Final

Prepared for:

Environment Agency

NGMS Data Provision Instructions

National Ground Water Modelling System

Report

May, 2007

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Contents

1   Essential background information

This chapter provides some context information to understand why it is essential to follow the instructions for data provision.

1.1   Essentials on the NGMS

1.1.1   What is a configuration

The National Groundwater Modelling System is based on a combination of groundwater models (mostly Modflow-based) with the generic DelftFEWS-software infrastructure. The generic software is used to automatically run the models and their pre- and post-processing steps. The exact instructions for each step are contained in the so-called 'Configuration'. A major part of the configuration is the set of XML-files, each of them being a kind of script for a processing step.

1.1.2   NGMS data is location bound

Within the NGMS-database, *data is bound to geographical locations which are pre-defined in the Configuration*. Generally, all data can be made accessible in a grid layer. However, *it is practically impossible to provide data access to specific locations,* such as observation boreholes, wells, SW discharge points, accretion profiles etc. *if these are not defined beforehand.*

As a consequence, **all geographical features of potential interest should preferably be identified and specified beforehand** (i.e. when providing the data for model implementation).

An NGMS configuration is centred on 4 basic module data sets:
*   the Historic (calibrated) module data set
*   the Naturalized module data set
*   the Recent Actual module data set (if available)
*   the Fully Licenced module data set (if available)

1.1.3   Mapping licences to module data

For each module data set, users expect expected that the abstraction licences are correctly mapped to the time series in the WEL and STR files for each individual run. The NGMS uses an IdMapping table to map a licence to an abstraction time series in the WEL or STR file. If multiple abstractions are taken from the same model cell, the only distinctive feature left in the WEL or STR file is the sequence of occurrence.
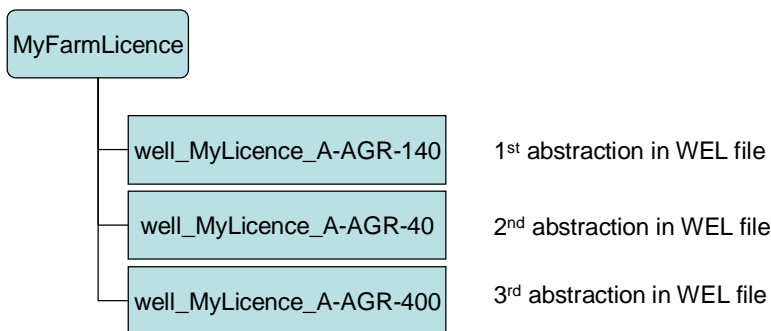
To compose a proper mapping table, it is essential that the data provider clearly relates each licence to its occurrence in each WEL or STR file (i.e. for the Historic, Naturalized, Recent Actual and FullyLicenced).

1.1.4   The concept of parent locations

Boreholes may have multiple time series associated to one XY-coordinate in the real world. Examples are abstractions in multiple model layers or multiple licence abstractions in same layer. Similarly, several SW discharge points may be related to one Row-Column position in the model grid. On a map, only one point can be shown. To provide access to the individual time series, the concept of 'parents' and 'childs' is used (see Figure 1).

- A parent location is a location shown on the map. It functions as the geographical entry point to the individual and merged data of its children.
- A child location is a location at the same XY-coordinate. It is represented on the map the parent, but it functions as a placeholder for the individual time series. Child locations have their own entry points in the short cuts list of the Time Series Display.
  Child locations may have individual entry points in the scenario editor.

Sample use of parent and childs, all at same borehole (x,y coordinate)

Figure 1 Illustration of the parent-child concept

Macro's have been created to sort out the appropriate parent locations. For GW abstractions, the OS-reference is used, for all other locations, the cell coordinates are used.

1.2   The role of data provision in setting up the NGMS

Experiences from the pilot implementation have indicated that <u>provision of a complete location information set at once</u>, clearly related to the various module data sets, is the best method to achieve efficient implementation of the NGMS.

