Metadata Guidelines for Geospatial Data Resources - Part 3

Metadata quality

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This document was originally written by Les Rackham and Rob Walker, and subsequently revised by Rob Walker.

Update history

Version	Date	Author	Status
2.1	2011-07-13	R S Walker, L J Rackham	Published version of Guidelines corresponding to GEMINI2.1
2.2	2015-04-13	R S Walker	Amended to correspond to GEMINI2.2

Contents

Preface

This is the third part of a set of guidelines for metadata for geospatial data resources. These Guidelines are intended for general use in the UK geographic information environment. They are primarily concerned with geospatial data and services (i.e. that which references data to a location on the surface of the Earth), and which has a limited geographic extent (i.e. is restricted to a defined territory). They have been developed within the context of a UK Location Discovery metadata service meeting the requirements of the EU INSPIRE Directive, and the UK GEMINI2 metadata standard. However, they are sufficiently broadly based to be applicable in a wider context of geospatial metadata creation and management.

The Guidelines are aimed at data managers and creators of metadata, providers of metadata services and general data users. They include guidance on quality management such that they could be used in the context of a national metadata service.

This part of the Guidelines deals with metadata quality and covers quality evaluation and quality management of metadata including guidance on establishing acceptable quality levels (AQLs). Part 1 covers the basics of metadata and provides an introduction to the other two parts. It includes a glossary of terms and set of references. Part 2 provides a set of detailed guidelines for compiling UK GEMINI 2 metadata elements. This part deals with metadata quality including guidance on establishing acceptable quality levels. It has been revised to correspond to version 2.2 of UK GEMINI.

Any comments on these guidelines or on the UK GEMINI2 metadata standard should be sent to gemini@agi.org.uk.

1. INTRODUCTION

1.1 Purpose and scope

This part of the *Metadata Guidelines for Geospatial Data Resources* describes the quality evaluation and quality management of metadata for a national metadata service or a service internal to an organisation or specialist user community.

The purpose of this Part is to introduce the principles and concepts of metadata quality in the context of metadata creation, maintenance and utilisation in a metadata service. Although these principles and concepts are applicable to any metadata service for the discovery of geospatial data resources, they are applied here with particular reference to UK GEMINI2.2. Taken together, they can be used as a guide to the quality evaluation methods and acceptable quality levels that could be employed in a metadata service based on UK GEMINI2.2.

Just as for software development, data capture or manufacturing, quality is not an "add-on", nor is it merely a cursory check at the end of the metadata creation or maintenance process. To produce metadata which is fit for the purpose, quality needs to be built into these processes. Given the right tools, procedures and above all, people trained in the processes, this need not be onerous. General guidance is therefore offered here on how quality can be built in with particular reference to the respective roles of the metadata creator, service provider and service user.

Readers should note that the following are out of scope of this Part:

- detailed operational procedures for quality evaluation in a specific context;
- specifications for software for the validation of metadata;
- service quality, e.g. performance, availability and reliability beyond the significant impact made on service quality by the quality of the metadata itself.

It should be emphasised that what follows are guidelines, they are not incontrovertible rules for how quality is to be managed. It is not possible to cover every possible type of requirement or implementation. Acceptable quality levels (AQLs) are proposed but care needs to be taken before adopting them, as they may not be appropriate in the user's particular context. Since there will be some organisations responsible for hundreds of metadatasets and others that maintain only one or two, the guidelines need to be used with common sense in a particular implementation.

1.2 Who should read this

These Guidelines are aimed primarily at those in the UK who are using, or plan to use, UK GEMINI2.2 as their metadata specification and are:

- responsible for managing the creation and maintenance of metadata;
- responsible for quality management including metadata creation and maintenance;
- proposing to start creating and maintaining metadata;
- running metadata services whether internal to an organisation or user community or at a national level.

Although this part may be of general interest to those directly responsible for entering the metadata, practical guidance on making these entries and common errors made at entry are found in Part 2 of the Guidelines.

Others who are responsible for maintaining only a few metadatasets should still find the principles described here of value. It may not be feasible or appropriate to apply the principles in the way described. Nevertheless, even if there is no formal processes for quality assurance, there still need to be checks that the quality of the data is meeting and maintaining acceptable quality levels.

1.3 Using this document

The following indicates where you can find specific information and guidance.

- To better understand **quality roles** – this is particularly aimed at the larger producers and service providers, see:

  2. Quality roles – metadata creator, service provider and service user.

- To understand **metadata quality**, the differences with geospatial data quality, the main quality components and how these apply to UK GEMINI see:

  3.1 What is metadata quality?

  3.2 What are the main components of metadata quality?

- To find out about **acceptable quality levels** (AQLs) for metadata and how these can be applied to metadata produced using UK GEMINI2.2 see:

  3.3 What are acceptable quality levels?

  Annex A: Aggregated AQLs applicable to metadata based on UK GEMINI2.2.

- To know about **quality assurance and quality control** in general see:

  3.4 How to quality assure metadata

- To find out how you can **evaluate metadata quality** and the **methods** that can be used in general and specifically in relation to metadata based on UK GEMINI2.2 see:

  3.5 How to evaluate metadata quality

  Annex B: Quality evaluation procedures for UK GEMINI2.2 metadata elements

  Annex C: Quality evaluation methods

- To find out more about **maintaining and improving metadata quality** see:

  3.6 Maintaining and improving metadata quality.

- For a very concise distillation of what is in the rest of the document read:

  4 “Dos and don’ts” of metadata quality.

2. QUALITY ROLES

2.1 What are quality roles?

Between creating the metadata and discovering information about data resources there are a number of quality roles. By quality roles is meant the function or part played in maintaining and improving metadata quality. The two primary roles are:

- the metadata creator[1]
- the service provider

A third role, often overlooked, is:

- the service user

An understanding of these roles and the responsibilities that these carry are essential to the continuing delivery of metadata that is fit for purpose. The roles need to be seen in the context of the overall operation for creating, maintaining and using metadata. A simple process model is introduced in Part 1 of the Guidelines. A more comprehensive process model is presented at Figure 1 showing the quality related processes in more detail.

The quality roles of each of the players are examined in more detail below. Inevitably, the account given here is idealised with a strong emphasis on maintaining and improving metadata quality. In reality, there are many contexts in which a metadata service can operate – entirely internal to one organisation or as a web-based system. Web-based systems may use one centralised metadatabase or distributed metadatabases maintained by several organisations.

The interface between metadata creator and service provider is likely to be regulated by a service level agreement (SLA). This will govern, amongst other things, the quality of metadata which passes across the interface and the procedures to be followed if metadata does not meet the AQLs or service users find fault with the metadata.

The key points to derive from this process model are the need for:

i. quality to be made integral to the metadata creation and maintenance process (and in turn for this to be an integral part of the overall business process);

ii. an overall approach to quality assurance with clear points at which there are quality controls;

iii. documented quality evaluation procedures and agreed AQLs;

iv. the right tools for the job both for metadata entry and quality control (and people trained in their use);

v. good feedback loops from user to service provider and on to metadata creator – without these there is unlikely to be any quality improvements over time.

[1] In the UK Location Programme Metadata Service, the role of metadata publisher is also identified, but in these guidelines, in essence, the creator and publisher are rolled into one.

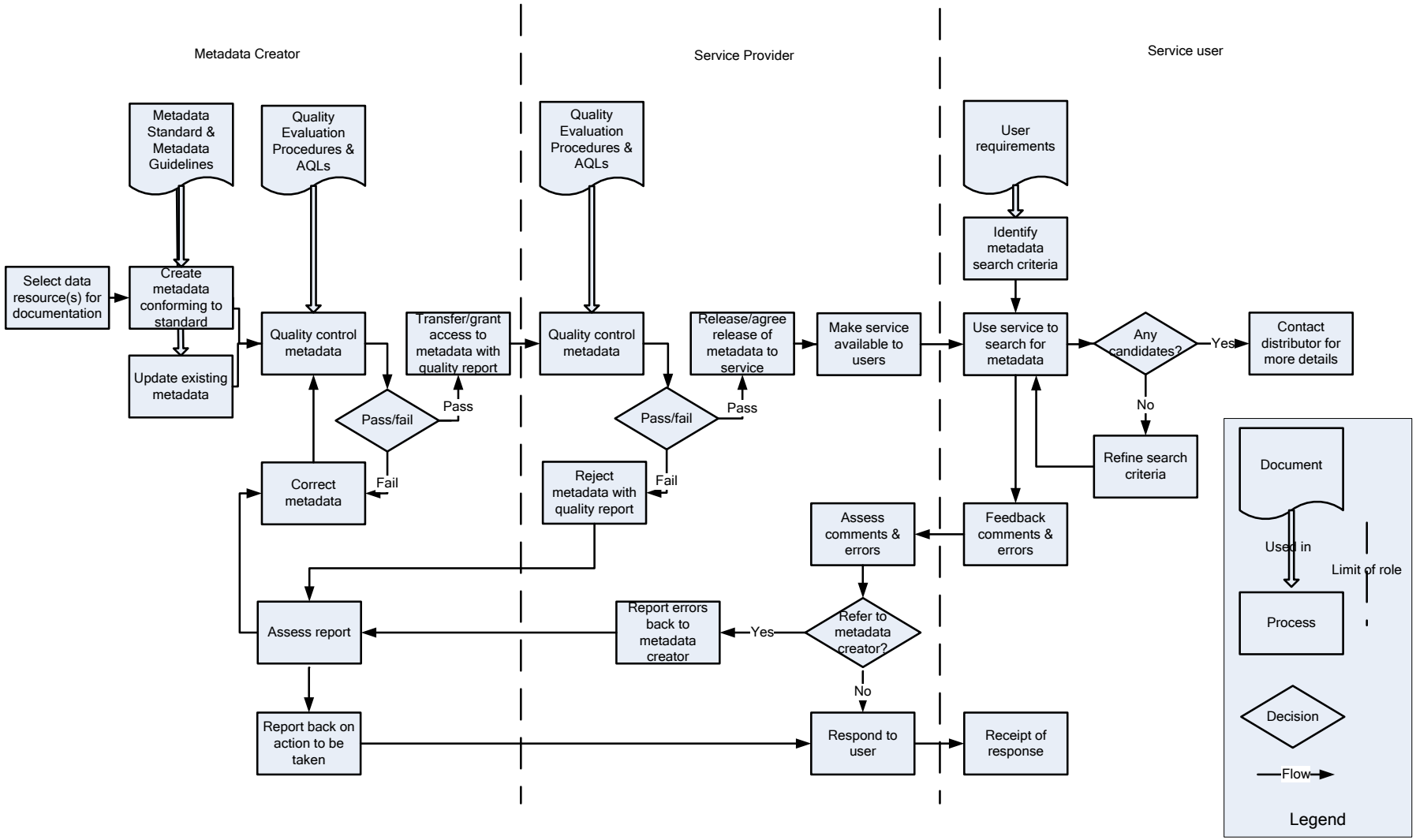

Figure 1. Idealised process model for metadata creation, maintenance, service provision and use.

