ENVIRONMENT AGENCY

EATimeSeriesDataExchangeFormat.XSD

Plain English description of the Environment Agency's Time-Series Data Exchange Format

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AMENDMENT HISTORY

Version No.	Reason for Change	Amended By	Date
0.1	Original Draft	John Cima	
0.2	Redrafted post initial consultation	Chris Beales	22/4/03
0.3	Additions preparing for next round of consultation.	S. Sanderson	30/4/03
0.4	Consolidation + addition of worked examples.	Chris Beales	2/5/03
0.5	Proof read	John Cima	3/5/03
0.6	Made changes to answer issues raised in second round of consultation. This included reworking the Values section + all examples; adoption of a split Parameter/Qualifier; consolidation of Quality and Data Flags; removing names from consultation lists; and missing data definition.	Chris Beales	21/5/03
0.7	Finished modifications ready for final proofread.	Chris Beales	23/5/03
0.8	• Checked and incorporated updates from proofread by Simon Wood, including new Flags and Parameters tables. • Extracted document version and date control to the document properties. • Further clarification about what will not be exchanged added to Section 3. • Added info about the EAMetadataFormat Schema to Section 4. • Updated Section 5, specifically the header/metadata and the Value parts. • Updated examples in Section 6. • Fixed typos identified by Dave Burrows in Appendix A. • Redrafted all examples & stylesheets in Appendix B. • Updated Appendix C Schema with v0.6a and added the EAMetadataFormat Schema.	Chris Beales	5/6/03
0.9	• Checked and incorporated updates from proofread by Dave Burrows including addition of Region Table • Significant changes to section 5.1 specifically around minimum requirements. • Cosmetic changes	Giles Colton Dave Burrows	26/6/2003 26/06/2003
1.0	• Cosmetic changes. • Final copy released. • Fixed formatting on Schema (section 10.1), set default tab stop to 0.1" and reset document version number & date.	Steven Sanderson Chris Beales	02/07/03
1.1	• Schema replaced with v1.1 (as created on 5/5/2004, with dc:Date and dc:Identifier updated to "2004-06-11" and "{http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat}v1.1" respectively). • Additional parameters, qualifiers and new productRef attribute from new version of the Schema added to relevant sections: 5.4, 8.25, 8.26 and example in 9.2.	Ian Dawes Chris Beales	11/06/2004

	• Addition of section 6.7 – Guidance Notes & System Notes. Note that a new document will now acompany this Plain English Document called: EATimeSeriesResourceIndex.doc – refer to this for the latest Guidance & System Notes, etc.		
1.1 Additions	• Appendices G, H, I and J Added - System Specific Notes and resources.	James Procter (Doug Whitfield and Chris Beales notes)	29/06/04
1.1 Additions	• Added Implementation Guide (section 6.1) following NFFS/WISKI meeting, changed section 6.2 to reflect incorporation of Appendices. • Section 6.5 & 6.8 combined and expanded.	James Procter	29/06/04

DISTRIBUTION LIST

This will include the Working Group and the Consultation Group (see Appendix F). The document is intended to be publicly available and will be posted alongside the Schema on the Environment Agency's website.

CONTENTS

1 Purpose of the Document

1.1 Aim of the Plain English document

This document has been written to introduce you to the Environment Agency's data standard for the exchange of Environmental Time-Series Data. This data standard has been agreed after consultation with a number of interested parties and is designed to exchange data between a number of key data gathering, modelling and archiving systems.

The aim of this document is to give you a "Plain English" description of the data standard. This should enable you to exchange data with the Agency or other parties who use the format. As you read through this you will be talked through the options that are available so that you can create your own files or read other people's files.

1.2 The EATimeSeriesDataExchangeFormat Schema

The data standard has been described using an XML Schema[1]. XML stands for eXtensible Mark-up Language and is a file format designed to exchange any form of text-based data. The format is an international standard, defined by the World Wide Web Consortium. It is system independent so it will work on UNIX, PC, Mac, etc. It is also endorsed by the UK government, as defined in the e-GIF[2] recommendations: http://www.govtalk.gov.uk/documents/e-GIF_v5_part1_2003-04-25_Word_no%20cover.pdf.

The XML Schema provides a definition of the acceptable format for exchanging environmental time-series data with the Environment Agency by declaring the acceptable structure options and validation rules that will apply to a valid exchange file. Version control information is written into the comments at the start of the Schema.

All files used to exchange data according to the standard are written as XML documents. These must be formatted so that they comply with the restrictions imposed by the Schema. Various programs can be used to read and write the data documents that will automatically validate these files (e.g. "MSXML40.dll").

For this data standard the Schema file is called "EATimeSeriesDataExchangeFormat.xsd".

[1] For a technical description of XML and XML Schemas go to the following sources: www.w3.org/XML, www.w3.org/TR/xmlSchema-0, www.w3.org/TR/xmlSchema-1 and www.w3.org/TR/xmlSchema-2. There are also numerous books available on the subject that you will find a little friendlier to the reader.

[2] e-Gif is the United Kindom Governments electronic-Government Interoperability Framework for the exchange of information between government systems and the interactions between UK Government and citizens, Businesses (worldwide), Government organisations and other Governemnts (UK, EC, UK/US, etc.).

1.3 Content of the plain English document

The document covers the following:

- The purpose of the Schema
- The types of data that are to be exchanged
- The structure of the Schema
- The data items that are to be exchanged
- The validation rules that are to be applied
- The resulting format of the exchange data

Where appropriate the rationale behind any decisions in devising the exchange format is explained.

The validation rules that apply to items defined by the Schema are presented in Appendix A.

Examples of the XML files that comply with the EATimeSeriesDataExchangeFormat.xsd are attached in Appendix B.

The Environment Agency Time-Series Data Exchange Format XML Schema (EATimeSeriesDataExchangeFormat.xsd) is listed in Appendix C.

1.4 Compliance with e-GIF recommendations

Some departure has been made from the e-GIF recommendations with the use of attributes, rather than enclosing all data in tags[3]. This was necessary to allow for efficient file sizes. e-GIF also recommends that dates and times are broken down into their constituent year, month, date, hour, minute and second but this would be impractical with the large volumes of data that will be transferred using these files.

[3] See section 4.2 for further information on tags and attributes.

2 Purpose of the Schema

The Environment Agency needs to exchange a variety of sets of time-series data with both internal and external stakeholders. Currently a wide variety of file formats are used to facilitate these data exchange requirements.

With the rollout of new Telemetry systems, a new Hydrometric archive and a new River Flow Forecasting System within the Agency, the opportunity to converge on a standard has presented itself. In conjunction with the developers of these new systems and the main external interested parties a common transfer format and associated XML Schema has been devised.

The data exchange routes that the Schema is intended to address are shown in the following diagram.

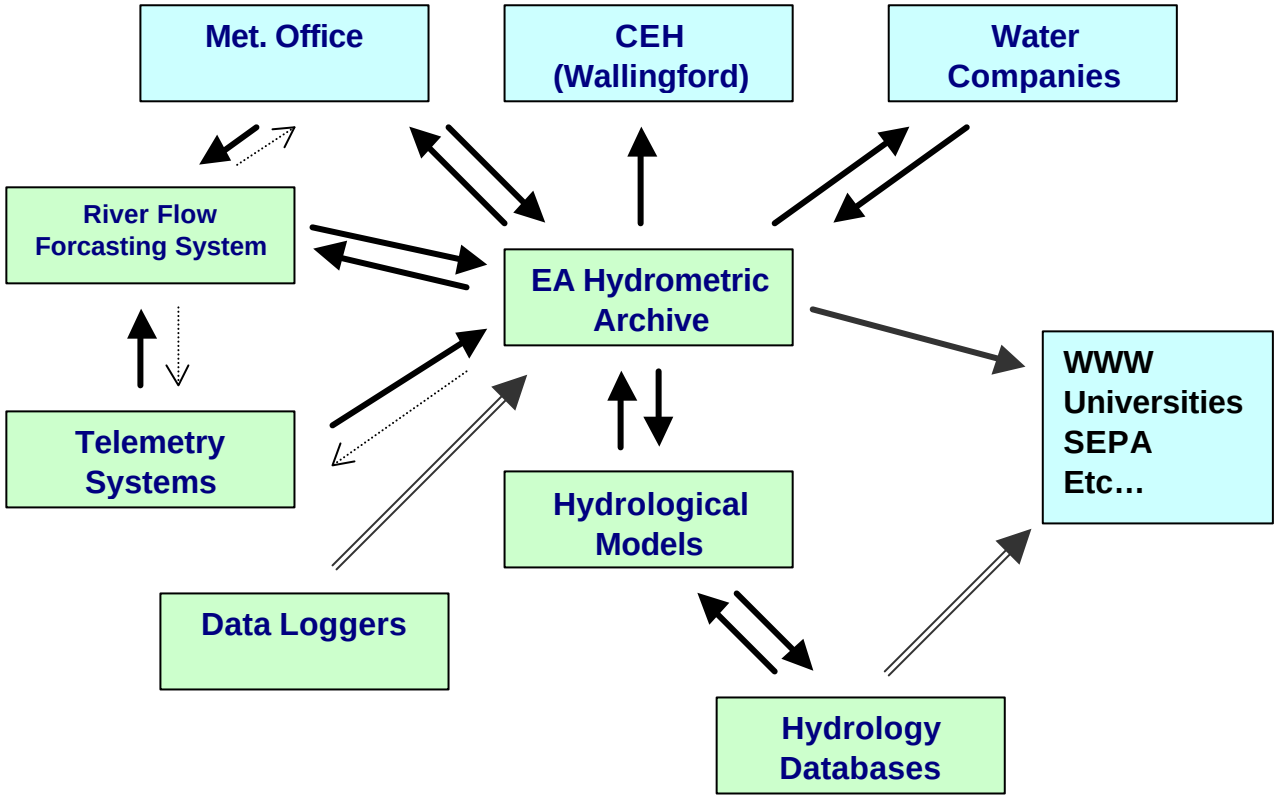


Figure 1 – Principal Data Exchange Paths

The solid arrows identify the data flows of the current interested parties. The dotted lines identify exchange options that could be used by those parties. The parallel line arrows depict the obvious future data exchange opportunities. The design of the Schema has taken both the current and future needs into account.

To clarify, the Schema is intended to support the following:

- Input of telemetry data into the new Hydrometric archive and River Flow forecasting systems.
- The input of time-series Met Office data into the Hydrometric archive (e.g. quality controlled storage rainfall) and River Flow forecasting systems.
- The transfer of Hydrometric archive (and River Flow forecasting) time-series data to the Met Office (e.g. unvalidated rainfall data).
- The transfer of daily river flows from the Hydrometric archive to CEH (Wallingford) for the National River Flow Archive.
- The exchange of time-series data between the UK Water Utilities and the Hydrometric archive.
- The exchange of time-series data between the Hydrometric archive and River Flow forecasting system.
- The exchange of time-series data between the Hydrometric archive and Hydrological models (e.g. The Thames Soil Moisture Model).
- The exchange of time-series data between Hydrology databases and Hydrological models.
- The external provision of time-series environment data from the Hydrometric archive
- [Future] The external provision of time-series environment data from Hydrology databases.
- [Future] The provision of data to the Hydrometric archive from loggers.

The Schema has been designed as a generic standard. It was based on the following systems.

System	Owner
Joint Telemetry Project (JTP)	Environment Agency
South West & Anglian Telemetry System (SWANTEL)	Environment Agency
Hydrometric Archive Replacement Project (HARP) (System:WISKI)	Environment Agency/Kisters AG
Thames Water's new Hydrological Archive (AEGIS)	Thames Water
National River Flow Archive (NRFA)	CEH (Wallingford)
National Rainfall Archive	Met Office
Thames Soil Moisture Model & Catchmod	Environment Agency – Thames Region
National River Flow Forecasting System (NFFS)	Environment Agency
Hyrad	Environment Agency
Tidebase	Environment Agency
Data Distribution Server	Environment Agency

The Schema will be used to replace the methods of data exchange currently in place for these systems. The use of the Schema will also be promoted wherever its use is appropriate.

The longer-term aim of the Schema is therefore that it is adopted more widely and so enable more providers of data to standardise their systems with associated benefits for users of published information who will then be able to compare and review data from a common perspective.

3 Data to be exchanged

The Environment Agency Time-Series Data Exchange Schema has been devised to accommodate the exchange of most forms of environmental, time-series data: i.e. data that consists of:

- A date (plus time) stamp
- A value
- "Flags" to indicate the quality information associated with the value
- Comments, giving further information about a specific value or a range of time connected with the dataset.

The Schema has also been specifically designed to simply exchange data. This means that it only allows very basic information about the source of the time-series, which is referred to as a Station[4]. Other Schemas will be developed to exchange more detailed 'metadata' about stations, e.g. asset information, addresses, datum histories, etc. This information is often complex and specific to the type of station, which is why it is absent from EATimeSeriesDataExchangeFormat so that there is no risk of the Schema being compromised by trying to meet this need.

Currently the Schema has been designed to facilitate the exchange of the following forms of environmental data:

- Rainfall amounts
- River levels and flows
- Tide levels
- Lake and reservoir levels
- Groundwater levels
- Areal modelled evaporation, soil moisture deficits, etc.
- Continuously monitored water quality parameters: e.g. dissolved oxygen and ammonia quantities
- Climate station data: e.g. temperatures, wind speed and radiation

Other parameters can be added in the future as long as they are of the simple "date, value, quality + comments" form of time-series.

[4] Note that a "Station" could be any Hydrometric, Meteorological or Water Quality site, etc. or it could refer to something that is not a point source but is an areal location, e.g. Greater London.

3.1 Data that will not be exchanged

The Schema is **not** suitable for more complex data forms, for example gridded space-time data, because it has been optimised to exchange data as efficiently as possible within the constraints of XML.

Please note that new Schemas (or other data exchange standards) will probably need to be developed for the exchange of:

- Gridded space-time data (e.g. for a grid of model nodes, whose values change with each model timestep: in this case it would be more efficient to have a tabular format for the data in the file)
- Current meter gauging data
- Rating curves for a discharge rating or rating history information
- Water quality sample results
- Station metadata including datum histories or asset information

4 Description of the Schema and the Data Files

The **Schema** is a controlled document that is issued by the Environment Agency. A **Schema** defines the format, data items and rules that are acceptable for the **Data files**. The **Schema** also defines what data items are **Required** and which are **Optional**, in this way there is an added flexibility to allow for the different needs of all parties/systems that will use the **Schema**.

Data files are created by individual systems and used to transfer information. **Data files** are **Validated** against the rules that are contained within the **Schema**. In this way only acceptable data is either imported or disseminated. The options available in the construction of each **Data file** are given in section 5.

4.1 Structure of Data files

XML data files that conform to the Schema have a tree-like structure. This is very similar to the directory structure on a computer.

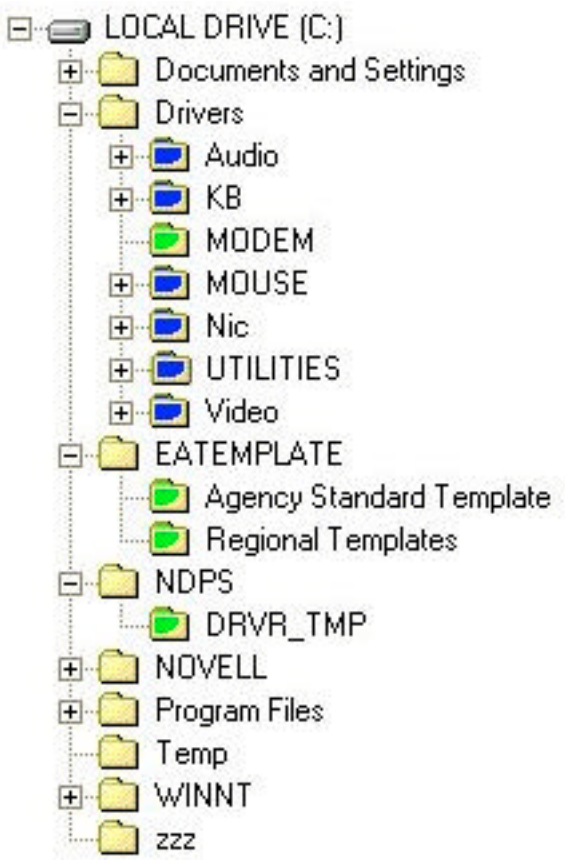


Figure 2 – Directory Structure on a PC

- Each data exchange file must contain one, but only one, header record. This is like the "LOCAL DRIVE C:" in Figure 2. Metadata about who created the file, when and why immediately follows this

header.

- Thereafter data is to be provided on a station-by-station basis. The data file could contain no stations or any number of stations. These are similar to the first level folders in Figure 2. There is no limit on the number of stations that can be contained within the data exchange file. A data file with no stations would be valid to confirm that no data was available from a data exchange stakeholder.

- Different "Sets of Values" may apply at a station for example Daily-mean River flow and 15-minute Water level. Each station can have any number of associated sets of values. The data file could contain no sets of values associated with a station or any number of sets of values associated with a station. There is no limit to the number of sets of values that can be associated with a station. A data file with a station with no associated sets of values would be valid to confirm that no data was available for a specific station within a data exchange from a stakeholder. In Figure 2 the blue and green folders could be considered to be sets of values.

- Within each set of values, any number of actual value records or comment records can be written.

- Each set of values could contain no values (like the green folders) or any number of values (like the blue folders). There is no limit to the number of values that can be associated with a set of values. A data file with a station and a set of values for a specific type of measurement, with no associated sets of values, would be valid to confirm that no data was available for that specific station, for that specific measurement type.

- Each set of values could contain no comments or any number of comments. There is no limit to the number of comments that can be associated with a set of values.

4.2 Validating an XML data file

In XML, information is either written between tags, e.g.

```
<myValue>12.2</myValue>
```

or attributes, e.g. the time in the following:

```
<myValue timeRecordedAttribute="12:15:20">12.2</myValue>
```

Note that both tag and attribute names are Case Sensitive in XML! E.g. if you typed `<MYvalue>` the tag would not be the same as `<myValue>`. Also note that if you have multiple attributes it does not matter what order you put them in.

The nesting of these provides the basic structure behind the XML data files. The following example gives the essential structure of the XML **data files**, ignoring the attributes. Note that the header is the same name as the Schema. This example has two stations in it, with one set of values each. Note also that the second station also contains comments.

```
<EATimeSeriesDataExchangeFormat>
      <Station>
       <SetOfValues>
        <Value>1</Value>
        <Value>2</Value>
        <Value>3</Value>
       </SetOfValues>
      </Station>

      <Station>
       <SetOfValues>
        <Value>1</Value>
        <Value>2</Value>

        <Comment>Hello</Comment>
        <Comment>I am a comment too</Comment>
       </SetOfValues>
      </Station>
</EATimeSeriesDataExchangeFormat>
```

This example file will **parse**[5] happily by an XML reader because every start tag has an associated end tag[6]. However, the XML data file is not **valid** against the Schema because a number of attributes, which are **required** by the Schema, are missing. The Schema therefore ensures that only valid data can be exchanged.

The Schema describes the data types that are required by each attribute or tag; e.g. if it is expecting a floating-point number then it will allow "15.87" but it will not be valid if "Fifteen point eight, seven" were written. This is very useful for systems that handle these files, as they only need to know that the data file is valid against the Schema, to know that there will be no unexpected types of data. XML parsers can read and validate the data files for you, which can massively cut down on the amount of effort it would take to create an interface that reads/writes the files.

The rules, as they apply to data types, are contained in Appendix A. Where types are lists of acceptable values these are either defined as lists of texts or lists of numbers associated with a text description. Numbers and associated text have been used where the text descriptions are long and are detrimental to the size of a file transfer. The lists have been drawn up to avoid duplicate definitions for example there are not separate entries for cumecs and metres cubed per second as they are the same thing.

In some instances supplementary rules are required and these are detailed within the item definition.

