NPWS Data Standards and Project Delivery Guidelines

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1. Introduction

At the beginning of a NPWS research project you will be supplied with a Project Delivery Pack by NPWS. This project pack, described in detail later, contains guidelines, project requirements, templates and checklists to help you to prepare for project delivery from the start of the project.

NPWS is undertaking a rationalisation and streamlining of all project resources held by Research and Conservation Services Branch of NPWS. As part of this initiative a review of the naming of project resource files and directory structures has been undertaken, leading to a proposed standardization of structures and naming conventions. As a result guidelines have been drawn up for use in delivery of future project resources to NPWS. The term *resource* as used here generally relates to the digital files or groups of files that form the products of the project. If there are hard-copy (paper) or other resources associated with the project then the Project Manager should discuss this with the NPWS Project Co-ordinator and agree an appropriate delivery format.

In tandem with the project resource organization NPWS have drawn up a set of data standard guidelines for the data associated with NPWS research projects. These guidelines are provided to ensure consistency and compatibility with other datasets within NPWS. **Section 1** of this document describes these standards. These data standard guidelines should be read prior to the start of the project, in conjunction with any project-specific requirements requested by NPWS.

Section 2 and **Section 3** describe the guidelines for the future delivery of project resources to NPWS. The system associated with delivery of the Project resources described here should be capable of:

- identifying the project that an isolated file belongs to
- identifying the top copy version of a file.

The structures proposed in this document will facilitate the future management and accessibility of project resources within NPWS. This will lead to the development of a standardized Project Resource Repository. This approach also ties in with another NPWS information management initiative: the production of a Project Resource Catalogue that will describe the contents of the Project Repository. Using a defined project resource directory template will help to increase the consistency across the Project Repository and the Resource Catalogue and enhance findability of resources. NPWS urges Project Authors to follow the procedures described in this document.

This document describes the following requirements for delivery of projects:

- Project naming conventions.
- Use of a defined top-level directory hierarchy for holding the project resources.
- File naming conventions.
- Use of required documentation related to the identification, content and structuring of the project resources.
- Project delivery requirements for projects being placed in the NPWS Project Repository.

Project Authors should be aware that the data standards and project resources requirements will vary depending on the nature and purpose of the project. This document provides guidance on the systems used for information management within NPWS, however, Project Authors should consult with the NPWS Project Co-ordinator and NPWS Data Manager early in the project to discuss the projects data requirements. This will ensure that the systems and standards in use from the project outset are appropriate for both the project, the contractors and NPWS data systems.

2. Terminology

The personnel associated with an NPWS Research Project are listed below.

Project Co-ordinator The NPWS Research staff member who identifies the requirement for the project and initiates the project. There may be more than one co-ordinator. The co-ordinator is responsible for overseeing the drafting of the tender and contracts documents and the sign-off on the resulting project deliverables.

Project Manager The contracting organisation project staff member responsible for the day-to-day management and liaison with the NPWS Project Co-ordinator. A Project Author will often double as the Project Manager. This person will be the key contractor point of contact with NPWS.

Project Author This is a global term for the individual or group that are fulfilling the requirements of the project. Generally these individuals will be external contractors.

Section 1: NPWS research project data standards

Datasets arising from project contracts should follow certain standards to ensure compatibility with other datasets. This adds value to a dataset as it is then useful for purposes other than that for which it was collected.

For information on how to use these standards, or to suggest additions/amendments please contact the NPWS Data Manager (datadelivery@ahg.gov.ie).

3. Nomenclature standards

Please refer to Appendix A in this document for details of standard nomenclatural references relating to species and habitats used by NPWS.

4. Database standards

4.1. General

The Microsoft Access 2000 *.mdb file format is used by all MS Access versions from 2000 to 2003 and as such this is the preferred format for data delivery to NPWS.

More recent versions of MS Access (2007/2010) have some extra functionality and a new native file format called *.accdb. If using Access 2010 it is important that the new feature of MS Access 2010 called multivalued fields is not used in data supplied to NPWS. For the present, data held in *.accdb databases should be exported to an *.mdb database in MS Access 2007/2010 prior to delivery to NPWS.

Other accepted data formats are: MS SQL Server (versions from 2000 to 2012) or dBASE (version III Plus or IV tables).

Packages such as Fox Pro, Filemaker Pro and Paradox are not in use in NPWS and therefore databases in these formats will not be accepted as a database product. MySQL databases are not acceptable either.

4.2. Species data

Species data are held by NPWS in a Recorder 6 database. Contractors should add species data directly to Recorder 6 and submit it to NPWS as an exported NBN zipped Access data file, or the data should be submitted in a MS Excel template for upload to Recorder 6. This template will be supplied to all external Project Authors as part of the project delivery tree (in *..\@templates\recorder\Recorder import template.xls)*.

Species records at a minimum require a species name, grid reference, date and recorder name, but some measure of abundance suited to the species is also useful. Where species data are gathered in the Mapmate application by Project Authors please export the data to a Recorder 6 database using the guidelines described on the NBN forum (http://forums.nbn.org.uk/viewtopic.php ?id=1577) .

These data will be sent to the National Biodiversity Data Centre for incorporation into the National database (also Recorder 6). The NBDC will then display the data on their map viewer that will assist NPWS in reducing the number of data requests. This map viewer uses a 1km^2 resolution, and if more detail is required the queries are referred back to NPWS. If there are any limitations on data presentation or access these should be flagged (e.g. *Margaritifera margaritifera* mapping resolution is presented on a 50km x 50km grid; *Trichomanes speciosum* on a 10km x 10km grid).

Marine mammal data records (Cetaceans and Seals) should follow the protocol developed by the NBDC for the Marine Mammal database (see http://www.biodiversityireland.ie/project-websites/biodiversity-themes/marine-mammal-database/ for further details).

Bird data requirements should be referred to NPWS Birds Unit.

4.3. Vegetation data

Where possible, projects recording vegetation data should use standard relevés and the DOMIN abundance scale for all species. In some cases there may be an argument for collecting data from the top 10 species, or using DAFOR etc…, but these data will not be of sufficient quality to reuse for additional purposes or incorporation into the National Vegetation Database (currently being managed on behalf of NPWS by the NBDC).

A standardized Relevé Recording card, and guidelines on its use (including the DOMIN scale) can be found at http://nationalvegetationdatabase.biodiversityireland.ie/. Issues such as appropriate relevé size should be discussed with the relevant NPWS habitat expert.

Consideration should also be given to how the relevés can be collected in such a way as to facilitate habitat monitoring requirements (e.g. at relevé point also collect monitoring stop data).

Vegetation data should be either entered directly into TurboVeg for Windows relevé management application (http://www.synbiosys.alterra.nl/turboveg/) or into a standard MS Excel template for upload into TurboVeg. This spreadsheet template will be supplied to all external Project Authors as part of the project delivery tree (in *..\@templates\turboveg\TurboVeg Excel template.xls*).

TurboVeg is also available as software for Windows mobile devices (i.e. field computers such as the Trimble GeoXT) to facilitate field-based data collection. This system should be utilised where possible to reduce data entry error.

A standardized list of Irish plant names (Ireland2008) should be used for compatibility purposes, and it can be downloaded from http://nationalvegetationdatabase.biodiversityireland.ie/.

4.4. Monitoring data

Where possible, data collected during surveys should try to follow standards that will allow the data to be incorporated into monitoring programmes and merged into larger datasets for reporting purposes.

In addition to the data derived from species, vegetation and habitat surveys, monitoring surveys also collect data on indicators that will allow the assessment of conservation status. These indicators include:

- **state indicators** - e.g. habitat area, the number of typical species;
- **pressure indicators** - e.g. area of scrub encroachment, number of developments; and
- **response indicators** - e.g. length of bog drains blocked, number of sheep removed, etc.

The indicators must be appropriate to the survey, easy to assess, and repeatable.

A list of activities has been drawn up and there is a protocol in place to assess the impacts of these activities. The protocol and a listing of impacts are available to Project Authors as part of the project delivery directory tree (*in ..\@templates\monitoring*). This means collecting a few standard data items recording any impacts and activities, the area affected, and simple measures of the intensity and level of influence of the activities.

As monitoring surveys are repeated over time it is very important to ensure that enough samples are surveyed to statistically detect change over time.

Two standardized database templates have been developed by NPWS to assist Project Authors in producing compatible databases. These monitoring database templates are available to Project Authors as part of the project delivery directory tree (in *..\@templates\monitoring*). Please contact NPWS Monitoring Unit for further information.

4.5. Site data

NPWS Site data are managed in the NPWS Sites Registry Database. This system lists more than just designated sites, so any new sites identified should be referred to Dr Neil Lockhart or Dr Mike Wyse Jackson.

A large digital archive of files relating to sites in the NPWS Sites Registry Database that mirrors the NPWS Sites paper document archive are managed through the Therefore viewer. For access to the Therefore system please contact Dr Neil Lockhart.

Where a project surveys sites that are listed in the NPWS Sites Registry Database (designated or non-designated), a list of sites and their sitecodes should be provided at the end of the project. This allows the project to be linked to the site within the NPWS Sites Registry Database and the Therefore viewer as an additional information source for the site.

Please contact Dr Neil Lockhart for a complete list of sites and sitecodes.

