# Requirements for a Lead Local Flood Authority asset register

*City of Bradford Metropolitan District Council in collaboration with the Pennine Water Group, the City of Paris Engineering School and members of the Yorkshire and Humber Learning and Action Alliance*

FV 100826

# Requirements for a Lead Local Flood Authority asset register


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# Executive Summary

This report is the result of a requirements analysis for a Lead Local Flood Authority Asset Register. The analysis was sponsored by City of Bradford District Council who were assisted by the Pennine Water Group from the University of Sheffield, and the Paris School of Engineering, all partners in th North West Europe Interreg IVB project FloodResilienCity.

Following initial contributions from Leeds City Council and Calderdale Council, the draft analysis was circulated to members of the Yorkshire and Humber Learning and Action Alliance and a workshop was held in Bradford on 9th August 2010. The feedback from this workshop was incorporated into the report.

The report identifies many issues for consideration by those specifying and developing asset registers for Lead Local Flood Authorities (LLFA), other relevant authorities and stakeholders in flood risk and water management. A check list is provided to facilitate specification and development.

Key areas of concern are the referencing of different types of drainage assets and the degree to which those should be incorporated within a LLFA asset register. Linked to this was how to manage the referencing of assets belonging to other relevant authorities and stakeholders not already included in the data that they have supplied and it is recommended that early action is taken to address these issues.

# Contents

# 1 Introduction

## 1.1 Context

Lead Local Flood Authorities (LLFA) have a need for a register of drainage assets sitting within the context of GIS based information systems for flood risk and integrated land and water management. This requirements analysis has been undertaken to identify the needs for an asset register from a LLFA perspective, but taking account of other stakeholders in flood risk and water management. This register if properly designed will facilitate communication between stakeholders in flood risk and integrated land and water management. This is illustrated in Figure 1

