ENGLISH NATURE

# Translation of Phase 1 data from field maps to GIS

## Learning gained from the Habitat Restoration Project

**No. 312 - English Nature Research Reports**

working today
for nature tomorrow

English Nature Research Reports

Number 312

# Translation of Phase 1 data from field maps to GIS

## Learning gained from the Habitat Restoration Project

Sallie-Anne Bailey and James Isaacs



ISSN 0967-876X

# Contents

# Executive Summary

As a result of work within the Habitat Restoration Project, standard protocols to translate Phase 1 field maps and target notes into digital format for use within GIS have been defined. These protocols can be used throughout English Nature and applied more widely. The GIS data set can be used as a basis for translation into other formats, eg Biodiversity Action Plan habitat types.

During initial survey the following points should be observed:

- use alphanumeric Phase 1 codes only when annotating field maps;
- the form presented in this report should be used for recording target note information;
- surveyors should be instructed to save all digital documentation. If target notes are transcribed into the format described in this report translation of the information into a database structure will be possible;
- use of mosaic codes should be avoided. Strings of codes should only be used when components of the mosaic are too closely located to be represented individually;
- all patches of sparsely distributed habitat should be enclosed by a dashed line;
- unsurveyed areas should be clearly defined with a bounding line and suitable symbol;
- detecting mis-matches along sheet edges should occur early in the Phase 1 mapping procedure, during the Phase 1 survey or on receipt of field maps from contractors;
- when translating the information from field maps and target notes the data should be structured to comply with that described in the report to enable flexible manipulation and analysis of the data once held in the GIS.

# 1. Introduction

Geographic Information Systems (GIS) have played a vital role in English Nature's Habitat Restoration Project (HRP) adopting a new approach to digital information than that used previously within English Nature. In the past, English Nature's use of digital information and GIS has been confined to site specific mapping or nationally using Natural Areas but, for the HRP, information has been plotted and analysed at a landscape scale.

GIS work has occurred in several key phases; capture of baseline information (Phase 1 survey), production of publicity maps (visions) and development of standard reporting procedures. At each point learning has occurred. New methods of working have been developed for the first of these key phases. Consequently, learning emerging from the HRP can be applied more widely through English Nature and promoted externally as good practice. This report will describe the development of processes and transferable protocols for the capture of Phase 1 information and translation into GIS.

# 2. The Habitat Restoration Project

The Habitat Restoration Project works with farmers and other countryside organizations to reverse fragmentation, a cause of wildlife loss in the English landscape. The creation of new wildlife habitat using existing environmental land management schemes is being encouraged in four trial areas (each 100 $km^2$). Experiences from this Project and elsewhere will be used within English Nature and disseminated more widely to individuals and organizations involved in countryside policy.

# 3. Phase 1 habitat survey

Phase 1 habitat survey is a standardised system designed to classify and map wildlife habitats throughout Great Britain. It was developed with the aim of providing information on the location, extent and distribution of natural and semi-natural vegetation and wildlife habitats relatively rapidly over large areas of countryside (Nature Conservancy Council, 1990; Wyatt, 1991).

## 3.1 Role of Phase 1 survey information in HRP

A Phase 1 survey was carried out in each of the trial areas. The information served a number of purposes:

- to provide an inventory of existing habitats within the trial areas;
- a baseline, to record the extent of semi-natural habitats and farmland prior to HRP activities against which achievements can be measured;
- with existing local records, to target BAP species and habitats for priority action;
- to target areas where habitat creation is most appropriate;
- to target the most appropriate habitats for restoration;

- to contribute to the development of an idealised 'vision' for each trial area.

The role of GIS in the HRP is summarised in Appendix 1.

## 3.2 Phase 1 survey and GIS

Once the Phase 1 information has been digitised into GIS format it has the added advantage of providing information for ecological models. Such models can identify the most cost effective locations for habitat creation and restoration. Combination of the digital Phase 1 information with other digital data sets for the survey area held by English Nature (such as SSSI boundaries, Ancient Woodland Inventory boundaries) provides a framework to determine nature conservation priorities. GIS can provide a rapid and accurate breakdown of the extent of habitats and other information for standard reports (assuming accuracy of original data) and used by project officers in their synthesis of habitats present in trial areas. The Phase 1 information can also be printed out in map form at any size or scale according to the users requirements, removing the need for storage of numerous duplicates of the same information.