[5] Parsing is the process where the information from a file is read in from the disk, into the computer's memory. In the case of XML, information is contained between tags or in the attributes. To pull this information out of the file, the parser must be able to find matching start and end tags so that it knows where the information starts and stops.
[6] An end tag has the same name as the start tag but with a slash in front of it, e.g. `</endTag>`.

4.3 Structure of the Schema

The Schema also has a very simple tree-like structure as demonstrated in Figure 3 below. The Schema structure defines the components that will make up the resulting data exchange file. The Schema is fully listed in Appendix C (section 10.1). It has been described in line with government best practice, with a header section called xsd:appinfo that contains detail about the Schema itself. This detail is metadata about the Schema and conforms to e-GMS, the e-Government Metadata Standard (see Appendix D for more information).

The structure identifies that there are the following components:

- Header
- Station details
- Set of values
- Values
- Comments

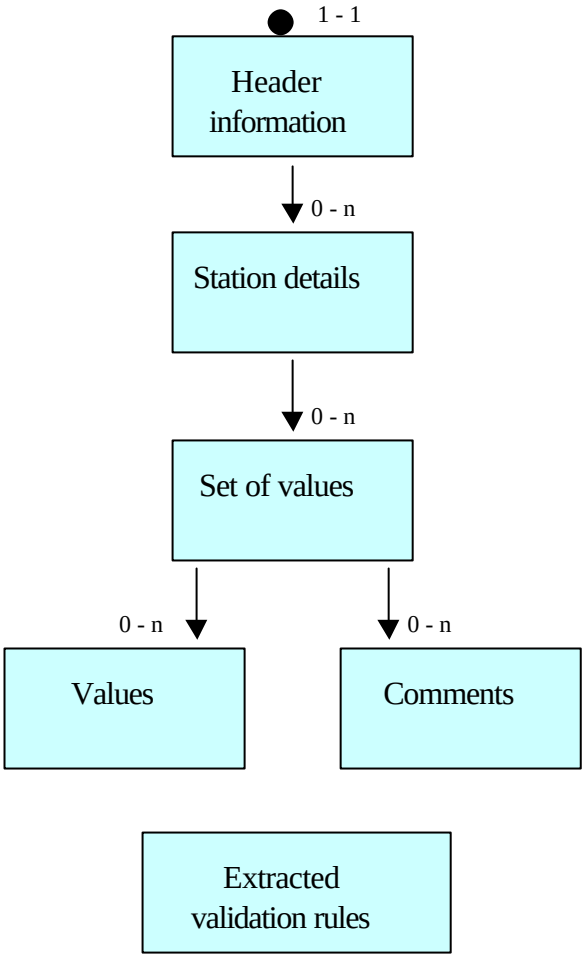


Figure 3 – Structure of the Schema

Each component within the Schema contains a number of data items for example date, time, creator, etc. Each component, its data items and the validation rules that apply are described in the following section.

The figure beside the arrow determines the maximum and minimum number of components that are required. "1 – 1" means that the header record is mandatory. All other components can have either zero or many occurrences. Note that the validation rules have been extracted so that they can be shared between components.

Note that the EATimeSeriesDataExchangeFormat Schema refers to another Schema, which is called EAMetadata and is also listed in Appendix C (section 10.2). This contains rules about the format of the metadata that can be used in the data files; e.g. who created the file, when and from what system. The reason why these rules have been extracted into a separate Schema is to generate consistency with future Schemas so, for example: the metadata at the start of a future XML document of asset information, will match that of an XML data file that conforms with the time-series exchange format.

5 Components of the data file

5.1 Header record.

The following two lines should appear at the start of every XML data file that is written to conform to this schema alone. You do not need to worry about what they mean, just make sure that they are there.

```
<?xml version="1.0"?>
<EATimeSeriesDataExchangeFormat xmlns="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat"
xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat">
```

- The first header line indicates that the file is an XML document.

- The second line contains the root element of the document, i.e. EATimeSeriesDataExchangeFormat. The attributes that follow this indicate various key information to the XML parser.

5.2 Metadata

There are a number of optional data items that can follow the Header. These items are metadata items and have been chosen to comply with e-GMS, the e-Government Metadata Standard. The metadata items that have been included are a subset of e-GMS and have been chosen to support information exchange. Enough metadata needs to be provided to adequately describe the file, its contents and its origin.

This optional metadata information is defined in the following table, system specific notes can be found in Appendices to this document, and from the document " EA Time Series Resource Index".

Item Name	Data type	String length	Descriptions
md:Publisher	String	255	The entity responsible for making the resource available (e.g. “Environment Agency”).
md:Source	String	255	The reference to the source (system) from which the data is derived (e.g. “Hydrometric Archive”).
md:Description	String	255	An account of the content of the data file. (e.g. “Data request for Joe Bloggs”).
md:Creator	String	255	The entity primarily responsible for producing the content of the resource. This is preferably not a named person but a post or a department.
md:Date	Date	-	The date that the file was created in XML format (ccyy-mm-dd).
md:Time	Time	-	The time that the file was created in XML format (hh:mm:ss).
md:Identifier	String	255	The hardware device (e.g. server identifier) from which the data file was created.

Table 1 – Optional Metadata elements

The following is an example of a full set of metadata. Note that any of these could have been missed out but that they must be listed in the correct order (i.e. md:Creator cannot come before md:Source, etc).

```
  <md:Publisher>Environment Agency</md:Publisher>
  <md:Source>Plain English Document</md:Source>
  <md:Description>Test data file demonstrating the metadata available for your XML
document</md:Description>
  <md:Creator>DIEA Thames</md:Creator>
  <md:Date>2003-06-19</md:Date>
  <md:Time>16:20:18</md:Time>
  <md:Identifier>//THKMH_GO6/Data/Groups</md:Identifier>
```

5.3 Station

As depicted in the data structure section, the data exchange is provided on a station-by-station basis with associated sets-of-values, values and comments.

There is no limit on the number of stations that can be included within the exchange file. Stations do not need to be tied geographically and the same station could occur twice within a single exchange of data.

A new set of station values is detected by the occurrence of the next station element.

The station data items that are made available by the Schema are defined in the following table. The table identifies the items that can be associated with the station component. The data type associated with the item is indicated. The validation for the item is contained within Appendix A. The table defines whether the item is mandatory or optional and provides a description of the data item to enable either the correct information to be supplied or the correct interpretation of data that is being provided.

Item Name	Data type	String length	Required	Descriptions
stationReference	**String**	**60**	**Required**	**The identifier associated with the station.**
region	RegionType	-	Optional	Environment Agency Region.
stationName	String	180	Optional	Name of the station e.g. site, station, gauge, point.
ngr	NgrType	-	Optional	The Ordnance Survey grid reference of the station (see 8.2.4).

Table 2 – Station attributes

Basic example:

```
<Station stationReference="12">
```

Example using all optional attributes:

```
<Station stationReference="3400TH"
     stationName="THAMES AT KINGSTON (TEDDINGTON)"
     ngr="TQ17706980" region="Thames">
```

5.4 Set-of-values

Each Station can have a number of set-of-values records associated. These set-of-values records can be applied to any parameter type, for example a station could have a set of readings relating to rainfall and another relating to flow.

The data exchange for a station is to be provided on a set-of-values by set-of-values basis. A new set-of-values record is detected for the current station by the occurrence of the next set-of-values element. There is no limit on the number of set-of-values records that can be assigned to a station in this way.

Item Name	Data type	String Length	Required	Descriptions
parameter	**ParameterType**	**-**	**Required**	**The parameter that is being measured for example Flow, Rainfall, Water Level, etc. (See 8.2.5).**
qualifier	ParameterQualifierType	-	Optional	This clarifies what the parameter is referring to, e.g. if the parameter = "Wind" the qualifier might be "direction" (See 8.2.6).
productRef	String	10	Optional	Free text descripton describing the origin of the set-of-values (usually a software reference). E.g.: • "N1" for the NWP Mesoscale, Forecast Total Rainrate • "H7" for the Nimrod, rainfall actual • "H11" for the Nimrod, forecast accumulations
dataType	**DataTypeType**	**-**	**Required**	**The specific way in that the parameter was either measured or is being presented for example: Mean, Total, Event, etc. (See 8.2.3).**
period	**DataPeriodIntervalType**	**-**	**Required**	**Period associated with the dataType, e.g. 15-minute. The 2 attributes therefore combine to describe the following dataset: e.g. Monthly Mean. (See 8.2.2).**
interval	DataPeriodIntervalType	-	Optional	Expected interval of data particularly applying to rolling accumulations where it is not the same as the data period. For example daily means may be recorded on an hourly basis. (See 8.2.2).
characteristic	CharacteristicType	-	Optional	Description of data source. This can be very useful to distinguish between measured, forecast and modelled data, etc (see 8.2.1).
pointReference	String	120	Optional	A unique reference associated with the analogue input or instrument used to make the measurement. e.g. "E123".
units	**UnitsType**	**-**	**Required**	**The units with which the set of values have been recorded e.g. m3/s, deg C, mAOD (see 8.2.9).**
startDate	Date	-	Optional	The start date for the set of values.
startTime	Time	-	Optional	The start time for the set of values.
endDate	Date	-	Optional	The end date for the set of values.
endTime	Time	-	Optional	The end time for the set of values.
dayOrigin	Time	-	Optional	The time at which a day value begins. For example 09:00:00 for water day or a rain day.
valuesPerDay	Unsignedint	-	Optional	The number of values expected for 'normal' day. For example 96 where 15 minute values are collected over a 24-hour period.

Table 3 – Attributes for SetOfValues

The set-of-values data items that are required by the Schema are defined in the Table 3. The table identifies the items that can be associated with the set of values component. The data type associated with the item is indicated. The validation for the item is contained within Appendix A. The table defines whether the item is mandatory or optional and provides a description of the data item to enable either the correct information to be supplied or the correct interpretation of data that is being provided.

Basic example:

```
<SetofValues parameter="Flow" dataType="Instantaneous" period="15 min"
units="m3/s">
```

Example using all optional attributes:

```
<SetofValues parameter="Flow"
qualifier="Logged"
 productRef=”H7”
dataType="Maximum"
period="12 h"
interval="1 h"
characteristic="Forecast"
pointReference="ABC123"
units="Ml/d"
startDate="2001-07-01"
startTime="12:00:00"
endDate="2001-12-31"
endTime="12:00:00"
dayOrigin="09:00:00"
valuesPerDay="24">
```

5.5 Values

Each set-of-values can have a number of values associated with it. Each value item must have a date associated with it. Each value item may also have an associated time (if relevant, i.e. if it is a sub-daily reading).

It was a consideration to use the set-of-values data to infer the date and time detail where regular values are being exchanged, for example continuous 15-minute readings. However this is not in keeping with XML’s ethos of clarity of information exchange and it is also less robust when it comes to the potential for data recovery, e.g. where a premature termination of the data stream occurs. It was subsequently decided that it was appropriate to expressly record the date and time with each value item.

The Schema can handle data and quality flags from both simple and very sophisticated flagging systems, where there may be a single flag or multiple flags applied to a data value in a time series. This applies equally to sub daily (high-resolution) data, such as 15 minute or hourly, derived data and summary data, such as daily monthly and annual means, minimum and maximum, modelled data etc.

There is no limit on the number of value records that can be assigned to a set-of-values.

The attributes made available by the Schema are defined in the following table. The table identifies the items that can be associated with the value component. The data type associated with the item is indicated. The validation for the item is contained within Appendix A. The table defines whether the item is mandatory or optional and provides a description of the data item to enable either the correct information to be supplied or the correct interpretation of data that is being provided.

Item Name	Data type	Required	Descriptions
date	**Date**	**Required**	**The date that the value applies to, e.g. 2003-04-02.**
time	Time	Optional	The time that the value applies to, e.g. 12:45:00. This will only be relevant to sub-daily data.
flag1	DataQualityFlagType	Optional	First data quality flag, which contains information about the value. See the DataQualityFlagType table in section 8.2.7, for a list of valid codes and the meaning behind them.
flag2	DataQualityFlagType	Optional	Second data quality flag (see above).
flag3	DataQualityFlagType	Optional	Third data quality flag (see above).
flag4	DataQualityFlagType	Optional	Fourth data quality flag (see above).
flag5	DataQualityFlagType	Optional	Fifth data quality flag (see above).
flag6	DataQualityFlagType	Optional	Sixth data quality flag (see above).
flag7	DataQualityFlagType	Optional	Seventh data quality flag (see above).
flag8	DataQualityFlagType	Optional	Eighth data quality flag (see above).
flag9	DataQualityFlagType	Optional	Ninth data quality flag (see above).
flag10	DataQualityFlagType	Optional	Tenth data quality flag (see above).
percentFlag1	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag1.
percentFlag2	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag2
percentFlag3	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag3.
percentFlag4	PercentageType	Optional	Percentage Relating to a derived value – indicates how much of the source data was considered to match flag4.
percentFlag5	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag5
percentFlag6	PercentageType	Optional	Percentage Relating to a derived value – indicates how much of the source data was considered to match flag6
percentFlag7	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag7
percentFlag8	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag8
percentFlag9	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag9
percentFlag10	PercentageType	Optional	Percentage relating to a derived value – indicates how much of the source data was considered to match flag10

Table 4 – Value attributes

The Value itself is a **Floating point number** (see 8.1 for a description). This means that it can hold any decimal number within a huge range of precision and size: e.g. 0.00000000123, 3.012, 15012300000, 1.56544e21 (i.e. 1.56544×10^{21}).

As follows:

```
<Value date="2003-04-23">0.00000000123</Value>
<Value date="2003-04-23">3.012</Value>
<Value date="2003-04-23">15012300000</Value>
<Value date="2003-04-23">1.56544e21</Value>
```

A floating-point number can also hold some special "values": "INF" and "-INF" mean infinity and minus infinity respectively. "NaN" means 'Not-A-Number'. This should be used by all systems to exchange any invalid/missing values.

```
<Value date="2003-04-23">-INF</Value>
<Value date="2003-04-23">NaN</Value>
```

5.5.1 Flags

The data-quality flags available are listed in Table A8 in Appendix A. These flags are written to the XML data files as numerical codes, e.g. `flag1="24"` (which means Test Calibration Data).

The flags can contain information about:

- The overall quality of the value.
- The quality of the data that was used to derive the value (e.g. a monthly total for a raingauge might be derived from daily totals, of varying qualities, that have been added together).
- The quality control process that has been applied to the value (e.g. editing and automated data checking).
- Processing information that has automatically been assigned to the value, e.g. if a flow has been calculated from a crump weir, flags will indicate whether the downstream (tail) water level was used in the calculation to indicate and correct for non-modular conditions at the weir.
- Telemetry system flags, e.g. alarms.
- Manual observations, which are important to consider when using the value, e.g. if a well is dry or if an accumulation has been measured at a raingauge.
- Tide indicators, for systems that forecast high and low tide data.

There are 10 available Data Flags: "flag1" to "flag10". Each flag can contain any of the codes from Table A8 (i.e. a number from 1 to 67). Please note that:

- There should only be one instance of each code, e.g. do not have `flag1="30"` and `flag2="30"`. The only exception to this rule is if you have quality information about the dataset that your value was derived from (see section 5.5.1.1 below).

- Flags must be filled sequentially with no gaps: e.g. if you have 3 flags to assign to a value, they should be assigned to flags 1 to 3, so `flag1="30" flag2="2" flag3="17"` is ok; `flag1="30" flag3="2" flag10="17"` is not ok. This allows the receiving system to read through the flags incrementally until it gets to an empty flag; it can then assume that this is the last flag to contain any information and move onto the next part of its processing.

- If available, the overall quality that you consider the value to have should always be assigned to flag1. This will allow systems that are only interested in the overall data quality to just have to look at flag1

for this information.

5.5.1.1 Quality Flag examples

- A value of 5.65, which has a quality flag indicating that it is "4 = Unchecked".

```
<Value date="1994-12-27" time="13:15:00" flag1="4">5.65</Value>
```

- A value of 5.65, which has a quality flag indicating that it is "Good" and another flag indicating that it is "Within rating"; note that the "1 = Good" flag must come before the "11 = Within rating" flag to indicate that the overall quality is considered good.

```
<Value date="1994-12-27" time="13:15:00" flag1="1" flag2="11">5.65</Value>
```

- A "Missing" value.

```
<Value date="2003-04-23" flag1="5">NaN</Value>
```

Further information may be available on the breakdown of the source data. The `percentFlag1`, `percentFlag2`, `percentFlag3`, etc., can be used to pair-up with flags to indicate this. These percent attributes are all floating-point numbers (between 0 and 100 percent). If the flag-percentFlag pair is present, they indicate how much of that quality data was used in the derivation of the value. If they are absent, it indicates that none of this quality data was used in the derivation of the value.

- A value of 5.65, which has a quality of "1 = Good" and that was derived from 100% Good quality data. Note that flag1 contains the overall quality and the flag2-percentFlag2 pair indicate the 100% good dataset that it was derived from.

```
<Value date="1974-12-27" flag1="1" flag2="1"
percentFlag2="100">5.65</Value>
```

- A value of 5.65, which has an overall quality of "2 = Suspect". The other attributes indicate that the value was derived from 14.5% "1 = Good" quality data, 65.5% "3 = Estimated" data and 20% of the source data was "5 = Missing".

```
<Value date="1974-12-27" flag1="2" flag2="1" percentFlag2="14.5" flag3="3"
percentFlag3="65.5" flag4="5" percentFlag4="20">5.65</Value>
```

Note that if a flag-percentFlag pair is not present to indicate missing data in the source dataset, and the sum of the other component pairs is less than 100%, you can infer that the remaining percentage was in fact missing: e.g.

```
<Value date="1974-12-27" flag1="1" flag2="1" percentFlag2="80" flag3="2"
percentFlag3="1" flag4="3" percentFlag4="4">5.65</Value>
```

In this example the sum total of Good, Suspect and Estimated 85%, the remaining 15% must be assumed to be missing.

5.5.1.2 Mixed Quality and Data Flag examples

- A “1 = Good” value at “66 = High tide”.

```
<Value date="2003-04-23" time="15:30:00" flag1="1" flag2="66">4.56</Value>
```

- A “2 = Suspect” value, which has been “9 = Edited” and is designated as a “38 = Dry well”.

```
<Value date="1974-12-27" time="12:37:13" flag1="2" flag2="9"
flag3="38">5.57</Value>
```

- A “8 = Automatically validated” value, which is considered “1 = Good” because “19 = pressure-tapping (a.k.a. crest-tapping) was used in the flow calculation but no correction was applied to the flow because the weir was found to be under modular conditions”. A warning has been noted that “22 = an engineer was on the site”.

```
<Value date="2003-05-21" time="17:15:00" flag1="1" flag2="22" flag3="8"
flag4="19">5.57</Value>
```

5.6 Comments

Each set-of-values can have a number of comments associated with it. The comment is independent of the value component, but may be used to clarify data values if required based on date and time.

Accordingly a comment can optionally have a date and time period associated with it. The assumptions of the use of date and time are as follows:

- If no date or time period is associated then it is assumed that the comment applies to all the values within the set-of-values.
- If only a date period is provided then it is assumed that the comment applies to the values associated with the defined day period. This will be assumed to be a calendar day if the dayOrigin="00:00:00" or if it is missing from the SetOfValues attributes.
- If a date and time period is associated with a comment then it is assumed that the comment applies to all the values associated with that time period.
- If no end period is defined then the comment is assumed to apply to either a day if only a start date is defined or to a specific reading if a start time is defined.

There is no limit on number of comments that can be assigned to a set-of-values. Comments can be nested so that more than one comment applies to a value. Note that comments must come after any values in the set-of-values.

The attributes made available by the Schema are defined in the following table. The table identifies the items that can be associated with Comment component. The data type associated with the item is indicated. The validation for the item is contained within Appendix A. The table defines whether the item is

mandatory or optional and provides a description of the data item to enable either the correct information to be supplied or the correct interpretation of data that is being provided.

