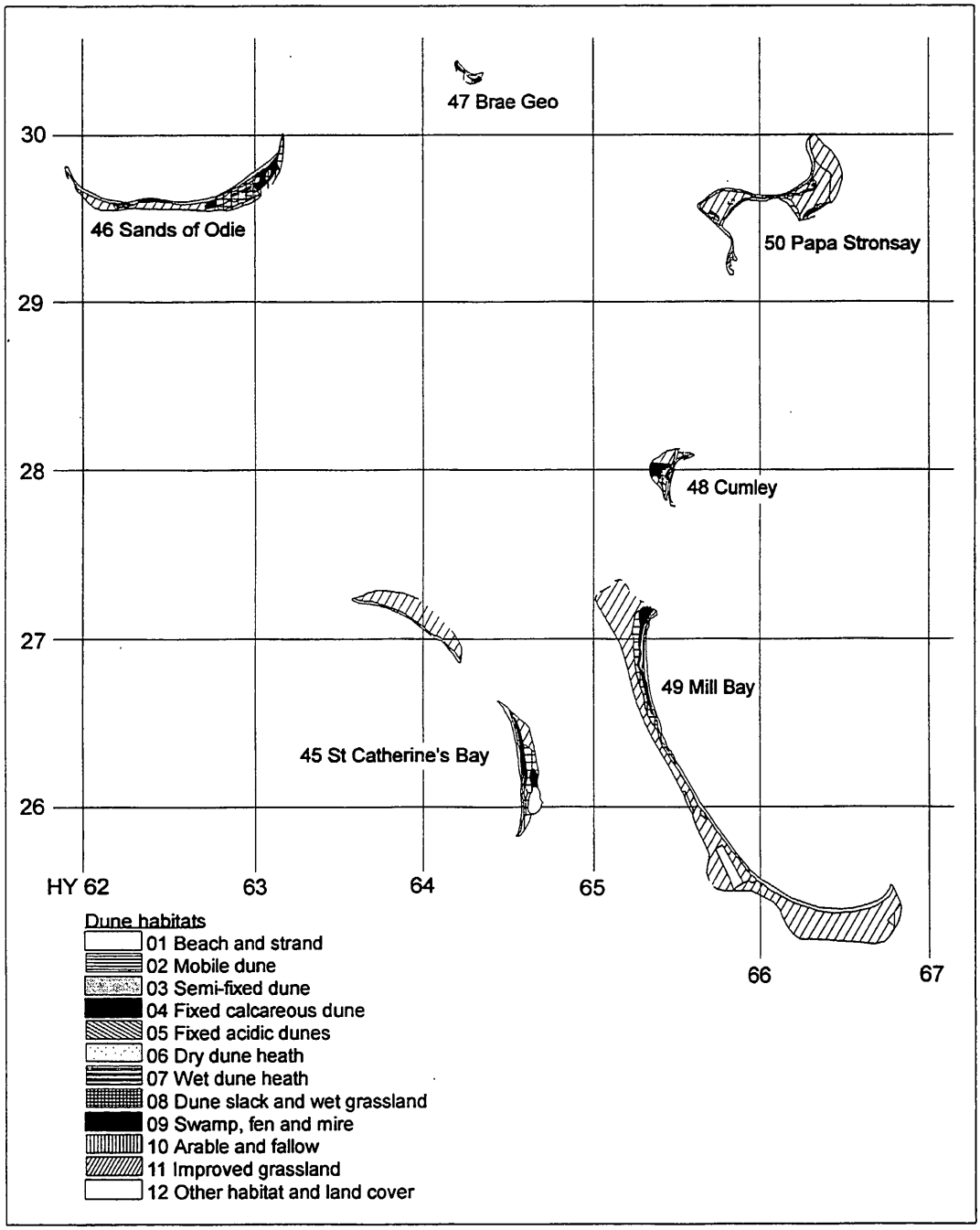
The geomorphological interest of the island is good, with a range of shingle landforms available in a very small area. The nature conservation interest of site vegetation is, however, low due to the scale of semi-improvement resulting from heavy sheep grazing.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.



Map 2a Dune habitats of Sand of Crook, Bight of Scarma, Inganoust, Sand of Rothiesholm - Bight of Matpow, Bay of Bomasty and Bight of Baywest (Stronsay)



Map 2b Dune habitats: St Catherine's Bay, Sands of Odie, Brae Geo, Cumley, Mill Bay (Stronsay) and Papa Stronsay

Table 3a Vegetation and other land cover (areas in ha)

Sites 39 - 42

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	39 Sand of the Crook	40 Bight of Scarma	41 Inganoust	42 Sand of Rothiesholm and Bight of Matpow	All Stronsay sites
A10	A10 *Polygonum amphibium* community	0.04				0.04
ARB	Arable - barley				9.59	11.75
ARO	Arable - oats	0.31	0.81			1.12
BBG	Buildings, bare ground and gardens			0.15	1.07	2.84
BBS	Bare beach sand (above MHWS, below vegetated dune zone)			0.33	1.44	4.26
BMC	Maritime cliff with little vegetation				0.31	1.58
BS	Bare sand (within vegetated sand zone)	1.11			0.91	2.12
BSH	Bare shingle	2.74	0.81	0.45	2.33	10.75
CMTY	Graveyard				1.75	1.75
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.80			1.41	3.47
M28x/S28	M28x/S28 intermediate				0.47	1.43
MG7	MG7 *Lolium perenne* leys	16.57	1.99	4.37	43.89	109.92
MG7/ MG11	MG7/MG11 intermediate	1.42	0.26			1.68
MG9/ MG11	MG9/MG11 intermediate	4.39				5.85
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	0.70			3.91	8.51
MG11/ MG13	MG11/MG13 intermediate					1.69
MG11/ SD17	MG11/SD17 intermediate	0.68				0.68
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.06			1.12	1.21
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)	0.16				0.16
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)	0.88				0.88
OW	Open water	23.88			0.35	25.28
PIT	Active sand pit or rock quarry	0.02				0.02
ROAD	Road and track		0.75		4.54	5.64
RUD	Ruderal-dominated vegetation	1.96	0.05	0.02	2.79	4.90
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community	4.07				4.07
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community					0.47
S19c/ SD17	S19c/SD17 intermediate	2.53			1.70	4.23

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 39 - 42

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	39 Sand of the Crook	40 Bight of Scarma	41 Inganoust	42 Sand of Rothiesholm and Bight of Matpow	All Stronsay sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline					0.11
SD4	SD4 *Elymus farctus* foredune				0.06	0.08
SD4/SD8c	SD4/SD8c intermediate	0.59			1.03	1.62
SD5/ SM28	SD5/SM28 intermediate			0.51	0.49	1.55
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community					0.05
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.25				0.78
SD6ae	SD6a/e intermediate					1.01
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)	0.02				0.95
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.52	0.53		0.78	4.93
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community	3.17			0.95	4.13
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	1.00			6.97	7.97
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community				1.12	1.12
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW				1.28	1.28
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community	7.09			3.50	10.59
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)			0.03	0.30	0.71
TIP	Rubbish tip				0.11	0.25
TOTALS (ha)		74.96	5.19	5.84	94.18	253.44

Table 3b Vegetation and other land cover (areas in ha)

Sites 43 - 46

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	43 Bay of Bomasty	44 Bight of Baywest	45 St Catherine's Bay	46 Sands of Odie	All Stronsay sites
A10	A10 *Polygonum amphibium* community					0.04
ARB	Arable - barley			0.36	0.67	11.75
ARO	Arable - oats					1.12
BBG	Buildings, bare ground and gardens					2.84
BBS	Bare beach sand (above MHWS, below vegetated dune zone)			0.90		4.26
BMC	Maritime cliff with little vegetation					1.58
BS	Bare sand (within vegetated sand zone)			0.05		2.12
BSH	Bare shingle	0.12	0.46	0.84	1.61	10.75
CMTY	Graveyard					1.75
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)				0.51	3.47
M28x/S28	M28x/S28 intermediate				0.96	1.43
MG7	MG7 *Lolium perenne* leys	0.33		7.36	3.30	109.92
MG7/ MG11	MG7/MG11 intermediate					1.68
MG9/ MG11	MG9/MG11 intermediate				1.46	5.85
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland			1.49	0.53	8.51
MG11/ MG13	MG11/MG13 intermediate				1.27	1.69
MG11/ SD17	MG11/SD17 intermediate					0.68
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland				0.02	1.21
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)					0.16
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)					0.88
OW	Open water			0.97		25.28
PIT	Active sand pit or rock quarry					0.02
ROAD	Road and track					5.64
RUD	Ruderal-dominated vegetation					4.90
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community					4.07
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			0.40		0.47
S19c/ SD17	S19c/SD17 intermediate					4.23

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 43 - 46

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	43 Bay of Bomasty	44 Bight of Baywest	45 St Catherine's Bay	46 Sands of Odie	All Stronsay sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline			0.11		0.11
SD4	SD4 *Elymus farctus* foredune					0.08
SD4/SD8c	SD4/SD8c intermediate					1.62
SD5/ SM28	SD5/SM28 intermediate	0.04		0.09	0.20	1.55
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community					0.05
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community				0.06	0.78
SD6ae	SD6a/e intermediate			0.58		1.01
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			0.37		0.95
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community		0.42	0.42	0.15	4.93
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community					4.13
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community					7.97
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community					1.12
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW					1.28
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community					10.59
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.03	0.05	0.09	0.20	0.71
TIP	Rubbish tip				0.03	0.25
TOTALS (ha)		0.51	0.93	14.03	10.99	253.44

Table 3c Vegetation and other land cover (areas in ha)

Sites 47 - 49

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	47 Brae Geo	48 Cumley	49 Mill Bay	All Stronsay sites
A10	A10 *Polygonum amphibium* community				0.04
ARB	Arable - barley	0.36		0.78	11.75
ARO	Arable - oats				1.12
BBG	Buildings, bare ground and gardens			1.63	2.84
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.14	0.28	1.18	4.26
BMC	Maritime cliff with little vegetation			1.27	1.58
BS	Bare sand (within vegetated sand zone)	0.05			2.12
BSH	Bare shingle	0.09	0.12	1.18	10.75
CMTY	Graveyard				1.75
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)		0.75		3.47
M28x/S28	M28x/S28 intermediate				1.43
MG7	MG7 *Lolium perenne* leys		1.19	30.92	109.92
MG7/ MG11	MG7/MG11 intermediate				1.68
MG9/ MG11	MG9/MG11 intermediate				5.85
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland			1.88	8.51
MG11/ MG13	MG11/MG13 intermediate		0.42		1.69
MG11/ SD17	MG11/SD17 intermediate				0.68
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland				1.21
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)				0.16
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)				0.88
OW	Open water		0.08		25.28
PIT	Active sand pit or rock quarry				0.02
ROAD	Road and track		0.35		5.64
RUD	Ruderal-dominated vegetation			0.08	4.90
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community				4.07
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		0.08		0.47
S19c/ SD17	S19c/SD17 intermediate				4.23

Table 3c (continued) Vegetation and other land cover (areas in ha)

Sites 47 - 49

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	47 Brae Geo	48 Cumley	49 Mill Bay	All Stronsay sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline				0.11
SD4	SD4 *Elymus farctus* foredune	0.02			0.08
SD4/SD8c	SD4/SD8c intermediate				1.62
SD5/ SM28	SD5/SM28 intermediate		0.22		1.55
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.05			0.05
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community			0.46	0.78
SD6ae	SD6a/e intermediate			0.44	1.01
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			0.56	0.95
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.26		1.87	4.93
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community				4.13
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community				7.97
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community				1.12
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW				1.28
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community				10.59
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)				0.71
TIP	Rubbish tip		0.11		0.25
TOTALS (ha)		0.97	3.59	42.24	253.44

Table 3d Vegetation and other land cover (areas in ha)

Site 50 - Papa Stronsay

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	50 Papa Stronsay
BS	Bare sand (within vegetated sand zone)	0.68
BSH	Bare shingle	2.50
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.36
MG7	MG7 *Lolium perenne* leys	3.38
MG7/ MG11	MG7/MG11 intermediate	0.09
MG7/ SD8c	MG7/SD8c intermediate	0.42
MG7/ SD8d	MG7/SD8d intermediate	6.42
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.15
RUD	Ruderal-dominated vegetation	0.05
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community	0.13
TIP	Rubbish tip	0.01
TOTALS (ha)		14.19

Annex 1 Target Notes

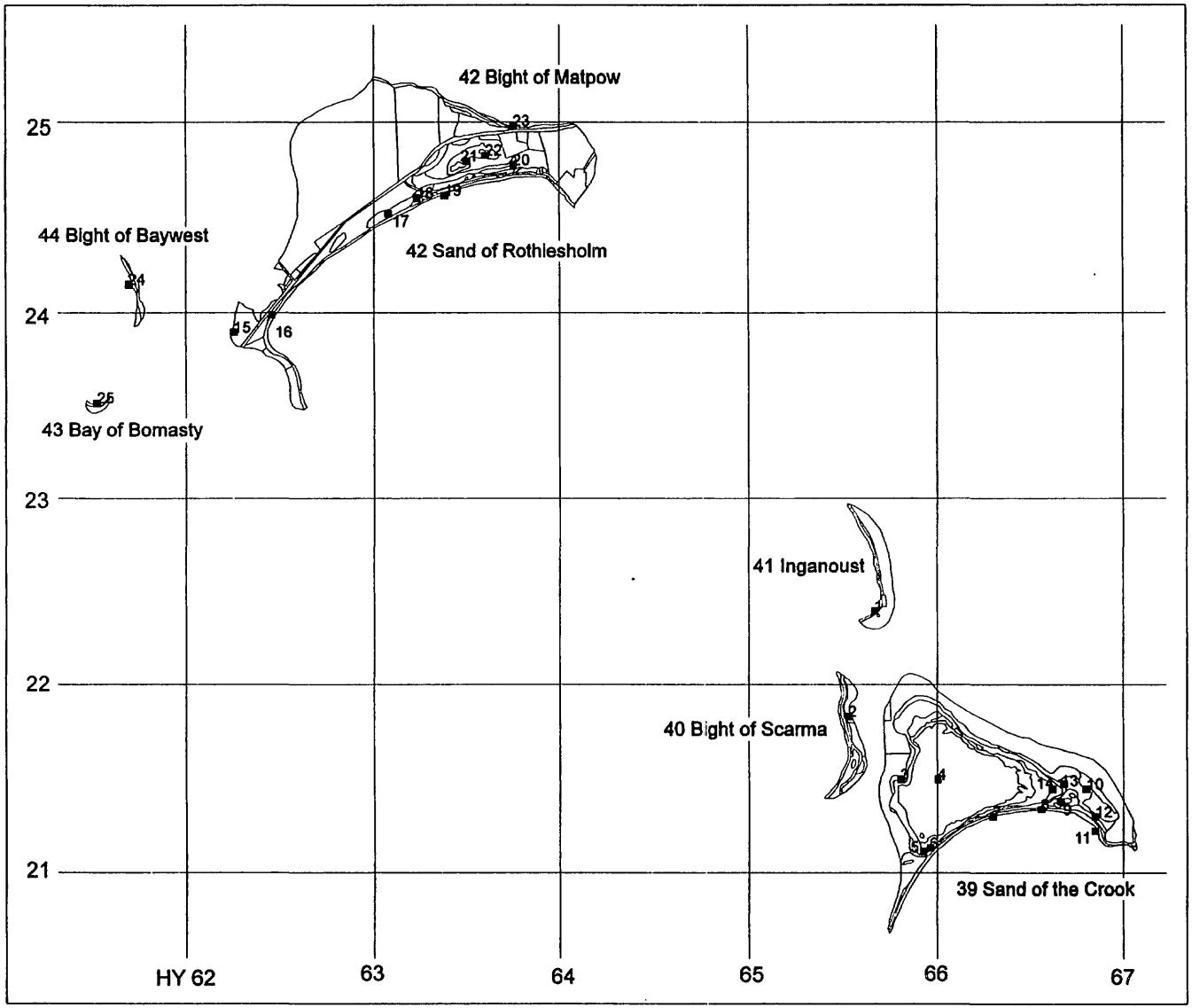
Target note locations are given in Map 3a-b, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY65662240	41 Inganoust	Moderately sloping shingle beach capped with 0.4-0.5 m sand. Dune edge cliffed but obscured by SDy strandline. Sand has SD5/SM28 vegetation, plus much *Heracleum sphondylium*. Probably receives large seaweed input. Sand increases upon beach to north. Only MG7 within boundary wall.
2	HY65522183	40 Bight of Scarma	Steep shingle beach capped by 1-3 m of blown sand. Dune edge cliffed 0.5-1 m. SD8a vegetation 6 m wide grazed by sheep. Wall acts as boundary to dune vegetation, enclosing oats, then MG7 grassland further south.
3	HY65802150	39 Sand of the Crook	Good gradation downslope to loch waters of Lea Shun. Tussocky MG9/MG11 (several snipe disturbed) to MG11/SD17, to impoverished SD17b at waters edge. Very sparse S19a also present in small patches but too small to map.
4	HY66002150	39 Sand of the Crook	Lea Shun is an extensive water body, with small quantity of *Polygonum amphibium* in the southwest. Large areas of S19a are present along the seaward edge. Not properly a machair loch - enclosed by shingle not by sand.
5	HY65922111	39 Sand of the Crook	Steep shingle beach capped by 0.2-0.5 m sand. Rear of shingle crest has much thicker sand, with many rabbit burrows and associated ruderals. Small blowouts developing with one long linear case against buried wall (probably initiated by sheltering stock). SD8c vegetation dominant.
6	HY65962113	39 Sand of the Crook	Sharp change in vegetation at fence. To southwest (stock grazed) is SD8c. To northeast (ungrazed by stock, but many rabbits present) vegetation is much taller (20 cm) with a great abundance of *Elymus repens, Heracleum sphondylium* and *Silene dioica* - sward is largely ruderal in character. Further northeast an SD8a sward develops, with small patches of SD7x semi-fixed dune.
7	HY46302130	39 Sand of the Crook	Signs of shingle extraction from top of shingle beach crest. Most sand on crest removed. Probably still active.
8	HY66562134	39 Sand of the Crook	Old sand pit beside track, 10 x 5 m area, with 1-2 m thickness of sand removed exposing shingle. Blowouts and sheep rubs now developing in pit face.
9	HY66682131	39 Sand of the Crook	Area of heavy sheep grazing and sand extraction. Moderate to large pits with rubbed sides and turf collapse. Area also used for dead stock burial.
10	HY66802145	39 Sand of the Crook	Extensive blowouts in area following fence line - possibly developed from old sand extraction. Area used for dead stock burial.
11	HY66852122	39 Sand of the Crook	Dunes above bedrock cliffs with rank SD8a vegetation outside fence.
12	HY66852130	39 Sand of the Crook	MG7/MG11 sward in extensive flat floor. Almost certainly old sand pit, now restored for grazing. Accounts for bare sand faces and blowouts along much of its northern and eastern periphery.

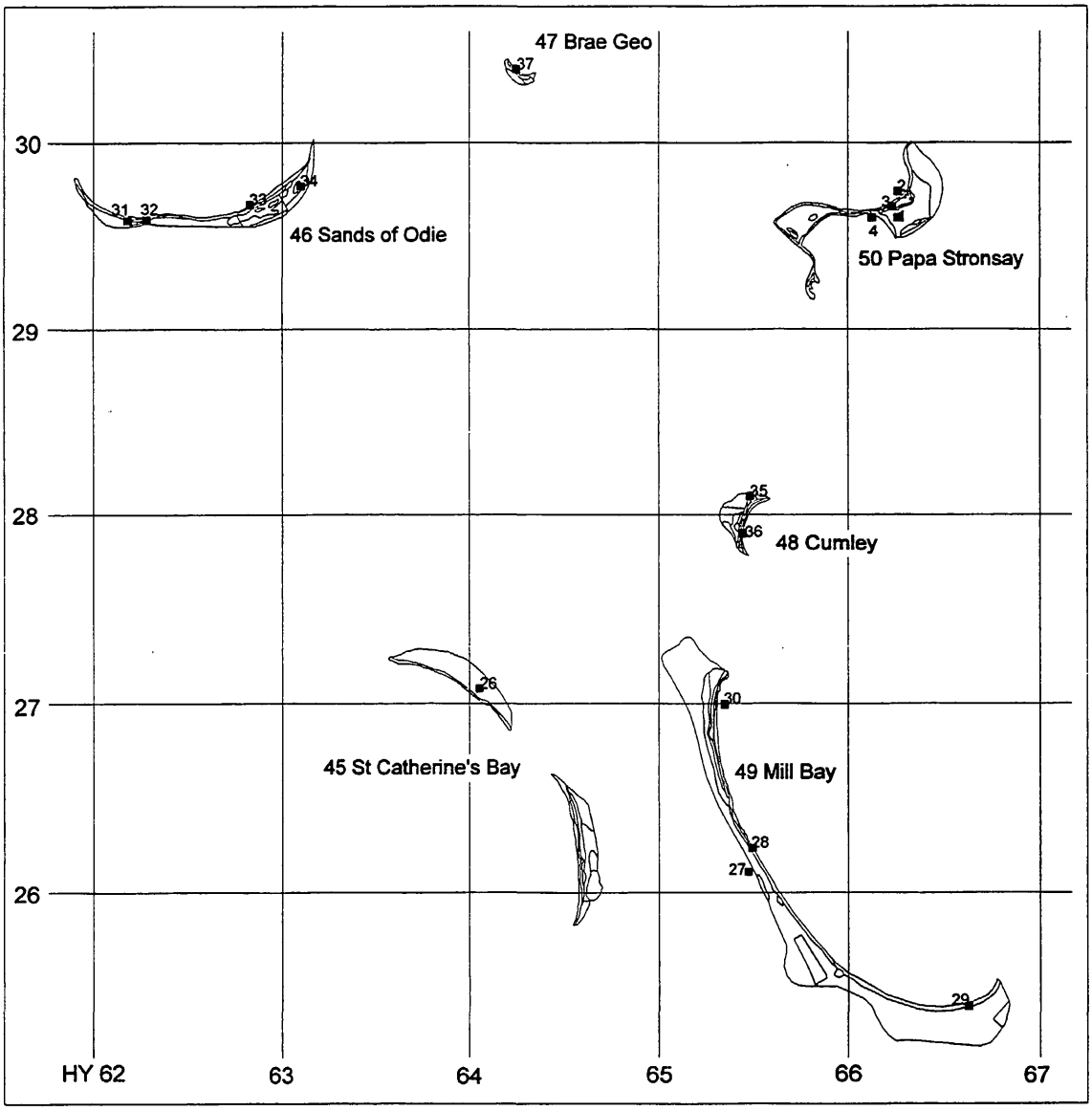
#	Grid Ref.	Site	Target Note Detail
13	HY66682148	39 Sand of the Crook	Large extent of ruderal vegetation dominated by *Poa annua* but also with *Urtica dioica, Elymus repens, Stellaria media, Polygonum aviculare, Plantago media.* Scattered *Lolium perenne* present possibly suggesting failed re-seed.
14	HY66622145	39 Sand of the Crook	Sand banked against wall, up to 1 m high. Adjacent to possible attempt at recent re-seed, which probably also involved ploughing to level topography and slurry spreading which would account for ruderal flora.
15	HY62252390	42 Sand of Rothiesholm	Shore of Loch of Rothiesholm heavily poached by stock, with MG13 and M28x vegetation suggesting winter inundation. Many snipe present.
16	HY62452399	42 Sand of Rothiesholm	Steeply sloping shingle beach with much seaweed in southern corner of bay. 2-3 m wide SDy strand present. SD8d sward grazed by cattle extends for long distance to northeast. No sign of rabbits .
17	HY63102446	42 Sand of Rothiesholm	Blowout with sheep rub, local areas of SD8c.
18	HY63232461	42 Sand of Rothiesholm	Dump for old cars and hay.
19	HY63382462	42 Sand of Rothiesholm	Foredune ridge with 1-4 m of sand on top of shingle, rapidly deflating. Blowouts have punched 5-20 m gaps in sand, leaving just shingle. Rear of dunes shows strangely little blown sand. Probably an area of former sand extraction just inside the foredune edge, easily exploited by any blowout development (especially if stock also present). Old metal and fencing dumped in three locations. Some small sand extraction still takes place, plus dead stock burial. Very poor management.
20	HY63752478	42 Sand of Rothiesholm	Inner dry dunes infested with rabbits. Extensive burrowing produces high cover of ruderals (40%) and SD8c from local sand blow (30%). Much *Senecio jacobaea, Ranunculus repens, Plantago lanceolata, Cirsium arvense.*
21	HY63502480	42 Sand of Rothiesholm	Nearly bare (heavily poached) lowest parts of wetland with leaves of *Ranunculus baudotii.* Surrounded by S19c/SD17 intermediate. Bare ground mapped as open water.
22	HY63602483	42 Sand of Rothiesholm	Scattered patches of *Salix repens* in SD17d sward. Also scattered patches of *Filipendula ulmaria.* Small amounts of *Parnassia palustris* present in higher parts of SD17b. Much of this wetland might receive blown sand from deflating foredunes to south.
23	HY63752498	42 Sand of Rothiesholm	St. Catherine's Bay shore - moderately sloping shingle beach with little sand. Dunes cliffed 1.5-2 m.
24	HY61702415	44 Bight of Baywest	Very steep shingle beach above intertidal sand. SDy strand on top of shingle, with thin layer of sand (up to 30 cm) blown a short distance inland to form SD8a sward.
25	HY61532351	43 Bay of Bomasty	Shingle beach above thin, intertidal sand over shingle. Little sand blown ashore - very narrow belt of SD5/SM28.
26	HY64052708	45 St Catherine's Bay (North)	Thin sand over shingle, with narrow SDy strand. MG7 fields severely limit dune vegetation - a very narrow (1-4 m) band of SD5/SM28 vegetation on 1-3 m cliffs.

#	Grid Ref.	Site	Target Note Detail
27	HY65482611	45 St Catherine's Bay (South)	Moderately sloping beach of thin sand over shingle. Good summer accretion bank in front of dunes cliffed 1-1.5 m. Bank has fine SD2 *Cakile maritima* strand. SD6ae dunes present in narrow band, changing rapidly to SD7x. Dune backslope quickly changes to MG11 wet grassland in depressions. Small blowouts present in backdune due to stock trampling.
28	HY65502624	49 Mill Bay	Thin sand over shingle. Dune foot cliffed 0.5-1.5 m. Very narrow band of SD5c on steep dune front. Abrupt transition to improved grassland inside fence.
29	HY66622539	49 Mill Bay	Thin sand on till cliffs rising from 1 m to 6 m.
30	HY65352700	49 Mill Bay	Very steep dune face, thin sand over till. SD6a in very narrow band, changing rapidly to SD7x which forms band up to 30 m wide. Probably best sand supply in site. SD8a inside the SD7x zone. Stable, virtually no blowouts.
31	HY62182968	46 Sands of Odie	Dump for household refuse and animal bedding. Thick ruderal growth of *Rumex obtusifolius* and *Cirsium arvense*. To north very thin cover of sand over base of steep shingle beach with SDy strand. Fragments of SD5c present on shingle crest.
32	HY62392972	46 Sands of Odie	Cliff section 2 m thick, with 50 cm of shingle/sand above till. Cliffed section continues for 450 m to east with shingle and SDy at foot. In places cliffs are 3 m high. Stone protection needed for underwater electricity cable coming ashore.
33	HY62822967	46 Sands of Odie	Wet depression immediately inland of foredune (a 10 m narrow band). MG11/MG13 sward extensive, with much *Polygonum hydropiper* and *Hippuris vulgaris* in wettest areas. Large area of M28x around old drains. Higher ground to south has good MG9/MG11.
34	HY63102977	46 Sands of Odie	Extensive M28x/S28 *Iris pseudacorus* - *Phalaris arundinacea* mire/swamp.
35	HY65492810	48 Cumley	Council refuse tip. Dump for large number of old cars.
36	HY65452790	48 Cumley	Small area of wetland enclosed by road embankment. Interior dominated by M28x, with lowest areas having MG11/MG13 wet grassland and S19c swamp. Small area of bare mud.
37	HY64253039	47 Brae Geo	Moderately sloping thin sand over shingle, no strand. Dunes at east end of beach degraded, with SD4 and SD5b. More stable SD8a to west. Sharp change to barley at fence.

#	Grid Ref.	Site	Target Note Detail
1	HY66252960	50 Papa Stronsay	Gently undulating fixed dune machair, semi-improved (MG7/SD8d). At rear of plain old blowouts have stabilised.
2	HY66252974	50 Papa Stronsay	Steep shingle beach with much seaweed accumulation. Thin sand at top, out of proportion to large quantities inland. Presume that a foredune was present but has been entirely lost, with sand blown inland. Linear blowout present on edge of low dune scarp 20 m to northeast - heavily trampled by sheep. Old kelp pits present behind shingle ridge crest.
3	HY66222966	50 Papa Stronsay	Long (200 m) blowout along top edge of low (1-2 m) dune scarp. Stock trampled, sheep rubs present.
4	HY66122960	50 Papa Stronsay	Sea wall 1.2 m high. Breach in dunes at east end. Used as dump for old metal. Dunes to rear have 20% bare sand - much used for shelter and rabbits. Strand on south side is entirely *Urtica dioica* on thin sand over seaweed.



Map 3a Target note position: Sand of the Crook, Bight of Scarma, Inganoust, Sand of Rothiesholm - Bight of Matpow, and Bight of Baywest (Stronsay)



Map 3b Target note positions: St Catherine's Bay, Sands of Odie, Brae Geo, Cumley, Mill Bay (Stronsay) and Papa Stronsay

51-55 EDAY

Location and conservation status

Five areas of windblown sand are present:

51	Sandyland	HY540314
52	Sealskerry Bay	HY532322
53	Sands of Doomy to Bay of London	HY560340
54	Mill Bay	HY569350
55	Bay of Greentoft	HY560290

The locations of site assemblages are given in Map 1a.

The site at Sands of Doomy to Bay of London falls partly within the Doomy and Whitemaw Hill SSSI (Map 1b). The SSSI is designated for breeding bird interest and consists of two separate blocks of land. The northern block (Doomy Hill HY560347, 209 ha) contains vegetated windblown sand.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

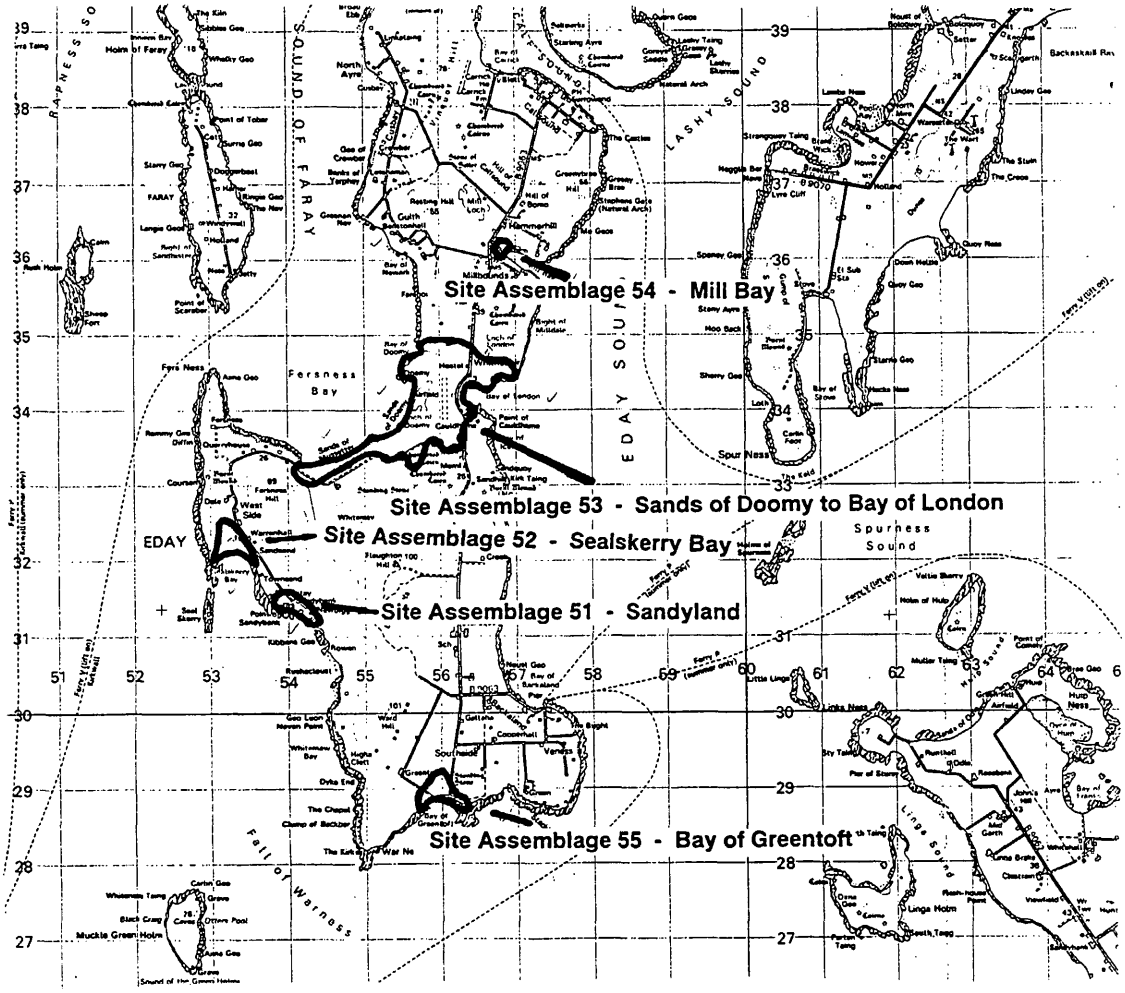
Survey details

Date	September 1996
Target notes	31 (Annex 1)
Quadrats	32 (Annex 2)
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Total windblown sand extent for Eday is 192.3 ha (excluding beach zone), with 174.4 ha vegetated and the remainder comprising bare sand (0.7 ha), arable/fallow (2.3 ha), and land take for buildings, gardens, roads, sand pits etc. (13.2 ha). All sites are small (<10 ha) apart from Sands of Doomy to Bay of London (169.4 ha).



Map 1 Site assemblage location
See Volume 3 for NVC maps
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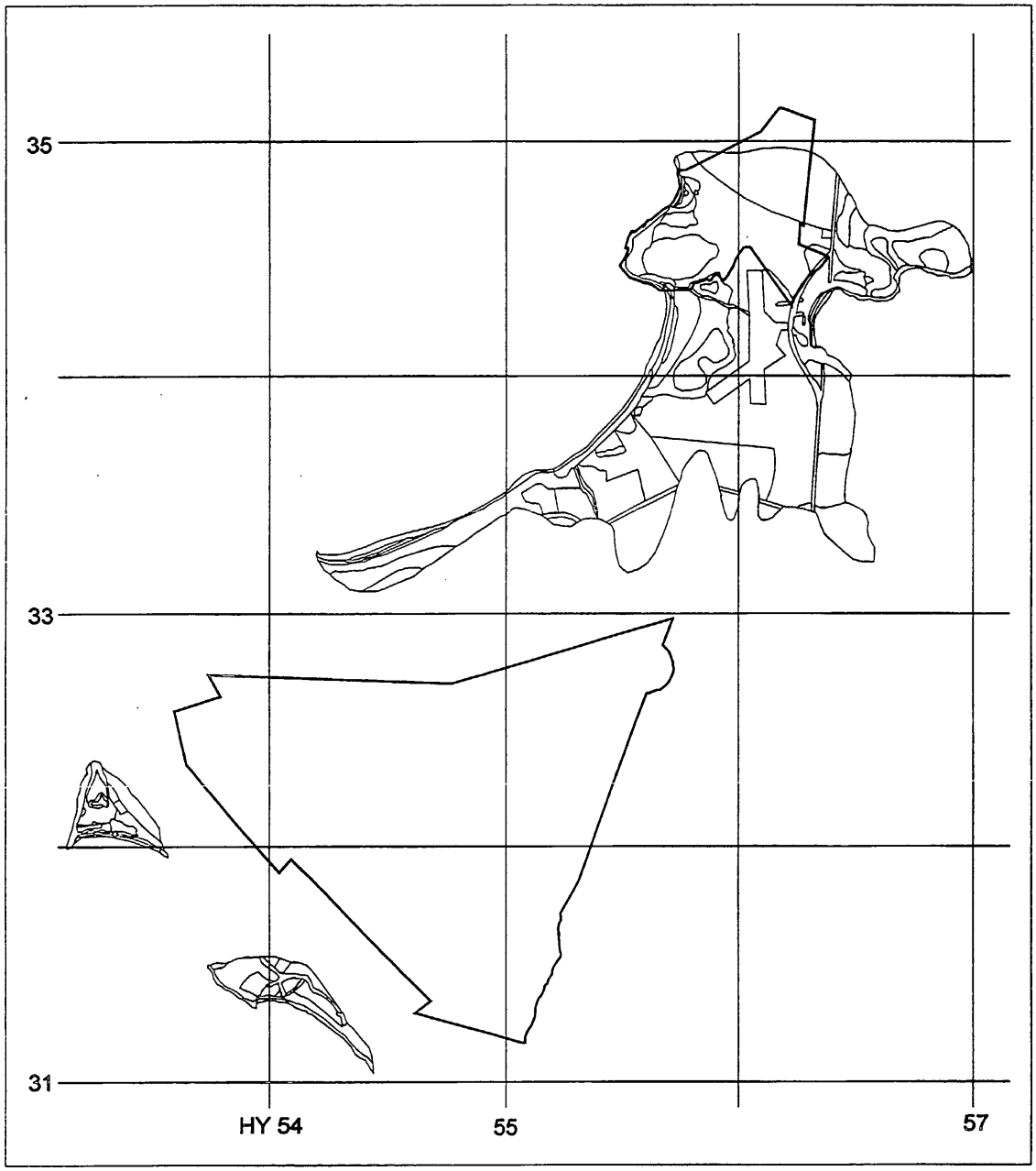


Map 1b Doomy and Whitemaw Hill SSSI (Eday)

SSSI boundary with thick black line

Dune habitats (Table 2, Map 2a-b)

Eday sites (together with Rackwick, Hoy) are distinct from other Orkney dune sites in having a large area of acidic sands supporting fixed acidic dune grassland, dry dune heath and wet dune heath. Dry fixed calcareous dune grassland is rare, again in contrast to other Orkney sites. Eday therefore has a full range of dune habitats except for dune scrub which is absent from Orkney. Sand supply seems to be poor because the total extents of mobile dune (3.6 ha) and semi-fixed dune (1.0 ha) are low. Wet heath (80.8 ha) also replaces mire and swamp conditions which occupy a much lower extent than in other Orkney island site groupings (1.4 ha).

Table 1 Broad land cover extents (ha)

	51 Sandyland	52 Sealskerry Bay	53 Sands of Doomy to Bay of London	54 Mill Bay	55 Bay of Greentoft	All Eday sites
Windblown sand land cover						
Beach above MHWS	0.11	0.34	4.68	0.07	0.45	5.64
Bare sand		0.10	0.61			0.71
Vegetated sand (except fallows)	7.74	6.39	153.49	0.84	8.09	176.25
Arable and fallow	0.23	1.85		0.05		2.14
Buildings, roads, gardens, tips, pits, cemeteries, airfield	1.43		10.60		1.13	13.16
Total windblown sand excluding beach zone	9.10	8.34	164.71	0.92	9.22	192.29
Total windblown sand extent above MHWS	9.21	8.69	169.39	0.98	9.67	197.94
Surveyed but not on blown sand						
Bare rock						
Unvegetated maritime cliff	0.82	0.09	0.64	0.14		1.69
Saltmarsh				0.02		0.02
Open water			0.27			0.27

Table 2 Extents (ha) of dune habitats and other ground

	51 Sandyland	52 Sealskerry Bay	53 Sands of Doomy to Bay of London	54 Mill Bay	55 Bay of Greentoft	All Eday sites
Habitat 1 - Beach and strand	0.14	0.38	5.02	0.12	0.93	6.59
Habitat 2 - Mobile dune		0.44	3.19			3.62
Habitat 3 - Semi-fixed dune			0.95			0.95
Habitat 4 - Fixed dry calcareous dune	0.09				0.33	0.41
Habitat 5 - Fixed acidic grassland	4.17	2.45	16.47	0.19		23.28
Habitat 6 - Dry dune heath			28.61			28.61
Habitat 7 - Wet dune heath			80.81			80.81
Habitat 8 - Dune slack and wet grassland		2.91	23.38	0.52	1.01	27.82
Habitat 9 - Mire and swamp	0.10	0.46	0.83		0.03	1.42
Habitat 10 - Arable and fallow	0.23	2.05		0.02		2.30
Habitat 11 - Improved grassland	2.69			0.14	6.24	9.07
Habitat 12 - Other habitats	2.60	0.09	11.04	0.14	1.13	15.01
TOTALS (ha)	10.03	8.78	170.29	1.12	9.67	199.89

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As indicated by dune habitat data, Eday has the largest extents of acidic dune vegetation types in Orkney and almost all of the resource is concentrated at the Sands of Doomy to Bay of London site. These types include: H11 *Carex arenaria - Calluna vulgaris* dry dune heath (H11a *Erica cinerea* 4.5 ha; H11b *Empetrum nigrum* 0.8 ha, H11ab intermediate 22.0 ha); M15 *Scirpus cespitosus - Erica tetralix* wet heath (14.8 ha), M16 *Erica tetralix - Sphagnum compactum* wet heath (59.9 ha), plus a distinct protoslack type (M16x provisional *Agrostis stolonifera* sub-community (5.9 ha); M6 *Carex echinata - Sphagnum recurvum/S. auriculatum* flushed peatland; SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* dune grassland (12.5 ha). The H11 types are particularly notable because they contain west Scotland (H11a) and east Scotland (H11b) types but are dominated by an intermediate heath which contains both *Erica cinerea* and *Empetrum nigrum* - Orkney dry dune heath seems to contain an intermediate resulting from overlap of two distinct biogeographical types. The M16 wet heaths are also invaded by *Empetrum nigrum* and are very similar to wet heaths in the Moray Firth and northeast Scotland (e.g. wet slacks, Sands of Forvie in Grampian). These acidic dune types are also associated with other types more typical and common in acidic conditions, notably MG10 *Holcus lanatus - Juncus effusus* rush pasture, U4 *Festuca ovina - Agrostis capillaris - Galium saxatile* calcifugous grassland, and U20 *Pteridium aquilinum - Galium saxatile* bracken (0.2 ha). These are uncommon in northern Scotland on dunes and are more typical of conditions on acidic dunes in Argyll, the Clyde coast, Dumfries and Galloway.

Other features of note include no embryo dune (SD4 *Elymus farctus*) vegetation and low extents of mobile (SD5 *Leymus arenarius*, SD6 *Ammophila arenaria*) and semi-fixed (SD7 *Ammophila arenaria - Festuca rubra*) dunes. Poor sand supply is the likely explanation. There are low extents for all types of SD8 *Festuca rubra - Galium verum* fixed calcareous dune grassland. Unlike most Orkney islands, Eday has a relatively low degree of dune pasture improvement, with restricted amounts of MG7 *Lolium perenne* ley (7.7 ha) and an MG7/MG13 *Agrostis stolonifera - Alopecurus geniculatus* intermediate (1.4 ha).

Site descriptions

51 Sandyland (Map 2a)

This small (9.1 ha) bay dune site is located on the southwest coast of Eday immediately east of a small headland named Point of Sandybank. It is exposed to a short 10 km fetch SSW to Shapinsay. Beach sand is very restricted and occurs only over an 80 m sector, with the remainder of the dune edge formed by flagstone outcrops. Very small amounts of SD5 *Leymus arenarius* mobile dune (SD5b *Elymus farctus* and SD5c *Festuca rubra* sub-communities) are restricted to the rear of the sand beach. The site interior is largely MG7 improved grassland but close to the shore there are areas of SD12 acidic dune grassland and a small amount of H11ab dry dune heath. The nature conservation interest of the vegetation is low to moderate given its small size and partial improvement.

52 Sealskerry Bay (Map 2a)

This small bay dune (8.3 ha) is located at the head of Sealskerry Bay on the southwest coast of Eday, 500 m NW of the Sandyland site. It is exposed to a 10 km fetch south to Shapinsay and is sheltered from westerly winds by a low headland on its western side. The shingle beach has a patchy SDy *Atriplex glabriuscula* strand and a narrow zone of SD5b and SD5c mobile dunes but stock have access to the beach and *Leymus arenarius* and *Elymus farctus* are heavily grazed and trampled. SD12 acidic dune grassland is moderately extensive inland and depressions contain good wetland zonations (MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland, MG11/MG13 *Agrostis stolonifera - Alopecurus geniculatus* intermediate inundation grassland, S19c *Eleocharis palustris* swamp *Agrostis stolonifera* sub-community and a large patch of SHv *Hippuris vulgaris* swamp). The zonations are best developed in very wet ground on the edge of Sealskerry Loch. Some tillage of SD12 fixed acidic dune grassland has occurred and fallow vegetation is present (SD12F). The overall nature conservation interest of the vegetation is moderate given the small size of the site, but the wetland quality is good and there is probably an additional breeding wader interest in this habitat.

53 Sands of Doomy to Bay of London (Map 2b)

This moderately large (164.7 ha) bay and climbing dune complex occupies the narrow 'waist' of Eday between Ferness Bay in the west and Bay of London in the east. Climbing dunes are developed on the flanks of Doomy Hill to the north and Whitemaw Hill to the south. The western beach is by far the largest (it has a length of almost 3 km) and comprises three sectors: Bay of Doomy (HY556347) in the north, Sands of Doomy in the centre (HY554337), and Sands of Mussetter in the southwest (HY545333). These beaches are sheltered in the west by the Fers Ness headland but there is exposure to a narrow but long northerly fetch into the Arctic Ocean. The eastern beach of the Bay of London (HY564343) has a length of 400 m and is exposed to a short 3.5 km fetch ESE to Spur Ness, the most southern point of Sanday. The main north - south road on Eday runs through the site close to the edge of the Bay of London and a grass airstrip is maintained for local passenger flights, with a surfaced apron for car parking and safety vehicles.

The importance of the site in terms of its large extent of acidic wet and dry dune conditions has already been emphasised. SD12 acidic dune grassland, H11 dune heath (H11a, H11b and the dominant H11ab intermediate)and an H11/SD12 intermediate form mosaics on all dry ground close to the coast around the Bay of London, Bay of Doomy, Sands of Doomy and Sands of Mussetter. Low ground between the western and eastern shores has M16 wet heath and this changes to M15 wet heath on the slopes of hills to the north and south. Flushed ground in the northeast has good-quality M6 vegetation on peat which overlies blown sand. The most extensive M15 vegetation is on the lower flanks of Doomy Hill and the northern edge of windblown sand is uncertain because it is overlain by blanket peat. Deep drains on the hillslope show sand at the base of sections. Blanket peat over blown sand is a rare phenomenon on the Scottish coast (other cases occur at Red Point in Wester Ross and Laggan Bay on Islay) and suggest a long history of deflation and sand blow inland, predating peat formation.

A further striking feature of this site is the distinctive foredune ridge above the beach zone in the Sands of Doomy and an extensive wet deflation plain immediately inland. The foredune ridge is very narrow, with SD6b *Ammophila arenaria* mobile dune *Leymus arenarius - Elymus farctus* sub-community developed on steep outer and inner dune faces which have a knife-edge crest for much of the foredune length. The top profile of the foredune ridge is ragged in places and its narrow width suggests inherent instability and exposure to periodic deflation. The deflation plain inland also reflects periodic instability of the foredune ridge. Young dune slack (SD17x *Potentilla anserina - Carex nigra* protoslack provisional *Agrostis stolonifera* sub-community) and young dune heath (M16x *Erica tetralix - Sphagnum compactum* wet heath provisional *Agrostis stolonifera* sub-community, often with *Littorella uniflora* and *Radiola linoides*) are zoned inland, with the wettest area on the main deflation plain occupied by the SD17d *Hydrocotyle vulgaris - Ranunculus flammula* slack sub-community. This latter type is probably under water for much of the year, with the SD17x and M16x types inundated from winter to early summer. The northeastern side of the deflation plain receives hill drainage and near-permanent open water is present, with *Littorella uniflora* present (the area was dry during survey and the surface damaged by trail bikes using it as a skid pan). The dramatic foredune shape and young deflation plain inland are unique among Orkney sites and are amongst the best to be seen in Scotland. Equivalents developed on machair hindshore systems in the Western Isles are larger but perhaps not so clear, and the Sands of Doomy has the additional distinction of having these features developed upon acidic sands.

Overall the site is in good condition and the nature conservation interest of the vegetation is very high. It is further enhanced by the geomorphological interest (blanket peat over blown sand, fine foredune and deflation plain). There has been slight damage from trail biking, tipping and small-scale sand extraction. There is little highly-improved grassland but MG10 *Holcus lanatus - Juncus effusus* rush pasture indicates M15 and M16 areas converted by drainage and perhaps past re-seeding and fertiliser addition. The present northern SSSI block boundary (Map 1b) is concentrated on Doomy Hill and does not include the fine foredune and deflation plain area, or much of the acidic dry dune conditions further east and southwest. It is therefore recommended that the SSSI boundary is extended to take in these areas on the grounds that they are the best examples in Orkney and they contain the most northern examples of high-quality dune heath in Britain (the habitat is missing from Shetland. The dry and wet dune heaths would also probably be rated as priority habitats under Annex I of the EC Habitats Directive (16.23 decalcified fixed dunes with *Empetrum nigrum*; 16.24 Eu-Atlantic decalcified fixed dunes (*Calluno-Ulicetalia*)) and there might be a case in the future for rating the site as a Special Area of Conservation, perhaps as an addition to some Sanday dunes which qualify with high-quality fixed calcareous dunes.