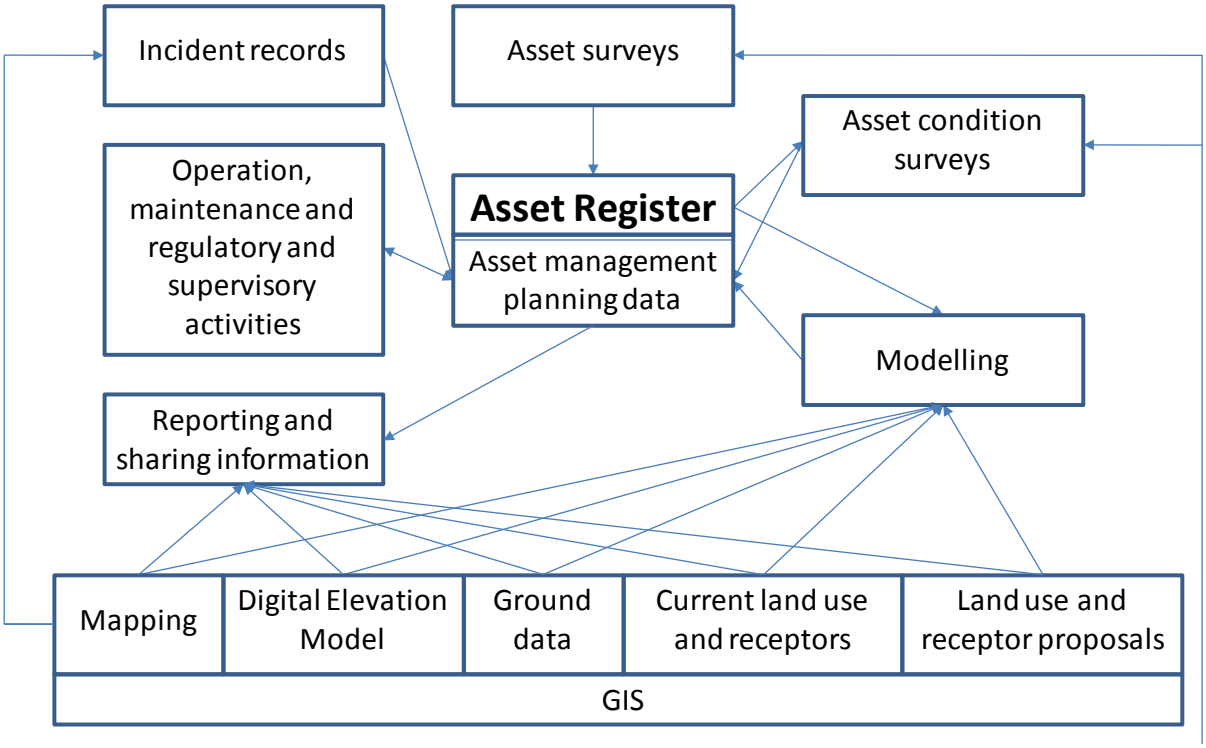


**Figure 1: Illustration of GIS and data management structure and data flows**

The contribution of GIS to this process is significant and the chosen solution for the development of an asset register must be compatible with GIS applications. Most LLFAs will use either Arc or Map Info, but others may be used.

## 1.2 Aim

The aim of this report is to identify the requirements of LLFAs for an integrated drainage asset register that will facilitate the sharing and use of data from a number of stakeholders involved in flood risk and water management. The identified requirements will facilitate the production of a specification for an asset register.

## 1.3 Deliverables

This report provides an analysis of

1. Data to be shared and its integrity.
2. The need for flexibility, starting with small achievable objectives such as the digitising of current asset data and recording local high priority data with provision for expansion and enhancement as and when required.
3. The referencing system
    a. The need to accommodate the referencing systems of the data suppliers
    b. The need to provide for the future requirements of LLFAs in the management of their own data
4. The need to deal with point and polygon nodes and links, their connectivity, geographical location and directionality
5. Mandatory, desirable and useful data
6. Data validation
7. Data import and export

# 2 Methodology adopted for the production of the report

## 2.1 Rationale

An asset register is one part of an asset management system typically required by a LLFA to support its new role. Many LLFAs already have the basis of an asset registers and asset management systems and are considering how to develop these further. Whether internally developed or proprietary systems, it will be beneficial to consider the wider issues when taking the first steps so as to avoid the need to rework the development process. The requirements analysis will assist internal systems developers and the developers of proprietary systems alike in specifying the systems content and functionality. The draft requirements analysis was produced by City of Bradford MDC. This was circulated to members of the YHLAA prior to a workshop. At the workshop, the participants outlined their general requirements for data and asset management and then moved on to reviewing the draft requirements. The draft document was amended and enhanced based on the comments made at the workshop.

## 2.2 Work plan

### 2.2.1 Tasks and activities

This is a long term venture which has a potential for phased development and implementation by a range of stakeholders. The tasks and activities resulting in the production of this report have been associated with the identification of requirements. Next, users' attention will focus on the development of an overall programme for implementation and specifications for high priority areas of an asset register appropriate to their individual circumstances.

This activity is being carried out alongside the implementation of PFRAs which requires the consideration of the use of the National Receptor data set, enhanced by locally maintained data sets and other data. In addition there will be a need to take account of how the results of modelling of different forms will be linked to the asset register and how the whole will be managed, enhanced and presented within the LLFA, to other authorities and to the public.

The draft requirements analysis was produced during a seven week period with the assistance of students from the Paris School of Engineering, supported by staff from CBMDC, the Pennine Water Group, and other organisations (Leeds City Council, Calderdale MDC, Environment Agency, British Waterways etc.)

The activities undertaken included

- Identification of potential data types and data owners that may be included within the register
- Understanding the issues relating to referencing and data structure in terms of
    - Asset types
    - Asset location
    - Connectivity and direction of flows
    - Identifying essential, desirable and optional data
    - Links to asset management
    - Facilitating communication with stakeholders and the public
- Data validation
- Data exchange
- Data transformation

Following a workshop the draft requirements analysis was amended and improved in the form of this final report.