Item Name	Data type	String length	Required	Descriptions
startDate	Date	-	Optional	The start date of the period that the comment applies to.
startTime	Time	-	Optional	The start time of the period that the comment applies to.
endDate	Date	-	Optional	The end date of the period that the comment applies to.
endTime	Time	-	Optional	The end time of the period that the comment applies to.

Table 5 – Comment attributes

The Comment itself is a **String** of unrestricted length. Note (as with all strings) that there are a few characters that cannot be directly used in XML, e.g. the "<" character as this would get confused with the identifier for the data tags. Further information about these restrictions, and how to overcome them, are supplied in Appendix E.

Example:

```
 <Comment startDate="2003-04-23" endDate="2003-04-23">This comment would refer
to all values on the 23rd April 2003. If the dayOrigin is 9am then it is a Water
Day/Rain Day</Comment>
```

6 Basic example, Additional Information and Recommendations

6.1 Implementation Notes

Some elements of the schema Version 1.0 were implemented in disparate ways, leading to additional complexity in import/export routines. The following standards are to be adhered to for any data interchange with the Environment Agency.

- **Order of time series data**.
  The schema does not state explicitly what order Time Series data should supplied, this has led to 2 approaches, only one of which was originally envisaged. Data exchange should take place with data supplied in **ascending chronological** order; ie oldest data first.

```
<Value date="2001-12-23" time="12:00:00" flag1="4">102.230</Value>
<Value date="2001-12-16" time="12:00:00" flag1="4">102.290</Value>
<Value date="2001-12-14" time="12:00:00" flag1="4">101.780</Value>
```

  Would not be considered valid, the correct form is

```
<Value date="2001-12-14" time="12:00:00" flag1="4">102.230</Value>
<Value date="2001-12-16" time="12:00:00" flag1="4">102.290</Value>
<Value date="2001-12-23" time="12:00:00" flag1="4">101.780</Value>
```

- **Optional Fields/Parameters**.
  Many parameters are "optional", rather than being mandated. This is to allow flexibility and a reduced number of rules. Given the wide variety of parameters and types of data exchange, it would not make sense for the schema to rigidly define what parameters should be grouped together. This has led to some implementations only including a very small subset of the parameters that are relevant.
  Optional fields are only optional where the sending system does not have the data items. This may be superceded where there is a specific requirement.
  This applies to data elements and metadata elements.

- **Parameter Qualifiers.**
  As with optional parameters, the qualifiers have been included without strict checking, for ease of implementation. Where a qualifier is appropriate (for temperature - Dry Bulb / Wet Bulb / Water), this provides needed information to the receiving system and must be included.

- **Data Period.**
  Where data is non-equidistant the period must be set to "Unspecified". Where the period is defined, the source system should define the type of period, such as;

```
15 min + Mean          - for flows from ultrasonics, etc
15 min + Instantaneous - for logged stage.
```

  The period type acts as a qualifier to the period itself, much as above, providing useful information to the receiving system.

- **File Size**

Different systems have different requirements for the volume of files, with telemetry data, for example, the following approaches have been taken;

1. XML Files contain information about multiple parameters at multiple sites - low numbers of large files.
2. XML Files contain information about multiple parameters at single sites - medium number and size of files.
3. XML Files contain information about a single parameter at a single site - large number of small files.

Although some latitude is available on an implementation specific basis, as a general rule Number 2, above, is the most appropriate.

- **File Naming**.

  XML Transfers can create large numbers of files. To ease management of this, some naming scheme must be defined. One implementation has led to the creation of a file naming standard, if no other suitable convention is used, this one can be adapted.

  All file names will be of the form:

  SR SS DR DS YYYYMMDD HHMMSS MMM.XML

  Where:

  SR is Source 'Region' Name
  Permitted entries:
  AN Anglian
  CY EA Wales
  MI Midlands
  NE North East
  NW North West
  SO Southern
  SW South West
  TH Thames
  EA National Agency System (e.g Hyrad, WISKI, Tidebase?)
  MO Met Office

  SS is Source system name
  Permitted entries:
  TS Telemetry System
  FS Forecasting System
  HY Hyrad
  WI Wiski
  XX Not applicable (e.g when from MO)

  YYYYMMDD is date
  HHMMSS is time

  MMM is time in milliseconds

  All characters to be upper case.

  DR is Destination 'Region' Name
  Permitted entries:
  AN Anglian
  CY EA Wales
  MI Midlands
  NE North East
  NW North West
  SO Southern
  SW South West
  TH Thames
  EA National Agency
  MO Met Office

  DS is Destination System Name
  Permitted entries:
  TS Telemetry System
  FS Forecasting System, see Notes below
  WI Wiski
  XX Not applicable (e.g when to MO)

Examples;

NETSNEFS20040122112038001.XML
File from NE Telemetry to NE Forecasting System generated at 11:20:38.001 on 22 Jan 2004

MIFSMITS20040118092334873.XML
File from Midlands Forecasting System to Midlands Telemetry System generated at 09:23:34.873 on 18 Jan 2004

EAHYSOFS20040124153538065.XML
File from Hyrad CatAvg to Southern Forecasting System generated at 15:35:38.065 on 24 Jan 2004.

- **Recommendations and assumptions to be used in the data files**

Using the Schema to validate XML data files will ensure that all the data types are correct but it will not ensure that the correct/sensible options have been used. For example, there is nothing to stop you creating a file with a SetOfValues for Daily Mean Level in Degrees Celsius, which is of course nonsense. It will be up to the creators and readers of the documents to check this.

Assuming that your file contains sensible data, there are a number of further assumptions that we suggest that all users of the Schema make (where relevant).

1. If a start date/time and end date/time are given as attributes for the Set-Of-Values, then between these dates the following data block should be assumed to contain a complete set of values from the source database that created the file.

2. To indicate periods of missing data for irregularly spaced values, new Set-Of-Values blocks should be used. For example if a year of Event logged, tipping-bucket raingauge data was written to an XML data file and one of the monthly logs was missing: there would be two SetOfValues blocks under the Station. The first would be from the start of the year to the beginning of the missing period; and the second, from the end of the missing block to the end of the year.

6.2 Basic example

A very basic example of a data file that will be valid according to the Schema is listed below. This simply contains a daily mean flow of 0.012 cumecs – which is considered to be Good and derived from a Complete set of data – for station "12", on the 23/4/2003. Note that colours have been used to help you to see the nested structure of the file more clearly.

```
<?xml version="1.0" encoding="UTF-8"?>
<EATimeSeriesDataExchangeFormat xmlns="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat"
  xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat"
  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation = "http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat
```

```
EATimeSeriesDataExchangeFormat.xsd">

   <md:Description>Basic example file</md:Description>

   <Station stationReference="12">
      <SetofValues
         parameter="Flow"
         dataType="Mean"
         period="Day"
         units="m3/s"
         dayOrigin="09:00:00">

         <Value date="2003-04-23" flag1="1" flag2="1"
                                    percentFlag2="100">0.012</Value>

         <Comment>Hello World</Comment>
      </SetofValues>
   </Station>
</EATimeSeriesDataExchangeFormat>
```

Further examples are listed in Appendix B, which use more extensive data blocks, comments, quality flags and some of the optional extra fields available.

6.3 XML Annotations

You can add further information to a file, in the form of annotations, e.g.

```
<!--I'm an annotation-->
```

These are ignored by any system reading the file but they can be of use, especially if you are manually editing the document. Using these and spacing out the tags can make the document a lot easier to read: Note that whitespace (i.e. spaces, tab and return characters) is also ignored between tabs and attributes.

For example, this fragment of a data file:

```
<Station region="Thames" stationReference="SP00/62" stationName="AMPNEY CRUCIS OBH"
ngr="SP05950190"><SetofValues parameter="Water Level" dataType="Instantaneous"
period="Unspecified" characteristic="Measured" units="mAOD" startDate="2001-07-01"
startTime="12:00:00" endDate="2001-12-31" endTime="12:00:00"><Value date="2001-07-01"
time="12:00:00" flag1="4">100.420</Value><Value date="2001-07-08" time="12:00:00"
flag1="4">100.450</Value><Value date="2001-07-12" time="12:00:00"
flag1="4">100.360</Value><Value date="2001-07-15" time="12:00:00"
flag1="4">100.340</Value><Value date="2001-07-22" time="12:00:00"
flag1="4">100.270</Value><Value date="2001-12-14" time="12:00:00"
flag1="4">102.230</Value><Value date="2001-12-16" time="12:00:00"
flag1="4">102.290</Value><Value date="2001-12-23" time="12:00:00"
flag1="4">101.780</Value><Value date="2001-12-30" time="12:00:00"
flag1="4">101.400</Value></SetofValues></Station>
```

is exactly the same as the following for an XML parser:

```
<Station region="Thames" stationReference="SP00/62"
 stationName="AMPNEY CRUCIS OBH" ngr="SP05950190">

  <!--The first set of data are dip values-->

  <SetofValues parameter="Water Level"
   dataType="Instantaneous"
   period="Unspecified"
   characteristic="Measured"
   units="mAOD"
   startDate="2001-07-01"
   startTime="12:00:00"
   endDate="2001-12-31"
   endTime="12:00:00">

    <Value date="2001-07-01" time="12:00:00" flag1="4">100.420</Value>
    <Value date="2001-07-08" time="12:00:00" flag1="4">100.450</Value>
    <Value date="2001-07-12" time="12:00:00" flag1="4">100.360</Value>
    <Value date="2001-07-15" time="12:00:00" flag1="4">100.340</Value>
    <Value date="2001-07-22" time="12:00:00" flag1="4">100.270</Value>

                  <!-- deleted some values here... -->

    <Value date="2001-12-14" time="12:00:00" flag1="4">102.230</Value>
    <Value date="2001-12-16" time="12:00:00" flag1="4">102.290</Value>
    <Value date="2001-12-23" time="12:00:00" flag1="4">101.780</Value>
    <Value date="2001-12-30" time="12:00:00" flag1="4">101.400</Value>
  </SetofValues>
</Station>
```

6.4 Zipping data files

Using XML to create these data transfer files can lead to very large file sizes. Testing has been carried out to assess the impact of this. It was decided that the performance is acceptable, especially taking into consideration the advantages offered by XML Schema validation.

Use of file compaction programs is however recommended. Specifically we recommend the use of WinZip, PKZIP or another compatible compression program that reads/writes ".zip" files. To give an idea

of the compression ratio, a 24,800 Kb XML document will zip down to 1,570 Kb. This will be of particular importance to those systems that transfer data via Wide Area Networks, the Internet or by e-mail.

6.5 Field mapping tables

Using the Environment Agency Time-Series Data Exchange Schema, you can transfer all of the environmental data mentioned in this document. However, the Schema is independent of any system so it is important that each system that uses the Schema interprets the options available in the same way. For all systems, some form of field mapping will be required.

For example, if you have a system with two archives: A "recorded" archive, which contains sub-daily data that may or may not be regular, and contains an unlimited number of values per day; and a "summary" archive, which contains min/max/mean summary data for water days.

- At the SetOfValues level, any data transferred from the recorded archive will need to have dataType = "Instantaneous", period = "Unspecified"; interval, characteristic, pointReference, valuesPerDay, etc. will not be present. The dates and times should be used.

- For summary data at the SetOfValues level: dataType will be "Mean", "Maximum" or "Minimum" as applicable, period = "Day", dayOrigin = "09:00:00"; again interval, characteristic, pointReference, valuesPerDay, will not be present. Dates but not times should be used.

- Field mapping to the parameter and qualifier will be required and a table should be drawn up to make those associations.

6.6 XML Stylesheets

These can be used to "mark-up" (i.e. convert) an XML document into a different XML format, or into HTML, CSV, or other text documents. Some example Stylesheets and their resultant documents are can be seen in Appendix B (see section 9.4).

6.7 Guidance Notes & System Notes

The XML Schema undergoes Version Control to ensure changes do not conflict with current implementations, this document is more likely to change; new implementations lead to further guidance and examples and this will be reflected within this document. Versions of this document may have an extra version number (ie Schema 1.1 may be accompanied by Guide 1.1.1, 1.1.2, 1.1.3 etc). Notes regarding specific systems are included as appendices to this document as an aid to the implementor. If this becomes unmanageable the document will be split.

Current appendices include system notes for National Flood Forecasting System (Appendix H), Thames Soil Moisture Model (Appendix I) and Real Time Flood Forecasting (Appendix J). Appendix G lists any currently available external resources.

7 Change Control Procedures

The consultation process undertaken by the Environment Agency when first establishing this standard is described in Appendix F. The consultation process is part of the Environment Agency Management System (AMS) procedure for the Approval and Adoption of a new EA data standards.

A working group was established to manage the consultation process. A number of internal and external consultees were identified. Appendix F also contains details of the working group and the list of consultees.

The Schema is now administered on behalf of the Environment Agency by the Environment Agency Data Standards team Data.Standards@Environment-Agency.gov.uk, however the Schema is owned collectively by the working group.

The Schema as published will not be changed other than by adhering to a strict change control process.

The change control process requires that a change request be submitted to the Environment Agency Data Standards Team. The Data standards team will acknowledge receipt of the request and process it. All requests for change will be actioned and replied to.

It may be that no change is required, for instance a change request that is outside of the scope of this Schema.

If a changed is required it will be categorised as follows:

- A change is minor (for example a spelling mistake in the text of the document or adding a missing value to a look up table). The change will be made without consultation and the new version issued. All users will be notified and the change will be identified in supporting notes within the Schema. The version of the Schema will be issued with a new sub-version number e.g. from version 1.1 to version 1.2.

- If the change is not minor then a full consultation process will be set into motion. The Schema will then not be re-issued until the consultation process has been completed. At this point new consultees may well be appointed from the current user base. If accepted the new version will be issued and again all users notified with supporting documentation. In this case the version will be given a full new version number e.g. from version 1.2 to version 2.0.

The criteria for treating a change as minor will be that the use of the Schema is not altered by the change.

How to register as a user. To register as a user of the Schema simply e-mail the data standards team quoting the name of the Schema, a contact name and e-mail address.

How to request a change. To request a change to the Schema e-mail the data standards team quoting the name of the Schema, a contact name and description of the change required.

8 Appendix A – Data Types

Attached are descriptions of the data types that are contained within the Environment Agency Time-Series Data Exchange Format. The common data types such as date, time, string, etc are first described. Thereafter the more specific data types such as NGR and Region are described.

Some data types are in a table of Schema item and description. The Schema item is used in the XML file.

Some data types are in a table of Schema number and description. The Schema number is to be used in the XML file.

Some data types just have a description of the validation contained within the Schema definition.

8.1 Common data types

8.1.1 Table A1- Common data types used in the Schema

Data type	Description
Date	Dates must be in the format CCYY-MM-DD where CC = century (e.g. 18, 19, 20), YY = year (99, 01, 03, etc.), MM = month (01 to 12) and DD = day (01 to 31). E.g. 25th April 2003 would be "2003-04-25" For further detail consult the e-GIF standard xs:date. e-GIF: http://www.govtalk.gov.uk/Schemasstandards/egif.asp
Floating point	This is an IEEE 32-bit single-precision number: i.e. a decimal number, which has a huge range of precision and size[7]. E.g. Valid numbers: 1, 1.000, 0.001, -1, -1E4, 167.77216e25, 12, INF (which means infinity) and NaN (which means Not-a-Number). For further detail consult the e-GIF standard xs:floatingpoint.
String	A character field. Many of these have restricted lengths in the Schema (see Tables 1 to 5). E.g. "Hello world"

[7] The actual range can be described from: *m2^e*, where *m* is an integer whose absolute value is less than *2^24*, and *e* is an integer between -149 and 104, inclusive.

	There are potentially illegal characters (e.g. "<"), see Appendix E for more information about this. For further detail consult the e-GIF standard xs:string.
Time	Time must be in the format hh:mm:ss where hh = hours (00 to 23), mm = minutes (00 to 59) and ss = seconds (00 to 59). E.g. "12:35:00", "00:00:00" For further detail consult the e-GIF standard xs:time.
UnsignedByte	An unsigned byte: i.e. a positive, whole number between 0 and 255. For further detail consult the e-GIF standard xs:unsignedByte.
UnsignedInt	An unsigned integer: again a positive whole number, but this is in the range from 0 to 4294967295. For further detail consult the e-GIF standard xs:unsignedInt.

8.2 Extracted data types

8.2.1 Table A2 – CharacteristicType

Description of data source. This can be very useful to distinguish between measured, forecast and modelled data, etc.

Schema Item	Description
Derived	Data that have been calculated from at least one other data set using a formula.
Forecast	Predicted data values for a point in time in the future.
Interpolated	Data values that are inserted within a time series, normally to fill a gap in the data.
Measured	Data values that have been measured in the environment.
Modelled	Data that is calculated using one or more environmental variables to reproduce the physical environment on a small scale.

8.2.2 Table A3 – DataPeriodIntervalType

The following times apply to both the data **period** and to the data **interval** (if present).

Schema Item	Description
Unspecified	The time period is not specified as the data is irregular.
1 s	One Second
2 s	Two Seconds
3 s	Three Seconds
4 s	Four Seconds
5 s	Five Seconds
6 s	Six Seconds
10 s	Ten Seconds
12 s	Twelve Seconds
15 s	Fifteen Seconds
20 s	Twenty Seconds
30 s	Thirty Seconds
1 min	One Minute
2 min	Two Minutes
3 min	Three Minutes
4 min	Four Minutes
5 min	Five Minutes
6 min	Six Minutes
10 min	Ten Minutes
12 min	Twelve Minutes
15 min	Fifteen Minutes
20 min	Twenty Minutes
30 min	Thirty Minutes
1 h	One Hour
2 h	Two Hours
3 h	Three Hours
4 h	Four Hours
6 h	Six Hours
8 h	Eight Hours
12 h	Twelve Hours
24 h	Twenty Four Hours
48 h	Forty Eight Hours
72 h	Seventy Two Hours
Day	Day: This may be as a “Water Day” or a “Calendar Day”.
Week	Weekly (Seven Days)
Bi-weekly	Bi-weekly (every 2 weeks); also referred to as fortnightly.
Month	Monthly (Calendar Month)
Quarterly	3 Monthly or a quarter of a 12 month period.
Year	Calendar Year, i.e. 1st January to 31st December.

Water Year	UK Water Year, i.e. 1st October to 30th September of the next calendar year (e.g. 2002 water year starts on 1/10/2002).

8.2.3 Table A4 – DataTypeType

The specific way in which the parameter was either measured or is being presented for example: Mean, Total, Event, etc.

Schema Item	Description
Instantaneous	Instantaneous value taken at a point in time.
Event	For these data the time that the event occurred is important, e.g. the time at which a 0.2mm tip was measured by a tipping bucket raingauge.
Maximum	The maximum value recorded in a time period.
Mean	The mean value of a set of readings.
Minimum	The minimum value recorded in a time period.
Cumulative Total	A total of values that increases with each successive value over the time period.
Total	Total of all values over a time period.

8.2.4 Table A5 – NgrType

This is the format for grid references allowed by the Schema, which is an Environment Agency standard.

Description
The National Grid Reference (NGR) will be provided in the following format: XX (sheet reference) followed by an even number of digits with a minimum of 2 and a maximum of 12 For example: • "SU12" – which locates the Station to the nearest 10km square. • "TQ123456" – which is to the nearest 100m square. • "SP1234567890" – which is to the nearest metre.

8.2.5 Table A6 – ParameterType

The following table lists all of the parameters allowed by the Schema and indicates what they mean.