54 Mill Bay (Map 2b)

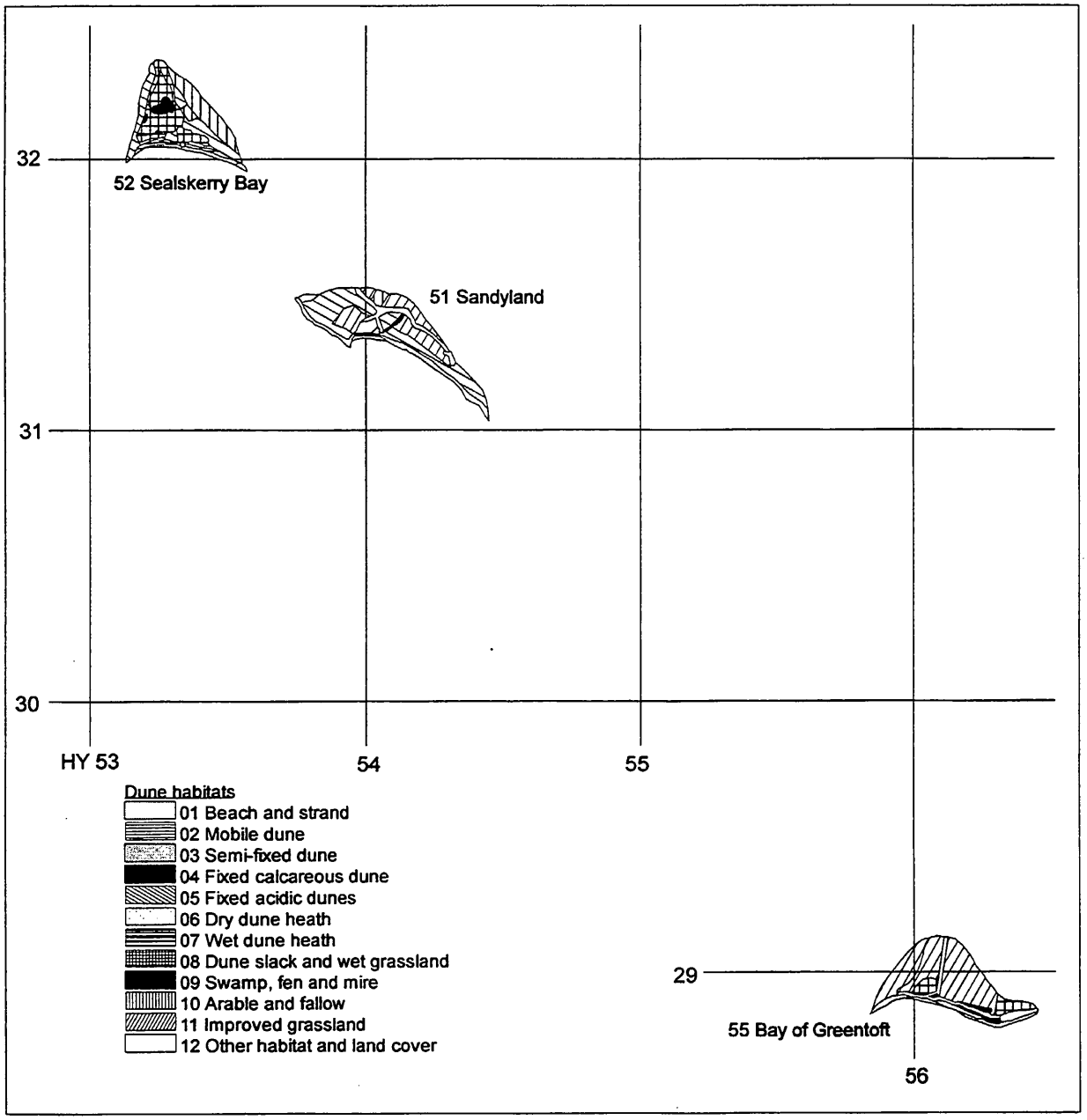
This very small (0.9 ha) bay dune site is located at the head of Mill Bay on the east coast of Eday. It is exposed to a short 3 km SE fetch to Sanday. Sand has been blown inland for 120 m on to poorly-drained till which receives drainage from adjacent hillslopes. Dune wetland is therefore developed (mainly MG10 rush pasture) but local drainage is influenced by deep drains cut to take outflow from a watermill a small distance up the valley draining into Mill Bay. Bracken is present on sand on the northern valley side. There is a small area of SDy and SD5/SM28 strand on a beach with much plastic, probably derived from fish cages offshore. Nature conservation interest is low due to the very small size of the site and its limited range of vegetation types.

55 Bay of Greentoft (Map 2a)

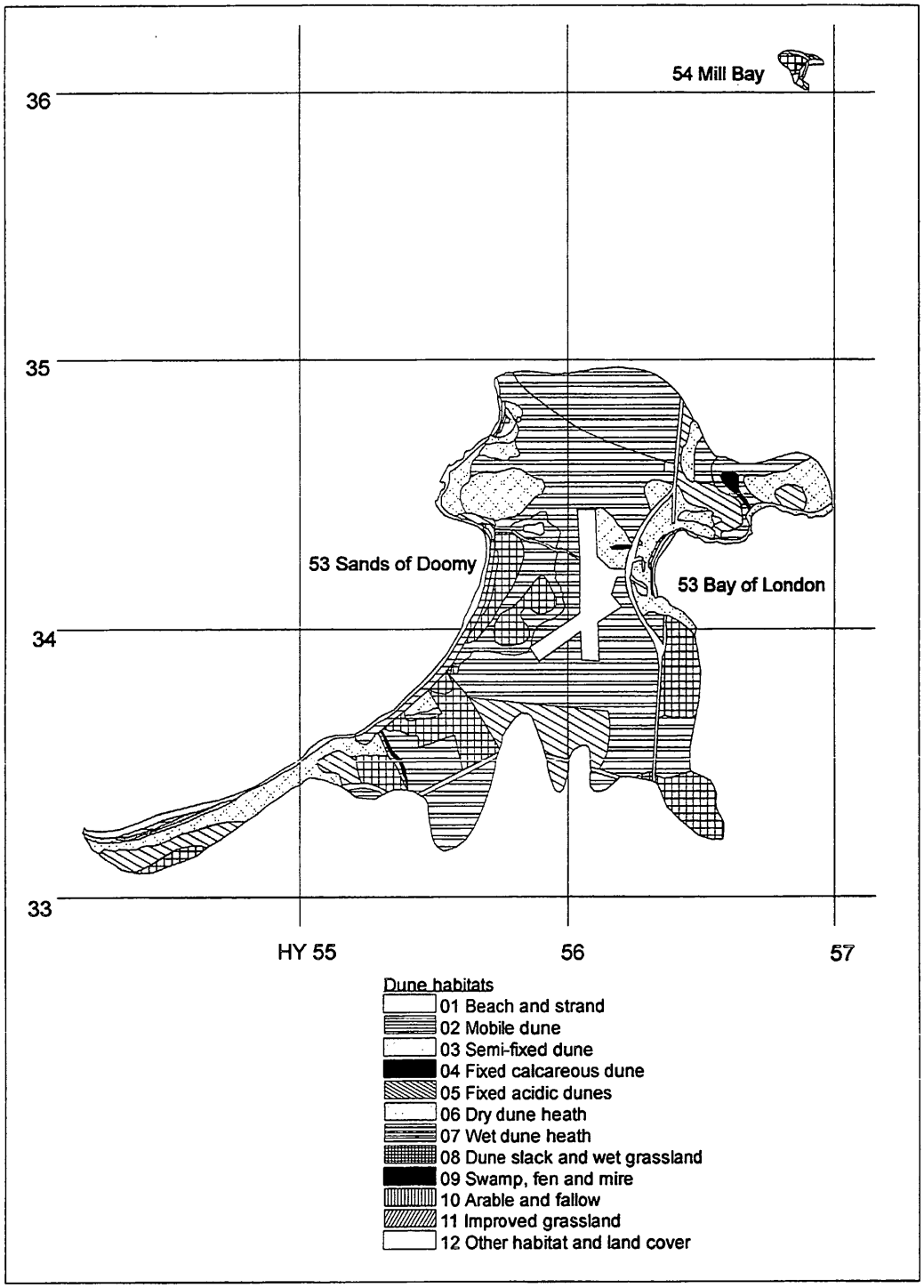
This small (9.2 ha) bay dune site is located on the south coast of Eday. Sand has been blown 200 m inland from a shingle beach which has patches of SDy and SD5/SM28 strand on thin sand deposits. Most of the interior is improved (MG7 Lolium perenne leys, MG7/MG13 intermediate) but there are small wetland remnants (MG13, M28x, MG11) and a very small area of SD8a fixed calcareous dune grassland. Nature conservation interest is very low due to small site size, extensive improvement and limited range of vegetation types.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.



Map 2a Dune habitats of Sandyland, Sealskerry Bay and Bay of Greentoft (Eday)



Map 2b Dune habitats of Sands of Doomy to Bay of London and Mill Bay (Eday)

Table 3 Vegetation and other land cover (areas in ha)

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	51 Sandyland	52 Sealskerry Bay	53 Sands of Doomy to Bay of London	54 Mill Bay	55 Bay of Greentoft	All Eday sites
AIRFIELD	Airfield runway, taxiing and apron surfaces			6.40			6.40
AP	Arable - potatoes				0.02		0.02
ARB	Arable - barley	0.23	1.85				2.09
BBG	Buildings, bare ground and gardens	0.55		0.15		0.33	1.02
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.11		3.66		0.17	3.94
BMC	Maritime cliff with little vegetation	0.82	0.09	0.64	0.14		1.69
BS	Bare sand (within vegetated sand zone)		0.10	0.61			0.71
BSH	Bare shingle		0.34	1.02	0.07	0.28	1.71
H11a	H11a *Carex arenaria - Calluna vulgaris* heath, *Erica cinerea* sub-community			4.50			4.50
H11a/b	H11a/b intermediate	0.42		21.53			21.95
H11b	H11b *Carex arenaria - Calluna vulgaris* heath, *Empetrum nigrum* sub-community			0.79			0.79
H11b/SD12	H11b/SD12 intermediate			0.96			0.96
M6	M6 *Carex echinata - Sphagnum recurvum/S. auriculatum* mire			0.49			0.49
M15	M15 *Scirpus cespitosus - Erica tetralix* wet heath			14.79			14.79
M16	M16 *Erica tetralix - Sphagnum compactum* wet heath			59.94			59.94
M16/SD6	M16/SD6 intermediate			0.18			0.18
M16x	M16 *Erica tetralix - Sphagnum compactum* wet heath, *Agrostis stolonifera* sub-community (PROVISIONAL NEW NVC TYPE)			5.89			5.89
M23b	M23b *Juncus effusus/acutiflorus - Galium palustre* rush pasture, *J. effusus* sub-community	0.09		0.34			0.43
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.01	0.10		0.18	0.05	0.34
MC10	MC10 *Festuca rubra - Plantago* spp. maritime grassland			0.25			0.25
MG7	MG7 *Lolium perenne* leys	2.69			0.14	4.86	7.69
MG7/ MG13	MG7/MG13 intermediate					1.38	1.38
MG10	MG10 *Holcus lanatus - Juncus effusus* rush pasture			9.88	0.33		10.22
MG10/U4	MG10/U4 intermediate			7.30			7.30
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland		1.26			0.58	1.84
MG11/ MG13	MG11/MG13 intermediate		1.65				1.65
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland					0.43	0.43
OW	Open water			0.27			0.27
PIT	Active sand pit or rock quarry			0.02			0.02
ROAD	Road and track	0.88		4.00		0.80	5.69
RUD	Ruderal-dominated vegetation			0.08			0.08
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		0.20				0.20

Table 3 (continued) Vegetation and other land cover (areas in ha)

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	51 Sandyland	52 Sealskerry Bay	53 Sands of Doomy to Bay of London	54 Mill Bay	55 Bay of Greentoft	All Eday sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline	0.03		0.07			0.10
SD5/SM28	SD5/SM28 intermediate			0.24		0.24	0.48
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.02	0.06				0.08
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.02	0.27				0.29
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community			1.39			1.39
SD6ae	SD6a/e intermediate			0.01			0.01
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community			0.68			0.68
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community			0.32			0.32
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community			0.50			0.50
SD7d	SD7d *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Tortula ruralis* ssp *ruraliformis* sub-community			0.12			0.12
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)			0.32			0.32
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.05				0.31	0.36
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community			0.19			0.19
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community			0.03			0.03
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW				0.04		0.04
SD12	SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* dune grassland	4.11	2.45	5.93			12.48
SD12F	SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* dune grassland, FALLOW		0.20				0.20
SD17d	SD17d *Potentilla anserina-Carex nigra* slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community			3.25			3.25
SD17x	SD17x *Potentilla anserina-Carex nigra* dune-slack, *Agrostis stolonifera* sub-community (PROVISIONAL NEW NVC TYPE)			2.91			2.91
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.04	0.03		0.24	0.31
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)		0.16				0.16
SM28	SM28 *Elymus repens* saltmarsh				0.02		0.02
TIP	Rubbish tip			0.04			0.04
U4	U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland			10.57			10.57
U20	U20 *Pteridium aquilinum-Galium saxatile* community				0.19		0.19
TOTALS (ha)		10.03	8.78	170.29	1.12	9.67	199.89

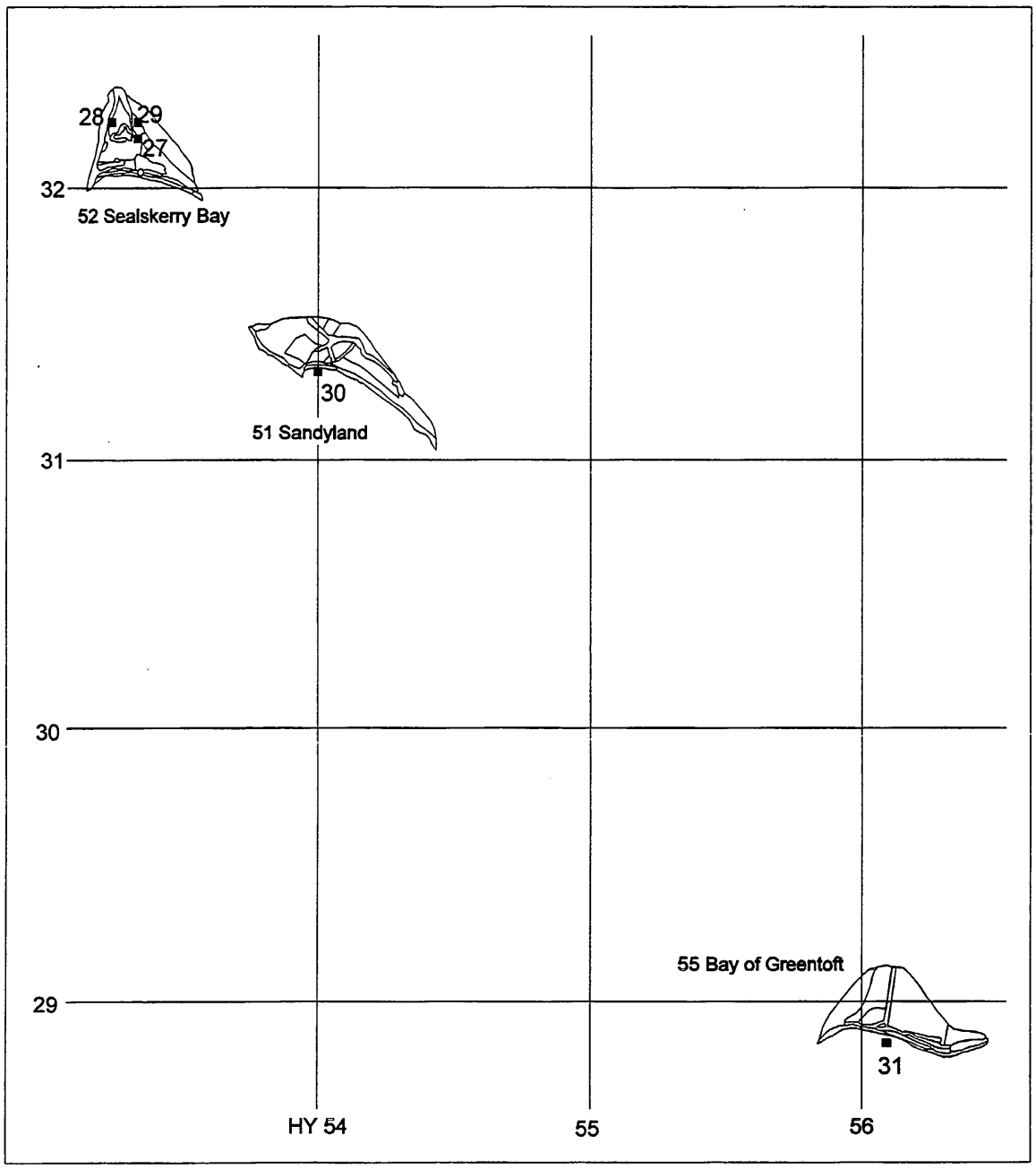
Annex 1 Target Notes

Target note locations are given in Map 3, following notes

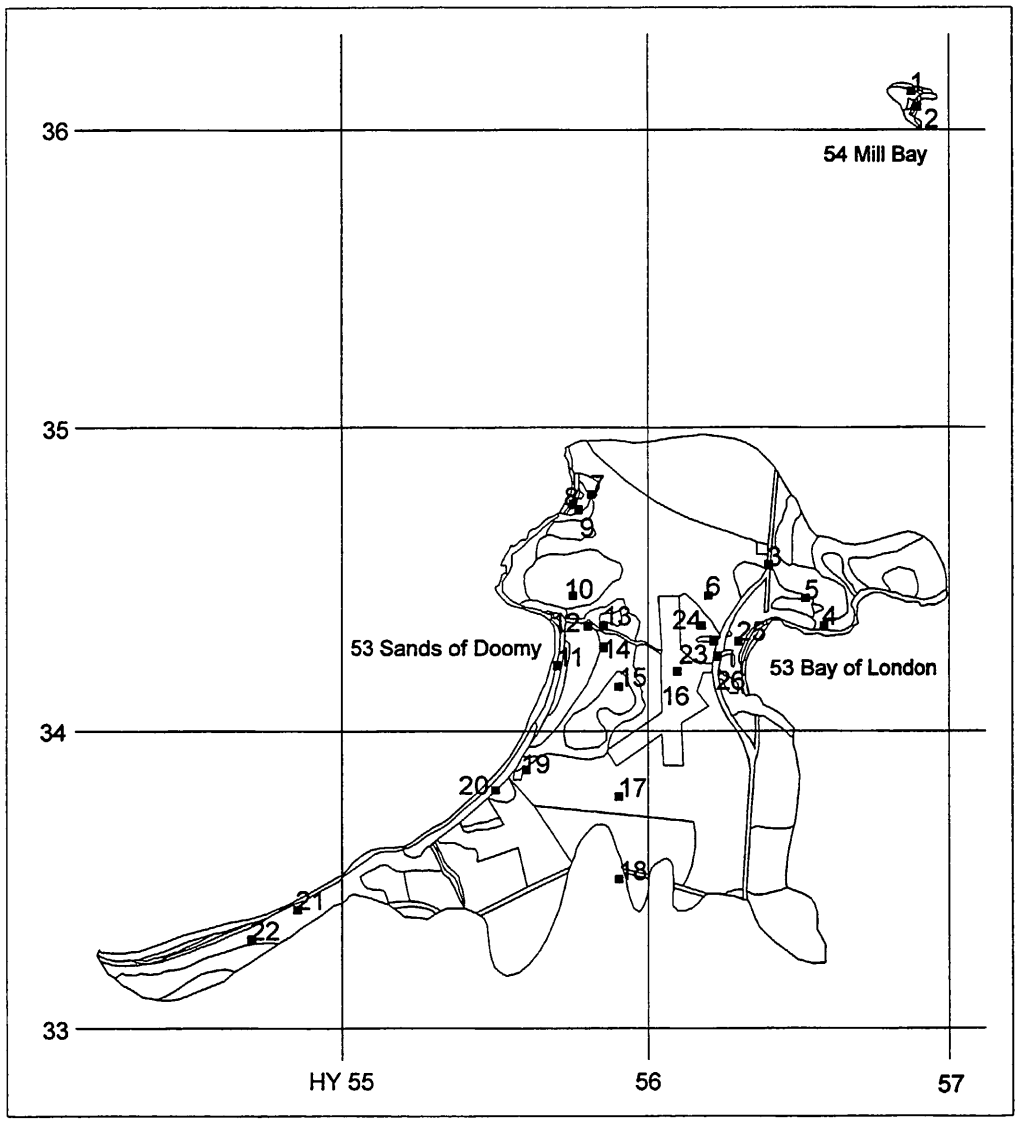
#	Grid Ref.	Site	Target Note Detail
1	HY56873613	54 Mill Bay	Drainage much influenced by water channel which used to carry outflow from corn mill (mill race further up valley). Section in 1.3 m deep ditch shows boulder till 0.8 m thick, with 0.5 m grey blown sand above. Vegetation a mix of MG10 and M28x. Drier areas of M28x have *Pteridium aquilinum*.
2	HY56893608	54 Mill Bay	Gently sloping beach of thin sand over shingle. Heavy seaweed deposition on shingle. Strand very untidy - much plastic, possibly derived from salmon farms offshore. 4 m wide SDy strand, 2 m wide zone of *Elymus repens*.
3	HY56403455	53 Sands of Doomy to Bay of London	Solitary *Rhododendron ponticum* adjacent to main road (6 x 4 m in size).
4	HY56583435	53 Sands of Doomy to Bay of London	Scattered small bushes of *Ulex europaeus* in H11a/b dune heath, not enough to consider as W23.
5	HY56523444	53 Sands of Doomy to Bay of London	Mosaic of H11a/b dune heath and SD12 acidic dune grassland with some slow shrub invasion.
6	HY56203445	53 Sands of Doomy to Bay of London	M16 heath (Q12) with 35 cm of peat over blown sand, established using soil auger.
7	HY55813478	53 Sands of Doomy to Bay of London	Peat-covered sand meets heath and acidic grassland developed directly on sand. Drain present with good section at back of dunes. 40 sq m irregular pool with *Sphagnum recurvum, Sphagnum papillosum* and *Potamogeton natans*. *Empetrum nigrum* invading SD12 acidic dune grassland.
8	HY55753475	53 Sands of Doomy to Bay of London	Moderately sloping beach with thin sand over cobbles. No strand. Narrow SD6ae sward, changing rapidly to SD7a (contains *Angelica sylvestris*), then into SD8c with *Brachythecium albicans, Tortula ruralis* ssp. *ruraliformis* but no *Galium verum*.
9	HY55773473	53 Sands of Doomy to Bay of London	Aberrant form of SD8e. Part buried by sand (bare sand cover 50%), with abundant *Parnassia palustris* (20% cover). No *Prunella vulgaris*. Small patches of invading *Empetrum nigrum*.
10	HY55753445	53 Sands of Doomy to Bay of London	Hummocky dune relief on hill-slopes of Doomy, showing dune heath as climbing dune variant.
11	HY55703422	53 Sands of Doomy to Bay of London	Very fine SD6b foredune ridge. Very steep front and rear, with a convex to knife-edge crest. Striking deflation plain to rear. A very unusual feature and unique to Orkney. Beach gently sloping sand, no strand vegetation except in north.
12	HY55803435	53 Sands of Doomy to Bay of London	An SD17x protoslack dominated by *Agrostis stolonifera*. Receives heavy sand inputs to remarkably flat floor. Damper patches have *Eleocharis palustris, Littorella uniflora, Radiola linoides, Collema* sp. Probably under water for most of winter but dry at time of survey.
13	HY55853435	53 Sands of Doomy to Bay of London	Small very wet area but dry at time of survey, with a floor of *Littorella uniflora* and scattered *Eleocharis palustris*. Surface damaged by trail bikes treating it as skidpan.

#	Grid Ref.	Site	Target Note Detail
14	HY55853428	53 Sands of Doomy to Bay of London	Rear of Loch Doomy. Very different topography compared to flat floor of T12 and T13. Still a flat plain but pronounced microtopography of very low (20-40 cm) dune hummocks. These show a very fine early stage of dune wet heath development, with abundant *Empetrum nigrum* - best example author has seen in Britain. This area probably receives much blown sand but is not often under water and wind can develop small dunes which heath then stabilises. See Q18.
15	HY55903415	53 Sands of Doomy to Bay of London	Large area of SD17d at rear of Loch Doomy, a more advanced stage (Q20) than SD17x protoslack of Q17.
16	HY56103420	53 Sands of Doomy to Bay of London	London Airport - sward a mix of acidic grassland types (U4/U5) and some *Dactylis glomerata, Lolium perenne*. Probably a fertilised re-seeded area. Mapped as airfield.
17	HY55903378	53 Sands of Doomy to Bay of London	Section in drain shows peat ranker (10 cm) over 40 cm blown sand, then 1.5 m peat.
18	HY55903350	53 Sands of Doomy to Bay of London	Acidic grassland (U4) derived from M16 wet heath. Many tussocks of *Juncus squarrosus* remain in sward.
19	HY55603387	53 Sands of Doomy to Bay of London	SD6e dunes with much *Empetrum nigrum* spreading in from adjacent M16 wet heath. Mapped as M16/SD6.
20	HY55503380	53 Sands of Doomy to Bay of London	Foredunes with scattered small cauldron blowouts, result of great exposure.
21	HY54853340	53 Sands of Doomy to Bay of London	Coast between Sands of Doomy and Sands of Mussetter forms impressive near-vertical cliffs, rising at western end to 15 m. Section in erosion scar shows 0.5-2 m sand thickness over bedrock. Beach at foot, thin sand over shingle. No strand.
22	HY54703330	53 Sands of Doomy to Bay of London	Dunes of Sands of Mussetter are cliffed (2-4 m height) throughout length. Beach is thin sand over shingle with fragments of SDy strand. Rapid change inland to SD12, H11a/b, including much *Empetrum* in SD12 sward. Mapped as H11/SD12.
23	HY56223430	53 Sands of Doomy to Bay of London	30 m x 10 m sand pit, still being excavated, H11a/b turf collapse on side.
24	HY56183435	53 Sands of Doomy to Bay of London	Major deep drain carrying water from wet heath and Loch of Doomy southeast to sea. Exposes pipeline running north to south.
25	HY56303430	53 Sands of Doomy to Bay of London	Low (3 m) SD5b foredune ridge in north of Bay of London. Moderately sloping sand beach with discontinuous SDy strand. 10-40 m to east in intertidal sand there is a part buried wall designed to protect dunes from erosion. Very narrow SD8c zone at interior, invaded by H11a/b species.
26	HY56233425	53 Sands of Doomy to Bay of London	Old tip with ruderals (*Rumex obtusifolius, Cirsium arvense*). To east there is an H11a/b dune scarp used for tipping grass cuttings from airfield. Ruderals developing here.
27	HY53333218	52 Sealskerry Bay	Steep shingle beach with patchy SDy strand, capped with 1-3 m sand. Old fence collapsed and stock have full access to foredune. *Leymus arenarius* and *Elymus farctus* are heavily grazed and trampled. Much turf collapse. Foredune is narrow and MG11 is developed at base of rear. Immediate interior is SD12 acidic dune grassland.

#	Grid Ref.	Site	Target Note Detail
28	HY53233224	52 Sealskerry Bay	Sealskerry Loch has good wetland zonation. Centre is SHv *Hippuris vulgaris* swamp with narrow S19c surround. A MG11/MG13 intermediate with *Caltha palustris* and scattered *Juncus effusus* forms the outer wet zone. Many snipe disturbed.
29	HY53333224	52 Sealskerry Bay	SD12F fallow (previous crop uncertain) with thick growth of *Rumex acetosa, Stellaria media, Potentilla anserina.*
30	HY54003133	51 Sandyland	Dunes developed upon and behind low bedrock cliffs. Very limited accretion in corner of bay, with good SD5b and SD5c plus a SD2 strand. Elsewhere the cliff edge is SD12 grassland with fragments of H11a/b heath. Cliffs have a few scattered *Rosa rugosa* derived from shrub planting around houses.
31	HY56092885	55 Bay of Greentoft	Steep shingle beach with thin sand cover and good SDy strand. Backed by 0.5-1 m sand crest with SD5/SM28 upper strand as a near continuous, narrow (4 m) band. Much of interior MG7 but some wetland remains. Tangle platforms on western side of track.



Map 3a Target note positions: Sandyland, Sealskerry Bay and Bay of Greentoft (Eday)



Map 3b Target note positions: of Sands of Doomy to Bay of London and Mill Bay (Eday)

Annex 2 Quadrat Data

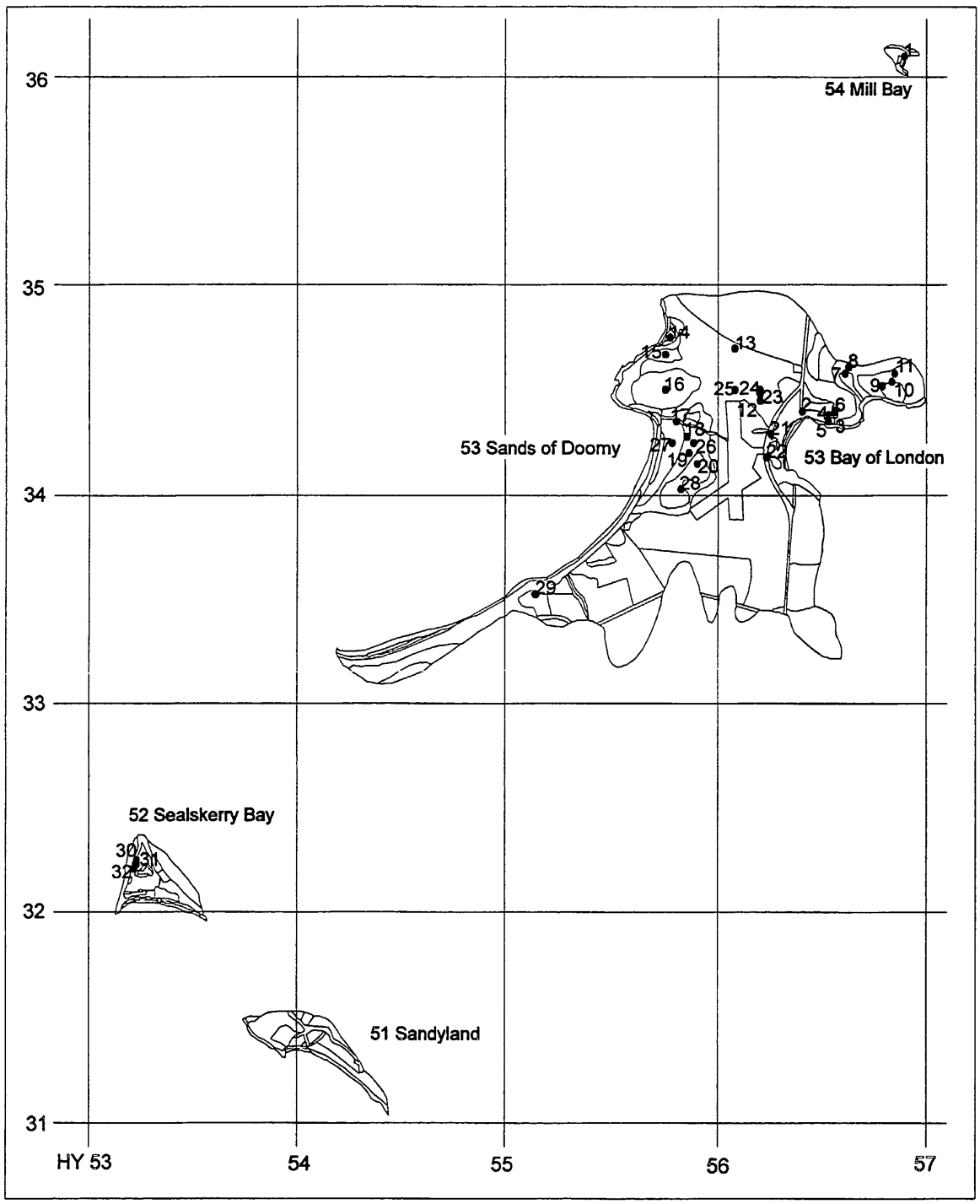
Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

Dry dune quadrats

	Quadrat number	14	4	6	10	22	29	16	2	3	5	9	21	15
	NVC type	SD 8c	SD 12	SD 12	SD 12	SD 12	SD 12	H 11a	H11 a/b	H11 a/b	H11 a/b	H11 a/b	H11 a/b	H 11b
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	557	565	565	568	562	551	557	564	565	565	567	522	557
3	Grid reference northing	357	343	344	345	351	335	345	344	343	343	345	342	346
11	Herb height, centimetres	3	10	35	7	35	25	10	15	15	25	30	12	10
12	Moss height, centimetres	2	3	-	3	-	4	2	5	5	7	5	1	3
14	Shrub cover, %	-	5	-	-	-	-	100	95	98	95	100	90	100
15	Herb cover, %	10	95	100	90	100	100	20	7	2	2	5	15	5
16	Moss cover, %	20	30	-	60	-	20	5	65	40	60	20	5	5
22	Bare soil/litter (incl.sand)	70	-	-	-	-	-	-	-	-	-	-	-	-
123	Agrostis capillaris	-	6	6	5	5	5	-	2	-	-	-	2	-
159	Ammophila arenaria	2	-	-	-	-	-	-	-	-	-	-	-	-
167	Angelica sylvestris	-	-	1	-	-	-	-	-	-	-	-	-	-
171	Anthoxanthum odoratum	-	4	5	4	4	5	-	3	3	2	-	4	-
230	Bellis perennis	2	-	-	-	-	-	-	-	-	-	-	-	-
278	Calluna vulgaris	-	4	-	-	-	-	9	9	8	8	8	8	8
304	Carex arenaria	3	4	5	4	6	5	5	4	4	3	3	4	3
384	Cerastium fontanum triviale	-	1	-	-	-	-	-	-	-	-	-	-	-
478	Deschampsia flexuosa	-	-	-	-	-	-	-	2	-	2	4	-	-
515	Empetrum nigrum nigrum	1	-	-	-	-	-	-	3	4	6	6	5	5
541	Erica cinerea	-	2	-	-	-	-	4	4	5	3	2	4	-
576	Festuca rubra	4	-	-	-	4	-	-	-	-	-	-	-	-
578	Festuca vivipara	-	4	4	5	4	4	-	-	3	2	-	4	-
610	Galium saxatile	-	5	-	5	-	-	-	-	-	-	-	-	-
680	Holcus lanatus	-	6	5	4	4	4	-	-	3	-	-	2	-
706	Hypochoeris radicata	-	-	-	-	-	-	-	1	-	-	-	3	-
736	Juncus squarrosus	-	-	-	-	-	-	-	2	-	-	3	-	2
800	Lotus corniculatus	-	-	-	-	-	-	-	-	-	-	-	2	-
807	Luzula campestris	-	-	-	4	-	-	-	-	-	-	-	-	-
809	Luzula multiflora	-	4	-	-	2	3	-	-	2	-	-	2	-
972	Plantago coronopus	2	-	-	-	-	-	-	-	-	-	-	-	-
988	Poa pratensis	-	-	3	-	3	-	-	-	2	-	-	2	-
1046	Potentilla erecta	-	2	2	4	-	4	-	1	-	-	-	2	-
1081	Ranunculus acris	-	1	-	-	-	-	-	-	-	-	-	-	-
1095	Ranunculus repens	-	-	-	-	-	2	-	-	-	-	-	-	-
1139	Rumex acetosa	-	3	5	4	5	4	-	-	-	-	-	2	-
1401	Veronica officinalis	-	-	-	-	-	-	-	-	2	-	-	-	-
1510	Brachythecium albicans	4	-	-	-	-	-	-	-	-	-	-	-	-
1638	Dicranum scoparium	-	-	-	-	-	-	2	2	2	-	-	-	-
1761	Hylocomium splendens	-	-	-	4	-	-	-	7	-	7	5	-	-
1872	Pleurozium schreberi	-	-	-	5	-	-	-	5	4	4	-	-	-
1914	Pseudoscleropodium purum	-	-	-	-	-	2	-	-	-	-	-	-	-
1940	Rhytidiadelphus squarrosus	-	6	-	6	-	5	-	-	-	-	-	-	-
1941	Rhytidiadelphus triquetrus	-	-	-	-	-	-	-	4	6	5	-	-	-
2023	Tortula ruralis ssp ruraliform	5	-	-	-	-	-	-	-	-	-	-	-	-
2130	Frullania tamarisci	-	-	-	-	-	-	-	2	-	-	-	-	-
2366	Cladonia portentosa	-	-	-	-	-	-	-	-	3	-	-	-	2
2695	Hypnum jutlandicum	-	-	-	-	-	-	4	2	2	5	-	4	4
2846	Gentianella amarella septentri	2	-	-	-	-	-	-	-	-	-	-	-	-
	Number of species per sample	9	14	9	12	9	11	5	16	15	11	7	15	6

Wet dune quadrats

	Quadrat number	1	11	32	31	8	12	13	23	24	25	18	19	26	27	28	7	20	17	30
	NVC type	MG	MG	MG	11/	MG	M	M	M	M	M	M	M	M	M	M	M	SD	SD	S
		10	10	MG	13	3x	16	16	16	16	16	16x	16x	16x	16x	16x	23b	17b	17x	Hv
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	568	568	532	532	566	562	560	562	562	560	558	558	558	557	558	566	559	558	532
3	Grid reference northing	361	345	322	322	346	344	347	354	345	345	342	342	342	342	340	345	341	343	322
11	Herb height, centimetres	30	60	25	5	45	20	8	10	12	25	20	15	10	12	12	70	8	2	35
12	Moss height, centimetres	-	5	-	-	5	7	5	1	1	1	1	1	1	1	1	20	2	1	-
14	Shrub cover, %	-	-	-	-	50	80	60	70	90	95	60	70	45	50	65	-	-	-	-
15	Herb cover, %	100	100	100	55	50	20	15	20	10	3	15	50	40	60	40	70	50	50	30
16	Moss cover, %	-	30	-	-	50	40	60	30	40	20	60	70	20	40	25	70	100	5	-
22	Bare soil/litter (incl.sand)	-	-	-	-	-	-	-	-	-	-	10	-	10	5	2	-	-	50	-
122	Agrostis stolonifera	7	-	6	3	4	-	-	2	-	2	3	4	5	5	5	3	5	5	-
123	Agrostis capillaris	-	4	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
156	Alopecurus geniculatus	-	-	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
167	Angelica sylvestris	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
171	Anthoxanthum odoratum	-	-	-	-	3	-	-	3	-	2	-	-	-	-	-	-	-	-	-
278	Calluna vulgaris	-	-	-	-	5	8	8	8	9	9	2	4	4	-	5	-	-	-	-
279	Caltha palustris	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
295	Cardamine pratensis	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304	Carex arenaria	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
319	Carex echinata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
333	Carex nigra	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	2	4	-	-
418	Cirsium palustre	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
470	Dactylorhiza majalis purpurell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
478	Deschampsia flexuosa	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
494	Drosera rotundifolia	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
509	Eleocharis palustris	-	-	4	3	-	-	-	-	-	-	-	-	-	-	-	-	4	3	3
515	Empetrum nigrum nigrum	-	-	-	-	5	3	2	4	4	4	7	8	6	7	8	-	-	-	-
525	Epilobium palustre	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
542	Erica tetralix	-	-	-	-	4	5	4	4	4	4	4	4	4	4	4	2	-	-	-
546	Eriophorum angustifolium	-	-	-	-	5	5	4	-	4	2	-	-	-	-	2	2	-	-	-
576	Festuca rubra	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
578	Festuca vivipara	-	-	-	-	4	-	-	-	-	2	-	-	-	-	-	4	-	-	-
609	Galium palustre	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-
610	Galium saxatile	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
642	Glyceria x pedicellata	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
646	Filaginella uliginosa	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
679	Hippuris vulgaris	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6
680	Holcus lanatus	5	5	-	-	4	-	-	2	-	2	4	4	4	4	4	5	3	-	-
690	Hydrocotyle vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	4	-	-
706	Hypochoeris radicata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
722	Juncus articulatus	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-
725	Juncus bufonius	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
730	Juncus effusus	5	5	4	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
736	Juncus squarrosus	-	-	-	-	2	-	-	5	2	2	4	5	5	5	5	-	-	-	-
791	Littorella uniflora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
809	Luzula multiflora	-	-	-	-	-	-	-	-	2	1	2	2	-	-	2	3	-	-	-
900	Nardus stricta	-	-	-	-	-	-	-	-	-	-	2	-	-	5	-	-	-	-	-
901	Narthecium ossifragum	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
947	Pedicularis sylvatica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
1043	Potentilla anserina	-	-	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1046	Potentilla erecta	-	4	-	-	4	2	2	-	4	3	-	-	-	-	2	3	-	-	-
1080	Radiola linoides	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	-
1085	Ranunculus baudotii	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1089	Ranunculus flammula	-	-	3	4	-	-	-	-	-	-	-	-	-	1	-	-	5	2	2
1095	Ranunculus repens	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1116	Rorippa palustris	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1139	Rumex acetosa	2	5	1	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
1147	Rumex obtusifolius	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1210	Scirpus cespitosus	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
1236	Senecio aquaticus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
1427	Viola palustris	-	-	-	-	-	-	-	-	-	-	-	5	-	2	2	-	-	-	-
1445	Calliergon cuspidatum	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	10	2	-
1546	Bryum pseudotriquetrum	-	-	-	-	-	-	-	2	-	-	2	2	2	-	2	-	-	-	-
1872	Pleurozium schreberi	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1891	Polytrichum commune	-	-	-	-	-	-	-	-	-	-	-	2	-	-	5	-	-	-	-
1940	Rhytidiadelphus squarrosus	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	Sphagnum capillifolium	-	-	-	-	-	7	8	-	-	-	-	2	-	-	-	-	-	-	-
1972	Sphagnum papillosum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
1976	Sphagnum recurvum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-
1984	Sphagnum tenellum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
2206	Moerckia hibernica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
2256	Aneura pinguis	-	-	-	-	-	-	-	-	-	-	3	8	2	4	2	-	-	-	-
2362	Cladonia furcata	-	-	-	-	-	-	-	3	4	-	-	-	-	-	-	-	-	-	-
2365	Cladonia gracilis	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
2366	Cladonia portentosa	-	-	-	-	-	-	-	4	5	3	-	-	-	-	-	-	-	-	-
2377	Cladonia pocillum	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-
2381	Cladonia rangiformis	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
2391	Cladonia uncialis	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
2486	Peltigera canina	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
2695	Hypnum jutlandicum	-	-	-	-	-	4	-	5	5	5	-	-	-	-	-	-	-	-	-
2807	Bryum sp	-	-	-	-	-	-	-	-	-	-	8	4	5	6	4	-	-	-	-
2846	Gentianella amarella septentri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2982	Taraxacum seedling/sp	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
3094	Collema sp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
4331	Senecio x ostenfeldii	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4	-	-
	Number of species per sample	7	9	12	10	11	7	9	14	10	16	13	15	11	13	18	17	11	9	3



Map 4 Quadrat positions: Sandyland, Sealskerry Bay, Sands of Doomy to Bay of London and Mill Bay (Eday)

56-65 WESTRAY

Location and conservation status

Ten areas of windblown sand are present:

56	Bay of Tafts	HY498418
57	Wasbister	HY490426
58	Garth	HY470449
59	Bay of Tuquoy	HY452451
60	Mae Sand	HY443433
61	Bay of Noup	HY413489
62	The Links, Grobust and Pierowall	HY435490
63	Bay of Skaill	HY455515
64	Bay of Brough	HY455472
65	Bay of Swartmill	HY480460

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology Mather, Smith & Ritchie (1974)

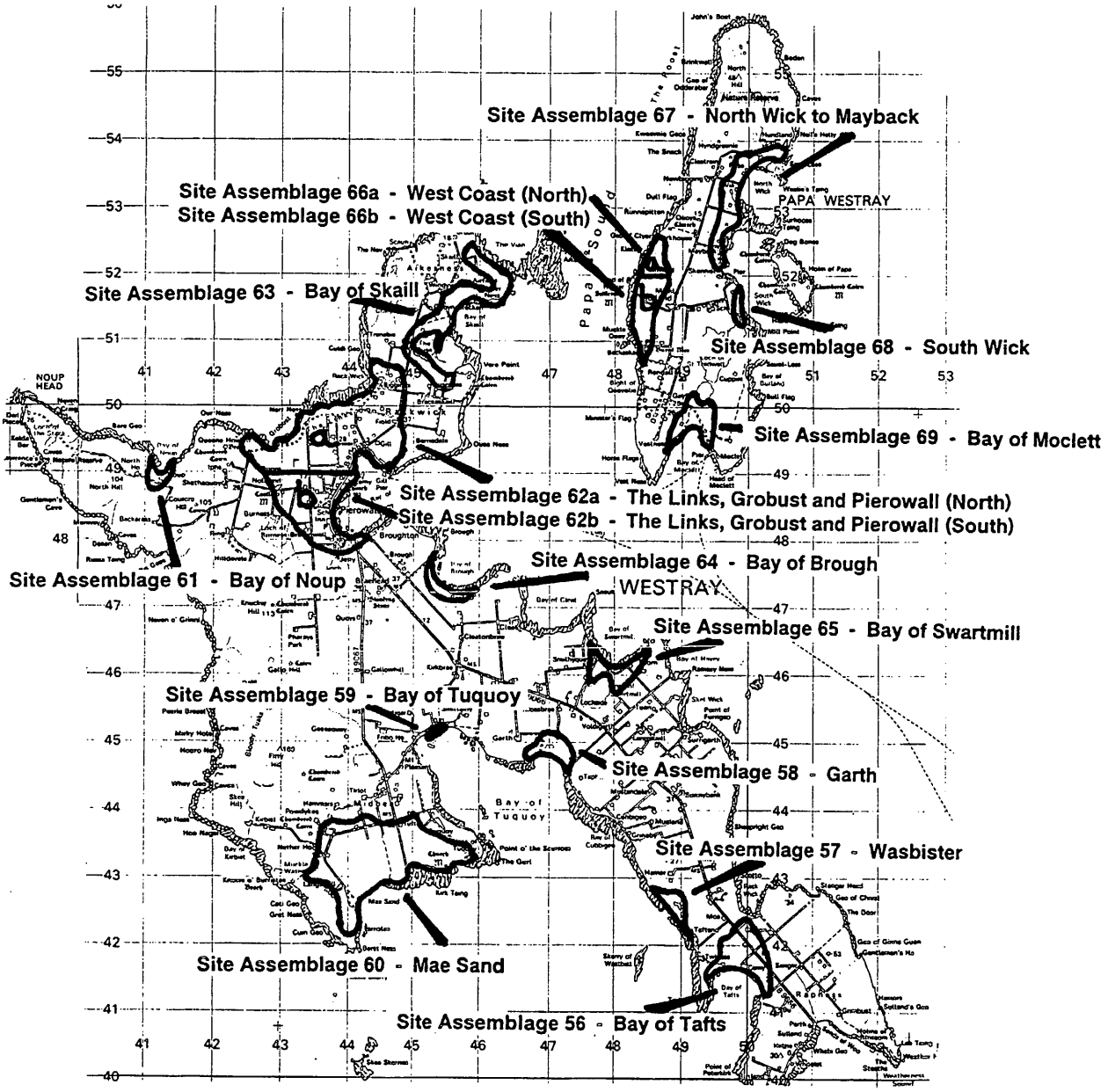
Survey details

Date	September 1996
Target notes	50 (Annex 1)
Quadrats	15 (Annex 2)
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Total windblown sand area on Westray is 633.7 ha (excluding beach zone). Vegetated ground is 547.7 ha, with the remainder taken up with bare sand (17.4 ha), arable and fallow (14.1 ha), and land take for buildings, gardens, roads, sand pits, tips etc. (49.4 ha). There is a wide range in site size (from Bay of Tuquoy 0.4 ha to The Links, Grobust and Pierowall 293.3 ha).



Map 1 Site assemblage location,
(Map includes sites on Papa Westray)
See Volume 3 for NVC maps

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Table 1 Broad land cover extents (ha)

Sites 56 - 60

	56 Bay of Tafts	57 Wasbister	58 Garth	59 Bay of Tuquoy	60 Mae Sand	All Westray sites
Windblown sand land cover						
Beach above MHWS	1.44	1.32	1.16	0.09	3.82	19.66
Bare sand			0.15		4.26	17.38
Vegetated sand (except fallows)	46.38	8.22	19.38	0.31	155.14	552.79
Arable and fallow					1.91	14.13
Buildings, roads, gardens, tips, pits, cemeteries, airfield	2.09	1.69	0.52	0.05	4.81	49.44
Total windblown sand excluding beach zone	48.47	9.91	20.05	0.36	166.12	634.14
Total windblown sand extent above MHWS	49.91	11.23	21.21	0.45	169.95	653.80
Surveyed but not on blown sand						
Bare rock						
Unvegetated maritime cliff		0.25	0.44		0.72	5.49
Saltmarsh						0.41
Open water				0.03		0.70

Sites 61 - 65

	61 Bay of Noup	62 The Links, Grobust and Pierowall	63 Bay of Skaill	64 Bay of Brough	65 Bay of Swartmill	All Westray sites
Windblown sand land cover						
Beach above MHWS	0.79	5.47	4.21	1.06	0.31	19.66
Bare sand	0.09	12.86	0.02			17.38
Vegetated sand (except fallows)	3.96	238.98	58.39	5.82	16.20	552.79
Arable and fallow	1.50	6.13	3.28	1.31		14.13
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.88	35.30	1.73	0.21	2.16	49.44
Total windblown sand excluding beach zone	6.42	293.43	63.67	7.35	18.36	634.14
Total windblown sand extent above MHWS	7.21	298.90	67.88	8.40	18.67	653.80
Surveyed but not on blown sand						
Bare rock						
Unvegetated maritime cliff	0.31	3.03	0.11		0.63	5.49
Saltmarsh		0.15	0.25			0.41
Open water					0.67	0.70

Dune habitats (Table 2, Maps 2a-c)

Westray lacks fixed acidic dune grassland, dry dune heath and wet dune heath (habitats which are confined to Hoy and Eday) but has all other dune types, including large extents of mobile dune, fixed calcareous dune, dune slack/wet grassland and improved grassland. The latter habitat is dominant (406.4 ha, total survey area 660.0 ha) and shows that the bulk of potential nature conservation interest has been lost.

There is a sharp contrast between mobile dune extent (45.1 ha) and semi-fixed dune (0.4 ha) and this reflects the definition of the mobile dune habitat type. It includes bare sand (17.4 ha) and a particular type of fixed dune vegetation (SD8c *Festuca rubra - Galium verum* fixed dune *Tortula ruralis* ssp. *ruraliformis*, 25.7 ha) which indicates sand deposition and a changing dune surface, producing a high cover of the moss *T. ruralis* ssp. *ruraliformis*. The SD8c type makes up the bulk of the mobile dune area and classic mobile dunes with the large grasses *Leymus arenarius* and *Ammophila arenaria* are in fact rare and have a low extent (SD5 and SD6 communities, 3.2 ha). The mobile dune areas in Maps 2a-b, particularly at Mae Sand and The Links, Grobust and Pierowall, are locations which could support classic mobile dune conditions but these are suppressed by excessive grazing pressure which in turn increases dune erosion and sand deposition rates. It is thus an important habitat to distinguish at the habitat scale.

Table 2 Extents (ha) of dune habitats and other ground

Sites 56 - 60

	56 Bay of Tafts	57 Wasbister	58 Garth	59 Bay of Tuquoy	60 Mae Sand	All Westray sites
Habitat 1 - Beach and strand	2.26	1.48	1.22	0.32	4.41	24.12
Habitat 2 - Mobile dune	0.67		0.69	0.07	13.95	45.09
Habitat 3 - Semi-fixed dune					0.38	0.38
Habitat 4 - Fixed dry calcareous dune	1.88				22.55	75.53
Habitat 5 - Fixed acidic grassland			0.28			0.28
Habitat 6 - Dry dune heath						
Habitat 7 - Wet dune heath						
Habitat 8 - Dune slack and wet grassland		1.35	5.27		12.76	25.51
Habitat 9 - Mire and swamp		0.93	2.00	0.02	3.22	11.97
Habitat 10 - Arable and fallow					1.91	14.13
Habitat 11 - Improved grassland	42.94	5.78	11.12		105.92	406.41
Habitat 12 - Other habitats	2.16	1.94	1.07	0.08	5.56	56.55
TOTALS (ha)	49.91	11.48	21.65	0.48	170.67	659.99

Sites 61 - 65

	61 Bay of Noup	62 The Links, Grobust and Pierowall	63 Bay of Skaill	64 Bay of Brough	65 Bay of Swartmill	All Westray sites
Habitat 1 - Beach and strand	0.79	6.14	4.89	2.24	0.39	24.12
Habitat 2 - Mobile dune	0.09	28.37	1.25			45.09
Habitat 3 - Semi-fixed dune						0.38
Habitat 4 - Fixed dry calcareous dune	1.37	46.14	2.32	1.27		75.53
Habitat 5 - Fixed acidic grassland						0.28
Habitat 6 - Dry dune heath						
Habitat 7 - Wet dune heath						
Habitat 8 - Dune slack and wet grassland	0.02	1.46		0.30	4.36	25.51
Habitat 9 - Mire and swamp		3.44			2.37	11.97
Habitat 10 - Arable and fallow	1.50	6.13	3.28	1.31		14.13
Habitat 11 - Improved grassland	2.15	171.42	54.13	3.07	9.89	406.41
Habitat 12 - Other habitats	1.62	38.84	2.12	0.21	2.95	56.55
TOTALS (ha)	7.52	301.93	67.99	8.40	19.96	659.99

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

A total of 59 vegetation and other land cover types is mapped, including 47 vegetation types and 12 other land cover categories. As indicated in dune habitat results, the most extensive cover is improved grassland (MG7 *Lolium perenne* leys, 388.2 ha), together with semi-improved intermediates (MG7/MG11 10.6 ha, MG7/SD8 5.1 ha). Arable land (including potatoes) covers 13.9 ha. Dry calcareous fixed dune is the most extensive typical dune vegetation, involving three main types: SD8a *Festuca rubra - Galium verum* community Typical sub-community, 29.2 ha; SD8c *Tortula ruralis* ssp. *ruraliformis* sub-community, 25.7 ha; SD8d *Ranunculus acris - Bellis perennis* sub-community, 34.5 ha. No other vegetation type approaches these levels of areal coverage and several typical dune types are grossly under-represented in the Westray spectrum: mobile dunes (SD5, SD6 communities - total extent 3.2 ha), semi-fixed dune (SD7 community, 0.4 ha) and dune wetland (SD8e *Prunella vulgaris* sub-community, SD17 dune slack, MG11 and MG13 inundation grassland, M28x *Iris pseudacorus* beds, Mx *Carex nigra* rich fen sedge mires and S19 *Eleocharis palustris* swamp - total extent 27.4 ha). These under-represented types have probably been the principal losses to improvement.