During the pilot, nearly 60 days have been spent on processing location related information and fixing errors due to incomplete provision of information. Even for tiny mistakes it takes serious effort to analyze the cause, acquire the missing information, merge it with the existing configuration en test again. As an example, the latest YNN-fix took about 8 hours to trace and fix 7 locations missing for the FullyLicenced run.

1.3   This document

To improve this data provision process, this document has been composed in combination with a spreadsheet template. Based on the spreadsheet template, a set of data processing tools are under development to automate a portion of the configuration work

This document describes the data provision requirements for the module data sets (chapter 2), supportive GIS-layers (chapter 3) and information to be incorporated in the spreadsheet (chapter 4). Finally, chapter 5 discusses the provision of monitoring data.

2   Module data sets

Within the EA, one typically prepares 3 or 4 module data sets of a specific model to represent the following situations:
- Historic reference (calibration run)
- Naturalized run
- Recent Actual run
- Fully Licenced run

To accept a module data set, the following requirements need to be met:
1. each module data set should be completed in terms of data files
2. an executable should be provided which executes the module data set properly and provide the appropriate answers
3. Since the NGMS intends to operate with MF_VKD.executable[1] as the basic Modflow version, any specific executable requirements should be highlighted. These requirements maybe:
   - use IO for Entec 4R
   - run single/double precision
4. for each module data set all meta-information should be provided via worksheet 'Model_info' of the NGMS-data provision-spreadsheet

Table 1 contains a check list, which is provided separately as well.

Table 1 Check list module data set provision

ModuleDataSet	Historic	Naturalized	RecentActual	FullyLicenced
all files included	☐	☐	☐	☐
exe included	☐	☐	☐	☐
req. specified in spreadsheet	☐	☐	☐	☐
meta-info specified	☐	☐	☐	☐

For each model to be placed on the system it is expected that at least 3 out of 4 module data sets are available and need to be made accessible

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[1]   *The MF_VKD code is available in single and double precision and compiled with the Intel Visual fortran compiler 9.1. It can run native Modflow 96 models and supports IO-requirements for Entec 4R.*

3 GIS-files

The NGMS is not a GIS system. However, it uses GIS-files for the following purposes:
- map background
- data processing

Files delivered should be listed (preferably with some versioning information) in the spreadsheet, worksheet 'model_info'.

3.1 GIS-files used for map background

The support the user in its navigation, the following ESRI shape layers should be provided:
- observation boreholes
- river/stream gauging stations
- GW abstraction points
- SW discharge points
- SW abstraction points (may be combined with SW discharge points)
- model boundary
- GWM-units.
- rivers/streams included in accretion profiles

If additional GIS-maps are desired (e.g. urban areas, protected habitats etc), it is recommended to provide them now as it is easier to include them as hidden them than adding them at a later stage.

For each shape file, it is recommended that the associated DBF contains relevant geographic information, such as station names, area names/codes, river names etc.

Please note that <u>no quality control is done on GIS-layers</u> provided. Any polygon mismatch with national provided GIS-files (coastlines, regional administrations etc.) will not be addressed by the configuration team.

3.2 GIS-files used for post processing

Two GIS-files are used in data processing, namely:
- an ESRI shape file containing the GWM-units
- a DEM (ESRI ascii grid format) containing a digital elevation model at the model resolution

The DEM is only required if a depth below ground level needs to be computed.

<u>A DEM which does not meet the file format (ESRI ASCII grid) or the model resolution is not accepted.</u>

4 Provision of model info and locations

4.1 General

As part of the Data Provision package, the NGMS_DataTemplate.xls is developed.

This spreadsheet has been prepared in such way that all information which is relevant to the configuration is included. Macros will be developed to process the data into the relevant XML-files. Therefore, data providers are requested to stick to the columnar organization and do not merge information pieces in one cell

It contains the following worksheets:
- Instructions
- model_info
- GWabs_org
- OBH_org
- Gauges_org
- SWlat_org
- Branches_org
- ClassBreaks

Within a worksheet, colours are used to distinguish between instructions (orange), the column headers (light blue), examples (light green) and the area to fill in (yellow or white).

