

GUIDANCE

ON THE MANAGEMENT OF
HIGHWAY DRAINAGE ASSETS



NOVEMBER 2012

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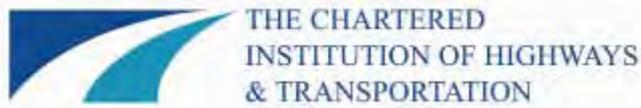
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COMMENTS AND FEEDBACK

The HMEP Programme Board would welcome any comments and feedback on this report so that it may be reviewed, improved and refined to give the sector the best advice possible. If you wish to make a comment, please e-mail your comments to highwayefficiency@dft.gsi.gov.uk with the header "Comments on the guidance on the management of highway drainage assets".

Front cover image: Courtesy of FM Conway & Matt Chisnall, Architectural Photography

This report is supported by the following organisations:





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I FOREWORD

ABOUT THE HIGHWAYS MAINTENANCE EFFICIENCY PROGRAMME

The Highways Maintenance Efficiency Programme (HMEP) is a sector-led transformation initiative that will maximise returns from investment and deliver efficiencies in highway maintenance services. The Programme started in April 2011 with sponsorship from the Department for Transport and is intended to run until 2018.

The Programme is offering local highway practitioners benefits from different ways of working. The vision is that over time, those involved in highways maintenance delivery, the local authorities as clients and their service providers, be they from the private or public sector will adopt an ambitious and longer-term approach to enable them to:

- Continuously find new and improved ways of delivering services to highway users and managing highways assets,
- Make use of collaborative partnerships to improve processes and outcomes, and
- Deliver a sustainable balance between meeting the needs of highways users, improving quality and minimising costs.

The overall programme has been developed by the Programme Board through key personnel who support HMEP's development. This will ensure that:

- The Programme is truly being driven by what the whole sector needs and wants ('by the sector for the sector'),
- The solutions identified by the sector are relevant, realistic, repeatable, scalable and sustainable, and
- HMEP is benefits-led, driving true transformation of the sector with tangible efficiency gains and a lasting legacy.

As a transformation initiative HMEP is targeting the ways local highway authorities conduct their business. It invites the sector to adopt new ways of working to deliver efficiency savings through:

- **Collaboration & Change** - looking at how alliances between authorities, and clients and their providers, can be formed to deliver efficiencies in the delivery of highway maintenance services. Other projects are looking at changing business processes; for instance by applying Lean thinking to the processes behind service delivery and how services or processes can be streamlined to realise efficiencies.

- **Procurement, Contracting and Standardisation** – advising on the routes to procurement enabling authorities to determine how their current service is aligned to current thinking and which is the best procurement option to realise their future service ambitions. It also provides the tools so that efficiencies can arise through the use of, for instance, a standardised form of contract and highway maintenance specification which are better aligned to the activities that local highway authorities undertake.
- **Asset Management** – by providing advice to the sector in the form of updated asset management guidance; for both a simplistic and, where appropriate, more complex lifecycle planning tool to determine whole life asset costs, thus moving away from a reactive to a longer-term approach for maintaining highways assets. To provide training specifically targeted at practitioners to help them move towards an asset management approach and to adopt the new HMEP guidance and tools.
- **Benchmarking & Performance** – collecting, sharing and comparing performance data on Customer/Quality/Cost to help both understanding to show how effective local highway authorities are in delivering Value for Money services and drive targeted efficiencies.

Products and tools are being developed for each of these themes and are being designed to be interdependent, but complementary, so that authorities can maximise their returns from their investments.

ABOUT THIS TOOLKIT

The majority of local highway authorities do not have comprehensive drainage inventories and as a consequence of the increasing impact of climate change they are experiencing a greater frequency of severe weather events, particularly flooding, which causes major disruption and damage to the highway network. Local highway authorities must therefore develop strategies to deliver road maintenance that balance growing service demands with limited resources. Applying the principles as outlined within this guidance document will help local highway authorities to achieve value for money by balancing short term interventions with a long term management approach. HMEP has therefore commissioned this review into highway drainage asset management which highlights three main themes:

- **Defining the asset,**
- **Service delivery, and**
- **People and partnerships**

The objective of this work is to provide guidance to local highway authorities on the most cost effective approach to managing and maintaining drainage assets, based on having better drainage inventory data and the application of asset management principles.

II SUMMARY OF RECOMMENDATIONS

The recommendations made in this guidance document are grouped into themes. Within each theme the recommendations are listed by priority, not the order in which they appear.

THEME: DEFINING THE ASSET

Understanding evolving duties and responsibilities

Recommendation 2

New regulations bring new obligations. These evolving responsibilities will have an effect on budgets and operations. Understand and adapt to these changes.

Data Use

Recommendation 6

Use highway drainage asset data to focus, support and inform maintenance activities. These should be linked to the overall asset management objectives for local highways.

Selection of highway drainage asset survey equipment

Recommendation 3

Before selecting equipment, have a detailed equipment requirement specification and evaluation check-list to ensure that equipment being trialled is done in an objective and consistent manner. Allow sufficient time for the trial. Ensure mobile GPS software complies with the latest National Marine Electronics Association (NMEA) protocols.

Involvement of colleagues in selecting technology

Recommendation 4

Understand your authority's information technology procurement processes, purchasing documentation requirements and get the appropriate council staff (finance, IT GIS etc.) involved early on.