Site descriptions

56 Bay of Tafts (Map 2a)

This moderately-sized (48.5 ha) bay and climbing dune site is located on the southeast coast of Westray, with a fetch of 11 km SSW to Rousay. It is sheltered from westerly winds by the Twiness headland. The eastern side of the beach is eroding and tangle platforms (stone benches used to dry kelp) close to the shore are largely buried, suggesting a recent retreat of the shore edge and some sand transport inland. Sand is blown 600 m inland but the interior is entirely improved. Fragmented dune vegetation is present close to the beach: SD5/SM28 strand, SD5c mobile dune, SD8a fixed dune. Nature conservation interest is low due to the scale of improvement.

57 Wasbister (Map 2a)

This small (9.9 ha) bay site is located on the southeast coast of Westray, 1 km NW of the Bay of Tafts. It is predominantly shingle with a small capping of sand on the main shingle ridge and a thin cover blown further inland for up to 150 m. It is exposed to an 11 km fetch SW to Rousay. Patches of SDy *Atriplex glabriuscula* strand and an SD2 *Cakile maritima - Honkenya peploides* and SD3 *Matricaria maritima - Galium aparine* strand intermediate are present on the upper beach. A track runs along the shingle ridge crest and the backslope falls rapidly to wet ground, most of which is MG7 improved grassland. The lowest ground still retains wetland, with a good zonation from MG13 inundation grassland to S10 *Equisetum fluviatile* swamp and open water, plus M28x *Iris pseudacorus* and S28 *Phalaris arundinacea* beds. The nature conservation interest of vegetation is low overall, but with a moderate rating for the small area of wetland which probably has a greater interest for breeding waders.

58 Garth (Map 2b)

This small to moderately-sized (20.1 ha) bay and climbing dune site occupies a sandy coastal inflexion on the eastern side of the Bay of Tuquoy (south-central Westray). It is exposed to a 12 km fetch SW to Rousay across Westray Firth. The beach is shingle with a thin sand cover and a small amount of SDy strand. The western side of the site is eroding, with 1 - 4 m high cliffed SD5b foredunes which have active turf slumping. Heavy rabbit grazing in this area is concentrated on *Elymus farctus*. Sand is blown 450 m inland but most of the east and rear of the site is MG7 improved grassland. The western side has a notable area of wetland developed on acidic sands: MG10 rush pasture and MxPp provisional *Carex nigra - Potentilla palustris* rich fen are the most extensive types; the latter is high-quality. There are good zonations of damp MG10 and MG13 inundation grassland around the Loch of Garth. Overall nature conservation interest of vegetation is low to moderate due to small site size and the scale of improvement, with moderate to good interest for the wetland. There is also likely to be an additional interest here from breeding waders.

59 Bay of Tuquoy (Map2b)

This is the smallest Westray site (0.4 ha) and represents a thin sand cover to a shingle spit stretching across a small part of the Bay of Tuquoy close to a stream entering the sea. The site is very sheltered at the head of the bay, with a 4 km fetch SE to the opposite Westray shore. Sand is only present at the neck of the spit and a small area of SD5c *Leymus arenarius* mobile dune *Festuca rubra* sub-community is present. An SDy *Atriplex glabriuscula* strand is located on shingle. Nature conservation interest for such a small site is very low.

60 Mae Sand (Map 2a)

This is a large (166.1 ha) bay and climbing dune site located on the southwest coast of Westray. It is exposed to a 15 km SE fetch to Eday. Blown sand is present in coastal sections for 1.4 km east of the main beach, suggesting the present area of sand is much smaller than in the past. Sand has been blown 1 km inland but most of the interior has been improved apart from a large block of SD8d fixed dune grassland on the western side of the site. Part of the SD8d sward is exploited as a sand pit and the remainder is infested with rabbits, with a high ruderal content to the turf.

The main beach is a mix of shingle and sand. Little is sand present on the upper beach which has a prominent shingle berm, part of which (the eastern end) is used for small-scale mineral extraction. Inland from this are some of the most eroded dunes in Orkney. A former fixed dune surface is dissected by wide linear blowouts leaving mesa-like fingers of old surface upstanding. Stock trampling and sheltering, plus intensive rabbit burrowing, are responsible for very active turf slumping and much sand blow. Shingle is exposed in several blowout floors and a small area of soft aeolinite (dune sandstone). Despite much blown sand there are only restricted fragments of SD6 *Ammophila arenaria* mobile dune. The most extensive vegetation type is SD8c fixed dune with abundant *Tortula ruralis* ssp. *ruraliformis*, plus small patches of MG11 inundation grassland in blowout floors. Bare sand and shingle are dominant in this zone of erosion which extends inland for 130 m.

Inland from this large area of erosion is a zone of damp grassland (SD8e *Prunella vulgaris* sub-community and MG11 inundation grassland) which has scattered heads of *Parnassia palustris* and many flowering spikes of the nationally scarce *Carex maritima*. The turf had been spread with cattle dung at the time of survey and such enrichment is not be the best management for this important piece of dune wetland. A further area of partly drained wetland is present in the east of the site, with SD17b dune slack patches, S19c swamp and extensive M28x *Iris pseudacorus* beds. *Equisetum fluviatile* is very common in the turf and S10 swamp was probably extensive in the area prior to drainage.

The nature conservation interest of this site has been dramatically reduced by poor management over a long period of time. Sand extraction, lack of rabbit control and bad stock management have contributed to major instability in the outer dunes. Drainage and improvement in the interior have greatly restricted dune wetlands, parts of which are still high quality. Overall interest is only moderate due to the scale of long-term damage but there are localised patches of great interest, and the site as a whole deserves a planned long-term management scheme to maintain the best current interest, restore former wetland and stabilise areas of wind erosion.

61 Bay of Noup (Map 2c)

This is a small (6.4 ha) bay and climbing dune site located on the north coast of Westray, 2.5 km east of Noup Head. It is exposed to a very long NNE fetch into the Arctic Ocean. The beach is formed of large flagstone slab boulders and a single foredune ridge rises steeply to 5 m height immediately behind the beach crest. The ridge is broken by a stream and three stabilised blowouts. Stock have access to the dune front which is largely bared by trampling and rabbit burrowing. Patches of ruderal vegetation are extensive. SD8a fixed dune grassland is present further inland and is then replaced by MG7 improved grassland or arable land. Ruderal cover is high in most non-arable ground. High stock and rabbit numbers, plus heavy dunging, have reduced the interest of most remaining dune vegetation and overall nature conservation interest is low.

62 The Links, Grobust and Pierowall (Map 2c)

This is the largest Westray site (293.3 ha) and is a complex representing bay dunes along the north (Grobust to The Links) and northeast (Pierowall) coasts of Westray which are connected by a climbing dune interior. The maximum width of the site from bay to bay (Grobust to Pierowall) is 1.2 km and the total volume of sand in the system is probably very large.

The southeastern and central parts of the site have been improved or developed for housing around Pierowall, the principal settlement of Westray. The north coast still retains much of interest but has suffered from poor management over a considerable period of time. The eastern side (The Links) is undergrazed and used as a dump for old cars, with SD8a fixed dune dissected by a dense reticulate network of grass tracks used by visitors for informal recreation and access to tangle platforms which are frequent along the dune edge. Dunes further west at Grobust are amongst the worst eroded in Orkney. Extensive areas of bare sand are present, with a few upstanding mesa-like remnants of the former dune surface. Fence lines marking different land ownerships show varied attempts to control erosion but in general stock numbers are far too high and most of the area is riddled with active rabbit burrows. SD8c fixed dune grassland is the only extensive vegetation type and there are small patches of SD6 *Ammophila arenaria* mobile dune and SD10 *Carex arenaria* dune (often heavily grazed by rabbits). This zone of active erosion extends 450 m inland.

Further south there is a large area of SD8d fixed dune grassland in good condition and this area is used as a golf course. Stock grazing and rabbits keep the sward low away from greens which have fences to exclude stock and are hand mown. An SD8 sward is maintained throughout and no improved amenity grassland is present. This area is the best managed sector of the whole site. A large sand pit is present at the rear of this area. The only significant expanse of wetland is in the southwest where M28x *Iris pseudacorus* beds are in a mosaic with MxTm *Carex nigra - Triglochin maritima* rich fen in good condition.

The massive scale of improvement and poor management of much of the remaining dune vegetation reduce the nature conservation interest to only a moderate level, although there are very localised patches of high-quality vegetation (golf course fixed dune grassland, the main wetland area). There is much scope for better management at Grobust and The Links via a planned management scheme aiming to stabilise eroding dunes (Grobust) and increase the diversity of rank fixed dunes (The Links).

63 Bay of Skaill (Map 2c)

This moderately-sized (63.4 ha) bay and climbing dune system is located on the northeast coast of Westray, fringing a very sheltered bay and spit system termed The Ouse which lies inside the more exposed Bay of Skaill. It is exposed to a very short 2.5 km fetch ENE to Papa Westray. The western edge of blown sand is very close to the northeastern limit of the Pierowall - Grobust - The Links system. Blown sand continues east and north beyond the Bay of Skaill, rounding the headland of Aiker Ness as climbing dune in The Vian embayment on the northeastern tip of Westray.

The sheltered conditions in The Ouse allow saltmarsh to develop below the beach as a 5 - 8 m wide zone. A narrow SD5/SM28 strandline is present but inland there is a fence and then MG7 improved grassland which dominates the site, together with some arable land. The more exposed southern and northern shores of the Bay of Skaill have dune cliffs as evidence of erosion and this is particularly severe towards the north of the site where 6 m vertical sand faces are developed and fencing close to the coastal edge is collapsing.

Nature conservation interest is low due to the scale of improvement and restriction of semi-natural conditions to the strand zone. The only exception is a small area of SD8c fixed dune grassland developed on thin sand at the southern end of the shingle spit sheltering The Ouse. Rabbit activity here is intense and *Silene dioica* is a common weed growing on disturbed soils around burrows. Geomorphological interest is probably higher, given the range of different exposures present.

64 Bay of Brough (Map 2b)

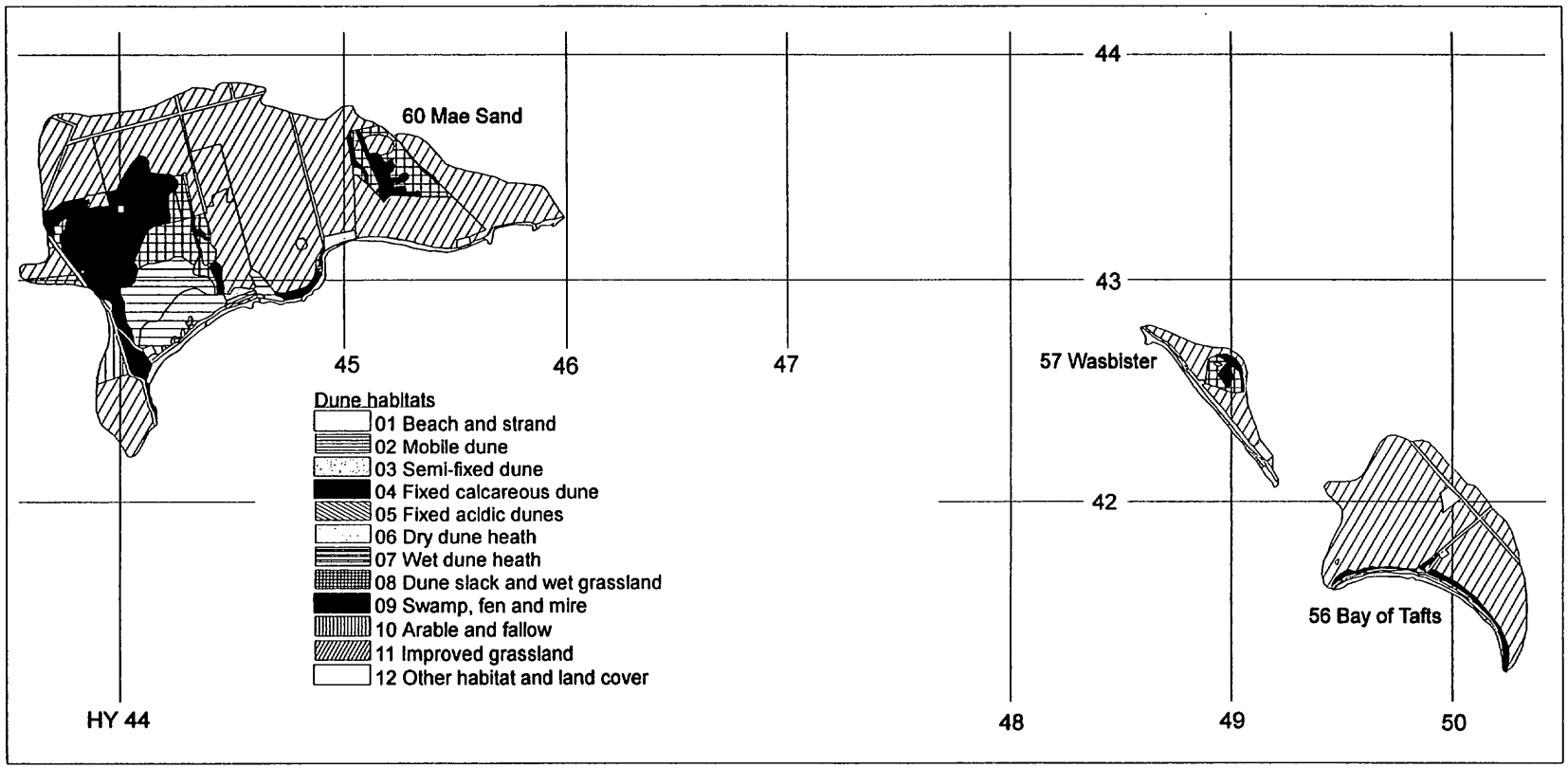
This small (7.4 ha) bay dune site is located on the northeast coast of Westray, 2 km SE from Pierowall. It is exposed to a short 3.5 km fetch NE to Papa Westray. The western end shows 3 m loss of the coastal edge due to erosion, leaving buildings protected by a stone wall exposed by retreat. A thin SD5/SM28 strand is present but virtually all of the interior is improved grassland or arable land. One small area of MG13 inundation grassland is present. Nature conservation interest is very low due to the small size of the site and lack of semi-natural dune vegetation.

65 Bay of Swartmill (Map 2b)

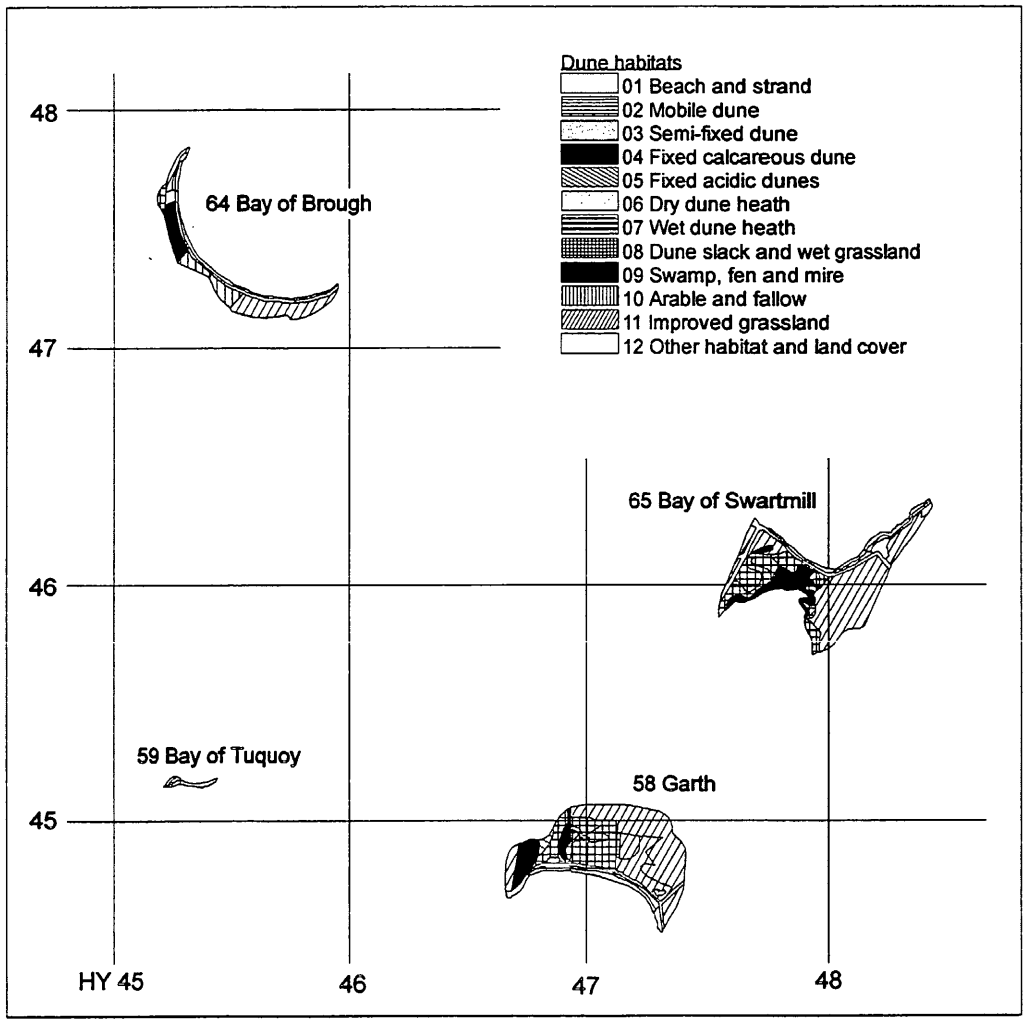
This small (18.4 ha) bay and climbing dune system is located on the northeast coast of Westray 5 km SE of Pierowall. It is exposed to a short 3 km fetch NNE to Papa Westray. The beach is of thin sand over shingle which impedes drainage inland from the Loch of Swartmill. Sand supply is sufficient to develop a good strand and narrow zone of SD5c mobile dune in front of a road which runs close to the coastal edge where it is protected by rock-filled gabion baskets. There is good wetland with fine transition patterns from MG11/MG13 inundation grassland to MG13, S19c and finally S19a swamp in open water on the edge of the Loch of Swartmill. A small area of SHv provisional *Hippuris vulgaris* swamp is also present. Climbing dune developed on the western and eastern sides of the site are all converted to MG7 improved grassland. Nature conservation interest is low to moderate due to the small size of the site but wetland quality is good and there is probably an additional breeding wader interest.

References

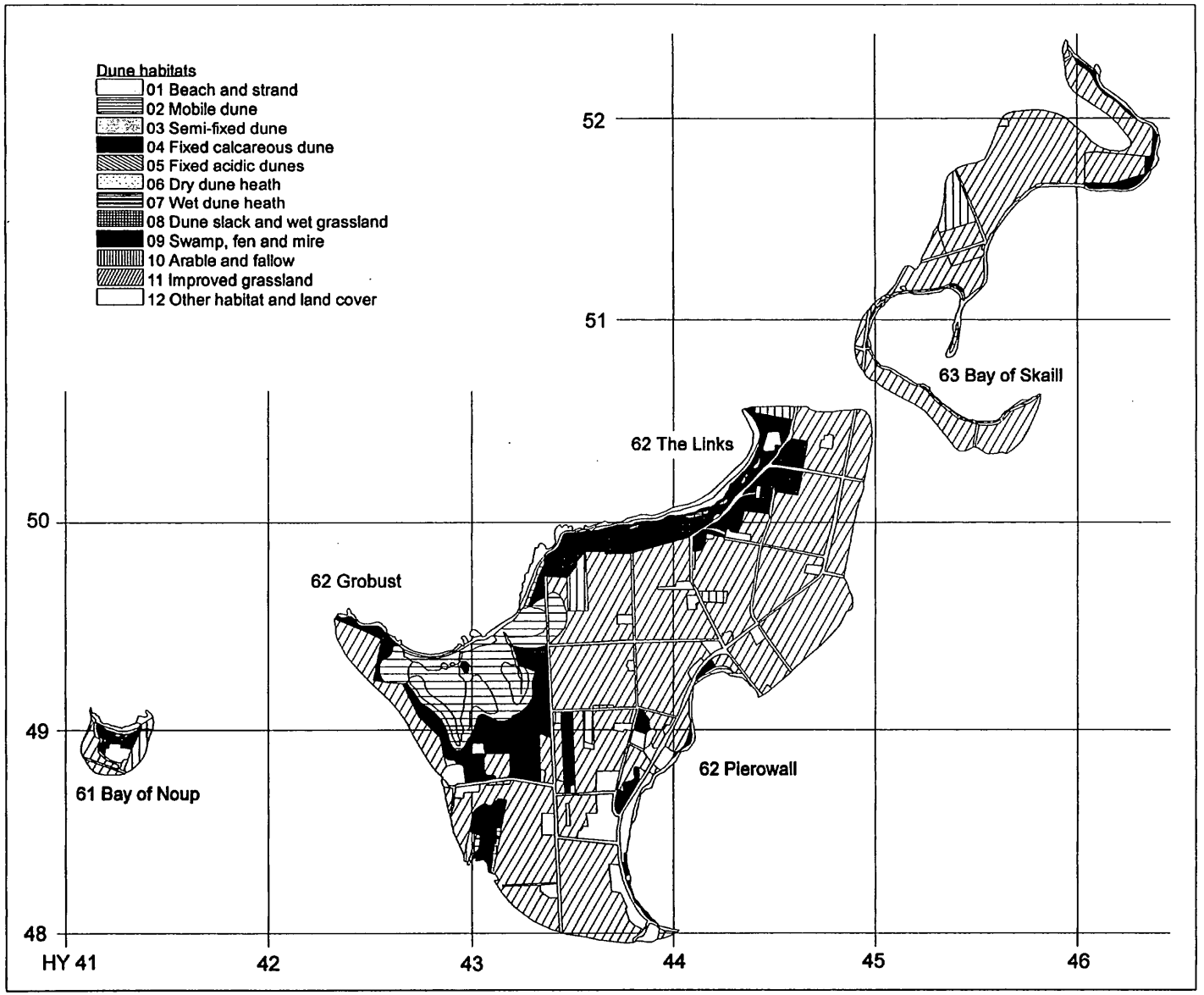
Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.



Map 2a Dune habitats of Bay of Tafts, Wasbister and Mae Sand (Westray)



Map 2b Dune habitats of Garth, Bay of Tuquoy, Bay of Brough and Bay of Swartmill (Westray)



Map 2c Dune habitats of Bay of Noup, Pierowall to Grobust and The Links, and Bay of Skaill (Westray)

Table 3a Vegetation and other land cover (areas in ha)

Sites 56 - 59

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	56 Bay of Tafts	57 Wasbister	58 Garth	59 Bay of Tuquoy	All Westray sites
AP	Arable - potatoes					2.27
ARB	Arable - barley					11.62
BBG	Buildings, bare ground and gardens	0.59	0.37			19.76
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	1.24	1.04	0.92	0.09	6.81
BMC	Maritime cliff with little vegetation		0.25	0.44		5.49
BS	Bare sand (within vegetated sand zone)			0.15		17.38
BSH	Bare shingle	0.20	0.28	0.24		12.85
CMTY	Graveyard	0.09				0.91
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire					0.04
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)		0.46	0.17		4.73
M28x/S28	M28x/S28 intermediate					0.21
M28x/S4	M28x/S4 intermediate					0.24
MG1	MG1 *Arrhenatherum elatius* coarse grassland					2.09
MG7	MG7 *Lolium perenne* leys	42.94	5.78	8.03		388.20
MG7/ MG11	MG7/MG11 intermediate			2.26		10.58
MG7/SD8	MG7/SD8 intermediate			0.82		5.13
MG9/ MG11	MG9/MG11 intermediate					4.54
MG10	MG10 *Holcus lanatus - Juncus effusus* rush pasture			4.34		4.34
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland			0.15		4.35
MG11/ MG13	MG11/MG13 intermediate			0.09		2.16
MG11/ SD8	MG11/SD8 intermediate					0.61
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland		1.35	0.69		3.14
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)			1.82		1.82
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)					1.85
MxTm/ M28x	MxTm/M28x intermediate					0.12
OW	Open water				0.03	0.70
PIT	Active sand pit or rock quarry					0.59
ROAD	Road and track	1.42	1.32	0.52	0.05	28.11
RUD	Ruderal-dominated vegetation	0.06		0.12		7.02
S10	S10 *Equisetum fluviatile* swamp		0.42			0.42
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community					1.00
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			0.01		1.13
S28	S28 *Phalaris arundinacea* fen		0.05		0.02	0.07

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 56 - 59

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	56 Bay of Tafts	57 Wasbister	58 Garth	59 Bay of Tuquoy	All Westray sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline					0.01
SD2/SD3	SD2/SD3 intermediate		0.03			0.03
SD2/SD4	SD2/SD4 intermediate					0.25
SD4/SD8c	SD4/SD8c intermediate					0.39
SD5/ SM28	SD5/SM28 intermediate	0.82				2.93
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community			0.15		0.15
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.67		0.39	0.07	2.29
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community					0.15
SD6ae	SD6a/e intermediate					0.45
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community					0.16
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community					0.38
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.48				29.15
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community					25.71
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community					34.52
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community					4.64
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW					0.24
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)	1.40				4.55
SD10	SD10 *Carex arenaria* dune community					0.19
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community					1.40
SDx	SDx *Potentilla anserina* strandline community (PROVISIONAL NEW NVC TYPE)					0.48
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.12	0.06	0.23	0.84
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)					0.05
SM16	SM16 *Festuca rubra* saltmarsh					0.25
SM28	SM28 *Elymus repens* saltmarsh					0.15
TIP	Rubbish tip					0.06
U5d	U5 *Nardus stricta - Galium saxatile* grassland, *Calluna vulgaris - Danthonia decumbens* sub-community			0.28		0.28
TOTALS (ha)		49.91	11.48	21.65	0.48	659.99

Table 3b Vegetation and other land cover (areas in ha)

Sites 60 - 63

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	60 Mae Sand	61 Bay of Noup	62 The Links, Grobust and Pierowall	63 Bay of Skaill	All Westray sites
AP	Arable - potatoes		0.09	2.18		2.27
ARB	Arable - barley	1.91	1.17	3.95	3.28	11.62
BBG	Buildings, bare ground and gardens		0.43	17.45	0.19	19.76
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	1.11	0.52	0.39	0.20	6.81
BMC	Maritime cliff with little vegetation	0.72	0.31	3.03	0.11	5.49
BS	Bare sand (within vegetated sand zone)	4.26	0.09	12.86	0.02	17.38
BSH	Bare shingle	2.71	0.27	5.09	4.00	12.85
CMTY	Graveyard	0.20		0.62		0.91
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire			0.04		0.04
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	2.77		1.18		4.73
M28x/S28	M28x/S28 intermediate	0.21				0.21
M28x/S4	M28x/S4 intermediate			0.24		0.24
MG1	MG1 *Arrhenatherum elatius* coarse grassland	0.05		1.99	0.04	2.09
MG7	MG7 *Lolium perenne* leys	94.03	2.15	169.77	53.41	388.20
MG7/ MG11	MG7/MG11 intermediate	7.17		0.28		10.58
MG7/SD8	MG7/SD8 intermediate	3.31		1.01		5.13
MG9/ MG11	MG9/MG11 intermediate	3.69				4.54
MG10	MG10 *Holcus lanatus - Juncus effusus* rush pasture					4.34
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	2.11	0.02	1.46		4.35
MG11/ MG13	MG11/MG13 intermediate					2.16
MG11/ SD8	MG11/SD8 intermediate	0.61				0.61
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.04				3.14
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)					1.82
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)			1.85		1.85
MxTm/ M28x	MxTm/M28x intermediate			0.12		0.12
OW	Open water					0.70
PIT	Active sand pit or rock quarry	0.29		0.31		0.59
ROAD	Road and track	4.32	0.46	16.87	1.53	28.11
RUD	Ruderal-dominated vegetation	2.15	0.73	2.92	0.76	7.02
S10	S10 *Equisetum fluviatile* swamp					0.42
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community					1.00
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community	0.60				1.13
S28	S28 *Phalaris arundinacea* fen					0.07

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 60 - 63

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	60 Mae Sand	61 Bay of Noup	62 The Links, Grobust and Pierowall	63 Bay of Skaill	All Westray sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline				0.01	0.01
SD2/SD3	SD2/SD3 intermediate					0.03
SD2/SD4	SD2/SD4 intermediate	0.25				0.25
SD4/SD8c	SD4/SD8c intermediate	0.02		0.37		0.39
SD5/ SM28	SD5/SM28 intermediate			0.50	0.43	2.93
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community					0.15
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community			0.05	1.06	2.29
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community	0.15				0.15
SD6ae	SD6a/e intermediate	0.45				0.45
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community			0.16		0.16
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community	0.38				0.38
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	1.20	1.07	22.97	2.28	29.15
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community	9.17		16.37	0.17	25.71
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	20.17		14.36		34.52
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community	4.64				4.64
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW		0.24			0.24
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)			3.15		4.55
SD10	SD10 *Carex arenaria* dune community			0.19		0.19
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community	1.35				1.40
SDx	SDx *Potentilla anserina* strandline community (PROVISIONAL NEW NVC TYPE)	0.48				0.48
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.15			0.23	0.84
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)					0.05
SM16	SM16 *Festuca rubra* saltmarsh				0.25	0.25
SM28	SM28 *Elymus repens* saltmarsh			0.15		0.15
TIP	Rubbish tip			0.06		0.06
U5d	U5 *Nardus stricta - Galium saxatile* grassland, *Calluna vulgaris - Danthonia decumbens* sub-community					0.28
TOTALS (ha)		170.67	7.52	301.93	67.99	659.99

Table 3c Vegetation and other land cover (areas in ha)

Sites 64 - 65

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	64 Bay of Brough	65 Bay of Swartmill	All Westray sites
AP	Arable - potatoes			2.27
ARB	Arable - barley	1.31		11.62
BBG	Buildings, bare ground and gardens	0.21	0.53	19.76
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	1.00	0.31	6.81
BMC	Maritime cliff with little vegetation		0.63	5.49
BS	Bare sand (within vegetated sand zone)			17.38
BSH	Bare shingle	0.06		12.85
CMTY	Graveyard			0.91
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire			0.04
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)		0.14	4.73
M28x/S28	M28x/S28 intermediate			0.21
M28x/S4	M28x/S4 intermediate			0.24
MG1	MG1 *Arrhenatherum elatius* coarse grassland			2.09
MG7	MG7 *Lolium perenne* leys	3.07	9.02	388.20
MG7/ MG11	MG7/MG11 intermediate		0.87	10.58
MG7/SD8	MG7/SD8 intermediate			5.13
MG9/ MG11	MG9/MG11 intermediate		0.85	4.54
MG10	MG10 *Holcus lanatus - Juncus effusus* rush pasture			4.34
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland		0.62	4.35
MG11/ MG13	MG11/MG13 intermediate		2.07	2.16
MG11/ SD8	MG11/SD8 intermediate			0.61
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.30	0.76	3.14
MxPp	MxPp *Carex nigra - Potentilla palustris* mire (PROVISIONAL NEW NVC TYPE)			1.82
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)			1.85
MxTm/ M28x	MxTm/M28x intermediate			0.12
OW	Open water		0.67	0.70
PIT	Active sand pit or rock quarry			0.59
ROAD	Road and track		1.63	28.11
RUD	Ruderal-dominated vegetation	0.13	0.15	7.02
S10	S10 *Equisetum fluviatile* swamp			0.42
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community		1.00	1.00
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		0.51	1.13
S28	S28 *Phalaris arundinacea* fen			0.07

Table 3c (continued) Vegetation and other land cover (areas in ha)

Sites 64 - 65

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	64 Bay of Brough	65 Bay of Swartmill	All Westray sites
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline			0.01
SD2/SD3	SD2/SD3 intermediate			0.03
SD2/SD4	SD2/SD4 intermediate			0.25
SD4/SD8c	SD4/SD8c intermediate			0.39
SD5/ SM28	SD5/SM28 intermediate	1.19		2.93
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community			0.15
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.05	2.29
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community			0.15
SD6ae	SD6a/e intermediate			0.45
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community			0.16
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community			0.38
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	1.15		29.15
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community			25.71
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community			34.52
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community			4.64
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW			0.24
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)			4.55
SD10	SD10 *Carex arenaria* dune community			0.19
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community		0.05	1.40
SDx	SDx *Potentilla anserina* strandline community (PROVISIONAL NEW NVC TYPE)			0.48
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.04	0.84
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)		0.05	0.05
SM16	SM16 *Festuca rubra* saltmarsh			0.25
SM28	SM28 *Elymus repens* saltmarsh			0.15
TIP	Rubbish tip			0.06
U5d	U5 *Nardus stricta - Galium saxatile* grassland, *Calluna vulgaris - Danthonia decumbens* sub-community			0.28
TOTALS (ha)		8.40	19.96	659.99

Annex 1 Target Notes

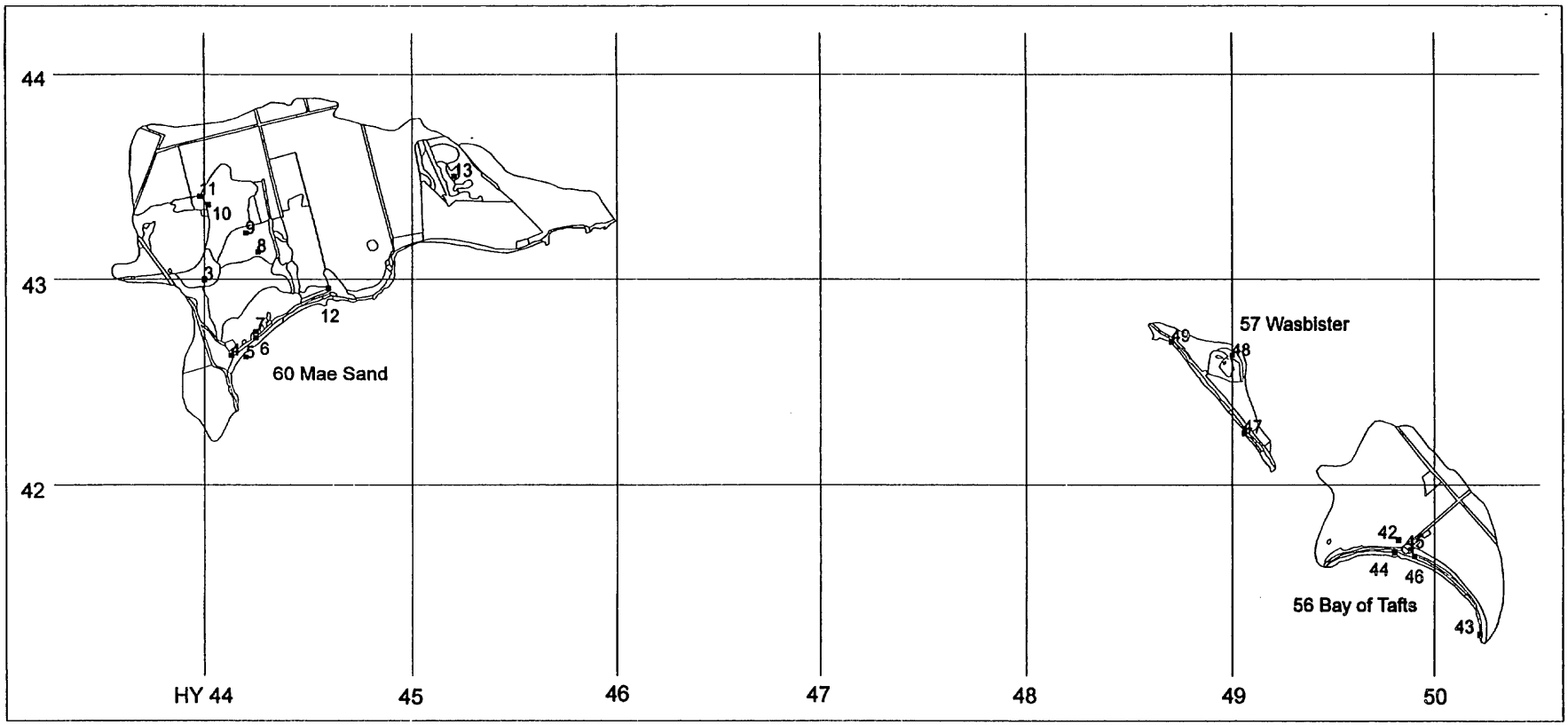
Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY41334900	61 Bay of Noup	Sand below steep slab boulder storm beach. Dunes behind storm beach rise steeply to 5 m height, ridge broken by one temporary stream and three stabilised blowouts. Stock have access to dunes - dune scarp front largely bared by trampling and rabbits. Thick *Urtica dioica* cover in centre of dune front and in large patches elsewhere. Rubble dumped onto shingle.
2	HY41184894	61 Bay of Noup	Animal bedding dumped onto bare sand scar on steep 30 degree slope - thick *Urtica dioica* growth.
3	HY44004300	60 Mae Sand	SD8d dune slopes infested with rabbit burrows - very high area of bare sand and ruderals, especially *Urtica dioica*.
4	HY44134263	60 Mae Sand	Sand pit with 40 m long face up to 3 m high, probably developed in floor of blowout, part of a complex for the site. Large pile of shingle on pit edge, probably taken from beach.
5	HY44204262	60 Mae Sand	Beach with thin sand over shingle. Steep front to shingle, with SD2/SD4 (*Honkenya peploides*) developed behind shingle crest.
6	HY44254272	60 Mae Sand	Low (0.5-1 m) dune with 50% cover of SD2/SD4 plus patches of *Achillea millefolium* and *Potentilla anserina*. An embryo dune formed in floor of blowout.
7	HY44254275	60 Mae Sand	Fixed dunes largely lost to wind erosion. Upstanding linear mesa dunes up to 3 m high are capped with SD8c vegetation. Rabbit burrows and past stock trampling have created great lengths of turf slumping. Wide blowout floors present with patches of shingle exposed. Much cattle dung in floor. Soft aeolinite present up to 1 m thick. There are fragments of SD6 dunes left in patches on the coastal edge of the deflation complex.
8	HY44264313	60 Mae Sand	Extensive damp machair plain with SD8e turf containing scattered *Parnassia palustris* and many spikes of *Carex maritima*. Profuse scattering of cattle dung - probably spread - should be discouraged.
9	HY44204322	60 Mae Sand	Abrupt change in sward quality at fence. Good SD8e to south, poor SD8e/MG11 to north.
10	HY44024336	60 Mae Sand	50 m square sandpit with screening machine. Sand face up to 2.5 m high exploited.
11	HY43984340	60 Mae Sand	Area infested with rabbit burrows. Plants acting as ruderals have extensive cover including *Senecio jacobaea, Centaurea nigra, Plantago lanceolata, Primula vulgaris, Ranunculus repens, Stellaria media*. All are close to sand excavated from burrows.
12	HY44604296	60 Mae Sand	Large pile of shingle extracted from beach (150 cu. m).
13	HY45204350	60 Mae Sand	Probable former area of SD17 slack and Mx *Carex nigra* poor fen. Drained and lightly grazed, still has much interest. SD17b patchily common with S19c in wettest area, with much *Equisetum fluviatile* (probably remnant of former S10 swamp).

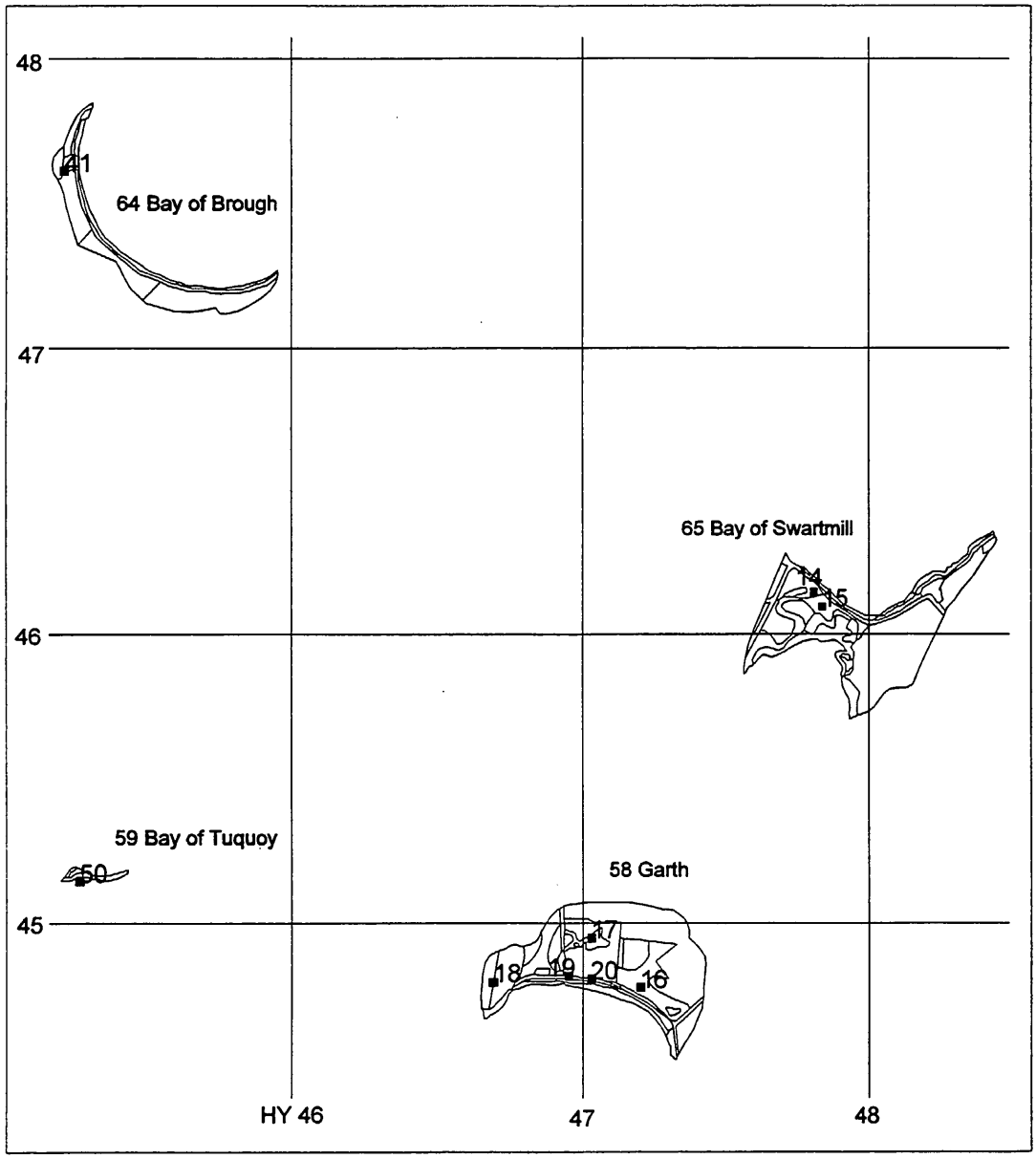
#	Grid Ref.	Site	Target Note Detail
14	HY47804665	65 Bay of Swartmill	Beach of thin sand over shingle with SDy *Atriplex glabriuscula - A. prostrata* strand and very narrow SD5c with *Elymus repens* between strand and road. Road protected by rock-filled gabions.
15	HY47834610	65 Bay of Swartmill	*Potentilla palustris* present in S19c vegetation with *Hippuris vulgaris*.
16	HY47204478	58 Garth	Bay dune system with shingle upper beach at east end, thin sand over shingle for remainder. SDy strand at east end. No strand on sand section. Very narrow band of SD5 dunes, halting at fence. Sand foredune might have been artificially raised in height to provide shelter - abruptly cliffed on inner side along track.
17	HY47034495	58 Garth	Loch of Garth. Good zonation from damp MG10 to wet MG13, then to S19c swamp occupying most of loch. Large numbers of snipe present. *Filipendula ulmaria* present in MG10 at western end beside fence. Ditch prevents much grazing.
18	HY46704580	58 Garth	Fine example of acidic MxPp *Carex nigra - Potentilla palustris* poor fen, receiving drainage from upslope. Further north sand ends abruptly in U5d.
19	HY46954482	58 Garth	Drain carried through shingle and foredune ridge in concrete channel, blocked by blown sand and seaweed.
20	HY47034481	58 Garth	SD5b foredunes cliffed 1-4 m in height, turf collapse down to steep shingle beach. Much rabbit grazing, with *Elymus farctus* as preferred species.
21	HY45055075	63 Bay of Skaill	Southern shore of Bay of Skaill. Strand of tall *Leymus arenarius* with much *Atriplex glabriuscula, Sonchus arvensis, Elymus repens*. Probably receives much seaweed. Further east scour removes much of this vegetation and 1 m cliffed dunes are present.
22	HY45045109	63 Bay of Skaill	Shore fronted by 5-8 m wide SM16 saltmarsh, but sand present in sections behind this. SD5/SM28 present as narrow line between saltmarsh and fence. All fields are improved (MG7).
23	HY45255115	63 Bay of Skaill	Dump of old agricultural machines scattered on shingle beach.
24	HY45415100	63 Bay of Skaill	Neck of Ayre of the Ouse is entirely shingle with scattered *Atriplex glabriuscula* and *Atriplex prostrata*. Southern sectors have 30 cm - 1 m of blown sand. Many rabbit burrows in SD8c turf - profuse growth of *Silene dioica* as ruderal on rabbit disturbed ground.
25	HY45535120	63 Bay of Skaill	Dunes cliffed 1-2 m above steep shingle beach. Fence is collapsing in places.
26	HY45555124	63 Bay of Skaill	Severe cliff erosion, with 6 m high vertical faces with no vegetation (50 m stretch).
27	HY45555135	63 Bay of Skaill	Recent excavation of shingle and sand from beach. Vehicle tracks and disturbed ground for 40 m stretch of beach.
28	HY44245016	62 Pierowall to Grobust and The Links	Very steep shingle beach, no strand vegetation. Rear slope to shingle has many tangle platforms, with clusters of ruderals (*Urtica dioica, Sonchus arvensis, Cirsium vulgare*) marking old dumps of wrack.

#	Grid Ref.	Site	Target Note Detail
29	HY44245006	62 Pierowall to Grobust and The Links	Dump of old cars, metal and rubble - much ruderal cover.
30	HY43904990	62 Pierowall to Grobust and The Links	Rank SD8a broken into blocks by dense reticulate network of SD8a grass tracks with patches of *Bellis perennis*. Probably serve as access to tangle platforms.
31	HY43434982	62 Pierowall to Grobust and The Links	Scattered dumped cars. One patch of shingle (1 cu. m) extracted from beach.
32	HY43304966	62 Pierowall to Grobust and The Links	Heavy stock and rabbit grazing producing SD8c and SD8d swards. Stock access to exposed beach has prevented any foredune formation, allowing much sand blow onto adjacent dune grassland to form SD8c.
33	HY43294957	62 Pierowall to Grobust and The Links	Severe wind erosion of fixed dunes. Most of SD8 turf gone, leaving relict mesa dunes, large areas of bare sand and upstanding rubble mounds (probably dumped).The area is possibly a former sand pit exploited by wind once the coastal edge was destroyed. Sand now blown well to rear of main bared area and this, combined with rabbit grazing has produced a SD8c sward with 10% cover of *Cirsium arvense* and *Urtica dioica*. The area is very unsightly.
34	HY43304945	62 Pierowall to Grobust and The Links	Golf course. No mown fairways. Stock is excluded from each hole by barbed wire rectangle with concrete corner and additional wooden posts. Only hole areas are mown. Minimal impact on site ecology.
35	HY43184930	62 Pierowall to Grobust and The Links	Part stabilised long linear blowout with much rabbit burrowing, stock trampling and turf slumping. Dead stock buried in sides.
36	HY43204933	62 Pierowall to Grobust and The Links	Stream runs through floor of blowout. Very narrow zone of MG11 on side with margins having *Veronica anagallis-aquatica* and *Catabrosa aquatica* (nationally scarce).
37	HY43094929	62 Pierowall to Grobust and The Links	Major change in state of erosion at fence boundary. To east the ground is pitted with 20% cover of shallow 2-5 m diameter saucer shaped blowouts, all with rabbit burrows in sides. Turf is entirely SD8c apart from large clusters of ruderals. To west the situation is much worse. Seems to have been overstocked, reducing sward to <10% cover with irregular bare sand hummocks resulting from coalescing blowouts. Very poor management over whole of the area.
38	HY43034925	62 Pierowall to Grobust and The Links	Attempt at management using small mesh netting to exclude rabbits - only a partial success because mesh acts as sand trap and rabbits can jump the fence. Good areas of SD10a *Carex arenaria* dune established (Q14). Close to burrows the *Carex arenaria* is heavily grazed.
39	HY42904940	62 Pierowall to Grobust and The Links	Adjacent to beach there are signs of management attempts to stabilise sand. Plastic hose pipes are present and a SD8c turf rich in *Honkenya peploides* is present. Might have been watered to establish cover. One small area has a lot of plastic - possibly a buried dump.
40	HY43014887	62 Pierowall to Grobust and The Links	Sand pit, actively excavated, 100 m face, 1.5-2 m sand thickness exploited.