Note:
To prevent deletion of critical sections, most of the coloured cells have been 'locked' without a password. To unlock, pick menu item Tools→protection→Unprotect Sheet.

4.2 Worksheet Instructions

This worksheet provides a short overview of instructions.

4.3   Worksheet Model_info

This worksheet specifies all meta information on the model, the module data sets and GIS-layers provided. Much of the information will be presented in a tooltip describing the model features.

General model information

To ensure proper execution of the model, the relevant executable version should be attached as well as described in wording. Any 'good-to-know' features on the code should be described.
To provide users with information on the model, the model documentation should be attached as PDF.

Model grid information

Since the model grid orientation of Modflow is different compared to the grid orientation of the Spatial display, two cell coordinates have been requested. The one on the lower left cell corner is used by Modflow and the Modflow Adapter. The one for the Upper left cell centre is used by the NGMS. By providing both coordinates, we can also check on errors.

Coordinates need to be given in Easting, Northing based on the Ordnance Survey 1936 geoDatum.

Rotations should be defined in 360 degrees, anticlockwise direction.

If the model contains inactive layers, they should be identified by number.

Geological layers

To provide information on geological layers in the model, the formation names should be provided.

Data files

For archiving purposes, it is desired to list the original file names/fields that are shipped in for each different module data set. If any input file is missing, don't hesitate to add an extra row.
The number of wells contained in the WEL-file should meet the number of individual licenses listed in the GWabs_org-worksheet.

Run Information

The section defines the simulation settings. In the remarks section, one can specify the construction methods of the stresses used (e.g. repeating years etc.). Please indicate how many years have been used to compose the Recent Actual abstractions.

Representative hydrological conditions

Currently, the following dates are assumed for representative hydrological conditions:
- wet: 1st March 1988
- dry: 1st August 1991
- avg. 1st May 1994

Please indicate the suggested dates for the model.

GIS-layers

Please list the files provided. Check Chapter 3 for details on requirements.

4.4   Worksheet GWabs_org

This worksheet provides all information on the groundwater abstractions incorporated in the system. Please specify all abstractions included in the Module Data Sets. If any new abstraction locations are foreseen, they might be included as well.

In case multiple abstractions refer to one borehole (X, Y-coordinate), the sequence of occurrence in the WEL or STR file is essential. Automated processing routine s have been established to identify at what coordinates parent location need to be defined in addition to the individual licences. Please read Section 1.1.4 on the concept of parent locations if needed.

Text constructors

The section on text constructors defines the visualization and listing methods of the locations. Figure 2 shows an example of the location list in the Explorer. Note that the software defines the order on an alphabetic basis. Figure 3 illustrates an example of the location list in the time Series Display. The short cut ordering is manually defined in the configuration, thus allowing a name first and ordering according to Id.
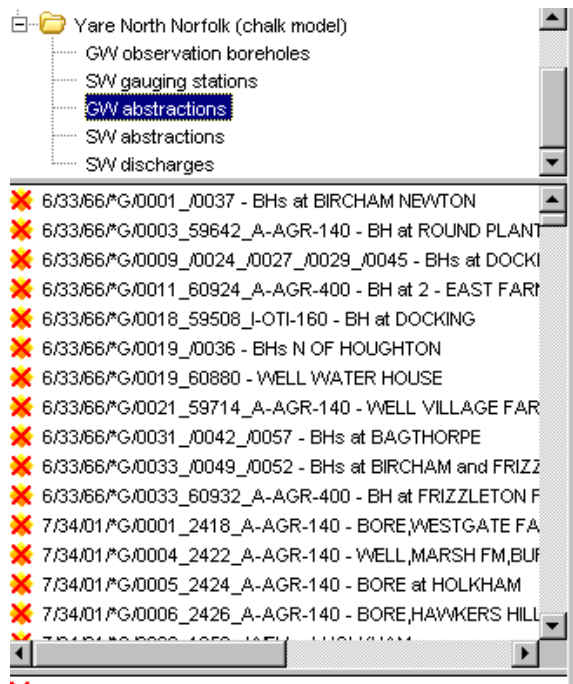