5. GIS data standards

ESRI software is in general use in NPWS. This includes the Arc suite of packages, ArcView 3.2, ArcPad, ArcView 8.x, 9.x, ArcInfo, etc… ArcGIS 10 will be used by NPWS in 2011.

5.1. GIS Data Formats

ESRI shapefiles remain the standard format required by NPWS. ESRI support a number of other formats such as the personal geodatabase (PGDB), file-based geodatabase (FBGB) and coverage. Remember that the shapefile should contain at least three component files:

- .shp - the file that stores the feature geometry.
- .shx - the file that stores the index of the feature geometry.
- .dbf - the dBASE file that stores the attribute information.

If there are additional file components please supply them too. Examples include:

- .xml – the file that stores shapefile metadata
- .prj – projection information

In exceptional circumstances, NPWS GIS Unit may be able to import or convert other compatible formats. If accepting data in Mapinfo format please note that Mapinfo MIF is compatible with ESRI, Mapinfo TAB is not. Certain Computer Aided Design (CAD) formats are compatible but may not support attribute (non-spatial) data. NPWS does not currently accept AutoDesk DWG or DXF files that contain attribute data stored as XDATA (Extended Entity Data). Consideration may be given to accepting XDATA on a case-by-case basis if a contractor can demonstrate to NPWS that such attributes can be imported readily into ArcGIS.

In ArcGIS 10 there is a new possibility to create a map package' to share both the data and the mxd as part of one package; see:

http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//0017000000q5000000.htm.

Please contact the NPWS GIS Unit prior to delivering data in non-ESRI formats.

Reminder: ArcView 3.2 Projects (APR), ArcGIS 9.x and 10.x Map Documents (MXD) do not contain data.

5.2. Scale and Resolution

Data are produced with levels of accuracy and resolution that make it appropriate for use only at certain scales, and in combination with data of similar scales.

The NPWS now has access to new Ordnance Survey Ireland large scale mapping vector data at 1:1,000 to 1:5,000 (the mapping is actually a mosaic of 1:1,000 , 1:2500 and 1:5000 mapping depending on urban, peri /sub urban and rural respectively) as well as 1:10,560 raster data. The GIS Unit is in the process of transferring SAC data to the 1:5,000 base. The NPWS are obliged to employ the 'best available national mapping' as provided by OSi, the national mapping agency. As such NPWS are moving to the use of OSi large scale mapping (1:1,000 to 1:5,000) and phasing out the use of 1:10,560 (6") mapping. The OSi large scale mapping vector data will not be in general use until a complete set of SAC data (either county or national coverage) is available. The 1:1,000 to 1:5,000 vector data may be used for new data capture projects.

Projects should not merge 1:10,560 data with 1:5,000 data in a piecemeal manner. For example, extensions to sites originally captured using 1:10,560 data should continue to use 1:10,560 data.

5.3. Points to remember:

- Paper map accuracy depends on scaleable or plottable accuracy. Scalable or plottable accuracy refers to a person's ability to visually resolve the millimetre divisions on a scale rule into smaller measurements. The average person can discern the millimetre divisions on a scale rule; one can estimate the half-millimetre point; one can then judge whether a point of map detail lies nearer to a millimetre division, halfway between two divisions, or if it is nearer to a quarter millimetre. Thus one can measure and plot using a scale rule to 0.25 of a millimetre.

- At a map scale of 1:1000, 0.25 millimetres subtends 0.25 metres (i.e. 0.25mm x 1000) on the ground. At a scale of 1:50,000, 0.25 millimetres subtends 12.5 metres (i.e. 0.25mm x 50000). Thus, generally, the nominal scale of a map dictates the accuracy of that map and, by extension, the accuracy with which new data must be captured if those data are to be mapped at that scale. At a scale of 1:10,000 plottable accuracy is 2.5m. This value provides an estimate of the accuracy of the original data used, the methods used to capture the data and to compile the map. Note, the positional accuracy of a map is ultimately based on the sum of all errors associated with each data source used to create that map (e.g. error associated with the data capture, projection and processing errors).

- Raw GPS measurements, directly read from a hand-held instrument, can only achieve a repeatable accuracy of between 10 and 20 metres. Post-processing using specialist software or live subscription to Ordnance Survey Ireland can be used to achieve sub-metre accuracy.

5.4. Spatial entities, layers and fuzzy boundaries

Within a GIS, real world features should be represented by points, line or polygon entities. Scale dictates which is appropriate. Points, lines and polygons cannot be combined into single shapefiles.

Where polygon habitat data is being submitted, habitats should be in one continuous layer differentiated by habitat attribution. There should be no gaps between adjacent polygons. For projects mapping designated areas or for projects where a boundary shapefile has been provided, habitat data must match the spatial extent of the boundary shapefile. The habitat data should not either extend outside or stop short of the boundary provided.

ArcEditor or ArcInfo licences have built in functionality to ensure generation of topologically correct geometry.

One way of providing polygon files without undesired overlaps or gaps would be to start off with a layer covering the entire Area of Interest. Using the 'Cut polygon feature' tool in ArcGIS 9, or the 'Draw line to split polygon' – tool in ArcView 3, areas of different habitat cover could then subsequently be defined. For creating polygons within other polygons (*island polygons*), see the help file 'Common polygon editing tasks' for ArcGIS 9 or use the 'Subtract features' tool in ArcView 3.

Digitising along existing line or polygon features (e.g. by using the snapping tool) is not recommended, as this usually leads to sliver polygons and gaps. Such anomalies can only be avoided if the new line snaps to EVERY vertex along the existing line. This can be achieved using the 'Trace' tool in the later releases of ArcMap (9.x onwards). Where a new polygon is being created which joins an existing polygon, use of the 'Auto-complete Polygon' function will ensure that the shared boundary between the two polygons is

consistent and the polygon is topologically correct.

For habitat shapefiles, linear features such as roads or rivers should preferably not be digitised as lines but rather be included in the single polygon layer to facilitate the calculation of areas.

Where changes between entities are gradual in nature, such as vegetation zones or soil types, indistinct boundaries exist. Representation of fuzzy boundaries in the vector data model requires the delimiting of discrete polygon boundaries for, what may in reality be, a gradual spatial transition. This problem can be somewhat overcome through the use of fuzzy classification or membership classes. When surveyors encounter fuzzy boundaries they should use their expertise to identify the interface between two different zones. Overlapping polygons should never be used to portray fuzzy boundaries. If mosaics need to be identified then a specific, standardized, attribute should be assigned to the polygon(s).

Refer to the ArcGIS Topology Rules poster produced by ESRI as a useful pointer. This poster can be downloaded as an Acrobat PDF at:

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Topology_rules_poster.

6. GIS datasets quality checks

Prior to the submission of any GIS dataset to NPWS the set of quality checks outlined below should be performed. If a dataset does not pass all of these initial checks it will not be accepted for inspection by NPWS. The quality checks below are considered to be the minimum checks to be carried out and can be performed with the ArcView, ArcEditor and ArcInfo licenses for ArcMap.

As the majority of GIS datasets submitted to NPWS are polygon files, the quality checks outlined below focus on this type of dataset. Some information on data quality checks for point and polyline datasets can be found at the end of this section.

Table 1 below provides an overview of the proposed quality checks and identifies the capabilities of a range of ESRI GIS products to complete these checks.

Table 1. A comparison of data quality checks available in common ESRI GIS tools

	GIS Tool			
Quality check	ArcView 3.2	ArcView 8x, 9x	ArcEditor	ArcInfo
Geometry errors	✗	✓	✓	✓
Multipart features checked	✓ Use Explode	✓	✓	✓
Polygon omission and inclusion errors checked	✓	✓	✓	✓
Overlapping/duplicate polygons checked	✓	✓	✓	✓
Sliver polygons checked	✓	✓	✓	✓
Missing attribute values checked	✓ Use visual inspection	✓	✓	✓
Check for Duplicate attribute values, where applicable	✗	✗	✗	✓
Polygon omission errors & overlapping/duplicate polygons checked using Topology Rules	✗	✗	✓	✓

Quality checks using an ArcView licence

6.1. Check for geometry errors

The Check Geometry tool of ArcToolbox inspects all features in a dataset for geometry problems. This tool performs checks for self-intersections, empty parts, incorrect ring ordering, unclosed rings, null geometries along with a number of others.

If geometry errors are identified then the corresponding Repair Geometry tool of ArcToolbox can be run to rectify these errors.

6.2. Check for multipart features

Polygon data submitted to NPWS must be comprised of Singlepart polygons not Multipart polygons. Multipart polygons are composed of more than one physical part but only reference one set of attributes. There may be several polygons in a multipart polygon, which will only be represented by a single record

in the attribute table. The Multipart to Singlepart tool of ArcToolbox separates multipart features into separate single-part features. This tool adds a field named ORIG_FID to the attribute table, which can be used to identify which, if any, polygons have been separated from multipart polygons. If this tool has separated multipart polygons the attribute values of these separated polygons need to be checked to ensure they are correctly attributed, as they may have been initially merged in error. This tool also works in the same manner for point and polyline datasets.

6.3. Check for polygon omission and inclusion errors

The procedure outlined below is more time-consuming than the topology checks possible with an ArcEditor/ ArcInfo license, and involves non-automated steps. Still, using the Union tool available with a basic ArcView license allows the identification of polygon omission (gaps between polygons) and inclusion errors within a dataset.