2.2 What is the quality role of the metadata creator?

The metadata creator, who is frequently also the data producer, is responsible for assuring the quality of the metadata before making it available to metadata service and then maintaining the quality thereafter.

In summary, key responsibilities are likely to be:

i. understanding the quality requirements for the metadata whether established internally or by some external service provider;

ii. having an agreement with the service provider and clear procedures for dealing with errors and user feedback;

iii. establishing or agreeing AQLs that meet requirements (or at least can be practically achieved);

iv. providing quality assurance through flowline design with adequate quality control built-in;

v. ensuring that procedures are in place for both metadata creation and maintenance;

vi. providing mechanisms for ensuring that changes to data resources trigger changes to the metadata;

vii. ensuring that suitable tools are available for metadata capture which conform to the prevailing metadata standard and, preferably, have some validation at time of entry;

viii. having quality evaluation procedures backed by suitable testing tools;

ix. providing for the identification, quarantining and correction of metadata failing quality evaluation;

x. providing for adequate training such that staff have an understanding of the purpose of the metadata and the data resources to be documented and are familiar with the capture and test tools;

xi. having established change control procedures;

xii. creating a culture of quality improvement where feedback is encouraged and lessons are learned and applied.

2.3 What is the quality role of the service provider?

The service provider (who may also be part of the same organisation as the metadata creator or may be part service owner and part contractor) will have a different perspective from that of the metadata creator. However, the extent of their quality responsibilities will vary according to their remit which could range from a basic service provision through to being the main player in driving a national metadata service forward.

As a minimum, the service provider is likely to seek assurance that the metadata will not cause the service to fail. At least, they could be expected to make elementary validation checks using software when the metadata is transferred to them. If the metadata creator is exposing the metadata to the service themselves (e.g. via their own

node on a distributed internet service), then the service provider could require a quality report and a certificate stating that certain tests have been run and the metadata passed. The service provider might still insist on running their own independent tests (see Figure 1).

If the service provider has a wider remit then they will also be seeking:

- some sort of consistency across all metadata such that user searches yield a uniformity of results regardless of sources;
- fitness for purpose from a service user's perspective (although in practice this may be difficult to define).

Given the wider role, the key responsibilities are likely to be:

i. understanding the user requirements and hence the quality requirements for the metadata;

ii. developing and negotiating a service level agreement with the metadata creators setting out minimum AQLs and clear procedures for dealing with errors and user feedback;

iii. leading on metadata quality within the metadata creator community – providing advice and training;

iv. developing and managing a programme to bring existing metadata on the service up to current quality levels;

v. conducting quality audits to determine current data quality and provide a benchmark;

vi. providing quality assurance with adequate quality controls built-in - the emphasis will be on consistency across metadata as much as quality levels within metadatasets;

vii. ensuring that procedures are in place for metadata acceptance and release to the metadata service;

viii. having quality evaluation procedures backed by suitable testing tools;

ix. providing mechanisms for ensuring that metadata creators regularly review and update the metadata;

x. providing advice and support on suitable tools for metadata capture conforming to the prevailing metadata standard;

xi. giving adequate training of staff for the operation of the service with an emphasis on metadata quality;

xii. having established change control procedures agreed with metadata creators;

xiii. having in place mechanisms for service users to feed back errors and comments;

xiv. having procedures for processing and responding to user feedback;

xv. creating a culture of quality improvement where feedback is encouraged, lessons are learned and applied.

2.4 What is the role of the service user?

The service user is the ultimate beneficiary. Without the user, there is no point in creating metadata and having a service. In many metadata services, they are afforded no quality role at all because there are no effective feedback mechanisms. However, they do not have to be passive players in this; they can be tremendous source of free (and unsolicited) comment and informal quality control.

Eventually they will vote with their feet (or more aptly their internet browsers) and cease to use the service if the quality of the metadata does not reach an acceptable level from their perspective. There is every reason for the service provider and the metadata creator to try and involve the service user. They will experience inconsistencies and notice errors. By submitting comments they can contribute to the improvement process but it has to be seen that the service provider and the metadata creator are pro-active in this area or else the users will cease to submit feedback and go elsewhere.

3. PRINCIPLES OF METADATA QUALITY

3.1 What is metadata quality?

3.1.1 The concept of metadata quality

The success of any metadata service used for the discovery of data resources is ultimately dependent on the quality of the metadata which it uses. So what is quality? Quality can be defined as:

i. 'Fitness for purpose';

ii. 'Performance against specification';

iii. 'Totality of characteristics of a product that bear on its ability to satisfy stated and implied needs'[2].

In the case of metadata this can be redefined as:

i. Fitness for use in a metadata service;

ii. Degree of conformance to a specified metadata standard;

iii. Totality of characteristics of metadata that bear on its ability to satisfy the needs of the users in their identification of data resources meeting their stated or implied needs.

We have two types of user for metadata, the service user and the service provider. Frequently, the service user's needs in the context of a metadata service are rarely stated beyond the simple need to discover data resources suitable for the user's purpose. Different service users have different requirements and expectations. Beyond the need to provide an effective and efficient service for the service users, the service provider is likely to have some very specific requirements in respect of certain aspects of the quality of the data such as data format, data type and domain without which the service cannot function let alone produce results. The service provider and ultimately, the service user will also be looking for consistency in the recording of metadata such that there is a reasonable assurance that all data resources meeting the user's search criteria are returned by the service regardless of who created the metadata in the first place.

As a minimum, the needs that have to be satisfied in the case of metadata used for the discovery of data resources having geospatial content are likely to be that:

i. the theme or subject matter of the data resource is correct and comprehensive;

ii. the geographic area or areas that the data resource relates to are accurately and consistently recorded;

iii. the purpose for which the data resource can be used is clear;

iv. the information about how the data was collected, who owns the data and from whom the data can be obtained is reliable;

v. the dates relating to capture, update and publication are accurate.

[2] International Standard - ISO 9000:2000 QMS – fundamentals and vocabulary

Note the use of the terms, “correct”, “comprehensive”, “accurately”, “consistently”, “clear” and “reliable” – these are all relative terms, accurate for one user is inaccurate for another. Likewise, saying that all metadata has to be of the “highest quality” to ensure that all needs are satisfied is largely meaningless because it is, once again, a relative term. If by “highest quality” is meant that all metadata must be completely accurate, correct and consistent this is both unrealistic and unachievable. It is unrealistic because it implies a base against which accuracy, correctness and consistency can be measured. As we will see later, this does not exist. It is unachievable because the effort required in attempting to reach “100% quality” is out of all proportion to the value added.

3.1.2 Achieving acceptable metadata quality

Pragmatically, the quality achieved in metadata is going to be a compromise between what is reasonable for the metadata creator to deliver, the needs of the service provider and the (largely implied) needs of the users of the metadata service. This means that we need to be able to:

i. specify or describe the components of the quality that is required;

ii. set quality levels that are achievable and maintainable by the metadata creator whilst meeting the perceived needs of the users of the metadata service;

iii. develop working practices which will support the achievement, maintenance and, ultimately, the improvement of quality levels;

iv. measure the quality that has actually been achieved;

v. control and manage metadata that does not meet the required quality levels.

3.2 What are the main components of metadata quality?

3.2.1 Quality elements and sub-elements

Just as in the case of geospatial data, the quality of metadata can be described in terms of a number of distinct components or elements relating to the current state of the data resource, such as:

- Completeness – presence or absence of metadata;
- Logical consistency – degree of adherence to logical rules;
- Positional accuracy – accuracy of the bounding coordinate box or extent;
- Temporal accuracy – correctness of dates[3];
- Thematic accuracy – accuracy or correctness of the values entered.

These elements can be further divided into sub-elements such as omission and commission in relation to completeness. Quality sub-elements can then be measured and tested in various ways to establish how well the metadata meets the metadata standard being used, subject to the limitations discussed earlier.

[3] This does not include currency or “up-to-dateness”. This is considered here to be part of content accuracy i.e. entries are correct or accurate to the date of last update of the metadata.

Quality sub-elements can be applied at two levels:

i. at the metadataset level, i.e. when assessing the quality of metadata pertaining to a single data resource;

ii. at the metadata element level, i.e. when assessing the quality of each metadata element in a metadataset.

Note that not all quality elements and sub-elements are applicable to all of the metadata elements. For example temporal accuracy is only applicable to those metadata elements involving dates.

3.2.2 Applicability to UK GEMINI2.2

The quality elements and sub-elements applicable to metadata at the discovery level based on UK GEMINI2.2 are set out in Table 1 below. This is indicative and not exhaustive, other sub-elements may be applicable to particular applications. Nevertheless, they form the basis of the quality evaluation procedures described in these Guidelines.

Table 1. Metadata quality elements and sub-elements applicable to metadata based on UK GEMINI. Adapted in part from ISO 19113:2002 Geographic information – Quality principles.