THEME: SERVICE DELIVERY

Understanding demand and service delivery requirements

Recommendation 9

Develop a clear understanding of the demand or service delivery level for the drainage asset, as this will clarify and focus activities and budgets to deliver efficient and effective service.

SUMMARY OF RECOMMENDATIONS

Solutions

Recommendation 12

Do not let the management tool become more important than the job deliverables and recommend simple solutions that do not require a great deal of maintenance or administration.

Effective use of limited budgets

Recommendation 1

Adopt highway drainage asset management strategies based on information held.

Resourcing

Recommendation 11

Allocate resources and funds to routes, sections, or specific areas or assets where most needed. Monitor the maintenance of these assets and require contractors to provide details of the condition of assets; for example, gully cleansing records that details the location of the asset and amount of material removed.

Data Integration

Recommendation 5

Link systems to maintenance activities, focus future activities and map 'hotspots'. Address the causes of problems as opposed to symptoms.

THEME: PEOPLE AND PARTNERSHIPS

Use peoples knowledge

Recommendation 10

In many cases the organisation's employees are the best source of asset management information. Ensure local knowledge of drainage assets held by long service experienced staff is captured and incorporated into data records.

Data Sharing

Recommendation 8

Drainage data must be transferable between owners and stakeholders who understand its value and make use of it.

Partnerships

Recommendation 7

Form partnerships with all relevant bodies, such as the Environment Agency and water companies, to address water management issues and to cooperate in service delivery and information sharing.

1 INTRODUCTION

BACKGROUND

- 1.1 Over the last twenty years scientists have warned of the possible effects of climate change and considerable research has been carried out. In the UK this has been coordinated by the United Kingdom Climate Impacts Programme (UKCIP) which published its latest findings in [UKCP09](#). Whilst it is impossible to say that particular flood events have been caused by climate change, scientists are now suggesting that the increased frequency of severe flooding events does appear to be a result of global warming.
- 1.2 The flooding events of autumn 2000, summers of 2007, 2009 and 2012 were a reminder of the risks posed by flooding, not only to residential and commercial properties, but also to the strategic infrastructure managed by local highway authorities.
- 1.3 The [Pitt Review](#) was set up after the floods of 2007 by the Government to review the flood management processes. It made several recommendations that were taken up by local highway authorities in an effort to better understand and mitigate against increased flood risk in their areas.
- 1.4 A further consequence of the *Pitt Review* was the *Flood and Water Management Act 2010*. This Act establishes a hierarchy of authorities responsible for managing flood risk, and the local highway authority is one such risk management authority, responsible for ensuring its actions are consistent with the national flood and coastal erosion risk management strategy in England, prepared by the Environment Agency (EA). Lead local flood authorities (LLFA) were given further duties under the Act, including consulting with risk management authorities such as local highway authorities. in the production and implementation of their strategies. Local highway authorities and lead local flood authorities are responsible for the same administrative areas in England and Wales.
- 1.5 Element 2 was a Department for Transport initiative that started in 2008 to encourage local highway authorities to develop their asset management around the use of data. Ten local highway authorities were awarded funding for the use of data to manage highway drainage. As a key principle of HMEP is to draw on best practice from across the sector, the Element 2 work is now being used to shape a number of the HMEP asset management projects, such as this guidance on the use of data to manage highway drainage.

PURPOSE

- 1.6 The aim of this guidance has been to identify good practice through proactive engagement in order to demonstrate how local highway authorities may best use data to manage highway drainage systems efficiently and effectively.
- 1.7 In order to manage drainage systems cost effectively, it is necessary for local highway authorities to have a robust drainage asset management strategy. The strategy must be able to support and inform decision making that addresses the need to deliver highway maintenance in a way that balances growing service demands with reducing resources.
- 1.8 Improvements to drainage asset management systems will allow local highway authorities to quantify the condition of their drainage assets, prioritise maintenance, and assess the suitability of those assets to deal with present and future flood and contamination risks. It is recognised that local highway authorities' drainage systems do not operate in isolation and interact with drainage systems and watercourses operated and maintained by utilities and land drainage authorities. Local highway authorities therefore have to be aware of and manage a more complex set of systems and relationships than simply their own.
- 1.9 This guidance will explore evidence from case studies that will support a long term approach to maintaining the highway drainage asset:
- Why adopt asset management for highway drainage? (see Section 2),
 - Current good management practice (see Section 3), and
 - Good practice tools and techniques (see Section 3).

CONSULTATION

- 1.10 One of the first actions of the review was to identify the various stakeholders and asset owners, their respective duties and responsibilities in order to develop an understanding of their approach to asset management best practice. To do this a review of the Element 2 Department for Transport funded drainage strategy development projects was carried out as well as an investigation into strategies adopted by utility service providers and highway authorities.
- 1.11 Two groups of authorities were consulted in some detail. Those authorities who focussed on flood risk as a driver for their projects formed one group:

INTRODUCTION

these were Oxfordshire County Council, Dorset County Council and three authorities working together: Swindon Borough Council, Wiltshire Council, and Gloucestershire County Council. The second group focussed on drainage asset management efficiencies: these were Warwickshire County Council, Nottinghamshire County Council and the three city unitary authorities working together, Nottingham, Leicester, and Derby City Councils ("Three Cities Asset Management Plan").