### 2.2.2 Data and data sources

In order to develop a comprehensive list of requirements, it was necessary to consider all types of drainage assets, no matter how unlikely it would be for practical purposes that all those assets would be included within the register. Unless this was done, it would not be possible to specify features of the asset register that would be fully fit for purpose as additional asset types are added in the future. However, it is not assumed that all fields can be completed from the outset

Types of data and data sources (not necessarily asset ownership) are identified in Table 1. Including Ordnance survey which provides information on the location of open water

**Table 1 types and sources of data**

| | Local Authority (Including internal departments and district councils in areas with two tier authorities | Environment Agency | Water and Sewerage Company | British Waterways | Land drainage boards | Highways Agency | Network Rail | The Crown (MoD etc.) | Coastal Groups | Ordnance survey | Other (private) asset owners |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sewers and ancillaries (public, private) | X | | X | | | | | X | | | |
| Open drains, (highway, private) | X | | | | | X | X | X | | | |
| Piped drains, (highway, private) | X | | | | | X | X | X | | | |
| Gullies | X | | | | | X | | X | | | |
| Other inlets | X | X | | X | | X | X | X | | | |
| SUDS/source control (Hard, Soft) | X | | X | | | X | | X | | | |
| Source control | X | | X | | | X | | X | | | |
| Designated surface pathways | X | | | | | | | X | | | |
| Natural watercourses (EA managed, IDB managed, LA managed, but all having riparian ownership) | X | X | | | X | X | X | X | | X | |
| Open modified watercourses (Channels) | X | X | | | X | X | X | X | | X | |
| Piped modified watercourses (culverts) | X | X | | | X | X | X | X | | | |
| Artificial drainage channels | X | | | | X | | | X | | X | |
| Artificial drainage channel culverts | X | | | | X | | | X | | | |
| Bridges | X | X | | | | X | X | | | X | |
| Built over watercourses (Natural or modified) | X | X | | | | X | X | | | X | |
| Lakes | X | X | X | | | | | X | | X | |
| Reservoirs | X | X | X | X | | | | X | | X | |
| Canals | | | | X | | | | | | X | |
| Designated walls | X | X | | | | X | X | | X | | |
| Designated embankments | X | X | | | | X | X | | X | | |

The asset register will be required to satisfy the needs of all the stakeholders in the provision and receipt of data

# 3 Results

## 3.1 Sources of data

Contact has been established with organisations with data and the potential to share it as follows:

### 3.1.1 Local Authorities

GIS based local authority asset registers where they exist appear to have developed on a piecemeal basis. There are many paper and computer based systems, some of which, have been given a great deal of thought. However it is inevitable that these reflect the needs at the time of their development rather than looking at an integrated asset register covering all aspects of the new local authority responsibilities.

Some local authority departments have extensive information on assets such as culverts and bridges, but these are locked up in electronically stored drawings rather than what is generally considered to be an asset register.

Other local authorities may have purchased a proprietary system to record details of some types of asset. Many local authorities have agreed standards for recording assets in and under highways (highway drains, gullies, culverts etc) and will require data to be able to be referenced to the National Street Gazetteer).

The issue here is that many local authorities will have systems electronic or otherwise covering at least some aspect of drainage asset management. Therefore, there is a requirement for flexibility in the design of any new asset record system, so that it can work alongside or encompass existing systems. This includes referencing of assets, data structure and exchange of data.

One of the first steps to be taken is the digitisation of existing paper and electronic based records. This process needs to cover a bare minimum of mandatory data required to create an asset record system. However users should have the option of including additional data in the digitisation process where this is available.

Another immediate requirement is to be able to record the location and details of assets which are being surveyed as part of general investigation work.

Currently it is proposed that local authorities become SUDS adoptions bodies under the Flood and Water Management Act 2010 although there are arguments that other organisations should have this responsibility. Nevertheless there is need for LLFAs to make preparations to hold asset records for SUDS to ensure compliance with their future duties as the SUDS approval body.