Quality element	Description	Quality sub-element	Description
Completeness	Presence or absence of metadata.	Commission	Excess occurrences of metadata elements in metadataset (e.g. multiple occurrences when only a single allowed).
		Omission	Absence of occurrences of mandatory metadata elements.
Logical consistency	Adherence to logical rules for format and domain and the ordering and consistency between metadata elements.	Data type consistency	Correctness of data type to that specified in standard.
		Domain consistency	Adherence of values to domains specified in standard.
		Ordering	Presentation of items in their specified sequence (e.g. start date < finish date, north coordinate is north of south coordinate, the maximum value > minimum value).
		Relative consistency	Consistency of related metadata elements (e.g. dataset reference or publication date >= capture or update date, named or described extent overlaps with bounding box).
Positional accuracy	Accuracy of the lateral and vertical extent of data resource as documented in metadata.	Coordinate accuracy	Accuracy of the coordinates defining the bounding box in relation to the extent of the data resource.
		Vertical accuracy	Accuracy of height values defining the maximum and minimum height in relation to the data resource.
		Extent accuracy	Accuracy of the coverage(s) of the data resource is contained within polygon(s) defined by stated extent.
Temporal accuracy	Accuracy of dates in metadata	Date accuracy	Accuracy of date(s) in relation to the data resource or date of update of metadata.
Thematic accuracy	Accuracy of quantitative and correctness of non-quantitative metadata elements and the classifications given relative to the last date of update of the metadata.	Classification correctness	Correctness of classes assigned to instances of metadata elements in relation to data resource.
		Non-quantitative correctness	Correctness of non-quantitative values recorded in metadata in relation to data resource.
		Quantitative accuracy	Accuracy of the quantitative values in relation to the data resources being documented.

3.3 What are acceptable quality levels (AQLs)?

3.3.1 Basis of AQLs

Acceptable quality levels (AQLs)[4] are threshold values applied to the results of testing data quality to determine whether the data resource (or in this case the metadata) meets criteria determined from a standard, specification or user requirements.

AQLs can be based on various types of values such as Boolean (true or false), numeric or percentage depending on the types of measures adopted. In the case of metadata these are usually Boolean. Where AQLs are being related to metadatasets as a whole (see below) these could be numeric or percentage.

3.3.2 Simple and aggregated AQLs

For metadata, AQLs can be applied to the results from tests for a specific component of quality such as 'extent accuracy' and be specific to one metadata element such as 'extent' to determine whether that metadata element meets the specified criteria.

Alternatively, AQLs can be applied to the aggregated results from a number of tests to determine whether a metadataset meets the specified criteria[5]. For example aggregated AQLs could be:

i. 100% pass/fail – all metadata elements in a metadataset must reach or exceed the AQL for each element;

ii. Weighted pass/fail – the results of individual tests for each metadata element are weighted and scored according their perceived significance. Those not achieving a threshold score are deemed to have failed;

iii. Subset pass/fail – only those metadata elements considered important, e.g. all mandatory elements must pass to achieve an overall pass.

The approach proposed for UK GEMINI is to use aggregated AQLs to define three levels of conformance; the two lowest levels are based on subsets passing with the highest level being 100% pass (see below).

3.3.3 Setting AQLs

AQLs for metadata should be SMART, i.e.

- **S**pecific – they should either relate to (i) a particular quality sub-element for the evaluation of the quality of individual metadata elements or (ii) specified groups of quality sub-elements and metadata elements when aggregating results.
- **M**easurable – an AQL has to be measurable or else it cannot be tested effectively.

[4] Referred to as "Conformance Quality Levels" in ISO 19114: 2003 Geographic information – Quality evaluation procedures, the more familiar term is used here.
[5] Derived in part from ISO 19114: 2003, Annex J

- **A**chievable – setting AQLs which are unachievable by the metadata creator has no purpose since this will result in no metadata being accepted.
- **R**ealistic – this means that there needs to be a compromise between what can be feasibly achieved by the metadata creator, what can be feasibly tested and what is deemed acceptable by the user.
- **T**imely – in the sense of being expedient and practical, e.g. to conduct tests to measure the quality level.

AQLs cannot be created in a vacuum; a pragmatic approach has to be taken. There is no point in deriving AQLs which cannot be either measured or achieved.

3.3.4 Who should set AQLs?

At the very least, the service provider should be setting a minimum level of conformance to which all metadata available on the service should comply. This minimum level of conformance is likely to relate to completeness and logical consistency and be susceptible of software validation. Although this may mean that the service can function, it does not mean that the results of searches will be reliable. Any service provider concerned with the quality of the results will need to set AQLs which also relate to the accuracy and correctness of the metadata content.

In setting the AQLs, the service provider needs to ensure that these are achievable and realistic; the only way to do this is in dialogue and agreement with the metadata creators. The quality evaluation procedures also need to be specified whether these are automatic or manual.

The metadata creator may unilaterally wish to set more stringent AQLs for a number of reasons:

- the metadata supports internal business process;
- rework is reduced;
- there is reduced user dissonance;
- there is greater user take-up of the geospatial data documented in the metadata.

If this is the case then they may need to set up further quality evaluation procedures to measure that these levels are being achieved.

3.3.5 Applicability to UK GEMINI2.2

AQLs applicable to metadata based on UK GEMINI2.2 are given in Table 2. Also included is the aggregated AQL for the metadataset corresponding to an intermediate level of conformance proposed for UK GEMINI2.2. This is discussed below.

Table 2 illustrates some of the difficulties of trying to apply AQLs to metadata. Although they can be specific, they are not always easily measurable given the limited basis for establishing the correctness and accuracy of much of the content. If there is no independent source of information then the evaluator has to be realistic and accept that the data passes. Or the best that can be done is to apply basic and highly subjective tests of reasonableness.

Table 2. Examples of AQLs applicable to individual metadata elements and aggregated AQLs applicable to a metadataset - for metadata based on UK GEMINI. (See Annexes A and B for full details of AQLs).

Quality element	Quality sub-element	Example AQL for metadata element	Example of aggregated AQL for metadataset
Completeness	Commission	No multiple occurrences where single occurrence specified.	No errors of commission in metadataset
	Omission	No absence if obligation mandatory.	No errors of omission in metadataset
Logical consistency	Data type consistency	No violation of specified data type	No violations of specified data type
	Domain consistency	No violation of specified domain	No violations of specified domains
	Ordering	No inconsistency in ordering	No inconsistencies in ordering
	Relative consistency	No relative inconsistency	No relative inconsistencies
Positional accuracy	Coordinate accuracy	Coordinates of bounding box within +/- 0.1 degree of latitude or longitude of that independently determined	All coordinates correct.
	Vertical accuracy	Maximum and minimum values of height envelope within +/- 100m of that independently determined	No AQL
	Extent accuracy	Area covered by the data resource completely contained in the Extent(s) as independently determined.	All extents accurate.
Temporal accuracy	Date accuracy	Date accurate to nearest year where determinable by independent sources.	All dates accurate.
Thematic accuracy	Classification correctness	Classification correct to date of last metadata update where determinable by independent sources.	All classifications correct for mandatory elements.
	Non-quantitative correctness	Content correct to date of last metadata update and in conformance with the standard where determinable by independent sources.	All non-quantitative content correct for mandatory elements.
	Quantitative accuracy	Content within value range appropriate to metadata element and correct to date of last metadata update where determinable from independent sources.	All quantitative values correct for mandatory elements.

Three levels of conformance and associated aggregated AQLs are proposed for metadatasets which may need to be established during the development of a metadata service.

- **Conformance Level 1 - Basic**
  Minimum conformance required for inclusion in a metadata service:
  i. all mandatory metadata elements are present with no errors of omission or commission;
  ii. if optional or conditional elements are present there are no errors of commission;
  iii. all data types are valid, no values lie outside their specified domains;
  iv. values (dates, coordinates and heights) are correctly ordered and there is relative consistency between specified dates and between named extents and coordinates.

- **Conformance Level 2 - Intermediate**
  Basic conformance plus:
  – the accuracy and correctness of the content of the mandatory metadata elements achieves or exceeds a specified aggregated AQL.

- **Conformance Level 3 - Full**
  Intermediate conformance plus:
  – the accuracy and correctness of the content of optional or conditional metadata elements achieves or exceeds a specified aggregated AQL.

Conformance Level 1 is susceptible of confirmation using software validation methods because they are all internal tests (i.e. they rely on information contained in the metadata) and relate to logical consistency or completeness. This level might be expected to be adopted by a service provider as a minimum.

Conformance Level 2 is probably realistic and achievable in that it concentrates on logical consistency and the content of the mandatory metadata elements. Thus the results from searches based on location, date or topic should be reliable if it is possible to adequately test accuracy and content.

Conformance Level 3 may be unachievable or unfeasible. It may not be realistic to expect all elements to pass all individual AQLs and it may be expedient to allow a lower level of conformance. Certainly, this is unlikely to be achieved at the initiation of any service.

3.4 How to quality assure metadata

As was stated in the Introduction, quality is not an “add-on”. To meet specified AQLs, quality needs to be built into the metadata creation and maintenance processes, it is not just a question of testing at the end of the production process or leaving it to the service provider to accept or reject the metadata.

The overall planning of production processes to ensure that the product meets the required quality levels is often referred to as “quality assurance” whereas “quality control” refers to the way in which quality checks are carried out during the

production process and items failing quality checks are managed.[6] Examples of where quality control could operate in a metadata production flowline are shown in Figure 1 and described in 2.1.

During metadata creation and supply there may be a number of checks carried out:

i. at data entry – depending how the metadata is compiled it may be possible to build-in validation of certain quality components such that all mandatory metadata elements are completed, all values fall within specified domains and certain basic consistency checks are made;

ii. prior to data export to the service provider – more comprehensive checks are made using manual and automatic checks;

iii. on receipt by the metadata service provider – e.g. all metadata is run through a software validation process.

If any metadata does not pass one of these checks then there have to be procedures for identifying, quarantining and dealing with the failures.

The creation of metadata may be in the context of a broader "quality management system" in operation throughout the whole organisation. This goes further than quality assurance and embraces all those activities needed to deliver quality i.e. planning, operations, evaluations and staff training. There is a strong emphasis on prevention rather than correction and continuous quality improvement.