- 1.12 Initial investigations were carried out through desk studies and consultation with stakeholders either by direct interview or by telephone. Stakeholder workshops were held in Loughborough and Swindon on the 3rd and 8th of November 2011 respectively. Those included in the discussions included the local authorities who had Department for Transport funded Element 2 projects, those that were independently engaged in developing asset management strategies for drainage, and organisations such as the Environment Agency, Highways Agency and water companies who are involved with similar systems.
- 1.13 The workshops enabled the delegates to share their experiences of asset surveys, compiling databases and the use of technology. It also gave the opportunity for the local highway authorities' representatives to say what they would want to see in the proposed new guidance. A list of contributors is included in Appendix A.

IMPLEMENTATION OF THE RECOMMENDATIONS

- 1.14 Guidance for local highway authorities in highways maintenance is provided in, *Well-maintained Highways*, the UK Roads Liaison Group (UKRLG) code of practice for highway maintenance management and the soon to be published *Guidance for Infrastructure Asset Management*. It is intended that the recommendations in this guidance be included in the next revision of these documents.
- 1.15 Implementation of the recommendations made in this guidance document will help local highway authorities realise more effective outcomes for highway users and should be read in conjunction with the information on [efficiency](#) and good practice held on the HMEP website.

COMPLEMENTARY WORK WITHIN HMEP

1.16 A number of projects are being delivered through the Highways Maintenance Efficiency Programme that are relevant to this review. These include:

Asset Management

1.17 This advice to the sector reflects the changing advice to practitioners with greater than ever emphasis on the need to realise cost savings. Packages comprise:

- A [simplified Asset Management tool to enhance planning around asset lifetime](#) for those authorities wishing to move to an asset management approach but who do not have the asset inventory information to adopt a more complicated approach.
- A [deterioration model for bituminous surfacing](#) to enhance planning around bituminous surfacing asset lifetime.
- A [report reviewing the Department for Transport funded 'Element 2' work relating to drainage assets](#), summarising consultations with a number of local highway authorities and outlining the next steps of the project.
- To provide an update to the [County Surveyors Society \(CSS\), now ADEPT, code of practice](#) and other asset management publications provided since 2005.
- [Training](#) on asset management practice.

Collaboration and Change

1.18 This advice is intended to realise savings through collaboration leading to [joint procurement activities](#) and to deliver improved services through greater sharing of resources.

Procurement Contracting and Standardisation

1.19 To help local highway authorities select the optimal procurement route for their authority. It is aimed at authorities with less than two years to run on their existing contracts.

Benchmarking and Performance

- 1.20 To establish a national 'network of networks' and enable a wider use of existing performance management arrangements to improve the quality and extent of service benchmarking.
- 1.21 A means of establishing a balanced relationship between costs, quality and customer satisfaction in highway maintenance service activities.

2 WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

OVERVIEW

- 2.1 The use of an asset management approach for highway drainage systems can contribute to meeting organisational goals in respect of efficiency gains, legislative compliance, and flood risk management.
- 2.2 Asset managers are able to understand and address highway drainage management issues in a proactive way and can develop sufficient asset knowledge to build and defend deliverable budgets.
- 2.3 Decisions based on asset management planning principles take wider organisational goals and practices into account and in so doing have a greater chance of successful delivery.

EFFICIENCY GAINS

- 2.4 One of the main themes that came out of the stakeholder workshop held in Swindon in 2012 was the difference between Efficiency and Effectiveness and the following example was offered to explain the concepts:

Efficiency versus Effectiveness

The efficiency of a gully cleaning operation can be measured by the number of gullies it takes a gang to clean in a day. The effectiveness of the work can be measured by how many of those gullies needed cleaning, and how much cleaner they were after the work. Both the efficiency and effectiveness will influence the overall cost effectiveness of the work.

Figure 1: Example illustrating efficiency and effectiveness

- 2.5 It is important that the distinction between efficiency and effectiveness is clearly understood and implemented in the asset management planning process.
- 2.6 A management approach that addresses specific points of service need, as opposed to a conventional top down approach that focuses on a route hierarchy (major down to minor), has the potential to focus constrained budgets to deliver the greatest benefit. This is illustrated by the following case study from Cornwall Council.

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

Case study: Cornwall Council

Outcomes based prioritisation of roads

In Cornwall it is often the case that minor roads can experience heavier traffic than major routes. Rather than using the traditional classification of road type (Motorway, A or B class) to prioritise maintenance, in common with many authorities, Cornwall Council makes use of a maintenance hierarchy, derived from the base hierarchy in *Well-maintained Highways*, which uses traffic type and loading to determine its priority routes for capital maintenance. In the case of drainage works this is further adapted by incorporating information derived from Strategic Flood Risk Assessments (SFRA) and locally identified “flooding hotspots” as a method of assessing risk based on the understanding of the outcomes from failure. In Cornwall this methodology underpins the determination of the gully inspection / cleansing programme and is a key input to the capital maintenance scheme prioritisation matrix outlined in Appendix B of this document.

- 2.7 This risk-based approach allows the local highway authority to focus limited resources towards the greatest need without having to resort to expensive survey and data storage techniques.

Recommendation 1

Effective use of limited budgets

Adopt highway drainage asset management strategies based on information held.

REDUCING FLOOD RISK

- 2.8 Flood risk management is an important driver for proactive investment and intervention.
- 2.9 Specific events such as the flooding of 2007 raised the public/political profile of flood prevention, particularly in areas worst affected. This led to a number of initiatives such as the recommendations from the [Pitt Review](#), which have

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

facilitated political support for measures that ordinarily would have been difficult for local highway authority managers to sell.