ParameterType	Description
Actual Evapotranspiration	Amount of moisture actually evaporated and/or transpired into the atmosphere.
Ammonia	Ammonia concentration.
Barometric Pressure	Barometric air pressure.
Coil Current	Current in coil.
Conductivity (Field)	Measure of Conductivity of a liquid that has been taken in the field.
Dissolved Oxygen	Dissolved Oxygen concentration.
Effective Rainfall	Amount of precipitation that remains (after evaporation and relief of soil moisture deficit) that contributes to surface run-off and/or percolation.
Evaporation	Amount of moisture evaporated into the atmosphere.
Flow	The volume of liquid flowing through a cross-section in a unit time (may also be referred to as Discharge). This may be measured using Ultrasonic, Electromagnetic or Acoustic Doppler flow gauges or using a Stage-Discharge Relationship. (See qualifier for clarification.)
Freeze Level	The altitude at which water will freeze.
Gate Position	Position of opening for a gate. (See qualifier for clarification.)
Gate Angle	Measure of the angle of opening for a tilting or rotating gate. (See qualifier for clarification.)
pH	Power of Hydrogen ion concentration: i.e. a measure of how acid/alkali a solution is.
Potential Evapotranspiration	The amount of moisture that would be evaporated and/or transpired into the atmosphere from a saturated soil.
Probe Voltage	Measure of the voltage in probes, normally associated with the probes of an electromagnetic flow gauge.
Radiation	Incoming solar radiation or net radiation. (See qualifier for clarification.)
Rainfall	Measure of precipitation. (See qualifier for clarification.)
Relative Humidity	Amount of moisture in the air as a percentage of saturation.
Residual	The component of tidal water level attributable to meteorological effects.
Salinity (In situ)	Measure of salinity at a point.
Snow Level	Depth of snow.
Soil Moisture Deficit	Amount of moisture (e.g. from incoming precipitation) it would take to saturate the soil.
State	Digital state.
Sunshine Hours	Hours of direct sunshine.
Swell Wave	Waves that have been generated elsewhere and have been moved out of the generating area. Alternatively, the generating wind force has decayed or moved away.
Temperature	Average heat of a material, e.g. as measured by a thermometer. (See qualifier for clarification.)

Total Wave	Wave conditions resulting from combined effect of Wind Wave and Swell Wave.
Turbidity	Measure of the amount of suspended solids within the water column.
Vapour Pressure	Pressure exerted by the moisture in the air.
Velocity	Measurement of velocity at a particular depth in a river.
Voltage	Measurement of voltage (maybe referred to as the Electromotive force).
Water Level	Measurement of the depth or distance down to the water surface or level relative to a specific datum.
Wind	Measurement of a current of air moving at speed (See qualifier for clarification, e.g. Wind – Direction or Wind – Speed.)
Wind Wave	Wave conditions directly attributable to recent winds in the generating area.

8.2.6 Table A7 – ParameterQualifierType

Where necessary this qualifier will clarify what the Parameter refers to. This is particularly relevant where there are more than one of the same type of parameter associated with a Station.

ParameterQualifierType	Description
Abstraction	E.g. Flow abstracted from a river for public water supply.
Air	Air temperature.
Areal	Parameter refers to a modelled or measured area.
as N	Concentration of ammonia as N.
as O	Concentration of Dissolved Oxygen.
Crest Tapping	Static head measured at the separation pocket behind the crest of a weir.
Crest Tapping (2)	Second Crest Tapping.
Direction	Wind direction.
Downstream Stage	Water level measured downstream of a weir (also known as 'tail' level).
Dry Bulb	Dry bulb temperature.
Effluent Discharge	E.g. Flow discharged into a river from a sewerage treatment works.
Groundwater	Groundwater level (units distinguish whether the level is the measured dip or whether it is adjusted to metres above Ordinance Datum).
Height	In the case of Waves, vertical distance between crest and successive trough.
Logged	Data returned from a logger.
Maximum	Measured maximum value, e.g. Maximum Temperature.
Minimum	Measured minimum value, e.g. Minimum Temperature.
MOSES	Data from a Soil and Surface Moisture Model
Net	Net radiation.
NWP	Data from a Numerical Weather Prediction
Penstock	Water level at penstock.
Percentage of Saturated	E.g. Concentration of Dissolved Oxygen as a percentage of saturated.
Percolation Tank	Water level in a percolation tank.
Radar	Rainfall amount inferred from RADAR.
Reservoir Level	Reservior water level.
Run	Run of wind.
Sluice Gate	Gate is a sluice gate.
Soil	E.g. Soil temperature.
Solar	Incoming solar radiation.
Speed	Wind speed.
Stage	Water level in a river channel. Note that at a site with more than one water level, this refers to the primary level. If the site is a weir, this is the Upstream Stage.
Storage Raingauge	Manually read raingauge.
Sump Level	Water level in a sump.
Tidal Level	Tidal water level.
Tipping Bucket Raingauge	Rainfall intensity gauge, usually connected to a logger and/or telemetry.

Unionized	Concentration of unionized ammonia.
Water	E.g. water temperature.
Wet Bulb	Wet bulb temperature.
1	First of a set of multiple measures of the same parameter, e.g. Velocity paths at an ultrasonic gauge or gates at a control weir.
2	Second set of multiple measures of the same parameter
3	Third set of multiple measures of the same parameter
4	Fourth set of multiple measures of the same parameter
5	Fifth set of multiple measures of the same parameter
6	Sixth set of multiple measures of the same parameter
7	Seventh set of multiple measures of the same parameter
8	Eighth set of multiple measures of the same parameter
9	Ninth set of multiple measures of the same parameter
10	Tenth set of multiple measures of the same parameter
11	Eleventh set of multiple measures of the same parameter
12	Twelfth set of multiple measures of the same parameter
13	Thirteenth set of multiple measures of the same parameter
14	Fourteenth set of multiple measures of the same parameter
15	Fifteenth set of multiple measures of the same parameter
16	Sixteenth set of multiple measures of the same parameter
17	Seventeenth set of multiple measures of the same parameter
18	Eighteenth set of multiple measures of the same parameter
19	Nineteenth set of multiple measures of the same parameter
20	Twentieth set of multiple measures of the same parameter

8.2.7 Table A8 – DataQualityFlagType

The data flags that can be associated with the value must be unsigned-bytes between 1 and 67. The meanings behind these numbers are described in the following table.

Number	Name	Description
1	Good	Best data quality.
2	Suspect	Failed the latest quality control or there are strong grounds for suspecting the accuracy of the observation. This is better than missing.
3	Estimated	Estimated value (e.g. modelled value).
4	Unchecked	This value has not undergone sufficient quality control.
5	Missing	Gaps / missing data.
6	Complete	The source data set is complete (e.g. daily summary derived from all 96 values from a 15-min measured series).
7	Incomplete	The source data set is not complete, but enough data is provided to calculate the summary data.
8	Auto validated	The data has been subject to automatic validation routines.
9	Edited	The data value has been edited; this may be a manual or automatic process. This may be associated with a reason for edit and or comment.

10	Extrapolated	Flows are above or below the limit of a stage-discharge relationship and have been extrapolated. These flows will occur between Within Rating and Beyond Limit of Rating flags.
11	Within rating	The flows are within the upper and lower limits of the stage-discharge rating.
12	No rating	There is no rating present for this data.
13	Beyond upper limit	Beyond upper limit of rating when flows calculated using a stage-discharge equation.
14	Beyond lower limit	Beyond lower limit of rating when flows calculated using a stage-discharge equation.
15	Head only	Indicates the Upstream Head only has been used in the flow calculation.
16	Tail - modular	Indicates tail water level used in the flow calculation and the weir was found to be modular.
17	Tail - non-modular	Indicates tail water level used in the flow calculation. The weir was found to be non-modular so a reduction factor has been applied to the data.
18	Tail - extremely non-modular	Indicates tail water level used in the flow calculation. The weir was found to be extremely non-modular so a drowned flow reduction factor has been applied to the data.
19	Crest – modular	Indicates pressure-tapping level used in the flow calculation and the weir was found to be modular.
20	Crest - non-modular	Indicates pressure-tapping level used in the flow calculation. The weir was found to be non-modular so a reduction factor has been applied to the data.
21	Crest – extremely non-modular	Indicates pressure-tapping level used in the flow calculation. The weir was found to be extremely non-modular so a drowned flow reduction factor has been applied to the data.
22	Engineer on Site	Indicates an engineer is on site, some data values may be affected by their work.
23	Normal QC complete	The Quality Control procedures have been completed.
24	Test Calibration Data	The data has been generated during the process of testing and calibrating the sensor.
25	Item in Alarm	The item that is being recorded by the Telemetry system is in a state of alarm.
26	Off Scan/Disable	The telemetry outstation is set to Off Scan or has been disabled.
27	Out of Range	The data recorded is out of the minimum or maximum calibrated range of the measuring sensor.
28	Manually Entered Data	A user has manually updated the source system.
29	Master Station Override	The telemetry master station override is active. This may have affected the data.
30	Invalid State	This indicates the Digital Status is invalid from the source system.

31	Invalid Time	This indicates the time is invalid from the source system.
32	Trace	Some rain has fallen but it is too little to measure.
33	Accumulation (Start)	First value for an accumulated data block.
34	Accumulation	Rainfall that has accumulated over more than one day between readings for a storage type gauge. Note that there should be Start and End of accumulation flags.
35	Accumulation (End)	Last value for an accumulated data block.
36	Snow	Precipitation that has fallen as snow but has not been converted to rainfall equivalent.
37	Snow converted to rain	Precipitation that has fallen as snow that has been converted to rainfall equivalent.
38	Well Dry	Maximum depth of well reached (i.e. the bottom): there could be water at greater depth in the aquifer.
39	Automatic Estimate	Estimate/correction derived automatically from a program with no manual intervention.
40	Manual Estimate	Estimate/corrected value has been set manually (with or without assistance from a program).
41	Observer Estimate	Estimate/correction has been obtained retrospectively from the observer/station.
42	Derived Estimate	Precipitation estimate/correction has been derived from snow/rainfall equivalence, or trace estimate/correction has been set for consistency with present weather.
43	Units Correction	Correction has been obtained by changing units of measurement.
44	Systematic Correction	Correction has been obtained by applying a systematic adjustment.
45	Inaccessible	Measurement impossible, because of snow, etc.
46	Unavailable	An estimate where the original value is not available.
47	Unreliable Estimate	An unreliable estimate (used in radiation QC).
48	Correction	A correction (a reported value is assumed to be in error).
49	Reverted to Original	Value reverted to original.
50	Raw	Original value verified by observer.
51	Original	The data value is the original or raw value retrieved from an external source without any verification.
52	Completed	The original data value was missing and was replaced by a value that was derived by a model.
53	Failed SDB/MetDB	Failed Synoptic Database (SDB) or Met Office Database (MetDB) QC check.
54	Failed MIDAS	Failed MIDAS validation.

55	Position/Movement Failed	Failed climate QC marine position or movement check.
56	Range Failed	Failed climate QC range check.
57	Consistency Failed	Failed climate QC internal consistency check.
58	Sequence check Failed	Failed climate QC sequence check.
59	Areal check Failed	Failed climate QC areal check.
60	MO QC level 0	Initial climate QC program has not been run.
61	MO QC level 1	Initial climate QC program has been run.
62	MO QC level 2	Initial QC queries processed.
63	MO QC level 4	Further range or internal consistency or sequence checks job(s) run and queries processed.
64	MO QC level 6	Final (or only) areal or buddy job run and queries processed.
65	MO QC level 8	Final (or only) monthly job(s) run and queries processed.
66	High Tide	Water level at High tide: note that this is usually a forecast.
67	Low Tide	Water level at Low tide: note that this is usually a forecast.

8.2.8 Table A9 – UnitsType

These are the units that are associated with the set-of-values.

Schema item	Description
---	Missing Unit - none specified
%	Percentage
% opening	Percentage opening (when applied to Gate or Sluice Gate)
% Sat	Percentage Saturation
1000m3	Thousand cubic metres
1000m3/d	Thousand cubic metres per day (TCMD)
10m3	Ten cubic metres
Amps	Amperes (electrical current)
Bar	14 lbs per square inch - atmospheric pressure
cm	Centimetres
cm2	Square centimetre
cm3	Cubic centimetres
cm3/s	Cubic centimetres per second
deg	Degrees
deg opening	Degrees of Opening

deg C	Degrees Centigrade / Celsius
deg d	Degrees referenced to True North
deg F	Degrees Fahrenheit
ft	Feet
ft/s	Feet per second
ft2	Square feet
FTU	Formazic Turbidity Units
g/l	Grams per litre
Hazen	Hazen Colour Units
in	Inches
in2	Square inches
J	Joules
J/cm2	Joules/Square Centimetre
J/m2	Joules/Square metre
K	Kelvin (absolute temp)
km	Kilometres
km2	Square kilometres
Knots	Knots
kW	Kilowatts
kWh	Kilowatts per hour
l/h	Litres per hour
l/s	Litres per second
m	Metres
m/s	Metres per second
m2	Square metres
m3	Cubic metres
m3/d	Cubic metres per day
m3/h	Cubic metres per hour
m3/s	Cubic metres per second (also know as cumecs)
m3/year	Cubic metres per year
mA	MilliAmps
mAOD	Metres above Ordnance Datum
mASD	Metres above Station Datum
mbar	Millibar
mBDAT	Metres below Datum
mg/l	Milligrams per litre
micro g/l	Micrograms per litre
micro m	Micrometres
micro S/cm	Micro seimens per centimeter
micro V	Micro Volts
Mile	Miles
min	Minutes
Ml	Megalitres
Ml/d	Megalitres per day
mm	Millimetres

mm/d	Millimetres per day
mm/h	Millimetres per hour
mmol/l	Milli-Mols per litre
mol/m3	Moles per cubic metre
mph	Miles per hour
mS/cm	Milli Seconds per centimeter
mS/m	Milli Seconds per metre
mV	MilliVolts
mW/m2	Milliwatts per metre squared
ng/l	Nanograms per litre
NTU	Nephelometric Turbidity Units
NTU %	Percentage of National Turbidity Units
on/off	Digital Status
pH	Power of Hydrogen ION concentration (nit Range 1 to 14)
ppt	Parts per thousand
revs	Revolutions
s	Seconds
Sec opening	Seconds of opening (Gate or Sluice Gate)
V	Volts
W/m2	Watts per metre squared

8.2.9 Table A10 – RegionType

The UK Region in which Environment Agency Offices Operate

Region
Anglian
Head Office
Midland
North East
North West
South West
Southern
Thames
EA Wales

9 Appendix B – XML Sample files

9.1 The most basic example

This file contains no data!

```
<?xml version="1.0" encoding="UTF-8"?><EATimeSeriesDataExchangeFormat xmlns="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation = "http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat EATimeSeriesDataExchangeFormat.xsd"/>
```

9.2 Mixed example

This example contains two stations and demonstrates different types of dataset. Annotations are included for clarity.

```
<?xml version="1.0" encoding="UTF-8"?>
<EATimeSeriesDataExchangeFormat xmlns="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation = "http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat EATimeSeriesDataExchangeFormat.xsd">

  <md:Publisher>Environment Agency</md:Publisher>
  <md:Source>Plain English Document</md:Source>
  <md:Description>Mixed data file</md:Description>
  <md:Date>2003-06-20</md:Date>
  <md:Time>15:30:15</md:Time>

  <Station
    region="Thames"
    stationReference="2200"
    stationName="RIVER THAMES AT READING"
    ngr="SU71807406">

<!-- Four days of daily mean flows  -->

    <SetofValues
      parameter="Flow"
      dataType="Mean"
      period="Day"
      characteristic="Derived"
      units="m3/s"
      startDate="2003-04-20"
      endDate="2003-04-23"
      dayOrigin="09:00:00">

      <Value date="2003-04-20" flag1="1" flag2="1" percentFlag2="100">15.63</Value>
      <Value date="2003-04-21" flag1="2" flag2="1" percentFlag2="92.5">16.21</Value>
      <Value date="2003-04-22" flag1="1" flag2="1" percentFlag2="87" flag3="2" percentFlag3="5.5">16</Value>
      <Value date="2003-04-23" flag1="2" flag2="1" percentFlag2="85.2" flag3="2" percentFlag3="14.8">17.36</Value>
```

```
        <Comment startDate="2003-04-22">This daily mean flow was derived from an incomplete set of good and suspect data but has
been validated and found to be of good overall quality</Comment>
        <Comment startDate="2003-04-21" endDate="2003-04-23">This demonstrates that you can have nested comments</Comment>

      </SetofValues>

<!-- 1 and a half hours of recorded levels (e.g. from telemetry) -->

      <SetofValues
        parameter="Water Level"
        qualifier="Stage"
        dataType="Instantaneous"
        period="15 min"
        characteristic="Measured"
        productRef="H12"
        units="m"
        startDate="2003-04-20"
        startTime="12:00:00"
        endDate="2003-04-20"
        endTime="13:30:00"
        dayOrigin="09:00:00"
        valuesPerDay="96">

        <Value date="2003-04-20" time="12:00:00">3.125</Value>
        <Value date="2003-04-20" time="12:15:00">3.126</Value>
        <Value date="2003-04-20" time="12:30:00">3.125</Value>
        <Value date="2003-04-20" time="12:45:00">3.127</Value>
        <Value date="2003-04-20" time="13:00:00" flag1="25">8.568</Value>
        <Value date="2003-04-20" time="13:15:00">3.127</Value>
        <Value date="2003-04-20" time="13:30:00">3.126</Value>
      </SetofValues>
    </Station>

    <Station region="Thames" stationReference="265922"
    stationName="CAVERSHAM LOCK" ngr="SU72067403">

<!-- 1 monthly rainfall total -->

      <SetofValues
        parameter="Rainfall"
        qualifier="Storage Raingauge"
        dataType="Total"
        period="Month"
        characteristic="Measured"
        units="mm"
        startDate="2003-04-01"
        endDate="2003-04-01"
        dayOrigin="09:00:00">

        <Value date="2003-04-01" flag1="4">36.5</Value>

      </SetofValues>
    </Station>
</EATimeSeriesDataExchangeFormat>
```

9.3 A data file that contains a list of stations

This example demonstrates that you can create **basic** station lists that are valid against the Schema.

```
<?xml version="1.0" encoding="UTF-8"?>
<EATimeSeriesDataExchangeFormat xmlns="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-
agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation =
"http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat EATimeSeriesDataExchangeFormat.xsd">

  <md:Publisher>Environment Agency</md:Publisher>
  <md:Source>Plain English Document</md:Source>
  <md:Description>A station list example</md:Description>
  <md:Date>2003-06-20</md:Date>
  <md:Time>15:30:15</md:Time>

  <Station region="Thames" stationReference="2200"
  stationName="RIVER THAMES AT READING" ngr="SU71807406"/>
  <Station region="Thames" stationReference="2201"
  stationName="River Thames at Caversham Lock" ngr="SU72067403"/>
  <Station region="Thames" stationReference="2210"
  stationName="RIVER KENNET AT MARLBOROUGH" ngr="SU18706862"/>
  <Station region="Thames" stationReference="2219"
  stationName="RIVER OG AT MARLBOROUGH (POULTON FARM)" ngr="SU19256984"/>
  <Station region="Thames" stationReference="2222"
  stationName="River Kennet at Mildenhall (Durnsford Mill)" ngr="SU22196938"/>
  <Station region="Thames" stationReference="2223"
  stationName="River Kennet at Stichcombe" ngr="SU22626939"/>
  <Station region="Thames" stationReference="2227"
  stationName="River Kennet at Ramsbury (Howe Mill)" ngr="SU27977153"/>
  <Station region="Thames" stationReference="2229"
  stationName="ALDBOURNE AT RAMSBURY" ngr="SU28967173"/>
  <Station region="Thames" stationReference="2230"
  stationName="RIVER KENNET AT KNIGHTON" ngr="SU29507102"/>
  <Station region="Thames" stationReference="2232"
  stationName="River Kennet at Knighton - side" ngr="SU29457096"/>
  <Station region="Thames" stationReference="2236"
  stationName="River Kennet at Eddington Bridge" ngr="SU34216902"/>
  <Station region="Thames" stationReference="2238"
  stationName="River Shalbourne at Smitham Bridge" ngr="SU33106830"/>
  <Station region="Thames" stationReference="2239"
  stationName="RIVER DUN AT HUNGERFORD" ngr="SU32136852"/>
  <Station region="Thames" stationReference="2240"
  stationName="River Kennet at Marsh Benham" ngr="SU42306700"/>
  <Station region="Thames" stationReference="2241"
  stationName="RIVER SHALBOURNE AT HUNGERFORD" ngr="SU33066831"/>
  <Station region="Thames" stationReference="2250"
  stationName="RIVER KENNET AT NEWBURY" ngr="SU47136717"/>
  <Station region="Thames" stationReference="2251"
  stationName="River Lambourn at Lambourn" ngr="SU32787901"/>
  <Station region="Thames" stationReference="2252"
  stationName="River Lambourn at Eastbury Rd Bridge" ngr="SU34807700"/>
  <Station region="Thames" stationReference="2253"
  stationName="River Lambourn at East Shefford" ngr="SU38907460"/>
  <Station region="Thames" stationReference="2255"
```

```
   stationName="River Lambourn at Welford" ngr="SU41117306"/>
   <Station region="Thames" stationReference="2260"
   stationName="River Kennet U/S Ham Bridge" ngr="SU49106710"/>
   <Station region="Thames" stationReference="2262"
   stationName="Winterbourne Stream at Winterbourne" ngr="SU45307150"/>
   <Station region="Thames" stationReference="2264"
   stationName="WINTERBOURNE STREAM AT BAGNOR" ngr="SU45266947"/>
   <Station region="Thames" stationReference="2267"
   stationName="River Kennet at Donnington Grove" ngr="SU45706890"/>
   <Station region="Thames" stationReference="2269"
   stationName="RIVER LAMBOURN AT SHAW" ngr="SU47036821"/>
   <Station region="Thames" stationReference="2271"/>
   <Station region="Thames" stationReference="2298"
   stationName="River Kennet at Blakes Lock" ngr="SU72737353"/>
</EATimeSeriesDataExchangeFormat>
```