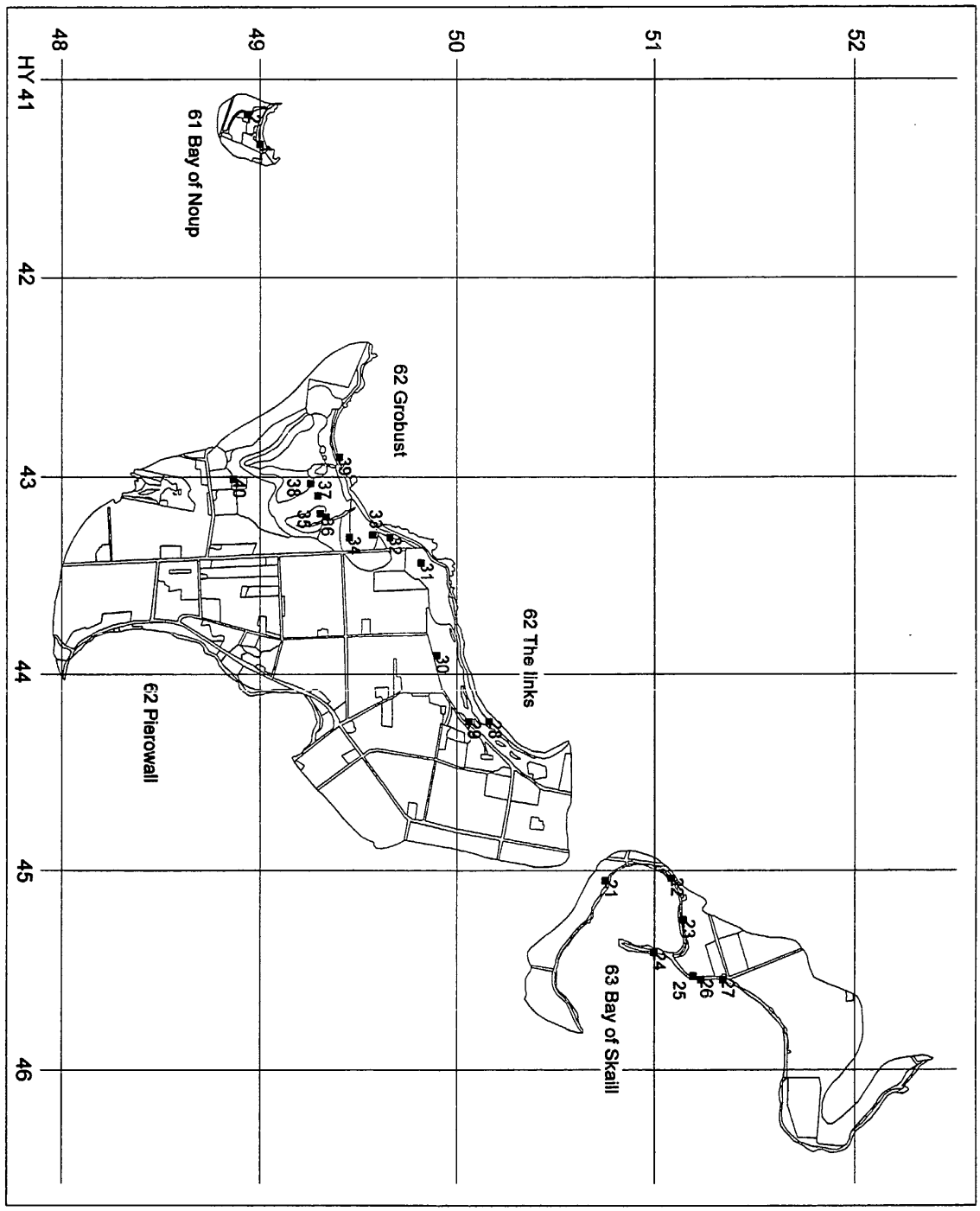
#	Grid Ref.	Site	Target Note Detail
41	HY45234761	64 Bay of Brough	Stone wall built in front of buildings to protect them from erosion. Destroyed parts suggest a retreat of 3 m at western end.
42	HY49824173	56 Bay of Tafts	Gently sloping, relatively sheltered sandy beach. Scattered individuals of *Cakile maritima* in front of SD5/SDy strand at east end and with (10 m) SDy/SD2 *Atriplex glabriuscula* - *Honkenya peploides* strand in centre of bay. Narrow SD5c zone, with upper parts of foredune SD8a.
43	HY50224128	56 Bay of Tafts	Eastern side of bay much more exposed. Sand stripped from upper beach to expose shingle, with till cliffs rising to 4 m.
44	HY49804167	56 Bay of Tafts	Drain cuts through foredune ridge. Nationally scarce *Catabrosa aquatica* present on damp ground in strand zone. Rubble dumped at foot of foredune in attempt to stop winter cliffing.
45	HY49884168	56 Bay of Tafts	*Petasites hybridus* present in weedy ground by side of track. No sign of it spreading rapidly.
46	HY49904165	56 Bay of Tafts	Tussocky SD8a with high sand and seaweed input - much *Sonchus arvensis* and *Heracleum sphondylium*. Old tangle platforms largely buried by sand - suggesting steady retreat of dune edge, with sand thrown inland, raising dune height.
47	HY49064225	57 Wasbister	Very steep shingle beach capped with small amount of blown sand.
48	HY49004263	57 Wasbister	Wet depression partly influenced by grazing on edges (to MG13 inundation grassland). Centre has extensive S10 *Equisetum fluviatile* swamp with scattered *Hippuris vulgaris*. There are patches of S28 *Phalaris arundinacea* swamp. Several snipe disturbed. The MG13 would probably convert to MxTm poor fen if grazing was relaxed temporarily.
49	HY48704270	57 Wasbister	Gently sloping sandy beach with cliffed SDy strand in front of SD5/SM28 dune front. Fence marks boundary of dune vegetation - MG7 to east.
50	HY45284514	59 Bay of Tuquoy	Shingle spit has developed across head of bay, with a small stretch of sand at its western end, with an SDy strand and a narrow band of SD5c dune vegetation.



Map 3a Target note positions: Bay of Tafts, Wasbister and Mae Sand (Westray)



Map 3b Target note positions: Garth, Bay of Tuquoy, Bay of Brough and Bay of Swartmill (Westray)



Map 3c Target note positions: Bay of Noup, Pierowall to Grobust and The Links, and Bay of Skaill (Westray)

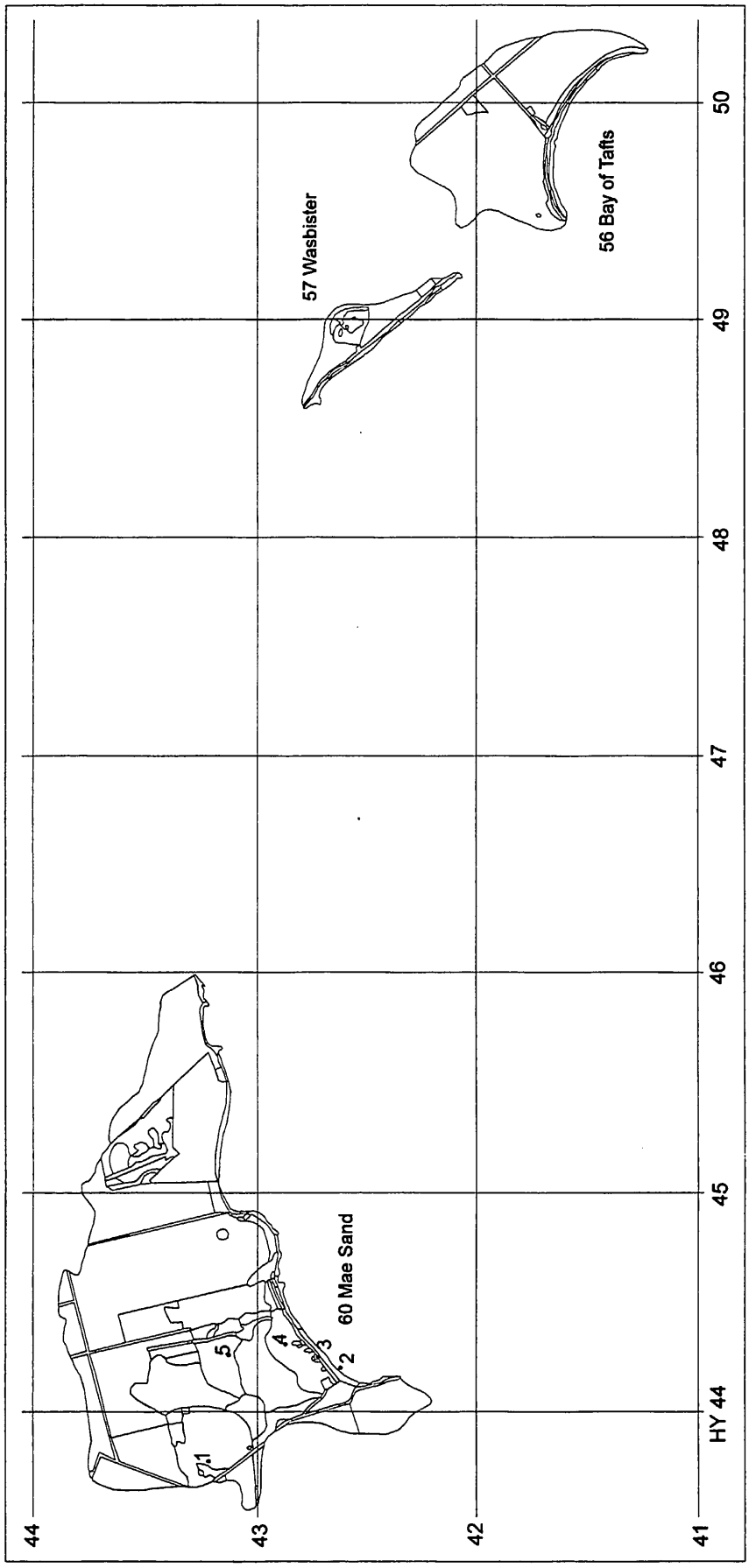
Annex 2 Quadrat Data

Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

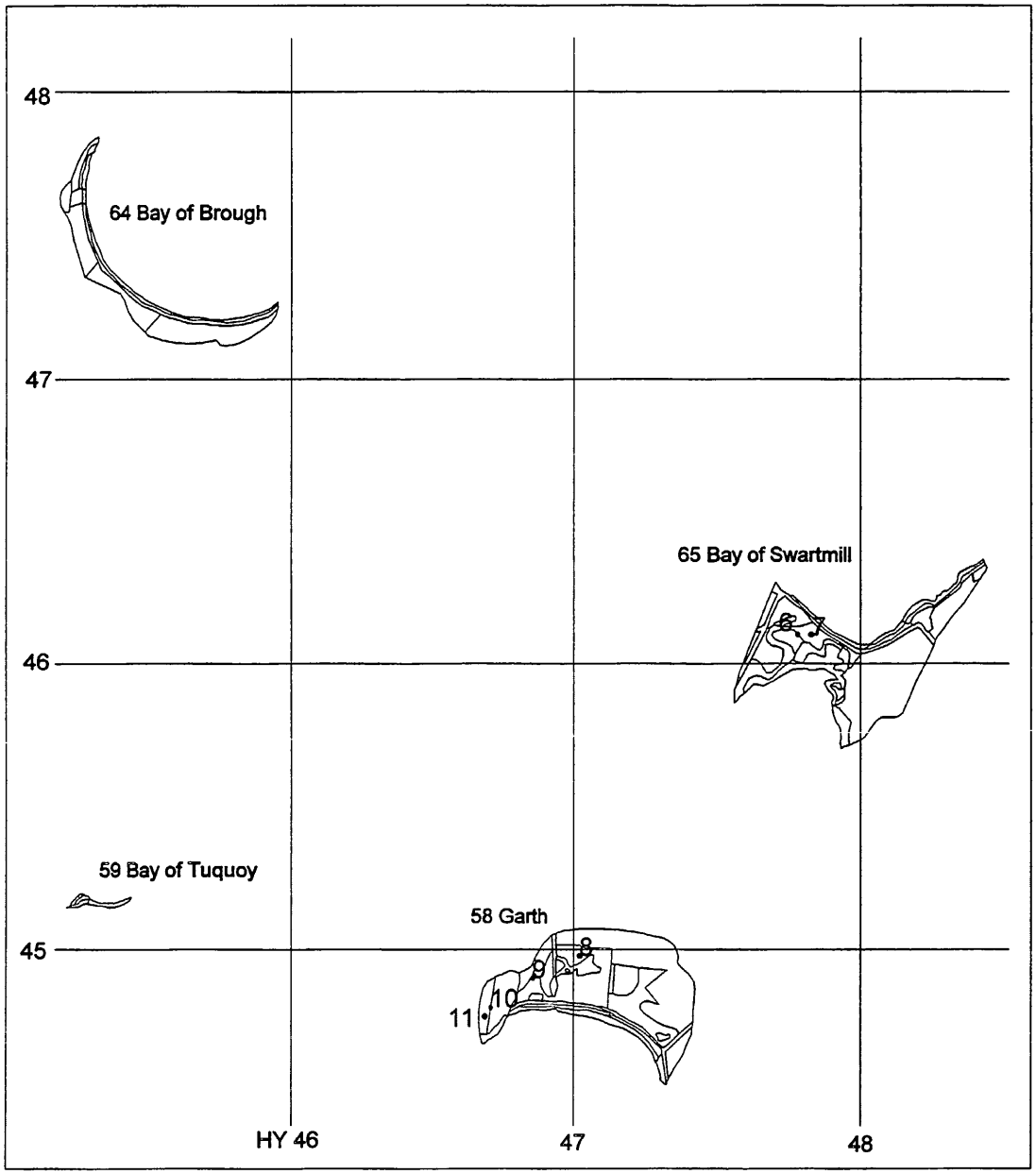
	Quadrat number	2	3	4	1	5	13	14	12	8	6	9	10	15	11	7
	NVC type	SD2/SD4	SD2/SD4	SD 8c	SD 8d	SD 8e	SD 8x	SD 10a	SD5/SM28	MG 10	MG 13	Mx Pp	Mx Pp	Mx Tm	U4	S 19c
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	442	442	443	437	442	442	430	450	470	477	468	467	431	466	478
3	Grid reference northing	426	427	428	432	431	500	492	507	449	461	449	458	485	457	461
11	Herb height, centimetres	3	4	15	12	4	50	12	100	15	20	30	35	30	8	40
12	Moss height, centimetres	-	-	2	-	2	-	-	-	-	-	2	5	2	3	-
15	Herb cover, %	10	60	20	100	100	100	90	100	100	100	100	90	100	100	100
16	Moss cover, %	-	-	60	-	10	-	-	-	-	-	80	90	15	5	-
22	Bare soil/litter (incl.sand)	80	40	20	-	-	-	10	-	-	-	-	-	-	-	-
104	Achillea millefolium	-	-	2	2	-	-	2	-	-	-	-	-	-	-	-
116	Elymus farctus boreali-atlanti	4	5	2	-	-	2	-	-	-	-	-	-	-	-	-
118	Elymus repens	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
122	Agrostis stolonifera	-	-	-	-	4	5	-	4	7	7	4	4	5	5	5
123	Agrostis capillaris	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
156	Alopecurus geniculatus	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-
171	Anthoxanthum odoratum	-	-	-	-	-	-	-	-	2	-	-	-	2	5	-
216	Atriplex glabriuscula	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
230	Bellis perennis	-	-	3	4	5	-	-	-	-	-	-	-	-	-	-
279	Caltha palustris	-	-	-	-	-	-	-	-	-	-	4	3	4	-	-
295	Cardamine pratensis	-	-	-	-	-	-	-	-	-	-	-	2	3	-	-
304	Carex arenaria	-	-	2	-	-	5	7	-	-	-	-	-	-	-	-
323	Carex flacca	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
331	Carex maritima	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
333	Carex nigra	-	-	-	-	2	-	-	-	-	-	5	5	4	-	-
371	Centaurea nigra	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-
383	Cerastium glomeratum	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
384	Cerastium fontanum triviale	-	-	-	2	-	-	-	-	-	-	-	-	2	-	-
419	Cirsium vulgare	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-
509	Eleocharis palustris	-	-	-	-	-	-	-	-	-	3	-	-	-	-	4
513	Leymus arenarius	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-
525	Epilobium palustre	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
532	Equisetum arvense	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
535	Equisetum palustre	-	-	-	-	3	-	-	-	-	-	3	-	4	-	-
546	Eriophorum angustifolium	-	-	-	-	-	-	-	-	-	-	3	4	2	-	-
568	Euphrasia officinalis agg	-	-	4	-	-	-	-	-	-	-	-	-	-	2	-
576	Festuca rubra	-	3	4	5	5	7	4	4	-	-	-	-	5	-	-
578	Festuca vivipara	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
605	Galium aparine	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-
609	Galium palustre	-	-	-	-	-	-	-	-	-	-	3	4	-	-	-
613	Galium verum	-	-	2	3	2	3	-	-	-	-	-	-	-	-	-
679	Hippuris vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
680	Holcus lanatus	-	-	-	5	3	-	-	-	7	-	4	2	4	6	-
682	Honkenya peploides	4	5	-	-	-	-	-	-	-	-	-	-	-	-	-
690	Hydrocotyle vulgaris	-	-	-	-	-	-	-	-	2	-	4	4	-	-	-
722	Juncus articulatus	-	-	-	-	3	-	-	-	-	-	3	3	-	-	-
730	Juncus effusus	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
758	Lathyrus pratensis	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
768	Leontodon autumnalis	-	-	-	-	2	-	-	-	1	-	2	-	-	2	-
800	Lotus corniculatus	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
809	Luzula multiflora	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
813	Lychnis flos-cuculi	-	-	-	-	-	-	-	-	-	-	2	4	4	-	-
855	Mentha aquatica	-	-	-	-	-	-	-	-	-	-	2	-	2	-	6
876	Molinia caerulea	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
890	Myosotis secunda	-	-	-	-	-	-	-	-	-	-	-	2	-	-	5
900	Nardus stricta	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
944	Parnassia palustris	-	-	-	-	3	-	-	-	-	-	4	-	-	-	-
973	Plantago lanceolata	-	-	4	4	-	-	6	-	-	-	-	-	-	-	-
988	Poa pratensis	-	-	-	4	4	3	-	-	-	-	-	-	2	-	-
990	Poa trivialis	-	-	-	-	-	-	-	-	-	4	-	-	-	-	3
1043	Potentilla anserina	-	5	-	-	4	-	-	-	3	-	2	-	2	-	-
1046	Potentilla erecta	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
1049	Potentilla palustris	-	-	-	-	-	-	-	-	-	-	3	6	-	-	5
1059	Prunella vulgaris	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-

Annex 2 Quadrat Data (continued)

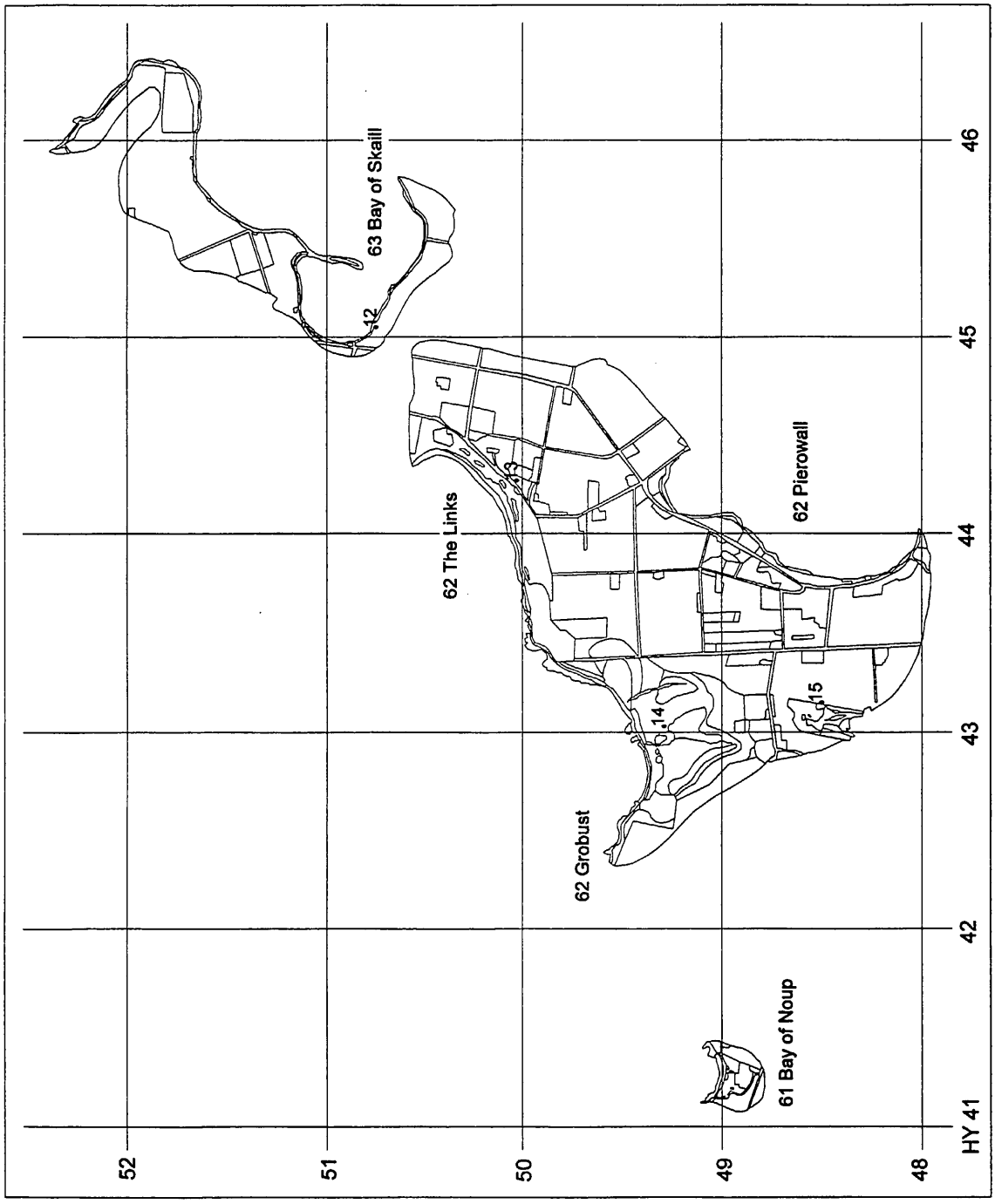
	Quadrat number	2	3	4	1	5	13	14	12	8	6	9	10	15	11	7
	NVC type	SD2/ SD4	SD2/ SD4	SD 8c	SD 8d	SD 8e	SD 8x	SD 10a	SD5/ SM28	MG 10	MG 13	Mx Pp	Mx Pp	Mx Tm	U4	S 19c
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	442	442	443	437	442	442	430	450	470	477	468	467	431	466	478
3	Grid reference northing	426	427	428	432	431	500	492	507	449	461	449	458	485	457	461
11	Herb height, centimetres	3	4	15	12	4	50	12	100	15	20	30	35	30	8	40
12	Moss height, centimetres	-	-	2	-	2	-	-	-	-	-	2	5	2	3	-
15	Herb cover, %	10	60	20	100	100	100	90	100	100	100	100	90	100	100	100
16	Moss cover, %	-	-	60	-	10	-	-	-	-	-	80	90	15	5	-
22	Bare soil/litter (incl.sand)	80	40	20	-	-	-	10	-	-	-	-	-	-	-	-
1081	Ranunculus acris	-	-	-	5	5	-	-	-	-	-	-	-	4	-	-
1086	Ranunculus bulbosus	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
1089	Ranunculus flammula	-	-	-	-	-	-	-	-	2	-	4	2	-	-	3
1095	Ranunculus repens	-	-	-	-	-	-	2	-	3	-	5	-	2	-	-
1106	Rhinanthus minor	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
1139	Rumex acetosa	-	-	-	-	-	-	-	-	2	-	-	-	-	4	-
1143	Rumex crispus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
1156	Sagina nodosa	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
1236	Senecio aquaticus	-	-	-	-	-	-	-	-	-	-	4	-	2	-	2
1239	Senecio jacobaea	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-
1271	Sonchus arvensis	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-
1350	Trifolium repens	-	2	2	5	5	-	-	-	-	-	4	-	4	4	-
1353	Triglochin maritima	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
1354	Triglochin palustris	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
1355	Matricaria maritima	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
1368	Urtica dioica	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
1444	Calliergon cordifolium	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-
1445	Calliergon cuspidatum	-	-	-	-	4	-	-	-	-	-	9	5	4	-	-
1510	Brachythecium albicans	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
1562	Homalothecium lutescens	-	-	4	-	2	-	-	-	-	-	-	-	3	-	-
1801	Rhizomnium punctatum	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
1807	Plagiomnium undulatum	-	-	-	-	-	-	-	-	-	-	-	-	4	4	-
2023	Tortula ruralis ssp ruraliform	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-
2167	Lophocolea bidentata	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
2256	Aneura pinguis	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	Number of species per sample	2	5	15	10	22	9	6	9	10	4	23	16	26	14	10



Map 4a Quadrat positions: Bay of Tafts, Wasbister and Mae Sand (Westray)



Map 4b Quadrat positions: Garth, Bay of Tuquoy, Bay of Brough and Bay of Swartmill (Westray)



Map 4c Quadrat positions: Bay of Noup, Pierowall to Grobust and The Links, and Bay of Skaill (Westray)

66-69 PAPA WESTRAY

Location and conservation status

Four areas of windblown sand are present:

66	West Coast	HY486520
67	North Wick to Mayback	HY497530
68	South Wick	HY498516
69	Bay of Moclett	HY491499

The locations of site assemblages are given in Map 1.

No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974)

Survey details

Date	September 1996
Target notes	11 (Annex 1)
Quadrats	6 (Annex 2) - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

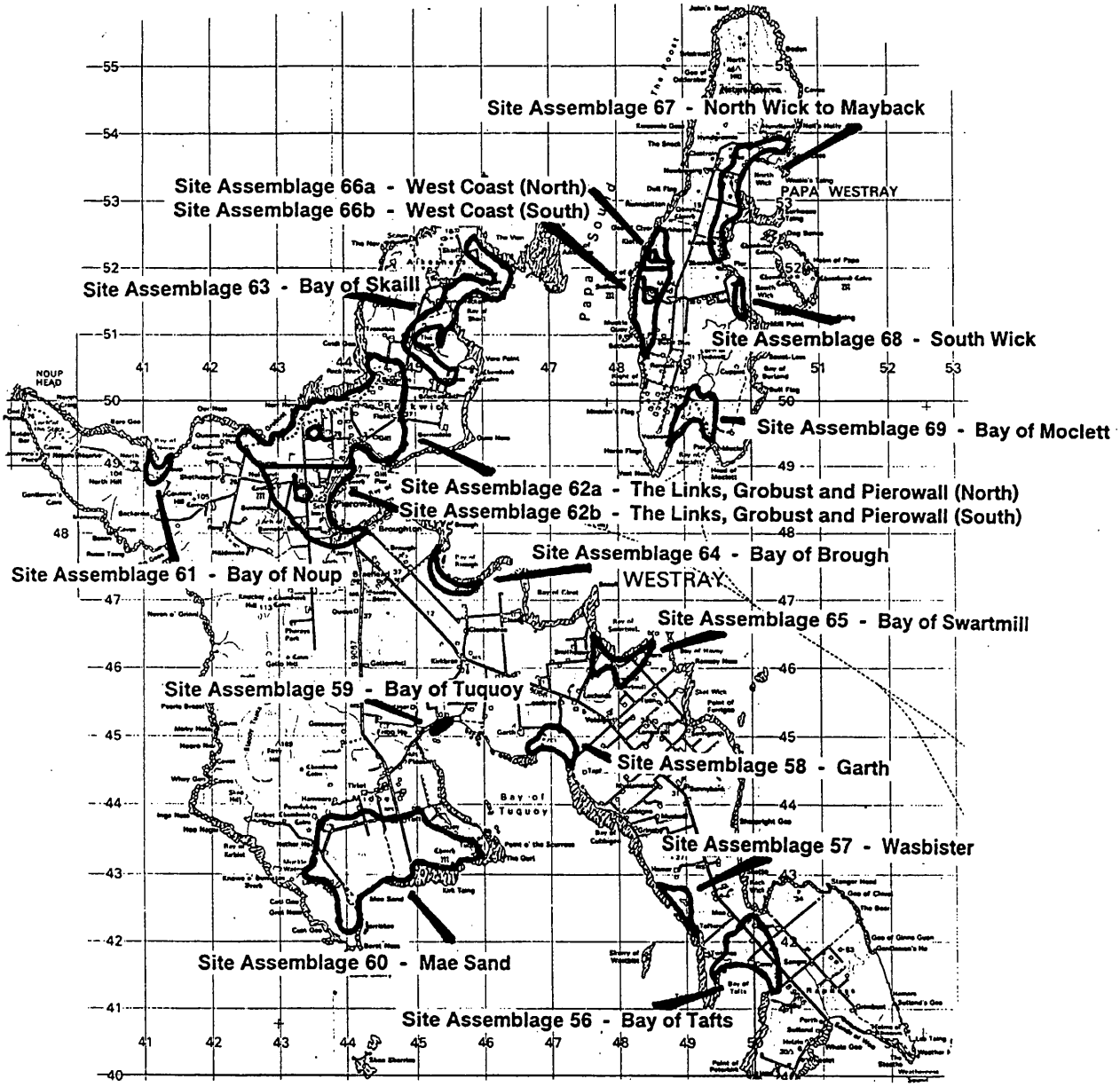
Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

The total extent of windblown sand on Papa Westray is 126.7 ha (excluding beach), most of it vegetated (118.7 ha). The remaining area comprises bare sand (0.1 ha), arable/fallow ground (0.2 ha) and land take for roads, buildings, sand pits, etc. (6.5 ha).

Dune habitats (Table 2, Map 2)

The total surveyed area for Papa Westray is 134.9 ha. The island lacks acidic dune grassland, dry dune heath and wet dune heath (all restricted to Hoy and Eday) like most islands in Orkney but, in addition, there is very little mobile dune (0.9 ha) and no semi-fixed dune. The very low extent and absence of the latter two categories suggests very poor sand supply. Fixed calcareous dune grassland is also low (4.7 ha) but there is a moderate extent of dune wetland (slack/wet grassland 28.8 ha; mire and swamp 2.3 ha). Improved grassland dominates habitat extent (83.0 ha) and there is a small amount of arable/fallow ground (0.2 ha).



Map 1 Site assemblage location,
(Map includes sites on Westray)
See Volume 3 for NVC maps

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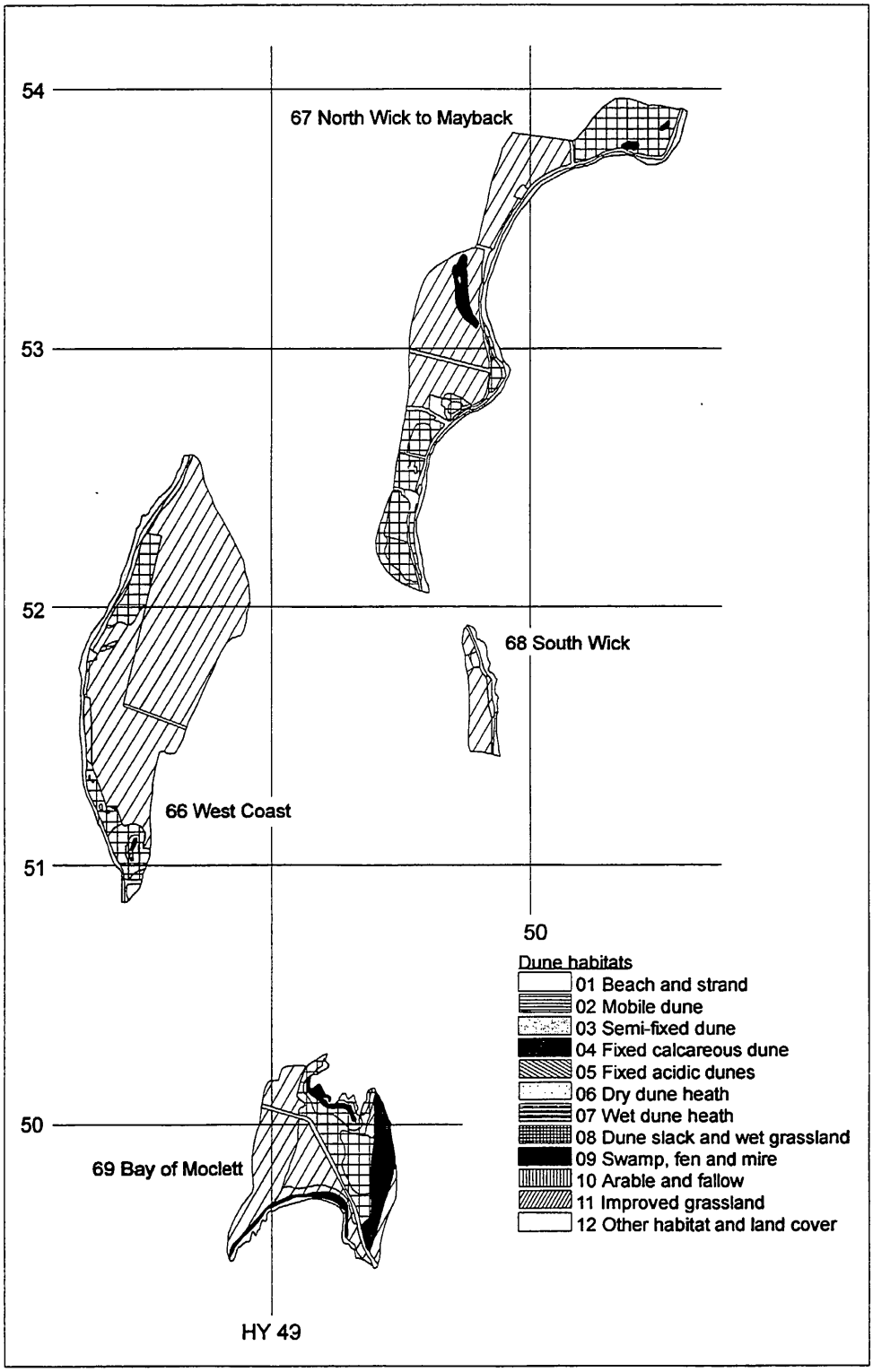
Table 1 Broad land cover extents (ha)

	66 West Coast	67 North Wick to Mayback	68 South Wick	69 Bay of Moclett	All Papa Westray sites
Windblown sand land cover					
Beach above MHWS	2.42	3.38	0.92	0.33	7.05
Bare sand			0.08	0.05	0.13
Vegetated sand (except fallows)	51.97	37.35	3.44	27.07	119.82
Arable and fallow			0.18		0.18
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.59	4.74	0.12	1.07	6.52
Total windblown sand excluding beach zone	52.56	42.09	3.82	28.19	126.65
Total windblown sand extent above MHWS	54.98	45.46	4.74	28.52	133.7
Surveyed but not on blown sand					
Bare rock					
Unvegetated maritime cliff	0.51			0.66	1.17
Saltmarsh					
Open water	0.02	0.03			0.04

Table 2 Extents (ha) of dune habitats and other ground

	66 West Coast	67 North Wick to Mayback	68 South Wick	69 Bay of Moclett	All Papa Westray sites
Habitat 1 - Beach and strand	2.94	3.51	1.13	0.37	7.95
Habitat 2 - Mobile dune		0.92			0.92
Habitat 3 - Semi-fixed dune					
Habitat 4 - Fixed dry calcareous dune				4.65	4.65
Habitat 5 - Fixed acidic grassland					
Habitat 6 - Dry dune heath					
Habitat 7 - Wet dune heath					
Habitat 8 - Dune slack and wet grassland	6.37	14.84		7.53	28.75
Habitat 9 - Mire and swamp	0.13	1.53		0.64	2.30
Habitat 10 - Arable and fallow			0.18		0.18
Habitat 11 - Improved grassland	45.46	19.95	3.31	14.26	82.97
Habitat 12 - Other habitats	0.60	4.73	0.12	1.73	7.19
TOTALS (ha)	55.50	45.49	4.74	29.18	134.91



Map 2 Dune habitats of West Coast, North Wick to Mayback, South Wick, and Bay of Moclett (Papa Westray)

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

As indicated by dune habitat results, Papa Westray is dominated by MG7 *Lolium perenne* improved grassland (76.7 ha plus MG7/MG11 and MG7/SD8 intermediates). Of 23 mapped vegetation types, 12 are typical of damp or wet conditions, with MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland (7.8 ha) and an MG9 *Holcus lanatus - Deschampsia cespitosa* - MG11 intermediate (9.8 ha) having the highest covers.

Site descriptions

66 West Coast

This moderate-sized (52.6 ha) climbing dune site is located on the west coast of Papa Westray, due west of the settlement at Holland and close to a grass strip airfield. It is exposed to a short 2 km fetch west to Westray and also to a very long NNW fetch into the Arctic Ocean. The source of sand for the climbing dune system has disappeared and the coastal fringe is cliffed flagstone bedrock and shingle, but coastal sections show a sand thickness of 0.5 - 1 m over head deposits. Most of the site interior is MG7 improved grassland but seepage zones at the base of hillslopes creates dune wetland in the north (MG9/MG11 inundation grassland intermediate) and south of the site. The latter area is particularly diverse, with open water, S19 swamp, MG13 inundation grassland and extensive *Iris pseudacorus* beds present within a wider area containing the MG9/MG11 intermediate. *Ranunculus baudotii* is present in this area, as is a form of MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland with the Red Data Book species *Rorippa islandica* on patches of bare sandy mud. Overall nature conservation is only moderate due to the scale of improvement but the restricted areas of wetland are good quality and provide strong local interest. Breeding waders are also likely to use the wetland sectors.

67 North Wick to Mayback

This moderate-sized (42.1 ha) bay and climbing dune system stretches over 2 km along the central eastern coast of Papa Westray. The southern (Mayback) sector is partly sheltered by the offshore island of Holm of Papa but most of the coast is exposed to a 25 km fetch ESE to Sanday. The northern beach has 0.5 m cliffed dune edges above a shingle beach, suggesting slow coastal retreat. Much of the centre of the site is improved but MG9/MG11 intermediate wet grassland is extensive in the north on climbing dune with poor drainage and a good variety of wet grassland and M28 *Iris pseudacorus* beds are extensive in the south (MG11, MG11/MG13, MG13, M28x/MG13). The high cover of *Iris pseudacorus* provides structural diversity and bird cover, probably adding a breeding wader interest to this area. Overall nature conservation interest for vegetation is moderate due to the scale of improvement but with strong local influence in the south around the dune wetlands.

68 South Wick

This is a small (3.8 ha) climbing dune site on the east coast of Papa Westray a short distance to the south of the North Wick to Mayback site. It is sheltered by the Holm of Papa but is influenced by an 18 km SE fetch to Sanday. There are patches of sand amongst beach shingle but this is unlikely to be the source for the climbing dune sand which probably originated from a much larger fringing sand beach which has been lost. A road runs through the site and all of the interior is MG7 improved grassland. The only semi-natural vegetation is an SD5/SM28 strand. Overall nature conservation interest is very low.

69 Bay of Moclett

This moderately-sized (28.2 ha) bay and climbing dune system is located on the south coast of Papa Westray. It is exposed to a short 4 km fetch due south to Westray. The dune edge is cliffed 1 - 2 m in height, showing erosion and slow inland retreat. There are small SD4 *Elymus farctus* embryo dunes present and a narrow zone of SD4/SD8a intermediate fixed dune. Immediately inland from this there is semi-improved damp grassland (MG7/MG11), changing abruptly in the west to MG7 leys. A zone of wetland habitat extends north beyond a road crossing the site and there are good zonations around the southern shore of Loch of St. Tredwell (MG11 inundation grassland to SD17b slack, MxTm rich fen and S19c swamp). Climbing dunes on the eastern side of the site have damp (SD8e) and dry (SD8d) fixed dune which is used as a 9-hole golf course. No green improvement is present and sheep and rabbit grazing is sufficient to keep the sward short enough for play. The nature conservation interest of the site is moderate to good, with the range of wetland conditions being a strong feature which also will attract breeding waders.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

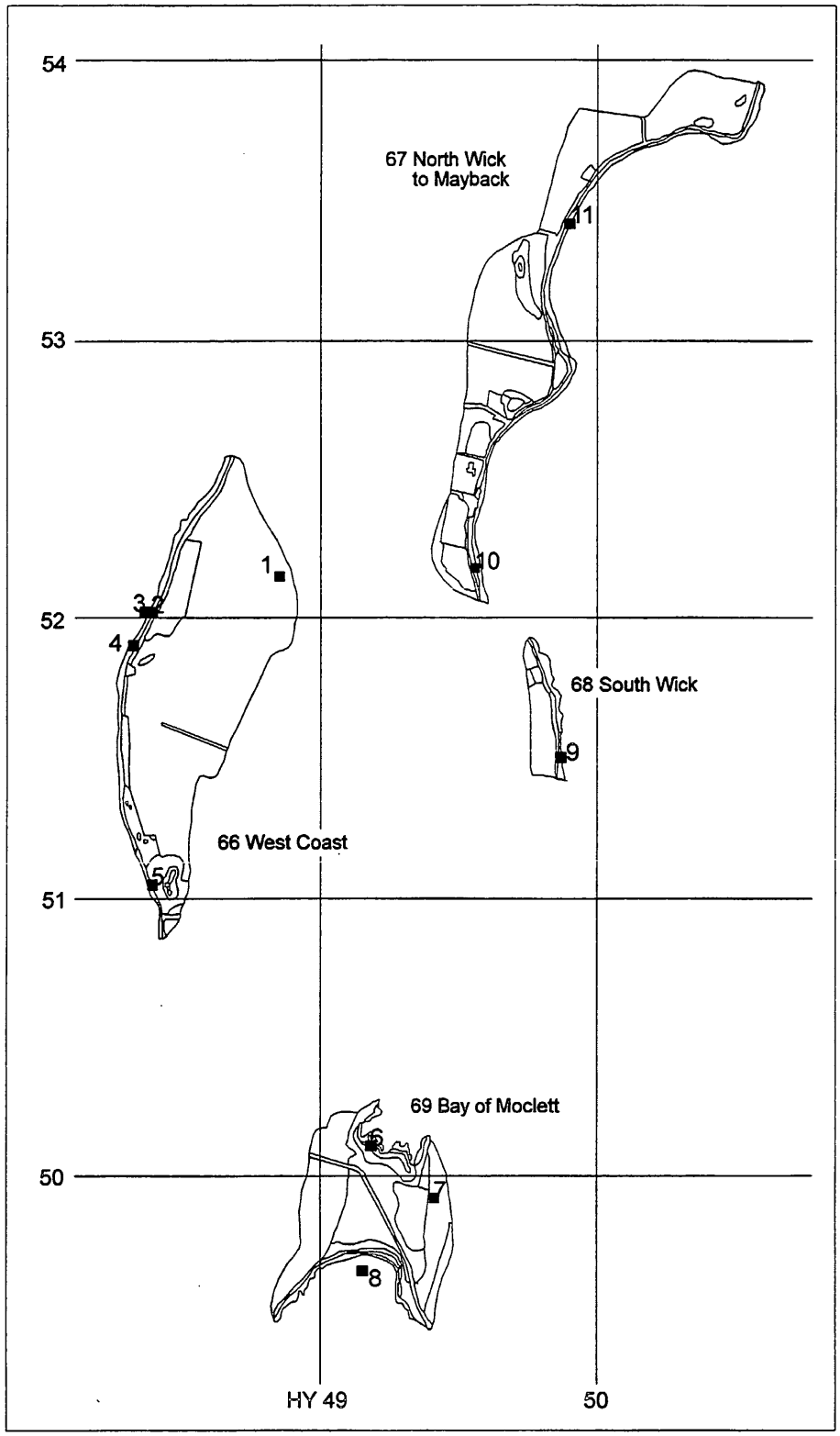
Table 3 Vegetation and other land cover (areas in ha)

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	66 West Coast	67 North Wick to Mayback	68 South Wick	69 Bay of Moclett	All Papa Westray sites
AP	Arable - potatoes			0.18		0.18
BBG	Buildings, bare ground and gardens	0.19	1.01	0.12		1.32
BBS	Bare beach sand (above MHWS, below vegetated dune zone)		1.09	0.11		1.20
BMC	Maritime cliff with little vegetation	0.51			0.66	1.17
BS	Bare sand (within vegetated sand zone)			0.08	0.05	0.13
BSH	Bare shingle	2.42	2.29	0.81	0.33	5.85
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.06	1.17		0.10	1.33
M28x/ MG13	M28x/MG13 intermediate	1.67	2.09			3.76
MG7	MG7 *Lolium perenne* leys	43.45	20.50	3.23	9.52	76.70
MG7/ MG11	MG7/MG11 intermediate	0.61			3.39	4.00
MG7/ SD8a	MG7/SD8a intermediate	1.39				1.39
MG7/ SD8d	MG7/SD8d intermediate	0.85			1.36	2.20
MG9/ MG11	MG9/MG11 intermediate	3.32	6.45			9.78
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	0.13	3.75		3.94	7.83
MG11/ MG13	MG11/MG13 intermediate		1.51			1.51
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.38	0.19			0.58
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)	0.02				0.02
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)				0.41	0.41
OW	Open water	0.02	0.03			0.04
ROAD	Road and track	0.40	3.73		1.07	5.20
RUD	Ruderal-dominated vegetation		0.19	0.04		0.22
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community	0.08				0.08
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		0.44		0.23	0.67
SD4	SD4 *Elymus farctus* foredune				0.04	0.04
SD4/SD8a	SD4/SD8a intermediate				0.60	0.60
SD5/ SM28	SD5/SM28 intermediate	0.01		0.17		0.17
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		0.92			0.92
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community				0.27	0.27
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community				3.73	3.73
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community				2.33	2.33
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community				1.17	1.17
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.14			0.14
TOTALS (ha)		55.50	45.49	4.74	29.18	134.91

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY48855215	66 West Coast	Large field used as airfield grass landing strip. MG7 sward.
2	HY48405202	66 West Coast	Possible old sand pit, 20 m x 15 m size. Heavy trampling by cattle, rabbit burrows in vertical face (0.5-1.5 m) . Poached MG11 floor with scattered *Stellaria media*.
3	HY48375202	66 West Coast	Steep shingle beach laid over steeply dipping bedrock. Sand forms 0.5-1.5 m layer on top of 30-50 cm of head.
4	HY48335190	66 West Coast	Spring-fed pond (120 sq m) with trampled edges. *Nasturtium officinale* on western edge.
5	HY51405105	66 West Coast	Fine wetland in sand-filled depression behind shingle beach. Small area of open water with summer-dry mud colonised by MG13x vegetation, with *Ranunculus baudotii* (Q2) and S19a swamp.
6	HY49185011	69 Bay of Moclett	Southern shore of Loch of St Tredwell has good gradation from S19a to S19c to MxTm to SD17b to MG11, with patches of M28x present (and a few spikes of *Filipendula ulmaria*). This is a very typical and good machair loch zonation. Heavy cattle poaching maintains diversity. Several snipe disturbed.
7	HY49414992	69 Bay of Moclett	Green of small traditional 9 hole golf course. Sheep and rabbit grazed, mown SD8d sward. Very little impact. On valley side many small cauldron blowouts, most fully stabilised. A few have active sheep rubs.
8	HY49154966	69 Bay of Moclett	Moderately sloping slab shingle beach with cliffed 1.5-2 m dune front. Much stock trampling and rabbit grazing. Slow turf collapse of SD4/SD8 edge. Patches of grazed SD4 embryo dune present.
9	HY49875150	68 Southwick	Gently sloping shingle beach with narrow bank of intertidal sand. Back capped with 1-1.5 m cliffed sand. Largely MG7, with animal bedding dumped over edge. Nutriphiles (*Urtica dioica, Rumex obtusifolius, Cirsium vulgare*) common.
10	HY49565218	67 North Wick to Mayback	Steeply sloping shingle beach capped with 30 cm-1 m sand. Edge a SDy and SD5/SM28 strand.
11	HY49905342	67 North Wick to Mayback	Moderately sloping shingle beach with 0.5 m cliffed dunes. SD2 strand with narrow SD5/SM28.

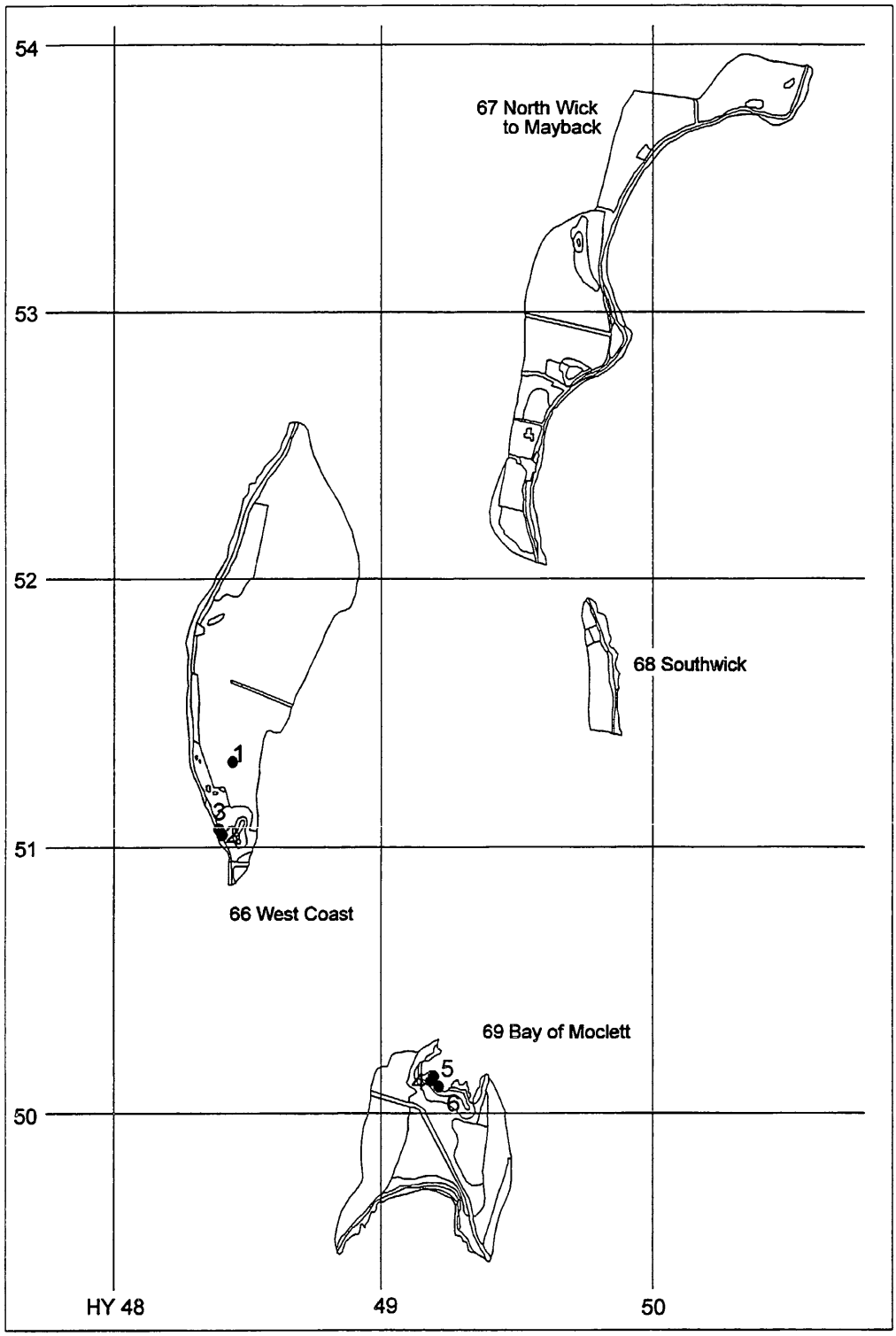


Map 3 Target note positions: West Coast, North Wick to Mayback, South Wick, and Bay of Moclett (Papa Westray)

Annex 2 Quadrat Data

Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

	Quadrat number	1	2	3	4	5	6
	NVC type	MG	MG	MG	S	Mx	SD
		7	13x	13	19c	Tm	17b
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY
2	Grid reference easting	488	514	513	491	491	492
3	Grid reference northing	521	510	510	501	501	501
11	Herb height, centimetres	12	2	10	35	40	10
12	Moss height, centimetres	-	-	-	-	3	2
15	Herb cover, %	100	10	80	65	95	100
16	Moss cover, %	-	-	-	-	40	35
22	Bare soil/litter (incl.sand)	-	90	20	-	-	-
122	Agrostis stolonifera	-	3	4	5	-	-
156	Alopecurus geniculatus	-	2	3	-	-	-
163	Anagallis tenella	-	-	-	-	-	2
230	Bellis perennis	3	-	-	-	1	-
279	Caltha palustris	-	-	2	4	4	4
323	Carex flacca	-	-	-	-	3	3
329	Carex lepidocarpa	-	-	-	-	5	-
333	Carex nigra	-	-	-	3	5	4
339	Carex panicea	-	-	-	-	-	4
384	Cerastium fontanum triviale	2	-	-	-	-	2
418	Cirsium palustre	-	-	-	-	-	1
465	Dactylis glomerata	5	-	-	-	-	-
468	Dactylorhiza maculata maculata	-	-	-	-	-	1
509	Eleocharis palustris	-	2	3	6	3	-
525	Epilobium palustre	-	-	-	-	3	2
535	Equisetum palustre	-	-	-	-	3	3
546	Eriophorum angustifolium	-	-	-	4	4	3
568	Euphrasia officinalis agg	-	-	-	-	-	3
576	Festuca rubra	3	-	-	-	3	5
583	Filipendula ulmaria	-	-	-	2	4	-
642	Glyceria x pedicellata	-	-	7	-	-	-
680	Holcus lanatus	-	-	-	-	4	4
690	Hydrocotyle vulgaris	-	-	-	-	5	4
725	Juncus bufonius	-	3	-	-	-	-
768	Leontodon autumnalis	-	-	-	-	3	4
796	Lolium perenne	8	-	-	-	-	-
813	Lychnis flos-cuculi	-	-	-	-	-	2
855	Mentha aquatica	-	-	-	-	4	-
944	Parnassia palustris	-	-	-	-	4	2
973	Plantago lanceolata	-	-	-	-	-	2
975	Plantago maritima	-	-	-	-	-	2
988	Poa pratensis	4	-	-	-	-	-
1043	Potentilla anserina	-	-	2	-	-	2
1059	Prunella vulgaris	-	-	-	-	-	4
1081	Ranunculus acris	-	-	-	-	-	4
1085	Ranunculus baudotii	-	4	-	-	-	-
1089	Ranunculus flammula	-	-	-	3	3	3
1106	Rhinanthus minor	-	-	-	-	-	4
1116	Rorippa palustris	-	4	2	-	-	-
1143	Rumex crispus	-	1	2	-	-	-
1156	Sagina nodosa	-	-	-	-	3	3
1235	Selaginella selaginoides	-	-	-	-	-	2
1236	Senecio aquaticus	-	-	-	-	4	-
1349	Trifolium pratense	-	-	-	-	-	4
1350	Trifolium repens	5	-	-	-	-	4
1353	Triglochin maritima	-	-	-	2	2	-
1354	Triglochin palustris	-	-	-	2	-	-
1445	Calliergon cuspidatum	-	-	-	-	4	6
1571	Campylium stellatum	-	-	-	-	7	-
2167	Lophocolea bidentata	-	-	-	-	-	3
2256	Aneura pinguis	-	-	-	-	2	3
2922	Plagiochila asplenioides	-	-	-	-	-	3
	Number of species per sample	7	7	8	9	23	33



Map 4 Quadrat positions: West Coast, Northwick to Mayback, South Wick, and Bay of Moclett (Papa Westray)

70-75 SANDAY

Location and conservation status

Six areas of windblown sand are present:

70 North Bay	HY661423	71 North Coast	HY685457
72 Taing of Crudy	HY709432	73 East Coast	HY740444
74 Backaskaill Bay	HY645395	75 Doun Helzie and Pool Bay	HY625370

The locations of site assemblages are given in Map 1a.