### 3.1.2 The Environment Agency

The Environment Agency (EA)operates a national “Detailed River Network” (DRN) data management system. The system is well documented and the documentation is available from the EA[1]. The DRN uses Master Map to define the locations of rivers and has built in routines to predict the routing of culverted sections of watercourse. Although in some cases these routines work well, this is not always the case and though the system satisfies the EAs national needs its appropriateness for local use is a matter for discussion and there is a clear need for passing locally derived information to the regional and national operators of DRN.

[1] Detailed River Network (DRN) Data Description & Guide Document, Version 4.0b, 30th May 2008.

The biggest reported problem with the DRN is that the linear channel features are of vastly varying lengths, which do not lend themselves to the allocation of useful attributes (e.g. ownership, channel type, etc). Hence the need is to be able to sub divide the reach lengths as described.

It is not the role of the LLFA to update the DRN. That is the responsibility of the EA. However, it is appropriate for LLFAs to identify sub divisions of the DRN based on identified assets and also sub divisions based on ownership. These need to be separately recorded for the purposes of the LLFA and passed on to the EA so that they can update the DRN.

### 3.1.3 Water and Sewerage Companies.

Yorkshire Water Services (YWS)is the W&SC for most of the Yorkshire and Humber region, although United Utilities, Severn Trent Water and Anglian Water also cover some of the area. The asset record systems used by the W&SCs have their roots in Standing Technical Committee Report 25[2] and later in the manual of Sewer Condition Classification (MOSCC)[3]. Proprietary software has been developed for these systems, but over the years W&SCs have tended to adapt the data formats for use within their own corporate GIS systems.

W&SCs are currently developing protocols for data sharing and once these are agreed it will be possible to identify the specific data that LLFAs will be required to manage. However the format is likely to be along the lines of STC25/MOSCC

Prior to 2000, most district councils acted as sewerage agents for water authorities and more latterly W&SCs. Although W&SC focus is on statutory sewer records, it is possible as a result of local authority practice, prior to 2000 that there are archives of information on other assets such as highway drains and watercourses. This data will clearly be out with the standard protocol, but where it does exist is may be held in a common format with sewer data.

The Flood and Water Management act passes responsibilities for private sewers to W&SCs. To what extent information on these assets are to be held on asset record systems has yet to emerge, but it will be worth considering the possibility of this within this report. The issue is not about data formats as these are no different than sewers, but there is a need to consider how this will affect the data referencing system.

As with the DRN for watercourses, it is not the role of the LLFA to update the W&SC's sewer records. However, there is a need to hold updated information where appropriate and provide the W&SC with this information so that they can update their records.

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[2] Standing Technical Committee on Sewers and Water Mains, Department of the Environment, National Water Council, Standing Technical Committee reports Number 25, NWC June 1980.
ISBN 0 904561 85 2

[3] Manual of Sewer Condition Classification - 4th Edition, WRC, 2004. ISBN 9781898920502

### 3.1.4 British Waterways

British Waterways (BW) hold GIS based information on canal alignment, sluices and flood weirs and also have Excel files on historic breaches and overtopping. BW are to provide information on data formats as shown in Appendix 1.

### 3.1.5 Land Drainage boards, Highways Agency and Network Rail

Preliminary contact has been established, but more detailed information has yet to be obtained. However, apart from local referencing all the data formatting issues are similar to those of LAs, the EA, W&SCs and BW

### 3.1.6 The Crown and Coastal Groups

Contact has yet to be established. However it is likely that data formatting issues are similar to those of LAs, the EA, W&SCs and BW.

## 3.2 Understanding the issues relating to referencing and data structure

### 3.2.1 Asset types and referencing

Table 1 identifies a large number of assets. However, these can be reduced to a small number of asset types which can be expressed as Nodes or Links.