The Nature Conservancy Council reviewed Phase 1 habitat survey use and application in the early 1990s (Wyatt, 1991) and, for a variety of habitats, how much information can be extracted from repeated Phase 1 survey of the same area (Dargie, 1993). When Wyatt's (1991) review was compiled, the cost of GIS was considered to be sufficient to prohibit sole use for Phase 1 survey. However, if the survey was to be combined with other digital data sets and GIS was available, translation of Phase 1 survey information was encouraged. The time and labourious nature of translating Phase 1 information from paper maps to GIS was, however, emphasised.

The original guidelines, published in the Phase 1 survey handbook emphasise the need for a standardised system, consistent survey method and level of detail and accuracy. Such ideas were reinforced with the publication of Dargie's (1993) report, in which it was again stressed that accurate mapping was vital to the validity of subsequent analyses. Although Dargie (1993) recommended modification of the Phase 1 survey handbook this has not occurred. Unless standards and protocols are set for the translation of Phase 1 field information to digital form and structure of information in GIS are established, variation in data quality will make national collation and cross-analysis of Phase 1 data from different regions impossible. This report provides documentation for these procedures to enable them to be more widely applied.

# 4. Standards for translation of Phase 1 survey from field maps to digital data sets

During the translation of the field maps into digital data, a number of issues arise that necessitate the development of standards for the capture of the information in the field and the input of information in the GIS. These issues will be considered in order with which they occurred in the translation procedure.

## 4.1 Standard format for Phase 1 data

The quality of information held in Phase 1 field documents and associated target notes varied between trial areas. During the progress of the Habitat Restoration Project, Phase 1 data has been

described in many different ways, some of which lend themselves more easily to digital conversion. Variation was found in the representation of a number of elements:

- format of habitat codes used in survey;
- representation of mosaic habitats;
- recording of target notes;
- representation of sparse vegetation;
- representation of unsurveyed areas;
- edge matching of adjacent maps.

If maps are to remain in hard copy and not be compared with others these differences would be difficult to detect. However, the translation of the maps into digital form makes the discrepancies immediately noticeable and problematic.

To achieve rapid capture of Phase 1 information and conversion into digital format, the Phase 1 survey data (maps and target notes) must be presented in a standard format. To avoid similar difficulties in future projects and to simplify the data conversion process, it is suggested that a standard protocol, as summarised in Table 1 should be used by surveyors when capturing data in the field.

**Table 1. Recommended protocols to capture Phase 1 information and convert to GIS**

| Issue | Protocol |
|---|---|
| Common codes for mapped information | Only the alphanumeric codes should be used when annotating field maps. This would give a significant time saving in capturing attribute information and recognising habitat classification. |
| Standard format target notes | The form presented in Table 2 should be used for recording target note information. |
| Duplication of target note information | Surveyors should be instructed to save all documentation. If target notes are transcribed into the suggested format, translation of the information into database structure will be possible. |
| Representation of mosaic habitats | To avoid loss of integrity of Phase 1 data, use of mosaic codes should be avoided. Strings of codes should only be used when components of the mosaic are too closely located to be represented individually. |
| Representation of sparse vegetation | All patches of sparsely distributed habitat should be enclosed by a dashed line. |
| Representation of unsurveyed areas | Unsurveyed areas should be clearly defined with a bounding line and suitable symbol, for example 'N/S'. |
| Edge matching of adjacent maps | Detecting mis-matches along sheet edges should occur earlier in the Phase 1 mapping procedure, during the Phase 1 survey or on receipt of field maps from contractors. Phase 1 surveyors and nominated officers of contracted surveys should check that maps match at their edges. |

### 4.1.1 Common codes for mapped information

Two sets of Phase 1 mapping codes exist; the hierarchical alphanumeric reference codes and the lettered codes for use on monochrome maps. Both sets of codes, and combinations of both, may be used on field maps. Data look-up tables, held within Intergraph[1], that provide information required for part of the attribution process required to give 'geographical intelligence' to the maps, were coded to represent the alphanumeric codes. If the lettered codes were used on Phase 1 maps, it was necessary to translate them into alphanumeric codes during data capture prior to attribution of digital maps.