9.4 XSL Stylesheet – Mark-up example

9.4.1 The XML data file

The following is a listing of a data file. Note that the line in **blue** directs the reader to mark-up the file using the "Transform_Comma_Sep.xsl" stylesheet.

```
<?xml version="1.0" encoding="UTF-8"?>

<?xml-stylesheet type="text/xsl" href="Transform_Comma_Sep.xsl"?>

<EATimeSeriesDataExchangeFormat xmlns="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-
agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation =
"http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat EATimeSeriesDataExchangeFormat.xsd">

   <md:Publisher>Environment Agency</md:Publisher>
   <md:Source>Plain English Document</md:Source>
   <md:Description>Stylesheet example file</md:Description>
   <md:Date>2003-06-20</md:Date>
   <md:Time>15:30:15</md:Time>

   <Station region="Thames" stationReference="TQ27/337"
   stationName="HAMMERSMITH OBH" ngr="TQ22307834">

      <SetofValues parameter="Water Level" dataType="Instantaneous" period="Unspecified" units="mAOD">
         <Value date="1974-12-27" time="05:15:00" flag1="2">5.57</Value>
         <Value date="1974-12-27" time="05:30:00" flag1="2" flag2="38" flag3="9">5.57</Value>
         <Value date="1974-12-27" flag1="2" flag2="1" percentFlag2="14.5" flag3="3" percentFlag3="65.5" flag4="5"
percentFlag4="20">5.65</Value>
      </SetofValues>

      <SetofValues parameter="Water Level" dataType="Instantaneous"
      period="Unspecified" units="mAOD"
      startDate="2000-01-01" endDate="2003-12-31">
         <Value date="2000-01-01" time="11:32:28" flag1="1">-34.988</Value>
```

```
        <Value date="2000-01-01" time="17:32:28" flag1="1" flag2="9">-35.015</Value>
        <Value date="2000-01-01" time="23:32:28" flag1="4">-34.978</Value>
        <Value date="2000-01-02" time="05:32:28" flag1="4">NaN</Value>
        <Value date="2000-01-02" time="11:32:28" flag1="4">-34.978</Value>
        <Value date="2000-01-02" time="17:32:28" flag1="4">-35.006</Value>
        <Value date="2000-01-02" time="23:32:28" flag1="4">-34.905</Value>
        <Value date="2000-01-03" time="05:32:28" flag1="4">-34.96</Value>
        <Value date="2000-01-03" time="11:32:28" flag1="4">-34.886</Value>
        <Value date="2000-01-03" time="17:32:28" flag1="4">-34.942</Value>
        <Comment startDate="2000-01-02" startTime="05:32:28" endDate="2000-01-02" endTime="05:32:28">I'm a comment that applies
to an invalid value</Comment>
      </SetofValues>

      <SetofValues parameter="Water Level" qualifier="Logged" dataType="Instantaneous"
      period="Unspecified" units="mAOD"
      startDate="2000-01-01" endDate="2003-12-31">
        <Value date="2000-01-01" time="11:32:28">-34.988</Value>
        <Value date="2000-01-01" time="17:32:28">-35.015</Value>
        <Value date="2000-01-01" time="23:32:28" flag1="24">-34.978</Value>
        <Value date="2000-01-02" time="05:32:28" flag1="27">NaN</Value>
        <Value date="2000-01-02" time="11:32:28">-34.978</Value>
      </SetofValues>
    </Station>
</EATimeSeriesDataExchangeFormat>
```

9.4.2 The Transform_Comma_Sep.xsl stylesheet

Note that this is a very basic stylesheet. Using the functionality available to XML parsers, most text file formats can be emulated. These can be developed as and when required.

9.4.2.1 Basic CSV stylesheet

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:ea="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-
agency.gov.uk/XMLSchemas/EAMetadataFormat">

<!--

Basic CSV mark-up stylesheet for the EATimeSeriesDataExchangeFormat

Chris Beales, June 2003

-->

<xsl:output method="text" media-type="text/plain" />
<xsl:strip-space elements="*" />

<xsl:template match='/'>
  <xsl:apply-templates select="md:EAMetadataFormat" />
  <xsl:apply-templates select="ea:EATimeSeriesDataExchangeFormat" />
```

```
</xsl:template>

<xsl:template match='EAMetadataFormat'>
  <xsl:apply-templates select="md:*"/>
</xsl:template>

<xsl:template match="md:*" />

<xsl:template match='EATimeSeriesDataExchangeFormat'>
  <xsl:apply-templates select="ea:Station"/>
</xsl:template>

<xsl:template match="ea:Station" >Region: <xsl:value-of select="@region"/>
Station Name: <xsl:value-of select="@stationName"/>
Station Reference: <xsl:value-of select="@stationReference"/>
NGR: <xsl:value-of select="@ngr"/><xsl:text>&#xd;&#xA;</xsl:text>
<xsl:apply-templates select="ea:SetofValues"/>
</xsl:template>

<xsl:template match="ea:SetofValues">
&quot;Parameter&quot;,&quot;<xsl:value-of select="@parameter"/>&quot;<xsl:if test="@qualifier">
&quot;Qualifier&quot;,&quot;<xsl:value-of select="@qualifier"/>&quot;</xsl:if>
&quot;Data Type&quot;,&quot;<xsl:value-of select="@dataType"/>&quot;
&quot;Period&quot;,&quot;<xsl:value-of select="@period"/>&quot;
&quot;Interval&quot;,&quot;<xsl:value-of select="@interval"/>&quot;
&quot;Characteristic&quot;,&quot;<xsl:value-of select="@characteristic"/>&quot;
&quot;Point Reference&quot;,&quot;<xsl:value-of select="@pointReference"/>&quot;
&quot;Units&quot;,&quot;<xsl:value-of select="@units"/>&quot;
&quot;Start Date&quot;,<xsl:value-of select="@startDate"/>
&quot;Start Time&quot;<xsl:value-of select="@startTime"/>
&quot;End Date&quot;,<xsl:value-of select="@endDate"/>
&quot;End Time&quot;,<xsl:value-of select="@endTime"/>
&quot;Day Origin&quot;,<xsl:value-of select="@dayOrigin"/>
&quot;Values Per Day&quot;,<xsl:value-of select="@valuesPerDay"/><xsl:text>&#xd;&#xA;</xsl:text>
<xsl:apply-templates select="ea:Value"/>
<xsl:apply-templates select="ea:Comment"/>
</xsl:template>

<xsl:template match="ea:Value">
<xsl:value-of select="@date"/><xsl:if test="@time">&#x20;<xsl:value-of select="@time"/></xsl:if>,<xsl:value-of
select="@flag1"/>,<xsl:value-of select="."/><xsl:text>&#xd;&#xA;</xsl:text>
</xsl:template>

<xsl:template match="ea:Comment">
&quot;Comments&quot;
<xsl:value-of select="@startDate"/>,<xsl:value-of select="@startTime"/>,<xsl:value-of select="@endDate"/>,<xsl:value-of
select="@endTime"/>,<xsl:value-of select="."/><xsl:text>&#xd;&#xA;</xsl:text>
</xsl:template>

</xsl:stylesheet>
```

9.4.2.2 CSV Results (based on 9.4.1)

```
Region: Thames
Station Name: HAMMERSMITH OBH
```

```
Station Reference: TQ27/337
NGR: TQ22307834

"Parameter","Water Level"
"Data Type","Instantaneous"
"Period","Unspecified"
"Interval",""
"Characteristic",""
"Point Reference",""
"Units","mAOD"
"Start Date",
"Start Time"
"End Date",
"End Time",
"Day Origin",
"Values Per Day",
1974-12-27 05:15:00,2,5.57
1974-12-27 05:30:00,2,5.57
1974-12-27,2,5.65

"Parameter","Water Level"
"Data Type","Instantaneous"
"Period","Unspecified"
"Interval",""
"Characteristic",""
"Point Reference",""
"Units","mAOD"
"Start Date",2000-01-01
"Start Time"
"End Date",2003-12-31
"End Time",
"Day Origin",
"Values Per Day",
2000-01-01 11:32:28,1,-34.988
2000-01-01 17:32:28,1,-35.015
2000-01-01 23:32:28,4,-34.978
2000-01-02 05:32:28,4,NaN
2000-01-02 11:32:28,4,-34.978
2000-01-02 17:32:28,4,-35.006
2000-01-02 23:32:28,4,-34.905
2000-01-03 05:32:28,4,-34.96
2000-01-03 11:32:28,4,-34.886
2000-01-03 17:32:28,4,-34.942

"Comments"
2000-01-02,05:32:28,2000-01-02,05:32:28,I'm a comment that applies to an invalid
value

"Parameter","Water Level"
"Qualifier","Logged"
"Data Type","Instantaneous"
"Period","Unspecified"
"Interval",""
"Characteristic",""
"Point Reference",""
"Units","mAOD"
"Start Date",2000-01-01
```

```
"Start Time"
"End Date",2003-12-31
"End Time",
"Day Origin",
"Values Per Day",
2000-01-01 11:32:28,,-34.988
2000-01-01 17:32:28,,-35.015
2000-01-01 23:32:28,24,-34.978
2000-01-02 05:32:28,27,NaN
2000-01-02 11:32:28,,-34.978
```

9.4.3 The Transform_HTML.xsl stylesheet

This is another basic example stylesheet, which converts the XML data file into an HTML web page. To direct the parser to use this sheet, you would need to alter the xml-stylesheet line to:

<?xml-stylesheet type="text/xsl" href="Transform_HTML.xsl"?>

9.4.3.1 Basic HTML stylesheet

```
<?xml-stylesheet type="text/xsl" ?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:ea="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:md="http://www.environment-
agency.gov.uk/XMLSchemas/EAMetadataFormat">

<!--

Basic HTML mark-up stylesheet for the EATimeSeriesDataExchangeFormat

Chris Beales, June 2003

-->


  <xsl:template match="/">
    <html>
      <head>
        <title>Untitled</title>
      </head>
      <body>
        <xsl:apply-templates select="md:EAMetadataFormat"/>
        <xsl:apply-templates select="ea:EATimeSeriesDataExchangeFormat"/>
      </body>
    </html>
  </xsl:template>


  <xsl:template match="md:Publisher"/>
  <xsl:template match="md:Source"/>

  <xsl:template match="md:Description">
    <H1><xsl:value-of select="."/></H1>
  </xsl:template>

  <xsl:template match="md:Date">
    <I>File created on <xsl:value-of select="."/> at </I>
  </xsl:template>

  <xsl:template match="md:Time">
    <I><xsl:value-of select="."/></I>
  </xsl:template>


  <xsl:template match="EATimeSeriesDataExchangeFormat">
```

```
  <xsl:apply-templates select="ea:Station"/>
</xsl:template>


<xsl:template match="ea:Station">
  <table class="tblhdr" width="500" cellpadding="0" cellspacing="0" border="1" bordercolor="steelblue">
    <tbody align="left">
      <tr>
        <th bgcolor="#D3D3D3">Station</th>
      </tr>
      <tr>
        <th>Region: <xsl:value-of select="@region"/>
        </th>
      </tr>
      <tr>
        <th>Station Name: <xsl:value-of select="@stationName"/>
        </th>
      </tr>
      <tr>
        <th>Station Reference: <xsl:value-of select="@stationReference"/>
        </th>
      </tr>
      <tr>
        <th>NGR: <xsl:value-of select="@ngr"/>
        </th>
      </tr>
      <xsl:apply-templates select="ea:SetofValues"/>
    </tbody>
  </table>
</xsl:template>


<xsl:template match="ea:SetofValues">
  <tr>
    <th bgcolor="#D3D3D3">Set of Values Header</th>
  </tr>
  <tr>
    <th>Parameter:<xsl:value-of select="@parameter"/>
    <xsl:if test="@qualifier"> - <xsl:value-of select="@qualifier"/></xsl:if>
    </th>
  </tr>
  <tr>
    <th>Data Type:<xsl:value-of select="@dataType"/>
    </th>
  </tr>
  <tr>
    <th>Period:<xsl:value-of select="@period"/>
    </th>
  </tr>
  <xsl:if test="@interval">
    <tr>
      <th>Interval:<xsl:value-of select="@interval"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@characteristic">
    <tr>
```

```
      <th>Characteristic:<xsl:value-of select="@characteristic"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@pointReference">
    <tr>
      <th>Point Reference:<xsl:value-of select="@pointReference"/>
      </th>
    </tr>
  </xsl:if>
  <tr>
    <th>Units:<xsl:value-of select="@units"/>
    </th>
  </tr>
  <xsl:if test="@startDate">
    <tr>
      <th>Start Date:<xsl:value-of select="@startDate"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@startTime">
    <tr>
      <th>Start Time:<xsl:value-of select="@startTime"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@endDate">
    <tr>
      <th>End Date:<xsl:value-of select="@endDate"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@endTime">
    <tr>
      <th>End Time:<xsl:value-of select="@endTime"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@invalidNumber">
    <tr>
      <th>Invalid Number:<xsl:value-of select="@invalidNumber"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@dayOrigin">
    <tr>
      <th>Day Origin:<xsl:value-of select="@dayOrigin"/>
      </th>
    </tr>
  </xsl:if>
  <xsl:if test="@valuesPerDay">
    <tr>
      <th>Values Per Day:<xsl:value-of select="@valuesPerDay"/>
      </th>
    </tr>
  </xsl:if>
  <tr>
```

```
      <th bgcolor="#D3D3D3">Value + Quality</th>
    </tr>
    <xsl:apply-templates select="ea:Value"/>
    <tr>
      <th bgcolor="#D3D3D3">Comments</th>
    </tr>
    <xsl:apply-templates select="ea:Comment"/>
  </xsl:template>


  <xsl:template match="ea:Value">
    <tr>
      <th bgcolor="#D3D3D3">
        <xsl:value-of select="@date"/>
        <xsl:if test="@time">
          &#x20;<xsl:value-of select="@time"/>
        </xsl:if>
      </th>
    </tr>
    <tr>
      <th>Amount: <xsl:value-of select="."/></th>
    </tr>
    <xsl:if test="@flag1">
      <xsl:choose>
        <xsl:when test="@flag1 = 1">
          <tr>
            <th>Quality: Good</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 2">
          <tr>
            <th>Quality: Suspect</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 3">
          <tr>
            <th>Quality: Estimated</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 4">
          <tr>
            <th>Quality: Unchecked</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 5">
          <tr>
            <th>Quality: Missing</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 6">
          <tr>
            <th>Quality: Complete</th>
          </tr>
        </xsl:when>
        <xsl:when test="@flag1 = 7">
          <tr>
            <th>Quality: Incomplete</th>
```

```
            </tr>
          </xsl:when>
        </xsl:choose>
      </xsl:if>
    </xsl:template>

    <xsl:template match="ea:Comment">
        <tr>
          <th>Start Date: <xsl:value-of select="@startDate"/></th>
        </tr>
        <tr>
          <th>Start Time: <xsl:value-of select="@startTime"/></th>
        </tr>
        <tr>
          <th>End Date: <xsl:value-of select="@endDate"/></th>
        </tr>
        <tr>
          <th>End Time <xsl:value-of select="@endTime"/></th>
        </tr>
        <tr>
          <th>Comment: <xsl:value-of select="."/></th>
        </tr>
    </xsl:template>
</xsl:stylesheet>
```

9.4.3.2 HTML Results

Stylesheet example file

File created on 2003-06-20 at 15:30:15

Station
Region: Thames
Station Name: HAMMERSMITH OBH
Station Reference: TQ27/337
NGR: TQ22307834
Set of Values Header
Parameter:Water Level
Data Type:Instantaneous
Period:Unspecified
Units:mAOD
Value + Quality
1974-12-27 05:15:00
Amount: 5.57
Quality: Suspect
1974-12-27 05:30:00

Amount: 5.57
Quality: Suspect
1974-12-27
Amount: 5.65
Quality: Suspect
Comments
Set of Values Header
Parameter:Water Level
Data Type:Instantaneous
Period:Unspecified
Units:mAOD
Start Date:2000-01-01
End Date:2003-12-31
Value + Quality
2000-01-01 11:32:28
Amount: -34.988
Quality: Good
2000-01-01 17:32:28
Amount: -35.015
Quality: Good
2000-01-01 23:32:28
Amount: -34.978
Quality: Unchecked
2000-01-02 05:32:28
Amount: NaN
Quality: Unchecked
2000-01-02 11:32:28
Amount: -34.978
Quality: Unchecked
2000-01-02 17:32:28
Amount: -35.006
Quality: Unchecked
2000-01-02 23:32:28
Amount: -34.905
Quality: Unchecked
2000-01-03 05:32:28
Amount: -34.96
Quality: Unchecked
2000-01-03 11:32:28

Amount: -34.886
Quality: Unchecked
2000-01-03 17:32:28
Amount: -34.942
Quality: Unchecked
Comments
Start Date: 2000-01-02
Start Time: 05:32:28
End Date: 2000-01-02
End Time 05:32:28
Comment: I'm a comment that applies to an invalid value
Set of Values Header
Parameter:Water Level - Logged
Data Type:Instantaneous
Period:Unspecified
Units:mAOD
Start Date:2000-01-01
End Date:2003-12-31
Value + Quality
2000-01-01 11:32:28
Amount: -34.988
2000-01-01 17:32:28
Amount: -35.015
2000-01-01 23:32:28
Amount: -34.978
2000-01-02 05:32:28
Amount: NaN
2000-01-02 11:32:28
Amount: -34.978
Comments

10 Appendix C – Schema Listing

10.1 EATimeSeriesDataExchangeFormat

Listing of the Environment Agency's Time-Series Data Exchange Format (Version 1.1).

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat"
elementFormDefault="qualified" attributeFormDefault="unqualified">
  <!--

  XML Architecture Schema for time-series data exchange

  Purpose: This schema is used to supply the base building data structures for time-series data exchange
    within, to and from the Environment Agency.

  Author:  Chris Beales, EA Data, Information and Environmental Assessment, and
    Simon Wood, HARP Build Stage Manager
    based on an original design by Dave Burrows, and Giles Colton, EA CIS Development Team.

  For further information please refer to the document EATimeSeriesSchemaDescription.doc
    which is located at http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat/PlainEnglish/EATimeSeriesSchemaDescription.doc


  Current Version 1.1, Modified: 2004-06-29
  ========================================

  Edit: James Procter

  -    modified Dublin Core date to current release - (dc:Date 2004-06-29 dc:Date)

  Current Version 1.1, Modified: 2004-05-05
  ========================================

  Edits & testing: Ian Dawes and Chris Beales
```

- additional optional attribute field named productRef introduced to the SetOfValues element between the qualifier and dataType fields to permit unique identification of Met Office gridded products. This field can then be populated with the Agency's unique product references that are assigned to every Met Office radar/gridded data stream.