Case study: Gloucestershire County Council

Flood Levy

In 2007, Gloucestershire had its worst flooding in 60 years. Left with costs of £35 million and the threat of further floods, Gloucestershire County Council took a lead in securing better flood prevention and protection for the future. A public survey showed popular support for paying an additional levy for flood risk management in the council tax bill resulting in the application of a 1.1% levy that raised an additional £2.3 million fund for fighting flooding. The council used some of this money to carry out additional work towards raising additional funds until it had a total of over £6 million for flood risk management programmes.

- 2.10 Third party claims arising from flood damage raise the importance of accurate drainage asset information and is increasingly relied upon to defend against claims or litigation arising from flooding to third parties. Investigations are needed to address lack of maintenance or under designed assets, which can cause liability.

LEGISLATIVE REQUIREMENTS

- 2.11 Developments in legislation and regulatory governance have placed new responsibilities on local highway authorities necessitating the mobilisation of resources to fulfil a new function to assess, understand, and address areas of risk. Compliance with evolving obligations and delivery against new responsibilities such as the LLFA role has resulted in an expanded understanding of data sources, their usefulness to delivery and deployment of sufficient resources in support of acquiring useful asset knowledge. The most important of these are:

The Water Framework Directive (2000)

- 2.12 Adopted in 2000, the [Water Framework Directive](#) (WFD) established a framework for management of water resources throughout the European Union. It will be fully effective by 2015 and its key objectives are to prevent deterioration of, and to enhance and restore bodies of surface and ground water so they achieve good chemical and ecological status.

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

2.13 Roads are a source of diffuse pollution and highway runoff can affect these water bodies. There is a growing appreciation of how good practice in highways design, use of Sustainable Drainage Systems (SuDS), effective highways maintenance and efficient cleansing regimes can provide cost effective solutions for controlling the volume, rate and quality of highways runoff.

The Groundwater Directive (2006)

2.14 The [Groundwater Directive](#) was adopted in 2006. It establishes the criteria by which groundwater chemical status is assessed, explains how trends in groundwater can be identified and if these are downward how they can be reversed.

Case study: Highways Agency

Groundwater Objectives Response – Priority Soakaways

The Highways Agency researched and established a database of over 2000 soakaways and developed a risk assessment process (hazard ranking system - HRS) that identified risks to groundwater from routine runoff. Using this asset knowledge, the Highways Agency was able to generate a prioritised list of sites that need to be addressed and developed programmes for delivery. The guidance on assessment and associated tools are available upon request.

The Management of Flood Risks Directive (2007)

2.15 The [Management of Flood Risks Directive](#) was adopted in 2007 and established a framework for management of flood risks throughout the European Union. The Directive was translated into English and Welsh law through the Flood Risk Regulations 2009 (SI 2009 No 3042) and came into force in 2009.

2.16 Specific requirements are:

- Preliminary Flood Risk Assessments which will allow the identification of areas of potential significant risk,
- Maps showing impact and extent of possible future significant flood events, and

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

- Flood Risk Management Plans, identifying how significant flood risks are to be mitigated.

The Flood and Water Management Act (2010)

2.17 The [Flood and Water Management Act 2010](#) makes provision for sustainable drainage regulations that would require new developments and redevelopments in England and Wales to have drainage plans approved prior to construction of the drainage works.



Flooded road,
Image courtesy of Leicestershire County Council

2.18 Lead local flood authorities have the following responsibilities under Flood and Water Management Act 2010:

- **Co-ordination:** LLFAs are responsible for leading the coordination of the response to flood risk in their areas of activity. This will avoid delays or confused responsibilities. LLFAs may delegate flood or coastal erosion functions to other risk management authorities, such as local highway authorities. As each LLFA is responsible for the same area as the local highway authority, there will be the opportunity for close liaison between the relevant personnel within each local authority.
- **Local Partnerships:** The Act encourages effective partnerships between LLFAs and other relevant stakeholders. It requires relevant stakeholders, such as local highway authorities, to cooperate with each other in exercising authority under the Act and they can delegate to each other. It also empowers the Environment Agency or LLFAs to obtain information from others for their flood and coastal erosion risk management functions.
- **Flood risk management strategy:** LLFAs must develop, maintain, apply, and monitor a strategy for local flood risk management. In doing so, LLFAs will need to consider all measures consistent with a risk based approach. Asset management planning will assist LLFAs in adopting this approach through providing data on resilience, age maintenance and flooding events.
- **Duty to investigate and maintain a register:** To ensure greater co-ordination of information and avoid situations where bodies do not accept responsibility

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

LLFAs will investigate flooding incidents in their areas and publish the results of any investigation, and notify any relevant authorities. They will also maintain a register of structures or features that they consider could have a significant effect on flood risk in their area, at a minimum recording ownership and state of repair.

- **Works Powers:** The Act provides the LLFAs with powers to do work to manage flood risk from surface runoff and groundwater. Powers to do works on ordinary watercourses remain with either district or unitary authorities, or internal drainage boards. All works must be consistent with the local flood risk management strategy for the area.
- **Sustainable Drainage Systems (SuDS):** The Act provides for the establishment of a SuDS Approving Body (the “SAB”), which will be the LLFA. The SAB will have responsibility for the approval of proposed drainage systems in new developments and redevelopments. Local highways authorities will be responsible for maintaining SuDS in public roads, to the National Standards for sustainable drainage, which are also provided for in the Act. Implementation of the National Standards and SAB’s responsibilities under the Act are planned for 2014.