***It is recommended, therefore, that only the alphanumeric codes (Appendix 1; NCC, 1990) should be used when annotating field maps. This would give a significant time saving in capturing attribute information and recognising habitat classification.***

### 4.1.2 Standard format target notes

Format of target note information varied between each of the trial areas. This made transcribing the information for inclusion in the GIS extremely time-consuming and has limited the potential for cross-comparison of biological information between trial areas. The Phase 1 Survey Handbook instruction on the recording of target notes is rather ambiguous, apparently suggesting two formats for target note information. A standard format should be adhered to, to avoid the inconsistencies encountered in this project. The format suggested in this report combines that used in one of the trial areas, the structured form described in the Phase 1 Survey Handbook and also enables incorporation of new information, eg Biodiversity Action Plan and Natural Area (Table 2). The major change in this form as opposed to the original (Appendix 6; Nature Conservancy Council, 1990) is the use of six figure grid references and unique reference numbers to identify the location of the target note. Both are required to link the information in the target note to the target note label held within the GIS.

***The form presented in Table 2 should be used for recording target note information.***

### 4.1.3 Duplication of target note information

The transcribing process, from field target notes to word processed documents, had also been repeated in some instances. Repetition arose when the original transcribed word-processed documents were deleted. The information may have been useable with a small amount of additional processing.

***Surveyors should be instructed to save all documentation. If target notes are transcribed into the suggested format, translation of the information into database structure will be possible.***

[1] Intergraph is the mainframe GIS used by English Nature's Geographic Information Unit

**Table 2. Proposed structure for target notes**

| | |
|---|---|
| Date: | Surveyor: |
| Site name and Ensis code if SSSI:: | Unique number (also mark on map): |
| Map sheet number: | Grid references (six figure): |
| County/Natural Area: | Owner: |
| Area surveyed (ha): | Conservation status: |

| | | |
|---|---|---|
| Habitat type: | Alphanumeric code(s): | Area (ha) or length (m): |
| Dominant plants: | Species codes (Appx 3 NCC, 1990): | Abundance (DAFOR): |

| |
|---|
| Notable species (BAP, nationally scarce, indicators..): |
| Notes on condition of habitat: |
| Sketch map and additional notes overleaf. |

### 4.1.4 Representation of mosaic habitats

Depicting areas that contain mosaics of different habitats is fraught with difficulty. Translating this information into GIS exacerbates the problem of representing such habitats appropriately. Mosaics can be represented as strings of alphanumeric codes found within the polygon, for example; 'J12/C12/A122/A22/D5' could represent an area containing amenity grassland, bracken (continuous and scattered), coniferous plantation, scattered scrub and dry dwarf shrub heath. For clarity, it became necessary to assume that the first habitat present in the string was dominant and those following were of secondary importance. This was field checked at a sample of sites and with staff who knew the ground well. The entry for individual polygons was modified accordingly. In one of the trial areas, where mosaics of semi-natural habitats were common, labelling of such areas with strings of habitat codes, extended the number of habitats to over two hundred. Once the protocol of first habitat dominance had been adopted, this number was greatly reduced by aggregating the duplicate mosaics.

***It is recommended that to avoid loss of integrity of Phase 1 data, use of mosaic codes should be avoided. Strings of codes should only be used when components of the mosaic are too closely located to be represented individually (Dargie, 1993).***

### 4.1.5 Representation of sparse vegetation

The representation of sparse vegetation on field maps is often by a smattering of symbols according to the habitat being represented. Translation of this ambiguous information into the GIS is difficult, as two-dimensional information must be bound by an enclosing polygon. It is suggested in the Phase 1 Survey Handbook that where no marked boundary exists between habitats a dashed line should be marked to aid visual assessment of maps and area calculations. Adopting this practice will also aid accurate translation of such information to the GIS. Clear boundaries for all Phase 1 information is noted by Dargie (1993) as essential for accurate transcription of extents of areas and transition data.