Figure 2 Explorer - GW abstractions starting with LicenceCode (ordered by LicenceCode)
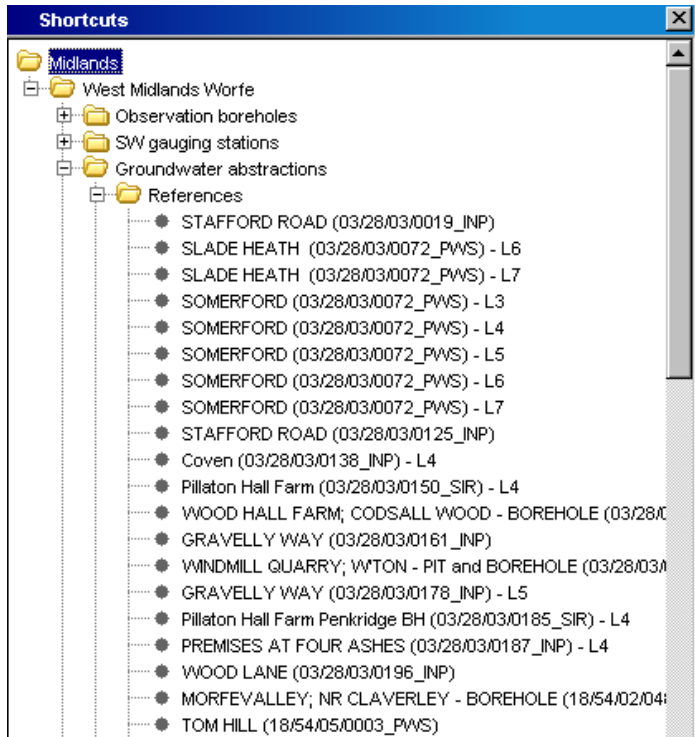
Figure 3 Time Series display - Abstractions starting with SiteName (ordered by licence code)

Figure 4 illustrates how supportive information can be combined in the tooltip.
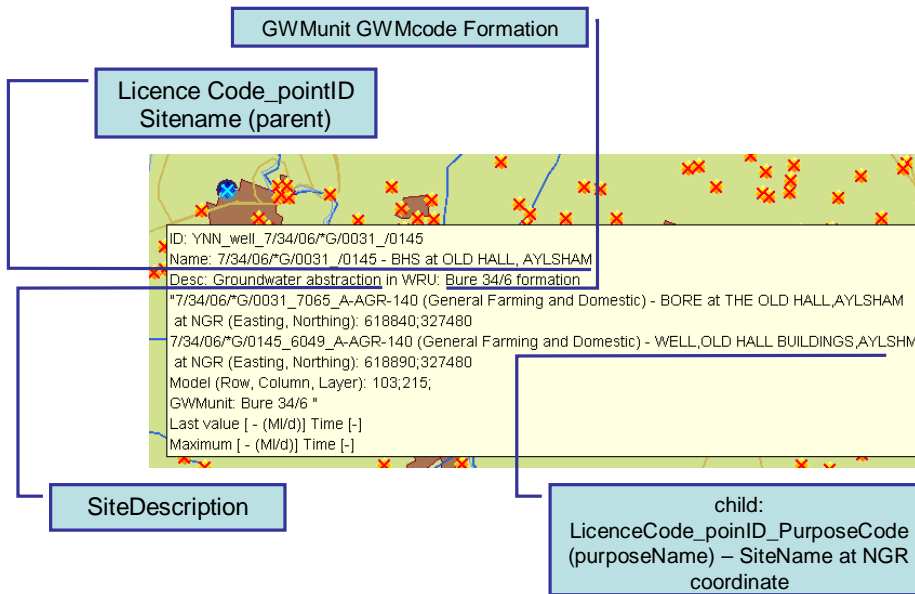
Example: Parent with two childs

Figure 4 Illustration of information use as specified in spreadsheet

Position in WEL-file

The worksheet starts with the identification of the position (line number) of the abstraction time series in the well file. In general the licence will be mapped to a time series based on the Row, Column, Layer number. However, for any cell with multiple abstractions, line number is the only means available to map the licence correctly to a time series.