2.19 The following is a more general list of legislation applicable to drainage asset management for highways:

- Water Framework Directive (England and Wales) Regulations 2003 ([SI 2003 No 3242](#))
- The Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2003 ([SR 2003 No 544](#))
- The Water Environment (Controlled Activities) (Scotland) Regulations 2005 ([SI 2005 No 348](#))
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 ([SI 2011 No. 209](#))
- [The Water Environment and Water Services \(Scotland\) Act 2003](#)
- The Groundwater (England and Wales) Regulations 2009 ([SI 2009 No 2902](#))
- The Groundwater Regulations (Northern Ireland) 2009 ([Statutory Rule NI No 254](#))
- The Management of Health and Safety at Work Regulations 1999 ([SI 1999 No 3242](#))

WHY ADOPT ASSET MANAGEMENT PLANNING FOR HIGHWAY DRAINAGE?

- The Construction (Design and Management) Regulations 2007 ([SI 2007 No 320](#))

Case study: Leicester, Derby & Nottingham City Councils

Development of practice guidance incorporating new duties

Leicester, Derby and Nottingham City Councils have collaborated in the development of a practice guide for the management of highway assets. A primary driver for this guidance is the recognition that the roles and responsibilities of local highway authorities are expanding and evolving to accommodate changes in the operational 'landscape' brought about by developments in legislation and regulatory frameworks.

Part of the project was to assess and measure the impacts these changes would have and to develop procedures for meeting them. These procedures were then included in the practice guidance to help these authorities meet their responsibilities in an efficient and effective way.

Recommendation 2

Understanding evolving duties and responsibilities

New regulations bring new obligations. These evolving responsibilities will have an effect on budgets and operations. Understand and adapt to these changes.

3 CURRENT GOOD PRACTICE

OVERVIEW

- 3.1 This section reviews current good practice and is drawn from stakeholder interviews and a review of Element 2 Department for Transport funded authorities' approaches to implementing drainage asset management.
- 3.2 This section is restricted to providing information on systems and approaches that have been proven to deliver benefit.
- 3.3 It should be noted however, that these approaches are often unique to the situation for which they were developed and may not offer a best fit for all without adaptation or modification to suit local needs.

DATA COLLECTION, STORAGE AND USE

Collection

- 3.4 A linear approach may be adopted by local highway authorities where the baseline level of data is reasonably good. Surveys are programmed for specific areas of interest on an annual basis and as much data is collected for the area as possible. These areas may be prioritised through road refurbishment and maintenance activities and contribute to a centralised asset database.
- 3.5 Where the baseline is less well developed, data collection should radiate out from known flood hotspots or areas of concern for local highway authorities where the asset knowledge is quite poor or where flooding is a particular problem.
- 3.6 Drainage data is available from multiple sources. These can be from existing records or third party reporting of incidents. Approaches that are more active include low impact surveys that focus on collecting data on surface assets as part of their maintenance regime. The most detailed surveys using Close Circuit Television (CCTV) provide high quality comprehensive data.
- 3.7 The data collection process starts with a review of the existing state of data that is then consolidated into a baseline to inform further collection. It is important to identify gaps in knowledge and rank them according to importance. The process is illustrated in Figure 1 below.