Two SSSIs have extents which include windblown sand. Central Sanday SSSI (HY700403, 654.7 ha) is designated for its geomorphological interest (sand and shingle landforms, including tombolos, spits, sand flats, dunes and machair/links of great complexity) and botanical value. Northwall SSSI (HY740445, 251.3 and 621.2 ha) is designated for its biological interest, particularly its machair and machair lochs which are stated as possibly the largest extent of these habitats outside of the Western Isles (this is probably incorrect, given the extent of machair and machair loch on Tiree). The site is divided into four separate blocks, each centred on a links/machair loch. The boundaries of these SSSIs are illustrated in Map 1b, superimposed on the boundaries of the East Coast site assemblage.

Previous surveys

Geomorphology	Mather, Smith & Ritchie (1974) Keast (1994)
Vegetation	Shaw, Hewett & Pizzey (1983) - site 51 Holland (covers Backaskaill Bay and Doun Helzie or Quoy) and site 73 Overbister (covers part of East Coast) Shimwell (1985) - covers part of East Coast

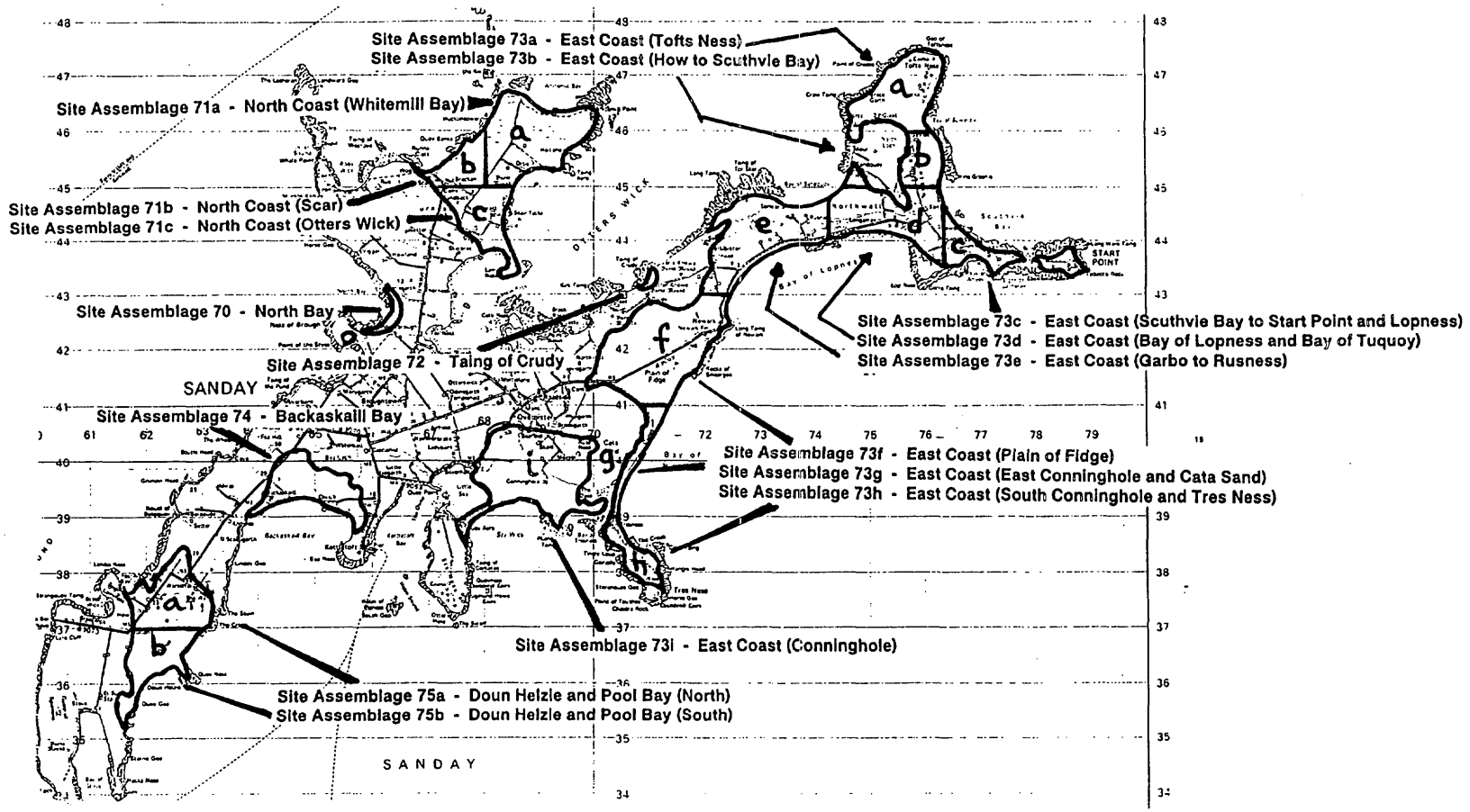
Survey details

Date	September 1996
Target notes	152 (Annex 1)
Quadrats	89 (Annex 2), plus additional samples in Shimwell (1985)
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Total windblown sand extent on Sanday excluding the beach zone is 2120.1 ha. Most of this is vegetated (1982.1 ha), with additional areas of bare sand (20.0 ha), arable and fallow land (47.1 ha) and land take for buildings, gardens, roads, cemeteries, pits, tips, etc. (68.4 ha). Sanday has by far the largest extent of blown sand of any island in Orkney. The East Coast site dominates total area (1314.2 ha).



Map 1a Site assemblage location
See Volume 3 for NVC maps

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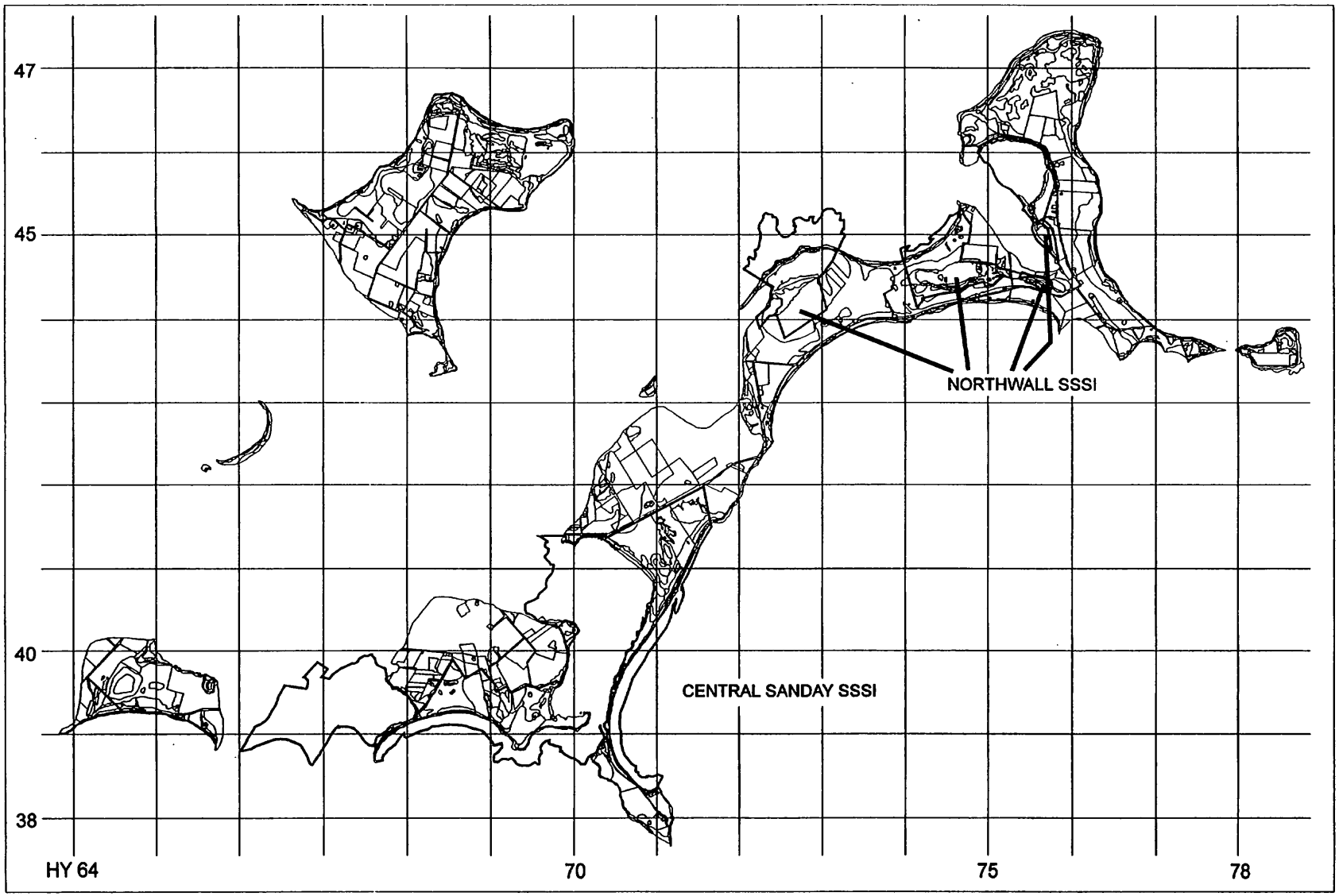


Map 1b Central Sanday and Northwall SSSIs, Sanday

SSSI boundaries with thick black line

Table 1 Broad land cover extents (ha)

	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
Windblown sand land cover							
Beach above MHWS	1.96	8.68	0.32	47.04	1.80	2.56	62.36
Bare sand		1.68		15.24	0.22	2.81	19.96
Vegetated sand (except fallows)	6.05	380.62	2.71	1243.94	98.49	252.77	1984.57
Arable and fallow		0.91		12.60	29.17	4.46	47.14
Buildings, roads, gardens, tips, pits, cemeteries, airfield	0.04	15.81		42.40	4.88	5.27	68.40
Total windblown sand excluding beach zone	6.09	399.69	2.71	1318.42	132.77	265.31	2124.99
Total windblown sand extent above MHWS	8.05	408.38	3.03	1365.47	134.57	267.86	2187.35
Surveyed but not on blown sand							
Bare rock							
Unvegetated maritime cliff		0.45		3.85	0.48	2.67	7.44
Saltmarsh		0.68		4.24			4.92
Open water		1.92		6.99	0.40		9.31

Dune habitats (Table 2, Map 2a-d)

The total area surveyed for Sanday is 2204.1 ha. Like most Orkney islands it lacks fixed acidic dune grassland, dry dune heath and wet dune heath (habitats largely confined to Hoy and Eday). For all other habitats there are good extents present. The areas of mobile (51.9 ha) and semi-fixed dune (98.6 ha) are by far the largest in Orkney and fixed dry calcareous dune is common (373.5 ha). Improved grassland is extensive (748.9 ha) but forms a lower proportion of total extent than most other Orkney islands (see Volume 1). Arable and fallow ground (46.7 ha) is also smaller as a proportion of total sand area.

The most impressive figure is the area for dune slack and wet grassland (665.5 ha) which far exceeds any other site (the total for all Orkney is 870.1 ha), plus 49.6 ha of mire and swamp. There are probably three contributory factors explaining the large extent of dune wetland on Sanday. First, the large size of some sites allows an extensive watertable to develop and influence vegetation. Second, the indented and long irregular coastline of Sanday has a very extensive shingle-fringed edge to dune systems which encloses sand-filled depressions within which much wetland is developed. Third, two areas (Plain of Fidge and Conninghole, part of the very large East Coast site) are hindshore dune systems and have deflation plains in which slacks develop in the floors of blowouts.

Table 2 Extents (ha) of dune habitats and other ground

	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
Habitat 1 - Beach and strand	2.17	10.14	0.36	52.34	2.21	2.77	69.98
Habitat 2 - Mobile dune	0.09	8.41	0.18	39.44	1.69	2.12	51.94
Habitat 3 - Semi-fixed dune		0.70		26.22	3.27	68.43	98.62
Habitat 4 - Fixed dry calcareous dune	0.08	45.43	0.29	273.21	8.03	46.47	373.50
Habitat 5 - Fixed acidic grassland							
Habitat 6 - Dry dune heath							
Habitat 7 - Wet dune heath							
Habitat 8 - Dune slack and wet grassland	1.07	147.13	0.63	469.69	34.60	12.41	665.54
Habitat 9 - Mire and swamp	0.03	16.17	0.38	19.82	13.10	0.08	49.59
Habitat 10 - Arable and fallow		0.91		12.12	29.17	4.46	46.66
Habitat 11 - Improved grassland	4.57	163.00	1.19	419.71	34.88	125.50	748.85
Habitat 12 - Other habitats	0.04	18.84		63.76	8.48	8.29	99.42
TOTALS (ha)	8.05	410.74	3.03	1376.30	135.44	270.53	2204.10

Vegetation and other land cover types (Table 3; Annex 2 - quadrat data; Volume 3 - NVC maps)

In addition to having the largest extent of windblown sand of any island in Orkney, Sanday has the largest diversity of vegetation types. A total of 89 vegetation types is mapped for the island, plus 13 other land cover types. As indicated in dune habitat results, this range lacks acidic vegetation types but in other respects represents the fullest spectrum of dune and links/machair vegetation conditions of any Orkney island. The most notable features of this vegetation spectrum are as follows:

- a large area of M28 *Iris pseudacorus* beds (17.6 ha), covering only a small extent of the published M28 *Iris pseudacorus - Filipendula ulmaria* community (0.1 ha) and dominated by the M28x provisional *Poa trivialis* sub-community (14.1 ha) in which *F. ulmaria* is almost absent due to grazing pressure. There are also intermediate types involving S28 *Phalaris arundinacea* tall-herb fen (2.1 ha) and SM28 *Elymus repens* saltmarsh (1.3 ha). The only other mire types recorded are modest extents of Mx provisional new *Carex nigra* rich fen, vegetation which is much commoner in the Western Isles and Inner Hebrides. Two forms are mapped: an Mxbd type (5.8 ha) with *Prunella vulgaris* and *Molinia caerulea*, and an MxTm type (6.5 ha) with *Triglochin maritima*.
- a large area of MG1 *Arrhenatherum elatius* coarse grassland (19.7 ha), together with four intermediates (total extent 17.1 ha), which indicate ungrazed or undergrazed pastures. This feature is rare elsewhere in Orkney and suggests that less intensive management is present in some areas of Sanday.
- a very large area of improved grassland, including MG6 *Lolium perenne - Cynosurus cristatus* pasture (108.0 ha, plus 13.5 ha intermediates) and MG7 *Lolium perenne* leys (547.2 ha, plus 59.7 ha of intermediates). The MG6 type is rare elsewhere in Orkney. The overall extent of improved grassland, though high, is lower than on blown sand on most other Orkney islands and also suggests that agricultural methods are less intense on Sanday compared with many other Orkney locations.
- a very large area of wet neutral grasslands which forms the bulk of dune wetland in Sanday. Three main types, plus many intermediates, are involved and suggest a continuum of wetland variation extending through neutral grassland, wet fixed dune, dune slack and swamp conditions. The MG9 *Holcus lanatus - Deschampsia cespitosa* coarse grassland is uncommon (8.7 ha) but an important MG9/MG11 intermediate (63.1 ha) is more extensive and there is a small area with an MG9/SM28 saltmarsh intermediate (1.5 ha). The MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland community is by far the most extensive (331.3 ha). It is the most characteristic habitat of wet ground on Sanday blown sand and is the product of extensive stock grazing with little or no fertiliser input except indirectly by dunging from animals receiving winter feed. This sward also has many intermediates, involving the following other vegetation types: MG1, MG6, MG7, MG13, S10, S19, SD3, SD8a, SD8e. These intermediates total 128.5 ha and represent vegetation responses to partial improvement (including drainage and fertiliser addition) and different moisture conditions. The MG11 type is even more extensive in the Western Isles where it is also associated with a wider range of intermediates. In both the Western Isles and Orkney (especially Sanday) it occupies ground similar to slacks and may well be the result of long-term grazing, trampling and dunging of a former slack environment. Its much greater extent in the Western Isles may also be related to tillage of wet ground and the addition of seaweed as fertiliser. These practices might have also been used extensively in the past in Orkney. The third neutral grassland type is MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland. Extent is 2.1 ha, plus a distinct new type (MG13x provisional new sub-community) with the Red Data Book species *Rorippa islandica* (0.4 ha) and an intermediate with MG11 wet grassland (4.1 ha).
- a modest area of swamp (22.4 ha), with eight communities present and extent dominated by forms and intermediates with S19 *Eleocharis palustris* swamp (10.3 ha).
- the largest area of strandline vegetation in Orkney (6.7 ha), including 1.7 ha of an SDy provisional *Atriplex glabriuscula* strand and an SD5 *Leymus arenarius* mobile dune - SM28 *Elymus repens* saltmarsh intermediate (SD5/SM28, 2.8 ha) which is characteristic of sheltered shorelines and areas receiving quantities of windblown seaweed. This zone is rarely more than 2 m wide and total extent suggests a strandline length of *c.* 30 km around the sand (and shingle) shore of Sanday which encloses blown sand. The SDy type is also characteristic of shingle and extends beyond the blown sand area. The nationally scarce *Mertensia maritima* is occasionally present on Sanday strandlines.

- the largest area (54.6 ha) of combined embryo dune (SD4 *Elymus farctus* community) and mobile dune (SD5 *Leymus arenarius* and SD6 *Ammophila arenaria* communities, excluding the SD5/SM28 strandline intermediate) of any Orkney island. Given the large area of windblown sand on Sanday, this is only a modest total but suggests the best sand supply in Orkney and lower losses of this habitat to agricultural improvement. There are several SD4 intermediates with SD8 fixed dune grassland (total extent 17.9 ha) in which *Elymus farctus* is an important turf constituent and it is always present in a coastal zone which is receiving windblown sand close to the dune edge. It could therefore indicate former mobile dune which has been eradicated by grazing and replaced by distinctive SD4/SD8 swards.
- the largest area and by far the best examples of semi-fixed dune (SD7 *Ammophila arenaria - Festuca rubra* community, 101.0 ha) in Orkney, including examples which dominate large climbing dunes which elsewhere have been converted to SD8 pasture or improved grassland/arable land.
- the largest area (359.6 ha) of fixed calcareous dune grassland (SD8 *Festuca rubra - Galium verum* community), dominated by the SD8a Typical sub-community (216.4 ha) and with good extents for the SD8d *Ranunculus acris - Bellis perennis* (83.3 ha) and SD8e *Prunella vulgaris* (47.7 ha) sub-communities. The latter type is common in transitions to MG11 inundation grassland and slack, with some areas holding good populations of the nationally scarce *Carex maritima*.
- the largest area (188.8 ha) of dune slack (SD17 *Potentilla anserina - Carex nigra*) in Orkney, dominated by the SD17b *Carex flacca* sub-community and including areas of young slack habitat (protoslack conditions) in the floors of recent blowouts (SD17x provisional *Agrostis stolonifera* sub-community).

Site descriptions

70 North Bay (Map 2a)

This small bay dune site is located on the northwest coast of Sanday at the head of North Bay. It also includes a very small area of blown sand on the western side of Bay of Brough (HY655423) to the immediate south, since both are developed on major shingle ridges which form a tombolo 150 m wide linking Ness of Brough to the Sanday mainland. Neither bay has much sand as part of the shingle system. The North Bay sector is exposed to a narrow but long NW fetch across the Atlantic to Iceland. The Bay of Brough sector is sheltered and sediments are probably derived via waves reflected off shingle shores further east on this short coastal sector. There are small amounts of strand (SD3 *Matricaria maritima - Galium aparine* community), SD5b *Leymus arenarius* mobile dune *Elymus farctus* sub-community, plus MG11 inundation grassland, but much of the site is improved grassland. Nature conservation interest is low due to small size and limited diversity.

71 North Coast (Map 2a)

This large (399.0 ha) site occupies all of the northern end of the Burness peninsula on the north coast of Sanday. Thick sand deposits have accumulated upon large shingle ridges which are aligned as bays hinged on low bedrock outcrops around the western (Quoy Banks to Hucklinsower), northern (Whitemill Bay) and eastern (Otters Wick) sides of the peninsula. The ground behind the shingle ridges is sand-covered but lower and wet. The southern half of the site is largely made up of climbing dune which rises to *c.* 12 m OD, with a low ridge running 1.5 km NNE up the centre of the site. This ridge acts a watershed for moisture moving under the surface sand and rapidly forms flushed damp and wet ground, particularly on slopes draining to the northwest. The site is therefore complex in form and is exposed to a wide range of long fetches from NW to NNE directions,. The east coast side (part of Otters Wick bay) is more sheltered, with fetches of 4 - 10 km NE to other parts of the Sanday Coast and North Ronaldsay. The east coast sector also has a sand-covered shingle spit developed at its southern end (Lama Ness).

The western coast is largely stable but in at least one short sector there are signs of the shingle ridge moving slightly inland and further southwest the dune edge above shingle is cliffed with a little turf slumping. Sand sheets have been blown inland in two sectors (behind Quoy Banks and Hucklinsower beach sectors) and support SD8a fixed dune, with a prominent but narrow band of SD4/SD8 vegetation along the coastal edge, possibly demarcating a former mobile dune edge removed by grazing. Water draining off hillslopes inland forms good swamp and mire in the Hucklinsower sector, including SxTHF provisional new *Phragmites australis - Calliergon cordifolium* tall-herb fen. Ground in this area might have been made wetter from increased water running from field drains installed for improved pastures to the northeast which support MG6 and MG7 vegetation.

Little sand appears to be blown inland at the northwest corner of the site and there is a steep backslope behind the outer ridge leading into a very wet area with good swamp and open water together with heavily poached margins with slack and MG11 vegetation. Many snipe were disturbed feeding in this area. Further east, along the northern edge of the site, a wider foredune is developed extending up to 50 m inland before slopes lead into an extensive wet depression. The foredune edge has several blowouts, including one large example with clear trampling damage from stock sheltering. Stock fencing runs to the edge of blown sand and there is little mobile dune vegetation. Instead, the edge is formed by SD4/SD8c and SD8c vegetation, suggesting sand deposition is occurring in conjunction with grazing which eliminates the main mobile dune grasses. The northeastern corner of the site (Whitemill Point) has a narrow area receiving higher sand input and SD6 *Ammophila arenaria* mobile dune is present, changing rapidly inland to SD7x semi-fixed dune. Most of the north coast appears stable but the mobile dunes at Whitemill Point are all cliffed and turf slumping is present. Slow retreat seems to be occurring here. A wide zone of SD8e damp fixed dune stretches 300 m inland before changing to MG11 inundation grassland and this area includes a slight rise with thin sand over shingle. Heavy scraping and burrowing by rabbits in this area, together with possible leaching of the sand layer, allows one of the few areas of clear SD8b *Luzula campestris* fixed dune sub-community on Sanday to develop. Wetness increases inland until, at the foot of gentle hillslopes below the central ridge, patches of good-quality mire and swamp are developed. Former drains cut across this area and suggest past attempts to reduce the watertable.

The east coast of the site in the north shows a continuation of the narrow zone of dry sand over shingle around the shingle edge, changing rapidly inland to wet grassland. *Mertensia maritima* is present on the strandline south of Whitemill Point. A small headland between Helliehow and Ortie forms a break in conditions (MG6 and MG7 grassland are developed on slightly higher ground). Further south, a large bay dune extends to the end of the site at Lama Ness, with a thin zone of mobile dune (SD5b) replaced inland by a narrow area of SD4/SD8c or SD8a fixed dune. There are large areas of MG11 wet grassland further inland, plus a very large area of M28x *Iris pseudacorus* bed, but there is also much improved pasture. The Lama Ness spit is covered largely in SD8a and SD8c fixed dune grassland but the sand-capped shingle tombolo connecting it to the Sanday mainland is breached in three short sectors (2 m, 4 m and 3 m wide respectively), exposing 0.7 - 1 m of sand in eroding sections.

The southern climbing dune sector of the site, including the spur of higher ground extending northeast, is largely MG7 improved grassland. Large areas north of a road running northeast along the spur are either MG11 or SD17b slack (with good populations of *Parnassia palustris* in the sward) and these habitats were probably much more extensive before drainage, re-seeding and fertiliser addition were used to improve pasture in this area.

The site carries no nature designation but its nature conservation value is high, despite extensive improvement. Most interest resides in the site wetlands, which are extensive and show great diversity in NVC types and structure. The breeding wader interest is also likely to be high. Some consideration should be given to designating the northern and northwestern part of the site as an SSSI, perhaps by integration with other current SSSIs at Northwall and Central Sanday. Several small sand pits are present (some are disused) but these are unlikely to be a reason for major objection to designation.

72 Taing of Crudy (Map 2b)

This small (2.7 ha) bay dune site is located on the south shore of Otters Wick bay between the Burness and Northwall peninsulas which make up the indented northern coast of Sanday. The site is exposed to a short 3.5 km fetch west towards the western sector of Otters Wick and the sheltered inlet of Lamaness Firth. Sand is blown inland for almost 100 m from the shingle beach. A very narrow edge of SD5c mobile dune is replaced by SD8a fixed dune which extends down the backslope of the outer shingle ridge which has a thin covering of blown sand. Dry conditions are then replaced by MG9/MG11 intermediate wet grassland and MG7 improved grassland. The nature conservation interest of site vegetation is low due to small site size and the large extents of similar habitat elsewhere on Sanday.

73 East Coast (Map 2b - 2c)

This is the largest site on Sanday and in Orkney, with 1314.2 ha of windblown sand above the beach zone. It also contains the best calcareous dune vegetation in the region. The site is extensive and forms a near-continuos area of blown sand from Tofts Ness and Start Point at the end of the Northwall peninsula (northeast Sanday) to Conninghole and Little Sea on the southeast coast of Sanday. It includes a very fine 2 km long sand-capped shingle tombolo connecting the Plain of Fidge to the island of Tres Ness, the tombolo enclosing extensive sand flats (Cata Sand) between the open sea of the Bay of Newark and the eastern side of the Conninghole area. The total coastal length of this sector, excluding the sheltered shores of the Cata Sand and Little Sea sand flats, is approximately 27 km.

The northern sector consists of sand-capped shingle ridges anchored to bedrock outcrops, forming a series of bays of different orientation and length from eastern Otters Wick and the Bay of Sandquoy, past Tofts Ness to Scuthvie Bay and Start Point island, to the Bay of Lopness. The bay dunes on opposite coasts of the Northwall peninsula are only separated by distances of 200 - 1000 m and in structure this sector is similar to the North Coast site, with a narrow coastal edge of dry dune changing rapidly inland to dune wetland developed on sand blown inland onto lower ground. A series of machair-like lochs are developed in the depression between the north - south and west - east sides of the Northwall peninsula. Brackish conditions are present in the most western case (Westayre Loch) via a sea inlet from the Bay of Sandquoy on the north coast. Exposure varies considerably, ranging from long NNW and northerly fetches to Iceland and the Arctic to southerly and SE fetches across the North Sea to the Netherlands, Germany and Denmark.

The southern sector is more complex. Climbing dunes cover low hills behind the settlement of Newark (HY723423) and these act as a break between the multiple bay dune and wet depression sector at Northwall and the landforms further south. The Plain of Fidge is a machair hindshore plain developed at the north end of the Bay of Newark. Sand supply here is good and a wide (150 m) foredune ridge is developed, behind which there is a very irregular deflation plain with narrow and broad blowouts holding good damp grassland and slack habitat in their floors. Inland from the deflation floor is a low, dissected inner dune scarp, similar in form to inner scarps developed behind the classic machair deflation floors of the larger Western Isles machair systems. Climbing dune sand is then developed on very low hills inland, extending much of the way to the shore of Otters Wick on the north coast. Longshore drift has created the fine tombolo connecting the Plain of Fidge to Tres Ness island. The shingle tombolo has a thick cover of blown sand, with mobile dunes well-developed at its northern end. There are two breaches present in the blown sand capping, one of them exposing a thin layer of soft aeolinite (dune sandstone). A thin sand cover is present over most of Tres Ness island apart from ground at the far southwest. All of this sector (Bay of Newark) is exposed to southeasterly winds with a long fetch across the North Sea to Denmark.

The sand flats of Cata Sand between the Tres Ness tombolo and Coninghole create a break in the continuity of blown sand, leaving the Coninghole sector as a large detached sector. It could be treated as a separate site but is aggregated here with the remainder of the East Coast because its forms part of a sedimentary complex recognised by the definition of the Central Sanday SSSI boundary. Coninghole, like the Plain of Fidge, is a machair hindshore plain, with a spit developed at its eastern (Cata Sand) end and a short 500 m long tombolo at its western end connecting to the island of Els Ness. Sand supply is probably poorer than for the Plain of Fidge and Conninghole lacks a good foredune, though a narrow but discontinuous outer zone of mobile dune is present. An irregular deflation plain is present inland for approximately 700 m, with its inner edge obscured by pasture improvement. The inner dune scarp present on the Plain of Fidge is also present here but it is much more weakly developed.

The shorelines of Cata Sand and Little Sea are notable for their shelter, compared to the open coast of other dune sites on Sanday. There is good strand development, particularly of the SD5/SM28 type, in the Little Sea area. Parts of Cata Sand are subject to tidal scour, especially on the western side of the tombolo which has well-developed short shingle recurves. Fragments of SD2 *Cakile maritima - Honkenya peploides* are present here. Further north, the northeastern side of Conninghole and the southwestern shore of the Plain of Fidge are more sheltered, with an SD5/SM28 strand developed above saltmarsh (only the uppermost SM16 *Festuca rubra* community sectors were mapped).

The vegetation of this very large site closely reflects its varied character. The northern sector of Northwall (Map 2b) has a simple zonation inland from thin mobile or semi-fixed dune to fixed dry dune grassland (the latter varying in width according to orientation (increasing eastwards for bays facing north or south, showing the effects of prevailing westerly winds on waves and sediment supply. Depressions further inland then hold slack or wet grassland as dominant cover, with swamp and mire forming more restricted surrounds to the edges of open water in machair lochs.

These excellent simple habitat zonations are almost intact between the Bay of Tuquoy and bay of Lopness but, unfortunately, they are broken by large patches of improved pasture south of Tofts Ness and west of Scuthvie Bay. The NVC mosaics associated with habitat zonations are often complex, reflecting sand supply and management variations in dry dune habitats and moisture variation in wetland conditions. At Tofts Ness there are simple, narrow coastal edge zonations from shingle to SD4/SD8a and SD4/SD8c vegetation, changing rapidly inland to extensive SD17b and MG11 vegetation in mosaics which hold areas of species-rich vegetation containing much *Parnassia palustris* and *Gentianella amarella*. Sparse numbers of *Juncus balticus* are also present here in MG11 grassland (see quadrat 45), a new vice-county record for this nationally scarce species and its most northerly location in Britain. The only better areas of MG11 and SD17b vegetation are in the west of the Northwall area, around Westayre Loch which also has excellent saltmarsh to freshwater transitions, including areas with *Rorippa palustris*. Wetland further east around Loch of Langamay and Loch of Brue is also excellent and the SD17b swards in this area contain high densities of *Parnassia palustris*, with total flowering spikes perhaps running into hundreds of thousands. The quality of wetland is not so high further north around North Loch and Loch of Rummie but these areas contain good typical zonations of wet grassland, slack and wetter ground. Overall, the wetlands in the Northwall area probably comprise the largest and highest quality examples in Orkney.

The site sector from the Plain of Fidge to Conninghole is distinguished by the best mobile dunes in Orkney, especially on the Tres Ness (Cata Ayre) tombolo, and much larger areas of fixed dune grassland which cover much of the machair hindshore plains. A few localities have a species-rich dry dune turf with lichens which is heavily grazed by rabbits, forming an intermediate between SD8a and SD8b sub-community types, though these might have been reduced in extent since the survey of Shimwell in 1985. The sward includes *Cladonia rangiformis, Thymus praecox, Galium sterneri,* and *Gentianella amarella* ssp. *septentrionale*. Notable areas of SD7x *Ammophila arenaria - Festuca rubra* semi-fixed dune provisional new *Galium verum* sub-community are also present, together with wet grassland and slack vegetation in deflation floor blowouts which contain the nationally scarce *Carex maritima*. Habitat types and NVC mosaics closely relate to landforms over much of this area except to the rear of blown sand which is largely improved. The western shore of the Plain of Fidge and parts of the eastern coast of Conninghole are probably accreting at a very slow rate, in contrast to much of the remaining site coastline which is undergoing slow retreat.

Within the Central Sanday SSSI the geomorphology of this area is complex and of high quality. The nature conservation interest of vegetation does not perhaps come up to quite so high a standard, particularly on the Plain of Fidge, due to management which could be improved. Fixed dune grasslands have had a serious rabbit problem for many years, with large areas of bare sand excavated around burrows which in turn provide seed beds for infestations of ruderals, particularly *Senecio jacobaea* and the hybrid with *S. aquaticus* (*S.* x *ostenfeldii*) which is also present in high quantity in damper ground. Dunging and trampling by cattle also probably assist in keeping ruderal cover high and conferring a very unkempt appearance on the area. One inadequate solution has been to plough warrens in some fenced areas at irregular intervals. Unfortunately this has removed a significant amount of semi-fixed dune at the rear of the Plain of Fidge foredune facing the Bay of Newark. Grazing management could also be improved, with more intensive stocking to reduce sward height and increase species diversity in wet and dry SD8 types. Large areas with very high infestations of ruderals are avoided by cattle and swards here are particularly rank and species-poor.

A short to medium term management programme for the Plain of Fidge might consider a combination of glyphosate application by weedwipe to eliminate some tall ruderals, sharply reducing (but not eradicating) rabbit numbers and finally substituting sheep for cattle for a short period (two to three years), keeping grazing levels high to maintain a short sward and pruning *Senecio* spp. to ground level. This should reduce the ruderal problem and increase species diversity over a wider area. Thereafter, grazing levels can be relaxed to include a summer rest to allow flowering and seed dispersal for all species. Rabbit numbers should then be allowed to return to higher numbers to allow them to assist in maintaining a short and species-rich sward. Some of these recommendations follow Shimwell (1985) whose management suggestions do not seem to have been taken up.

Some consideration should also be given to increasing the size of SSSIs to take in a more representative range of dune wetland. The quality of ground at Tofts Ness ranks very highly but is currently outside the Northwall SSSI boundary and an extension here to include as much of the Tofts Ness headland is highly desirable. A slight increase in annual grazing pressure here, together with a summer relaxation from stocking, would probably increase species diversity and improve the ground even further for nature conservation interest. Land within both current SSSIs does not include several important types of dune wetland, including SD8e damp fixed dune grassland, Mxbd and MxTm *Carex nigra* rich fens, and areas with *Phragmites australis* (S4, SxTHF). An extension to include the north end of the Burness peninsula (part of Site 71 North Coast) would bring in these types, together with other good examples west of the Plain of Fidge (HY703418).

74 Backaskaill Bay (Map 2d)

This large (132.8 ha) site is located on the south coast of Sanday, forming a small machair hindshore between the Kettletoft headland in the east and the long peninsula to Spur Ness (the southern point of Sanday) in the west. A machair loch (Bea Loch) is enclosed on its inner edge. The site has a short 8 km fetch south to Stronsay. Climbing dunes rise to 40 m on the flanks of hillslopes on the western (most exposed) side of the site, though all ground here is improved grassland or arable land. The coastal edge has little mobile dune but a foredune with SD7x semi-fixed dune vegetation is present, changing inland to SD8a fixed dune which is widest in the centre of the bay, marking an area receiving sand from deflation at the coastal edge of the site. An excellent wetland zonation is present between the SD8a zone and the shore of Bea Loch, with zonations from SD8e damp grassland to species-rich SD17b slack and Mxbd rich fen (on the western side), and additional zonations from SD8e to SxTHF *Phragmites australis - Calliergon cordifolium* provisional new tall-herb fen to S4 *Phragmites australis* reedswamp and S10 *Equisetum fluviatile* swamp. Unlike other Sanday sites further north there is little MG11 inundation grassland and this might be the result of shelter, producing little spray to influence water quality and hence change SD8e and SD17b swards into the MG11 type. The eastern part of the site is largely improved pasture or arable land.

Despite the scale of improvement, the site is an excellent example of dune wetland with zonations which are not closely repeated elsewhere. Overall nature conservation interest for the wetland vegetation is high. The site is rather small to form a separate SSSI but, if deemed worthy, a major revision of Sanday SSSIs could incorporate the wetland as one of several detached SSSI outliers. The extent of wet ground is also probably important for breeding waders.

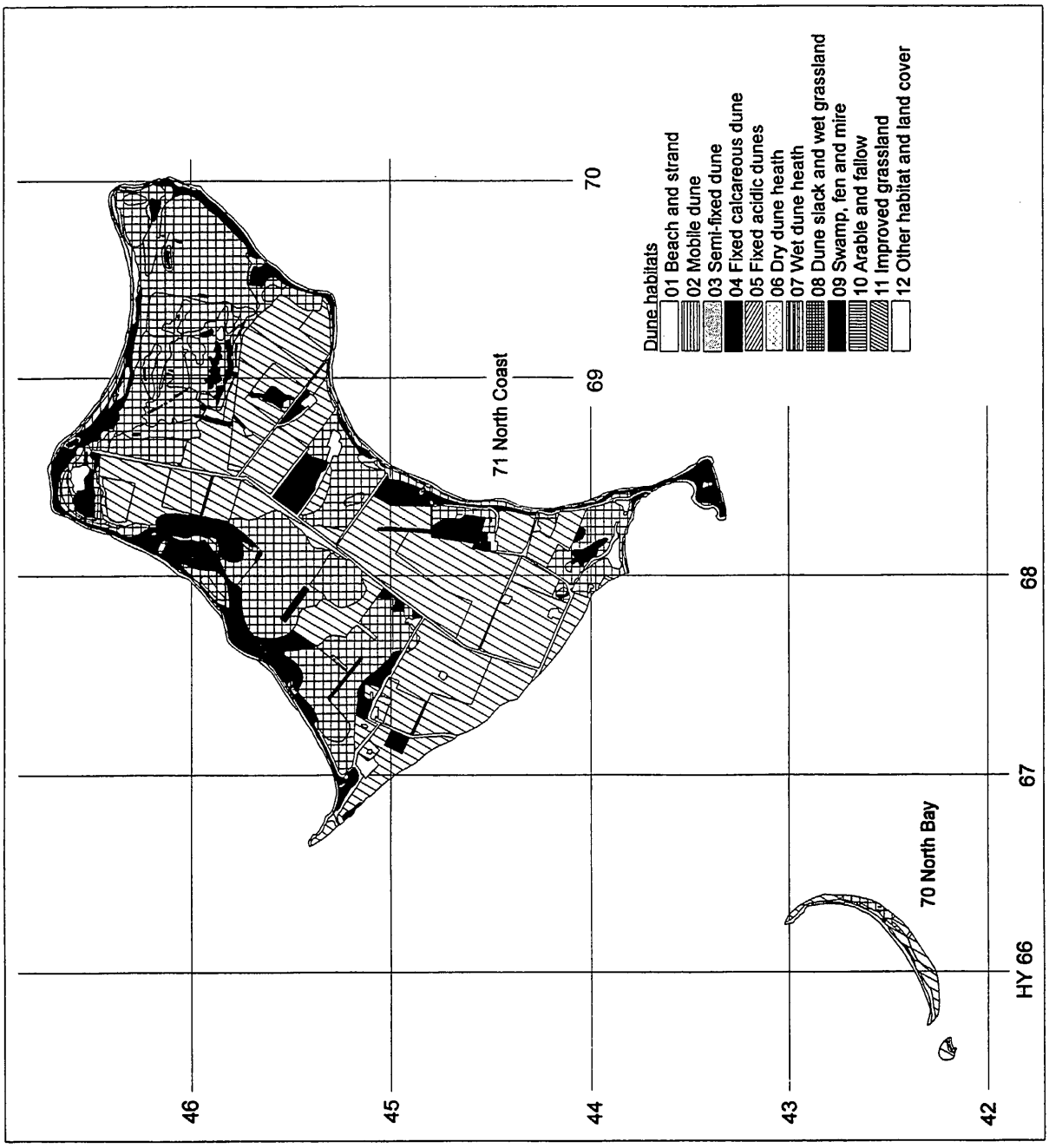
75 Doun Helzie and Pool Bay (Map 2d)

This large (265.3 ha) is located on the eastern side of the Spur Ness peninsula and consists of two bay dune systems either side of a small headland (Quoy Ness) and very large climbing dune interior which extends 1.5 km to the north, reaching the northern shore of the peninsula at Pool Bay. The site is exposed to a long fetch SE to Denmark and the German coast. The eastern parts of the site are not visible from the main road across the peninsula and these sectors are probably the most isolated dunes in Orkney.

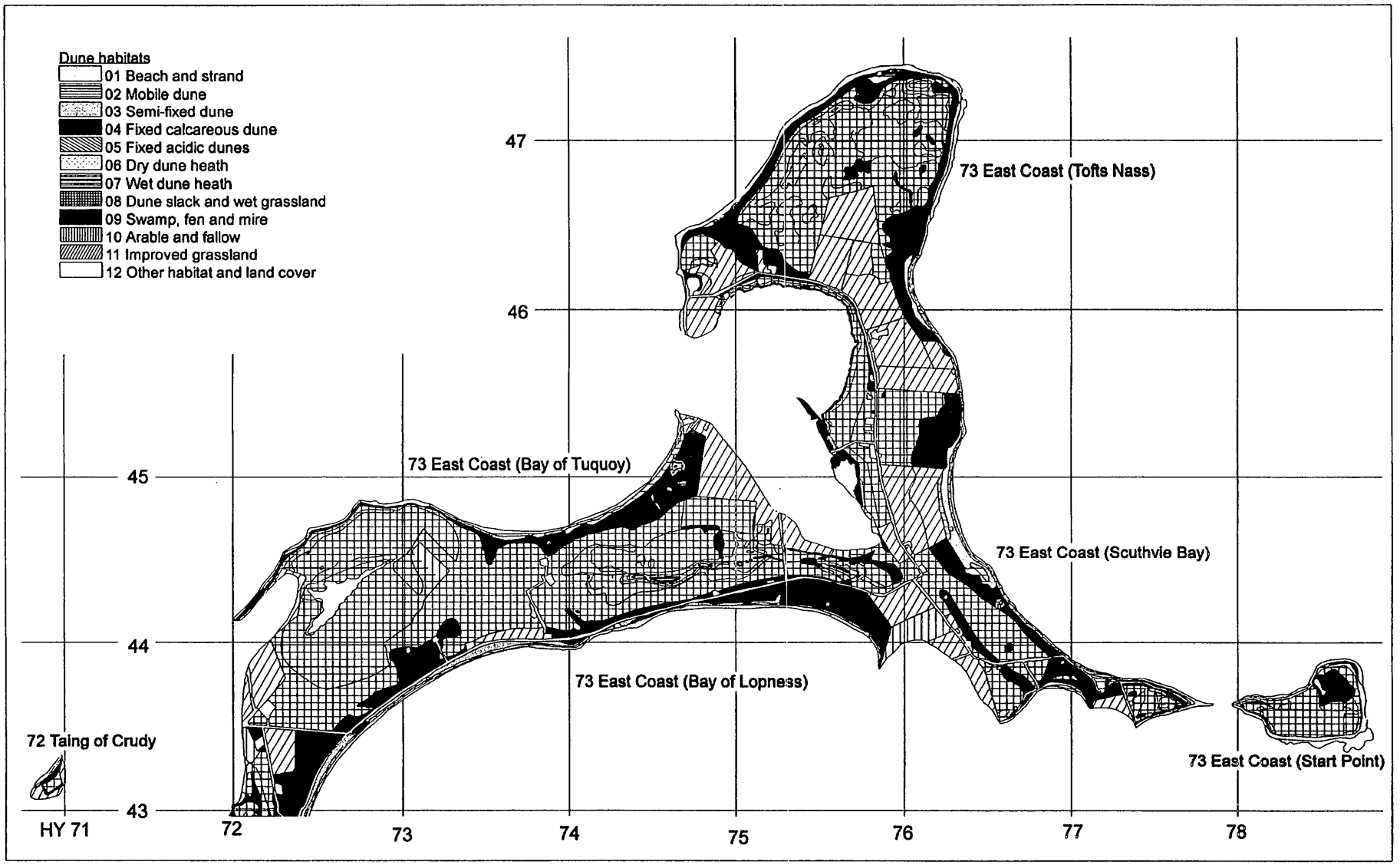
The most outstanding feature of the site is the largest area of SD7 *Ammophila arenaria - Festuca rubra* semi-fixed dune in Orkney which forms much of the seaward sector of climbing dune. Sectors of this habitat most distant from the shore, and with reduced sand input, have a large block of SD7y *Hylocomium splendens* (provisional new sub-community), a type which is moderately common in the Moray Firth area and which is part of a suite of vegetation types which may represent a distinct coastal biogeographical region, making this site an important outlier. The remainder of the SD7 vegetation is made up of the SD7x *Galium verum* (provisional new sub-community) which is widespread in small quantity in Orkney and abundant in the Western Isles, Shetland and west coast mainland of Scotland. The two potentially-new sub-communities usually have distinct distributions and Orkney could be an important area of potential overlap. The widespread loss of the semi-fixed dune zone throughout Orkney makes it impossible to assess this overlap beyond this site.

The site contains a good area of fixed dune grassland inland from the semi-fixed dune zone. There are several locations for dune wetland. Small extents of SD8e damp fixed dune are present at the base of hillslopes on the eastern coast and further small patches are found in deflation hollows in the northeast. Wet neutral grassland (MG11, MG9/MG11) is found on shallow sand over till in the northeast and ungrazed MG1/MG11 grassland is present with SD8e damp grassland and S10 swamp on poorly drained ground at the foot of hillslopes on the north coast at Pool Bay. The remainder of the site is improved grassland or arable land.

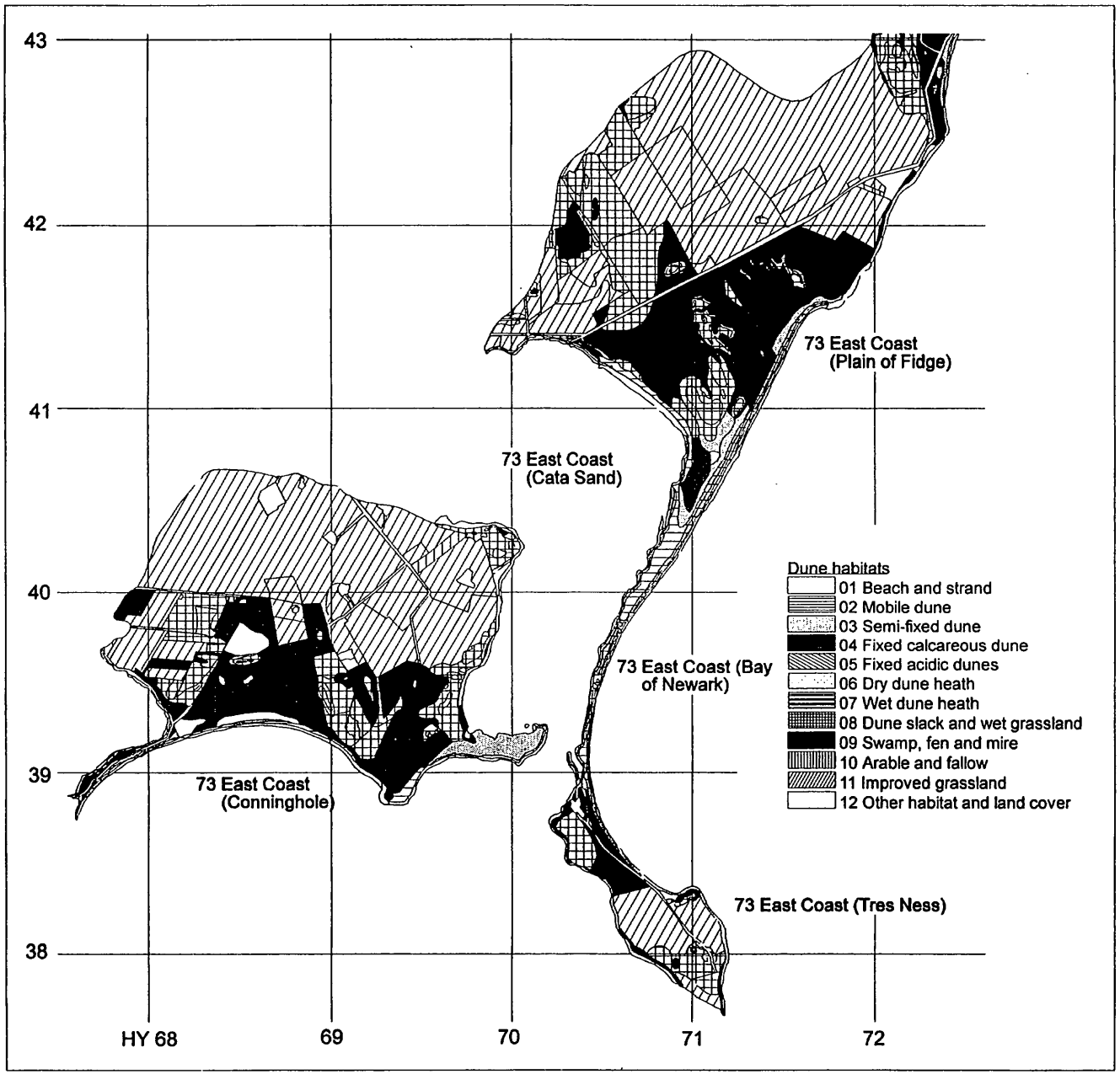
A small sand pit is present in the west of the site. Despite a large amount of improvement the nature conservation importance of vegetation for this site is high, since it represents the last large climbing dune system in Orkney with a large proportion of intact semi-fixed dune. Elsewhere, either grazing has transformed this to SD8 fixed dune grassland, or improvement and tillage have removed dune vegetation entirely. The site is rather small to form a separate SSSI but, if deemed worthy, a major revision of Sanday SSSIs could incorporate the eastern sectors as one of several detached SSSI outliers.