To identify gaps, overlaps and slivers, a Union operation should be performed using the boundary dataset and the habitat dataset, with the ONLY FID option under the JoinAttributes drop down menu selected from the Union tool dialog box. In the attribute table of the newly created dataset, two fields, one for the FID of the boundary shapefile and one for the FID of the habitat shapefile, will be added.

Any record with a value of -1 entered in the FID field of the boundary dataset is a polygon that represents an area contained in the habitat dataset but which is located outside the defined boundary. Such polygons are errors of inclusion and as such are incorrect and should be rectified in the habitat dataset. Any record with a value of -1 present in the FID field of the habitat dataset is a polygon representing either a gap between polygons in the habitat dataset or a gap between the extent of the habitat dataset and the defined boundary. Such polygons signify errors of omission and should be rectified in the habitat dataset. The polygons highlighted as errors (polygons with a FID value of -1) may be multipart features. By use of the Multipart to Singlepart tool as outlined above, prior to checking for omission and inclusion, the identified polygon errors can be separated and used to rectify the errors in the original habitat dataset.

If no boundary is being mapped to then errors of inclusion will not exist. However, there is still a need to check for errors of omission (gaps between polygons). In this situation one would have to create a new polygon dataset, which is larger than the extent of the habitat dataset and then perform the Union operation using this newly created dataset and the habitat dataset. Any record with a value of -1 entered in the FID field of the habitat dataset is a polygon representing a gap between polygons in the dataset and as such should be rectified in the habitat dataset.

6.4. Check for overlapping/duplicate polygons

The procedure outlined below is more time-consuming than the topology checks possible with an ArcEditor/ ArcInfo license, and involves non-automated steps. Still, using the Intersect tool available with a basic ArcView license allows the identification of overlaps within a dataset.

As a first step, a second polygon dataset encompassing all the features from the file that will be checked must be created. This dataset can consist of just one simple polygon, the shape of which is not important, as long as it is larger than the extent of the input dataset. Subsequently the two polygon datasets are intersected using the Intersect tool.

The number of polygons contained in the resulting intersected dataset can be compared to the number of polygons in the input dataset. If the number of polygons of the resulting dataset is greater than in the original dataset, then it is clear that overlapping polygons are present. If the number of polygons is the same in both datasets then it is clear that there are no overlapping polygons in the original dataset.

To identify the overlapping regions, the polygon areas in the intersected dataset's attribute table are (re-)calculated, and the attribute table sorted by area. As overlapping parts will have identical areas, any polygons with the same area entries are likely to indicate overlapping or duplicate polygons.

For each overlapping area, the features that do not contain the valid attributes for the area can be deleted. In many cases, e.g. when polygons overlap in different areas, a 'Multipart to Singlepart' operation is necessary before being able to remove single polygon parts.

6.5. Sliver polygons

Sliver polygons are small polygons commonly occurring along boundary areas, often created as a result of of poor digitising or an overlay of two or more polygon datasets.

Due to their often very small size, sliver polygons can normally be spotted by sorting the dataset's attribute table by area, and inspecting the smallest polygons. They can then be merged to whatever neighbouring polygons hold the same attributes.

Both the procedures for correcting overlapping/duplicate and sliver polygons are rather tedious and very time-consuming. Often errors involving overlaps and slivers, as well as gaps, are a result of combining separate datasets into one combined dataset. Therefore it is strongly recommended to never produce datasets that are resulting from a combination of two or more datasets covering adjacent areas.

6.6. Check for missing attribute values

For attribute data fields which must have an attribute value entered for each record, a SQL query created in the Select By Attributes dialog box can be used to identify missing attribute values. For example, if one was inspecting a habitat dataset to ensure all features contained a habitat type one would query the HABITAT_TYPE field with the SQL statement: HABITAT_TYPE = ' ' (or ''). This query searches the HABITAT_TYPE field for records with null values and returns a list of rows fulfilling this criterion. This attribute query functionality can similarly be used to run routine checks on consistency in attribution.

Quality checks using an ArcInfo / ArcEditor licence

If one possesses either the ArcEditor or ArcInfo license type for ArcMap then additional checks and alternative methodologies can and should be utilized prior to the submission of GIS datasets to NPWS..

6.7. Check for duplicate attribute values (ArcInfo license only)

For attribute table fields which must have unique attribute values entered for each record, the Frequency

tool of ArcToolbox can be used to identify duplicate attribute values in these fields. This tool creates a table with a list of unique attribute value occurrences and their frequency. If the calculated frequency is more than one then this signifies the presence of duplicate values.

This tool can also be used to identify attributes, which are not standardized throughout a given field. If for example an attribute has been entered as WD1 / WD2 ten times and then a further ten times as WD1_/_ WD2 the Frequency tool will create two separate occurrences each with a frequency of ten. This will allow for the identification of the non-standardized attribute, which can then be rectified.

6.8. Check for polygon omission errors and overlapping/duplicate polygons by the use of Topology Rules

If one possesses either the ArcEditor of ArcInfo licence type then an alternative methodology is available to identify and fix polygon omission errors and overlapping/duplicate polygons. By creating a Topology in a Geodatabase it is possible to set a number of topology rules for polygon datasets. Many of the rules are not suitable for use with all datasets but are used depending on the nature of the data contained in the dataset. However, the two topology rules of "Must not have gaps" and "Must not overlap" should be used for all polygon datasets submitted to NPWS. The "Must not have gaps" rule requires that there are no gaps within a single polygon or between adjacent polygons. The "Must not overlap" rule requires that the interior of polygons do not overlap. This rule will identify areas of the dataset, which incorrectly belongs to two or more polygons.

It is also possible to create a Topology for both polyline and point datasets within a Geodatabase. A number of useful topology rules can be used for polyline datasets such as "Must not overlap", "Must not self overlap", "Must not intersect", "Must not self intersect" and "Must not have dangles". For points rules such as "Must be properly inside polygons" and "Point must be covered by line" can be applied. The suitability of the available topology rules will depend upon the nature of the data contained in the dataset.

7. Data structure and consistency

Attribute data must be consistent is terms of naming conventions, spelling, spacing and punctuation.

Naming conventions: The following variations are inconsistent in terms of spelling and naming convention.

- "Ballyhillian, Malin Head"
- "Ballyhillin, Malin Head"
- "Ballyhillion"
- "Ballyhillion, Malin Hd."

When processing, or querying, a dataset the variation in these attribute values will create errors when grouping or selecting sites. Agree on naming conventions prior to capturing data. Where several surveyors are involved in data capture, or where data are being captured over a number of years, it is crucial that a consensus exists as to taxonomies, the names and extents of localities, etc.

Consistency in spacing and punctuation is equally important. For example a GIS will treat 'F 63.1' (with a

space) as being different to 'F63.1' (no space). Similarly, in the context of site names, the site name: 'Ballylar/Shannagh, Fanad' (with two spaces) will be treated as a different site to 'Ballylar/Shannagh, Fanad' (one space). And 'Captain's Road', with its apostrophe, will not be treated as the same site as 'Captains Road' during processing.

Data provided must be consistently structured and entirely free of errors in spelling and in formatting. Before handing over data, contractors should check the unique instances of attributes in each database field (there are several tools and approaches that can be used to do this). Inconsistencies must be corrected before delivering data to NPWS. Where the expertise exists, data capture tools should enforce range and domain checking during the attribution process to ensure consistency.

Where a project requires a database to be developed as a project deliverable then the Project Author should contact the NPWS Project Co-ordinator regarding the data structure and management requirements.

7.1. Quality Assurance

The NPWS GIS Unit should be provided with an early sample of any spatial data created. This will allow the GIS Unit to check that the format, structure and quality is fit for purpose prior to the contractor fully committing to the GIS data capture phase. The NPWS Project Co-ordinator will be the point of contact within NPWS.

7.2. Habitat mapping

Habitat classification schemes are mutually exclusive. Where possible, when printing habitat maps as project deliverables, two separate habitat maps should be included, one for the Habitats Directive habitat classification and one for the Heritage Council classification scheme.

A set of mapping standards has been developed as a joint project of NPWS and the Heritage Council to try to ensure that all habitat maps produced nationally are compatible. The published version of this standards document: *Best Practice Guidance for Habitat Survey and Mapping* has been made available for download on the Heritage Council website:

http://www.heritagecouncil.ie/fileadmin/user_upload/Publications/Wildlife/Habitat_Survey_Guidance/Habitat_Survey_Guidance_Heritage_Council_2011_2.pdf

A version for easy reading & navigation onscreen is also available:

http://www.heritagecouncil.ie/fileadmin/user_upload/Publications/Wildlife/Habitat_Survey_Guidance/Habitat_Survey_Guidance_Hyperlinked_2.pdf

Project Authors should refer to the habitat mapping guidance document to assist in developing their habitat mapping methodology, but the developed methods should be discussed with the NPWS project officers and data management staff before field mapping and digitising starts.

8. Image data format

Any photographs or other appropriate images produced in the course of the project should be provided digitally, with an accompanying MS Excel spreadsheet to allow them to be automatically uploaded onto the NPWS Image databank. An image catalogue spreadsheet template will be supplied to all external Project Authors as part of the project delivery tree (in ..\@templates\image_catalogue\image_catalogue_template.xls). Please ensure that all fields in the spreadsheet are completed and accurate. It is crucial that the accompanying MS Excel spreadsheet lists any copyright and user restrictions so that NPWS doesn't inadvertently use images for the wrong purposes.