- Nodes which can be considered either points or some form of polygon
- Links may represent pipes, controls, natural (irregular) channels and modified (regular channels)
- Non-spatial elements, or components, of spatial features (e.g. maintainable items - such as screens, valves, weirs, sensors, telemetry, etc – which may be associated with a manhole or other chamber). These can be held in a relational database, with a reference that links them in a many-to-one fashion with a unique node. Options would be to create a large number of optional attribute fields for each node (to indicate whether a node has any of these components), which is not good database practice, or to record the asset components (screens, valves, weirs etc. as links as is done in Infoworks etc. In the case of the latter additional (ghost) nodes would have to be created. In either case, the items such as sensors or telemetry would have to be recorded as attributes.

Each node and link needs to be referenced in a way that can be understood by the LLFA, but each node and link also needs to be referenced in a way that can be understood by the original supplier of the data. Without this communication between stakeholders about the assets will be difficult to say the least.

System developers will need to consider how LLFAs may wish to present their data. Some may prefer to focus solely, on electronic systems, but others may also wish to use hard copy drainage maps. In the first case, blocks of numbers can be used to reference assets, but in the second case a geographically based referencing system such as STC 25 would be more appropriate. It is likely that W&SCs will have to re-evaluate the STC25/MOSCC system as a result of the adoption of private sewer systems. If this is the case, then the development of a system encompassing SUDS, private surface water sewers, highway drains, gullies and other assets may be appropriate.

Ownership needs to be recorded, but as a separate layer, as it bears no relationship to the attributes of the asset

#### *3.2.1.1 Connectivity and direction*

Connectivity and direction are viewed as an essential feature and can be determined using the Node and Link referencing system

### 3.2.2 Asset location

All nodes occupy space, but for the purposes of recording and displaying drainage assets, it is convenient to considers some as points, whereas others because of their size need to be recorded as polygons

#### *3.2.2.1 Point nodes.*

In piped drainage systems, the majority of nodes can be classed as point nodes. At most the nodes may be a few metres in diameter and so it is appropriate to locate the node using the National Grid Reference (NGR) to the nearest metre. The referencing system allows each end of a pipe to be associated with the upstream and downstream nodes and can hence be located.

#### *3.2.2.2 Polygon nodes.*

Polygon nodes representing ponds, lakes and SUDS features such as swales, source control features, infiltration basins etc, can be located using a NGR and a shape. However, the links entering and leaving the node may not end at the specified NGR. In this case accurate location of the links can be achieved by assigning NGRs to each end of the link or alternatively as a GIS polyline.

#### *3.2.2.3 Ghost nodes*

Ghost nodes are particular relevant to piped systems. Information on links is normally surveyed at access nodes, but other (buried) nodes in the system may need to be recorded.

If there is a change of material, shape or gradient it is desirable to insert what is termed an attribute ghost node.

At buried junctions it will be necessary to insert what are termed junction nodes.

Finally at changes of direction it is convenient to insert location ghost nodes. The length of the pipes between access, junction and attribute ghost nodes can be calculated using location ghost nodes. Location ghost nodes are not necessary where links are defined as GIS polylines.

### 3.2.3 Identifying mandatory, desirable and optional data

Although it is desirable to have as much information as possible on an asset there are limits to the amount of data that can be produced and it is possible to have too much data because of the need to update information that changes at frequent intervals

A bare minimum of data should be classed as mandatory. This includes the information that allows an asset to be identified and located. That is the referencing system and the geo referencing. Providing that the referencing system identifies the asset status, then this will be sufficient. Alternatively a mandatory field recording status will be required.

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The contents of the status field will determine the content of the subsequent tables describing the asset

The boundary between desirable and optional data is open to debate. But desirable data may be classed as dimensions, material, levels, ownership and function. Consideration could be given to aligning this with the need to map flood risk and flood hazards

Clearly, a LLFA holding W&SC asset data does not need to hold large amounts of asset management data for the W&SC. However it may be beneficial for a LLFA to hold asset management data for its own assets and inspection data for some 3rd party assets for which there is a LLFA requirement to inspect such as , private channels and culverts. The potential users need to review the beneficiaries of asset records and asset management data.

It is also desirable to identify the degree of confidence in key items of data by specifying whether it is measured, assumed, deduced, interpolated digitised from old records etc.