***All patches of sparsely distributed habitat should be enclosed by a dashed line.***

### 4.1.6 Representation of unsurveyed areas

Areas that had not been surveyed were evident in some trial areas. Generally, these areas were not indicated, merely left blank. This lack of clear definition of the extent of unsurveyed areas lead to ambiguity during transcription of Phase 1 information.

***Unsurveyed areas should be clearly defined with a bounding line and suitable symbol, for example 'N/S'.***

### 4.1.7 Edge matching of adjacent maps

It became clear during the translation of Phase 1 information, that patches of habitats that extended across the edges of adjacent field map sheets frequently failed to match. This lapse of accuracy was also noted and criticised by Wyatt (1991) in his assessment of the Phase 1 process. During the HRP, mis-matches were often not detected until the information was being input into the GIS. At this late stage, it was left to the GIS Project Officer to make an informed decision on the true identity of the habitat. Where this was not possible the information could not be modified.

The problem is more acute when the digitising of Phase 1 information is carried out by external contractors.

***Detecting mis-matches along sheet edges should occur earlier in the Phase 1 mapping procedure, during the Phase 1 survey or on receipt of field maps from contractors. Phase 1 surveyors and nominated officers of contracted surveys should check that maps match at their edges.***

## 4.2 Translation from Phase 1 habitat survey to digital format

The remainder of this report focuses on the processes and protocols English Nature's GIU used to input the Phase 1 data in the Habitat Restoration Project. It does not try to establish a global standard for using Phase 1 data with GIS as all GIS are different and the end use for the data may be different from that desired in the Habitat Restoration Project.

### 4.2.1 Tender documentation

Standard protocols have been established to translate information from Phase 1 habitat survey 1:10,000 field documents to a digital format to ensure adherence to GIU digital data quality standards. These procedures should also be used in tender documents for external digital mapping contractors to ensure standard format of digital Phase 1 data. Appendix 2 provides an example tender document. It stipulates a strict adherence to the processes described in this document with data being captured in Intergraph software and then converted into MapInfo format.

### 4.2.2 Structure of Phase 1 information in GIS

To be represented within a GIS, Phase 1 information must be translated into either point, line or polygon data. Table 3 gives examples of Phase 1 information and the form it will take in the GIS.

**Table 3. Structure of Phase 1 information in GIS**

| Point | Line | Polygon |
|---|---|---|
| Target notes | Boundaries (hedges, ditches, etc). | Expanse of habitat type |
| Trees (occasionally) | Running water | Unsurveyed information |

For the purposes of the Habitat Restoration Project each 5 km by 5 km tile was digitised and converted to MapInfo individually. For ease of analysis, all the tiles were merged together once they were in MapInfo. Each of the areas then had a single polygon layer which contained approximately 2500 individual polygons with a size of around 2 MB. This size of file proved suitable for the HRP analysis but the quantity of data being input might be larger for other projects. In that case a decision on a filing method which optimized electronic size and geographical coverage should be determined depending on technical and analytical specifications.

**4.2.3 Digitisation of Phase 1, 1:10 000 field documents of trial areas was performed to English Nature's Geographic Information Unit (GIU) standards. Elements were digitised in one of three ways:**

- Where the information follows the baseline information present on the Ordnance Survey 1:10,000 map used in the field survey, the information can be digitised over the Ordnance Survey 1:10,000 raster data as a backdrop ('heads-up digitising').

- Where information recorded in the field does not follow Ordnance Survey 1:10 000 base maps, the data must be captured 'heads-up' from scanned sections of the Phase 1 field map.

- Alternatively, the information can be captured by digitising the information with a digitising tablet (heads-down' digitising).

For the Phase 1 data to comply with other data capture in GIU, the initial data capture was performed in Intergraph (UNIX based GIS) and then, once the data had been attributed, translated into MapInfo. Linear and polygon data were attributed by using look-up tables. For linear features the look-up table held a numeric code from 1 to 200 that corresponded to an alphanumeric code representing Phase 1 information. Polygon data was attributed according to the Phase 1 alphanumeric value found in each polygon. To meet standards set in GIU the digitising was accurate to 1 metre at 1:10 000 and linework had to have perfect connectivity.

### 4.3 Conceptual design of data structure to represent Phase 1 information in GIS

To enable analysis of the Phase I data set, and any additional digital data sets, the data needed to be structured in a flexible manner.