- new SimpleType called String_10Type added

- Removal of the trailing space on the end of "deg " in UnitsType.

- Addition to ParameterType of
  - "Residual", "Total Wave", "Wind Wave", "Swell Wave" and "Freeze Level"

- Addition to ParameterQualifierType of
  - "Height", "Period", "MOSES", "NWP"

- Flag description changed from textual description to individually defined elements with attributes

History
=======

Version: 1.0, Date: 2003-06-27

- Original Release

-->

```
<xsd:annotation>
  <xsd:appinfo xmlns:gms="http://www.govtalk.gov.uk/CM/gms" xmlns:dc="http://purl.org/dc/elements/1.1/">
    <dc:Contributor/>
    <dc:Coverage/>
    <dc:Creator>EA Data, Information and Environmental Assessment; HARP and CIS Development</dc:Creator>
    <dc:Date>2004-06-29</dc:Date>
    <dc:Description>This schema is used to supply the base building data structures for time series data exchange within, to and from the Environment Agency</dc:Description>
    <dc:Format/>
    <dc:Identifier>{http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat}v1.1</dc:Identifier>
    <dc:Language/>
    <dc:Publisher>Environment Agency</dc:Publisher>
```

```
      <dc:Relation/>
      <dc:Rights/>
      <dc:Source/>
      <dc:Subject/>
      <dc:Title>Environment Agency Time Series Data Exchange Format Schema</dc:Title>
      <dc:Type/>
    </xsd:appinfo>
  </xsd:annotation>
  <xsd:import namespace="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" schemaLocation="EAMetadata.xsd"/>
  <xsd:element name="EATimeSeriesDataExchangeFormat">
    <xsd:annotation>
      <xsd:documentation>Hydrometric, Catchment Average Accumulations, National Tide Gauge Network, Tide Predictions, Surge and Wave forecasts.</xsd:documentation>
    </xsd:annotation>
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="md:Publisher" minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>The entity responsible for making the resource available (e.g. "Environment Agency")</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element ref="md:Source" minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>The reference to the source (system) from which the data is derived (e.g. "Hydrometric Archive")</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element ref="md:Description" minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>An account of the content of the data file (e.g. "Data request for Joe Bloggs")</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element ref="md:Creator" minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>The entity primarily responsible for producing the content of the resource. This is preferably not a named person but a post or a department.</xsd:documentation>
          </xsd:annotation>
        </xsd:element>
        <xsd:element ref="md:Date" minOccurs="0">
          <xsd:annotation>
            <xsd:documentation>The date that the file was created in XML format (ccyy-mm-dd)</xsd:documentation>
          </xsd:annotation>
```

```
</xsd:element>
<xsd:element ref="md:Time" minOccurs="0">
  <xsd:annotation>
    <xsd:documentation>The time that the file was created in XML format (hh:mm:ss)</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element ref="md:Identifier" minOccurs="0">
  <xsd:annotation>
    <xsd:documentation>The hardware device (e.g. server identifier) from which the data file was created</xsd:documentation>
  </xsd:annotation>
</xsd:element>
<xsd:element name="Station" minOccurs="0" maxOccurs="unbounded">
  <xsd:annotation>
    <xsd:documentation>site, station, gauge, point or areal location identification details</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="SetofValues" minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>set of values for a site, station, gauge, point or areal location</xsd:documentation>
        </xsd:annotation>
        <xsd:complexType>
          <xsd:sequence>
            <xsd:element name="Value" minOccurs="0" maxOccurs="unbounded">
              <xsd:annotation>
                <xsd:documentation>floating point, single precision value</xsd:documentation>
              </xsd:annotation>
              <xsd:complexType>
                <xsd:simpleContent>
                  <xsd:extension base="xsd:float">
                    <xsd:attribute name="date" type="xsd:date" use="required">
                      <xsd:annotation>
                        <xsd:documentation>value date (ccyy-mm-dd)</xsd:documentation>
                      </xsd:annotation>
                    </xsd:attribute>
                    <xsd:attribute name="time" type="xsd:time" use="optional">
                      <xsd:annotation>
                        <xsd:documentation>value time (hh:mm:ss)</xsd:documentation>
                      </xsd:annotation>
```

```
</xsd:attribute>
<xsd:attribute name="flag1" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>First data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag2" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Second data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag3" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Third data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag4" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Forth data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag5" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Fifth data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag6" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Sixth data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag7" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Seventh data quality flag</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="flag8" type="DataQualityFlagType" use="optional">
  <xsd:annotation>
    <xsd:documentation>Eighth data quality flag</xsd:documentation>
```

```
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="flag9" type="DataQualityFlagType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Ninth data quality flag</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="flag10" type="DataQualityFlagType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Tenth data quality flag</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag1" type="PercentageType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag1</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag2" type="PercentageType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag2</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag3" type="PercentageType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag3</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag4" type="PercentageType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag4</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag5" type="PercentageType" use="optional">
    <xsd:annotation>
      <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag5</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="percentFlag6" type="PercentageType" use="optional">
    <xsd:annotation>
```

```
            <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag6</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="percentFlag7" type="PercentageType" use="optional">
          <xsd:annotation>
            <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag7</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="percentFlag8" type="PercentageType" use="optional">
          <xsd:annotation>
            <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag8</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="percentFlag9" type="PercentageType" use="optional">
          <xsd:annotation>
            <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag9</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
        <xsd:attribute name="percentFlag10" type="PercentageType" use="optional">
          <xsd:annotation>
            <xsd:documentation>Percentage relating to a derived value - indicates how much of the source data was considered to match flag10</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
      </xsd:extension>
    </xsd:simpleContent>
  </xsd:complexType>
</xsd:element>
<xsd:element name="Comment" minOccurs="0" maxOccurs="unbounded">
  <xsd:annotation>
    <xsd:documentation>comment relating to a set of values</xsd:documentation>
  </xsd:annotation>
  <xsd:complexType>
    <xsd:simpleContent>
      <xsd:extension base="xsd:string">
        <xsd:attribute name="startDate" type="xsd:date" use="optional">
          <xsd:annotation>
            <xsd:documentation>The start date of the period to which comment applies (ccyy-mm-dd)</xsd:documentation>
          </xsd:annotation>
        </xsd:attribute>
```

```
                        <xsd:attribute name="startTime" type="xsd:time" use="optional">
                          <xsd:annotation>
                            <xsd:documentation>The start time of the period to which comment applies (hh:mm:ss)</xsd:documentation>
                          </xsd:annotation>
                        </xsd:attribute>
                        <xsd:attribute name="endDate" type="xsd:date" use="optional">
                          <xsd:annotation>
                            <xsd:documentation>The end date of the period to which comment applies (ccyy-mm-dd)</xsd:documentation>
                          </xsd:annotation>
                        </xsd:attribute>
                        <xsd:attribute name="endTime" type="xsd:time" use="optional">
                          <xsd:annotation>
                            <xsd:documentation>The end time of the period to which comment applies (hh:mm:ss)</xsd:documentation>
                          </xsd:annotation>
                        </xsd:attribute>
                      </xsd:extension>
                    </xsd:simpleContent>
                  </xsd:complexType>
                </xsd:element>
              </xsd:sequence>
              <xsd:attribute name="parameter" type="ParameterType" use="required">
                <xsd:annotation>
                  <xsd:documentation>The parameter that is being measured (eg. Flow, Rainfall or Water Level).</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="qualifier" type="ParameterQualifierType" use="optional">
                <xsd:annotation>
                  <xsd:documentation>Further clarification relating to the parameter, especially if there is more than one of the same parameter type (e.g. "Water level - Upstream Head" and
"Water Level - Downstream Head")</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="productRef" type="String_10Type" use="optional">
                <xsd:annotation>
                  <xsd:documentation>Met Office radar/gridded data stream unique product reference.
                    Examples include:
                    "N1" for the NWP Mesoscale, Forecast Total Rainrate
                    "N2" for the NWP Mesoscale, Forecast Total Rain Accumulations
                    "N3" for the NWP Mesoscale, Forecast Surface Temperature
                    "H7" for the Nimrod, rainfall actual
```

```
                    "H11" for the Nimrod, forecast accumulations
                    "H13" for the Gandolf, forecast accumulations
                  </xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="dataType" type="DataTypeType" use="required">
                <xsd:annotation>
                  <xsd:documentation>The specific way in which the parameter was either measured or is being presented (eg. Instantaneous, Maximum, Mean or
Minimum)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="period" type="DataPeriodIntervalType" use="required">
                <xsd:annotation>
                  <xsd:documentation>Period associated with the datatype (eg. 15 min, Daily, Annual, etc.).  When combined with the Data Type attribute, this attribute identifies the dataset (eg.
Monthly Mean)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="interval" type="DataPeriodIntervalType" use="optional">
                <xsd:annotation>
                  <xsd:documentation>Expected interval of data particularly applying to rolling accumulations where it is not the same as the data period (eg. 15 min, 1 h, Daily, etc.) - ie. Daily
Means may be recorded on an hourly basis.</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="characteristic" type="CharacteristicType" use="optional">
                <xsd:annotation>
                  <xsd:documentation>Description of data source (eg. Derived, Forecast, Measured, etc.).  This can be very useful to distinguish between measured, forecast and modelled data,
etc.</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="pointReference" type="String_120Type" use="optional">
                <xsd:annotation>
                  <xsd:documentation>A unique reference associated with the analogue input or instrument used to meak the measurement (eg. E123)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="units" type="UnitsType" use="required">
                <xsd:annotation>
                  <xsd:documentation>The units with which the set of values have been recorded (eg. Amps, km2, mAOD, mm, etc.)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
```

```
            <xsd:attribute name="startDate" type="xsd:date" use="optional">
              <xsd:annotation>
                <xsd:documentation>The start date for the set of values (ccyy-mm-dd)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="startTime" type="xsd:time" use="optional">
              <xsd:annotation>
                <xsd:documentation>The start time for the set of values (hh:mm:ss)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="endDate" type="xsd:date" use="optional">
              <xsd:annotation>
                <xsd:documentation>The end date for the set of values (ccyy-mm-dd)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="endTime" type="xsd:time" use="optional">
              <xsd:annotation>
                <xsd:documentation>The end time for the set of values (hh:mm:ss)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="dayOrigin" type="xsd:time" use="optional">
              <xsd:annotation>
                <xsd:documentation>The time at which a day value begins (eg. 09:00:00 for a water day or a rain day)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="valuesPerDay" type="xsd:unsignedInt" use="optional">
              <xsd:annotation>
                <xsd:documentation>The number of values expected for a 'normal' day (eg. 96 where 15 minute values are collected over a 24 hour period)</xsd:documentation>
              </xsd:annotation>
            </xsd:attribute>
          </xsd:complexType>
        </xsd:element>
      </xsd:sequence>
      <xsd:attribute name="stationReference" type="String_60Type" use="required">
        <xsd:annotation>
          <xsd:documentation>Identifier associated with the station (eg. site/station/gauge/point/areal location identifier)</xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
      <xsd:attribute name="region" type="RegionType" use="optional">
```

```
                <xsd:annotation>
                  <xsd:documentation>Environment Agency Region name</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="stationName" type="String_180Type" use="optional">
                <xsd:annotation>
                  <xsd:documentation>Name of the station (eg. site/station/gauge/point/areal location name)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
              <xsd:attribute name="ngr" type="NgrType" use="optional">
                <xsd:annotation>
                  <xsd:documentation>The Ordnance Survey grid reference of the station - in the format: XX (the sheet reference) followed by an even number of digits (minimum of 2, maximum of
12)</xsd:documentation>
                </xsd:annotation>
              </xsd:attribute>
            </xsd:complexType>
          </xsd:element>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
    <xsd:simpleType name="CharacteristicType">
      <xsd:annotation>
        <xsd:documentation>Description of data source (eg. Derived, Forecast, Measured, etc.)</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:enumeration value="Derived"/>
        <xsd:enumeration value="Forecast"/>
        <xsd:enumeration value="Interpolated"/>
        <xsd:enumeration value="Measured"/>
        <xsd:enumeration value="Modelled"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="DataQualityFlagType">
      <xsd:annotation>
        <xsd:documentation>
          <flagDescriptions>
            <flagDefinition flagNumber="1" flagName="Good">Best data quality.</flagDefinition>
            <flagDefinition flagNumber="2" flagName="Suspect">Failed the latest quality control or there are strong grounds for suspecting the accuracy of the observation. This is better than
missing.</flagDefinition>
```