CURRENT GOOD PRACTICE

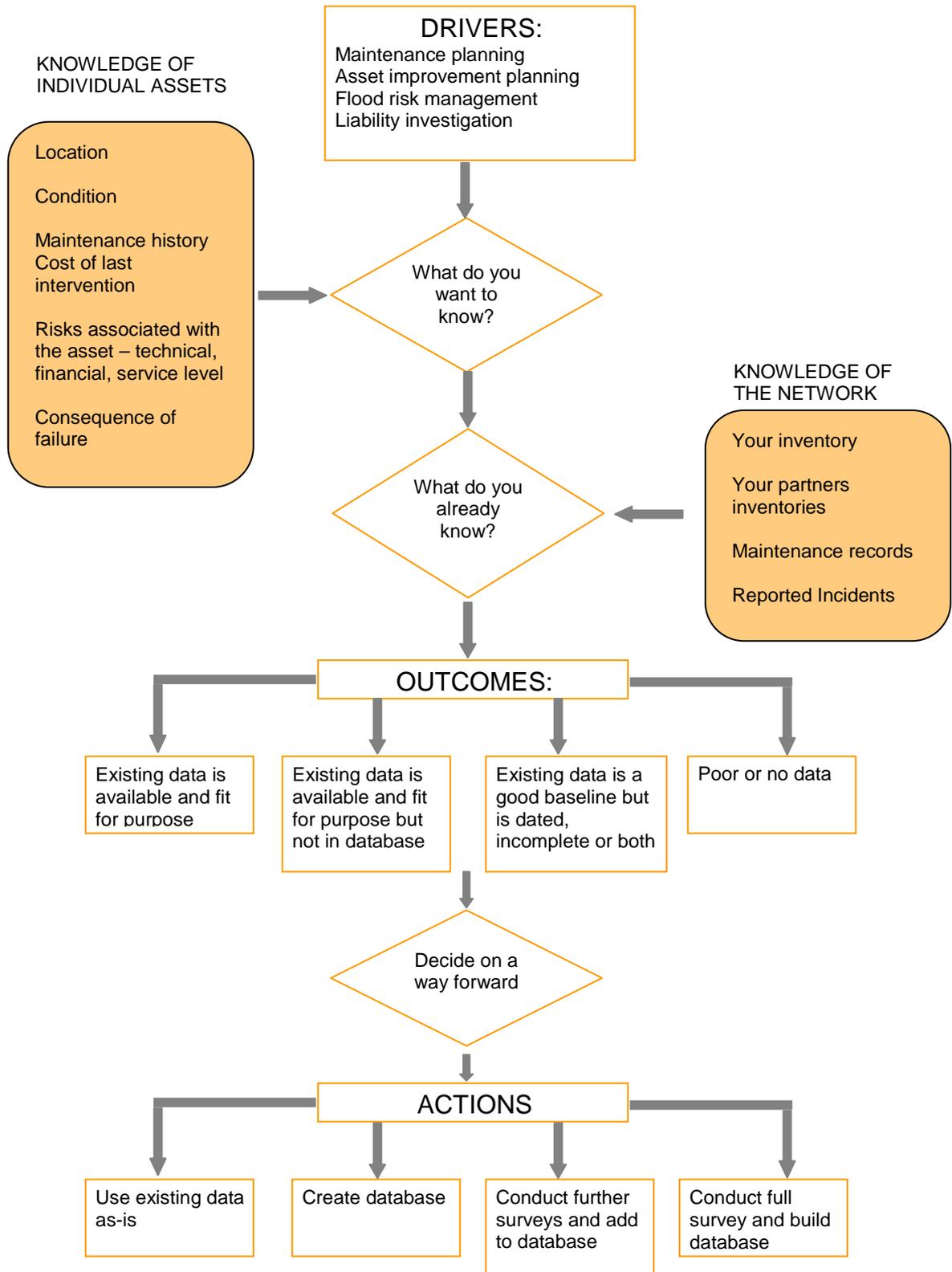


Figure 1: Data Collection process for all levels of complexity

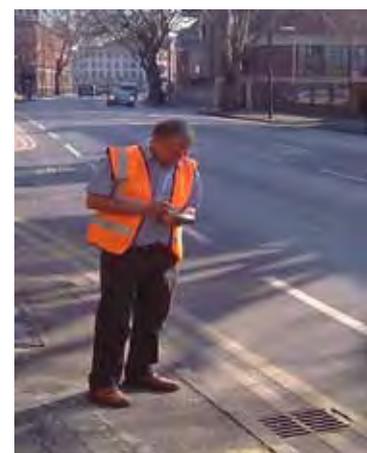
- 3.8 The issue of unknown assets may be addressed by supplementing data from other statutory undertakers' information and by reference to data held by other departments (e.g. planning office/ development control personnel) before embarking on costly fieldwork to collect data.
- 3.9 In many cases, subterranean asset data may be inferred from records of surface assets and the condition of these subsurface assets inferred from flood records. The Highways Agency uses 'Connectivity Surveys' to this effect.

Case study: Highways Agency

Connectivity Surveys

Connectivity surveys use surface observations to inform assessments of non-visible subsurface assets. The purpose of a connectivity survey is to obtain more confidence in the nature and configuration of the drainage asset inventory and to provide an indicative condition assessment for areas of little or no existing knowledge without costly and time-consuming CCTV methodologies currently employed. It supports operations, maintenance, pollution prevention, and flood control-driven decision making through rapidly identifying and locating drainage assets within a system, and gives an indication as to their general state/ fitness. It is quick, requires few resources, and is recommended for initial as-built verification or database population at suitable sites.

- 3.10 Methods of data collection in the field vary in complexity. Many local highway authorities use gully cleansing records supplemented by hand annotated drawings. Others use more advanced field Geographic Information Systems (GIS) systems for data collection or use a combination of approaches based on risk or engineering need. Many local highway authorities will want to establish or develop a competence in field survey of assets to supplement existing inventory or maintenance records. Care should be taken in the selection of equipment that needs to be thoroughly tested against service delivery needs. The following case study illustrates this.



Drainage data collection using field GIS. Image courtesy of Nottingham City Council

Case study: Nottingham City Council

Evaluation of Data Collection Devices

An initial review of field data collection needs led to Nottingham City Council splitting their requirements into:

- a) Small lightweight, but accurate Differential Global Positioning System (DGPS) hand-held devices for inventory data collection.
- b) Larger, more robust truck mounted Global Positioning System (GPS) tablet devices for asset maintenance updating.

This decision was based on inventory data collection requiring the (sub 1m) accuracy level possible from DGPS equipment whereas standard GPS as used in vehicle tracking systems was considered adequate for maintenance updating.

Suppliers of data collection equipment (handheld and tablet) were then approached for information and invited to demonstrate their devices. Supplier's equipment were then subjected to a month's trial, where the units tested were evaluated against:

- a) Compatibility with the Council's highway asset management system,
- b) Differential GPS capability to provide enhanced accuracy,
- c) Weight, ease of use and suitability to the task (e.g. long battery life),
- d) Cost effectiveness, and
- e) Level of on-going supplier support for their equipment.