Licence Identification

To enable identification of abstractions based on licences, all details (licence-code, abstraction pointId, and purpose should be defined separately. Please use the NALD-code and pointID if possible. If no pointId is available from NALD, the OSreference (XX12341234) should be used.

Coordinates

The NGMS will place abstractions on the map based on the NGR-coordinates. The cell coordinates will be used to assign data to the model grid.

$$\text{Model-X} = X_{upperleft} + (\text{column number - 1}) * dX$$

$$\text{Model-Y} = Y_{upperleft} - (\text{row number - 1}) * dY$$

Please use cell centres for $X_{upperleft}$ and $Y_{upperleft.}$

Descriptive items

The descriptive items are used to compose a tooltip with relevant information. Figure 4 indicates how the information is combined in a tooltip.

Quantity and period of abstraction (optional)

These items are optional. If provided, they can be used to check data generated by the NGMS.

4.5   Worksheet OBH_org

This worksheet provides all information on the GW observation boreholes incorporated in the system. Specify all observation boreholes which may be of interest. Data at observation boreholes can be downloaded from the server without the need to acquire entire grids.

In case multiple observation points refer to one borehole (X, Y-coordinate), a clear identification (name and layer) is needed to distinguish between the observation points. Automated processing routine s have been established to identify at what coordinates need to be defined for the parent location in addition to the individual observation points. Please read Section 1.1.4 on the concept of parent locations if needed.

Text constructors

The section on text constructors defines the visualization and listing methods of the locations. Figure 2 shows an example of the location list in the Explorer. Note that the software defines the order on an alphabetic basis. Figure 3 illustrates an example of the location list in the time Series Display. The short cut ordering is manually defined in the configuration, thus allowing a name first and ordering according to Id.

Site Identification

To enable identification of observation points, all details (site-code, OS reference, description/type of observation point) should be defined separately. Please use the WISKI codes where appropriate. If no code is available from WISKI or another system, the OS-reference (XX12341234) may be used.

Coordinates

The NGMS will place observations on the map based on the cell-coordinates, as these coordinates will be used to transfer data from the model grid to the observation point. The actual NGR-coordinates will be shown in the tooltip.

Model-X = $X_{upperleft}$ + (column number - 1) * dX

Model-Y = $Y_{upperleft}$ - (row number - 1) * dY

Please use cell centres for $X_{upperleft}$ and $Y_{upperleft.}$

Descriptive items

Screen information may be provided if available and appropriate.

Thresholds

Thresholds are shown as a horizontal line in the graphs. They can be used to warn area staff by highlighting consequences of certain groundwater heads (H) or head change (dH) compared against a reference. Consequences could be flooding, crop loss, overexploitation.

4.6   Worksheet Gauges_org

This worksheet provides all information on the river and stream gauging stations incorporated in the system. Please specify all gauging stations which may be of interest.

Text constructors

The section on text constructors defines the visualization and listing methods of the locations. Figure 2 shows an example of the location list in the Explorer. Note that the software defines the order on an alphabetic basis. Figure 3 illustrates an example of the location list in the time Series Display. The short cut ordering is manually defined in the configuration, thus allowing a name first and ordering according to Id.

Site Identification

To enable identification of observation points, all details (site-code, OS reference, description/type of observation point) should be defined separately. Please use the WISKI codes where appropriate. If no code is available from WISKI or another system, the OSreference (XX12341234) may be used.

Coordinates

The NGMS will place observations on the map based on the cell-coordinates, as these coordinates will be used to transfer data from the model grid to the observation point. The actual NGR-coordinates will be shown in the tooltip.

$$\text{Model-X} = X_{upperleft} + (\text{column number} - 1) * dX$$

$$\text{Model-Y} = Y_{upperleft} - (\text{row number} - 1) * dY$$

Please use cell centres for $X_{upperleft}$ and $Y_{upperleft}$.