<flagDefinition flagNumber="3" flagName="Estimated">Estimated value (e.g. modelled value).</flagDefinition>
<flagDefinition flagNumber="4" flagName="Unchecked">This value has not undergone sufficient quality control.</flagDefinition>
<flagDefinition flagNumber="5" flagName="Missing">Gaps / missing data.</flagDefinition>
<flagDefinition flagNumber="6" flagName="Complete">The source data set is complete (e.g. daily summary derived from all 96 values from a 15-min measured series).</flagDefinition>
<flagDefinition flagNumber="7" flagName="Incomplete">The source data set is not complete, but enough data is provided to calculate the summary data.</flagDefinition>
<flagDefinition flagNumber="8" flagName="Auto validated">The data has been subject to automatic validation routines.</flagDefinition>
<flagDefinition flagNumber="9" flagName="Edited">The data value has been edited; this may be a manual or automatic process. This may be associated with a reason for edit and or comment</flagDefinition>
<flagDefinition flagNumber="10" flagName="Extrapolated">Flows are above or below the limit of a stage-discharge relationship and have been extrapolated. These flows will occur between Within Rating and Beyond Limit of Rating flags.</flagDefinition>
<flagDefinition flagNumber="11" flagName="Within rating">The flows are within the upper and lower limits of the stage-discharge rating.</flagDefinition>
<flagDefinition flagNumber="12" flagName="No rating">There is no rating present for this data.</flagDefinition>
<flagDefinition flagNumber="13" flagName="Beyond upper limit">Beyond upper limit of rating when flows calculated using a stage-discharge equation.</flagDefinition>
<flagDefinition flagNumber="14" flagName="Beyond lower limit">Beyond lower limit of rating when flows calculated using a stage-discharge equation.</flagDefinition>
<flagDefinition flagNumber="15" flagName="Head only">Indicates the Upstream Head only has been used in the flow calculation.</flagDefinition>
<flagDefinition flagNumber="16" flagName="Tail - modular">Indicates tail water level used in the flow calculation and the weir was found to be modular.</flagDefinition>
<flagDefinition flagNumber="17" flagName="Tail - non-modular">Indicates tail water level used in the flow calculation. The weir was found to be non-modular so a reduction factor has been applied to the data.</flagDefinition>
<flagDefinition flagNumber="18" flagName="Tail - extremely non-modular">Indicates tail water level used in the flow calculation. The weir was found to be extremely non-modular so a drowned flow reduction factor has been applied to the data.</flagDefinition>
<flagDefinition flagNumber="19" flagName="Crest - modular">Indicates pressure-tapping level used in the flow calculation and the weir was found to be modular.</flagDefinition>
<flagDefinition flagNumber="20" flagName="Crest - non-modular">Indicates pressure-tapping level used in the flow calculation. The weir was found to be non-modular so a reduction factor has been applied to the data.</flagDefinition>
<flagDefinition flagNumber="21" flagName="Crest - extremely non-modular">Indicates pressure-tapping level used in the flow calculation. The weir was found to be extremely non-modular so a drowned flow reduction factor has been applied to the data.</flagDefinition>
<flagDefinition flagNumber="22" flagName="Engineer on Site">Indicates an engineer is on site, some data values may be affected by their work.</flagDefinition>
<flagDefinition flagNumber="23" flagName="Normal QC complete">The Quality Control procedures have been completed.</flagDefinition>
<flagDefinition flagNumber="24" flagName="Test Calibration Data">The data has been generated during the process of testing and calibrating the sensor.</flagDefinition>
<flagDefinition flagNumber="25" flagName="Item in Alarm">The item that is being recorded by the Telemetry system is in a state of alarm.</flagDefinition>
<flagDefinition flagNumber="26" flagName="Off Scan/Disable">The telemetry outstation is set to Off Scan or has been disabled.</flagDefinition>
<flagDefinition flagNumber="27" flagName="Out of Range">The data recorded is out of the minimum or maximum calibrated range of the measuring sensor.</flagDefinition>
<flagDefinition flagNumber="28" flagName="Manually Entered Data">A user has manually updated the source system.</flagDefinition>
<flagDefinition flagNumber="29" flagName="Master Station Override">The telemetry master station override is active. This may have affected the data.</flagDefinition>
<flagDefinition flagNumber="30" flagName="Invalid State">This indicates the Digital Status is invalid from the source system.</flagDefinition>
<flagDefinition flagNumber="31" flagName="Invalid Time">This indicates the time is invalid from the source system.</flagDefinition>
<flagDefinition flagNumber="32" flagName="Trace">Some rain has fallen but it is too little to measure.</flagDefinition>
<flagDefinition flagNumber="33" flagName="Accumulation (Start)">First value for an accumulated data block.</flagDefinition>
<flagDefinition flagNumber="34" flagName="Accumulation">Rainfall that has accumulated over more than one day between readings for a storage type gauge. Note that there must be Start and End of accumulation flags.</flagDefinition>

```
            <flagDefinition flagNumber="35" flagName="Accumulation (End)">Last value for an accumulated data block.</flagDefinition>
            <flagDefinition flagNumber="36" flagName="Snow">Precipitation that has fallen as snow but has not been converted to rainfall equivalent.</flagDefinition>
            <flagDefinition flagNumber="37" flagName="Snow converted to rain">Precipitation that has fallen as snow that has been converted to rainfall equivalent.</flagDefinition>
            <flagDefinition flagNumber="38" flagName="Well Dry">Maximum depth of well reached (i.e. the bottom): there could be water at greater depth in the aquifer.</flagDefinition>
            <flagDefinition flagNumber="39" flagName="Automatic Estimate">Estimate/correction derived automatically from a program with no manual intervention.</flagDefinition>
            <flagDefinition flagNumber="40" flagName="Manual Estimate">Estimate/corrected value has been set manually (with or without assistance from a program).</flagDefinition>
            <flagDefinition flagNumber="41" flagName="Observer Estimate">Estimate/correction has been obtained retrospectively from the observer/station.</flagDefinition>
            <flagDefinition flagNumber="42" flagName="Derived Estimate"> Precipitation estimate/correction has bee derived from snow/rainfall equivalence, or trace estimate/correction has been set for
consistency with present weather.                                    </flagDefinition>
            <flagDefinition flagNumber="43" flagName="Units Correction">Correction has been obtained by changing units of measurement.</flagDefinition>
            <flagDefinition flagNumber="44" flagName="Systematic Correction">Correction has been obtained by applying a systematic adjustment.</flagDefinition>
            <flagDefinition flagNumber="45" flagName="Inaccessible">Measurement impossible, because of snow, etc.</flagDefinition>
            <flagDefinition flagNumber="46" flagName="Unavailable">An estimate where the original value is not available.</flagDefinition>
            <flagDefinition flagNumber="47" flagName="Unreliable Estimate">An unreliable estimate (used in radiation QC).</flagDefinition>
            <flagDefinition flagNumber="48" flagName="Correction">A correction (a reported value is assumed to be in error).</flagDefinition>
            <flagDefinition flagNumber="49" flagName="Reverted to Original">Value reverted to original.</flagDefinition>
            <flagDefinition flagNumber="50" flagName="Raw">Original value verified by observer.</flagDefinition>
            <flagDefinition flagNumber="51" flagName="Original">The data value is the original or raw value retrieved from an external source without any verification.</flagDefinition>
            <flagDefinition flagNumber="52" flagName="Completed">The original data value was missing and was replaced by a value that was derived by a model.</flagDefinition>
            <flagDefinition flagNumber="53" flagName="Failed SDB/MetDB">Failed Synoptic Database (SDB) or Met Office Database (MetDB) QC check.</flagDefinition>
            <flagDefinition flagNumber="54" flagName="Failed MIDAS">Failed MIDAS validation.</flagDefinition>
            <flagDefinition flagNumber="55" flagName="Position/Movement Failed">Failed climate QC marine position or movement check.</flagDefinition>
            <flagDefinition flagNumber="56" flagName="Range Failed">Failed climate QC range check.</flagDefinition>
            <flagDefinition flagNumber="57" flagName="Consistency Failed">Failed climate QC internal consistency check.</flagDefinition>
            <flagDefinition flagNumber="58" flagName="Sequence check Failed">Failed climate QC sequence check.</flagDefinition>
            <flagDefinition flagNumber="59" flagName="Areal check Failed">Failed climate QC areal check.</flagDefinition>
            <flagDefinition flagNumber="60" flagName="MO QC level 0">Initial climate QC program has not been run.</flagDefinition>
            <flagDefinition flagNumber="61" flagName="MO QC level 1">Initial climate QC program has been run.</flagDefinition>
            <flagDefinition flagNumber="62" flagName="MO QC level 2">Initial QC queries processed.</flagDefinition>
            <flagDefinition flagNumber="63" flagName="MO QC level 4">Further range or internal consistency or sequence checks job(s) run and queries processed.</flagDefinition>
            <flagDefinition flagNumber="64" flagName="MO QC level 6">Final (or only) areal or buddy job run and queries cessed.</flagDefinition>
            <flagDefinition flagNumber="65" flagName="MO QC level 8">Final (or only) monthly job(s) run and queries processed.</flagDefinition>
            <flagDefinition flagNumber="66" flagName="High Tide">Water level at High tide: note that this is usually a forecast.</flagDefinition>
            <flagDefinition flagNumber="67" flagName="Low Tide">Water level at Low tide: note that this is usually forecast.</flagDefinition>
          </flagDescriptions>
        </xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:unsignedByte">
        <xsd:minInclusive value="1"/>
```

```
        <xsd:maxInclusive value="67"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="DataPeriodIntervalType">
      <xsd:annotation>
        <xsd:documentation>Period associated with the datatype (eg. 15 min, Day, Year, etc.) and/or the expected interval that data is collected and stored (eg. "1 h") - applying particularly to rolling accumulations where it is not the same as the data period</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:enumeration value="Unspecified"/>
        <xsd:enumeration value="1 s"/>
        <xsd:enumeration value="2 s"/>
        <xsd:enumeration value="3 s"/>
        <xsd:enumeration value="4 s"/>
        <xsd:enumeration value="5 s"/>
        <xsd:enumeration value="6 s"/>
        <xsd:enumeration value="10 s"/>
        <xsd:enumeration value="12 s"/>
        <xsd:enumeration value="15 s"/>
        <xsd:enumeration value="20 s"/>
        <xsd:enumeration value="30 s"/>
        <xsd:enumeration value="1 min"/>
        <xsd:enumeration value="2 min"/>
        <xsd:enumeration value="3 min"/>
        <xsd:enumeration value="4 min"/>
        <xsd:enumeration value="5 min"/>
        <xsd:enumeration value="6 min"/>
        <xsd:enumeration value="10 min"/>
        <xsd:enumeration value="12 min"/>
        <xsd:enumeration value="15 min"/>
        <xsd:enumeration value="20 min"/>
        <xsd:enumeration value="30 min"/>
        <xsd:enumeration value="1 h"/>
        <xsd:enumeration value="2 h"/>
        <xsd:enumeration value="3 h"/>
        <xsd:enumeration value="4 h"/>
        <xsd:enumeration value="6 h"/>
        <xsd:enumeration value="8 h"/>
        <xsd:enumeration value="12 h"/>
```

```
        <xsd:enumeration value="24 h"/>
        <xsd:enumeration value="48 h"/>
        <xsd:enumeration value="72 h"/>
        <xsd:enumeration value="Day"/>
        <xsd:enumeration value="Week"/>
        <xsd:enumeration value="Bi-weekly"/>
        <xsd:enumeration value="Month"/>
        <xsd:enumeration value="Quarterly"/>
        <xsd:enumeration value="Year"/>
        <xsd:enumeration value="Water Year"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="DataTypeType">
      <xsd:annotation>
        <xsd:documentation>Specific type of data (eg. Instantaneous, Mean, Minimum, etc.)</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:enumeration value="Instantaneous"/>
        <xsd:enumeration value="Event"/>
        <xsd:enumeration value="Maximum"/>
        <xsd:enumeration value="Mean"/>
        <xsd:enumeration value="Minimum"/>
        <xsd:enumeration value="Cumulative Total"/>
        <xsd:enumeration value="Total"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="NgrType">
      <xsd:annotation>
        <xsd:documentation>NGR in the format: XX (the sheet reference) followed by an even number of digits (minimum of 2, maximum of 12)</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:pattern value="[A-Z]{2}\d{2}(\d{2})?(\d{2})?(\d{2})?(\d{2})?"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="ParameterType">
      <xsd:annotation>
        <xsd:documentation>The parameter that is being measured (eg. Flow, Rainfall or Water Level).</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
```

```
        <xsd:enumeration value="Actual Evapotranspiration"/>
        <xsd:enumeration value="Ammonia"/>
        <xsd:enumeration value="Barometric Pressure"/>
        <xsd:enumeration value="Coil Current"/>
        <xsd:enumeration value="Conductivity (Field)"/>
        <xsd:enumeration value="Dissolved Oxygen"/>
        <xsd:enumeration value="Effective Rainfall"/>
        <xsd:enumeration value="Evaporation"/>
        <xsd:enumeration value="Flow"/>
        <xsd:enumeration value="Freeze Level"/>
        <xsd:enumeration value="Gate Position"/>
        <xsd:enumeration value="Gate Angle"/>
        <xsd:enumeration value="pH"/>
        <xsd:enumeration value="Potential Evapotranspiration"/>
        <xsd:enumeration value="Probe Voltage"/>
        <xsd:enumeration value="Radiation"/>
        <xsd:enumeration value="Rainfall"/>
        <xsd:enumeration value="Relative Humidity"/>
        <xsd:enumeration value="Residual"/>
        <xsd:enumeration value="Salinity (In situ)"/>
        <xsd:enumeration value="Snow Level"/>
        <xsd:enumeration value="Soil Moisture Deficit"/>
        <xsd:enumeration value="State"/>
        <xsd:enumeration value="Sunshine Hours"/>
        <xsd:enumeration value="Swell Wave"/>
        <xsd:enumeration value="Temperature"/>
        <xsd:enumeration value="Total Wave"/>
        <xsd:enumeration value="Turbidity"/>
        <xsd:enumeration value="Vapour Pressure"/>
        <xsd:enumeration value="Velocity"/>
        <xsd:enumeration value="Voltage"/>
        <xsd:enumeration value="Water Level"/>
        <xsd:enumeration value="Wind"/>
        <xsd:enumeration value="Wind Wave"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="ParameterQualifierType">
      <xsd:annotation>
        <xsd:documentation>Further clarification relating to the parameter, especially if there is more than one of the same parameter type (e.g. "Water level - Stage" and "Water Level - Downstream
```

```
Stage")</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:enumeration value="Abstraction"/>
        <xsd:enumeration value="Air"/>
        <xsd:enumeration value="Areal"/>
        <xsd:enumeration value="as N"/>
        <xsd:enumeration value="as O"/>
        <xsd:enumeration value="Crest Tapping"/>
        <xsd:enumeration value="Crest Tapping (2)"/>
        <xsd:enumeration value="Direction"/>
        <xsd:enumeration value="Downstream Stage"/>
        <xsd:enumeration value="Dry Bulb"/>
        <xsd:enumeration value="Effluent Discharge"/>
        <xsd:enumeration value="Groundwater"/>
        <xsd:enumeration value="Height"/>
        <xsd:enumeration value="Logged"/>
        <xsd:enumeration value="Maximum"/>
        <xsd:enumeration value="Minimum"/>
        <xsd:enumeration value="MOSES"/>
        <xsd:enumeration value="Net"/>
        <xsd:enumeration value="NWP"/>
        <xsd:enumeration value="Penstock"/>
        <xsd:enumeration value="Percentage of Saturated"/>
        <xsd:enumeration value="Percolation Tank"/>
        <xsd:enumeration value="Period"/>
        <xsd:enumeration value="Radar"/>
        <xsd:enumeration value="Reservoir Level"/>
        <xsd:enumeration value="Run"/>
        <xsd:enumeration value="Sluice Gate"/>
        <xsd:enumeration value="Soil"/>
        <xsd:enumeration value="Solar"/>
        <xsd:enumeration value="Speed"/>
        <xsd:enumeration value="Stage"/>
        <xsd:enumeration value="Storage Raingauge"/>
        <xsd:enumeration value="Sump Level"/>
        <xsd:enumeration value="Tidal Level"/>
        <xsd:enumeration value="Tipping Bucket Raingauge"/>
        <xsd:enumeration value="Unionized"/>
```

```
      <xsd:enumeration value="Water"/>
      <xsd:enumeration value="Wet Bulb"/>
      <xsd:enumeration value="1"/>
      <xsd:enumeration value="2"/>
      <xsd:enumeration value="3"/>
      <xsd:enumeration value="4"/>
      <xsd:enumeration value="5"/>
      <xsd:enumeration value="6"/>
      <xsd:enumeration value="7"/>
      <xsd:enumeration value="8"/>
      <xsd:enumeration value="9"/>
      <xsd:enumeration value="10"/>
      <xsd:enumeration value="11"/>
      <xsd:enumeration value="12"/>
      <xsd:enumeration value="13"/>
      <xsd:enumeration value="14"/>
      <xsd:enumeration value="15"/>
      <xsd:enumeration value="16"/>
      <xsd:enumeration value="17"/>
      <xsd:enumeration value="18"/>
      <xsd:enumeration value="19"/>
      <xsd:enumeration value="20"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="PercentageType">
    <xsd:annotation>
      <xsd:documentation>Percentage value</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:float">
      <xsd:minInclusive value="0"/>
      <xsd:maxInclusive value="100"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="RegionType">
    <xsd:annotation>
      <xsd:documentation>Environment Agency Region name</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="Anglian"/>
```

```
      <xsd:enumeration value="Head Office"/>
      <xsd:enumeration value="Midland"/>
      <xsd:enumeration value="North East"/>
      <xsd:enumeration value="North West"/>
      <xsd:enumeration value="South West"/>
      <xsd:enumeration value="Southern"/>
      <xsd:enumeration value="Thames"/>
      <xsd:enumeration value="EA Wales"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="UnitsType">
    <xsd:annotation>
      <xsd:documentation>Units for the set of values (eg. amps, km2, mAOD, mm, etc.)</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="---"/>
      <xsd:enumeration value="%"/>
      <xsd:enumeration value="% opening"/>
      <xsd:enumeration value="% Sat"/>
      <xsd:enumeration value="1000m3"/>
      <xsd:enumeration value="1000m3/d"/>
      <xsd:enumeration value="10m3"/>
      <xsd:enumeration value="Amps"/>
      <xsd:enumeration value="Bar"/>
      <xsd:enumeration value="cm"/>
      <xsd:enumeration value="cm2"/>
      <xsd:enumeration value="cm3"/>
      <xsd:enumeration value="cm3/s"/>
      <xsd:enumeration value="deg"/>
      <xsd:enumeration value="deg opening"/>
      <xsd:enumeration value="deg C"/>
      <xsd:enumeration value="deg d"/>
      <xsd:enumeration value="deg F"/>
      <xsd:enumeration value="ft"/>
      <xsd:enumeration value="ft/s"/>
      <xsd:enumeration value="ft2"/>
      <xsd:enumeration value="FTU"/>
      <xsd:enumeration value="g/l"/>
      <xsd:enumeration value="Hazen"/>
```

```
<xsd:enumeration value="in"/>
<xsd:enumeration value="in2"/>
<xsd:enumeration value="J"/>
<xsd:enumeration value="J/cm2"/>
<xsd:enumeration value="J/m2"/>
<xsd:enumeration value="K"/>
<xsd:enumeration value="km"/>
<xsd:enumeration value="km2"/>
<xsd:enumeration value="Knots"/>
<xsd:enumeration value="kW"/>
<xsd:enumeration value="kWh"/>
<xsd:enumeration value="l/h"/>
<xsd:enumeration value="l/s"/>
<xsd:enumeration value="m"/>
<xsd:enumeration value="m/s"/>
<xsd:enumeration value="m2"/>
<xsd:enumeration value="m3"/>
<xsd:enumeration value="m3/d"/>
<xsd:enumeration value="m3/h"/>
<xsd:enumeration value="m3/s"/>
<xsd:enumeration value="m3/year"/>
<xsd:enumeration value="mA"/>
<xsd:enumeration value="mAOD"/>
<xsd:enumeration value="mASD"/>
<xsd:enumeration value="mbar"/>
<xsd:enumeration value="mBDAT"/>
<xsd:enumeration value="mg/l"/>
<xsd:enumeration value="micro g/l"/>
<xsd:enumeration value="micro m"/>
<xsd:enumeration value="micro S/cm"/>
<xsd:enumeration value="micro V"/>
<xsd:enumeration value="Mile"/>
<xsd:enumeration value="min"/>
<xsd:enumeration value="Ml"/>
<xsd:enumeration value="Ml/d"/>
<xsd:enumeration value="mm"/>
<xsd:enumeration value="mm/d"/>
<xsd:enumeration value="mm/h"/>
<xsd:enumeration value="mmol/l"/>
```

```
      <xsd:enumeration value="mol/m3"/>
      <xsd:enumeration value="mph"/>
      <xsd:enumeration value="mS/cm"/>
      <xsd:enumeration value="mS/m"/>
      <xsd:enumeration value="mV"/>
      <xsd:enumeration value="mW/m2"/>
      <xsd:enumeration value="ng/l"/>
      <xsd:enumeration value="NTU"/>
      <xsd:enumeration value="NTU %"/>
      <xsd:enumeration value="on/off"/>
      <xsd:enumeration value="pH"/>
      <xsd:enumeration value="ppt"/>
      <xsd:enumeration value="revs"/>
      <xsd:enumeration value="s"/>
      <xsd:enumeration value="Sec opening"/>
      <xsd:enumeration value="V"/>
      <xsd:enumeration value="W/m2"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="String_10Type">
    <xsd:annotation>
      <xsd:documentation>String with a maximum length of 10 characters</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:maxLength value="10"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="String_60Type">
    <xsd:annotation>
      <xsd:documentation>String with a maximum length of 60 characters</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:maxLength value="60"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="String_120Type">
    <xsd:annotation>
      <xsd:documentation>String with a maximum length of 120 characters</xsd:documentation>
    </xsd:annotation>
```

```
      <xsd:restriction base="xsd:string">
        <xsd:maxLength value="120"/>
      </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="String_180Type">
      <xsd:annotation>
        <xsd:documentation>String with a maximum length of 180 characters</xsd:documentation>
      </xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:maxLength value="180"/>
      </xsd:restriction>
    </xsd:simpleType>
</xsd:schema>
```

10.2 EAMetadataFormat

The following is a listing of the Environment Agency's Metadata Format Schema. This is used by the Time-Series Data Exchange Schema to ensure that its metadata is consistent with other Schemas developed by the Environment Agency.

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XML Spy v4.4 U (http://www.xmlspy.com) by Dave Burrows (Environment Agency) -->
<xsd:schema targetNamespace="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat" elementFormDefault="qualified" attributeFormDefault="unqualified">
  <!--

  XML Architecture Schema for Environment Agency Metadata

  Purpose:  To define the elements required for Environment Agency Metadata and to allow their inclusion/import into other EA Schema.

  Date: 2003-06-11

  Version: 1.0
  Author: Dave Burrows, Giles Colton, EA CIS Development Team

   -->
  <xsd:annotation>
    <xsd:appinfo xmlns:gms="http://www.govtalk.gov.uk/CM/gms" xmlns:dc="http://purl.org/dc/elements/1.1/">
      <dc:Contributor/>
      <dc:Coverage/>
      <dc:Creator> Environment Agency CIS Development Team </dc:Creator>
      <dc:Date>2003-06-11</dc:Date>
      <dc:Description>This schema defines the elements required for Environment Agency Metadata, allowing their inclusion/import into other EA Schema</dc:Description>
      <dc:Format/>
      <dc:Identifier>{http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat}v1.0</dc:Identifier>
      <dc:Language/>
      <dc:Publisher>Environment Agency</dc:Publisher>
      <dc:Relation/>
      <dc:Rights/>
      <dc:Source/>
      <dc:Subject/>>
```

```
    <dc:Title>Environment Agency Metadata Schema</dc:Title>
    <dc:Type/>
   </xsd:appinfo>
  </xsd:annotation>
  <!--
            The following comply with Dublin Core Metadata Standards
  -->
  <xsd:element name="Contributor" type="String_255Type">
   <xsd:annotation>
    <xsd:documentation>An entity responsible for making contributions to the content of the resource (eg. a person, an organisation or a service). </xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Coverage" type="String_255Type">
   <xsd:annotation>
    <xsd:documentation>The extent or scope of the content of the resource (eg. time period, spatial location or jurisdiction).</xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Creator" type="String_255Type">
   <xsd:annotation>
    <xsd:documentation>An entity primarily responsible for making the content of the resource (eg. a person, an organisation or a service).</xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Date" type="xsd:date">
   <xsd:annotation>
    <xsd:documentation>A date of an event in the lifecycle of the resource (eg. creation or availability date).</xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Description" type="String_255Type">
   <xsd:annotation>
    <xsd:documentation>An account of the content of the resource, which may include an abstract, a table of contents, reference to a graphical representation of content or a free text account of the
content.</xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Format" type="String_255Type">
   <xsd:annotation>
    <xsd:documentation>The physical or digital manifestation of the resource, which may include the media-type or dimensions of the resource.</xsd:documentation>
   </xsd:annotation>
  </xsd:element>
  <xsd:element name="Identifier" type="String_255Type">
```

```
    <xsd:annotation>
      <xsd:documentation>An unambiguous reference to the resource within a given context (eg. a string or number conforming to a formal identification system).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Language" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>The language of the intellectual content of the resource.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Publisher" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>An entity responsible for making the resource available (eg. a person, an organisation or a service).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Relation" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>A reference to a related resource (eg. a string or number conforming to a formal identification system).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Rights" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>Information about rights held in and over the resource (eg. a rights management statement for the resource or reference to a service providing such
information).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Source" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>A reference to a resource from which the present resource is derived (eg. the system supplying file).</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Subject" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>A topic of the content of the resource expressed, typically, in keywords, key phrases or classification codes.</xsd:documentation>
    </xsd:annotation>
  </xsd:element>
  <xsd:element name="Title" type="String_255Type">
    <xsd:annotation>
      <xsd:documentation>A name given to a resource. Typically the name by which the resource is formally known.</xsd:documentation>
    </xsd:annotation>
```