CURRENT GOOD PRACTICE

Recommendation 3

Selection of survey equipment

Before selecting equipment, have a detailed equipment requirement specification and evaluation checklist to ensure that equipment being trialled is done in an objective and consistent manner. Allow sufficient time for the trial. Ensure mobile GPS software complies with the latest National Marine Electronics Association (NMEA) protocols.

Case study: Gloucestershire County Council

System integration

Like many other authorities Gloucestershire County Council opted for an asset management system that would depend on a smooth integration with the authority's existing information technology infrastructure and enabling support from diverse departments such as finance and IT. The asset management team conducted a thorough investigation into existing systems and the level of support offered by other departments and finance and selected a system that was compatible with existing systems and practices thereby ensuring organisational support for the project in the medium to long term.

Recommendation 4

Involvement of colleagues in selecting technology

Understand your authority's information technology procurement processes, purchasing documentation requirements and get the appropriate council staff (finance, IT GIS etc.) involved early on.

Recommendation 5

Data Integration

Link systems to maintenance activities, focus future activities and map 'hotspots'. Address the causes of problems as opposed to symptoms.

Storage and use

3.11 Data are stored and used by local highway authorities in the following hierarchy:

Essential data	Desirable data	Relevant third party data
Type of asset	Maintenance intervals	Water company and EA systems
Location of asset	Frequency of failure	Land drains
Condition of asset	Allocated risk factors	Unclassified flooding incident
	Maintenance requirements	Flood management forums
	Engineering specific data	

Table 1: Data storage hierarchy

3.12 Drainage databases should be integrated into existing asset management database systems where possible.

3.13 Ensure that data storage systems are designed to complement existing Information Technology infrastructure to avoid major delays in delivery and the consequent escalation of costs.

3.14 Data may be exported to GIS systems and while this is desirable, it is not fundamental to effective asset management. Many authorities use simple spreadsheet based gazetteers to store data.

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- 3.15 The focus should be on specific asset groups which may be ranked in terms of operational interest for maintenance; typically gullies and culverts rank highest with ditches next.
- 3.16 There is often little active focus on subterranean assets due to the costs involved in surveying them and because their location (and sometimes their presence) is unknown. However, data for these assets may be derived from major maintenance schemes on roads, for example involving reconstruction of the carriageway. This typically results in nodes of high-density data providing a great deal of system information surrounded by relatively low-density data providing little or no information.

Case study: Leicester City Council

Asset data used to address flood risk

In developing Leicester's Surface Water Management Plan (SWMP), pluvial modelling identified several areas of significant flood risk across the city. By using accurate gully location and sewer network data Leicester City Council has been able to model system performance under various flooding scenarios and demonstrate that a well-designed and adequately maintained highway drainage system can have a significant positive impact in reducing surface water flood risk.

Conversely if the system is poorly maintained or under capacity, Leicester City Council's model shows that it can increase this flood risk dramatically. An additional benefit from this has been to identify key components of the water company's sewer network (e.g. pumping stations) must operate satisfactory for the highway drainage system to remove the required surface water. Leicester City Council's staff are currently liaising with water company representatives to ensure that these key assets are highlighted in their records and maintained appropriately.

Recommendation 6

Data Use

Use highway drainage asset data to focus, support, and inform maintenance activities. These should be linked to the overall asset management objectives for local highways.

DATA RISK MANAGEMENT

- 3.17 The more complex the data, the greater the cost of collection, so a risk based prioritisation system is needed to select sites and the method of data collection to be employed at them.
- 3.18 Data is validated through field inspections and audits of contractors. The data to be collected is determined by database architecture with limitations placed on the type of data that may be entered onto data fields. Specifications for contracted work are carefully drafted providing specific deliverables and mechanisms for reporting. Data collection contractors are carefully vetted against past performance.

PARTNERSHIP AND DATA SHARING

- 3.19 Relationships with the Environment Agency, Internal Drainage Boards (IDBs), and water companies should focus on a common understanding of risks and responsibilities as well as asset knowledge sharing. Relationships can be variably productive especially with the water companies where commercial sensitivity can influence the degree of openness to data sharing and their willingness to undertake works; however, they are a good source of high quality data.
- 3.20 Other relationships with local bodies, such as interest groups and Parish Councils, are managed through flood management forums and act as useful points of contact for data collection and dissemination. These are more prevalent in rural areas where these forums allow for localism to be put into effect with stakeholders directly involved in decision-making, implementation, and remediation.
- 3.21 Partnership is advantageous to local highway authorities as it engages stakeholders at various stages within the decision making process, so that they can appreciate the challenges local highway authorities face. Effective engagement is key to developing local transport plans and an important opportunity for local highway authorities to manage expectations and agree priorities with stakeholders.



Forming an Alliance

Case study: Warwickshire County Council

Partnerships

Even before the severe floods of July 2007, Warwickshire County Council was in the process of developing a more structured, data led approach to highway drainage maintenance. The use of flooding and drainage information in supporting collaboration has helped the local highway authority assemble a number of local flood forums involving the District or Borough Councils, the Water Company and the Environment Agency.

Warwickshire County Council works in partnership with District Councils, Water Companies, the Environment Agency and Parish Councils to ensure that relevant information is shared to facilitate the successful co-ordination and delivery of joint projects.

Recommendation 7

Partnerships

Form partnerships with all relevant bodies, such as the Environment Agency and water companies to address water management issues and to cooperate in service delivery and information sharing.