Translation of the information into MapInfo format required a structure for data when held in Intergraph. A structure was developed by assigning different elements of the information into specific levels in the GIS. Essentially, points, linear features and polygons were separated into individual GIS levels. The Phase 1 information was structured as depicted in Table 4.

Once the information is present in Intergraph it can then be exported into MapInfo. At this point the information should take the form suggested in Table 5. This format will ensure data could be processed using software customised in English Nature's GIU.

# 5. Applications

Analysis of the extent and changes in habitat fragmentation in the trial areas as a result of the work of the Habitat Restoration Project required the following information to be derived from the digital Phase 1 data and interpreted according to Biodiversity Action Plan broad and priority habitats (UK Biodiversity Steering Group, 1995). These areas are described in more detail in two of the final reports for the trial areas (Wheeler, 1999; Williamson, 1999).

A flexible database design enabled the following information to be rapidly extracted from the GIS:

- area of trial area, total surveyed area, percentage coverage;
- patch count of unique Phase 1 codes;
- total area of Phase 1/BAP habitats - leading to percentage coverage of trial area and surveyed area;
- average area of Phase 1/BAP habitats;
- total perimeter of patches (by Phase 1 code/BAP habitats);
- average perimeter of patches (by Phase 1 code/BAP habitats);
- total length of linear habitats;
- average length of linear habitats.

**Table 4. Structure of digitised Phase 1 data in Microstation**

| Level in Microstation | Digital Feature | Phase 1 code | Colour | Style | Weight | Represents |
|---|---|---|---|---|---|---|
| 1 | **POLYGONS** Unspecified Boundary Polygons | NONE | 0 | 0 | 0 | all non specified boundaries |
| | May include other specified linear features that form part of boundary | eg J2.2.2 | 1 colour per habitat type* | 0 | 0 | Defunct species poor hedge |
| | AND boundaries ie with two or more codes | eg J2.2.2/ G2 | 1 colour per habitat type* | 0 | 0 | Defunct sp. poor hedge/running water |
| 2 | **LABELS** Polygon habitat code ***If a polygon contains more than 1 label, the labels must be separated by the symbol /*** | eg A1.1.1 | 0 | Font 1 or 2 | 0 | |
| 4 | **LINES** Linear Habitats Linear features that do not form part of a polygon | eg J2.2.2 | 1 colour per habitat type* | 0 | 0 | Defunct sp. poor hedge |
| 5 | **POINTS** Point Features (eg individual trees) Target Notes | None | Any | Text | 0 | Supplementary info |

* Refer to Appendix 3 for colours already assigned to linear habitats

## Table 5. Structure for associated MapInfo files

*Table 5a. Polygon features*

| Column heading | Description | Data Type |
|---|---|---|
| p_label | Alphanumeric Phase 1 mapping code of first label encountered in polygon (appendix 1, NCC, 1990) | Character (20) |
| h_label | All Phase 1 mapping codes encountered in polygon, delimited by a "/" | Character (20) |
| p_area | Area of polygon in hectares | Decimal (20,4) |

*Table 5b. Linear features*

| Column heading | Description | Data Type |
|---|---|---|
| l_label | Alphanumeric Phase 1 mapping code (appendix 1, NCC, 1990) | Character (20) |
| l_length | Length of line (metres) | Decimal (20,4) |

*Table 5c. Point features - excluding target notes*

| Column heading | Description | Data Type |
|---|---|---|
| pnt_label | Alphanumeric Phase 1 mapping code (appendix 1, NCC, 1990)Plus other point features (eg trees marked as green dots) excluding Target notes | Character (20) |
| pnt_feature | Description of point feature | Character (320) |
| pnt_east | Easting of point feature | Integer (10) |
| pnt_north | Northing of point feature | Integer (10) |

*Table 5d. Point features - Target notes*

| Column heading | Description | Data Type |
|---|---|---|
| target | Number of target note | Integer (10) |
| t_east | Easting of target note | Integer (10) |
| t_north | Northing of target note | Integer (10) |

# References


DARGIE, T. 1993. Repeat Phase 1 habitat survey and the detection of vegetation change. Peterborough: *English Nature Research Reports*, No. 51.