TIFF or JPEG are the preferred delivery formats for project-related images. JPEG is the minimum requirement. RAW or TIFF formats are the preferred delivery format for images purchased from professional photographers. Regardless of the output format chosen, photographers should always choose the largest resolution and highest quality camera setting (least amount of compression) available when taking photographs.

Image format requirements will differ with the nature of the research project. If there are significant benefits (present or future) from having the facility to post-process lossless images then the feasibility of capturing RAW images should be discussed with the NPWS Project Co-ordinator. If RAW files are being supplied then it is expected that the RAW files will also be supplied in DNG format using the DNG Converter to batch convert the RAW files.

ⓘ Comparing image file formats

Images should be provided as either RAW, TIFF or JPEG files. The main difference between these formats is that both JPEG and TIFF are "finished" images, where the camera has processed the image before writing the image file to the camera storage card. JPEG files have additional file compression applied that discards data to reduce the file size written onto the camera storage card. A RAW file is not a finished image; it is like a recipe to create an image and this provides a great degree of control over interpretation of the image when it is converted using RAW conversion software such as Adobe Camera Raw. This ability to interpret the image with such a high amount of control makes RAW the preferred file format for image capture.

If project authors are using cameras that shoot RAW format files (such as NEF format from Nikon or CR2 from Canon) these will provide high quality images with a smaller file size than TIFF. Many camera models that can save RAW images have an option to save images in both RAW and JPEG simultaneously. In such cases project authors are requested to use the dual output format and supply images in both formats. Generally cameras that save RAW images are sold with supporting image editing software that will permit RAW to JPEG conversion. Where the RAW file format is not available on a camera, TIFF image files should be used in preference to JPEG on account of their lossless quality.

There is another requested step required if RAW image files are produced. For archiving purposes, it is recommended that RAW images are saved to a non-proprietary format such as DNG (Digital Negative) as this is a universal format, is vendor neutral and holds metadata internally within the file. The free stand-alone application DNG Converter, available at http://www.adobe.com/products/dng/, can specify an entire folder of files and place them into a separate destination folder without overwriting the original RAW files.

The table below describes different delivery requirements based upon available image formats.

Image formats available	Delivery requirements
TIFF or JPEG	TIFF is preferred, if available. Supply as TIFF or JPEG.
RAW and JPEG (simultaneous)	Supply both RAW and JPEG. Convert RAW to DNG.
RAW or TIFF or JPEG	Only shoot RAW if software is available to batch-convert images to JPEG. Convert RAW to JPEG. Convert RAW to DNG. If no RAW to JPEG conversion software available then supply TIFF or JPEG images.

Note: Please differentiate between processed and unprocessed images by placing them in different directories so as to preserve unprocessed image files.

Specifications relating to georeferenced imagery should be discussed and agreed on a project basis with NPWS GIS Unit.

9. NPWS metadata standards compliance

The generation of metadata elements for NPWS spatial dataset information as well as other project resources will be a requirement for all future NPWS projects. NPWS is committed to producing consistent metadata to comply with the EU INSPIRE directive on spatial dataset and spatial dataset series. Metadata requirements for ISO 19115, Dublin Core and GBIF Darwin Core are also considered.

To facilitate compliance with international metadata standards NPWS have integrated this need for metadata capture into a wider requirement for a NPWS Project Resource Catalogue. This will allow the development and maintenance of a comprehensive list of data resources held by NPWS, out of which appropriate metadata elements can be served.

NPWS have produced a PDF form to allow the easy capture and collation of data, and metadata, for the Resource Catalogue. Details of how to use this form are supplied in an associated guidance document called: *NPWS_Resource_catalogue_form_entry_guidelines_external.pdf*. Both the PDF form and the guidance document are contained in the Project Directory tree supplied by NPWS.

10. Report format

A standard template for the Irish Wildlife Manual format, and instructions for its use, are available to Project Authors as part of the project delivery directory tree (in ..\@templates\wildlife_manual\). This template can be easily modified in order to produce a standardized and machine-readable document or PDF.

Machine readability is preferred for digitally disseminated reports and publications as it allows the documents to be accessed by visually impaired users. It also conforms to international accessibility and usability standards. As virtually all NPWS reports are digitally disseminated, it is crucial that we adhere to these standards. This has an additional future benefit as accessible documents are easier to view on a range of readers as they can reflow on small screens.

Where Project Authors have access to MS Word 2010 this software now allows the application of Alternative text to tables, images, charts, shapes and other document objects. Alternative text is used by Web browsers to display text during image downloads for users who have graphics turned off and for users who rely on screen-reading software to convert graphics on the screen to spoken words. Alternative text helps people with screen readers understand the content of pictures and tables. Word 2010 also provides an Accessibility Checker to check for potential accessibility problems that someone with a disability might encounter when accessing document content.

11. Data policy/ownership issues

The NPWS standard data policy for storing and disseminating biodiversity data (spatial and non-spatial) can be found at http://www.npws.ie/datapolicy/.

This policy is currently under review. NPWS are required to make any NPWS-owned data available to external users as dictated by the Re-use of Public Sector Information Regulations 2005, Aarhus Convention, etc... The INSPIRE Directive will also require NPWS to make any digital spatial data available. Annex I Protected areas and Annex II Habitat data are due for availability in 2012 with Annex II Landcover and Annex III Habitats and Biotopes being due for availability in 2014. Ensuring that NPWS data are standardized and collected systematically will make reaching these targets much more straightforward.

Any datasets (raw, derived or GIS), reports and other products created as part of a NPWS project are generally contractually required to become the sole property of the Minister for the Environment, unless otherwise decided by the NPWS Project Co-ordinator.

11.1. Third Part Requests for Ordnance Survey spatial data

Where a NPWS Research project requires the use of Ordnance Survey (OSi) spatial data NPWS may issue—under licence—project-specific OSi data to contracted Third Parties. In this case the external Project Author must fill in and sign a copy of the *Third Party Agreement form* and send this to the Project Co-ordinator. Details of the agreement procedure, along with a blank Third Party Agreement form, are held in the project directory ..\@templates\OSi_data_third_party_agreement within the Project directory tree. The agreement will ensure that the OSi data are used appropriately and that data are not retained beyond the project duration.

Section 2: Preparing for project delivery

12. Project pack overview

The project pack will consist of a ZIP archive holding the proposed top-level directory tree for project resources. In addition a template directory will hold supporting documentation and templates.

This project pack will contain the following items, mainly in the *..\@template* directory:

Key documentation	The current data standards and delivery guidelines document A project delivery checklist which includes GIS data quality checklist items Guidelines for filling in the Resource Catalogue Guideline documentation for DoEHLG Logo usage Guidelines for use of Irish Wildlife Manual template Impacts list spreadsheet with guidelines
Templates	Irish Wildlife Manual templates Project version history document NPWS issue log A Recorder import template A Turboveg data template Monitoring database model 1 - relevés (MS Access)
PDF Forms	A Resource catalogue form Sample completed Resource catalogue forms
Catalogues	Image catalogue Sample filled image catalogue
MS DOS Batch files	Executable scripts to generate lists of files in directories
DoEHLG Logo Kit	A series of logo images in TIFF, PNG and JPEG format

Initally, this project pack will be supplied to Project Authors as a zip archive via email or on CD. The pack may be posted on the NPWS Web Site for download in the future.

13. Top-level project directory hierarchy

The top-level directory hierarchy for holding project data resources has been defined by NPWS. This directory hierarchy is supplied in a ZIP archive that can be extracted to the project working folder. The archive contains the directory tree and supporting documents and templates. The Project Author can extend the directory structure to hold further subcategories of data. The directory structure supplied by NPWS should not be altered by renaming directories. However you may delete parts of the directory tree prior to delivery if there are no resources stored there.

If limitations or omissions exist in the current structure then please notify NPWS. NPWS will consider requests for change.

A diagram illustrating the Project directory structure is presented in Figure 1 on the following page. The expected directory content is explained in more detail in Appendix C.

Figure 1. The Project Directory structure

14. Project root directory naming convention

NPWS will require the digital project resources to be delivered in the supplied NPWS directory hierarchy. The top-level directory holding all of the resources for a NPWS Project (the project root directory) shall be named in a standard way. For new projects NPWS shall supply the directory name for the Project root directory. There are no restrictions on Project Authors applying a more meaningful name to the parent directory of the supplied project root directory as the key directory structure and data are held below the root directory.

The Project directory naming format is described in Appendix B below.

NOTE: When naming local parent directories please keep the directory name brief so as to ensure that the combination of the directory path + file name does not exceed the length limitation of 260 characters. For the same reason do not attempt to store a project directory tree deep within an existing directory tree.

15. File naming conventions

Ideally the proposed NPWS file naming scheme should be applied at project kick-off. Failing this, file naming should be implemented prior to the initial project resource delivery to NPWS. This will ensure that files referenced in correspondence can be easily identified. Please refer to the following subsection on file dependencies to see how to handle exceptions to the naming conventions.

15.1. File naming conventions explained

- NPWS need to be able to uniquely identify all resources in the Project Repository for a given project.
- The file name should be sufficiently descriptive to ensure that if someone was to remove a file from a given directory there would be enough information in the file name to allow the file to be replaced in the correct version of the project.
- Each file within a project must be assigned an appropriate unique filename string by the author responsible for producing that resource item. All of the project file names must be extended with project and version identifiers as outlined below. So all of the files for a project will begin with the same 7 characters.