3.5 How to evaluate metadata quality

As indicated above, there will be certain points in the metadata creation process where quality checks will be needed. At some point or points there will need to be more formal quality evaluation and reporting, particularly in organisations producing large numbers of metadatasets or where the service provider has an acceptance process.

The purpose of quality evaluation is to establish a quality result, i.e. a value or set of values resulting from applying a particular quality measure which may then be compared to a previously established quality level. This is done through a series of steps or procedures. The main steps in respect of metadata are shown in Table 3.

[6] The terms "quality assurance" and "quality control" are frequently interchanged leading to an erosion of meaning. The terms are used in the way defined here throughout the remainder of these Guidelines

Table 3. Steps in Metadata Quality Evaluation Process.

Step	**Process**
1. Identify quality elements and quality sub-elements applicable to metadata	See Table 1 for details of quality elements and sub-elements. The user requirements are an input to this process.
2. Identify metadata quality measures	Metadata quality measure - type of tests to be applied to evaluate each of the quality sub-elements (e.g. percentage of commissions).
3. Determine AQLs	AQLs are determined from: (i) the user requirements (e.g. those of the service provider), (ii) what can be measured and (iii) what is achievable by the metadata creator.
4. Select and apply metadata quality evaluation methods	Metadata quality evaluation method – the operations to be performed to arrive at a data quality result.
5. Determine the data quality results for each measure	Data quality result – the value or set of values together with the value type e.g. distance and value unit (e.g. metres) where applicable.
6. Determine if each result meets the AQL (pass/fail)	Compare each result with a conformance or acceptable quality level (AQL) for each measure (e.g. no omissions) and pass or fail it.
7. Aggregate results of testing	Summarise the results of the previous step.
8. Determine if metadataset meets the AQL for the metadataset	Compare the aggregated result with the acceptable quality level (AQL) for the metadataset and pass or fail it.
9. Report metadata quality result	This can be for each metadata element or a summary result for the metadataset as a whole.

3.6 Applicability to UK GEMINI2.2

Annex B contains proposed quality evaluation procedures for each metadata element created using UK GEMINI2.2. An outline of the evaluation method is given for each of these. These are summarised in Table 4. The table illustrates the difficulty of applying external tests consistently and with assurance because of the probable lack of reliable and complete independent information. Therefore checks, for example, of non-quantitative correctness may have to be partial and rely mainly on elementary and subjective checks of spelling, duplication, understandability and consistency with other entries. It should also be noted that all quality results are based on a Boolean value, i.e. true or false.

Table 4. Metadata quality elements and sub-elements with quality evaluation methods applicable to metadata based on UK GEMINI2.2

Quality element	Quality sub-elements	Evaluation method	Applicability (relevant metadata elements in brackets)
Completeness	Commission	Count occurrence of each element	Metadata elements with only one permitted occurrence (e.g. Title, Lineage, Additional Information Source, Metadata Language)
	Omission	Count occurrence of each element	All mandatory metadata elements (e.g. Title, Abstract, Topic Category)
Logical consistency	Data type consistency	Check data type conforms to Specification	All metadata elements.
	Domain consistency	Check domain conforms to Specification	All metadata elements.
	Ordering	Check dates for duration and east/west, north/south and maximum/minimum values correctly ordered	Metadata elements containing durations, latitude and longitude and maximum values (i.e. Temporal Extent, Dataset Reference Date, Bounding Box, Vertical Extent Information)
	Relative consistency	Check relationship of dates and extent between different metadata elements	Metadata elements containing dates and geographical extents (i.e. Dataset Reference Date and Temporal Extent, Bounding Box and Extent)
Positional accuracy	Coordinate accuracy	Using other sources, check that the locations referenced by the data resource are contained by the minimum definable bounding box	Metadata elements containing latitude or longitude (i.e. Bounding Box)
	Vertical accuracy	Using other sources, check the maximum and minimum values for the vertical extents define a minimum envelope containing all heights referenced by the data resource.	Metadata elements containing height information (i.e. Vertical Extent Information)

Quality element	**Quality sub-elements**	**Evaluation method**	**Applicability (relevant metadata elements in brackets)**
	Extent accuracy	Using other sources, check that the area covered by the data resource is completely contained in the stated extent(s).	Metadata elements containing extents (i.e. Extent).
Temporal accuracy	Date accuracy	Using other sources check accuracy of dates.	Metadata elements containing dates (i.e. Temporal Extent, Dataset Reference Date, Metadata Date).
Thematic accuracy	Classification correctness	Using other sources check each class is correct and current relative to the last date of update of the metadata.	Metadata elements using enumerated lists (i.e. Topic Category, Frequency of Update).
	Non-quantitative correctness	Using other sources check each item is correct and current relative to the last date of update of metadata.	Metadata elements containing free text (e.g. Title, Alternative Title, Dataset Language, Abstract, Keyword, Responsible Organisation, Lineage, Vertical Extent Information, Data Format, Additional Information Source, Resource Locator).
	Quantitative accuracy	Using other sources check that the value of the item is correct.	Metadata elements containing quantitative values - other than dates coordinates or heights (i.e. Spatial Resolution, Equivalent Scale).

3.7 Maintaining and improving metadata quality

3.7.1 Metadata maintenance

Metadata is unlikely to be static; the data resources which are documented by the metadata will change over time whether due to changes in the universe of discourse, product specification or geographical extent. Distributors can change or they can change their contact details. Failure to update the metadata will result in a reduction in service quality. Metadata services are replete with metadata that has not been updated for years despite the frequency of update of the resource being stated as "continuous".

Ideally, the metadata should be updated at the time of the change, if this is not feasible then there need to be periodic reviews, by the metadata creator preferably, to ensure that metadata elements in all metadatasets are current. It is often more urgent to update some details over others. For example, if the contact details of the distributor change then this needs rapid update even if there is a regime of six-monthly reviews.

Although it is possible to only quality control those metadata elements that have been updated during metadata maintenance, the danger is that the maintenance is incomplete and inconsistencies are created between elements. For example, the date for the content of the data resource (Temporal extent) is updated but not the reference date (Dataset reference date). The preferred approach is to subject the metadataset to complete quality control every time it is updated.

3.7.2 Quality improvement

Users will be looking for continuing improvements in the service and this means that there will be a drive for further quality improvement in the metadata. The process model at Figure 1 shows how metadata production and use would proceed on a day-to-day basis. For it to be an operation which is continually improving the quality of the output there need to be mechanisms for:

i. feeding back and acting on errors found in metadata;
ii. feeding back on improvements to processes by operators of those processes;
iii. learning and applying lessons from the use of current processes;
iv. managing change whether to the data resources, the AQLs or the standard.

Some feedback loops are shown in the process model, such as that initiated by the user, many other feedback loops are possible particularly during metadata creation. The key thing is that it is a true loop and not a "black hole" into which comments and reports disappear. The reporter deserves a response even if it is to say no action is being taken (preferably adding why there is no action!).

To use that old adage "prevention is better than cure", it is always going to be more cost-effective to create metadata that meets AQLs than to have to correct it every time. This is likely to be achieved through a combination of better procedures, tools and staff training. No-one knows better than the staff doing the job, they deserve to be heard and responded to where they have ideas for improving the process.

3.7.3 Change management

Change may be imposed by the service provider, can be internal or can be external such as a change to the standard. The most basic form of change, that to the data resource documented by the metadata, is discussed at 3.7.1.

Where changes are more fundamental, this needs to be a controlled process or else metadata quality will suffer. If, for example, the standard is changed and agreement is reached with the service provider that existing metadata will have to be updated and all newly created metadata has to meet the revised standard then a plan will have to be created and executed to:

i. modify and test the capture tools;

ii. retrain the staff;

iii. modify quality evaluation procedures and tests (possibly involving software changes);

iv. implement the changes in a controlled way at a time agreed with the service provider;

v. process all existing metadata to the revised standard;

vi. release the metadata to the service in a controlled way.

The service provider will need a complementary plan for dealing with the receipt of metadata to the revised standard or with the interface to any distributed metadatabases.

3.7.4 What to do about metadata not reaching current AQLs

If a metadata service has been running for some time but there has not been a process of quality assurance in place and no AQLs have been set, then there is the problem of dealing with metadata already in the service. To bring all metadata up to the current AQLs and ensure that these are maintained will require:

i. quality evaluation of the existing metadata;

ii. agreement between the metadata creators and the service provider on procedures to deal with metadata not reaching the required level;

iii. changes or a check on current processes to ensure that they are capable of maintaining the AQLs – this is likely to require the sort of change management discussed at 3.7.3.

iv. a controlled programme of work.

This cannot be done at a stroke and will require the full co-operation of all parties. Thought could also be given to prioritising activities to ensure that key or core metadata is dealt with first.

4. "DOS AND DON'TS" OF METADATA QUALITY

1. **Do think about the metadata user**, they are looking for suitable data resources to solve their problems, is your metadata complete, up-to-date and accurate? Is it documented at an appropriate level – too coarse or too fine a granularity? Can they discover the data resource using the extent that you have given them, are all the topics included? Are the distributor details current and correct?

2. **Do make metadata creation and maintenance integral with your other business process** – do not make it a Cinderella process given to someone that understands little and cares less about the result.

3. **Do ensure that people are trained in metadata creation** and understand the data resources that they are documenting.

4. **Do give people the right tools for the job** - make metadata entry as easy as possible and make the logical consistency checks at entry.

5. **Do think about quality as being built-in to the process** and not an add-on or incidental that may or may not be done at the end.

6. **Do strive for consistency and currency in your metadata –** have periodic checks of your metadata to ensure that no changes have taken place.

7. **Do be pragmatic when establishing AQLs –** accept that you are not striving for perfection – be SMART and come up with achievable and realistic levels. Do not develop them in a vacuum; ensure there is agreement between metadata creator and service provider.

8. **Don't ignore the obvious checks of spelling, understandability and reasonableness** – they may not be objective but they can alert you to actual or potential errors.

9. **Don't ignore the user and the feedback that they can provide** – build this into your quality improvement.