EPPEY, K., HORTON, P. & HALL, J. 1998. *Opportunities for enriching the Vale: A vision for habitat restoration in the Blackmore Vale.* Peterborough: English Nature.

UK BIODIVERSITY STEERING GROUP. 1995. *Biodiversity: The UK Steering Group Report. Vol 1.: Meeting the Rio challenge.* London: HMSO.

NATURE CONSERVANCY COUNCIL. 1990. *Handbook for Phase 1 habitat survey: A technique for environmental audit.* Peterborough: Joint Nature Conservation Committee.

WHEELER, N. & HORTON, P. 1997. *Ouse Valley Link Trial Area Report.* Peterborough: English Nature.

WHEELER, N. 1999. English Nature Habitat Restoration Project: Ouse Valley Link Trial Area Report. *English Nature Research Reports*, No 326.

WILLIAMSON, B. & HORTON, P. 1997. *Renewing the Alde Trial Area Report.* Peterborough: English Nature.

WILLIAMSON, B. 1999. Habitat Restoration Project. The Renewing the Alde Project - final report for the Suffolk trial area. *English Nature Research Reports*, No. 327.

WYATT, G. 1991. *A Review of Phase 1 habitat survey in England.* Peterborough: Nature Conservancy Council.

# Appendix 1

## Habitat Restoration Project - GIS Support

### 1. Role of GIS Support

1.1 Digitisation of Phase 1 1:10 000 field documents of trial areas (100 $km^2$ each), to GIU standards.

1.2 Development of processes to capture Phase 1 information in GIS.

1.3 Capture of Phase 1 information according to the processes described in (1.2). Verification of data and translation into MapInfo format.

1.4 Production of "Vision" maps - for inclusion in "Vision" statements.

1.5 Conceptual design of Paradox database (linked to MapInfo) to hold target note information.

1.6 Conceptual design of Paradox database (linked to MapInfo) to hold monitoring information.

### 2. Future Applications within the HRP

2.1 Provision of spatial analysis using GIS techniques to identify likely areas for habitat restoration.

2.1.1 Production of standard reporting techniques for Project Officers.

2.2 Specialised analysis of Phase 1 and other additional data sets where available.

2.2.1 Analysis of habitat fragmentation.

2.2.2 Guidelines for the location of new habitat.

### 3. Transferable applications

3.1 Introduction: techniques developed within HRP readily transferable to other conservation oriented applications of GIS. Specifically, applications such as:

3.1.1 translation of Phase 1 field survey to digital information;

3.1.2 techniques to monitor habitat restoration;

3.1.3 quantification of habitat fragmentation.

# Appendix 2

## Example of Project specification for tender applications

### The Habitat Restoration Project

The Habitat Restoration Project is working with farmers and other countryside organizations to reverse wildlife loss from the countryside. The creation of new wildlife habitat using existing environmental land management schemes will be encouraged in four Trial Areas. Experiences from this project and information gained on the ways to restore wildlife will be used by English Nature and disseminated to individuals and organizations involved in countryside policy.

### Phase 1 habitat maps digital data capture

Outline requirement

Tenders are invited for the transfer of Phase 1 Habitat information (NCC, 1990) for Sherwood Trial Area from paper maps to digital format. The Phase 1 Habitat mapping system uses a standardized method for classifying and mapping wildlife habitats over Great Britain. The digital information is to be used and directly compared with similar digital information for three other trial areas within the Habitat Restoration Project. The work will involve digitizing information from a number of 1:10 000 scale Ordnance Survey maps to create digital features (points, polygons and polylines) in a multi-layer structure for use within Microstation Version 5 and MapInfo 4.1.5.

### Tasks to be carried out by the contractor

Heads up digitizing of Phase 1 Habitat information where the information follows that which is represented on raster back-drop. Polygons/polylines not represented on raster back-drop must be input by using digitizing tablet or heads up digitizing of scanned phase 1 maps.
Delivery of digital data to EN as either a Microstation design file(.dgn) **or** a data exchange format (.dxf) file **and** MapInfo files (.tab, .map, .dat, .id) containing the Phase 1 data in it's correct geographical position using British National Grid projection.