Descriptive items

At least the station name and the river/stream should be defined.

Thresholds

Thresholds are shown as a horizontal line in the graphs. They can be used to warn area staff by highlighting consequences of certain flow rates (Q) or flow change (dQ) compared against a reference.

4.7   Worksheet SWlat_org

This worksheet provides all information on the surface water discharges and abstractions (i.e. surface water laterals) in the model. Please specify all surface water laterals.

In case multiple laterals refer to same segment, only one combined time series is available via the STR-file. In such case, the laterals will be accessible as a joint time series only. Semi-automated processing routines have been established to identify the associated parent location. Please read Section 1.1.4 on the concept of parent locations if needed.

On individual lateral discharges can only be made accessible if the data is provided in a separate time series file (see chapter 5).

Text constructors

The section on text constructors defines the visualization and listing methods of the locations. Figure 2 shows an example of the location list in the Explorer. Note that the software defines the order on an alphabetic basis. Figure 3 illustrates an example of the location list in the time Series Display. The short cut ordering is manually defined in the configuration, thus allowing a name first and ordering according to Id.

File inclusion

Since differences may exist between the STR-files of the various model runs, one needs to identify which runs include the lateral listed.

Type

Please distinguish at minimal between abstraction and discharge. The type may also indicate if the (abstraction) licence is associated to another (discharge) licence.

Licence Identification

To enable identification of laterals based on licences, all details (licence/consent-code, pointId, and purpose) should be defined separately. Please use the NALD-code and pointID if possible. Use the OS-reference (XX12341234) if no pointId is available from NALD.

Coordinates

The NGMS will place laterals on the map based on the cell-coordinates, as these coordinates will be used to transfer data from the model grid to the observation point. The actual NGR-coordinates will be shown in the tooltip.

Model-X = $X_{upperleft}$ + (column number - 1) * dX

Model-Y = $Y_{upperleft}$ - (row number - 1) * dY

Please use cell centres for $X_{upperleft}$ and $Y_{upperleft}$.

Descriptive items

The descriptive items will be used to provide additional information via the tooltip.

4.8   Worksheet Branches_org

This worksheet defines the accretion profiles that will be made accessible in the system. For each profile, the stream name as well as its chainage and sequence of stream cells is needed. Chainage should be consistent in direction. The accretion profile will show a chainage of '0 km' on the left side of the graph.

Features of interest can be shown along a vertical line in the graph. These tags can be used to provide navigational content to the user of the system. However, too much tags clotter the diagram.

4.9   Worksheet Classbreaks

This worksheet defines any class breaks that should be used for the spatial plots. E.g. specific types of application (RSA, CAMS) or specific areas (e.g. wetlands, watercress) may have specific thresholds to sustain the habitat conditions.

Although the system does not yet support multiple sets of class breaks for one parameter, it will in future. Hence multiple sets may be defined.

5   Time series provision

In addition to model results, the NGMS can be used to present to display model data with observation data or licence time series in one graph to the users.

The Modflow Module Adapter can be used to retrieve time series of individual groundwater abstractions from the Modflow WEL file. Unfortunately, individual surface water discharges or abstractions time series cannot be retrieved from the Modflow STR-file, as this Modflow file does not distinguish several time series in one model cell. Hence surface water laterals need to be provided in another way.

Similarly, observation data (e.g. river gauging station data or observation borehole data) will need to be provided separately.

5.1   Required file formats

The NGMS communicates with the 'outside' world using a small variety predefined file formats, based on XML-technology. The system supports the standardized time series formats of the EA[2] (,the WISKI data format and the Delft Published Interface format[3] (PI). A sample XML file according to the PI format is provided in Figure 5. A sample for the EA-timeseries format is provided in Figure 6.

One of these data formats need to be used.

Preferable, data is acquired from WISKI and provided in the EA-timeseriesformat.