10. **Don't expect to bring all existing metadata up to current expectations of quality at a stroke** – it will take time to get the procedures and checks in place and to overhaul what is already in the system.

ANNEX A. AGGREGATED AQLS FOR THREE LEVELS OF CONFORMANCE

Applicable to a metadata produced with UK GEMINI2.2 – for guidance only

The Tables indicate AQLs by metadata element. Table A.1 applies to datasets and datasets series, while Table A.2 applies to services. Note that some elements are conditional. These are applicable only when the condition is met.

Metadata elements marked with (O) are optional and those marked with (C) are conditional. In both cases the AQLs are conditional on the metadata element being present.

Level 1 **–** all AQLs in cells with **Bold type** have to be met to achieve Level 1 conformance.

Level 2 **–** all AQLs in cells with **Bold type +** Normal type have to be met to achieve Level 2 conformance.

Level 3 **–** all AQLs in cells with **Bold type +** Normal type + *Italic type* have to be met to achieve Level 3 conformance.

See 3.3 for an explanation of conformance levels.

Table A.1 AQLs for datasets and dataset series

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi-cation**	**Non-quantitative**	**Quantitative**
Title	**No commission**	**No omission**	**No violation(s) of data type**	**No violation(s) of domain**								Item must pass	
Alternative title (O)												*Item(s) must pass*	
Dataset language (C)		**No omission**										Item(s) must pass	
Abstract	**No commission**												
Topic category											Item(s) must pass		
Keyword												Item(s) must pass	
Temporal extent					**Item must pass**					Item(s) must pass			
Dataset reference date													
Lineage	**No commission**											Item must pass	
Extent (O)			**No violation(s) of data type**	**No violation(s) of domain**		**All items must pass**			Item(s) must pass				

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi-cation**	**Non-quantitative**	**Quantitative**
Vertical extent information (O)	**No commission if class present**	**No omission if class present**	**No violations of data type in class instances**	**No violations of domain in class instances**	**All class instances must pass**			*All class instances must pass*				*All class instances must pass*	
Minimum value	**No commission**	**No omission**	**No violation(s) of data type**	**No violation of domain**	**Item must pass**			*Item(s) must pass*					
Maximum value													
Coordinate reference system												*Item must pass*	
Spatial reference system											Item must pass		
Spatial resolution (C)													*Item must pass*
Resource locator (C)												Item(s) must pass	
Data format (O)													

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi-cation**	**Non-quantitative**	**Quantitative**
Responsible organisation		**No omission**	**No violations of data type in class instances**	**No violations of domain in class instances**								All class instances must pass	
Contact position (O)	**No commission**		**No violation of data type**	**No violation of domain**								*Item(s) must pass*	
Organisation name		**No omission**											
Postal address (O)													
Telephone number (O)													
Facsimile number (O)													
Email address		**No omission**											
Web address O)													
Responsible party role		**No omission**											
Frequency of update	**No commission**										Items must pass		

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi-cation**	**Non-quantitative**	**Quantitative**
Limitations on public access		**No omission**	**No violation of data type**	**No violation of domain**								*Items must pass*	
Use constraints													
Additional information source (O)	**No commission**												
Metadata date		**No omission**								Item must pass			
Metadata language (C)												*Items must pass*	
Metadata point of contact		**No omission**											
Unique resource identifier													
Resource type	**No commission**										Item must pass		
Conformity (C)		**No omission if class present**	**No violations of data type in class instances**	**No violations of domain in class instances**								*All class instances must pass*	
Specification		**No omission**	**No violation of data type**	**No violation of domain**								*Items must pass*	
Degree													
Explanation													
Equivalent scale (O)													*Item must pass*

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**		**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
		Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
		Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi-cation**	**Non-quantitative**	**Quantitative**
Bounding box		**No commission**	**No omission**	**No violation(s) of data type**	**No violation(s) of domain**								*All class instances must pass*	
	West bounding longitude							Item(s) must pass						
	East bounding longitude													
	South bounding latitude					**Item must pass**								
	North bounding latitude													

Table A.2 AQLs for services

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi -cation**	**Non-quantitative**	**Quantitative**
Title	**No commission**	**No omission**	**No violation(s) of data type**	**No violation(s) of domain**								Item must pass	
Alternative title (O)												*Item(s) must pass*	
Dataset language (C)		**No omission**										Item(s) must pass	
Abstract	**No commission**												
Keyword													
Temporal extent (C)					**Item must pass**					Item must pass			
Dataset reference date													
Lineage (O)	**No commission**											Item must pass	
Extent (O)			**No violation(s) of data type**	**No violation(s) of domain**		**All items must pass**			Item(s) must pass				

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi -cation**	**Non-quantitative**	**Quantitative**
Vertical extent information (O)	**No commission if class present**	**No omission if class present**	**No violations of data type in class instances**	**No violations of domain in class instances**	**All class instances must pass**			*All class instances must pass*				*All class instances must pass*	
Minimum value	**No commission**	**No omission**	**No violation of data type**	**No violation of domain**	**Item must pass**			*Item(s) must pass*					
Maximum value													
Coordinate reference system												*Item must pass*	
Spatial reference system (C)											Item must pass		
Spatial resolution (C)													*Item must pass*
Resource locator (C)												Item(s) must pass	
Data format (O)													

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi -cation**	**Non-quantitative**	**Quantitative**
Responsible organisation		**No omission**	**No violations of data type in class instances**	**No violations of domain in class instances**								All class instances must pass	
Contact position (O)	**No commission**		**No violation of data type**	**No violation of domain**								Item(s) must pass	
Organisation name		**No omission**											
Postal address (O)													
Telephone number (O)													
Facsimile number (O)													
Email address		**No omission**											
Web address (O)													
Responsible party role		**No omission**											

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi -cation**	**Non-quantitative**	**Quantitative**
Frequency of update (C)	**No commission**		**No violation(s) of data type**	**No violation (s) of domain**							Items must pass		
Limitations on public access		**No omission**										*Items must pass*	
Use constraints													
Additional information source (O)	**No commission**												
Metadata date		**No omission**								Item must pass			
Metadata language (C)												*Items must pass*	
Metadata point of contact		**No omission**											
Unique resource identifier (O)													
Spatial data service type		**No omission**									Item must pass		
Coupled resource												Items must pass	
Resource type	**No commission**										Item must pass		

Element name Those marked (O) are optional, those marked (C) are conditional **(Elements equating to a class)**	**Metadata quality elements and Metadata quality sub-elements** **AQL in cells**												
	Completeness		**Logical consistency**				**Positional accuracy**			**Temporal accuracy**	**Thematic accuracy**		
	Commission	**Omission**	**Data type**	**Domain**	**Ordering**	**Relative**	**Coord accuracy**	**Vertical accuracy**	**Extent accuracy**	**Date accuracy**	**Classifi -cation**	**Non-quantitative**	**Quantitative**
Conformity (C)		**No omission if class present**	**No violations of data type in class instances**	**No violations of domain in class instances**								*All class instances must pass*	
Specification		**No omission**	**No violation of data type**	**No violation of domain**								*Items must pass*	
Degree													
Explanation													
Equivalent scale (O)													*Item must pass*
Bounding box(C)	**No commission**	**No omission**	**No violations of data type in class instances**	**No violations of domain in class instances**								*All class instances must pass*	
West bounding longitude (C)	**No commission**	**No omission**	**No violation of data type**	**No violation of domain**			Items must pass					*Items must pass*	
East bounding longitude (C)													
South bounding latitude (C)					**Item(s) must pass**								
North bounding latitude (C)													

ANNEX B. QUALITY EVALUATION PROCEDURES

These apply to UK GEMINI2.2 elements and are for guidance only.

Explanation of the tables

- Each metadata element, including those equating to a class within a main element, has a separate table;
- Definitions and descriptions of metadata elements and rules for their creation are found in Part 2 of the Guidelines;
- Metadata quality elements and sub-elements are defined in Table 1 of these Guidelines;
- Quality measure – type of test to be applied to evaluate a quality sub-element e.g. absence of items, validity of data type;
- Measure description – type of measure used in the test, e.g. pass-fail;
- Evaluation method - the operations to be performed to arrive at a metadata quality result, e.g. check data type;
- Value type – type of value or unit used for reporting the metadata quality result, e.g. Boolean variable, distance in metres, percentage;
- AQL – Acceptable Quality Level.

Note: Conditional Pass-Fail – this means that the procedure is conditional on the element being present, i.e. it is an optional element.

Annex B.1 Title

Metadata element name				Title
Obligation				Mandatory
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Title. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Title. If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check item is Free Text. If not valid Free Text then fail else pass
			Value type	Boolean variable
			Conformance level	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Title of data resource correct. If other sources confirm Title or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include, product catalogues and distributor's website. Even if there are no other sources or the data resource has no formal name and one has been created, elementary checks against Abstract and of spelling, understandability and conformance to rules for entry should be made.

Annex B.2 Alternative title

Metadata element name				Alternative title
Obligation				Optional
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Alternative title(s) present then check data type of each item. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Alternative title(s) present then check domain of each item. Check item is Free Text. If not valid Free Text then fail else pass
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Alternative title(s) present then use other sources to check that each Alternative title of data resource is correct . If other sources confirm Alternative title or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against Abstract and of spelling, understandability and conformance to rules for entry should be made. Check for duplicate entries.

Annex B.3 Dataset language

Metadata element name				Dataset language
Obligation				Conditional – data resource contains textual information
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Check if resource contains textual information. If so, then count occurrences of Dataset language. If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type of each occurrence. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check each occurrence is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	Recommended that this conforms to a controlled vocabulary e.g. ISO 639-2 (see rules for entry in Part 2 of these Guidelines). If so, then this can be checked
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check against each Dataset language for correctness. If other sources confirm Dataset language or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	All items must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. Is the item a recognised language and is it spelt correctly? Check for duplicate entries

Annex B.4 Abstract

Metadata element name				Abstract
Obligation				Mandatory
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Abstract. If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Abstract. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check item is Free Text. If not valid Free Text then fail else pass
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Abstract correct. If other sources confirm content and or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	All items must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. Is the item in a recognised language and is it spelt correctly? Does the abstract conform to the rules for entry and provide a clear statement of the content of the data resources and not just general background information?