### Source material

The chosen contractor will be supplied with:

- 8 x 1:10 000 scale Ordnance Survey base maps. These maps will have Phase 1 Habitat information marked on them for an area of approximately 100 $km^2$ on the ground.
- 1:10 000 scale OS raster data (400dpi as TIFFs) to cover relevant area.
- An example of digital data that conforms to requirements and structure, produced in house (provided on CD or on Exabyte tape; UNIX command: CPIO or TAR).

**Data Capture**

The Phase 1 information will be of a complex and detailed nature and so must be captured using a predefined method outlined in this document. This method must be adhered to ensure compatibility with the information captured "in house" for other three Trial Areas.

Linework to be digitised using the OS 1:10 000 raster data as a backdrop, or where necessary scanned Phase 1 maps or digitizing tablet. Accuracy of the digitizing must be to 0.1 mm at 1:10000.

Data format

Working units

Working area 4294967m
Sub units: 100cm.
Positional units: 10.

Projection: British National Grid

**Output**

Data exported as either microstation design file(.dgn) **or** a data exchange format (.dxf) file **and** MapInfo files (.tab, .map, .dat, .id) (for MapInfo 4.1). Four MapInfo coverages should be captured; one containing polygon features, one containing linear features, one containing point features and finally one containing target note locations. The file containing polygon information must contain only 'closed region' polygons. Any hole and 'donut' relationships within the polygons should be represented.

If the data capture is done using Microstation it must take the form described in Table 1. When exported as a DXF file the data must be captured in such a way that it is in the form described in Table 1.

Polygon data: Polygons (all on Level 1 in .dgn file) must be snapped and error free (line checking required for sliver polygons, dangling nodes and "knots"). Where polygons adjoin, the adjoining linestring should be shared not duplicated.

The data set should not be attributed, it should remain in "dumb" format. The data set will be attributed "in house".

Polygon identity: Phase 1 habitat codes should be located in polygons in way outlined in Table 1. The codes must be of Alphanumeric type (as described in Appendix 1, NCC, 1990).

All polygons in the MapInfo file should be converted to regions and together with lines and points be attributed. The associated tab file must have the structure described in Table 2.

**Technical queries**

If any queries arise regarding any aspect of this specification they must be addressed to Habitat Restoration GIS Support Officer, English Nature, Northminster House, Peterborough, PE1 1UA. tel: 01733 455334, email: XXXX @english-nature.org.uk

**Confidentiality**

All details will be treated as confidential.

All data will be deleted from the contractors system after completion of job to avoid copyright infringement.

**Ordnance Survey copyright**

All work included in this contract is covered by English Nature's service level agreement with the Ordnance Survey.

**Delivery requirements**

Media: CD or on Exabyte tape; UNIX command: CPIO or TAR
Test plots: The tenderers will be required to produce test area of digital data and plots (size: 1km$^2$) before the contract is awarded.

**References**

NATURE CONSERVATION COUNCIL. 1990. *Handbook for Phase 1 habitat survey – a technique for environmental audit.* England Field Unit, Nature Conservancy Council.