Format: **PPPPPP_<RRR...> _99a.EXT**

Example: LMPV09_HD_habitats_01a.shp

PPPPPP: Project abbreviation

As described for project directory naming. See Appendix B. Value is supplied by NPWS.

<RRR...>: Unique Resource file prefix

Supply a sensible description of variable length. Ideally link this to the current file name if the file already exists. Keep the unique resource name short. Words within file names should be connected with underscores ("_") not with spaces.

☞ See "Appendix D" for general file and directory naming conventions.

Examples: Habitat e.g. HDHab
Map type e.g. HD_Habitat_map
Relevé data e.g. Fen_releve_data

99a: Project/File version code

99: Project version. This will hold values from 01 to 99.
New versions are decided by NPWS.

a: the File version using an lower-case letter from **a** to **z**.

.**EXT**: System generated file type

Generally, the Project version '99' will be incremented when major changes are made to the Project. The File version 'a' may be incremented as minor amendments are made. It may also be used as a means of effecting back-ups. If a large number of edits has been made to, say, LMPV09_HD_habitats_01a.shp, then the file should first be saved as version _01a, then saved again as _01b before proceeding to apply further edits. This will provide a degree of security against accidental loss of work.

If the Project Version is incremented by NPWS then this does not affect existing file names. The Project directory tree can have files with previous project versions in file names. New project files will use the incremented project version.

15.2. Handling file dependencies

Some project resources will have inter-file dependencies and will contain references to other resources or to external sources. In some cases, such as web development and file geodatabases, the application of a file naming convention may not be feasible as it may break the implicit links between different files. If such a situation arises with resources intended for delivery with a project then please contact the NPWS Data Manager to discuss and agree the naming strategy associated with these files.

An associated issue with file dependencies is that of directory pathnames. Where possible, all cross-referencing of files, such as the linking of web pages to image files or other web pages, should use relative pathnames. The advantage of using a relative pathname format is that resources such as webs or sub-webs can be moved without compromising the hyperlinks that relate different web pages. A relative pathname points to a file or directory relative to the current working directory. The description in Appendix G clarifies the difference between relative and absolute pathnames and illustrates the notation required for relative pathnames.

Resources for delivery should be assessed up-front to ensure that file and directory renaming will not impact upon or break project deliverables.

Later versions of ESRI's ArcGIS provide the option of setting each Map Document (MXD) to Relative or Absolute paths. The option is to be found in ArcMap 9.x under 'File | Document Properties... | Data Source Options...'. The option may be exercised for the current MXD or applied to all future MXDs. In ArcGIS 10 there is a new possibility to create a map package to share both the data and the mxd as part of one package; see:

http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//0017000000q5000000.htm.

Section 3: Delivering the project

This section guides you through the project delivery process. An associated checklist PDF form that summarises the process has been supplied along with this document in ..\@templates\delivery_guidelines:

NPWS_Project_Author_checklist_form_enabled.pdf

Please refer to this form during the project and tick off the completed tasks. Please save the completed form in Acrobat Reader and supply this form as one of the project deliverables.

16. The Project delivery process (new project delivery)

This section summarises the steps required prior to the delivery of a set of project resources to NPWS. The process should begin at the start of the project.

16.1. Install the Project Delivery Pack to your working hard drive

If you are supplied with a zip archive for the project pack then copy the archive to your allocated project parent directory. Use a file decompression utility such as Winzip to unzip the directories and files to your hard drive. Refer to figure 1 for an overview of the directory tree. Make sure that you choose the 'Use Path names' or 'Re-create sub-folders' option so that the entire tree structure is re-created on your computer.

16.2. Check that the project root directory name matches that assigned by NPWS

You will have been notified of the project root directory name by NPWS. Apply the project root directory name to the directory *..\add_project_code_and_version* if this has not been done already.

16.3. Check project file naming conventions have been implemented (ongoing)

Refer to Section 15 above for guidelines. Make sure that inter file dependencies are not broken if any renaming of files is required.

The following steps relate to preparation for delivery when the project has been completed.

16.4. Complete the details in the image catalogue

Complete the Image Catalogue entries for all project images using the spreadsheet document *image_catalogue_template.xls* in the *..\@templates\image_catalogue* directory to list details of all of the images. A sample catalogue is stored in the *..\images\catalogue* directory to give you an idea of proposed content.

A MS-DOS batch file called *list_images.bat* is stored in the ..\images directory. Double click on the batch file to generate a list of images in the ..\images directory for use in populating the spreadsheet *image_catalogue_template.xls*. The resulting text file [*image_list_<datestamp>.txt*)] is created in the *..\images\catalogue* directory. You can open this text file and copy the file names generated by the batch file into the image catalogue.

16.5. Check project files are allocated to the correct directories

Confirm that the Project directory tree is complete and that all required files are allocated correctly. Refer to Appendix C for further information on expected directory content.

16.6. Generation of archival PDF versions of project reports (where specified)

Generally you will not be required to produce PDF versions of project documents. Documents should be supplied in MS Word format, ideally in Word 2010 or below, or in Rich Text Format (RTF) if documents are being produced in some other word processing package. NPWS will generate suitable PDF versions of documentation for deployment to the NPWS website or for archival purposes.

In special cases where you are explicitly required to deliver PDF versions of documents please produce a PDF/A -1a:2005 compliant PDF document for key reports. Refer to Appendix E for further directions.

16.7. Record project version history

NPWS need to retain a long-term history of the events associated with the resources contained in a project. Well established version control practices are a prerequisite for proper repository management. It is important that everything required for a project is delivered in an expected delivery and that a history of each project item can be thoroughly accounted for. The initial delivery of project resources to NPWS, once approved, will constitute what is termed a *baseline*[1]. The approved project resources will then be submitted to the Project Repository. Thereafter any changes to the contents in the repository will be controlled. NPWS will require a clear statement on what has changed and why.

Prior to delivering the project resources to NPWS please fill in details of the delivery in the version history template in the *..\@versions* directory called *NPWS_Project_Version_History.doc* to provide a brief overview of the project. Clearly identify the current Project version, supplying both the project code and the project version. Indicate the Author(s) and date of delivery.

In general the project resources will not be committed to the NPWS Project Repository until the delivered project content is approved and signed off. If a project delivery represents a revision of the current baseline version of the project that has already been assigned to the NPWS Project Repository then a more detailed change history should be supplied in the version history. Supply a list of which files have been added, edited or deleted from the project. This should list both the file names and their associated directory path. Add extra pages to the version history template to record details of new project versions and to list the changes to the resources. A copy of this revised Version History should accompany any delivery or partial delivery to NPWS.

16.8. Complete the NPWS Resource Catalogue form

There should be a copy of the NPWS Resource Catalogue Form called *ResourceCatalogueForm_external_enabled.pdf* in the *..\@resource_catalogue* directory. A copy is also held in the *..\@template\resource_catalogue* directory. Use this form to record details of the project and to describe the associated project resources. Refer to the guidelines document:

NPWS_Resource_catalogue_form_entry_guidelines_external.pdf

in the directory: *..\@template\resource_catalogue\guidance_document*

for guidance on filling the NPWS Resource Catalogue Form fields.

1 **Baseline**: A specification or product that has been formally reviewed and agreed upon, that thereafter serves as a basis for further development, and that can be changed only through formal change control procedures.

16.9. Build a Project Manifest

A mandatory step in the building of the project resource deliverables will be the generation of a project manifest. A project manifest in its simplest form is a list of all the project resources (the file names) along with the size and modification date and time the files were last modified. The directory pathname should also be indicated for each file. To simplify this procedure a MS DOS batch file has been supplied that when executed will generate a plain-text manifest which fulfils the minimal manifest requirements.

Just prior to Project delivery to NPWS a project manifest should be generated using the MS DOS batch file (*build_manifest.bat*) supplied in the project root directory. Double clicking the batch file name in Windows Explorer will generate a text file holding a listing of the files and directories in the Project directory tree. A MS DOS Console window will notify you that the manifest has been created. Hit any key to close this window. The text file will hold the creation date stamp of the manifest file and this will also be added to the batch file name to ensure that it is unique. The resulting plain-text manifest file is stored in the *..\@manifest* directory with a name such as *project_manifest_20101210_093640.txt*. NPWS will generate a further version of the manifest file upon delivery of the project resources and the contents will be compared using a difference tool to check that the file complement matches the original manifest.

16.10. Ship the Project resource products

If the Project resources are of small physical size then the Project directory tree could be stored in a ZIP archive and delivered attached to an email. For guidance on the archive procedure refer to Appendix F. Otherwise the directory tree should be copied to removable storage, preferably a CD/R or DVD+R disk. Alternatively a USB-drive could be used. CD or DVD media should be clearly labelled with the Project Code, the Project Version, the date and the author/organization's name.

17. Supplying project updates to the NPWS Project Repository

If the project is a long term ongoing project it may be necessary to provide staged deliveries to NPWS. A new project stage will generate a new project version number and this will be notified by NPWS. This will trigger changes to the project root directory name and also to the file naming requirements.