Annex B.5 Topic category

Metadata element name				Topic category
Obligation				Mandatory for datasets and dataset series, optional for services
Number of occurrences				Multiple
Data Type				Class
Domain				Code list
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, then count occurrences of Topic category. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type of each item. If code of type specified in Standard then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain of each item. If domain not within code range listed in Specification then fail else pass.
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	Currently the Specification contains integer codes in the range 001-019.
	Thematic accuracy	Classification	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check each Topic category is correct. If other sources confirm Topic category or impossible to check then pass. If checks indicate discrepancy or key Topic categories omitted then fail.
			Value type	Boolean variable
			AQL	All items must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. Do the topic categories relate to the Abstract? Do those chosen follow the rules for data entry? Are they complete? Check for duplicate entries.

Annex B.6 Keyword

Metadata element name				Keyword
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Keyword. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type of each item. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check each item of Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check against each Keyword for correctness. If other sources confirm Subject or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	All items must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. There should be some correlation with the Abstract and Topic category. Check for duplicate entries.

Annex B.7 Temporal extent

Metadata element name				Temporal extent
Obligation				Mandatory for datasets and dataset series, conditional for services
Number of occurrences				Multiple
Data Type				Date as specified by ISO 8601
Domain				Duration of period as specified by ISO 8601
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is dataset or dataset series, count occurrences of Temporal extent. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid date data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If date conforms to ISO 8601 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	There must be a date, even if only for a century. Nulls are not valid.
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain, which may indicate duration between two dates. The fromdate or todate may be to any degree of precision allowed by ISO 8601 from century to full date and time. The fromdate or todate may be left blank to indicate uncertainty but not both dates (see Part 2 of these Guidelines). If valid date(s) then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Ordering	**Quality measure**	Date ordering
			Measure description	Pass-Fail
			Evaluation method	If duration given then check consistency of date ordering. If fromdate > todate then fail else pass.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

(Continued overleaf)

Metadata quality element **Metadata quality sub-element**				
	Temporal accuracy	Date accuracy	**Quality measure**	Date accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Temporal extent for accuracy of date. (fromdate or todate of data capture should correspond to the dates in the data resource to the nearest year.) If fromdate (where supplied) and todate (where supplied) accurate or impossible to check then pass. If other sources indicate a discrepancy in fromdate (where supplied) or todate (where supplied) then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of dates should be made.

Annex B.8 Dataset reference date

Metadata element name				Dataset reference date
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				Date as specified by ISO 8601
Domain				Date
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Dataset reference date. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If comprises date and date type then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check date is a single date not duration and may be to any degree of precision allowed by ISO 8601 from year to full date and time (see Part 2 of these Guidelines). Check date type is one of creation, publication, revision. If either date or date type not valid domain then fail else pass.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Temporal accuracy	Date accuracy	**Quality measure**	Date accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check date for accuracy. If date accurate or impossible to check then pass. If other sources indicate a discrepancy in date or then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of date and conformance to the rules for entry should be made.

Annex B.9 Lineage

Metadata element name				Lineage
Obligation				Mandatory for datasets and dataset series, optional for services
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	Count number of occurrences of Lineage. If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Conditional Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, then count number of occurrences. If one or more, then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Lineage present then check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Lineage present then check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	In addition could check if item in valid language
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Lineage present then using other sources check Lineage of data resource correct. If other sources confirm Lineage or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of spelling, understandability and conformance to the rules for entry should be made.

Annex B.10 Extent

Metadata element name				Extent
Obligation				Optional
Number of occurrences				Multiple
Data Type				Class
Domain				code identifying the extent, plus optional authority code
Metadata quality element **Metadata quality sub-element**	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check that the class comprises an identifier and (optionally) an authority code. If so then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check that the identifier code and the authority code if present are valid values. If so, then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Relative	**Quality measure**	Extent v latitude/longitude
			Measure description	Pass-Fail
			Evaluation method	Check that for each Extent that some part of the bounding box defined by the East and West bounding longitude and the North and South bounding latitude overlaps with some part of the polygon defined by that Extent. If overlap occurs then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-
	Positional accuracy	Extent accuracy	**Quality measure**	Extent accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the locations referenced by the data resource are completely contained in the Extent(s). If other sources confirm the area completely contained then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a map base and the rules for entry should be made.

Annex B.11 Vertical extent information

Metadata element name				Vertical extent information
Obligation				Optional
Number of occurrences				Single
Data Type				Class
Domain				Aggregated class EX_VerticalExtent (see below)
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count number of occurrences of item. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical Extent Information class present then for each class instance check no omissions of elements. If all instances pass then pass else fail.
			Value type	Boolean variable
			AQL	No omission if class present
			Notes	All elements must be present in each class instance.
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical Extent Information class present then for each class instance check conformance of each element. If all instances pass then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type in each element in each class instance
			Notes	This is to test that all element values pass in each class instance.
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical extent information class present then for each class instance check conformance of each element. If all instances pass then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain in each element in each class instance
			Notes	This is to test that all element values pass in each class instance.
		Ordering	**Quality measure**	Max/min ordering
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical extent information class present then for each class instance check conformance of Minimum Value element. If Minimum value passes then pass else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that Minimum value is less than or equal to Maximum value in each class instance.

(Continued overleaf)

Metadata quality element Metadata quality sub-element				
	Positional box accuracy	Vertical accuracy	**Quality measure**	Max/Min accuracy
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical extent information class present then for each class instance check conformance of Minimum value and Maximum value. If Minimum Value and Maximum value pass then pass else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that Maximum and Minimum values pass accuracy test in each class instance.
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Vertical extent information class present then for each class instance check correctness of Coordinate reference system. If Coordinate reference system passes then pass else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that Coordinate reference system passes content accuracy test in each class instance.

For details of EX_VerticalExtent Class see below.

EX_VerticalExtent Class

Metadata element name				Minimum value
Obligation				Mandatory
Number of occurrences				Single
Data Type				Real
Domain				Real
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Minimum value within Vertical extent information. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Minimum value within Vertical extent information element. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If Real of any value then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Ordering	**Quality measure**	Max/min consistency
			Measure description	Pass-Fail
			Evaluation method	Check the Minimum and Maximum values for consistency. If Maximum value => Minimum value then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-
	Positional accuracy	Vertical accuracy	**Quality measure**	Max/Min accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the Minimum value of the vertical extent in the data resource. If Maximum value = > Minimum value or impossible to check then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a contour map base should be made.

EX_VerticalExtent Class

Metadata element name				Maximum value
Obligation				Mandatory
Number of occurrences				Single
Data Type				Real
Domain				Real
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Maximum value within Vertical extent information. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Maximum value within Vertical extent information element. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If Real of any value then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Ordering	**Quality measure**	Max/min consistency
			Measure description	Pass-Fail
			Evaluation method	Check the Minimum and Maximum values for consistency. If Maximum value > Minimum value then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-
	Positional accuracy	Vertical accuracy	**Quality measure**	Max/Min accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the Maximum value of the vertical extent in the data resource. If value > Minimum value or impossible to check then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a contour map base should be made.

EX_VerticalExtent Class

Metadata element name				Coordinate reference system
Obligation				Mandatory
Number of occurrences				Single
Data Type				Class
Domain				Class comprises an identifier of the coordinate reference system plus an (optional) authority code
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Coordinate reference system within Vertical extent information. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Coordinate reference system within Vertical Extent Information element. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Class then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If valid coordinate reference system identifier then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check that Coordinate reference system is a recognised coordinate reference system applicable to the data resource, and that a selection of coordinate values are consistent with the coordinate reference system. If checks indicate a discrepancy then fail, else pass.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Annex B.12 Spatial reference system

Metadata element name				Spatial reference system
Obligation				Optional, but should be provided where relevant
Number of occurrences				Multiple
Data Type				Class
Domain				(optional) authority code plus code identifying the spatial reference system
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If one or two codes then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If code within range specified by authority then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Classification	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Identify Spatial reference system from code and check that it is appropriate for the data resource. If check indicates discrepancy then fail, else pass.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Annex B.13 Spatial resolution

Metadata element name				Spatial resolution
Obligation				Conditional – for datasets and dataset series where a resolution distance can be specified, and for services where there is a restriction on the spatial resolution of the service
Number of occurrences				Multiple
Data Type				Real
Domain				Real>0
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Spatial resolution present then check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Spatial resolution present then check domain. If Real > 0 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Spatial resolution present, then using other sources check that the value of the item is within +/- 50%[7] of the value believed to be true. If other sources confirm the value or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks for conformance to rules for entry and reasonableness should be made (e.g. if the data resource is a 1:50,000 map then it is not going to have a spatial resolution of (say) <10 m).

[7] Proposed value – subject to modification.

Annex B.14 Resource locator

Metadata element name				Resource locator
Obligation				Conditional – when on-line access is available
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Resource locators(s) present then check data type of each item. If Character String then pass, else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Resource locators(s) present then check domain of each item. Check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Resource locator(s) present then use other sources to check that each occurrence is correct and current. If other sources confirm Resource lLocator or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. If a URL or other location is given, can it be accessed and the data downloaded? Check for duplicate entries.

Annex B.15 Data format

Metadata element name				Data format
Obligation				Optional
Number of occurrences				Multiple
Data Type				Class MD_Format from ISO 19115
Domain				The following is required: – name of format – version of format (date, number etc)
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type of each item. If Class MD_Format then pass, else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check each item contains name and version. If valid Free Text then pass, else fail
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check against each Data format for correctness and currency relative to the Date of Update of Metadata. If other sources confirm Data format or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	All items must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made for conformance to rules for entry, spelling and accepted data format names. There may be some correlation with the Abstract. Check for duplicate entries.