### 3.2.4 Links to asset management

The type of asset management data that may be of benefit to hold include the results of model simulations, data on asset condition (structure and serviceability) maintenance schedules and incident records. In addition the asset record may be used to facilitate the construction of models or the scheduling of asset condition surveys so data formats should be specified in ways that can facilitate these uses. Where data such as condition or silt levels is included within the register, fields to record the source and date of the assessment should be included.

### 3.2.5 Facilitating communication with stakeholders and the public

It is important that LLFAs respects the conditions placed on the use of data specified by data providers so it will be necessary to place controls and checks on the way that data is shared with others. Nevertheless in developing a specification for a data management system it will be necessary to consider how the data is to be used and communicated.

## 3.3 Data validation

Data validation will become an essential part of the data management system's quality assurance procedures and is compatible with the EU Inspire Directive and the Defra SPatial Information Repository project. Typically checks will include:

- Connectivity and direction – Need to identify that all downstream links are reciprocated and that all upstream links are reciprocated and that nodes and links are not duplicated
- Location – Need to ensure that nodes and links are correctly located and that NGRs have no identifiable errors
- Presence of mandatory data – Need to check that mandatory data is present
- Attribute data consistency – Need to ensure data consistency for all data included. Shape, material, dimensions should be the same at either end of links. Extreme gradients should be flagged. Unconnected nodes and links should be flagged. Missing data should be flagged. Etc
- Polygon consistency – Unclosed polygons, slivers and gaps should be flagged

Consideration should be given to operator date and time stamping these operations and archiving of amended data. Ideally this should be introduced from the start, although this may be introduced at a later stage, depending on the status of the data management system (interim or permanent).

## 3.4 Data exchange

Data exchange import and export is needed to share data with other organisations and with other systems used by LFFAs. The routines involved in this process should form part of the quality assurance processes designed to meet the needs of the organisations exchanging data. Data selection and pre export validation checks are required as are pre and post import checks to ensure that data are in the correct formats. However, these checks should be confined to ensuring that data have not been inadvertently altered in the import and export processes. The intention is not to validate the data supplied by others. Only data owned by the LLFA should go through the full validation process.

Data suppliers should be consulted to determine their preferences for refreshing data. The options for full replenishment or simple updates should be considered.

## 3.5 Data transformation

As with data validation and data exchange, data transformation, including editing needs to be carried out in a controlled manner. Again consideration should be given to operator date and time stamping these operations from the start, although this may be introduced at a later stage depending on the status of the data management system.

## 3.6 Data sub-sets

Facilities for the creation of sub sets through queries, upstream and downstream searches, graphical techniques and merging, intersection, subtracting existing sub-sets should be included

## 3.7 Remarks etc

Adequate fields should b provided for remarks, photographs, sketches and drawings

## 3.8 Logging

Consideration should be given to operator date and time stamping all operations from the start, although this may be introduced at a later stage depending on the status of the data management system.

# 4 Conclusions

This report describes the requirements associated with the development of a GIS based integrated drainage asset record system identified by those who participated in the requirements analysis. However it is by no means the final step in the process. Not all stakeholders whose data may be included have been consulted within this process, but they should be prior to the finalisation of a specification. Nevertheless the report provides a basis for engagement with stakeholders to ensure that their needs, concerns and priorities about the operation of data management systems are addressed in their specification, design and implementation.

# 5 Recommendations

This document may be used by those engaged in the development of asset registers to help them identify their specific needs prior to the specification process. In order to facilitate the development of effective specifications, the following check list is provided. This list although comprehensive should not be regarded as complete. Nor should it be regarded as compulsory to spend hours of deliberation over each item