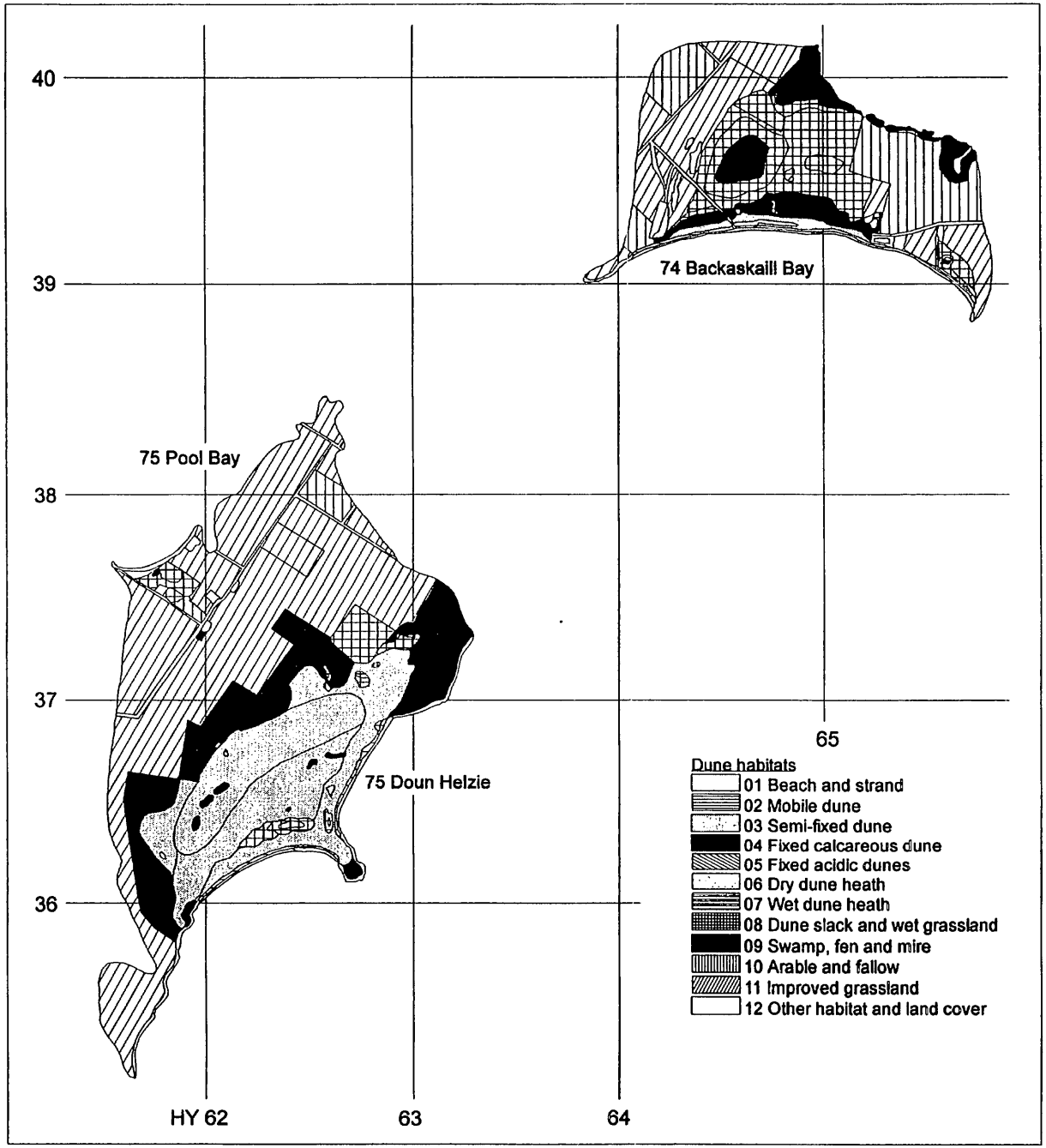
Map 2a Dune habitats of North Bay and North Coast (Sanday)



Map 2b Dune habitats of East Coast (northern sector) and Taing of Crudy, Sanday



Map 2c Dune habitats of East Coast (Southern Sector), Sanday



Map 2d Dune habitats of Backaskaill Bay and Doun Helzie to Pool Bay (Sanday)

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Table 3a Vegetation and other land cover (areas in ha)

Sites 70 - 73

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	All Sanday sites
AOB	Arable - oats and barley					20.26
AP	Arable - potatoes		0.47		0.48	0.96
ARB	Arable - barley				11.64	25.01
BBG	Buildings, bare ground and gardens		3.92		12.01	17.87
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	0.08	2.46		15.71	21.36
BMC	Maritime cliff with little vegetation		0.45		3.85	7.44
BS	Bare sand (within vegetated sand zone)		1.68		15.24	19.96
BSH	Bare shingle	1.88	6.22	0.32	31.33	41.00
CMTY	Graveyard					0.37
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire		0.09			0.09
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.03	7.97	0.38	4.08	14.11
M28x/S28	M28x/S28 intermediate				1.21	2.10
M28x/ SM28	M28x/SM28 intermediate				1.30	1.30
MC9	MC9 *Festuca rubra - Holcus lanatus* maritime grassland				0.61	0.61
MC9/SD8	MC9/SD8 intermediate				1.46	1.46
MG1	MG1 *Arrhenatherum elatius* coarse grassland		12.83		4.29	17.27
MG1/ MG11	MG1/MG11 intermediate				0.27	1.93
MG1/ MG7	MG1/MG7 intermediate				13.80	13.80
MG1/ SD8a	MG1/SD8a intermediate				0.19	0.19
MG1/ SD8x	MG1/SD8x intermediate				1.18	1.18
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community		1.36		1.06	2.42
MG6	MG6 *Lolium perenne - Cynosurus cristatus* pasture	2.16	103.69		2.17	108.02
MG6/ MG11	MG6/MG11 intermediate				3.82	3.82
MG6/ SD17	MG6/SD8a intermediate				3.55	3.55
MG6/ SD8a	MG6/SD17 intermediate				6.12	6.12
MG7	MG7 *Lolium perenne* leys	1.97	54.60	1.19	329.81	547.20
MG7/ MG11	MG7/MG11 intermediate				49.69	49.69
MG7/SD8	MG7/SD8 intermediate				7.94	7.94
MG7/ SD8a	MG7/SD8a intermediate				2.06	2.06
MG9	MG9 *Holcus lanatus - Deschampsia cespitosa* grassland		3.12		5.61	8.74
MG9/ MG11	MG9/MG11 intermediate		20.24	0.63	39.09	63.05
MG9/ SM28	MG9/SM28 intermediate				1.51	1.51

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 70 - 73

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	All Sanday sites
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	1.07	90.69		234.79	331.34
MG11/ MG13	MG11/MG13 intermediate				4.14	4.14
MG11/ RUD	MG11/RUD intermediate				0.50	0.50
MG11/ S10	MG11/S10 intermediate					0.73
MG11/ S19	MG11/S19 intermediate				0.33	0.33
MG11/ SD8a	MG11/SD8a intermediate				1.16	1.16
MG11/ SD8e	MG11/SD8e intermediate				2.14	2.14
MG11F	MG11F *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland - FALLOW		0.44			0.44
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland		0.38		1.22	2.09
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)				0.38	0.38
Mxbd	Mxbd *Carex nigra - Prunella vulgaris - Molinia caerulea* mire (PROVISIONAL NEW NVC TYPE)				1.61	5.75
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)		3.39		3.05	6.45
OW	Open water		1.92		6.99	9.31
PIT	Active sand pit or rock quarry				0.06	0.44
ROAD	Road and track	0.04	11.89		30.08	49.46
RUD	Ruderal-dominated vegetation	0.44	3.74		27.18	38.77
S4	S4 *Phragmites australis* reedbed		0.17			1.29
S6	S6 *Carex riparia* swamp					0.83
S10	S10 *Equisetum fluviatile* swamp				0.97	3.59
S10/S19	S10/S19 intermediate		0.09			0.09
S10a	S10a *Equisetum fluviatile* swamp, *E. fluviatile* sub-community		0.12		0.51	0.63
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community		0.57		4.00	4.82
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		1.28		1.72	3.00
S19c/ SD17c	S19c/SD17c intermediate				0.78	0.78
S19c/ SD17d	S19c/SD17d intermediate				1.32	1.32
S20	S20 *Scirpus lacustris* ssp. *tabernaemontani* swamp		0.02			0.02
S28	S28 *Phalaris arundinacea* fen		0.47		0.51	0.98
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline		0.09		0.68	0.91
SD2/SD6c	SD2/SD6c intermediate				0.63	0.63
SD2/SD8c	SD2/SD8c intermediate				0.12	0.12
SD2/SDy	SD2/SDy intermediate				0.10	0.10
SD3	SD3 *Matricaria maritima-Galium aparine* strandline	0.19	0.71		0.38	1.28
SD3/ MG11	SD3/MG11 intermediate	0.05				0.05
SD3/SD5	SD3/SD5 intermediate		0.03			0.03
SD4	SD4 *Elymus farctus* foredune		0.13		0.78	0.91
SD4/SD8	SD4/SD8 intermediate		2.78			2.78
SD4/SD8a	SD4/SD8a intermediate		0.25		9.02	9.26
SD4/SD8c	SD4/SD8c intermediate		2.64		3.16	5.80

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 70 - 73

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	All Sanday sites
SD5/ SM28	SD5/SM28 intermediate				0.90	1.17
SD5a	SD5a *Leymus arenarius* mobile dune, species-poor sub-community		0.16		0.07	0.24
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community	0.01	2.59			2.61
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.04	1.67	0.18	7.09	9.23
SD5c/ SM28	SD5c/SM28 intermediate				0.66	0.66
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community		0.05		2.36	2.51
SD6ae	SD6a/e intermediate				9.40	12.64
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community				1.11	1.11
SD6d	SD6d *Ammophila arenaria* mobile dune, Typical sub-community				0.06	0.06
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community				6.99	6.99
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community				0.18	0.18
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)		0.58		26.87	69.94
SD7y	SD7y *Ammophila arenaria-Festuca rubra* semi-fixed dune community, *Hylocomium splendens* sub-community (PROVISIONAL NEW NVC TYPE)					30.87
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.08	30.07	0.29	180.19	216.38
SD8b	SD8b *Festuca rubra-Galium verum* fixed dune grassland, *Luzula campestris* sub-community		0.43			0.43
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community		1.20		6.37	8.43
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community				40.41	83.31
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community		5.15		19.51	47.69
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW				0.48	0.48
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)		0.36		2.99	3.35
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community		16.82		138.70	165.52
SD17b/ SM16d	SD17b/SM16d intermediate				0.62	0.62
SD17c	SD17c *Potentilla anserina-Carex nigra* slack, *Caltha palustris* sub-community				2.44	2.44
SD17d	SD17d *Potentilla anserina-Carex nigra* slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community		6.71		11.92	18.63
SD17d/ SM16d	SD17d/SM16d intermediate				1.12	1.12
SD17x	SD17x *Potentilla anserina-Carex nigra* dune-slack, *Agrostis stolonifera* sub-community (PROVISIONAL NEW NVC TYPE)				0.45	0.45
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)		0.20	0.04	1.28	1.74
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)		1.33		0.26	1.66

Table 3a (continued) Vegetation and other land cover (areas in ha)

Sites 70 - 73

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	70 North Bay	71 North Coast	72 Taing of Crudy	73 East Coast	All Sanday sites
SM16	SM16 *Festuca rubra* saltmarsh		0.68		2.56	3.23
SM16d	SM16d *Festuca rubra* saltmarsh, *Festuca rubra* sub-community				1.43	1.43
SM28	SM28 *Elymus repens* saltmarsh				0.25	0.25
SxTHF	SxTHF *Phragmites australis - Calliergon cordifolium* tall-herb fen community, (PROVISIONAL NEW NVC TYPE)		1.83			3.44
TIP	Rubbish tip				0.26	0.26
TOTALS (ha)		8.05	410.74	3.03	1376.30	2204.10

Table 3b Vegetation and other land cover (areas in ha)

Sites 74 - 75

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
AOB	Arable - oats and barley	20.26		20.26
AP	Arable - potatoes			0.96
ARB	Arable - barley	8.91	4.46	25.01
BBG	Buildings, bare ground and gardens	0.87	1.08	17.87
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	1.80	1.31	21.36
BMC	Maritime cliff with little vegetation	0.48	2.67	7.44
BS	Bare sand (within vegetated sand zone)	0.22	2.81	19.96
BSH	Bare shingle		1.25	41.00
CMTY	Graveyard	0.37		0.37
M28	M28 *Iris pseudacorus - Filipendula ulmaria* mire			0.09
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	1.64		14.11
M28x/S28	M28x/S28 intermediate	0.90		2.10
M28x/ SM28	M28x/SM28 intermediate			1.30
MC9	MC9 *Festuca rubra - Holcus lanatus* maritime grassland			0.61
MC9/SD8	MC9/SD8 intermediate			1.46
MG1	MG1 *Arrhenatherum elatius* coarse grassland		0.15	17.27
MG1/ MG11	MG1/MG11 intermediate		1.67	1.93
MG1/ MG7	MG1/MG7 intermediate			13.80
MG1/ SD8a	MG1/SD8a intermediate			0.19
MG1/ SD8x	MG1/SD8x intermediate			1.18
MG1a	MG1a *Arrhenatherum elatius* coarse grassland, *Festuca rubra* sub-community			2.42
MG6	MG6 *Lolium perenne - Cynosurus cristatus* pasture			108.02
MG6/ MG11	MG6/MG11 intermediate			3.82
MG6/ SD17	MG6/SD8a intermediate			3.55
MG6/ SD8a	MG6/SD17 intermediate			6.12
MG7	MG7 *Lolium perenne* leys	33.76	125.87	547.20
MG7/ MG11	MG7/MG11 intermediate			49.69
MG7/SD8	MG7/SD8 intermediate			7.94
MG7/ SD8a	MG7/SD8a intermediate			2.06
MG9	MG9 *Holcus lanatus - Deschampsia cespitosa* grassland			8.74
MG9/ MG11	MG9/MG11 intermediate	2.38	0.71	63.05
MG9/ SM28	MG9/SM28 intermediate			1.51

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 74 - 75

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	2.75	2.04	331.34
MG11/ MG13	MG11/MG13 intermediate			4.14
MG11/ RUD	MG11/RUD intermediate			0.50
MG11/ S10	MG11/S10 intermediate		0.73	0.73
MG11/ S19	MG11/S19 intermediate			0.33
MG11/ SD8a	MG11/SD8a intermediate			1.16
MG11/ SD8e	MG11/SD8e intermediate			2.14
MG11F	MG11F *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland - FALLOW			0.44
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.49		2.09
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)			0.38
Mxbd	Mxbd *Carex nigra - Prunella vulgaris - Molinia caerulea* mire (PROVISIONAL NEW NVC TYPE)	4.14		5.75
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)			6.45
OW	Open water	0.40		9.31
PIT	Active sand pit or rock quarry	0.28	0.10	0.44
ROAD	Road and track	3.36	4.09	49.46
RUD	Ruderal-dominated vegetation	4.65	2.76	38.77
S4	S4 *Phragmites australis* reedbed	1.13		1.29
S6	S6 *Carex riparia* swamp	0.83		0.83
S10	S10 *Equisetum fluviatile* swamp	2.53	0.08	3.59
S10/S19	S10/S19 intermediate			0.09
S10a	S10a *Equisetum fluviatile* swamp, *E. fluviatile* sub-community			0.63
S19a	S19a *Eleocharis palustris* swamp, *E. palustris* sub-community	0.26		4.82
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community			3.00
S19c/ SD17c	S19c/SD17c intermediate			0.78
S19c/ SD17d	S19c/SD17d intermediate			1.32
S20	S20 *Scirpus lacustris* ssp. *tabernaemontani* swamp			0.02
S28	S28 *Phalaris arundinacea* fen			0.98
SD2	SD2 *Cakile maritima-Honkenya peploides* strandline	0.09	0.04	0.91
SD2/SD6c	SD2/SD6c intermediate			0.63
SD2/SD8c	SD2/SD8c intermediate			0.12
SD2/SDy	SD2/SDy intermediate			0.10
SD3	SD3 *Matricaria maritima-Galium aparine* strandline			1.28
SD3/ MG11	SD3/MG11 intermediate			0.05
SD3/SD5	SD3/SD5 intermediate			0.03
SD4	SD4 *Elymus farctus* foredune			0.91
SD4/SD8	SD4/SD8 intermediate			2.78
SD4/SD8a	SD4/SD8a intermediate			9.26
SD4/SD8c	SD4/SD8c intermediate			5.80

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 74 - 75

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
SD5/ SM28	SD5/SM28 intermediate	0.27		1.17
SD5a	SD5a *Leymus arenarius* mobile dune, species-poor sub-community			0.24
SD5b	SD5b *Leymus arenarius* mobile dune, *Elymus farctus* sub-community			2.61
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community	0.25		9.23
SD5c/ SM28	SD5c/SM28 intermediate			0.66
SD6a	SD6a *Ammophila arenaria* mobile dune, *Elymus farctus* sub-community		0.10	2.51
SD6ae	SD6a/e intermediate	1.40	1.84	12.64
SD6b	SD6b *Ammophila arenaria* mobile dune, *Leymus arenarius - Elymus farctus* sub-community			1.11
SD6d	SD6d *Ammophila arenaria* mobile dune, Typical sub-community			0.06
SD6e	SD6e *Ammophila arenaria* mobile dune, *Festuca rubra* sub-community			6.99
SD7a	SD7a *Ammophila arenaria-Festuca rubra* semi-fixed dune, Typical sub-community			0.18
SD7x	SD7x *Ammophila arenaria-Festuca rubra* semi-fixed dune, *Galium verum* sub-community (PROVISIONAL NEW NVC TYPE)	3.27	39.23	69.94
SD7y	SD7y *Ammophila arenaria-Festuca rubra* semi-fixed dune community, *Hylocomium splendens* sub-community (PROVISIONAL NEW NVC TYPE)		30.87	30.87
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community	0.29	5.48	216.38
SD8b	SD8b *Festuca rubra-Galium verum* fixed dune grassland, *Luzula campestris* sub-community			0.43
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community		0.85	8.43
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	6.78	36.11	83.31
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community	19.83	3.19	47.69
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW			0.48
SD8x	SD8x *Festuca rubra - Galium verum* fixed dune community, *Centaurea nigra - Daucus carota* sub-community (PROVISIONAL NEW NVC TYPE)			3.35
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community	9.12	0.88	165.52
SD17b/ SM16d	SD17b/SM16d intermediate			0.62
SD17c	SD17c *Potentilla anserina-Carex nigra* slack, *Caltha palustris* sub-community			2.44
SD17d	SD17d *Potentilla anserina-Carex nigra* slack, *Hydrocotyle vulgaris - Ranunculus flammula* sub-community			18.63
SD17d/ SM16d	SD17d/SM16d intermediate			1.12
SD17x	SD17x *Potentilla anserina-Carex nigra* dune-slack, *Agrostis stolonifera* sub-community (PROVISIONAL NEW NVC TYPE)			0.45
SDy	SDy *Atriplex glabriuscula* strandline (PROVISIONAL NEW NVC TYPE)	0.05	0.17	1.74

Table 3b (continued) Vegetation and other land cover (areas in ha)

Sites 74 - 75

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	74 Backaskaill Bay	75 Doun Helzie and Pool Bay	All Sanday sites
SHv	SHv *Hippuris vulgaris* swamp (PROVISIONAL NEW NVC TYPE)	0.07		1.66
SM16	SM16 *Festuca rubra* saltmarsh			3.23
SM16d	SM16d *Festuca rubra* saltmarsh, *Festuca rubra* sub-community			1.43
SM28	SM28 *Elymus repens* saltmarsh			0.25
SxTHF	SxTHF *Phragmites australis - Calliergon cordifolium* tall-herb fen community, (PROVISIONAL NEW NVC TYPE)	1.61		3.44
TIP	Rubbish tip			0.26
TOTALS (ha)		135.44	270.53	2204.10

Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY68694654	71 North Coast	Stable beach of sand over flat rounded sandstone slabs forming most of steep upper beach. Narrow SD5a dune edge, changing rapidly to SD5c. Many tangle platforms along foredune ridge. Behind foredune is large SD8a and SD8c area flattened by vehicles, used as parking area at end of track from south. Foredune breached in one place to provide beach access for vehicles.
2	HY68404650	71 North Coast	Open water and emergent swamp vegetation, with extensive rafts of *Polygonum amphibium* and *Hippuris vulgaris*. S4 *Phragmites australis* reedbed with *Mentha aquatica* present on west side. Margins heavily grazed and poached by cattle on western side. Very large numbers of snipe (60+) present.
3	HY68214623	71 North Coast	Winter feeding area. Heavily trampled and dunged - much *Cirsium arvense, Stellaria media, Urtica dioica*. About 20 sq m affected.
4	HY68254600	71 North Coast	Swamp and mire vegetation marks poorly drained soils on thin sand over till. 1.5 m tall *Phragmites australis* mixed with *Iris pseudacorus* extensive. Wetter areas have *Equisetum fluviatile* and a little *Hippuris vulgaris* with *Deschampsia cespitosa, Agrostis stolonifera, Festuca rubra*.
5	HY67804583	71 North Coast	Very steep shingle beach with no vegetated crest. Probably moving slowly inland - shingle bare for 2-4 m inland. SD8 turf on interior, with much *Galium aparine* and *Sonchus arvensis*. Mapped as SD3/SD8a.
6	HY67784582	71 North Coast	Shingle ends, with dipping sandstone bedrock outcrop forming shoreline, capped with 0.5-1.5 m blown sand.
7	HY67754578	71 North Coast	SD8a and MG11 turf infested with *Cirsium arvense*.
8	HY67554560	71 North Coast	Steep slab shingle beach capped with 1-4 m of sand. Dunes cliffed 1-2 m with turf slumping patchily present. SD4 on dune cliff face. Scattered *Atriplex laciniata* at foot of cliff on sand over shingle. Dunes vegetated with SD4/SD8 sward - abundant *Elymus farctus*. Stock kept out of area by electric fence - sharp grazing difference between tall SD4/SD8 and short SD8a.
9	HY67444559	71 North Coast	Old sandpit 40 m in depth, 15 m wide, excavated behind foredune (10-15 m to sea). Sections show sand up to 2.5 m thick over shingle. Turf slumping on edges, rabbit burrows common. *Cakile maritima* common on pit sides close to sea.
10	HY67424556	71 North Coast	Former sand pit 40 m long, up to 30 m wide, excavated behind foredune (5 m to sea). Used as dump for creels, organic waste, old vehicles, batteries, engines. Nutriphiles common, mainly *Urtica dioica* and *Cirsium vulgare*.

#	Grid Ref.	Site	Target Note Detail
11	HY68884638	71 North Coast	Possible former sand pit, now developed into linear blowouts. Stock rubbing and trampling extensive, plus rabbit burrowing. Turf collapse common.
12	HY69054632	71 North Coast	Part of low (2-4 m high) dune ridge developed 30-40 m inland of sand-capped shingle dune edge. Northern edge has frequent blowouts, some with stone slabs placed to halt erosion. Crest is a mix of SD8c and SD4/SD8, with much *Elymus farctus* in turf. Wall marked on OS map largely buried. Ridge has probably developed in last two decades.
13	HY69804634	71 North Coast	Foredune ridge at Whitemill River rises to 3-4 m above shingle. Sea side cliffed with SD6a vegetation. No *Leymus arenarius* present but SD5b and SD5c a short distance to west.
14	HY69804636	71 North Coast	Rear of foredune edge with many rabbit burrows. SD7x turf with high cover of *Heracleum sphondylium* and *Cirsium vulgare*. Probably high sand and seaweed input to sward.
15	HT69834618	71 North Coast	SD8b turf on thin sand over shingle. Local disturbance by rabbit burrows, slight hummocks from past instability. *Cladonia rangiformis* in turf.
16	HY69804615	71 North Coast	Very high rabbit burrow density, producing high ruderal cover of *Cirsium arvense, Silene dioica, Urtica dioica, Ranunculus repens*.
17	HY69624571	71 North Coast	Upper shingle of steep beach has 50% cover of SD3, rich in *Mertensia maritima, Atriplex hastata* and *Sonchus arvensis*.
18	HY68704523	71 North Coast	Former sand pit cut into back of SD5b foredune ridge. Cars, drums and old fencing dumped on side. Southern side has blowout through to shore, partly blocked by SD5b dune.
19	HY68614513	71 North Coast	15 m wide, 40 m long former sand pit with shingle ridge exposed in part of floor. Much turf slumping on sides.
20	HY68954590	71 North Coast	Mx *Prunella vulgaris* mire area with distinct pools of irregular shape. Edges with S19a swamp, floors of most pools with abundant *Chara hispida*. One patch of S20 *Scirpus lacustris tabernaemontani* swamp. Cattle have access to this very swampy ground - it was possibly *Phragmites* swamp before being grazed out.
21	HY69044580	71 North Coast	MxTm swamp with a few patches of *Filipendula ulmaria*.
22	HY68354455	71 North Coast	Track breaches foredune ridge to beach. SD8 and SD5c foredune cliffed to 3 m, with turf collapse and fence collapsed. SD5b formed on face of cliff.
23	HY68414470	71 North Coast	Old sandpit used as dump for rubble and old cars.
24	HY68374378	71 North Coast	Confused area with rabbit scraped bare sand, patches of *Agrostis stolonifera, Juncus gerardi, Glaux maritima*. SM16, probably rarely under tidal influence. Highest areas have much *Matricaria maritima*.
25	HY68484360	71 North Coast	Isthmus linking Sanday to Lama Ness breached. Shingle bar has 0.7-1 m sand which has disappeared in three short gaps (2,4,3 m). A SD2/SD3 strand of *Atriplex glabriuscula* fills the gap. SD5c on east side is cliffed.
26	HY68424340	71 North Coast	Old sand pit 45 m x 20 m, most of sand and shingle floor vegetated. Only south end may still be used.
27	HY68404340	71 North Coast	SD8a turf grazed very short by very high rabbit numbers. Burrows and scrapes extensive, even *Leymus arenarius* in adjacent SD5c cut back.

#	Grid Ref.	Site	Target Note Detail
28	HY68304327	71 North Coast	Pile (2 cu m) of shingle excavated from beach.
29	HY69954025	73 East Coast	SD8a and SD8c with many rabbit burrows occupying ground just higher than adjacent MG11. Clusters of ruderals around burrows: *Urtica dioica, Urtica urens, Senecio jacobea, Arctium minus, Cirsium vulgare, Echium vulgare, Silene dioica.*
30	HY65604220	73 East Coast	Sheltered bay with limited thin sand over shingle. SD3 strand of *Urtica dioica, Matricaria maritima, Stellaria media.* These species continue inland mixed with *Agrostis stolonifera* and *Potentilla anserina.* Mapped as MG11/SD3.
31	HY65904226	73 East Coast	No sand on beach but thick deposits behind steep shingle front and crest. Many rabbit burrows, backslope infested with *Urtica dioica* and some *Cirsium vulgare.* Sward partly improved MG11 with much *Lolium perenne* and *Poa annua.*
32	HY66154238	73 East Coast	Rubble dump.
33	HY75694591	73 East Coast	Fence marks boundary between grazed (to south) and ungrazed (to north) wet mesotrophic grassland. Ungrazed sward to north is much more species poor (Q38-MG11, Q39-MG9) compared to grazed form (Q37-MG9/MG11).
34	HY75784623	73 East Coast	Attempt to improve MG11 sward, with patchy survival of *Lolium perenne.* Mapped as MG7/MG11. Used as pasture, no sign of hay crop in 1996.
35	HY76044621	73 East Coast	Sandy beach with good summer accretion bank obscuring winter cliffs at dune foot. Single foredune ridge, mainly SD6c with abundant *Cakile maritima* and *Sonchus arvensis.* Dune foot has a long SD2 *Cakile maritima* strand, with SDy *Atriplex glabriuscula* and *A. prostrata* type at north end. Behind foredune crest there is a rapid transition to SD7x, with low hummocks around marram stems suggesting moderate levels of winter sand deposition. Fence behind dune crest is largely buried in several places.
36	HY75904668	73 East Coast	Very extensive MG11 and SD17b with abundant *Parnassia palustris* and much *Gentianella amarella.* 40% of cover more rank with few attractive herbs which are largely confined to short turf. Suggests slight undergrazing. Slight depressions have SD17b, generally well grazed and diverse. The highest MG11 areas are less diverse, even when well grazed the transition zone between MG11 and SD17b clearly offers the best moisture conditions for species diversity.
37	HY75924738	73 East Coast	Most northern edge of Tofts Ness peninsula has steep slab shingle beach above intertidal sand. Shingle is capped with sand up to 4 m thick, broken by two short V shaped blowouts which are stabilised. Small patches of SD5c, most coastal edge turf is SD4/SD8 with *Honkenya peploides* frequent in low quantity. Intense rabbit activity, producing SD4/SD8c on dune backslope. *Cirsium vulgare* is only ruderal around rabbit burrows.
38	HY75324700	73 East Coast	Fine SD17b slack forming continuous 1 km 30-60 m wide depression inland of western side of Tofts Ness peninsula. Species rich sward. A few lower, small depressions have SD17d vegetation.

#	Grid Ref.	Site	Target Note Detail
39	HY74904655	73 East Coast	Small (2 cu m) pile of shingle excavated from beach. Local area (15 m radius) rich in *Honkenya peploides*, probably derived from successive shingle extractions.
40	HY78014366	73 East Coast	*Mertensia maritima* abundant (10 m sq total area) on thin small area of coarse shell sand over shingle at west end of Start Point island. Higher strand is SDy *Atriplex glabriuscula, A. prostrata, Matricaria maritima.*
41	HY78604370	73 East Coast	Wet depression has S19a swamp and open water surrounded by SD17d (with *Juncus gerardi*) and MG13 sward between *Carex nigra* tussocks. Probably receives much spray.
42	HY78704385	73 East Coast	MC9 sward very rich in *Rumex acetosa* (cover 10-20%) - probably derived from roosting and nesting birds. Related to SD8a - no *Galium verum* (too much sea spray).
43	HY77704360	73 East Coast	Very small area (0.2 sq m) of *Mertensia maritima* in SDy *Atriplex glabriuscula - Matricaria maritima* strand on thin coarse shell and over shingle.
44	HY77674360	73 East Coast	SD8a dune edge cliffed to 1.5 m over steep slab shingle beach.
45	HY77684364	73 East Coast	All grasslands at east end of headland are ungrazed and very rank. Drier forms have SD8x, wetter show inwash of *Deschampsia cespitosa* to form large area of MG9, with MG9/MG11 surrounds.
46	HY76964382	73 East Coast	Former sand pit - sides and floor now entirely re-vegetated with SD8a turf.
47	HY76704392	73 East Coast	Fine sheep grazed MG11 swards rich in *Parnassia palustris.*
48	HY76604373	73 East Coast	Rank, lightly grazed MG11 swards with low species diversity. Small area of MG9 to north - an additional indicator of light or no grazing.
49	HY76234458	73 East Coast	Very small active sandpit (2 m long face, 1.2 m high), set within much larger old pit which is fully re-vegetated with SD7x and SD8a vegetation. Used as dump for old agricultural machinery.
50	HY76264459	73 East Coast	Gentle sandy beach. Dunes at north end of beach (Hine Greenie) have a winter cliff to 1.5 m height, obscured to south by summer accretion bank. 2-3 m wide SD2 *Cakile maritima* strand. Strand species common in SD6ae front to foredune ridge, abruptly changing to SD7x behind ridge.
51	HY76474440	73 East Coast	Large former sandpit (150 m x 35 m) now largely re-vegetated with SD7x, SD8a and SD8c cover. Used as dump for old cars, rubble and fencing. Some rabbit activity, with small patches of shingle exposed in floor.
52	HY76524435	73 East Coast	Natural boundaries of SD5c and SD7x removed and SD8a extended east almost to foredune crest. Method of removing *Ammophila* and *Leymus* uncertain (possibly cut). Zone of change infested with *Senecio jacobea.*
53	HY76604430	73 East Coast	Former blowout used as tip for car, agricultural machinery and fencing. Heavily trampled by stock - much bare sand and some risk of renewed blowout activity.

#	Grid Ref.	Site	Target Note Detail
54	HY76594427	73 East Coast	Probable former sandpit, heavily trampled by stock. Risk of blowout initiation - rubble dumped to stop blowing on steep face.
55	HY75774415	73 East Coast	Base of rear slope to foredune ridge etched with wide shallow blowouts (formed by northerly winds), now stabilised. Top edges contain small (2-10 sq m) blowouts formed by stock trampling and rabbit burrowing.
56	HY75774411	73 East Coast	Fence marks sharp boundary to SD7x (ungrazed outside). *Ammophila* formerly extended inside - low hummocks are still present (SD4/SD8c). Probably burnt or grazed out of sward.
57	HY75534422	73 East Coast	Sandpit with 30 m long face, up to 2.5 m thickness of sand. Actively extracted (vehicle track, hole in face). Up to 200 cu m probably taken from site.
58	HY75384422	73 East Coast	Foundations of old military buildings largely buried by sand and SD8a and SD8c sward. Further north at least two air raid shelters are buried by vegetated sand.
59	HY75234422	73 East Coast	Abrupt change from SD8 to SD7x at fence boundary showing loss of *Ammophila* to east.
60	HY75234420	73 East Coast	Dune front cliffed to 3 m, with some fence collapse and much turf slumping. Weak summer accretion bank with SD2, SD4, SDy and SD6a fragments. Beach thin sand over shingle.
61	HY74604428	73 East Coast	Rank MG11 with small patches of *Parnassia palustris* suggesting grazing too light in recent past.
62	HY74154405	73 East Coast	Deep narrow ditch to sea, sides mainly very rank *Festuca rubra. Rumex crispus* in dry sections.
63	HY74114421	73 East Coast	Rank, species poor MG11 - undergrazed. Occasional patches of *Parnassia* - diversity probably falling.
64	HY74184430	73 East Coast	Magnificent area of SD17b with many thousands of *Parnassia* spikes over a large area (Q63). Similar conditions are present 200 m to north.
65	HY74124467	73 East Coast	Pile of shingle extracted from beach.
66	HY74124469	73 East Coast	Steep shingle beach with thin cover of sand, much blown up recently on to foredune ridge for 20-30 m inland. Shingle capped by up to 2 m of sand. Much Elymus farctus on seaward face and in SD8 turf. No strand vegetation.
67	HY74504480	73 East Coast	Area of major depressions and one linear blowout, marking old blowout activity now largely stabilised. Depressions have rank SD8a, with two small areas of MG11, both with *Parnassia palustris* and *Gentianella amarella* ssp *septentrionalis*.
68	HY74624508	73 East Coast	Large blowout, very irregular amoeboid shape. Heavy stock trampling, rubbing and rabbit activity. Much local sand blow producing SD4/SD8c sward.
69	HY74804455	73 East Coast	Very fine slacks showing alternation between SD17b and SD17d. Very heavily poached in recent past. Highest areas of SD17b have occasional *Deschampsia cespitosa* tussocks. Much local diversity associated with poached hollows and upstanding turf. Snipe and short-eared owl disturbed. Lowest areas have S10 *Equisetum fluviatile* swamp with abundant *Mentha aquatica*.

#	Grid Ref.	Site	Target Note Detail
70	HY74904447	73 East Coast	Lowest sectors of slack have species rich S19c/SD17d intermediate, with *Polygonum hydropiper* and scattered *Triglochin palustris* (Q65).
71	HY75204457	73 East Coast	More acidic and possibly flushed variant of SD17b with much *Carex panicea, Succisa pratensis* and *Pinguicula vulgaris* (Q67). Located on gentle slope down to main wetland depression. Might be linked to M16b *Erica tetralix - Sphagnum compactum* wetland, *Succisa pratensis - Carex panicea* subcommunity, or even to M10 *Pinguicula vulgaris - Carex dioica* flush.
72	HY76244577	73 East Coast	Former sand pit exposing shingle in base, used as dump for old fencing. Heavy trampling by sheep which also have access to beach and are rapidly destroying foredune ridge, with risk of blowouts. Ridge breached in one location, netting draped to hold sand in position (to little effect). Much turf slumping, mainly along front of single sheep field.
73	HY73864460	73 East Coast	Former sand pit used as old dump for old cars. Very heavy stock trampling, active turf collapse due to stock over rabbit burrows in edge. Blowouts developed in north face, part covered in very unsightly plasterboard to stop erosion.
74	HY73864464	73 East Coast	Stock have access to beach causing trampling, turf collapse and the start of small blowouts. Sand blow inland creates SD4/SD8a and SD4/SD8c.
75	HY73454470	73 East Coast	Dump of rubble and old metal (40 sq m), immediately behind foredune ridge, possibly in old sand pit.
76	HY72804460	73 East Coast	Very large, impressive expanse of SD17b with abundant *Parnassia palustris*. Drainage has probably dried the area, perhaps converting it from SD17d. Parts are poached, producing tussocks up to 20 cm high, often with clusters of high species diversity.
77	HY72854454	73 East Coast	SM16 vegetation, MG13x and good M16/SD17b transitions with high *Juncus gerardi* cover and scattered *Glaux maritima*. Westayre Loch presumably brackish via salt water ingress from drains to west. Loch margins have *Zanichellia palustris* and much *Enteromorpha* sp.
78	HY72054410	73 East Coast	Tidal deep drain connecting Westayre Loch to sea via pipe through shingle ridge.
79	HY72474285	73 East Coast	Drain choked with *Berula erecta, Caltha palustris, Agrostis stolonifera*.
80	HY73194377	73 East Coast	Track cuts through foredune ridge to beach. Large area of shingle within SD7x zone, probably marking storage area for material from beach.
81	HY72394255	73 East Coast	SD8a dune edge cliffed to 1.5 m above steep slab shingle beach with SDy *Atriplex glabriuscula - A. prostrata* strand.
82	HY72204283	73 East Coast	Deep drain with water 35 cm deep. Choked with *Callitriche stagnalis, Agrostis stolonifera, Hippuris vulgaris, Caltha palustris, Mentha aquatica, Carex riparia, Veronica anagallis-aquatica*.
83	HY71104250	73 East Coast	Very extensive drained and improved (MG7) grassland for pasture and silage. Much is very flat and was probably SD17 dune slack.

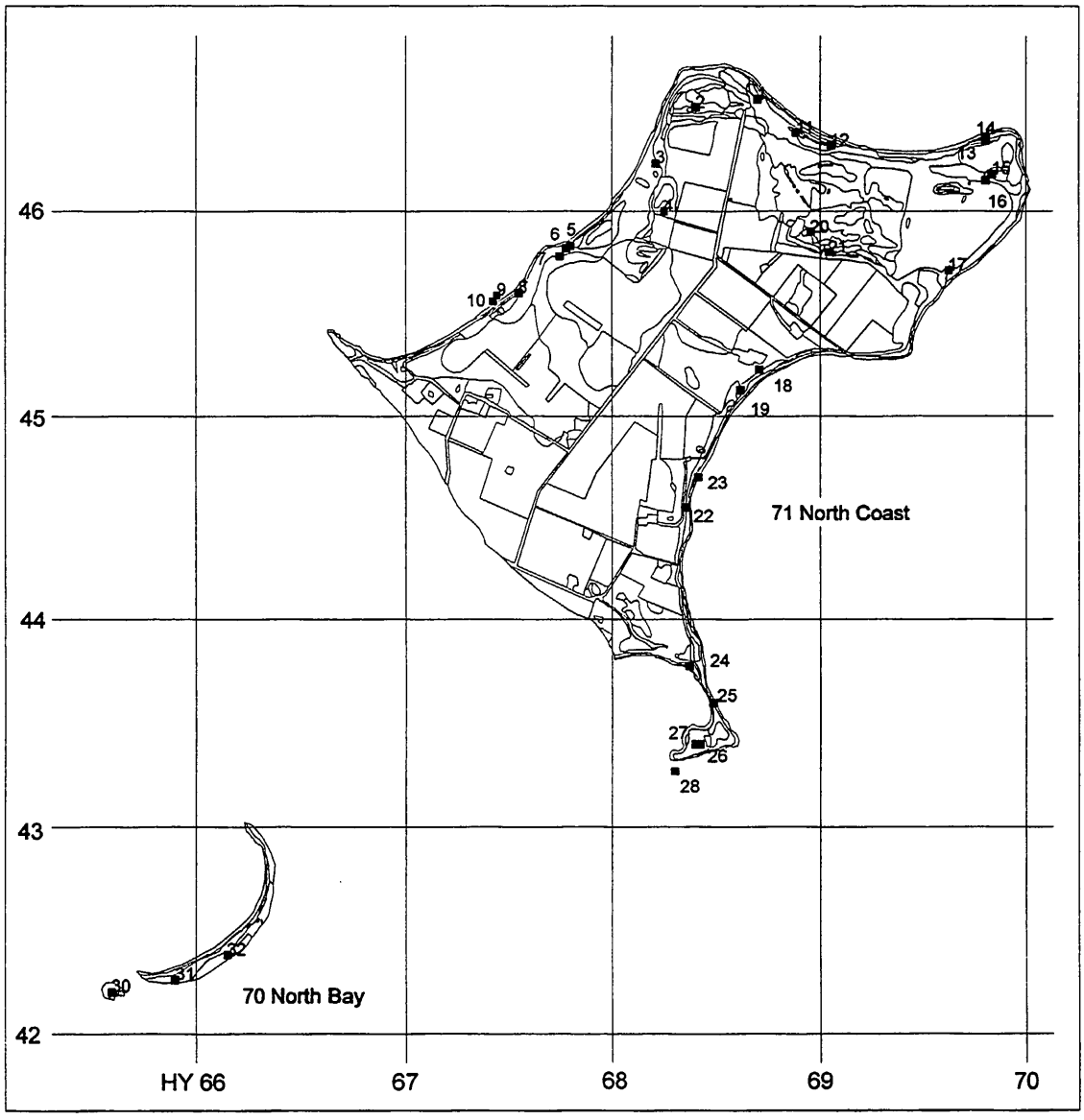
#	Grid Ref.	Site	Target Note Detail
84	HY70404222	73 East Coast	Ditch with much *Chara hispida* and scattered *Juncus articulatus* - suggests eutrophic groundwater.
85	HY70334213	73 East Coast	Remains of near-acidic Mxbd poor fen in mosaic with MG9/MG11. Has *Molinia caerulea, Salix repens, Succisa pratensis* (Q73). Further south there is good quality MxTm on wetter ground (Q74). Several Snipe and many Lapwing disturbed.
86	HY70653996	73 East Coast	Western sheltered side of tombolo. Dunes cliffed 1.5-2 m with slow turf slumping, most active on convex portions of sinuous dune edge. Good summer accretion bank in concavities. All section have a narrow band of SD6a and SD6b (*Ammophila arenaria, Leymus arenarius, Elymus farctus*) on their outer edge. This changes rapidly to narrow zone of SD6ae, then into tall SD6e with good quantities of *Heracleum sphondylium* and scattered *Angelica sylvestris*.
87	HY70753996	73 East Coast	Eastern, exposed side of tombolo. Dunes cliffed to 8 m with SD6b turf slumping, forming small amount of SD6a as turves slide down cliff face. Shingle exposed at foot.
88	HY70573983	73 East Coast	Breach in dunes with impressive dune cliffs to 10 m at north and south ends. Low (3 m) SD4 and SD6a dunes in centre of gap. Distance between cliffs approximately 50 m.
89	HY70573978	73 East Coast	Probably highest dunes. Cliffed on eastern side to at least 12 m with short blowouts cut into cliff top. Much *Cakile maritima* along top edge in SD6a vegetation
90	HY70453954	73 East Coast	Second large breach in dunes. Tall cliff to 14 m at north side. Dunes further south much lower (6-8 m). Breach size approximately 80 m. Centre of breach has 6 m high residual dune, virtually no vegetation. Much sand blown to eastern shore through the gap. Aeolinite exposed at foot of north side cliff.
91	HY70453934	73 East Coast	Foot of western side to dunes protected by 0.5 slab shingle wall, stone positioned vertically. Undercutting still sufficient to cause large partial mass movements on very steep slope - much larger scale than turf slumping.
92	HY71153785	73 East Coast	Sward rich in *Festuca rubra* and *Agrostis stolonifera* but status uncertain - no *Galium verum* (SD8) or *Potentilla anserina* (MG11). Probably a spray-soaked version of SD8a.
93	HY70484121	73 East Coast	Low dune edge cliffed to 0.5 m. Layer of organic sand exposed at 40 cm depth. SD8c turf to rear showing sand deposition.
94	HY70254135	73 East Coast	Very rank MG11 with much *Arrhenatherum elatius* - mapped as MG1/MG11. Suggests no grazing in this unfenced dune sector.
95	HY70334140	73 East Coast	Grazed sward with much *Dactylis glomerata, Festuca rubra* and patches of *Lolium perenne* mixed with SD8 herbs - very little *Galium verum*. Mapped as MG7/SD8a.
96	HY70004145	73 East Coast	Tussocky remnants of former SD17 slack, now converted largely to MG6 sward. 3 m wide MG13 drain runs through area - not marked on OS map. Drain contains *Caltha palustris, Hippuris vulgaris, Veronica anagallis-aquatica.*

#	Grid Ref.	Site	Target Note Detail
97	HY70604187	73 East Coast	Well grazed MG11 and MG9/11 with good quantities of *Parnassia palustris* and *Gentianella amarella* ssp *septentrionalis*.
98	HY70404185	73 East Coast	SD17b field with diagonal line of electric fencing separating grazed good SD17b from rank ungrazed and species poor form to north, but which also has rank MxTm.
99	HY71464177	73 East Coast	Sanday Golf Course. Very traditional links course with green mowing the only intensive management and this confined to approximately 15 m ellipse around each of 9 holes. Very minimal impact - high *Bellis perennis* cover (10-20%) on mown greens. Grazed to keep sward short on fairways and roughs.
100	HY71504165	73 East Coast	Large blowout complex with stock trampling plus rabbit burrowing maintaining bare sand on northern and eastern side. Floor fully stabilised with complex low linear ridges creating microtopographic gradients from dry SD8a to damp SD8e to wetter MG11 in hollows. MG11 areas frequently have scatter of *Deschampsia cespitosa* tussocks.
101	HY71604148	73 East Coast	Fine SD6a forming a 10 m wide flat, low foredune marking accretion zone. Eastern edge is cliffed to 1 m. Southern end marked by large area of SD4 embryo dunes,. Large and abundant *Elymus farctus* in this area.
102	HY71354125	73 East Coast	South eastern end of fenced field has dramatic management to back of foredune ridge. SD7x inside eastern boundary fence ploughed out and large hummock dunes show traces of plough lines in SD8a and SD8c turf. Probably done to destroy rabbit warrens. Many small blowouts present.
103	HY71104145	73 East Coast	Impressive large blowout deflation floor with SD8e and small SD17b area.
104	HY71054158	73 East Coast	Young blowout deflation floor dominated by *Agrostis stolonifera* (SD17x).
105	HY71134119	73 East Coast	Very large fully stabilised blowout deflation floor. Large areas of SD17b vegetation.
106	HY71134075	73 East Coast	Thick growth of nutriphiles, especially *Sonchus arvensis* and *Senecio jacobea*. Probably marks a formerly ploughed area.
107	HY70984111	73 East Coast	Well grazed area of SD17b slack - small numbers of *Moerckia flotoviana* and non-fruiting *Carex maritima*.
108	HY70984087	73 East Coast	Two abandoned cars and scattered items of rubbish. MG11 area inland marks former sand pit, now entirely revegetated.
109	HY68103925	73 East Coast	Relatively sheltered bay of Little Sea with end of SD16 saltmarsh, short stretch of sand (2 m SDy strand, then SD5/SM28 strand type), followed by bare shingle, narrower SDy strand and SD5c dune.
110	HY68153922	73 East Coast	SD7x dunes with distinct tussocky forms on eastern dune crest. Good *Ammophila* growth but signs of recent burning, followed by good regeneration. Possibly done to remove high ruderal content (unburnt areas have high *Heracleum sphondylium* cover).
111	HY68153919	73 East Coast	Exposed bay (Sty Wick). Steep shingle beach and fragments of SDy strand. SD6ae front then rapid change to SD7x. Dunes cliffed 0.5-1 m.