---

[2]   *<EATimeSeriesDataExchangeFormat*
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat"
xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat"
xsi:schemaLocation="http://www.environment-agency.gov.uk/XMLSchemas/EATimeSeries
DataExchangeFormat EATimeSeriesDataExchangeFormat.xsd
http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat EAMetadata.xsd">

[3]   *<TimeSeries xmlns="http://www.wldelft.nl/fews/PI"*
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wldelft.nl/fews/PI
http://fews.wldelft.nl/schemas/version1.0/pi-schemas/pi_timeseries.xsd" version="1.2">

```xml
<TimeSeries xmlns="http://www.wldelft.nl/fews/PI"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.wldelft.nl/fews/PI
http://fews.wldelft.nl/schemas/version1.0/pi-schemas/pi_timeseries.xsd"
version="1.2">
<series>
        <header>
                <type>instantaneous</type>
                <locationId>Robley Cottage</locationId>
                <parameterId>H.obs</parameterId>
                <timeStep unit="nonequidistant"></timeStep>
                <startDate date="1966-02-09" time="09:00:00"/>
                <endDate date="1966-07-08" time="09:00:00"/>
        <missVal>-1.0000000E-10</missVal>
        <units>mAOD</units>
        </header>
        <event date="1966-02-09" time="09:00:00" value="103.24" ></event>
        <event date="1966-03-22" time="09:00:00" value="104.21" ></event>
        <event date="1966-05-12" time="09:00:00" value="102.99" ></event>
        <event date="1966-06-08" time="09:00:00" value="103.05" ></event>
        <event date="1966-07-08" time="09:00:00" value="102.93" ></event>
</series>
<series>
        <header>
                <type>instantaneous</type>
                <locationId>Bailiffs Cottage</locationId>
                <parameterId>H.obs</parameterId>
                <timeStep unit="nonequidistant"></timeStep>
                <startDate date="1966-10-25" time="09:00:00"/>
                <endDate date="1967-05-21" time="09:00:00"/>
        <missVal>-1.0000000E-10</missVal>
        <units>mAOD</units>
        </header>
        <event date="1966-10-25" time="09:00:00" value="96.38" ></event>
        <event date="1967-03-21" time="09:00:00" value="101.99" ></event>
        <event date="1967-04-28" time="09:00:00" value="101.93" ></event>
        <event date="1967-04-30" time="09:00:00" value="101.61" ></event>
        <event date="1967-05-07" time="09:00:00" value="101.29" ></event>
        <event date="1967-05-14" time="09:00:00" value="100.96" ></event>
        <event date="1967-05-21" time="09:00:00" value="100.67" ></event>
</series>

</TimeSeries>
```

Figure 5 XML sample according to PI format (several sites shown in one file)