- NPWS will update the Project Version number. The Project root directory content should be archived / backed up locally and then renamed with the new project version number.
- The new Project version number will be applied to all new project files.
- Changes to existing project files will only trigger the incrementing of the file version letter, not the Project version number.
- All changes must be logged in the Version History prior to delivery.
- The Resource Catalogue Form content should be updated to reflect the changes if necessary.
- The manifest should be regenerated.

For minor updates to files or groups of files in the existing baseline directory structure updates to existing project files will only trigger incrementing of the file version letter, not the Project version number. The Project Version of new files will also remain unchanged in this case. If the volume of changes is minor then only the new/updated files along with a revision of the Version History documenting the changes is required by NPWS. The Resource Catalogue Form content should also be reviewed.

18. General Project Rules

Project Authors must follow the Project delivery guidelines where possible. If problems or limitations arise from use of the proposed system then please notify the NPWS Project Co-ordinator.

18.1. Use the directory structure as supplied to hold Project data.

18.2. Directory names apart from Project root directory are lower case. Please retain this convention for directories created at lower levels. Always use underscores "_" to separate words in the directory name.

18.3. If required, add additional directories below the NPWS Project Repository directories but make sure to keep directory names brief and meaningful. Please clarify the new directory usage in a readme.txt file in the relevant directory if necessary. Refer to Appendix D for guidelines on file and directory naming.

18.4. Keep unique parts of file names as short and clear as possible.

18.5. Assign any interim data to the *..\raw_data* directories.

19. Tools

NPWS use the following minimal tools to read and edit project resources. Project Authors should ensure that the tools that they use for building project deliverables are compatible with these tools. NPWS operates, at desktop level, primarily in a Microsoft Windows environment. Contractors using, in particular, Apple Mac-based systems should ensure that their deliverables are fully compatible with MS Windows applications.

- MS Word
- MS Excel
- MS Access
- Acrobat Reader 8+
- Text editor such as Notepad
- Turboveg for relevé data
- Recorder 6 for taxon records
- Winzip or another ZIP archiving tool for archiving project deliverables
- ArcGIS v9.3.1 (soon to be superseded by v10)
- ArcView 3.2 and 9.

Section 4: Appendices

Appendix A. Nomenclature standards

This appendix provides details of standard nomenclatural references relating to species and habitats used by NPWS.

General

Ferriss, S. E., Smith K. G., & Inskipp T. P. (eds.) Irish Biodiversity: a taxonomic inventory of fauna. *Irish Wildlife Manuals*, No. 38. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Plants

A combined and fully synonymised Vascular plant checklist, using the following references and some uniquely Irish amendments, has been collated by the National Botanic Gardens. This is available as '*irishvascular.txt*' on the National Botanic Gardens website. Synoptic lists of Bryophytes and Characeae of Ireland are also available on the National Botanic Gardens website. These documents along with a range of other useful species checklists can be downloaded from: http://www.botanicgardens.ie/herb/census/lists.htm.

Vascular plants	Stace, C. (2010) *New Flora of the British Isles*. 3rd Edition. Cambridge University Press.
Bryophytes	Blockeel, T. L. & Long, D. G. (1998) *A check-list and census catalogue of British and Irish bryophytes*. British Bryological Society, Cardiff.
Lichens	Coppins, B. J. (2002) *Checklist of Lichens of Great Britain and Ireland*. British Lichen Society, London.

Invertebrates

Lepidoptera	Asher, J., Warren, M., Fox, R., Harding, P., Jeffcoate, G. & Jeffcoate, S. (2001) *The Millennium Atlas of Butterflies in Britain and Ireland.* Oxford University Press; Bradley, J. D. (2000) *Checklist of Lepidoptera recorded from the British Isles.* 2nd Edition. Fordingbridge & Newent.
Dragonflies	Askew, R. R. (1988) *The dragonflies of Europe.* Harley Books, Colchester.
Molluscs	Anderson, R. (2005) *An Annotated List of the Non-Marine Mollusca of Britain and Ireland.* Journal of Conchology 38 No 6: 607-637.

Vertebrates

Fish, Amphibians & Reptiles

King, J., Marnell, F., Kingston, N., Rosell, R., Roche, W. & Cassidy, D. (2010) *Ireland Red List No. 5: Fish, Amphibians & Reptiles.* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland. [based on Maitland, P.S. (1972) *A key to the freshwater fishes of the British Isles: with notes on their distribution and ecology.* Freshwater Biological Association, Scientific Publication No. 27, Cumbria.; Maitland, P.S. & Herdson, D. (2008) *Key to the Marine and freshwater fishes of Britain and Ireland.* Environment Agency, Bristol.; Wheeler, A. (1969) *The fishes of the British Isles and north-west Europe.* Mc Millan & Co. London.]

Birds

Irish Rare Birds Committee (1998) *Checklist of the Birds of Ireland.* BirdWatch Ireland, Dublin.

Mammals

Wilson, D.E. & Reeder, D.M. (editors) (2005) *Mammal Species of the World. A Taxonomic and Geographic Reference* (3rd edition). Johns Hopkins University Press. [used in Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3.: Terrestrial Mammals.* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Protected Rare & Threatened species

NPWS (2011) *Checklist of protected & rare species in Ireland.*

Habitats & Vegetation

Habitats

European Commission (2007) *Interpretation Manual of European Union Habitats.* European Commission, Brussels; Fossitt, J. (2000) *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny.

Plant communities

White, J. and Doyle, G. (1982) *The vegetation of Ireland: a catalogue raisonné.* In: J. White (ed.), *Studies on Irish Vegetation.* Journal of Life Science 3, 280-368. Dublin. Royal Dublin Society.

Habitat Mapping

Smith, G.F., O'Donoghue, P., O'Hora, K. & Delaney, E. (2010) *Best Practice Guidance for Habitat Survey and Mapping.* The Heritage Council, Kilkenny.

General Record management

CMOD (2005) *Old Rules are Still Good Rules - Record Management Guidelines.* Department of Finance, Dublin.

Appendix B. Project Identifier and Version codes: format and usage

A unique Project Identifier will be generated by NPWS staff for each initiated project and supplied to the Project Manager and Project Authors. The format of the identifier is described below. This identifier is used in two ways when setting up and running a project:

1. The Project root directory is named using the Project Identifier along with the Project Version of the project being worked on.

2. All files held in the Project directory tree will use the Unique Project Abbreviation as the first part of the file name followed by a unique file name string defined by the Project Author and finally by a combined project and file version code. See "15. File naming conventions" on page 19.

Project Identifier

The Project identifier is a 11-character string consisting of a 4-digit **Project Type identifier**, an underscore and then a unique 6-character **Unique Project abbreviation**.

Project Identifier Format: ####_PPPPPP

The Project Type identifiers are 2-part numeric codes produced using 2 different sources called Themes and Categories as described below.

Digits **1-2**: **Themes**: These are a list of Themes of interest used by NPWS.

01 Freshwater
02 Grassland and Marsh
03 Heath and Dense Bracken
04 Peatlands
05 Woodland and Scrub
06 Exposed Rock and Disturbed Ground
07 Coastland
08 Marine
09 Invertebrates
10 Fish
11 Amphibians/Reptiles
12 Birds
13 Mammals
14 Plants/Fungi
15 Agri-Environment
16 Uplands
17 Irish Geological Heritage
18 Sites
19 Protected sites
20 Taxa
21 All EU Taxa
22 Selected EU Taxa
23 Habitats
24 EU Habitats
25 National Parks
26 Nature Reserves
27 Other NPWS Properties (not National Parks or Nature Reserves)
28 Locational - General
29 System
30 National Resource
00 Not known

Digits **3-4**: **Categories**: These categories are generic work areas used by NPWS.

01 Monitoring
02 Survey
03 Inventory
04 Historical
05 Conservation planning
06 Agri-environment
07 GIS
08 Data management
09 Red lists
10 Reporting
11 Research
12 Website

- **PPPPPP:** Unique Project abbreviation

The content of the abbreviation is decided by NPWS. Letters are upper case. For example, use Habitat abbreviation and year of initiation (e.g. LMPV09). In general the last two characters will be used to indicate the year that the project was initiated.

Project version code

- **_99**: Project version

Values from 01 to 99 beginning at 01 for the baseline Project version. NPWS are responsible for incrementing this code.

Usage:

The Project Directory tree format: **####_PPPPPP_99**

Example Project directory tree name: **0602_LMPV09_01**

Note that for file naming purposes only the Unique Project Abbreviation section of the Project Identifier is used. See "15. File naming conventions" on page 19.

Appendix C. Top-level directory tree description

This appendix describes the expected content of the directories in the Project directory tree. The directory tree is illustrated in figure 1. Details of documents, templates, forms and other supporting resources held within the directory tree are listed. This directory tree and existing and expected contents are held in the Project directory tree ZIP archive supplied by NPWS. The directory structure as supplied should be maintained but the structure can be augmented by additional directories, ideally at the lower levels in the directory tree.

For new projects there are two key directories below the project root: *..\@templates* and *..\<project_abbreviation + unique_ID + project version>*

These directories are described separately below.

..\@templates

This directory holds the current versions of support templates and associated guidelines for use. These directories will be excluded from the project deliverables. Copies of the resources supplied in these directories can be used to create and hold Project data. They are described in table 2 below.