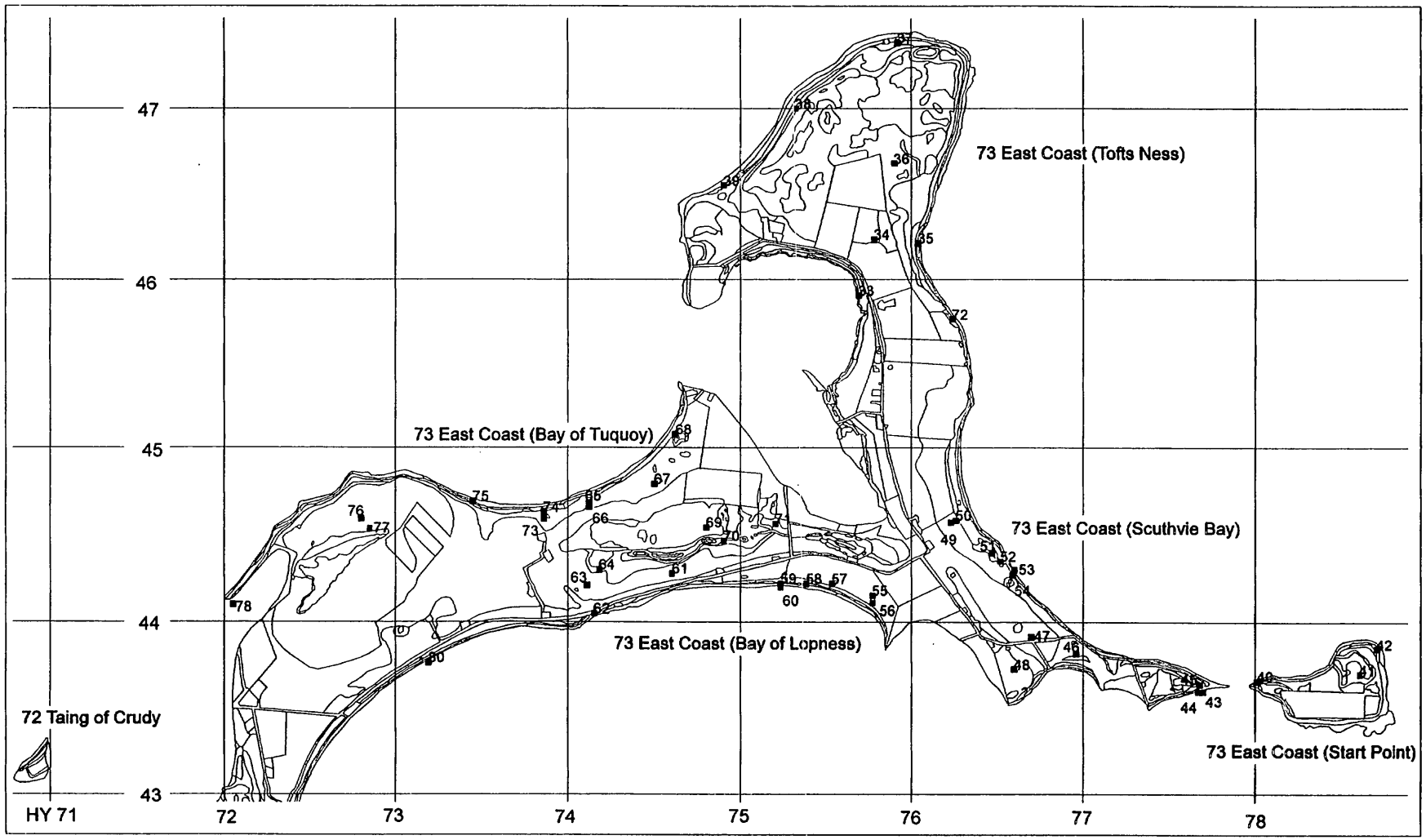
#	Grid Ref.	Site	Target Note Detail
112	HY67773903	73 East Coast	Small 30 m x 10 m ruderal patch marking tip for animal bedding. Further west (40 m) is dump of road chippings.
113	HY67753966	73 East Coast	Dunes cliffed and adjacent track protected by dumped rubble, animal bedding also dumped, giving high ruderal content to rank grassland.
114	HY68183928	73 East Coast	Winter feeding area - sward thick with *Matricaria matricarioides, Poa annua, Polygonum aviculare, Plantago media*. Rear of adjacent foredune in same field in very poor condition. Marram removed and thick ruderal cover developed: *Heracleum sphondylium, Stellaria media, Chenopodium* sp., *Cirsium vulgare, Capsella bursa-pastoris, Senecio vulgare, Urtica urens, Sonchus arvensis*. Result of heavy dunging - might have been spread in this area.
115	HY68283950	73 East Coast	Moderate quality SD8e, MG11 and SD17b wet grasslands and slack, with parts of the SD17b slack poached and supporting high species diversity. *Parnassia palustris* prominent but density not high. *Juncus gerardi* present in SD17b in low quantity.
116	HY68553966	73 East Coast	Very large expanse of ruderals and rank grassland, dominated by *Cirsium arvense, Poa trivialis, Stellaria media, Ranunculus repens, Plantago major*. Cause uncertain (slurry spreading?).
117	HY68603960	73 East Coast	MG11 depression (old blowout) in very poor condition - high ruderal content (*Plantago major, Stellaria media*). Many rabbit burrows in bare sand of blowout margin.
118	HY68503950	73 East Coast	SD8a grassland in very poor condition. turf highly varied with different ruderal composition. High quantities of *Poa annua, Plantago major, Ranunculus repens, Achillea millefolium, Capsella bursa-pastoris* and *Stellaria media* are general. There are also scattered large patches of *Cirsium arvense*. Cause uncertain - not likely to be due entirely due to rabbit effects. More likely to be weeds introduced via dung spreading on a regular basis. Low rises, often with best remaining vegetation show old ploughlines where failed attempts have been made to eradicate rabbit warrens. The normal machair variation (dry to wet grassland) in this field has been largely destroyed by poor management.
119	HY68653925	73 East Coast	Foredune ridge fenced to exclude cattle but sheep seem to have access. Seaward side has steep SD6ae slope and good marram growth. Cliffed at foot (1 m) above shingle beach. SD7x of crest has high ruderal content, especially *Heracleum sphondylium* and *Sonchus arvensis*. Immediately inside fence a pure ruderal sward is extensive.
120	HY68453980	73 East Coast	Turf in eastern half of field much cleaner - tall rank weeds absent apart from *Senecio jacobea*. Small nutriphiles still present.
121	HY69053945	73 East Coast	SD8d and SD8e mosaic with many signs of ploughing in past to remove rabbit warrens. Rabbit numbers now moderately high.
122	HY68983940	73 East Coast	Good SD17b slack with much *Parnassia palustris* and *Hydrocotyle vulgaris*. Has a surround of MG9/MG11 with much *Parnassia palustris* which also spreads into SD8e turf to south. Sward is low (5-10 cm) and maintained in good condition by moderately heavy grazing.

#	Grid Ref.	Site	Target Note Detail
123	HY69573946	73 East Coast	Old blowout, fully stabilised with SD8e floor. Wire and animal bedding dumped on western side.
124	HY69253905	73 East Coast	Extensive area of MG11/SD8e with good numbers of *Parnassia palustris*.
125	HY69103915	73 East Coast	Dunes form sand 2.5-3 m thick over steep shingle beach. SD4/SD8c on seaward face and inland for 30 m.
126	HY69293887	73 East Coast	Exposed shingle beach with SD3 strand extending inland for 20 m.
127	HY69753920	73 East Coast	Fine mix of *Honkenya peploides* and SD8c sward on sheltered strand.
128	HY69843922	73 East Coast	Dunes cliffed 1.5-2 m with SD7x turf slumping. Rabbit burrows contribute to retreat, weakening cliff face.
129	HY70163923	73 East Coast	Dunes cliffed 1-1.5 m with SD6ae edge, then rapidly into SD7x.
130	HY69503925	73 East Coast	Former sand pit with 50 m curved face with many rabbit burrows and a little turf slumping. Floor is SD17x *Agrostis stolonifera* proto-slack.
131	HY69623947	73 East Coast	SD8e slack in former blowout floor. Low floristic diversity. Animal bedding, fencing and old metal tipped on side.
132	HY69803964	73 East Coast	Good MG9/MG11 with many *Parnassia palustris* heads. Coast to east has patches of M28x on cliffed dune edge indicating seepage.
133	HY65583908	74 Backaskaill Bay	Gently shelving sandy beach. Dunes cliffed 0.5-1 m. Straw bales dumped over edge. SDy strand present.
134	HY65253921	74 Backaskaill Bay	Former sand pit, shell midden exposed in floor. Used until recently, floor has little vegetation. West end used as spread for slurry - very poor practice.
135	HY65253928	74 Backaskaill Bay	Sand pit, probably still active. Thick growths of nettles on sides and floor. Possibly used to spread slurry.
136	HY65583955	74 Backaskaill Bay	S6 *Carex riparia* swamp in area of M28x grading east into SHv swamp.
137	HY65103985	74 Backaskaill Bay	Fine dune wetland to machair loch transition, going from SD8e to SD17b, M28x, S10. Good quantities of *Parnassia palustris*.
138	HY64854000	74 Backaskaill Bay	Fine S4 *Phragmites australis* swamp with SxTHF tall herb fen margin grading into either MG13 or SD17b dune slack. Treacherous muddy ground prevented quadrat survey of S4 sector.
139	HY64783988	74 Backaskaill Bay	Ungrazed SD17b sward which is more acidic (*Festuca vivipara* on slight tussocks, scattered *Succisa pratensis*). Notable for large numbers of *Listera ovata* spikes.
140	HY64603965	74 Backaskaill Bay	Wettest low ground in good wet machair and dune slack area has Mxbd vegetation - more acidic with *Succisa pratensis, Molinia caerulea, Carex pulicaris* (Q84).
141	HY64553928	74 Backaskaill Bay	Gently shelving sand beach, dunes cliffed 0.5-1.5 m. Good SD2 (*Cakile maritima*) strand. SD6ae edge to dunes, then rapidly into SD7x. Scattered *Leymus arenarius* but no distinct NVC type. Rear of foredune along fence line is thick ruderal area (*Sonchus arvensis, Cirsium arvense, Heracleum sphondylium*) - probably result of inblow of seaweed.

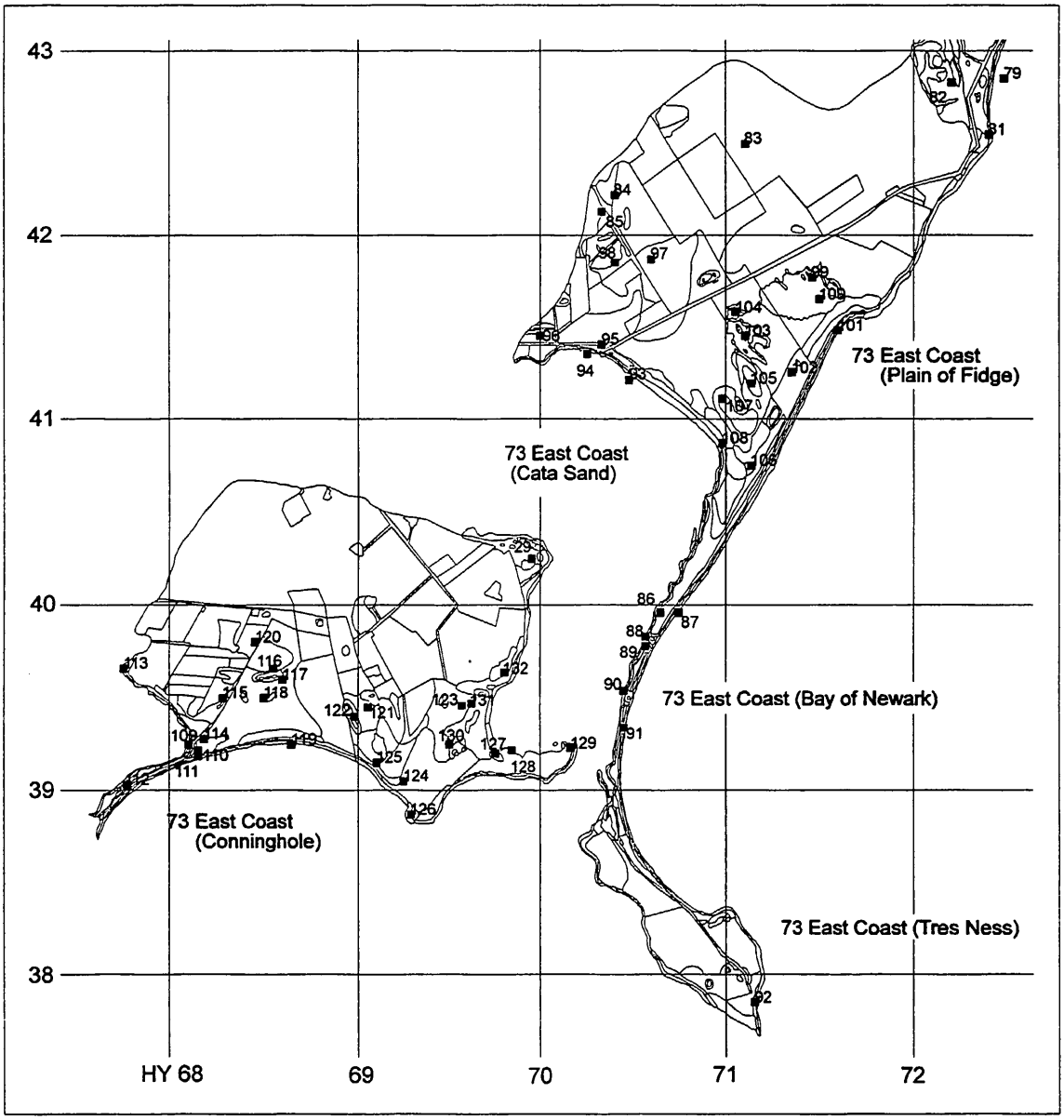
#	Grid Ref.	Site	Target Note Detail
142	HY61653763	75 Doun Helzie to Pool Bay	Laminess Bay - gently sloping sandy beach with shingle on upper sections. Wide (4-5 m) SDy strand, then SD5/SM28 rough grassland. Western edge with road protected by concrete wall topped with gabions.
143	HY61783762	75 Doun Helzie to Pool Bay	Flushed slope with MG11/S10 sward containing abundant *Tussilago farfara* and scattered tall *Angelica sylvestris.* Area ungrazed for a long time, species poor and very rank.
144	HY62083675	75 Doun Helzie to Pool Bay	Active sandpit 40 m x 12 m, exposed to 1.5 m depth. Also used for dead stock burial.
145	HY62253675	75 Doun Helzie to Pool Bay	Very fine climbing dune system, almost entirely of SD7y cover (*Ammophila arenaria - Festuca rubra* semi-fixed dune, *Hylocomium splendens - Rhytidiadelphus triquetrus* provisional sub-community). Broad irregular hummocks sweep up to crest of hill. Probably unique in Orkney.
146	HY62253660	75 Doun Helzie to Pool Bay	Transition on lower slopes from SD7y to SD7x - SD7y mosaic dune.
147	HY62383637	75 Doun Helzie to Pool Bay	Area of dune slack with scattered hummocky SD7x dunes providing microtopographic contrasts. *Parnassia palustris* present in low density. *Selaginella selaginoides* common in turf.
148	HY62333628	75 Doun Helzie to Pool Bay	Fine unspoilt beach. Gently sloping thin sand over shingle, with SD2 strand in eastern corner. Dunes cliffed to 3 m with very steep foredune scarp above. SD6ae cover, rapidly changing to SD7x on foredune crest.
149	HY62753663	75 Doun Helzie to Pool Bay	Steep shingle beach with thin sand cover on lower section. Dunes to north cliffed to 1 m height, with steep foredune scarp above (SD6ae). Seals haul out at northern end.
150	HY62753666	75 Doun Helzie to Pool Bay	SD7x dunes have scattered tall *Angelica sylvestris.*
151	HY62823712	75 Doun Helzie to Pool Bay	Possible former sand pit with deflation removing sand and exposing underlying sandstone. Damp and flushed (lower parts have 10 degree slope). *Carex panicea* abundant, with scattered *Prunella vulgaris* and *Parnassia palustris.* Mapped as SD8e.
152	HY62333700	75 Doun Helzie to Pool Bay	Deflation complex with SD8e floor (patches with bedrock and head exposed) and SD7y hummocks. Abundant *Hylocomium splendens* in SD8e turf - probably marks former SD7y.



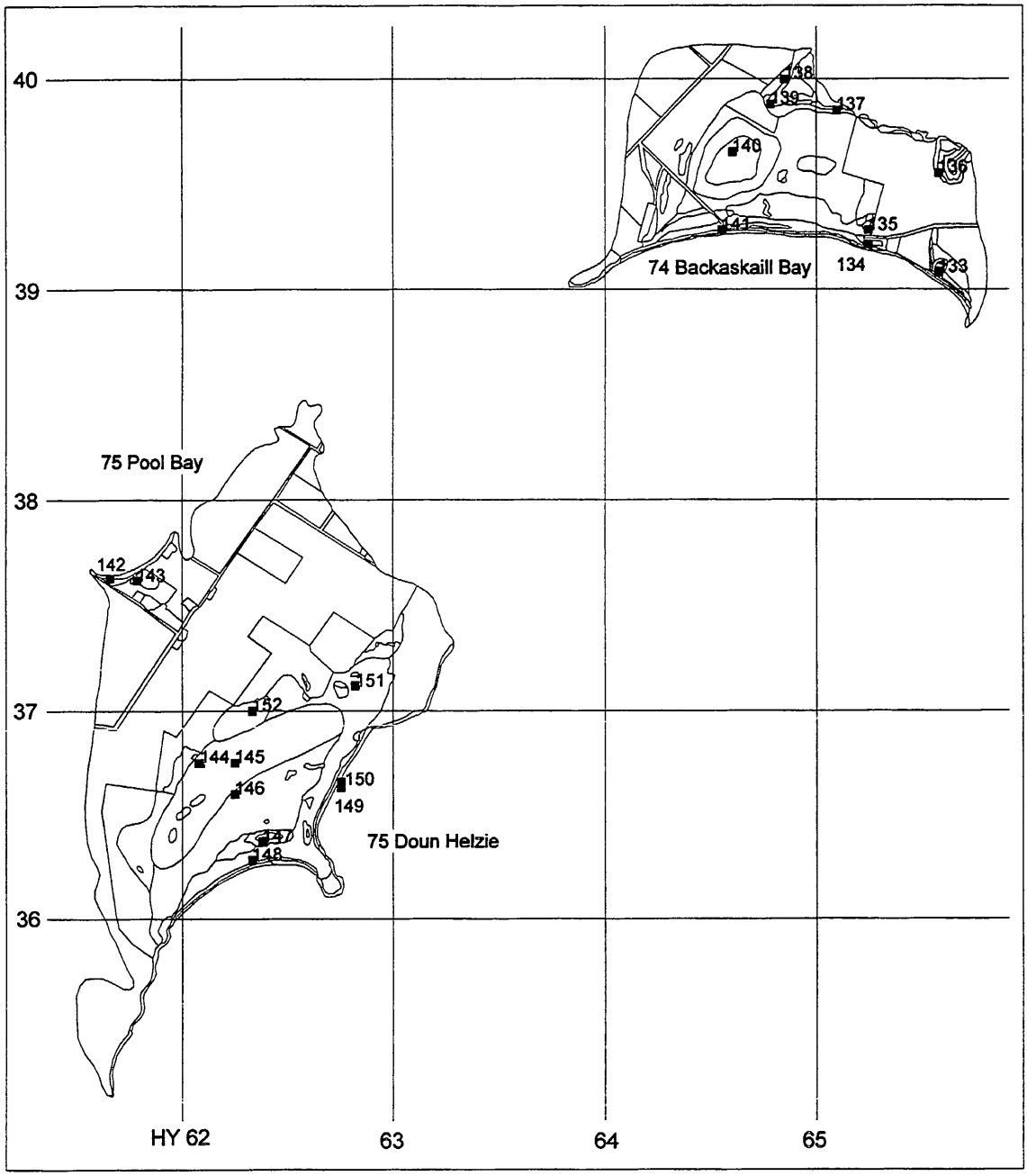
Map 3a Target note positions: North Bay and North Coast (Sanday)



Map 3b Target note positions: East Coast (northern sector) and Taing of Crudy (Sanday)



Map 3c Target note positions: East Coast (southern sector), Sanday



Map 3d Target note positions: Backaskaill Bay and Doun Helzie to Pool Bay (Sanday)

Annex 2 Quadrat Data

Full NVC nomenclature is given in Table 3. Quadrat locations are mapped following floristic tables (Map 4).

Strand and embryo dune quadrats

	Quadrat number	30	43	62	42	24	54	31	44	51	14
	NVC type	SD 2	SD 2	SD 2	SD2/ SD6c	SD 3	SD 3	SD3/ SD5	SD y	SD y	SD 4
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	684	760	751	760	696	776	683	760	780	674
3	Grid reference northing	447	462	442	462	457	435	437	462	436	455
11	Herb height, centimetres	20	25	7	90	20	10	60	25	6	25
12	Moss height, centimetres	-	-	-	-	-	-	-	-	-	-
15	Herb cover, %	50	15	70	100	60	40	100	55	30	60
16	Moss cover, %	-	-	-	-	-	-	-	-	-	-
22	Bare soil/litter (incl.sand)	50	85	30	-	-	10	-	45	50	40
116	Elymus farctus boreali-atlanti	2	2	-	-	-	-	-	3	-	8
118	Elymus repens	-	-	-	-	-	-	5	-	-	-
159	Ammophila arenaria	-	-	-	5	-	-	-	-	-	-
216	Atriplex glabriuscula	4	-	-	5	-	4	6	8	-	-
217	Atriplex prostrata	-	-	-	-	6	-	-	-	-	-
268	Cakile maritima	7	5	-	6	-	-	-	-	-	4
513	Leymus arenarius	1	-	-	5	-	1	6	-	-	-
576	Festuca rubra	-	-	-	2	-	-	-	-	-	-
605	Galium aparine	-	-	-	-	-	6	4	-	-	-
682	Honkenya peploides	-	-	8	-	-	-	-	-	-	-
865	Mertensia maritima	-	-	-	-	-	-	-	-	5	-
1043	Potentilla anserina	-	-	-	4	-	-	-	-	-	-
1271	Sonchus arvensis	-	-	-	5	4	2	4	-	-	-
1355	Matricaria maritima	-	-	-	-	5	-	-	-	4	-
	Number of species per sample	4	2	1	7	3	4	5	2	2	2

Mobile and semi-fixed dunes

	Quadrat number	18	25	17	61	59	60	90	91	85	86	87	88	89
	NVC type	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD
		5b	5b	5c	5c	6ae	7x	7x	7x	7y	7y	7y	7y	7y
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	689	687	689	762	762	762	622	760	621	622	622	623	624
3	Grid reference northing	463	452	463	445	445	445	366	426	367	369	368	368	367
11	Herb height, centimetres	45	40	40	35	70	80	45	40	40	45	40	40	40
12	Moss height, centimetres	-	-	-	-	-	3	7	-	12	12	12	12	12
15	Herb cover, %	40	40	100	100	80	90	90	70	40	60	60	30	40
16	Moss cover, %	-	-	-	-	-	1	30	-	80	70	80	75	80
22	Bare soil/litter (incl.sand)	60	60	-	-	20	10	-	30	-	-	-	-	-
104	Achillea millefolium	-	-	-	4	-	-	-	-	-	-	-	-	-
116	Elymus farctus boreali-atlanti	4	4	-	-	4	-	-	2	-	-	-	-	-
122	Agrostis stolonifera	-	-	5	3	-	2	-	-	-	-	-	-	-
159	Ammophila arenaria	-	-	-	-	8	8	6	5	4	5	5	4	5
216	Atriplex glabriuscula	-	-	-	-	2	-	-	-	-	-	-	-	-
268	Cakile maritima	-	4	-	-	2	-	-	-	-	-	-	-	-
304	Carex arenaria	-	-	-	-	-	2	3	-	2	2	-	2	2
323	Carex flacca	-	-	-	-	-	-	-	-	4	3	3	-	3
384	Cerastium fontanum triviale	-	-	-	2	-	-	-	-	-	-	-	-	-
419	Cirsium vulgare	-	-	-	4	-	1	2	4	-	1	-	-	-
513	Leymus arenarius	6	6	5	4	-	2	-	4	-	-	-	-	-
576	Festuca rubra	3	-	7	8	4	5	8	5	5	6	6	5	5
613	Galium verum	-	-	-	-	-	4	5	5	4	4	4	4	4
661	Heracleum sphondylium	-	-	-	4	-	5	-	-	-	-	-	-	-
680	Holcus lanatus	-	-	-	-	-	-	2	-	-	2	-	-	-
800	Lotus corniculatus	-	-	-	2	-	4	4	-	-	2	-	-	-
973	Plantago lanceolata	-	-	4	5	-	1	-	3	-	-	-	-	-
988	Poa pratensis	-	-	2	4	-	3	4	3	3	3	3	3	3
1043	Potentilla anserina	-	-	1	-	-	-	-	-	-	-	-	-	-
1081	Ranunculus acris	-	-	-	-	-	-	4	-	2	-	-	2	-
1095	Ranunculus repens	-	-	4	3	-	-	-	2	-	-	-	-	-
1143	Rumex crispus	-	-	1	-	-	-	-	-	-	-	-	-	-
1239	Senecio jacobaea	-	-	-	4	2	4	-	4	-	-	-	-	-
1271	Sonchus arvensis	4	1	2	-	4	2	-	-	-	-	-	-	-
1333	Thymus praecox arcticus	-	-	-	-	-	-	-	-	3	-	4	2	-
1350	Trifolium repens	-	-	2	3	-	2	-	-	-	-	-	-	-
1429	Viola riviniana	-	-	-	-	-	-	-	-	4	4	4	4	4
1562	Homalothecium lutescens	-	-	-	-	-	2	-	-	-	-	-	-	-
1761	Hylocomium splendens	-	-	-	-	-	-	-	-	7	6	5	7	7
1940	Rhytidiadelphus squarrosus	-	-	-	-	-	-	6	-	-	-	4	-	-
1941	Rhytidiadelphus triquetrus	-	-	-	-	-	-	-	-	7	7	8	7	7
2167	Lophocolea bidentata	-	-	-	-	-	2	-	-	-	-	-	-	-
2982	Taraxacum seedling/sp	-	-	-	-	-	1	-	4	-	-	-	-	-
	Number of species per sample	4	4	10	13	7	17	10	11	11	12	10	10	9

Fixed calcareous dune grassland

	Quadrat number	5	10	13	46	48	23	1	33	49	41	50	22	26	55
	NVC type	SD 8a	SD 8a	SD4/SD8a	SD4/SD8a	SD4/SD8a	SD 8a	SD 8c	SD 8c	SD4/ SD8c	SD 8d	SD 8d	SD 8e	SD 8x	SD 8x
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	682	678	675	763	759	698	686	699	759	759	759	697	685	776
3	Grid reference northing	463	458	456	472	473	461	465	402	473	462	473	462	451	436
11	Herb height, centimetres	7	35	20	20	10	3	10	1	10	12	10	5	40	25
12	Moss height, centimetres	-	-	-	-	1	1	1	1	2	2	-	1	1	-
15	Herb cover, %	100	70	85	100	90	90	95	15	40	100	100	95	100	100
16	Moss cover, %	-	-	-	-	1	20	2	60	25	5	-	10	5	-
22	Bare soil/litter (incl.sand)	-	-	15	-	10	-	5	30	40	-	-	-	-	-
104	Achillea millefolium	-	-	5	-	-	-	-	-	-	-	-	-	2	2
116	Elymus farctus boreali-atlanti	-	-	5	3	4	-	5	-	4	-	2	-	-	-
122	Agrostis stolonifera	4	4	2	4	-	4	3	3	-	4	-	4	2	4
125	Aira praecox	-	-	-	-	-	3	-	-	-	-	-	-	-	-
230	Bellis perennis	-	-	-	-	-	2	-	3	-	3	3	-	-	-
304	Carex arenaria	2	3	4	3	3	4	4	-	-	3	2	-	-	-
323	Carex flacca	-	-	-	-	-	-	-	-	-	-	-	4	-	-
371	Centaurea nigra	-	-	-	-	-	-	-	-	-	-	-	-	5	4
383	Cerastium glomeratum	-	-	-	-	-	-	-	3	-	-	-	-	-	-
384	Cerastium fontanum triviale	3	2	-	-	-	4	3	2	2	3	4	-	3	2
419	Cirsium vulgare	1	-	1	-	1	-	1	-	4	2	2	-	-	-
447	Crepis capillaris	-	-	-	-	-	-	-	-	-	3	-	-	-	-
513	Leymus arenarius	-	-	-	2	2	-	-	-	2	-	-	-	-	-
568	Euphrasia officinalis agg	4	-	-	-	-	4	4	1	-	4	5	4	-	-
576	Festuca rubra	8	8	5	9	8	6	6	5	5	6	5	5	8	9
605	Galium aparine	-	4	-	-	-	-	-	-	-	-	-	-	-	-
613	Galium verum	4	4	4	-	4	2	4	-	4	4	5	2	4	2
661	Heracleum sphondylium	-	-	-	-	-	-	-	-	-	-	-	-	4	-
680	Holcus lanatus	3	-	-	-	-	-	-	-	-	-	-	5	-	-
682	Honkenya peploides	-	-	-	-	3	-	-	-	-	-	-	-	-	-
786	Linum catharticum	-	-	-	-	-	3	-	-	-	-	-	-	-	-
800	Lotus corniculatus	-	-	-	4	-	-	-	-	3	4	3	-	2	-
807	Luzula campestris	-	-	-	-	-	3	-	-	-	-	-	-	-	-
944	Parnassia palustris	-	-	-	-	-	-	-	-	-	-	-	4	-	-
973	Plantago lanceolata	2	-	2	-	4	5	4	2	3	4	5	4	4	-
988	Poa pratensis	2	-	3	3	4	-	-	1	-	3	4	3	3	4
995	Polygala vulgaris	-	-	-	-	-	-	-	-	-	-	3	-	-	-
1059	Prunella vulgaris	-	-	-	-	-	-	-	-	-	-	-	2	-	-
1081	Ranunculus acris	-	-	-	-	-	-	-	-	-	4	5	4	-	2
1095	Ranunculus repens	-	-	-	-	-	-	-	2	-	-	-	-	2	-
1106	Rhinanthus minor	-	-	-	-	-	-	-	-	-	-	-	-	2	-
1239	Senecio jacobaea	-	-	-	-	-	-	-	3	-	4	-	-	-	-
1254	Silene dioica	2	1	-	-	-	-	-	-	-	-	-	-	-	-
1271	Sonchus arvensis	-	5	-	1	-	-	-	-	-	-	-	-	-	4
1350	Trifolium repens	5	-	5	4	4	5	5	2	2	5	5	5	5	3
1493	Barbula recurvirostra	-	-	-	-	-	-	-	4	-	-	-	-	-	-
1510	Brachythecium albicans	-	-	-	-	-	-	2	-	4	-	-	-	4	-
1562	Homalothecium lutescens	-	-	-	-	2	4	-	3	-	-	-	4	-	-
1593	Climacium dendroides	-	-	-	-	-	2	-	-	-	-	-	-	-	-
1868	Plagiothecium undulatum	-	-	-	-	-	-	-	-	-	-	-	4	-	-
1940	Rhytidiadelphus squarrosus	-	-	-	-	-	-	-	-	-	4	-	-	-	-
2023	Tortula ruralis ssp ruraliform	-	-	-	-	-	-	3	7	5	-	-	-	2	-
2380	Cladonia rangiferina	-	-	-	-	-	4	-	-	-	-	-	-	-	-
2486	Peltigera canina	-	-	-	-	-	4	-	-	-	-	-	-	-	-
2846	Gentianella amarella septentri	-	-	-	-	-	3	-	-	-	-	-	4	-	-
2982	Taraxacum seedling/sp	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	Number of species per sample	12	8	11	9	11	17	12	14	11	16	14	15	15	10

Dune slack

	Quadrat number	2	21	34	36	67	69	16	19	47	63
	NVC type	SD	SD	SD	SD	SD	SD	SD	SD	SD	SD
		17b	17b	17b	17b	17b	17b	17d	17d	17d	17x
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	685	692	699	757	752	730	686	690	761	741
3	Grid reference northing	466	462	402	456	445	446	465	462	473	443
11	Herb height, centimetres	15	10	45	25	12	6	35	20	18	10
12	Moss height, centimetres	2	1	3	1	2	1	3	4	1	1
15	Herb cover, %	95	80	100	100	80	90	95	80	100	80
16	Moss cover, %	30	70	2	2	60	40	10	70	20	60
22	Bare soil/litter (incl.sand)	-	-	-	-	-	-	-	-	-	-
122	Agrostis stolonifera	4	4	3	4	4	4	5	5	5	4
167	Angelica sylvestris	-	-	-	-	-	1	-	-	-	-
279	Caltha palustris	-	4	-	4	-	2	1	4	1	4
295	Cardamine pratensis	3	-	-	2	-	-	-	3	-	-
323	Carex flacca	4	4	4	4	3	3	-	-	-	-
333	Carex nigra	5	5	7	4	4	4	5	6	6	4
339	Carex panicea	-	-	-	-	5	4	-	-	-	2
347	Carex pulicaris	-	-	-	-	3	-	-	-	-	-
384	Cerastium fontanum triviale	-	-	-	2	-	2	-	-	-	-
468	Dactylorhiza maculata maculata	-	-	-	1	-	1	-	-	-	-
477	Deschampsia cespitosa cespitos	-	1	5	-	4	-	-	-	-	-
509	Eleocharis palustris	-	-	-	-	-	-	-	-	4	-
525	Epilobium palustre	-	-	-	-	-	-	-	3	-	3
533	Equisetum fluviatile	-	-	-	-	-	-	3	-	-	3
535	Equisetum palustre	4	-	-	2	3	3	-	-	-	-
546	Eriophorum angustifolium	-	-	-	-	-	-	-	3	-	3
568	Euphrasia officinalis agg	-	-	-	-	3	4	-	-	-	-
576	Festuca rubra	-	2	4	6	5	4	-	-	-	-
609	Galium palustre	5	-	-	-	-	-	4	4	4	-
619	Gentianella amarella	-	2	-	-	-	-	-	-	-	-
680	Holcus lanatus	-	-	3	3	3	4	-	-	-	-
690	Hydrocotyle vulgaris	4	6	-	3	4	4	-	4	2	5
722	Juncus articulatus	-	-	-	-	-	-	-	-	3	-
768	Leontodon autumnalis	-	3	-	3	2	4	-	2	-	3
800	Lotus corniculatus	-	2	-	2	2	-	-	-	-	-
813	Lychnis flos-cuculi	2	1	-	2	-	3	2	4	-	3
855	Mentha aquatica	1	3	-	-	2	2	4	4	5	4
889	Myosotis scorpioides	-	-	-	-	-	-	3	2	-	-
907	Odontites verna	2	-	-	-	-	-	-	-	-	-
917	Ophioglossum vulgatum	-	3	-	-	-	-		-	-	-
944	Parnassia palustris	4	4	-	4	4	4	-	1	-	5
946	Pedicularis palustris	-	1	-	-	-	-	-	-	-	4
970	Pinguicula vulgaris	-	-	-	-	4	-	-	-	-	-
973	Plantago lanceolata	-	-	1	2	2	-	-	-	-	-
975	Plantago maritima	-	-	-	-	4	2	-	-	-	2
988	Poa pratensis	3	-	-	-	3	-	-	-	-	-
1004	Polygonum hydropiper	-	-	-	-	-	-	4	-	-	2
1043	Potentilla anserina	5	3	6	2	-	-	4	-	5	2
1059	Prunella vulgaris	-	-	2	-	3	4	-	-	-	-
1081	Ranunculus acris	-	-	2	4	-	-	-	-	-	-
1086	Ranunculus bulbosus	-	-	1	-	-	-	-	-	-	-
1089	Ranunculus flammula	-	-	-	-	2	-	-	-	3	3
1095	Ranunculus repens	5	-	2	-	3	4	5	4	5	4
1143	Rumex crispus	-	-	-	-	-	-	-	-	2	-
1156	Sagina nodosa	-	-	-	-	-	3	-	-	-	3
1235	Selaginella selaginoides	-	-	-	-	3	-	-	-	-	-
1236	Senecio aquaticus	1	4	-	-	-	-	-	4	-	3
1239	Senecio jacobaea	-	-	-	2	-	-	-	-	-	-
1305	Succisa pratensis	-	-	-	-	4	-	-	-	-	-
1349	Trifolium pratense	-	-	-	5	4	4	-	-	-	-
1350	Trifolium repens	5	3	-	4	-	5	-	-	-	-
1353	Triglochin maritima	-	-	1	-	-	-	-	-	-	-
1411	Vicia cracca	-	-	-	2	3	-	-	-	-	-
1445	Calliergon cuspidatum	6	8	3	3	8	7	4	8	5	8
1654	Drepanocladus aduncus	-	-	-	-	-	-	-	2	-	4
1688	Fissidens cristatus	-	-	-	-	4	-	-	-	-	-
2167	Lophocolea bidentata	-	-	-	3	-	-	-	-	-	-
2256	Aneura pinguis	-	-	-	-	-	2	-	-	-	-
2846	Gentianella amarella septentri	-	-	-	-	-	3	-	-	-	-
4331	Senecio x ostenfeldii	-	-	4	-	1	1	-	-	-	-
	Number of species per sample	17	19	15	24	29	27	12	17	13	22

Maritime cliff and mesotrophic grasslands

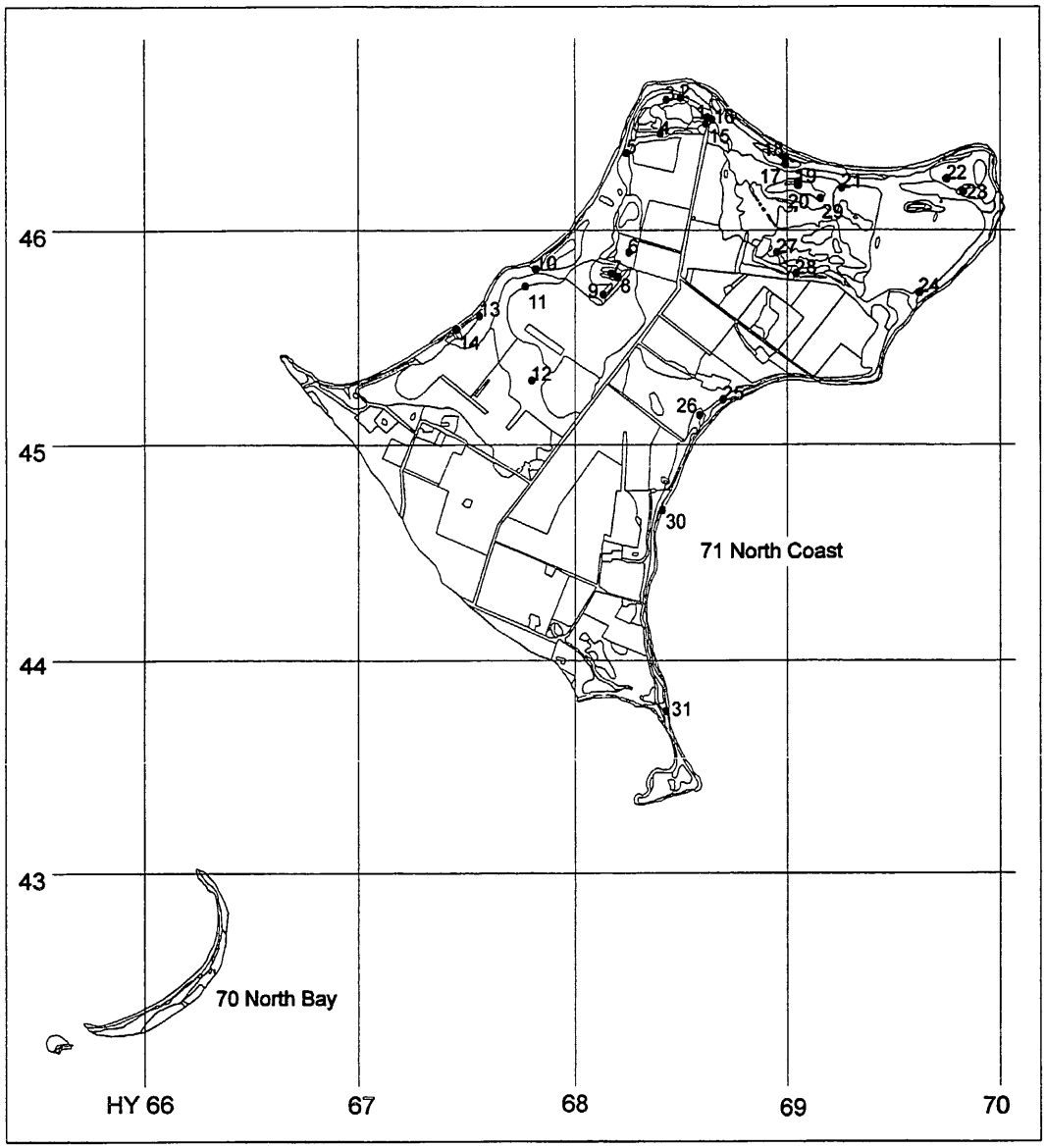
	Quadrat number	53	12	40	58	9	35	39	56	29	37	68	4	11	32	38	45	52	70	71	72
	NVC type	MC 9	MG 6	MG7/MG11	MG7/SD8	MG 9	MG 9	MG 9	MG 9	MG9/MG11	MG9/MG11	MG9/ S28	MG 11	MG 11	MG 11	MG 11	MG 11	MG 13	MG 13x	MG 13x	MG 13x
1	Grid reference 100km square	HY	HY	HY	HY	HY	NY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	787	678	757	762	681	699	756	774	691	756	758	684	677	698	756	761	786	727	727	-
3	Grid reference northing	438	453	462	447	457	402	459	436	461	456	444	464	457	402	459	470	437	445	444	-
11	Herb height, centimetres	25	4	25	15	45	40	70	60	35	35	55	30	12	15	45	12	10	3	3	5
12	Moss height, centimetres	-	-	-	-	-	2	-	-	5	-	-	-	-	3	3	-	-	-	-	-
15	Herb cover, %	100	100	100	100	100	100	100	100	60	100	100	100	100	100	100	100	80	90	90	80
16	Moss cover, %	-	-	-	-	-	2	-	-	70	-	-	-	-	2	1	-	-	-	-	-
22	Bare soil/litter (incl.sand)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	10	10	20
104	Achillea millefolium	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
116	Elymus farctus boreali-atlanti	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
118	Elymus repens	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
122	Agrostis stolonifera	4	-	5	3	-	3	-	5	4	4	5	8	4	4	4	4	8	6	7	6
156	Alopecurus geniculatus	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	4	-	-	5
197	Arrhenatherum elatius	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	Atriplex glabriuscula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
230	Bellis perennis	-	2	1	4	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
279	Caltha palustris	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
295	Cardamine pratensis	-	-	-	-	2	2	-	-	2	2	-	-	-	2	2	-	-	-	-	-
304	Carex arenaria	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
323	Carex flacca	-	-	-	-	-	5	5	-	2	3	-	-	3	3	3	4	-	-	-	-
333	Carex nigra	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
384	Cerastium fontanum triviale	3	2	2	3	-	-	-	-	-	-	-	-	3	2	-	2	-	-	-	-
415	Cirsium arvense	-	2	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
419	Cirsium vulgare	2	-	2	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
460	Cynosurus cristatus	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
465	Dactylis glomerata	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
477	Deschampsia cespitosa cespitos	-	-	-	-	5	9	8	8	5	5	6	-	2	4	-	-	-	-	-	-
532	Equisetum arvense	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
533	Equisetum fluviatile	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
535	Equisetum palustre	-	-	-	-	4	-	-	-	4	2	-	2	3	-	-	-	-	-	-	-
546	Eriophorum angustifolium	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
568	Euphrasia officinalis agg	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-	4	-	-	-	-
576	Festuca rubra	8	5	6	5	5	3	-	4	4	6	-	-	5	8	9	5	-	-	-	-
613	Galium verum	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
679	Hippuris vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	4
680	Holcus lanatus	3	4	4	-	4	3	4	3	3	4	4	4	3	3	4	4	-	-	-	-
690	Hydrocotyle vulgaris	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
715	Iris pseudacorus	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
723	Juncus balticus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
725	Juncus bufonius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	7	6
732	Juncus gerardi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
768	Leontodon autumnalis	-	-	-	-	-	-	-	-	-	3	-	-	-	2	-	2	-	-	-	-
796	Lolium perenne	-	4	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
800	Lotus corniculatus	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	4	-	-	-	-
813	Lychnis flos-cuculi	-	-	-	-	1	-	-	-	3	-	-	-	-	-	2	2	-	-	-	-
855	Mentha aquatica	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
907	Odontites verna	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
917	Ophioglossum vulgatum	-	-	-	-	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-
944	Parnassia palustris	-	-	-	-	-	-	-	-	-	-	-	-	4	3	-	3	-	-	-	-
955	Phalaris arundinacea	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-
973	Plantago lanceolata	4	4	-	2	2	-	-	-	-	2	-	-	-	4	-	3	-	-	-	-
988	Poa pratensis	-	4	4	3	-	-	-	-	2	-	-	-	3	-	-	3	-	-	-	-
990	Poa trivialis	-	-	-	-	-	3	-	-	-	-	4	3	-	-	-	-	-	-	-	-
1004	Polygonum hydropiper	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
1043	Potentilla anserina	-	-	5	-	-	3	-	2	4	4	-	5	6	4	4	2	3	4	5	2
1059	Prunella vulgaris	-	-	-	-	-	2	-	-	-	-	-	-	-	2	-	4	-	-	-	-
1081	Ranunculus acris	2	4	-	2	-	3	-	-	-	3	-	-	-	4	-	2	-	-	-	-
1085	Ranunculus baudotii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
1089	Ranunculus flammula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
1095	Ranunculus repens	-	4	4	-	2	3	-	-	4	-	-	5	4	-	3	-	-	-	2	-
1106	Rhinanthus minor	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
1116	Rorippa palustris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
1139	Rumex acetosa	5	-	-	-	3	-	-	5	-	-	-	-	-	2	-	-	-	-	-	-
1143	Rumex crispus	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
1236	Senecio aquaticus	-	-	-	-	2	-	-	-	1	-	-	4	-	-	-	-	-	-	-	-
1239	Senecio jacobaea	-	2	2	4	-	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-
1271	Sonchus arvensis	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1285	Spergularia media	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	1
1298	Stellaria media	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
1349	Trifolium pratense	-	-	-	2	-	-	-	-	-	5	-	-	-	3	-	5	-	-	-	-
1350	Trifolium repens	3	7	4	7	-	2	-	-	-	5	-	-	5	6	-	5	-	-	-	-
1354	Triglochin palustris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	-
1411	Vicia cracca	-	-	-	-	-	-	-	-	-	5	-	-	1	-	2	-	-	-	-	-
1445	Calliergon cuspidatum	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1801	Rhizomnium punctatum	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
1807	Plagiomnium undulatum	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
1914	Pseudoscleropodium purum	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-
1940	Rhytidiadelphus squarrosus	-	-	-	-	-	-	-	-	7	-	-	-	-	-	2	-	-	-	-	-
2167	Lophocolea bidentata	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2846	Gentianella amarella septentri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
4331	Senecio x ostenfeldii	2	-	-	-	-	3	-	-	-	2	-	-	-	-	-	2	-	-	2	-
	Number of species per sample	10	13	14	15	14	15	5	6	17	19	6	12	17	21	13	22	6	5	8	9

Mire and Mx *Carex nigra* provisional rich fen

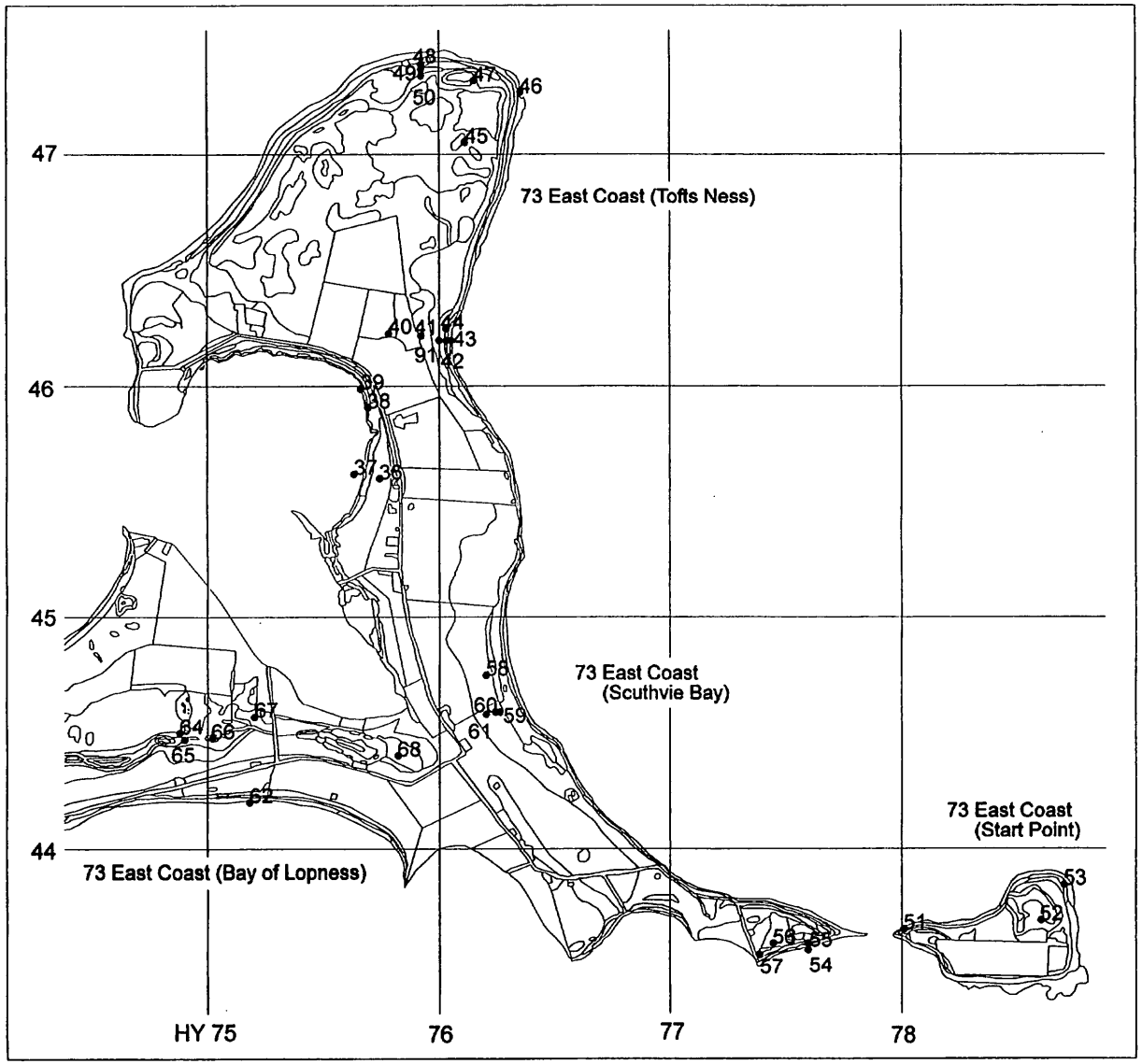
	Quadrat number	3	57	7	27	73	84	28	74	75	76
	NVC type	M 28x	M28x/ S28	Mx bd	Mx bd	Mx bd	Mx bd	Mx Tm	Mx Tm	Mx Tm	Mx Tm
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	684	773	681	689	703	646	690	703	703	703
3	Grid reference northing	466	435	458	459	421	396	458	420	418	418
11	Herb height, centimetres	50	120	35	35	35	6	40	25	30	30
12	Moss height, centimetres	1	-	4	3	-	1	4	2	3	3
15	Herb cover, %	100	100	90	90	100	90	90	85	65	60
16	Moss cover, %	2	-	60	60	-	40	40	50	80	100
22	Bare soil/litter (incl.sand)	-	-	-	-	-	-	-	-	-	-
116	Elymus farctus boreali-atlanti	-	5	-	-	-	-	-	-	-	-
122	Agrostis stolonifera	5	5	4	-	4	4	4	4	4	4
171	Anthoxanthum odoratum	-	-	-	2	2	-	-	-	-	-
279	Caltha palustris	4	-	5	4	-	-	-	2	2	4
295	Cardamine pratensis	-	-	4	2	-	-	3	2	2	4
323	Carex flacca	-	-	-	3	-	4	-	4	3	-
333	Carex nigra	-	-	6	5	4	5	5	4	4	5
339	Carex panicea	-	-	-	-	-	3	-	-	4	-
347	Carex pulicaris	-	-	-	-	-	3	-	-	-	-
477	Deschampsia cespitosa cespitos	-	-	-	-	5	-	-	-	-	-
509	Eleocharis palustris	-	-	3	-	-	-	4	-	-	3
525	Epilobium palustre	-	-	3	2	-	-	3	2	2	3
533	Equisetum fluviatile	-	-	3	-	-	-	-	-	-	-
535	Equisetum palustre	-	-	-	4	-	3	-	3	-	-
546	Eriophorum angustifolium	-	-	3	3	-	-	-	3	4	4
568	Euphrasia officinalis agg	-	-	-	-	-	3	-	-	-	-
576	Festuca rubra	-	-	-	5	4	4	-	3	3	2
578	Festuca vivipara	-	-	-	-	-	3	-	-	-	-
609	Galium palustre	3	-	-	-	-	-	4	3	2	3
679	Hippuris vulgaris	-	-	2	-	-	-	-	-	-	-
680	Holcus lanatus	-	-	2	4	4	3	-	4	2	-
690	Hydrocotyle vulgaris	-	-	5	-	-	2	5	7	6	3
706	Hypochoeris radicata	-	-	-	-	1	-	-	-	-	-
715	Iris pseudacorus	5	7	-	-	-	-	-	-	-	-
722	Juncus articulatus	-	-	3	-	-	3	-	-	-	-
768	Leontodon autumnalis	-	-	-	-	2	4	-	-	-	-
788	Listera ovata	-	-	-	-	-	1	-	-	-	-
800	Lotus corniculatus	-	-	-	-	-	4	-	-	-	-
809	Luzula multiflora	-	-	-	-	2	-	-	-	-	-
813	Lychnis flos-cuculi	-	-	2	3	4	-	3	4	2	2
855	Mentha aquatica	5	-	4	4	-	-	5	2	4	3
876	Molinia caerulea	-	-	-	-	4	4	-	-	-	-
889	Myosotis scorpioides	2	-	2	-	-	-	3	-	-	-
890	Myosotis secunda	-	-	-	-	-			-	-	1
944	Parnassia palustris	-	-	-	-	-	4	-	-	-	-
946	Pedicularis palustris	-	-	-	-	-	-	-	-	1	3
955	Phalaris arundinacea	-	5	-	-	-	-	-	-	-	-
970	Pinguicula vulgaris	-	-	-	-	-	3	-	-	-	-
973	Plantago lanceolata	-	-	-	2	-	-	-	-	-	-
975	Plantago maritima	-	-	-	-	-	4	-	-	-	-
990	Poa trivialis	4	3	-	-	-	-	-	-	-	-
1059	Prunella vulgaris	-	-	-	4	-	4	-	-	-	-
1081	Ranunculus acris	-	-	-	-	-	-	-	2	-	-
1089	Ranunculus flammula	-	-	3	3	2	-	-	-	3	2
1095	Ranunculus repens	5	-	-	4	4	-	3	-	-	-
1106	Rhinanthus minor	-	-	-	2	-	-	4	-	-	-
1139	Rumex acetosa	-	-	-	-	4	-	-	-	-	-
1156	Sagina nodosa	-	-	2	-	-	-	-	3	3	4
1179	Salix repens agg.	-	-	-	-	5	-	-	-	-	-
1235	Selaginella selaginoides	-	-	-	-	-	2	-	-	-	-
1236	Senecio aquaticus	4	-	-	4	-	-	1	-	-	-
1305	Succisa pratensis	-	-	-	-	2	-	-	-	-	-
1349	Trifolium pratense	-	-	-	-	-	4	-	-	-	-
1350	Trifolium repens	-	-	-	4	-	-	-	-	-	-
1353	Triglochin maritima	-	-	-	-	-	-	3	3	3	4
1354	Triglochin palustris	-	-	-	-	-	-	-	2	-	-
1429	Viola riviniana	-	-	-	-	-	2	-	-	-	-
1445	Calliergon cuspidatum	3	-	8	7	-	6	5	5	4	9
1446	Calliergon giganteum	-	-	-	-	-	-	-	-	-	4
1562	Homalothecium lutescens	-	-	-	-	-	4	-	-	-	-
1571	Campylium stellatum	-	-	-	-	-	-	-	6	4	-
1654	Drepanocladus aduncus	-	-	-	-	-	-	-	-	8	-
1801	Rhizomnium punctatum	-	-	4	-	-	-	5	-	-	-
1847	Philonotis fontana	-	-	-	-	-	-	-	-	2	4
1940	Rhytidiadelphus squarrosus	-	-	-	5	-	-	-	-	-	-
2256	Aneura pinguis	-	-	-	-	-	-	-	2	-	-
4331	Senecio x ostenfeldii	-	-	-	-	4	-	-	2	2	-
	Number of species per sample	10	5	19	21	17	25	16	22	23	20