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!-- =====================================================
 Inputtype:
 Inputversion:  1.0
 Outputtype:    EA XML Time Series Exchange Format
 Outputversion: 1.0
 ===================================================== -->
<EATimeSeriesDataExchangeFormat
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat"
       xmlns:md="http://www.environment-agency.gov.uk/XMLSchemas/EAMetadataFormat"
       xsi:schemaLocation="http://www.environment-
agency.gov.uk/XMLSchemas/EATimeSeriesDataExchangeFormat
EATimeSeriesDataExchangeFormat.xsd                           http://www.environment-
agency.gov.uk/XMLSchemas/EAMetadataFormat EAMetadata.xsd">
 <md:Publisher>Environment Agency</md:Publisher>
 <md:Source>WISKI</md:Source>
 <md:Description>Interim exchange with Thames Water</md:Description>
 <md:Creator>Chris Beales</md:Creator>
 <md:Date>2006-05-19</md:Date>
 <md:Time>10:16:19</md:Time>
 <md:Identifier>EAHARPCTX03</md:Identifier>
 <!-- Generated by WISKI - this document follows the recommended
      guidance issued in the Plain English description of the
      Environment Agency's Time-Series Data Exchange Format (version 1.1.2) -->
 <Station stationReference="0581GW"
          stationName="BURLINGTON"
          region="Midland"
          ngr="SJ77901159">
  <!-- Waters: === -->
  <SetofValues parameter="Water Level" qualifier="Groundwater"
               dataType="Instantaneous"
               period="Unspecified"
               units="mAOD"
               startDate="1996-09-04"
               startTime="00:00:00"
               endDate="1997-09-02"
               endTime="00:00:00">
   <!-- WISKI time series name: BURLINGTON / WL / 0581GW.WL.ir.P
               parameter:         Groundwater Level
               qualifier:         Water Level -->
   <!-- Non equidistant block from cached buffer -->
   <Value date="1996-09-04" time="10:14:00" flag1="1">93.15</Value>
   <Value date="1996-10-09" time="10:10:00" flag1="1">93.02</Value>
   <Value date="1996-11-06" time="11:15:00" flag1="1">92.89</Value>
   <Value date="1996-12-04" time="11:30:00" flag1="1">92.8</Value>
   <Value date="1997-01-08" time="12:00:00" flag1="1">92.73</Value>
   <Value date="1997-02-04" time="11:05:00" flag1="1">92.71</Value>
   <Value date="1997-03-04" time="11:10:00" flag1="1">92.61</Value>
   <Value date="1997-07-08" time="11:45:00" flag1="1">92.44</Value>
   <Value date="1997-08-04" time="12:03:00" flag1="1">92.61</Value>
   <Value date="1997-09-02" time="11:10:00" flag1="1">92.53</Value>
   <Comment    startDate="2001-01-01"    startTime="00:01:00"    endDate="2001-01-08"
endTime="11:49:00">There  are  no  values  in  the  time  range  01/01/2001  00:01:00  to
08/01/2001 11:49:00</Comment>
   <Comment    startDate="2003-07-07"    startTime="13:09:00"    endDate="2003-08-05"
endTime="23:59:00">There  are  no  values  in  the  time  range  07/07/2003  13:09:00  to
05/08/2003 23:59:00</Comment>
  </SetofValues>
 </Station>
</EATimeSeriesDataExchangeFormat>
```

Figure 6 XML-sample according to standardized EA-timeseries format (one station per file)

5.2   Spreadsheet support

During the pilot project, it has been indicated that it takes a lot of effort to obtain data from WISKI, while the data also is available in spreadsheets which have been used in model preparation and calibration.

To reduce the effort in providing time series for the system, a separate spreadsheet template has been developed, which includes a macro to generate the XML-file using a template file.

The spreadsheet template, named NGMS_tms_Template.xls contains at least one worksheet. The table format is strict to meet the code requirements.

- The first 3 columns (TYPE, DATE, TIME), are fixed, while the remainder columns provided the data for a station each.
- row 1 contains key words for the code. For each station a new column is added, with column header 'VALUE' (row 1)
- row 2 contains the sitename (or Id) which is clearly linked to the location names as provided in the NGMS_DataProvision_Template. If the link is not clear, a mapping table needs to be provided on a separate sheet. Column 2 and 3 remain empty.
- row 3 contains the parameter of the time series. Column 2 and 3 remain empty.
- row 4 contains the date (and time) of the first observations for this specific station. Please provide the start date and time in the following format: dd-mm-yyyy hh:mm:ss
- row 4 contains the date (and time) of last observations for this specific station. Please provide the start date and time in the following format: dd-mm-yyyy hh:mm:ss
- row 5..n contain the observation events.
  - If a specific station has no event for an event record in the table, the cell can be left empty.
  - If the data provider prefers to create a dedicated events table for a specific observation point (i.e. no 'empty records for this station'), just copy the worksheet into a new one and fill the table as appropriate.

NAME	DATE	TIME	VALUE	VALUE
site			Robley Cottage	Bailiffs Cottage
parameter			H.obs	H.obs
startdate			**09-02-1966 09:00:00**	**25-10-1966 09:00:00**
enddate			**28-05-2003 09:00:00**	**10-06-2003 09:00:00**
event	**15-mrt-59**	**9:00:00**		
event	**15-okt-59**	**9:00:00**	104.23	
event	**15-feb-60**	**9:00:00**		103.22

Figure 7 Sample format of the XLS-worksheet for time series provision