Table 2. Details of the expected contents of the Project details section fields

Directory name	Description of contents	Examples
delivery_guidelines	The latest version of the data standards and project delivery guidelines document is supplied here. A delivery checklist PDF form is also supplied. This should be completed and supplied to NPWS as part of the project delivery.	
image_catalogue	A template for the gathering of image metadata called *image_catalogue_template.xls* is supplied along with an example catalogue (*image_catalogue_example.xls*).	
logo	For reports the associated subdirectory contains copies of the DoEHLG logo and the Harp along with guidelines for applying these to documents.	Project final reports and Irish Wildlife Manuals
monitoring	A spreadsheet list of impacts along with a guidance document: "Report and suggestions on the use of the references for pressures, threats and impacts". Also a MS Access Monitoring database templates for relevés.	
OSi_data_third_party_agreement	A Microsoft Word data agreement form along with a procedure document. Applicants requiring access to OSi spatial data must fill in the form and sign it before delivery to the NPWS Project Supervisor.	
recorder	A Recorder 6 data import template called *Recorder_import_template.xls* is supplied. If possible input taxon records directly into Recorder 6.	
resource_catalogue	This directory and associated subdirectories holds a copy of the NPWS Resource Catalogue form. Refer to the guidelines document and two examples of filled forms in subdirectories.	
turboveg	A Turboveg data import template called *TurboVeg_Excel_template.xls* is supplied. Where possible input relevé data directly into Turboveg.	
wildlife_manual	Guidelines for the production of an Irish Wildlife Manual (*IWM template guidelines May 08.doc*) and two Word templates (*IWM_template_2012.dot* and *IWM_template_Aug_12.dotx*) are supplied.	

..\<project_abbreviation + unique_ID + project version>

This directory is the root directory for all project deliverables. The directory holds a single file called: *build_manifest.bat*. This file can be used to generate a list of files and directories in the Project directory tree and to save the results to the *..\@manifest* directory described below. Below the root directory there is a hierarchy of directories and these are listed and described below.

Table 3. Details of project directories

Data field	Description	Document example
@manifest	This directory will hold one or more instances of a complete text list of all resources associated with the current project. These are generated by running the batch file in the project root directory. The file names of these text files are timestamped.	project_manifest_20102810_113638.txt
@resource_catalogue	This directory holds a copy of the NPWS Resource Catalogue form. Refer to the guidelines document in *\@templates\resource_catalogue*.	
@version	This directory holds two documents: 1) A Version history for the whole project. This will be described elsewhere. 2) An Issue log spreadsheet describing Project Issues and their current status.	
data	This is the top directory for all current data products associated with a project.	
data\gis	Holding directory for GIS data resources.	
data\gis\aerial	A directory for holding project-related orthophotography. Note that it is not necessary to supply OSI orthophotography here as NPWS will be maintaining this independently.	
data\gis\gis_files	All GIS shape files or geodatabases related to the current project.	
data\images	Images additional to those used in project reports. Also holds a MS DOS batch file for generating a list of images for use in the image catalogue.	
data\images\catalogue	An image metadata catalogue based upon the template: *image_catalogue_template.xls* held in the *..\template\image_catalogue* directory is stored here.	
data\maps	Holds maps generated by the project. The expected formats are PDF, scanned image formats, Word documents or similar formats.	
data\non-spatial	Holding directory for non-spatial data resources.	
data\non_spatial \databases	Access database files.	
data\non_spatial \excel	Excel spreadsheets.	
data\non_spatial \other	Other categories of data that can be defined by subdirectories.	
data\non_spatial \recorder	Recorder 6 dataset(s).	
data\non_spatial \turboveg	Turboveg datasets	
docs	This is the top directory for all current documents generated by the project. Two accessability guideline documents are supplied here.	
docs\manuals	Important if there is an associated database or software application resource. User-oriented manuals held here.	
docs\publications	NPWS publications, such as Irish Wildlife Manuals, arising from the project.	
docs\reports	Project reports.	
docs\sysdocs	Data dictionaries, Data models, Specifications, User requirements	
raw_data	This is the top directory for all raw data sources generated by the project. This tree holds interim data such as drafts of reports, field data, scanned field cards, working spreadsheets.	
raw_data\source_data	Initial source data such as scanned field cards, GPS data, etc.	
raw_data\processing files	Interim data files.	
raw_data\publications	Interim versions of reports and publications.	

Appendix D. General file and directory naming conventions

The rules below are general rules for file and directory naming. While this document formalises NPWS naming conventions the naming of unique parts of file names as well as the addition of lower level directories is left to the Project Author. Therefore many of the rules supplied below should be considered when creating these items.

Note: Use unique file names within a project. Do not duplicate file names in different directories.

File naming rules

Use a structured file naming and storage strategy as a simple means of organizing and retrieving electronic files and folders.

Rule #01: Use the underscore (_) as element delimiter. Do not use periods or spaces.

Rule #02: Do not use spaces or other characters such as: ! # $ % & ‘ @ ^ ` ~ + , . ; =)(

Rule #03: Put sufficient elements in the structure for easy retrieval and identification but do not overdo it.

Rule #04: When elements include date stamps the dates should be ordered: YEAR, MONTH, DAY (use YYYYMMDD as the format). Always pad single digit days or months with leading zeroes; thus, use 20110207 for the 7th of February 2011 and not, obviously, 201127 as this would be ambiguous. If you are dealing with historical data that include vague dates such as ‘late-1850s’ or ‘Summer 1965’ then please consult with NPWS before proceeding.

Rule #05: Personal names within an element should have family name first followed by first names or initials. Where pre-existing citations use different forms of a name, NPWS may require a list of synonyms to be provided for effective database retrieval. This is especially important where data are being complied over a period of years or by different collectors. E.g. Smyth, J.S.; Smyth, J S; Smyth, John S.; Smyth, Prof. J.

Rule #06: Abbreviate the content of elements whenever possible. Abbreviating helps create concise file names that are easier to read and recognize.

Rule #07: Prefix the names of the pertinent sub-folders to the file name of files that are being shared via email or portable storage devices. Remember not to rely on the directory structure to provide detail and context when sending files to external persons.

Rule #08: Try to keep file names brief. Generally 25 characters should be sufficient. The maximum size of a file name is 255 characters but this does not take account of the directory path. See directory path rule 04 below.

Rule #09: To more easily manage drafts and revisions, include a version number on these documents. Use the convention: 01a, 01b, 01c .. 02a, 02b, etc.. Use the numbers for Project versions and the letters (a-z) for file-level updates.

Rule #10: Do not use periods or spaces to end a file name.

Rule #11: Try to be consistent.

Directory path usage rules

Rule #01: Avoid extra long folder names and complex hierarchical structures but use information-rich filenames instead.

Rule #02: Use the underscore (_) as an element delimiter. Do not use periods or spaces.

Rule #03: Do not use spaces or other characters such as: ! # $ % & ‘ @ ^ ` ~ + , . ; =)(

Rule #04: The total directory path + file name must not exceed 260 characters.

Rule #05: Generally many of the rules applied to file names make sense for directory paths as well.

Rule #06: Do not use periods or spaces to end a directory name.

Rule #07: Try to be consistent.

Appendix E. Document format requirements

E.1 Supply native document format

Project reports and other documents should be supplied in the native document format, ideally Microsoft Word. If the native document format is MS Word then the documents should be supplied as *.DOC files. For other word processor applications that do not export to the Word *.doc format the documents should be saved as Rich Text Format (RTF) which is a document format, produced and maintained by Microsoft Corporation, that can be opened in multiple applications such as Microsoft Office, Open Office and other word processors. Note that RTF format is acceptable only for basic formatted text documents but more complex documents with images and other complex layout features may require the native format to render correctly formatted print.

E.2 Acrobat PDF format requirements

If documents are supplied in PDF format then, where possible, they must comply with the following requirements:

- Ideally PDF documents should be saved as PDF/A 1a documents.
- If the document contains multimedia content, such as audio or video, then export to a PDF format that allows storage and usage of these media.

PDF/A is a format for long-term archiving of electronic documents, based upon the PDF Reference Version 1.4 (implemented in Acrobat 5) and it is defined by the ISO Standard: ISO 19005-1:2005. The key feature is that the document is reproducible and 100% self-contained; it is not reliant on any external sources to display the document. Use of this format will impose restrictions on the content. For example audio and video content are forbidden. All fonts must be embedded and external links are forbidden. A planned update to PDF/A (PDF/A Part 2) will address audio/video content and other areas. Applications such as MS Word 2007 allow for the direct export of PDF/A documents. Any applications, such as Word, that work with the Adobe Acrobat Professional PDF Maker add-on will allow the user to specify the requirement to save the exported PDF as a PDF/A 1a document.

E.3 Acrobat PDF accessibility requirements

Accessibility means providing equal access to digital information and services regardless of physical or developmental abilities or impairments. The Disability Act 2005[2] and international website accessibility best practice (http://www.w3.org/WAI/) mean that NPWS need to make PDF documents accessible. If documents are required to be supplied in PDF format for web upload then, where possible, they must comply with the accessibility requirements below.

PDFs cannot be made fully accessible, but they can be made accessible to some people with disabilities; for example people using screen readers. A PDF is made accessible by tagging certain elements within it, for example images. If a PDF is tagged properly then a person using a screen reader can often understand a PDF just as easily as a well-designed HTML document (i.e. a website). However PDF does not yet have all the features of HTML, and therefore an equivalent must always be provided. It is preferable to create a tagged PDF from a Word document. However the Word document must have been created in a particular way. The Irish Wildlife Manual template is set-up in the correct way, but there is no need to use it if you prefer your own style and can follow the basic guidelines. Please discuss the format with the NPWS Project Co-ordinator in advance.