```
 </xsd:element>
 <xsd:element name="Type" type="String_255Type">
  <xsd:annotation>
   <xsd:documentation>The nature or genre of the content of the resource (eg. terms describing general categories, functions, genres or aggregation levels).</xsd:documentation>
  </xsd:annotation>
 </xsd:element>
 <!--
            The following comply with EA Specific Metadata Standards
 -->
 <xsd:element name="Keywords" type="String_255Type">
  <xsd:annotation>
   <xsd:documentation>Keywords associated with the subject of the resource.</xsd:documentation>
  </xsd:annotation>
 </xsd:element>
 <xsd:element name="Time" type="xsd:time">
  <xsd:annotation>
   <xsd:documentation>A time of an event in the lifecycle of the resource (eg. creation or availability time).</xsd:documentation>
  </xsd:annotation>
 </xsd:element>
 <xsd:simpleType name="String_255Type">
  <xsd:annotation>
   <xsd:documentation>String with a maximum length of 255 characters</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
   <xsd:maxLength value="255"/>
  </xsd:restriction>
 </xsd:simpleType>
</xsd:schema>
```

11 Appendix D – e-GMS Metadata

11.1 COVERAGE

Definition	The extent or scope of the content of the resource.
Obligation	Recommended.

Purpose: this element is extremely useful for limiting a search to information about a particular place or time. It can be thought of as a sub-section of Subject.

11.2 CREATOR

Definition	An entity primarily responsible for making the content of the resource.
Obligation	Mandatory.

Purpose: to enable users to find items that were written or otherwise prepared by particular persons or organisations.

11.3 DATE

Definition	A date associated with an event in the life cycle of the resource.
Obligation	Mandatory.

Purpose: to enable users to find resources or limit the number of search hits according to the date a resource was made available or some other important date in its life cycle. It can also be referred to by those interested in the history of the resource.

11.4 DESCRIPTION

Definition	An account of the content of the resource.
Obligation	Optional.

Purpose: the description is often shown in lists of search results to allow the users to determine the usefulness of the resource. The description could cover:

Approach to subject (e.g. critique, explanation, beginners guide)
Reason for production of resource (e.g. to inform, invite comments)
Groups and organisations referred to
Events covered
List of key fields (database) or chapters
Key outcomes
Broad policy area
Level (academic, basic etc)
Any other useful information

11.5 IDENTIFIER

Definition	An unambiguous reference to the resource within a given context.
Obligation	Mandatory if applicable.

Purpose: identifiers are extremely useful for finding a specific resource, for confirming that you have the correct version, and as shorthand for referring to the resource elsewhere (see 'Relation' for examples of this).

Recommended best practice is to identify the resource by means of a string or number conforming to a formal identification system. Be cautious about using URLs as these can change. Identification codes automatically allocated by records management systems can be used.

11.6 LANGUAGE

Definition	A language of the intellectual content of the resource.
Obligation	Recommended.

Purpose: to enable searchers to limit their search to resources held in a particular language or languages.

11.7 PUBLISHER

Definition	An entity responsible for making the resource available.
Obligation	Mandatory if applicable.

Purpose: to enable users to find resources published by a particular organisation or individual. It can also be referred to by those seeking to re-use or re-publish the resource elsewhere, or purchase copies.

11.8 RELATION

Definition	A reference to a related resource.
Obligation	Optional.

Purpose: to enable users to find other resources closely related to a resource, or to group together individual items which form a collection. Recommended best practice is to reference the resource by means of a string or number conforming to a formal identification system, i.e. the referenced resource's Identifier.

11.9 SOURCE

Definition	A reference to a resource from which the present resource is derived.
Obligation	Optional.

Purpose: to enable people to find all items that have been developed using the content of a particular resource, e.g. all items based on a named set of statistics.

11.10 TITLE

Definition	A name given to the resource.
Obligation	Mandatory.

Purpose: enables people to find items with a particular title. It is also useful (though not infallible) for carrying out more accurate searches. The title is usually the key point of reference in lists of search results.

12 Appendix E – Illegal Characters and CData Blocks within XML.

XML parsers normally parse all the text in an XML document i.e. when an XML element is parsed, the text between the XML tags is also parsed:
e.g. <MyTag>This text is also parsed</MyTag>

The parser does this because XML elements can contain other elements, e.g. where the <name> element contains two other elements.

<name><first>Joe</first><last>Bloggs</last></name>

In this case the parser will normally break this up as follows

<name>
<first>Joe</first>
<last>Bloggs</last>
</name>

This causes a problem where the element content contains illegal characters such as '<' and '>' as the parser will interpret this as the beginning or end of an element. In effect this means that you cannot write xml such as

<comment>All values >= 9999 are invalid</comment>

There are two methods for dealing with these – use of CData blocks and entity references.

Entity References.
There are 5 predefined entity references in XML:

<	<	less than
>	>	greater than
&	&	ampersand
'	'	apostrophe
"	"	quotation mark

Entity references always start with the '**&**' character and end with the '**;**' character.
Note: Only the characters '<' and '&' are strictly illegal in XML. Apostrophes, quotation marks and greater than signs are legal, but it is a good habit to replace them.

12.1 CDATA Blocks

A CDATA section starts with '**<![CDATA[**" and ends with "**]]>**'. (Ensure no spaces between the characters) Everything within the Cdata block is ignored by the parser. This is especially useful where the content may contain many occurances of illegal characters such as in program code or equations.

In the example above, the element content could have been written

<comment><![CDATA[All values >= 9999 are invalid]]></comment>

Note: A CDATA section cannot contain another CDATA section. Also the CDATA section cannot contain the characters ‘]]>’ or ‘<![CDATA[‘.

13 Appendix F – Consultation process

The EA Time Series Data Exchange Format XML Schema was identified as requiring a new Schema standard. It was recognised that it's impact on other systems and business processes needed to be addressed via review and consultation.

The Schema has now been approved and published. Its maintenance is now subject to change control, which will involve all stakeholders.

The initial consultation process was undertaken as part of the Environment Agency Management System (AMS) procedure. As part of the process a working group was established and consultees identified

This step-by-step procedure that was undertaken is outlined below, together with the composition of the working group and the list of consultees.

13.1 The consultation procedure

Who	Activity	Steps
All EA staff	***NEW DATA STANDARD IDENTIFIED***	❑ Requirement for data identifies need for new EA data standard by consulting National Data Standards Team (NDST). ❑ Data Standard owner and development team (working group) are identified (see 'Working Group' table below).
National Data Standards team (NDST) and working group.	***PRODUCE DRAFT DATA STANDARD AND SUBMIT TO PROCESS***	❑ Review existing standards EA standards e-GIF standards EA Metadata International standards British Standards Other standards ❑ Agree name of data standard
NDST, data standard owner and working group.	***IMPACT ASSESSMENT***	❑ Assess the impact of the draft data standard on other systems, projects or datasets. ❑ Establish cross-cutting requirements of working group. ❑ Establish functional/domain specific requirements. ❑ Distribute the initial proposed draft standard for consultation. ❑ Determine business rules and permitted vales. ❑ It is the responsibility of the working group to identify a suitable, wider consultation group that includes all relevant stakeholders, internal and external (see 'Consultation Group' table below). ❑ The NDST will distribute the XML Schema for wider consultation.

EA functions, NDST, External organisations and government. (Consultation group).	***CONSULTATION***	❑ The consultation group are sent the proposed standard (XML Schema) for review, and are invited to return comments. A period of two weeks is set for this process. ❑ A 'Plain English Document' will accompany the standard to aid understanding of the nature and implications of implementation. ❑ Test revised standard against business rules and permitted values.
Data standard (XML Schema) owner and working group.	***FINALISE DRAFT AND RE-DISTRIBUTE***	❑ The working group takes the returned comments from the consultation period into consideration. ❑ These returned comments are also circulated. ❑ The standard is modified, where possible, to include and address consultation comments. ❑ The NDST will distribute draft standard for formal review.
NDST and Working group.	***FORMAL REVIEW***	❑ Review and return review comments in 5 working days. ❑ Test revised standard against business rules and permitted values. ❑ Extend review by agreement with the NDST and working group.
Data standard owner, NDST & working group.	***AGREE AND RE-DRAFT***	❑ Agree final changes and redraft Data Standard. ❑ If changes made to the XML Schema are significant, then the standard is sent out to the consultation group for a second round of consultation. ❑ Upon agreement distribute the standard for final approval.. ❑ Issue report to support approval.
National Data Standards Policy advisor, National Data Policy Advisor.	***APPROVE***	❑ Award formal approval of draft standard. ❑ Notify Data Standard Owner of approval.
NDST	***PUBLISH***	❑ Include approved data standard in electronic catalogue on Intranet. ❑ Promote implementation of data standards approved on new and existing systems. ❑ Submit to Office of e-Envoy for formal e-GIF review on Govtalk website.

13.2 The Working Group.

The working group consists of the following people:

John Cima & James Procter	National Data Standards Policy Advisor
Yvonne Walker	XML Advisor
Rod Furnell	Technical Manager Hydrometry
Keith Garrett	Technical Advisor (H)
Malcolm Tyler	National Telemetry

Rob Lincoln	NFFS Project Manager
Doug Whitfield	Senior Flood Forecasting Development Officer (Owner of Hyrad & Tidebase)
Simon Wood	Technical Advisor (Hydrometric Archive Replacement Project)
Chris Beales	Thames Models/EA-Thames Water data exchange (XML Schema testing, advice and options evaluation)
Dave Burrows	CIS (XML Schema development)
Giles Colton	CIS (XML Schema development)

13.3 Consultation Group.

The working group identified a group of stakeholders related to the respective business areas for which this XML Schema has implications. These stakeholders were approached to form the consultation group.

This group is not limited – more stakeholders may be identified throughout the life of the Schema. The working group has the responsibility to assess the validity of any comments returned from outside the consultation group.

The Consultation Group, including parties both internal and external to the Environment Agency, which was used to initially approve the Schema, was as follows:

Carlbro – Consultant supporting the NFFS project
Delft Hydraulics – System Supplier
Flood Forecasting Thames Barrier
Hydrometric Archive Replacement Project Representative
Hydrometry Process Representative
Kisters AG (supplier of WISKI)
Met Office
National Telemetry Representitive
Parsons Brinkerhoff (Servelec contact working on Swantel)
Regional Flood Forecasting Representitive
Regional Telemetry Representitives
Thames Water

14 Appendix G: External Resources

Currently available external resources are;

Name	Description	Available from
Read EATSDEF v2'7.xls	MS Excel spreadsheet that can validate an XML Data file against an XML Schema.	Data.Standards@environment-agency.gov.uk

15 Appendix H: System Notes - National Flood Forecasting System (NFFS).

Specific Requirements for Automated Data Transfers to and from NFFS

To permit wide application of the schema across a range of systems and activities, the schema has been made as flexible as possible. To achieve this flexibility necessitates that many data items are kept optional.

The Agency's National Flood Forecasting System (NFFS) exchanges data with a number of other systems within and outside the Agency. In order to efficiently process and derive maximum value from those data, some of the optional fields have been made mandatory (or mandatory in certain circumstances) for data passing to and from NFFS. The affected fields within each element are listed below. Although datasets that do not comply with these conditions would still be valid against the schema, they will be deemed unacceptable for automated exchange with NFFS.

Metadata

md:Publisher - this shall be "Environment Agency"
md:Source - this shall identify the type of data, typically "Midlands Telemetry System", or similar
md:Description - this shall be a textual description of the transfer type and reason, such as "Automated Telemetry Data, Export System"
md:Creator - this shall be the software that created the system including the version and build number.
md:Date - the date the file was created
md:Time - the time the file was created.
md:Identifier - this shall be the name of the server used to generate the file, this will identify failover conditions.

See Section 5.2 Table1 for guidance on values.

Station

stationName – If the stationName field cannot be populated, the phrase "===UNKNOWN===" shall be substituted

Set-of-Values

The following are only mandatory when the set of values are forecasts or derived from forecasts. In these cases the value of the CharacteristicType field shall be 'Forecast' and the startDate and startTime shall correspond to the time origin of the forecast.

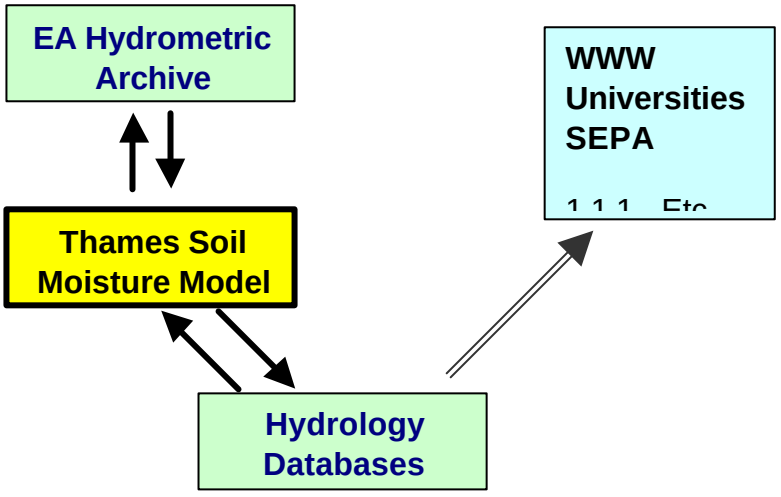
CharacteristicType
startDate
startTime

16 Appendix I: System Notes - Thames Soil Moisture Model

Description

The Thames Soil Moisture Model calculates *Soil Moisture Deficit*, *Effective Rainfall* and *Actual Evapotranspiration* from estimates of *Areal Rainfall* and *Potential Evapotranspiration*. The model is run for a number of internal and external customers, including: Flood Warning, Water Resources, Strategic Planning, Water Companies, Didcot Power Station and Hydrological research groups. The model is run on a weekly basis to give "live" estimates and then recalculated, at a later date, with verified data from the Met Office.

Principal Data Exchange Paths



Data exchange requirements (Input)

Note that XML documents are loaded manually.

Metadata

When the user chooses to load an XML document, the metadata will be displayed so that the user can check that they are loading the right file. Other than this though, the input module will ignore the metadata.

Station

Only the **stationReference** is used. Any stations that are not known to the model will be ignored. The model will expect data to be coming from the EA Hydrometric System (i.e. Wiski) and therefore will expect station numbers that match those in the Hydrometric System, e.g. "6010TH"

Set-of-values

Only **set-of-value** blocks with the following **parameter** and **qualifier** combinations will be read. Any others will be ignored.

XML Parameter	XML Qualifier	SMM Table	SMM Field

Rainfall	Areal		RF
Potential Evapotranspiration	Areal	Verified Areal Data	PE

The following attributes are all required and the data will not be imported if they are not as expected:

- The **dataType** must be "Total"
- The **period** must be "Day" (which incidentally is assumed to be a Water Day)
- The **units** can be either "mm" or "cm".

The **startDate** and **endDate** are both required by the import module. The model will expect a complete set of daily values within this period. If there are any gaps, the importer will raise an error and the data will not be loaded.

The import module will ignore all of the remaining attributes: **interval**, **characteristic**, **pointReference**, **productRef**, **startTime**, **endTime**, **dayOrigin** and **valuesPerDay**.

Values

The import module will expect that values are in chronological order. It will raise an error if:

- The **date** of the first value is not the same as the Set-of-values **startDate**.
- The **date** of the next value it reads is not one day after the current value, i.e.: it is either the same date, out of sequence or there is a gap.
- The **date** of the last value is not the same as the Set-of-values **endDate**.

The quality code from **flag1** will be loaded into the database if it is one of the following. Any other flag encountered will be ignored. Note that the model does not use the flags, they are stored only for reference.

XML flag1 code	XML flag description	SMM interpretation
1	Good	Good
2	Suspect	Suspect
5	Missing	Missing
9	Edited	Edited
36	Snow	Snow

The import module will ignore all of the remaining attributes: **time**, all other **flag** and **percentFlag** attributes.

The **Value** must be a number: "NaN", "INF" and "-INF" will all be treated as missing, which is not acceptable by the model and therefore will cause the data load to fail.

Comments

All comments are read into the Verification Log Table. No analysis is carried out with respect to the

contents of the attributes. The **startTime** and **endTime** will be ignored. Note that if the data load has failed then the comments will not be loaded for that Set-of-values.

Data export options (Output)

Metadata

The export module will write the following metadata:

md:Publisher = "Environment Agency"
md:Source = "Thames Region – Soil Moisture Model"
md:Description = "Export of model results"
md:Date = *date of file creation*
md:Time = *time of file creation*

The **md:Creator** and **md:Identifier** are unknown to the model and therefore will not be output.

Station

- The export module will write **stationReference** numbers to match the EA Hydrometric Archive (i.e. Wiski) via a look-up table.
- The **stationName** will be written and will match the model area name known internally by the model.
- The **region** will be written.
- The **ngr** will not be written, as this is not relevant to a model area.

Set-of-values

- The following **parameter** and **qualifier** options will be output from the model:

SMM Table	SMM Field name	XML Parameter	XML Qualifier
SM Model Output	RF	Rainfall	Areal
	SMD	Soil Moisture Deficit	Areal
	Perc	Effective Rainfall	Areal
	AE	Actual Evapotranspiration	Areal
	PE	Potential Evapotranspiration	Areal

- The **dataType** will always be "Total".
- The **period** will always be "Day" (which incidentally is assumed to be a Water Day)
- The **units** will always be "mm".
- The **characteristic** will always be "Modelled"
- The **startDate** and **endDate** will both be given and data can be assumed to be a continuous, sequential block of Values, between and including these dates.

The remaining attributes will not be exported as they are not relevant to the model: **interval**,

pointReference, **productRef**, **startTime**, **endTime**, **dayOrigin** and **valuesPerDay**.

Values

The model only deals with daily data and data is internally flagged as either verified or unverified, therefore on the following attributes will be output with the value:

- The **date** of the value (written from the "SM Model Output" table).
- Quality **flag1**, which will either be "1 – Good" meaning "Verified" or "4 – Unchecked" meaning "Unverified".
- The **Value** itself will be written from the "SM Model Output table", from the relevant field for that parameter. Note that it can never be missing or extremely large/small and will therefore never contain any of the following: "NaN", "INF" and "-INF".

No other **flags**, **percentFlags** or **times** will be output.

Comments

The Soil Moisture Model does not generate or store comments with it model output and therefore none will be output to the XML documents.

File Creation Options

- The model will write data to single file.
- There are currently 20 Stations in the model output table, some or all of these will be exported as required by the user.
- All 5 parameters will be written under each Station node.
- There will only be one incidence of each Station in a file.
- The exporter will suggest a naming convention of "*yymmdd*_SMM_Output.xml" but the user will be able to alter this.

17 Appendix J: Guidance on XML Values for Common Data Types used in Real Time Flood Forecasting.

Description of Data Type	Parameter	Qualifier	Data Type	Period	Units
Tipping Bucket Raingauge Based Rainfall Rate	"Rainfall"	"Tipping Bucket Raingauge"	"Mean"1	"15 min"	"mm/hr"
Tipping Bucket Raingauge Based Rainfall Accumulation	"Rainfall"	"Tipping Bucket Raingauge"	"Total"	"15 min" "1 h"	"mm"
Radar Based Rainfall Accumulation from Hyrad CatAvg[2]	"Rainfall"	"Radar"	"Total"	"15 min"	"mm"
Observed Water Level	"Water Level"	"Stage" "Downstream Stage" "Tidal Level" "Reservoir Level"	"Instantaneous"[3] "Mean"[4]	"5 min" "15 min" "1 h"	"m" "mAOD" "mASD"
Observed Flow	"Flow"		"Instantaneous"[3] "Mean"[4]	"5 min" "15 min" "1 h"	"m3/s" "Ml/d"
Observed Temperature	"Temperature"	"Wet Bulb" "Dry Bulb"	"Instantaneous"[3] "Mean"[4]	"15 min"	"deg C"
Observed Wind Speed	"Wind"	"Speed"	"Instantaneous"[3] "Mean"[4]	"5 min" "15 min"	"m/s"
Observed Wind Direction	"Wind"	"Direction"	"Instantaneous"[3] "Mean"[4]	"5 min" "15 min"	"deg"
Observed Radiation	"Radiation"	"Solar" "Net"	"Instantaneous"[3] "Mean"[4]	"15 min"	"W/m2"

[1] With a TBR, the 15min rate is an average inferred over the period of measurement
[2] All radar based rainfall whether rate or accumulation is converted to accumulation by Hyrad CatAvg
[3] Where the value is an instantaneous sample from within the time period.
[4] Where the value is an average of all the samples taken over the time period