Annex B.16 Responsible organisation

Metadata element name				Responsible organisation
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				Class
Domain				Class CI_ResponsibleParty
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count instances of Responsible organisation. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission.
			Notes	At least one Responsible organisation, with responsible party role ‘distributor’ should be present..
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check conformance of each Responsible organisation instance to data type. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type in each element in each instance
			Notes	This is to test that all element values pass within each class instance
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check conformance of each Responsible organisation instance to domain. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain in each element in each class instances
			Notes	This is to test that all element values pass in each class instance.
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check conformance of each Responsible organisation instance. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that all element values pass in each class instance.

For details of CI_ResponsibleParty Class see below

CI_ResponsibleParty Class

Metadata element name				Contact position
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count occurrences of Contact position. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources, check Contact position of data resource correct. If other sources confirm Contact position or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of spelling and conformance to rules for entry should be made.

CI_ResponsibleParty Class

Metadata element name				Organisation name
Obligation				Mandatory
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count occurrences of Organisation name. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count occurrences of Organisation name. If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Character String then pass, else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check item is Free Text. If valid Free Text then pass, else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Organisation name of data resource correct and current relative to the Metadata date. If other sources confirm Organisation name or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. Is it a recognised distributor, is it spelt correctly, is the name given in full?

CI_ResponsibleParty Class

Metadata element name				Postal address
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Presence of excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count number of occurrences of Postal address. If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Postal address is present then check data type. If Character String then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Postal address is present then check domain. If valid Free Text then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Postal Address is present then using other sources check that item is correct and current relative to the Metadata date If other sources confirm Postal address or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made. Is the address complete, does it have a post code, can you find it in PAF (e.g. can it be accessed on the Royal Mail website)?

CI_ResponsibleParty Class

Metadata element name				Telephone number
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Presence of excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count number of occurrences of Telephone number. If more than one then fail else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Telephone number is present then check data type. If Character String then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	If Telephone number is present then check domain. If valid Free Text then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Telephone number is present then using other sources. check that item is correct and current relative to the Metadata date. If other sources confirm Telephone number or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made. Is the telephone number complete, can you ring the number and get the correct distributor?

CI_ResponsibleParty Class

Metadata element name				Facsimile number
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Presence of excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	In each occurrence of Responsible organisation, count number of occurrences of Facsimile number. If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Facsimile Number present then check data type. If Character String then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Facsimile Number is present then check domain. If valid Free Text then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Facsimile Number is present then using other sources check that item is correct and current relative to the Metadata date If other sources confirm Facsimile number or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made. Is the facsimile number complete, can you contact the number and fax the correct distributor?

CI_ResponsibleParty Class

Metadata element name				Email address
Obligation				Mandatory
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Conditional Pass-Fail
			Evaluation method	For each occurrence of Responsible organisation, count number of occurrences of Email address If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of item
			Measure description	Conditional Pass-Fail
			Evaluation method	For each occurrence of Responsible organisation, count number of occurrences of Email address If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	Check data type. If Character String then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	Check domain. If valid Free Text then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	Using other sources check that item is correct. If other sources confirm Email address or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made. Can you successfully e-mail the address?

CI_ResponsibleParty Class

Metadata element name				Web address
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Presence of excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	For each occurrence of Responsible organisation, count the number of occurrences of Web address, If more than one then fail else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Web address is present then check data type. If Character String then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	If Web address is present then check domain. If valid Free Text then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Web address is present then using other sources check that item is correct. If other sources confirm Web address or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made. Can you successfully locate the URL?

CI_ResponsibleParty Class

Metadata element name				Responsible party role
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				CodeList
Domain				Code list ResponsiblePartyRole
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of item
			Measure description	Pass-Fail
			Evaluation method	For each occurrence of Responsible organisation, count number of occurrences of Responsible party role If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Code then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If valid code (1-11) then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	Using other sources check that item is correct. If other sources confirm or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks of should be made.

Annex B.17 Frequency of update

Metadata element name				Frequency of update
Obligation				Optional
Number of occurrences				Single
Data Type				Code list
Domain				Code list MD_MaintenanceFrequencyCode
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Frequency of update. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If code of type specified in Specification then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If within code range specified in Specification then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	Current Standard has codes in range 001-012
	Thematic accuracy	Classification	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check that Frequency of update is correct. If other sources confirm Frequency of update or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made to ensure that it appears reasonable in relation to the Abstract and conforms to the rules for entry.

Annex B.18 Limitations on public access

Metadata element name				Limitations on public access
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Limitations on public access. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	Check data type of each occurrence. If CharacterString then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	Check domain of each occurrence. If free text then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	Using other sources check that each constraint is correct and current. If other sources confirm value or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made to ensure that it appears reasonable in relation to the Abstract and Distributor and conforms to the rules for entry. Check for duplicate entries.

Annex B.19 Use constraints

Metadata element name				Use constraints
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Limitations on public access. If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	Check data type of each occurrence. If CharacterString then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	Check domain of each occurrence. If free text then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Use constraint(s) present then using other sources check that each constraint is correct and current. If other sources confirm Use constraint or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made to ensure that it appears reasonable in relation to the Abstract and Distributor. Check for duplicate entries.

Annex B.20 Additional information source

Metadata element name				Additional information source
Obligation				Optional
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Presence of excess items
			Measure description	Conditional Pass-Fail
			Evaluation method	If Additional Information Source present then count number of occurrences. If more than one then fail, else pass.
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Additional Information Source present then check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Additional Information Source present then check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	In addition could check if item in valid language
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Additional Information Source present then using other sources check Additional Information Source is correct and current relative to the Metadata date.. If other sources confirm Additional Information Source or impossible to check then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made. Is the source accessible if a URL? Does it only contain references and not additional information?

Annex B.21 Metadata date

Metadata element name				Metadata date
Obligation				Mandatory
Number of occurrences				Single
Data Type				Date as specified by ISO 8601
Domain				Single date as specified by ISO 8601
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Metadata date. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Metadata date. If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If date conforms to ISO 8601 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	Null dates are not valid
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain of Metadata date. A single date should be given to the precision of at least a year. If valid domain then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Temporal accuracy	Date accuracy	**Quality measure**	Date accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check accuracy of Metadata. date should correspond to the date of when the metadata was last changed or checked. If checks confirm date or impossible to check then pass. If other sources indicate a discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	This is difficult to check independently other than the test of reasonableness i.e. if the date is some years previously and yet the Abstract or Lineage refers to recent events, this will indicate that the Metadata date have not been updated. Check for conformance to rules for entry.

Annex B.22 Metadata language

Metadata element name				Metadata language
Obligation				Conditional – required for INSPIRE
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Absence of item
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Metadata language. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violations of domain
			Notes	Recommended that this conforms to a controlled vocabulary e.g. ISO 639-2 (see rules for entry in Part 2 of these Guidelines). If so, then this can be checked.
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check language of metadata for correctness of value of item. If correct or impossible to check then pass, else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Is the item a recognised language and is it spelt correctly?

Annex B.23 Metadata point of contact

Metadata element name				Metadata point of contact
Obligation				Mandatory
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count instances of Metadata point of contact. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission if item present.
			Notes	Organisation name and contact email address must be present.
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type of each Metadata point of contact. If CharacterString then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type in occurrence of item.
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check that each item contains free text. If all conform then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain in each occurrence.
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check each instance of Metadata point of contact to ensure that it is a valid contact and contains valid organisation name and valid contact email address. If all conform then pass else fail.
			Value type	Boolean variable
			AQL	All instances must pass
			Notes	-

Annex B.24 Unique resource identifier

Metadata element name				Unique resource identifier
Obligation				Mandatory for datasets and dataset series
Number of occurrences				Multiple
Data Type				Class
Domain				The class comprises a code and a codespace (optional)
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Unique resource identifier. If one or more then pass, else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	Not applicable for a service
Metadata quality element **Metadata quality sub-element**	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Unique resource identifier present then check data type of each item. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	Check that domain of each element is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	Check that Unique resource identifier identifies the data resource. If checks indicate discrepancy then fail, else pass.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Annex B.25 Spatial data service type

Metadata element name				Spatial data service type
Obligation				Conditional – if resource is a service
Number of occurrences				Single
Data Type				GenericName
Domain				Restricted list
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Spatial data service type If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	Only applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If GenericName then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check value. If contained within set of allowable values then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	Allowable values: • Discovery Service (discovery) • View Service (view) • Download Service (download) • Transformation Service (transformation) • Invoke Spatial Data Service (invoke) • Other Service (other)
	Thematic accuracy	Classification	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check that Spatial data service type is correct. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Annex B.26 Coupled resource

Metadata element name				Coupled resource
Obligation				Mandatory for services, not applicable to data
Number of occurrences				Multiple
Data Type				CharacterString
Domain				Unique resources identifier (URI) or locator of the data resources
	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Coupled resource If one or more then pass else fail
			Value type	Boolean variable
			AQL	No omission
			Notes	Only applicable for a service
Metadata quality element **Metadata quality sub-element**	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Coupled resource(s) present then check data type of each item. If Character String then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Coupled resource(s) present then check domain of each item. Check item is Free Text. If valid Free Text then pass else fail
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non- quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Coupled resource(s) present then check value identifies the data resource that the service operates on. If checks indicate discrepancy then fail, else pass.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Annex B.27 Resource type

Metadata element name				Resource type
Obligation				Mandatory
Number of occurrences				Single
Data Type				Code list
Domain				Code list MD_ScopeCode (from ISO 19115)
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Absence of item
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Resource type. If more than one then fail, else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Resource type. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If code of type specified in Standard then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If within code range specified in Standard then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	Allowable values are ‘dataset’, ‘series’, ‘service’
	Thematic accuracy	Classification	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check resource and determine whether Resource type is correct. If correct then pass, else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	.