In order to create a tagged PDF you will need Adobe Acrobat Professional and MS Word. Free PDF print driver software such as PDF995 will not work. Alternatively MS Word 2007 and 2010 provide a facility to export the document to a PDF and they take account of accessibility requirements.

Further details are supplied in : Adobe Acrobat 9 Pro Accessibility Guide: Best Practices for Accessibility (A9-access-best-practices.pdf) available from the Adobe website.

[2] Section 28 (1)(b) of the Disability Act 2005 states that 'Where a public body communicates with the public through electronic format it must ensure that, as far as practicable, the contents of its communications are made accessible to a person with a visual impairment availing of adaptive technology.'

Appendix F. Guidance on Project repository ZIP archiving

If a Project has few resources then it may be possible to deliver the project resources as a zipped archive. This section provides guidelines and requirements for ensuring that the archive is in the correct format. The key requirement is that the archive must contain the full project directory tree including all files **and** their directory paths. This is to ensure that the archive data can be extracted as an exact replica of the Project structure.

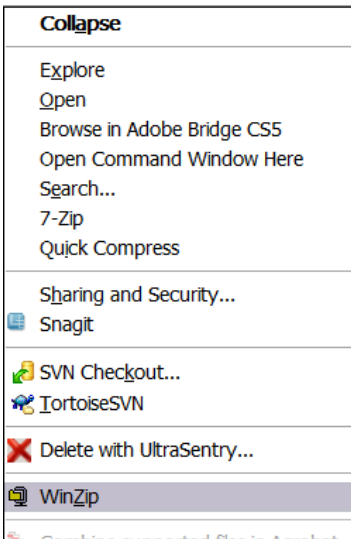
The standard software utility used on MS Windows systems for building and unzipping ZIP archives is Winzip. This is a shareware product. Many people use older versions of Winzip on a perpetual trial licence. If you do not have a ZIP archiver then you can obtain a 30-day trial version from the Winzip site: http://www.winzip.com. A licence costs less than €30.

7-Zip is an alternative freeware ZIP archiver. This is available at http://www.7-zip.org. However the lack of a working way of embedding a comment in the ZIP archive makes this less useful than Winzip. Hence Winzip is the recommended product.

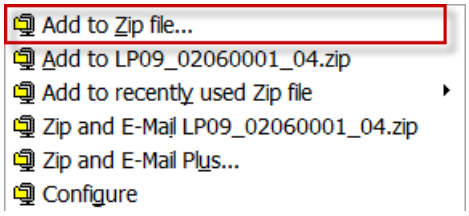
Where possible please add an identifying description to the archive along with details such as the project name, the person archiving the data and the date the archive was produced.

In both archiving applications, Winzip and 7-Zip, the resulting archive will hold all of the files in the directory tree, including all subdirectories, regardless of whether these directories contain documents or not. Be aware that viewing the ZIP archive contents does not explicitly indicate the presence of empty directories. The archive is generated in the parent directory of the directory tree being archived. It is vital that the directory structure is archived as part of the archive.

Winzip procedure (preferred option):



1. Select the project directory in Windows Explorer
2. Use the mouse right-click menu to select the Winzip fly-out menu.
3. Then from the fly-out menu select the *"Add to zip file..."* option.



Winzip will prompt you for an archive file name. You should be able to accept the default of the current directory name supplied by Winzip. The resulting Zip archive is generated to the parent directory of the directory that you are archiving. You may need to check in Winzip v8.0 or earlier versions that the "*Include subfolders*" checkbox is ticked to ensure that sub-folders are stored in the archive.

Appendix G. Absolute and relative pathnames

Directories are organized into a hierarchical structure that fans out like an upside-down tree. The topmost directory is known as the *root* and is written using a slash (either "\" or "/"depending upon the operating system or the usage). In Windows directory structures the root directory is preceded by the hard drive volume letter and a colon, e.g. "c:\". The root can contain multiple directories, each of which can contain multiple subdirectories, these can contain further subdirectories and so on. There is a limit to the length of a pathname imposed by the operating system. This is elaborated further in Appendix D of this document.

The term *pathname* is used to point to a particular file or a directory. It tells you the path of directories that you must travel to go where you want to go. There are two types of pathname: absolute and relative.

1. Absolute pathnames

Absolute pathnames always start from the root directory, which is indicated by a slash ("\" or "/").The absolute pathname starts at the top of the server directory hierarchy and you can move the file **referencing** the path to another directory on the server and links won't break.

An example of an absolute pathname is: *c:\repository\project\0602_LMPV09\readme.txt*. For Windows file systems the "c:\" indicates that you are starting at the root directory and this is necessary for indicating that a pathname is absolute.

The advantage of using absolute paths in cases such as web page links, image tags and other places where you provide the URL of a file on a PC or a server, is mobility. The downside is that you can't test pages on a local machine because the test machine is likely to have a different root directory to the server.

2. Relative pathnames

Relative pathnames point to a file or a directory relative to the current working directory. In situations where you build web pages linking to each other relative pathnames are commonly used within URLs to refer to files in other directories on the server.

For websites the server assumes you are using a relative pathname unless you specify an absolute pathname (beginning with a slash). Starting in your current directory you can trace your way up and down the directory hierarchy. The rest of this section explains the conventions used to reference files up and down the directory hierarchy.

When referring to a directory below the current directory then use \<*lower directory name*> to reference the directory. When referring to a file in a directory below the current directory then use \<*lower directory name*>\<*file name*> to reference the file. The pathname in Figure 2 illustrates the format for referencing the *reports* directory from the \data directory.

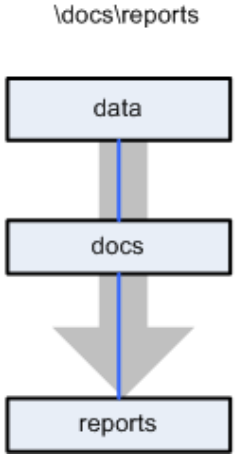


Figure 2. referencing directories below the current directory

To access a directory above the current directory the user must precede the pathname with ".." to move up one level. So in the example in Figure 3 a hyperlink in a report in the *..\reports* directory references an image catalogue spreadsheet in the *\catalogue* directory and has to traverse the directory tree.

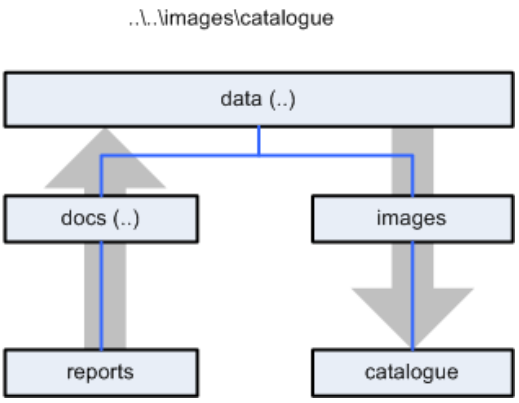


Figure 3. Traversing the directory tree from report directory to the catalogue directory

An example of the usage of a relative pathname in a web environment is the use of a *href* attribute value to link to a home page in a higher level directory, as follows:

```
<a href="../root/index.html">Home page</a>
```

Later versions of ESRI's ArcGIS provide the option of setting each Map Document (MXD) to Relative or Absolute paths. The option is to be found in ArcMap 9.x under 'File | Document Properties... | Data Source Options...'. The option may be exercised for the current MXD or applied to all future MXDs. Figure 4 below illustrates this facility in ArcGIS.

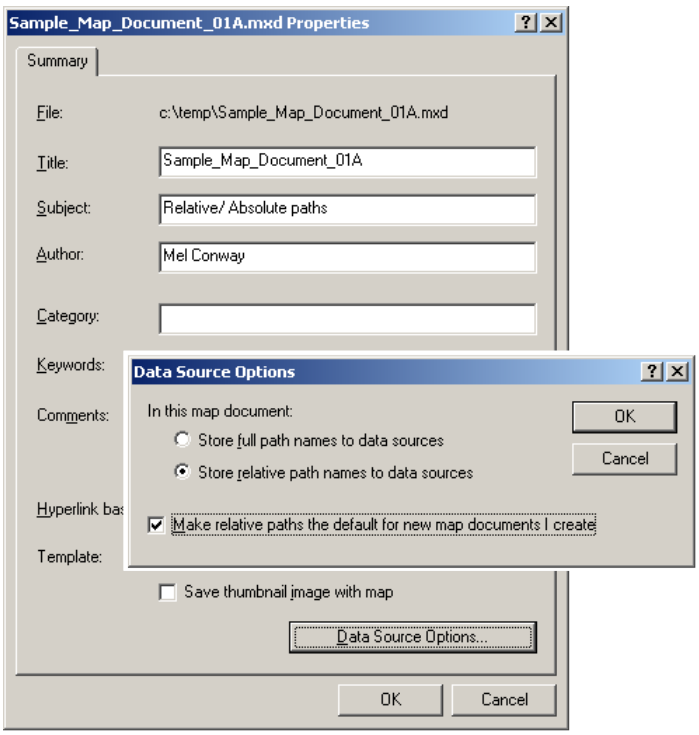


Figure 4. Map Document handling of relative and absolute paths in ArcGIS

End of document