Swamp and tall-herb fen

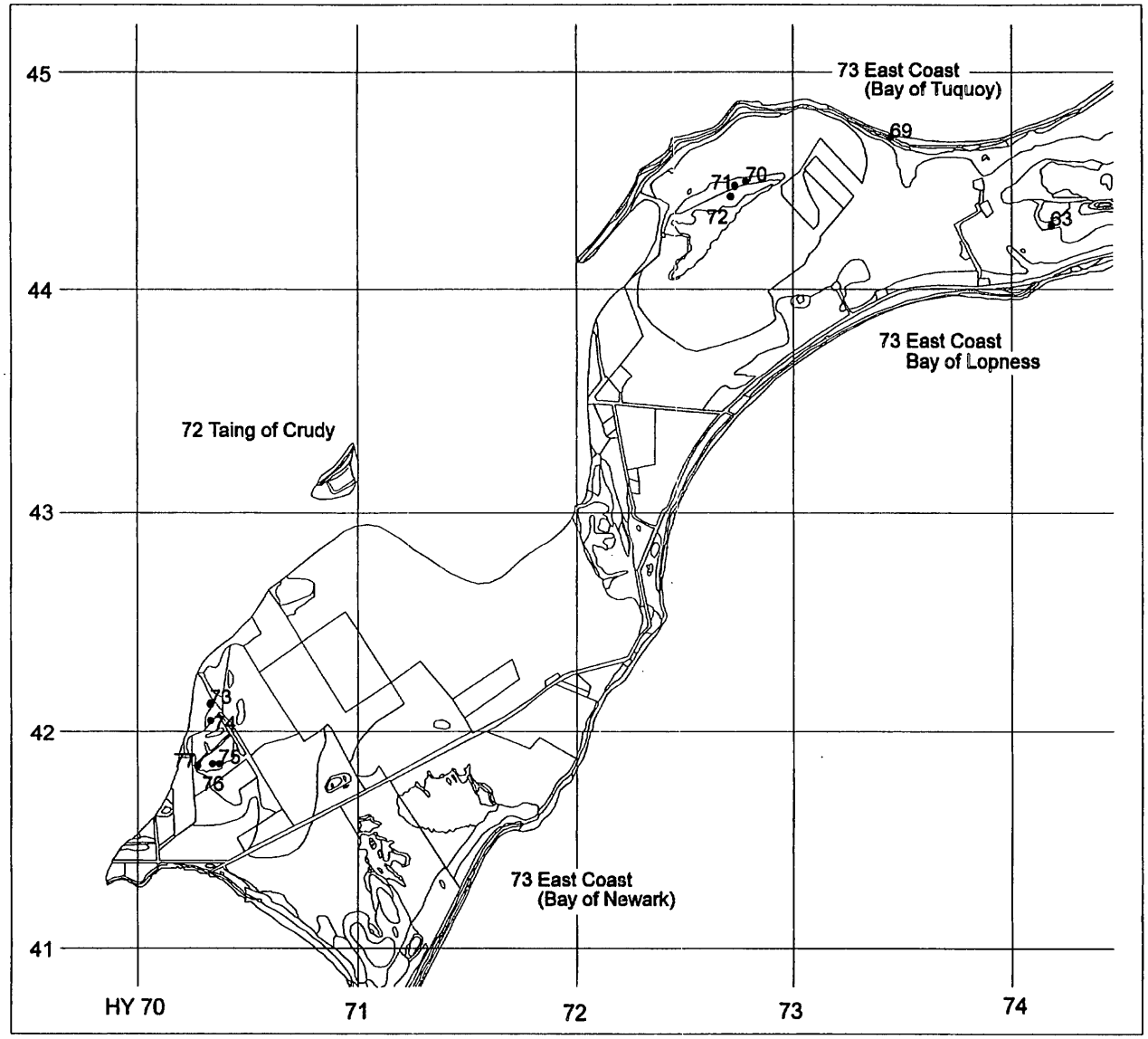
	Quadrat number	78	64	8	20	77	65	66	15	6	79	80	81	82	83
	NVC type	S6	S 10	S 19c	S 19c	S 19c	S 19c	S20/ SD17d	S 28	Sx THF	Sx THF	Sx THF	Sx THF	Sx THF	Sx THF
1	Grid reference 100km square	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY	HY
2	Grid reference easting	655	748	682	690	702	749	750	686	682	649	648	648	648	649
3	Grid reference northing	395	445	457	462	418	444	444	465	459	399	399	399	400	401
11	Herb height, centimetres	100	50	40	40	60	30	50	120	150	200	200	200	200	200
12	Moss height, centimetres	-	-	-	7	3	4	3	-	3	-	-	-	-	-
15	Herb cover, %	100	100	65	70	70	60	90	100	90	100	100	100	100	100
16	Moss cover, %	-	-	-	70	5	60	60	-	10	-	-	-	-	-
22	Bare soil/litter (incl.sand)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
122	Agrostis stolonifera	6	6	4	6	5	4	4	6	5	3	4	3	3	4
279	Caltha palustris	-	4	5	2	2	-	4	-	-	2	4	4	2	-
295	Cardamine pratensis	-	-	4	2	3	-	2	-	2	-	-	-	-	-
333	Carex nigra	-	-	-	-	-	5	4	-	3	-	-	-	-	-
339	Carex panicea	-	-	-	-	-	2	-	-	-	-	-	-	-	-
351	Carex riparia	8	-	-	-	-	-	-	-	-	-	-	-	-	-
352	Carex rostrata	2	-	-	-	-	-	-	-	-	-	-	-	-	-
468	Dactylorhiza maculata maculata	-	-	-	-	-	-	-	-	1	-	-	-	-	-
477	Deschampsia cespitosa cespitos	-	-	-	-	-	-	-	4	4	-	-	-	-	-
509	Eleocharis palustris	-	-	6	5	6	5	4	-	-	-	-	-	-	-
525	Epilobium palustre	-	-	3	4	-	-	2	-	-	-	-	-	-	-
533	Equisetum fluviatile	3	5	-	-	-	2	-	-	3	3	3	3	4	3
535	Equisetum palustre	-	-	-	-	-	-	-	3	3	-	-	-	-	-
546	Eriophorum angustifolium	-	-	-	-	4	-	-	-	-	-	-	-	-	-
576	Festuca rubra	-	-	-	-	-	-	-	-	6	-	-	-	-	-
609	Galium palustre	-	5	3	4	3	3	3	-	2	-	-	-	-	-
679	Hippuris vulgaris	4	-	3	3	3	-	-	-	-	2	3	3	2	3
680	Holcus lanatus	-	-	-	-	-	-	-	-	2	-	-	-	-	-
690	Hydrocotyle vulgaris	-	-	-	-	-	4	6	-	-	-	-	-	-	-
715	Iris pseudacorus	-	-	-	-	-	-	-	4	4	-	-	-	-	-
722	Juncus articulatus	-	-	-	3	3	-	-	-	-	-	-	-	-	-
768	Leontodon autumnalis	-	-	-	-	-	1	1	-	-	-	-	-	-	-
813	Lychnis flos-cuculi	-	-	-	-	-	-	2	-	2	-	-	-	-	-
855	Mentha aquatica	-	6	4	5	5	4	4	4	2	4	4	4	4	4
889	Myosotis scorpioides	-	-	2	-	-	-	-	-	-	-	-	-	-	-
944	Parnassia palustris	-	-	-	-	-	2	4	-	-	-	-	-	-	-
946	Pedicularis palustris	-	-	-	-	-	2	-	-	-	-	-	-	-	-
955	Phalaris arundinacea	3	-	-	-	-	-	2	7	-	-	-	-	-	-
961	Phragmites australis	-	-	-	-	-	-	-	-	6	9	9	9	9	9
990	Poa trivialis	-	-	-	-	-	-	-	4	2	-	-	-	-	-
1004	Polygonum hydropiper	2	-	-	-	-	4	2	-	-	-	-	-	-	-
1043	Potentilla anserina	-	-	-	-	-	-	2	-	-	-	-	-	-	-
1089	Ranunculus flammula	-	-	3	3	-	3	-	-	-	-	-	-	-	-
1095	Ranunculus repens	-	4	-	-	-	-	5	5	-	-	-	-	-	-
1106	Rhinanthus minor	-	-	-	-	-	2	4	-	-	-	-	-	-	-
1139	Rumex acetosa	-	-	-	-	-	-	-	-	2	-	-	-	-	-
1216	Scirpus lacustris tabernaemont	-	-	-	-	-	-	4	-	-	-	-	-	-	-
1236	Senecio aquaticus	-	-	-	-	-	1	2	-	-	-	-	-	-	-
1353	Triglochin maritima	-	-	-	-	3	-	-	-	-	-	-	-	-	-
1354	Triglochin palustris	-	-	-	-	-	3	-	-	-	-	-	-	-	-
1444	Calliergon cordifolium	-	-	-	-	-	3	-	-	-	-	-	-	-	-
1445	Calliergon cuspidatum	-	-	-	7	-	3	-	-	3	-	-	-	-	-
1446	Calliergon giganteum	-	-	-	6	4	8	8	-	-	-	-	-	-	-
1801	Rhizomnium punctatum	-	-	-	-	-	-	4	-	-	-	-	-	-	-
2167	Lophocolea bidentata	-	-	-	-	-	-	-	-	4	-	-	-	-	-
	Number of species per sample	7	6	10	12	11	19	21	8	18	6	6	6	6	5



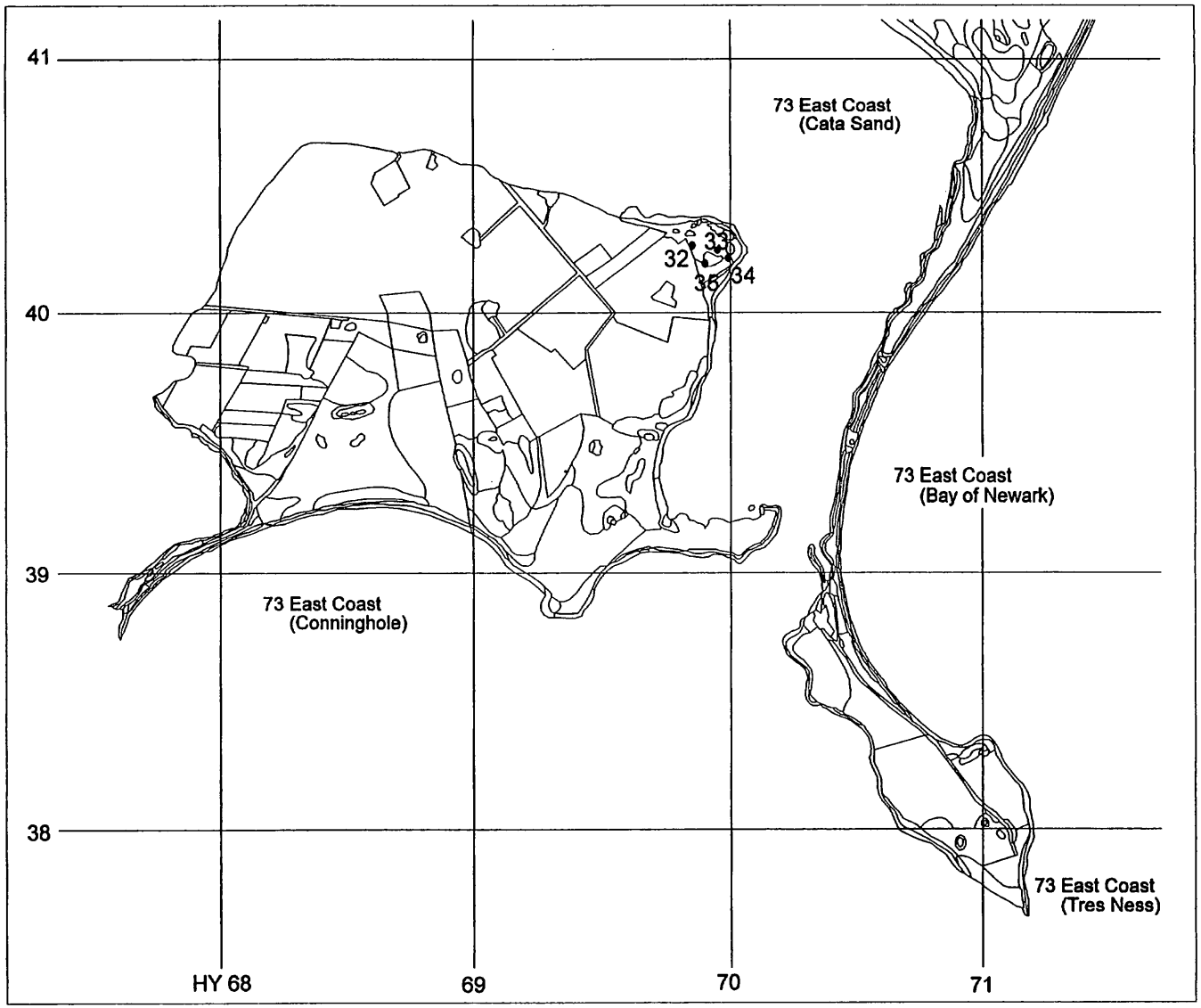
Map 4a Quadrat positions: North Bay and North Coast (Sanday)



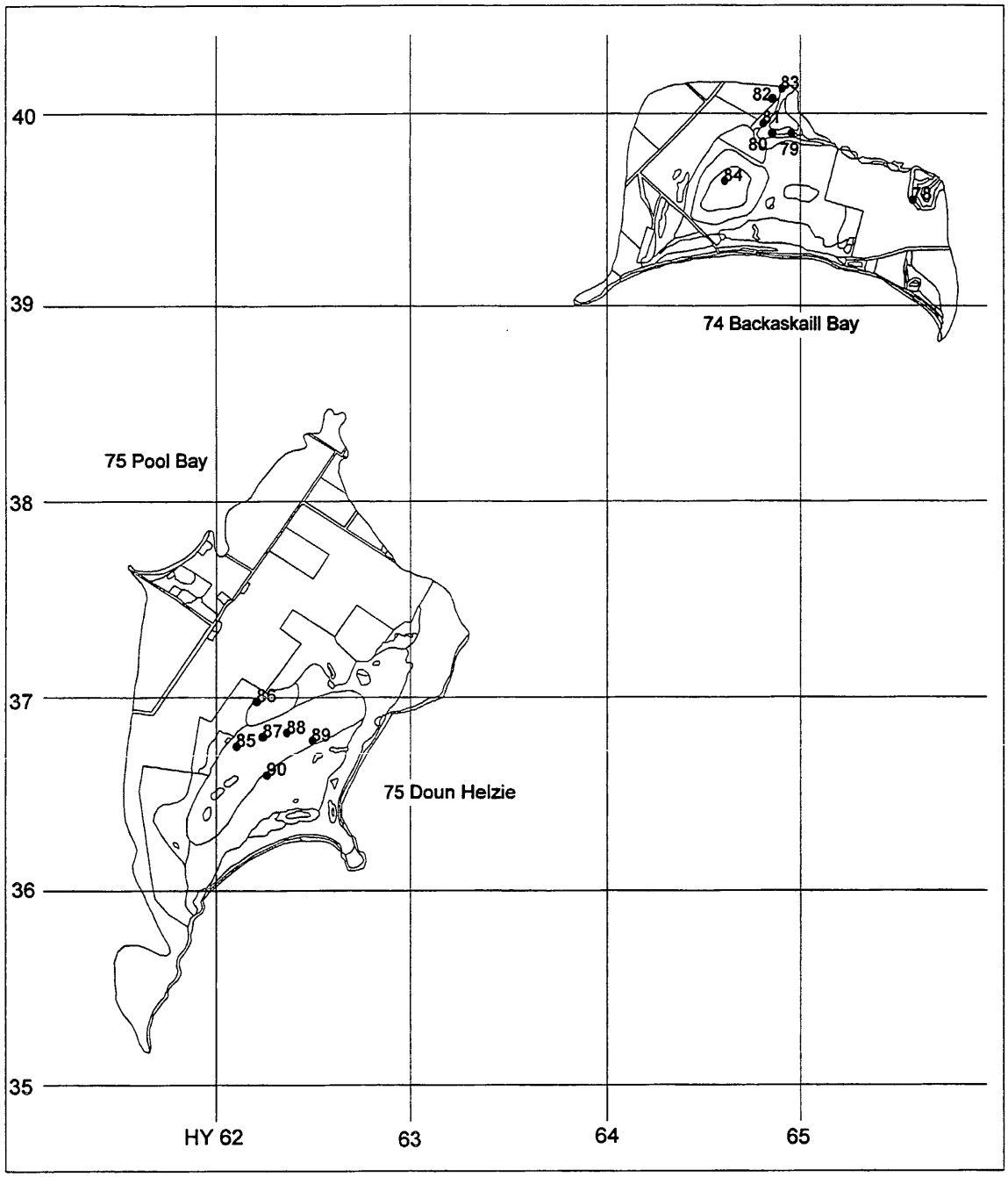
Map 4b Quadrat positions: East Coast (northern sector), Sanday



Map 4c Quadrat positions: East Coast (central sector) and Taing of Crudy (Sanday)



Map 4d Quadrat positions: East Coast (southern sector), Sanday



Map 4e Quadrat positions: Backaskaill Bay and Doun Helzie to Pool Bay (Sanday)

76-77 NORTH RONALDSAY

Location and conservation status

Two areas of windblown sand are present:

76 South Bay and Gairsna Geo HY754528 77 Linklet Bay HY765536

The locations of site assemblages are given in Map 1.
No site has a nature conservation or landscape designation.

Previous surveys

Geomorphology Mather, Smith & Ritchie (1974)

Survey details

Date	September 1996
Target notes	31 (Annex 1)
Quadrats	None - recording effort curtailed by lack of time.
NVC maps	Volume 3 (1:15000 maps reduced from 1:10000 originals)

Broad land cover categories

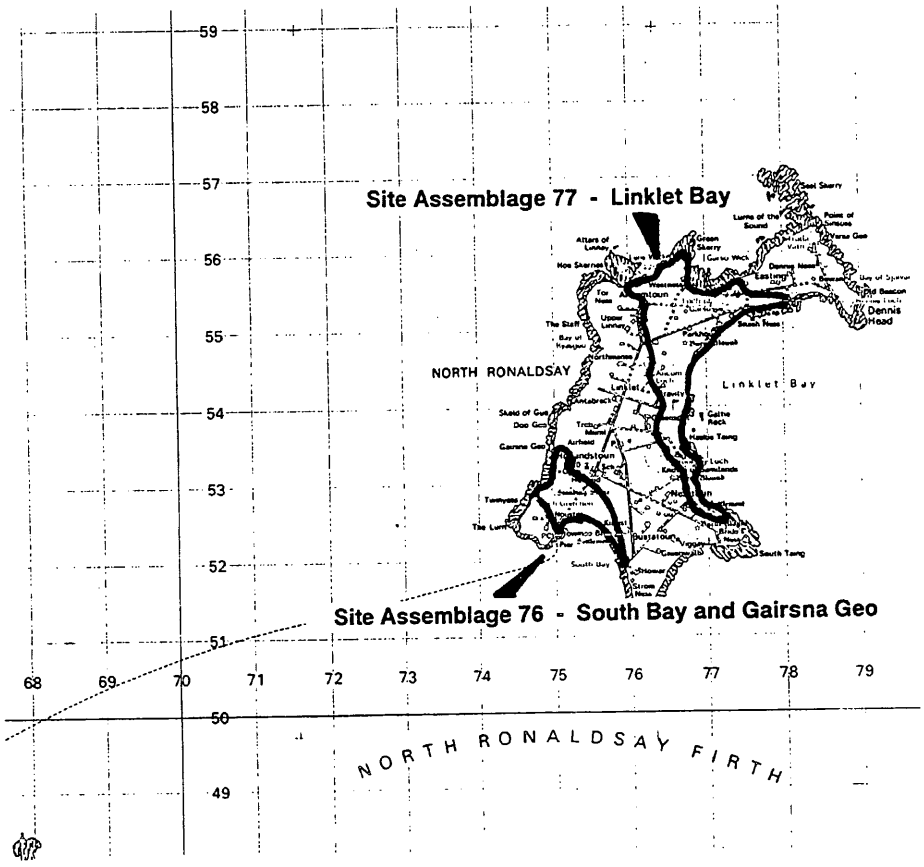
The data below (Table 1) provide basic information on broad land cover categories. Survey concentrated largely on windblown sand above the MHWS line, extending inland to the sand limit or the start of open water in lochs. Additional ground (e.g. saltmarsh, small open water sectors of lochs, low rock cliffs, bare rock patches) was occasionally surveyed and this is excluded from windblown sand figures. The total windblown sand area is divided into unvegetated beach (this includes bare shingle), bare sand (within the vegetated dune zone, associated with blowouts and intense rabbit burrowing), vegetated sand (natural and semi-natural vegetation cover, excluding recent fallows), arable and fallow ground, and man-made features such as buildings, tracks, roads, cemeteries, spoil, etc.. Total windblown sand area less beach above MHWS defines the extent of potential vegetated ground, the best measure of site area.

Total windblown sand extent for North Ronaldsay, excluding the beach zone, is 239.9 ha. Most of this is vegetated ground (209.8 ha), the remainder made up of bare sand (1.7 ha), arable and fallow land (14.6 ha) and land take for buildings, gardens, roads, etc. (12.4 ha).

Dune habitats (Table 2, Map 2)

Total surveyed area is 261.0 ha. As with most Orkney islands, North Ronaldsay lacks fixed acidic dune grassland, dry dune heath and wet dune heath (conditions largely restricted to Hoy and Eday). In addition, semi-fixed dune is absent from North Ronaldsay and there is very little mobile dune habitat (3.0 ha, much of it a form of fixed dune grassland rich in the moss *Tortula ruralis* ssp. *ruraliformis*, an indicator of sand deposition and changing dune form). Such absence and low extent for these habitats suggest low sand supply to North Ronaldsay beaches, together with heavy grazing pressure preventing the development of significant areas of the tall mobile dune grasses, *Leymus arenarius* and *Ammophila arenaria*. North Ronaldsay is unique in Orkney for running its own North Ronaldsay sheep breed as flocks which are confined by walls and fencing to the coastal edge of the island, relying on coastal grassland and seaweed for fodder. Grazing pressure is very high and only short sward grasses can survive in such conditions.

.A large proportion of remaining habitats is taken up by a combination of improved grassland (110.1 ha) and arable/fallow (14.6 ha) but there are sizeable extents of fixed calcareous dune grassland (44.0 ha), dune slack and wet grassland (48.9 ha) and mire/swamp (6.7 ha).



Map 1 Site assemblage location
See Volume 3 for NVC maps
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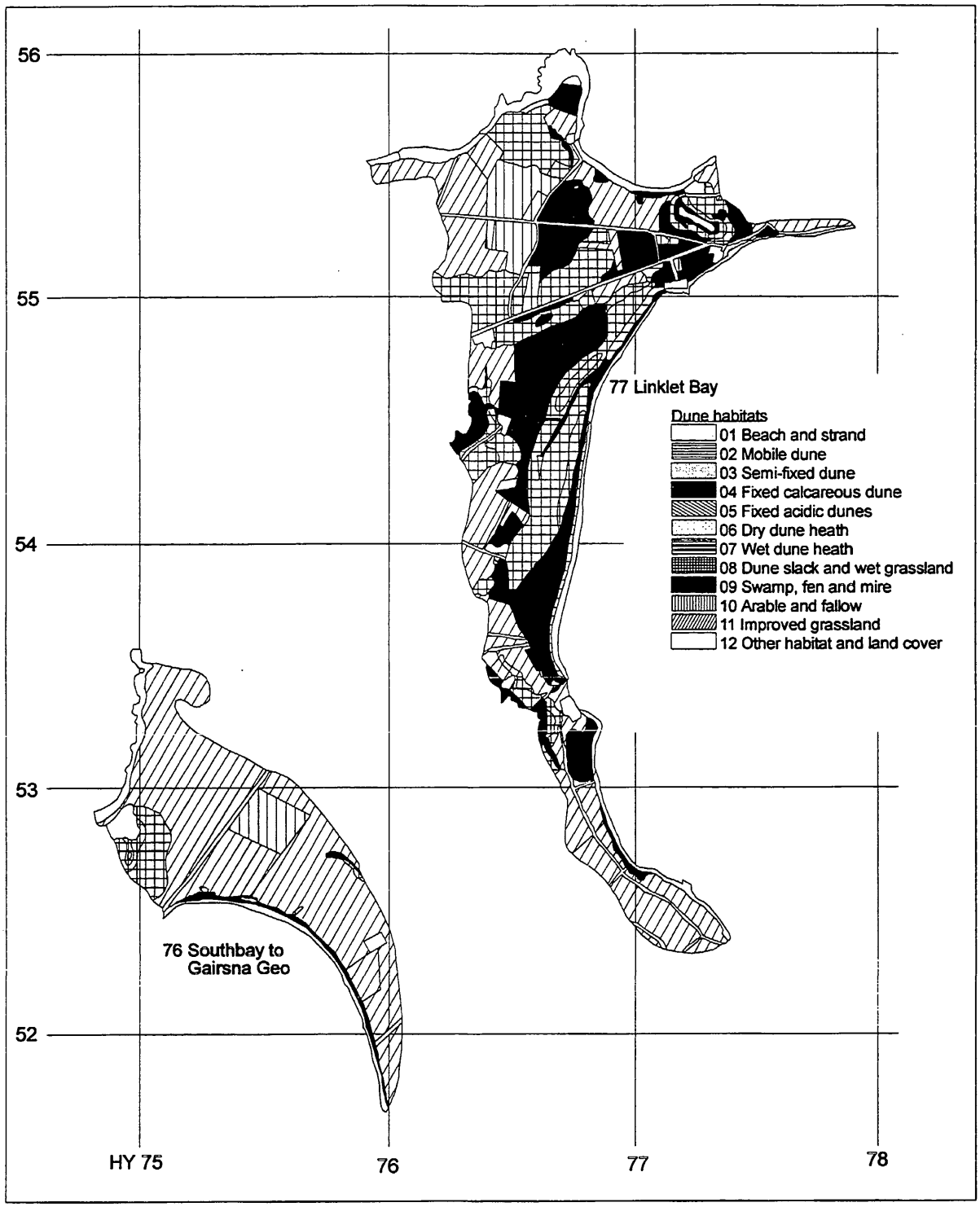
Table 1 Broad land cover extents (ha)

	76 South Bay and Gairsna Geo	77 Linklet Bay	All North Ronaldsay sites
Windblown sand land cover			
Beach above MHWS	4.77	13.44	18.21
Bare sand	0.05	1.69	1.74
Vegetated sand (except fallows)	65.23	145.84	211.07
Arable and fallow	4.80	9.84	14.64
Buildings, roads, gardens, tips, pits, cemeteries, airfield	1.68	10.73	12.40
Total windblown sand excluding beach zone	71.75	168.11	239.86
Total windblown sand extent above MHWS	76.52	181.55	258.07
Surveyed but not on blown sand			
Bare rock			
Unvegetated maritime cliff		1.27	1.27
Saltmarsh			
Open water	1.38	0.26	1.64

Table 2 Extents (ha) of dune habitats and other ground

	76 South Bay and Gairsna Geo	77 Linklet Bay	All North Ronaldsay sites
Habitat 1 - Beach and strand	4.77	14.50	19.27
Habitat 2 - Mobile dune		3.03	3.03
Habitat 3 - Semi-fixed dune			
Habitat 4 - Fixed dry calcareous dune	1.90	42.10	44.00
Habitat 5 - Fixed acidic grassland			
Habitat 6 - Dry dune heath			
Habitat 7 - Wet dune heath			
Habitat 8 - Dune slack and wet grassland	5.71	43.22	48.93
Habitat 9 - Mire and swamp	0.26	6.45	6.71
Habitat 10 - Arable and fallow	4.80	9.84	14.64
Habitat 11 - Improved grassland	57.40	52.66	110.07
Habitat 12 - Other habitats	3.05	11.27	14.32
TOTALS (ha)	77.90	183.08	260.98



Map 2 Dune habitats of South Bay to Gairsna Geo, and Linklet Bay (North Ronaldsay)

Vegetation and other land cover types (Table 3; Volume 3 - NVC maps)

As indicated by dune habitat data, North Ronaldsay vegetation on blown sand is dominated by MG7 *Lolium perenne* improved grassland (102.9 ha). Only 23 types of vegetation are mapped but the majority (14 categories) of these cover dune wetland and this is the main semi-natural interest of these sites. SD8e *Festuca rubra - Galium verum* fixed dune *Prunella vulgaris* sub-community (15.3 ha) and MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland are locally extensive (30.4 ha) and there are large blocks of M28x *Iris pseudacorus* beds (4.5 ha) creating structural diversity. Other wetland types are smaller in extent but show a good range of conditions from tussocky grassland (MG9 *Holcus lanatus - Deschampsia cespitosa* intermediate with MG11 inundation grassland, 5.9 ha) to MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland (0.5 ha) and a variant with the Red Data Book species *Rorippa islandica* (MG13x, 0.04 ha), plus SD17b *Potentilla anserina - Carex nigra* dune slack *Carex flacca* sub-community, 2.2 ha) and several swamp types (S10 *Equisetum fluviatile* community, 0.2 ha; S19c *Eleocharis palustris* swamp *Agrostis stolonifera* sub-community, 1.2 ha; S28 *Phalaris arundinacea* tall-herb fen). Some tillage is also practised on wet grassland, with fallows (MG11F, 0.8 ha) present in small quantity.

Dry dune conditions are much more restricted apart from a large total area of SD8a fixed dune grassland Typical sub-community (29.8 ha) and localised areas with the SD8d *Ranunculus acris - Bellis perennis* sub-community (8.2 ha). Fallows (SD8F, 7.8 ha) are present in areas of dry dune and are similar to Western Isles types which are rare on a national scale. Strand vegetation is absent and is probably consumed by sheep, with no opportunity to develop. SD5c *Leymus arenarius* mobile dune *Festuca rubra* sub-community (1.2 ha) is rare and semi-fixed dune (SD7 *Ammophila arenaria - Festuca rubra* community) is absent.

Site descriptions

76 South Bay and Gairsna Geo

This moderately-sized (71.8 ha) bay and climbing dune site is located in the south-west of North Ronaldsay. It is a complex site, occupying bay dunes on the south (South Bay, exposed to a fetch of 4.5 km south to Sanday) and southwest coast (south of Gairsna Geo, exposed to a very long fetch WNW across the Atlantic) and with climbing dunes connecting these coasts to form a continuous area of blown sand. The western side of the site has a shingle beach and grazing pressure from North Ronaldsay sheep is very high outside a wall enclosing extensive MG7 improved grassland. There is good-quality wetland around Loch Gretchen in the southwest of the site, with extensive MG9/MG11 tussocky wet grasslands and more confined areas of MG11 and MG13 inundation grasslands, including bare ground patches with *Rorippa islandica*.

The south shore shows signs of active retreat and erosion of the coastal edge. The outer boundary wall has collapsed in places and sheep have gained access inland for shelter, maintaining a long 80 m erosion scar in one area. Mobilised sand forms banks up to 1.5 m high against the wall on its north-facing side

Most of the site interior is improved or arable land. The overall nature conservation interest of vegetation is low due to the scale of improvement and heavy grazing pressure but there is local interest in the wetland area of the southwest.

77 Linklet Bay

This large (168.1 ha) bay and climbing dune system is located on the east and north coast of North Ronaldsay, with climbing dunes connecting bay dune sand in Linklet Bay on the east coast (exposed to a long fetch ESE across the North Sea to Norway and Denmark) and Garso Wick on the north coast (exposed to a long fetch north into the Arctic Ocean).

The northern coastal edge is rocky and heavily grazed by sheep, with little vegetation. Mobile sand is blown into banks against the grazing boundary wall. The eastern beach of Linklet Bay is primarily shingle with sand patches. The boundary wall comes inland in the southern part of the site, allowing North Ronaldsay sheep to graze on dune turf which is trimmed to a few millimetres height by the intense grazing pressure. The eastern dune edge is good SD8c fixed dune grassland *Tortula ruralis* ssp. *ruraliformis* sub-community, indicating sand is deposited in low but regular quantities in this zone. The SD8c is also present in patches further inland.

An important feature of the site is a depression between the outer zone of SD8 fixed dune grassland and an inner area of SD8a turf on higher ground which stretches for 1 km north south. The depression is mainly occupied by SD8e damp fixed dune grassland but the lowest areas have good SD17b dune slack. The wettest ground is found in three main areas. There are two concentrations on the inner edge of the site, with SD17b slack merging into MxTm *Carex nigra - Triglochin maritima* provisional rich fen and S19c swamp. M28x *Iris pseudacorus* beds provides structural diversity in both locations. The third location is in the northeast around Loch of Garso. This has a particularly fine SD17b slack with a very high density of *Parnassia palustris*. The very wet loch edges also have small patches of *Hippuris vulgaris*.

Large sectors of the inner parts of the site have been improved or converted to arable land but many fields, particularly in the northern climbing dunes, are not managed intensively and have large areas of fallow ground. These are analogous to traditional fallows present in the Western Isles, a habitat which is now rare in Scotland.

The overall nature conservation interest of the vegetation is moderate to high. Improvement and heavy sheep grazing have reduced interest but wetland areas and the fixed dune and slack depressions close the eastern coast are of high quality. The habitat mosaic is quite diverse compared to most Orkney sites and this is probably attractive to birds, including the passage migrants for which North Ronaldsay is famous.

References

Mather, A.S., Smith, J.S. & Ritchie, W. (1974). Beaches of Orkney. Perth, Countryside Commission for Scotland.

Table 3 Vegetation and other land cover (areas in ha)

Map codes	ORKNEY NVC VEGETATION AND LAND COVER TYPES	76 South Bay and Gairsna Geo	77 Linklet Bay	All North Ronaldsay sites
AP	Arable - potatoes		0.13	0.13
ARB	Arable - barley	4.80	1.07	5.87
BBG	Buildings, bare ground and gardens	0.41	3.07	3.48
BBS	Bare beach sand (above MHWS, below vegetated dune zone)	1.54	1.47	3.01
BMC	Maritime cliff with little vegetation		1.27	1.27
BS	Bare sand (within vegetated sand zone)	0.05	1.69	1.74
BSH	Bare shingle	3.23	11.97	15.20
M28x	M28x *Iris pseudacorus - Filipendula ulmaria* mire, *Poa trivialis* sub-community (PROVISIONAL NEW NVC TYPE)	0.26	4.25	4.51
M28x/S28	M28x/S28 intermediate		0.29	0.29
MC10/ SD8d	MC10/SD8d intermediate		0.10	0.10
MG7	MG7 *Lolium perenne* leys	56.42	46.44	102.86
MG9/ MG11	MG9/MG11 intermediate	4.19	1.71	5.89
MG11	MG11 *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland	1.23	29.17	30.40
MG11/ S28	MG11/S28 intermediate		0.24	0.24
MG11F	MG11F *Festuca rubra - Agrostis stolonifera - Potentilla anserina* inundation grassland - FALLOW		0.81	0.81
MG13	MG13 *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland	0.25	0.23	0.48
MG13x	MG13x *Agrostis stolonifera - Alopecurus geniculatus* inundation grassland, *Rorippa islandica* sub-community (PROVISIONAL NEW NVC TYPE)	0.04		0.04
MxTm	MxTm *Carex nigra - Triglochin maritima* mire (PROVISIONAL NEW NVC TYPE)		1.76	1.76
OW	Open water	1.38	0.26	1.64
ROAD	Road and track	1.26	7.62	8.88
RUD	Ruderal-dominated vegetation	0.98	1.11	2.09
S10	S10 *Equisetum fluviatile* swamp		0.17	0.17
S19c	S19c *Eleocharis palustris* swamp, *Agrostis stolonifera* sub-community		1.23	1.23
S28	S28 *Phalaris arundinacea* fen		0.07	0.07
SD4/SD8a	SD4/SD8a intermediate	1.29	0.50	1.79
SD5c	SD5c *Leymus arenarius* mobile dune, *Festuca rubra* sub-community		1.22	1.22
SD8a	SD8a *Festuca rubra-Galium verum* fixed dune grassland, Typical sub-community		29.77	29.77
SD8c	SD8c *Festuca rubra-Galium verum* fixed dune grassland, *Tortula ruralis* ssp *ruraliformis* sub-community	0.09	2.40	2.49
SD8d	SD8d *Festuca rubra-Galium verum* grassland, *Ranunculus acris-Bellis perennis* sub-community	0.47	7.72	8.19
SD8e	SD8e *Festuca rubra-Galium verum* grassland, *Prunella vulgaris* sub-community		15.32	15.32
SD8F	SD8F *Festuca rubra-Galium verum* fixed dune grassland, FALLOW		7.83	7.83
SD17b	SD17b *Potentilla anserina-Carex nigra* slack, *Carex flacca* sub-community		2.16	2.16
TIP	Rubbish tip		0.04	0.04
TOTALS (ha)		77.90	183.08	260.98

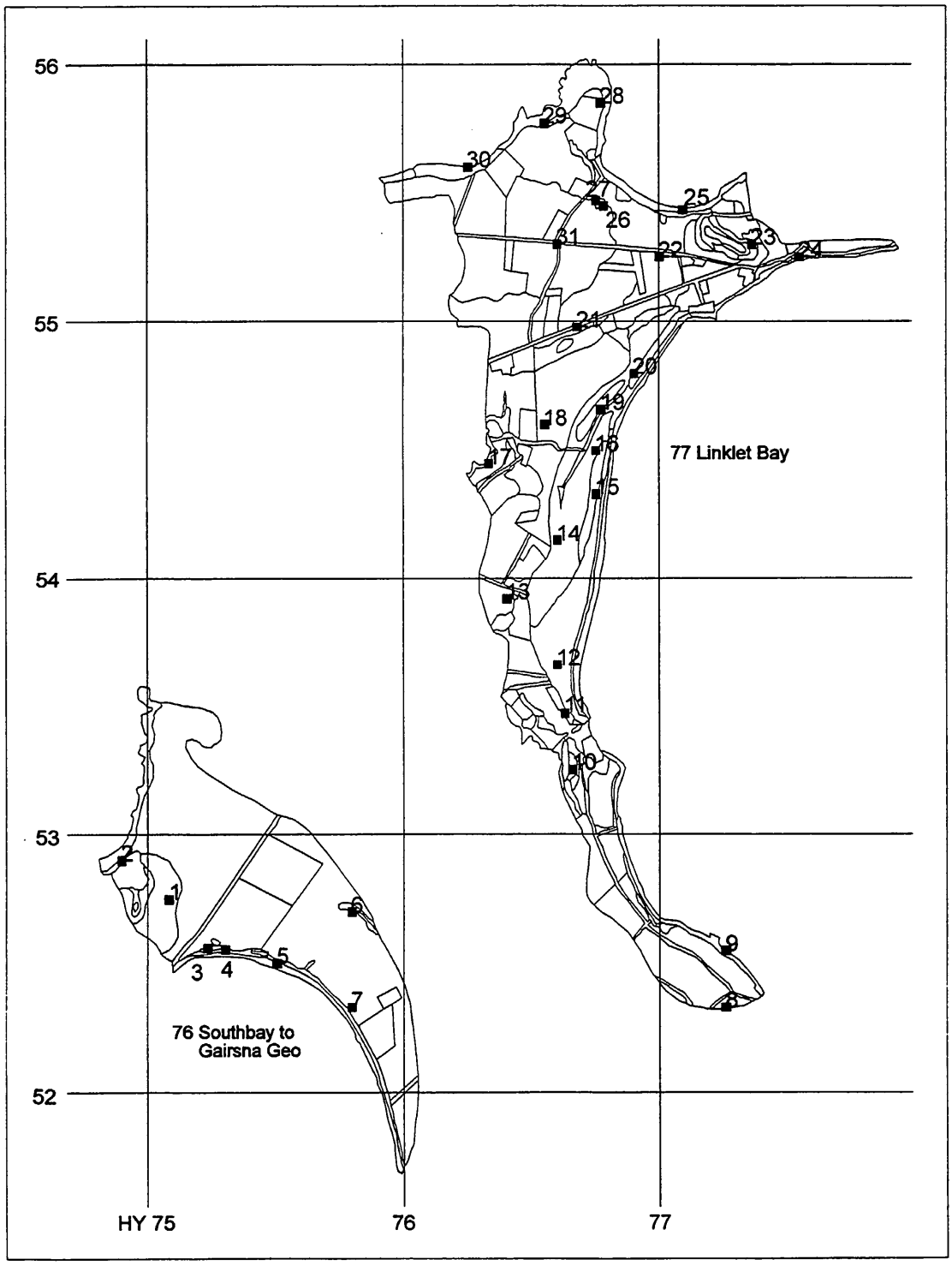
Annex 1 Target Notes

Target note locations are given in Map 3, following notes

#	Grid Ref.	Site	Target Note Detail
1	HY75085275	76 South Bay to Gairsna Geo	Higher levels of field improved, but centre towards Loch Gretchen has good quality MG9/MG11, with moderately heavy grazing and tussocks in part developed from past poaching. Scattered *Parnassia palustris* present.
2	HY74905290	76 South Bay to Gairsna Geo	Little sand visible in any coastal section but present in scars on adjacent hillsope. Very steep (15 m degree) beach with long distance to low water (30 m), formed of large slab cobbles and boulders. Heavy grazing by North Ronaldsay breed sheep.
3	HY75205240	76 South Bay to Gairsna Geo	1.5 m wall built along entire length of bay on top of dune and shingle ridge. Very little sand on southern side. Sward south of wall grazed by North Ronaldsay breed of sheep. Dwarf forms of *Poa annua, Plantago coronopus, Agrostis stolonifera, Plantago lanceolata, Polygonum aviculare* present.
4	HY75255250	76 South Bay to Gairsna Geo	80 m long erosion scar inside dune edge wall, with stock-rubbed face to 2 m height. Stock wall 10 m to south is broken in many places and sheep can get access to MG7 grassland. Sand bank up to 1.5 m built up behind wall. Field also used for winter feeding, with local patches of bare ground and weeds.
5	HY75505250	76 South Bay to Gairsna Geo	Old dune edge wall in centre of bay destroyed and set back 15 m inland. Heavy sheep grazing south of wall maintains a very patchy sward with much bare sand. Much sand banked on northern side of new wall, with SD2 vegetation (*Cakile maritima*). SD4/SD8a very prominent inland. Shows compression of vegetation zones very well.
6	HY75805270	76 South Bay to Gairsna Geo	M28x and MG11 wetland interest recently reduced by ditching to drain water to south.
7	HY75805233	76 South Bay to Gairsna Geo	Former silage clamp cut into dunes. Stock maintain erosion scars by rubbing on old edges. Floor of ruderals (*Elymus repens, Cirsium arvense, Urtica dioica*).
8	HY77255233	77 Linklet Bay	Old dune edge wall in great disrepair, with untidy wire fencing erected on top. An internal wire fence has been erected to confine sheep to beach and vegetated sand behind wall. Prominent zone of SD4/SD8a for 20 m inland of new wire fence.
9	HY77255255	77 Linklet Bay	Dune edge with 1.5 m wall along almost entire edge to confine sheep to beach and intertidal zone. Virtually no strand or dune vegetation outside of wall.
10	HY76665325	77 Linklet Bay	Good dune wetland mosaic on eastern side of Hooking Loch with sequence from SD8e to SD17b to MxTm to M28/S28. Moderate density of *Parnassia palustris* in SD8e and SD17b sectors.
11	HY76635347	77 Linklet Bay	Old dump for rubble and metal barrels.

#	Grid Ref.	Site	Target Note Detail
12	HY76605366	77 Linklet Bay	Steep short shingle beach with sand on lower sector. Inside this is a heavily grazed machair plain open to sheep, but confined by high 1.5 m inner wall. 1 cm high sward of SD8c, SD8d and MG11 in damper hollows. Turf rich in *Plantago coronopus*. Area is also used as golf course - no need for mowing.
13	HY76405392	77 Linklet Bay	Silage clamps in dunes.
14	HY76605415	77 Linklet Bay	Rear of machair plain has SD8e area with scattered *Parnassia palustris* and *Selaginella selaginoides* in turf.
15	HY76755433	77 Linklet Bay	Very short MG11 turf with small patches of *Hydrocotyle vulgaris*. Lowest ground has 30% bare sand and much *Gnaphalium uliginosum* and *Radiola linoides*, with dwarf forms of *Potentilla anserina* and *Agrostis stolonifera*.
16	HY76755450	77 Linklet Bay	1 m wide meandering drain with abundant *Myosotis scorpioides* on sides and in parts of channel.
17	HY76335445	77 Linklet Bay	Good MxTm poor fen merging into S19c swamp on edge of Ancum Loch.
18	HY76555460	77 Linklet Bay	SD8a grazed only by rabbits. Rank (35 cm height), with *Festuca rubra* dominant and a lot of *Carex arenaria* (Domin 4). Scattered *Carex flacca* present . With sheep grazing would develop into species rich SD8e, small patches of which exist in slight depressions.
19	HY76775466	77 Linklet Bay	Impressive bank of sand built up either side of wall (2.5 m high in places). SD8c and SD8d sward, with many rabbit burrows. Probably represents sand from deflated dunes on top of shingle of eastern beach. To west is rapid change to SD8e and SD17b slack.
20	HY72905480	77 Linklet Bay	Wall recently rebuilt with 30 cm open squares included to make it a porous barrier and thus resist strong winds. Sand greatly disturbed on both sides of wall.
21	HY76685498	77 Linklet Bay	Old 5 m wide tillage strips in MG11 area. Fallow vegetation dominated by *Potentilla anserina*, plus *Sonchus arvensis, Cirsium arvense, Capsella bursa-pastoris, Stellaria media*.
22	HY77005525	77 Linklet Bay	SD8a sward, very rank (35 cm) with occasional patches of ruderals (*Cirsium arvense, Taraxacum* sp). Probably developed from fallow following tillage. Very little tillage now.
23	HY77355530	77 Linklet Bay	Very fine SD17b slack surrounding Loch of Garso. Very high density of *Parnassia palustris*. Grades into S19c towards loch. Open water of loch has good S10 with scattered *Hippuris vulgaris*.
24	HY77535525	77 Linklet Bay	Shingle beach with wall on top built to stop blowouts in capping sand and to confine sheep to shore area. Fragments of *Plantago* spp. rich SD8d to south. No strand - probably always consumed by sheep.
25	HY77105550	77 Linklet Bay	Steep slab shingle beach. Only *Urtica dioica* present on higher parts except for Poa annua in a few sand pockets.
26	HY76785545	77 Linklet Bay	Tussocky rank (40 cm high) SD8a with scattered ruderals (*Urtica dioica, Sonchus arvensis*) which are probably remnants from on old fallow. No sign of recent tillage.
27	HY76755547	77 Linklet Bay	Dump of old agricultural machinery.

#	Grid Ref.	Site	Target Note Detail
28	HY76775585	77 Linklet Bay	Very heavily grazed MC10/SD8d rich in *Plantago coronopus* and *Plantago maritima*, with scattered *Armeria maritima*.
29	HY76555577	77 Linklet Bay	Heavily over grazed area at back of shingle ridge - scattered *Urtica dioica*, *Poa annua* and *Agrostis stolonifera*. Mapped as ruderal.
30	HY76255560	77 Linklet Bay	Steep shingle beach with sand blown on to upper portion against boundary wall. Nothing vegetated.
31	HY76605530	77 Linklet Bay	Area of rank *Festuca rubra*, no *Lolium perenne*, no *Galium verum*. Scattered ruderals present (*Sonchus arvensis, Cirsium arvense, Urtica dioica*), suggesting sward is result of old tillage and development from fallow. Scattered fields of bere barley in vicinity.



Map 3 Target note positions: South Bay to Gairsna Geo and Linklet Bay (North Ronaldsay)

Scottish Natural Heritage

Scottish Natural Heritage is an independent body established by Parliament in 1992, responsible to the Secretary of State for Scotland.

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