# Appendix 3

## Linear codes already assigned during digitising

| Phase 1 code | Description | Colour | WGT | Style |
|---|---|---|---|---|
| J2.2.2 | Defunct species poor hedge | 1 | 0 | 0 |
| F2.1 | Marginal veg | 2 | 0 | 0 |
| A3.1 | Broadleaved scattered trees | 3 | 0 | 0 |
| A2.1 | Dense continuous scrub | 4 | 0 | 0 |
| J2.1.2 | Intact species poor hedge | 5 | 0 | 0 |
| J.2.3.2 | Species poor hedge with trees | 6 | 0 | 0 |
| J2.7 | Boundary removed | 7 | 0 | 0 |
| A2.2 | Scattered scrub | 8 | 0 | 0 |
| A1.2.2 | Broadleaved plantation | 9 | 0 | 0 |
| J2.1.1 | Intact native species rich hedge | 10 | 0 | 0 |
| A3 | Woodland and scrub mixed | 11 | 0 | 0 |
| C3.2 | Tall herb and fern other non-ruderal | 12 | 0 | 0 |
| None | Sheet edges and liner features not defined in Phase 1 | 13 | 0 | 0 |
| J2.2 | Defunct hedge | 14 | 0 | 0 |
| G1.1 | Eutrophic standing water | 15 | 0 | 0 |
| J2.3.1 | Native species rich hedge | 16 | 0 | 0 |
| J2.2.1 | Defunct species rich hedge | 17 | 0 | 0 |
| G2 | Running water | 18 | 0 | 0 |
| G2.1 | Running water eutrophic | 19 | 0 | 0 |
| J2.6 | Dry ditch. | 20 | 0 | 0 |
| J2.4 | Fence | 21 | 0 | 0 |
| A1.1.2 | Plantation woodland | 22 | 0 | 0 |
| B1.2 | Semi-improved acid grassland | 23 | 0 | 0 |
| A1.1.1 | Semi-natural woodland | 24 | 0 | 0 |
| J2.5 | Wall | 25 | 0 | 0 |
| J2.2.1 | Defunct hedge native species rich | 26 | 0 | 0 |
| C1.1 | Continuous bracken | 27 | 0 | 0 |
| C3.1 | Tall herb and fern tall ruderal | 28 | 0 | 0 |
| G1 | Open standing water | 29 | 0 | 0 |
| B1.1 | Verge | 30 | 0 | 0 |
| J2.8 | Earth bank | 31 | 0 | 0 |
| F2.1/G2.1 | Marginal vegetation/running water eutrophic | 161 | 0 | 0 |
| J2.2.2/C1.1 | Defunct species poor hedge/bracken continuous | 162 | 0 | 0 |
| J2.1.2/C3.1/C3.2 | Intact species poor hedge/continuous bracken/tall herb and fern other non-ruderal | 163 | 0 | 0 |
| G2/A2.1 | Running water/dense continuous scrub | 164 | 0 | 0 |
| J2.2.2/C3.1 | Defunct species poor hedge/other tall ruderal | 165 | 0 | 0 |

| Phase 1 code | Description | Colour | WGT | Style |
|---|---|---|---|---|
| J2.2.2/J4 | Defunct species poor hedge/bare ground | 166 | 0 | 0 |
| J2.2.2/B2 | Defunct species poor hedge/neutral grassland | 167 | 0 | 0 |
| J2.1.2/J2.2.2 | Defunct species poor hedge/intact species poor hedge | 168 | 0 | 0 |
| J2.2.2/C1.2 | Defunct species poor hedge/tall scattered bracken | 169 | 0 | 0 |
| J2.1.2/C1.1 | Intact species poor hedge/continuous bracken | 170 | 0 | 0 |
| A2.2/B2.2 | Scattered scrub/semi-improved scattered grassland | 171 | 0 | 0 |
| C3.1/B2.2 | Tall ruderal herb fern/semi-improved neutral grassland | 172 | 0 | 0 |
| A1.1.1/C1.1 | Semi-natural broadleaved woodland/continuous bracken | 173 | 0 | 0 |
| C1.1/A2.2 | Continuous bracken/coniferous plantation | 174 | 0 | 0 |
| A2.2/J2.6 | Scattered scrub/dry ditch | 175 | 0 | 0 |
| J2.3.2/C1.1 | Species poor hedge/continuous bracken | 176 | 0 | 0 |
| J2.2.1/J2.3.1/C1.2 | Defunct native species rich hedge/native species rich hedge/tall scattered bracken | 177 | 0 | 0 |
| C1.1/J2.2.2 | Continuous bracken/defunct species poor hedge | 178 | 0 | 0 |
| B2.2/A2.2 | Semi-improved neutral grassland/scattered scrub | 179 | 0 | 0 |
| J2.2.2/C1.2/C3.1 | Defunct species poor hedge/Scattered scrub/tall ruderal | 180 | 0 | 0 |
| A1.1/A2.2/F2.1/G2.2 | Broadleaved scattered trees/scattered scrub/marginal vegetation/running water | 181 | 0 | 0 |
| G2.2/F2.1 | Running water mesotrophic/marginal vegetation | 182 | 0 | 0 |
| A2.1/G2.2 | Dense continuous scrub/running water mesotrophic | 183 | 0 | 0 |
| A2.2/G2.2/F2.1 | Scattered scrub/running water mesotrophic/marginal vegetation | 184 | 0 | 0 |