Annex B.28 Conformity

Metadata element name				Conformity
Obligation				Conditional – required if claiming conformance to INSPIRE
Number of occurrences				Multiple
Data Type				Class
Domain				Aggregated class (see below)
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Conditional Pass-Fail
			Evaluation method	If Conformity class present then for each class instance check no omissions of elements. If all instances pass then pass else fail.
			Value type	Boolean variable
			AQL	No omission if class present
			Notes	All elements must be present in each class instance.
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Conformity class present then for each class instance check conformance of each element. If all instances pass then pass else fail
			Value type	Boolean variable
			AQL	No violation of data type in each element in each class instance
			Notes	This is to test that all element values pass in each class instance.
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Conformity class present then for each class instance check conformance. If all instances pass then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain in each element in each class instance
			Notes	This is to test that all element values pass.
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Conformance class present then for each class instance check correctness of Specification and Degree. If Specification and Degree pass then pass, else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that Specification and Degree pass content accuracy test in each class instance.

For details of Class see below

Metadata element name				Specification
Obligation				Mandatory
Number of occurrences				Single
Data Type				Class
Domain				CI_Citation (from ISO 19115) – title and reference date
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Specification within Conformity element. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If CI_Citation (title and reference date) then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If valid title and reference date then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check Specification for correctness. If correct then pass, otherwise fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

Metadata element name				Degree
Obligation				Mandatory
Number of occurrences				Single
Data Type				Boolean
Domain				'true' or 'false'
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Degree within Conformity element. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Boolean then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If valid Boolean then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Degree for correctness. If other sources confirm Degree or impossible to check then pass. If checks indicate a discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. The element 'explanation' will give some indication of whether degree is correct or not.

Metadata element name				Explanation
Obligation				Mandatory
Number of occurrences				Single
Data Type				CharacterString
Domain				Free text
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count occurrences of Explanation within Conformity element. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If CharacterString then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If valid Free Text then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Using other sources check Explanation for correctness. If other sources confirm Explanation or impossible to check, then pass. If checks indicate a discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks should be made to ensure that it is a reasonable explanation.

Annex B.29 Equivalent scale

Metadata element name				Equivalent scale
Obligation				Optional
Number of occurrences				Multiple
Data Type				Real
Domain				Real>0
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Conditional Pass-Fail
			Evaluation method	If Spatial Resolution present then check data type. If Integer then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Conditional Pass-Fail
			Evaluation method	If Equivalent scale present then check domain. If Integer > 0 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Thematic accuracy	Quantitative	**Quality measure**	Correctness
			Measure description	Conditional Pass-Fail
			Evaluation method	If Equivalent scale present then using other sources check that the value of the item is within +/- 50%[8] of the value believed to be true. If other sources confirm the value or impossible to confirm then pass. If checks indicate discrepancy then fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks for conformance to rules for entry and reasonableness should be made.

[8] Proposed value – subject to modification.

Annex B.30 Bounding box

Metadata element name				Bounding box
Obligation				Mandatory for datasets and dataset series, conditional for services on there being a defined extent for the service
Number of occurrences				Multiple
Data Type				Class
Domain				Class, with the elements: • West bounding longitude • East bounding longitude • South bounding latitude • North bounding latitude
Metadata quality element **Metadata quality sub-element**	Completeness	Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	Count instances of Bounding box. If one or more then pass, else fail.
			Value type	Boolean variable
			AQL	No omission.
			Notes	-
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	For each element, check that data type. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of data type in each element in each instance
			Notes	This is to test that all element values pass within each class instance
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check conformance of each element to domain. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	No violation of domain in each element in each class instances
			Notes	This is to test that all element values pass in each class instance.
	Thematic accuracy	Non-quantitative	**Quality measure**	Correctness
			Measure description	Pass-Fail
			Evaluation method	Check conformance of each element. If all conform then pass, else fail.
			Value type	Boolean variable
			AQL	All class instances must pass
			Notes	This is to test that all element values pass in each class instance.

For details of the elements in the class see below.

West bounding longitude

Metadata element name				West bounding longitude
Obligation				Mandatory for datasets and dataset services, conditional for services
Number of occurrences				Single
Data Type				Real
Domain				-180.0 <= value <= 180.0
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count number of occurrences of item. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, count occurrences of item. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If -180 <= value <= 180 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Positional accuracy	Coordinate accuracy	**Quality measure**	Bounding box accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the limits of the locations referenced by the data resource fall within the minimum definable bounding box. If the value of the greatest westerly extent of data resource = value of west bounding longitude +/- 0.1^{o} then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a map base should be made. Limits other than +/- 0.1^{o} may be used as long as specified.

East bounding longitude

Metadata element name				East bounding longitude
Obligation				Mandatory for datasets and dataset services, conditional for services
Number of occurrences				Single
Data Type				Real
Domain				-180.0 <= value <= 180.0
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count number of occurrences of item. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, count occurrences of item. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If -180 <= value <= 180 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
	Positional accuracy	Coordinate accuracy	**Quality measure**	Bounding box accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the limits of the locations referenced by the data resource fall within the minimum definable bounding box. If the value of the greatest easterly extent of data resource = value of east bounding longitude +/- 0.1^{o} then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a map base should be made. Limits other than +/- 0.1^{o} may be used as long as specified.

South bounding latitude

Metadata element name				South bounding latitude
Obligation				Mandatory for datasets and dataset services, conditional for services
Number of occurrences				Single
Data Type				Real
Domain				-90.0 <= value <= 90.0
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count number of occurrences of item. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, count occurrences of item. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If -90.0 <= value <= 90.0 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Ordering	**Quality measure**	North/South ordering
			Measure description	Pass-Fail
			Evaluation method	Check the bounding coordinates for consistency. If South bounding latitude south of North bounding latitude then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

(Continued overleaf)

Metadata quality element **Metadata quality sub-element**	Positional accuracy	Coordinate accuracy	**Quality measure**	Bounding box accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the limits of the locations referenced by the data resource fall within the minimum definable bounding box. If the value of the greatest southerly extent of data resource = value of South bounding latitude +/- 0.1^{o} then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a map base should be made. Limits other than +/- 0.1^{o} may be used as long as specified.

North bounding latitude

Metadata element name				North bounding latitude
Obligation				Mandatory for datasets and dataset services, conditional for services
Number of occurrences				Single
Data Type				Real
Domain				-90.0 <= value <= 90.0
Metadata quality element **Metadata quality sub-element**	Completeness	Commission	**Quality measure**	Excess items
			Measure description	Pass-Fail
			Evaluation method	Count number of occurrences of item. If more than one then fail else pass
			Value type	Boolean variable
			AQL	No commission
			Notes	-
		Omission	**Quality measure**	Absence of items
			Measure description	Pass-Fail
			Evaluation method	If resource is a dataset or dataset series, count occurrences of item. If one or more then pass else fail.
			Value type	Boolean variable
			AQL	No omission
			Notes	May not be applicable for a service
	Logical consistency	Data type	**Quality measure**	Valid data type
			Measure description	Pass-Fail
			Evaluation method	Check data type. If Real then pass else fail.
			Value type	Boolean variable
			AQL	No violation of data type
			Notes	-
		Domain	**Quality measure**	Within specified domain
			Measure description	Pass-Fail
			Evaluation method	Check domain. If -90.0 <= value <= 90.0 then pass else fail.
			Value type	Boolean variable
			AQL	No violation of domain
			Notes	-
		Ordering	**Quality measure**	North/South ordering
			Measure description	Pass-Fail
			Evaluation method	Check the bounding coordinates for consistency. If north bounding latitude north of south bounding latitude then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	-

(Continued overleaf)

Metadata quality element **Metadata quality sub-element**	Positional accuracy	Coordinate accuracy	**Quality measure**	Bounding box accuracy
			Measure description	Pass-Fail
			Evaluation method	Using other sources check the limits of the locations referenced by the data resource fall within the minimum definable bounding box. If the value of the greatest northerly extent of data resource = value of north bounding latitude +/- 0.1^{o} then pass else fail.
			Value type	Boolean variable
			AQL	Item must pass
			Notes	Other sources could include product catalogues and distributor's website. Even if there are no other sources, elementary checks against a map base should be made. Limits other than +/- 0.1^{o} may be used as long as specified.

Annex C. Quality Evaluation Methods

C.1 Basic issues

The purpose of quality evaluation is to establish a quality result. Once the quality elements and sub-elements and their relevant measures have been identified, then quality evaluation methods have to be used to arrive at metadata quality result.

In arriving at suitable methods there are a number of basic issues that need to be resolved.

i. What is going to be the basis for evaluating quality - are external sources available or can we only test against the metadata itself?

ii. Can some or all of the methods be automated?

iii. Are tests going to be based on a full inspection of all metadata or only a sample?

These issues are inter-related and are discussed below. What follows is based in part on ISO 19114:2003 Geographic information – Quality evaluation procedures. These Guidelines do not include specific guidance on sampling methods nor do they propose suitable pass/fail criteria for batch testing; this is a major topic in its own right. The reader is referred to ISO 19114.

C.2 Basis for tests

Methods can be divided into:

- *internal* - these test metadata quality using only information contained within the metadata itself. For example, tests of logical consistency for data type and domain need only the metadata;
- *external* – these test metadata quality using whatever external sources may be available. For example, tests of positional accuracy or content correctness require information from sources independent of the metadata.

To effectively measure all elements of metadata quality both internal and external methods are required.

There are particular difficulties with assessing the quality of metadata because the universe of discourse is effectively much more limited than that of the data resource being documented. In some cases, for example if the service provider is testing the metadata, the data resource may not be available. This can limit external testing to whatever external sources are available and constrains what can be done. It can also introduce some elements of subjectivity such as reasonableness and understandability.

C.3 Automation of methods

For some types of measures, the evaluation methods may be susceptible of automation, this is typically so in the case of direct methods using internal sources. Measures of logical consistency frequently fall into this category where data types or domains are being tested. In other cases visual inspection will be needed.

C.4 Full inspection or sampling

Full inspection involves the testing of every item within scope which may be every instance of every metadata element or may be every metadataset in a batch of metadata. Typically, full inspection is relevant to small populations of metadata or automated methods.

Sampling involves the use of a sampling method such as random sampling such that sufficient items are tested to give a meaningful metadata quality result. This may be appropriate where large volumes of metadatasets from a single metadata creator need to be evaluated, for example by a service provider. Including metadatasets from a number of different metadata creators in a single sampling batch would not be appropriate unless the sampling was stratified by metadata creator.