**Requirements check list**

| Requirements for consideration | Response |
|---|---|
| **GIS Platform** – Has compatibility with GIS platforms been considered?<br>Arc<br>Mapinfo<br>Other | |
| **Data sources –** Has the storage of data from the following stakeholders been considered?<br>Lead local flood authority (including different departmental responsibilities)<br>District councils (including different departmental responsibilities)<br>Other adjacent local authorities (including different departmental responsibilities)<br>The Environment Agency<br>Water and Sewerage Companies<br>British Waterways<br>Land drainage boards<br>Highways Agency<br>Network Rail<br>The Crown<br>Coastal groups<br>Others | |
| **Assts types and referencing** – Have the following been considered?<br>The need for point and polygon nodes?<br>The need for links to represent pipes, controls (screens, valves, weirs etc.), irregular and regular channels etc.<br>The need to represent structures over channels, (bridges, buildings etc.)<br>The need to represent standalone flood defences (designated walls and embankments etc.)<br>The need to represent designated surface water pathways<br>The needs for an asset referencing system to be applied to electronic/hard copy mappings systems<br>The need to include the data providers' referencing system<br>The need for a consistent approach for referencing different local authority data (including different departmental responsibilities within the local authority) | |
| **Connectivity and direction** – Has the need to represent connectivity and direction been considered in the database structure? | |

| Requirements for consideration | Response |
|---|---|
| **Asset location** – Have the following been considered?<br>The need to identify and locate point nodes<br>The need to identify and locate polygon nodes<br>The need to identify and locate links between point and polygon nodes<br>The need to identify and allocate attribute ghost nodes<br>The need to identify and allocate junction nodes<br>The need to identify and allocate location ghost nodes | |
| **Identifying mandatory, desirable and optional data** – Have the following needs been identified?<br>The need for mandatory data (for identification and location)<br>Referencing (Supplier and local authority)<br>Location (Co-ordinates/polyline/polygon)<br>Status (Category of asset ownership )<br>Function (what the asset does)<br>Ownership of the data<br>Desirable data (for basic asset management and assessment of capacity)<br>Node type<br>Ground level at node<br>Other key node details<br>Link type<br>Link shape (at each end)<br>Link dimensions (at each end)<br>Link material (at each end)<br>Link depth (at each end)<br>Other data (to more advanced asset management)<br>Node attributes<br>Link attributes<br>Sensors and telemetry<br>Asset ownership (Should this be in separate layers or separate but integrated database?)<br>The need to identify the degree of confidence in key items of data | |
| **Links to asset management** – Has the integration of the asset register with the asset management system been considered?<br>Categorising and prioritising assets<br>Scheduling condition inspections<br>Summarising structural condition (including source and data of assessments)<br>Summarising service condition (including source and data of assessments)<br>Building models<br>Summarising hydraulic simulations (including version control of model)<br>Scheduling maintenance works<br>Summarising incidents | |

| Requirements for consideration | Response |
|---|---|
| **Communication** – Have the needs for communication between key stakeholders and communities been considered (including permissions to share data)/ | |
| **Data validation** – Have the following checks been considered?<br>Connectivity and direction (including downstream and upstream reciprocity)<br>Location checks<br>Mandatory data warnings<br>Attribute data consistency<br>Warnings for potential data errors<br>Missing data flags<br>Polygon inconsistencies | |
| **Data archiving** – Has consideration been given to archiving data prior to significant actions such as imports and major transformation processes? | |
| **Data import and export** – Haas consideration been given to validating data (fie lds and formats) prior to and after import and export? | |
| **Data updates** – Has consideration been given to the needs of data owners for regular updates. When importing, should the whole data set be replace or just the revisions. What is the required format for exports? | |
| **Data transformation** – Has consideration been given to the data transformation processes that users may require? | |
| **Sub-sets** – Has consideration been given to the creation and maintenance of sub sets for asset management purposes? | |
| **Remarks etc.** Has consideration been given to the provision of capacity for remarks, photographs, sketched and drawings? | |
| **Action logging** – Has consideration been given to date stamping and identifying operator actions? | |

Key areas of concern are the referencing of different types of drainage assets and the degree to which those should be incorporated within a LLFA asset register. Linked to this was how to manage the referencing of assets belonging to other relevant authorities and stakeholders not already included in the data that they have supplied and it is recommended that early action is taken to address these issues.