3.22 There are three options for data sharing:

- **Open:** All data is available to stakeholders on a shared open forum. Stakeholders may apply for data to be added and may read off data, usually on a map based interface. This system may also make provision for automatic notifications to certain stakeholders (flood risk management teams or maintenance managers) of changes to the database (e.g. Nottingham City Council).
- **Closed:** Data is held centrally on closed databases that may or may not be map-based interfaces. Data requests are processed and

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disseminated to stakeholders by the authority's Asset Management (AM) team. Similarly, data that is collected by survey or maintenance teams is checked and 'uploaded' by the AM team.

- **Variably open:** Some stakeholders have direct access to data held by the local highway authorities. External stakeholders will have diminishing levels of access based on their assessed needs and in some cases their contribution to the database.

3.23 Irrespective of the approach chosen, data owners should ensure that relevant data is available to stakeholders to support and inform decision making that meaningfully contributes to effective highway drainage asset management.

Recommendation 8

Data Sharing

Drainage data must be transferable between owners and stakeholders who understand its value and make use of it.

ALTERNATE DATA MODELS

- 3.24 An alternate approach to the creation of a digital drainage asset database that models systems and their relationships is to adopt a service level approach.
- 3.25 This approach may be directed towards delivering route availability or to the reduction of risk (direct and indirect) resulting from underperformance of the system.
- 3.26 It is less reliant on drainage inventory data and emphasises route performance as a measure of success and as a driver for maintenance. While still dependent on data collection surveys these are directed only to address specific issues and need not require specialist technologies for the storage or interpretation of data.
- 3.27 The advantage of this approach is that it is not dependent on technology and the complexity or simplicity inherent to it may be calibrated to suit most budgets, resources and existing organisational strategies.

- 3.28 The disadvantage of this approach is that it is highly dependent on human capital and so is vulnerable to abrupt variations in quality if not carefully managed.

Case study: Cornwall Council

Risk based approach to highway drainage asset management

Cornwall Council have adopted a hierarchical, risk-based approach to managing its road drainage infrastructure based on projected demand by road users.

The approach is centred around two systems for the classification of routes and evaluation of service delivery schemes which offer a way of comparing and prioritising activities and budgets in the short term (seasonally) as well as offering a strategic overview for future planning purposes:

1. Route maintenance hierarchy

Routes are ranked by function irrespective of road type.

2. Scheme prioritisation matrix

The matrix is used on capital schemes that require new or increased drainage capacity. It is not intended for routine maintenance.

Once a potential scheme has been identified, it is scored against the following attributes:

- The maintenance hierarchy for the road on which the proposed scheme is located,
- The impact of poor drainage performance at the proposed location,
- A measure of the potential detrimental effect on structural integrity if left untreated,
- Traffic Speed, and
- Incidence of flooding.

A Worked example is shown in Appendix B.

DEMAND

- 3.29 A clear understanding of the demand on service delivery level is the starting point for drainage asset management. This will clarify and focus activities and budgets to deliver efficient and effective service.

Case study: Highways Agency

Understanding Demand: Objective Specification

The primary objectives of the drainage system are defined in [HD33/06](#) (DMRB 4.2):

- The speedy removal of surface water (from the carriageway) to provide safety and minimum nuisance;
- Provision of effective sub-surface drainage to maximise longevity of the pavement and its associated earthworks; and
- Minimisation of the impact of the runoff on the receiving environment.

Good drainage is therefore an important factor in ensuring that the required level of service and value for money are obtained.

- 3.30 Once a demand baseline has been established, an assessment of potential drivers for changes to this demand may be carried out.

- 3.31 Examples of potential demand drivers:

- Climate change,
- New legislation or regulations,
- Change in use of adjacent land , and
- Changes in road use as a result of development, population growth and economic change.

- 3.32 Of these, the potential effects of climate change may have the most significant impact on local highway authorities.

3.33 The key UK Climate Impacts Programme (UKCIP) general predictions for climate change in the UK are:

- Annual average temperatures will increase,
- Summers will become hotter and drier,
- Winters will become milder and wetter,
- Soils will become drier on average,
- Snowfall will decrease,
- Heavy and extreme rainfall will become more frequent, and
- There could be more extreme winds and storms.

3.34 These projected climate changes are set to have significant impacts on the construction and maintenance of highway drainage systems. Wetter winters and more frequent heavy rainfall events will result in more frequent incidences of flooding, particularly in low-lying areas and floodplains.



UK Summer Floods 2007,
Image courtesy of Leicestershire County Council

3.35 Changes to the growing season as a result of warmer year-round temperatures are likely to mean that plants will grow faster and for longer periods and increased vegetation may also pose problems for drainage through gully blockages and erosion. Table 2 below highlights the main climate change impacts on drainage asset management planning.

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Factor	Outcome	Impact on asset	Impact on asset management
Higher winter precipitation	More pluvial/fluvial flooding	Drainage capacity tested	More frequent maintenance. Unplanned capital works to enhance capacity
Lower summer precipitation	Lower receiving watercourse levels	Water quality - Drainage dilution levels a concern	Asset underperforms against environmental objectives requiring works to remedy
More extreme rainfall events	More pluvial/fluvial flooding	Drainage capacity tested	More frequent maintenance
Sea level rise	Higher frequency of extreme storm surges	Flooding and risk of erosion of coastal assets	Loss or damage to network, delays. Unplanned capital works to enhance capacity

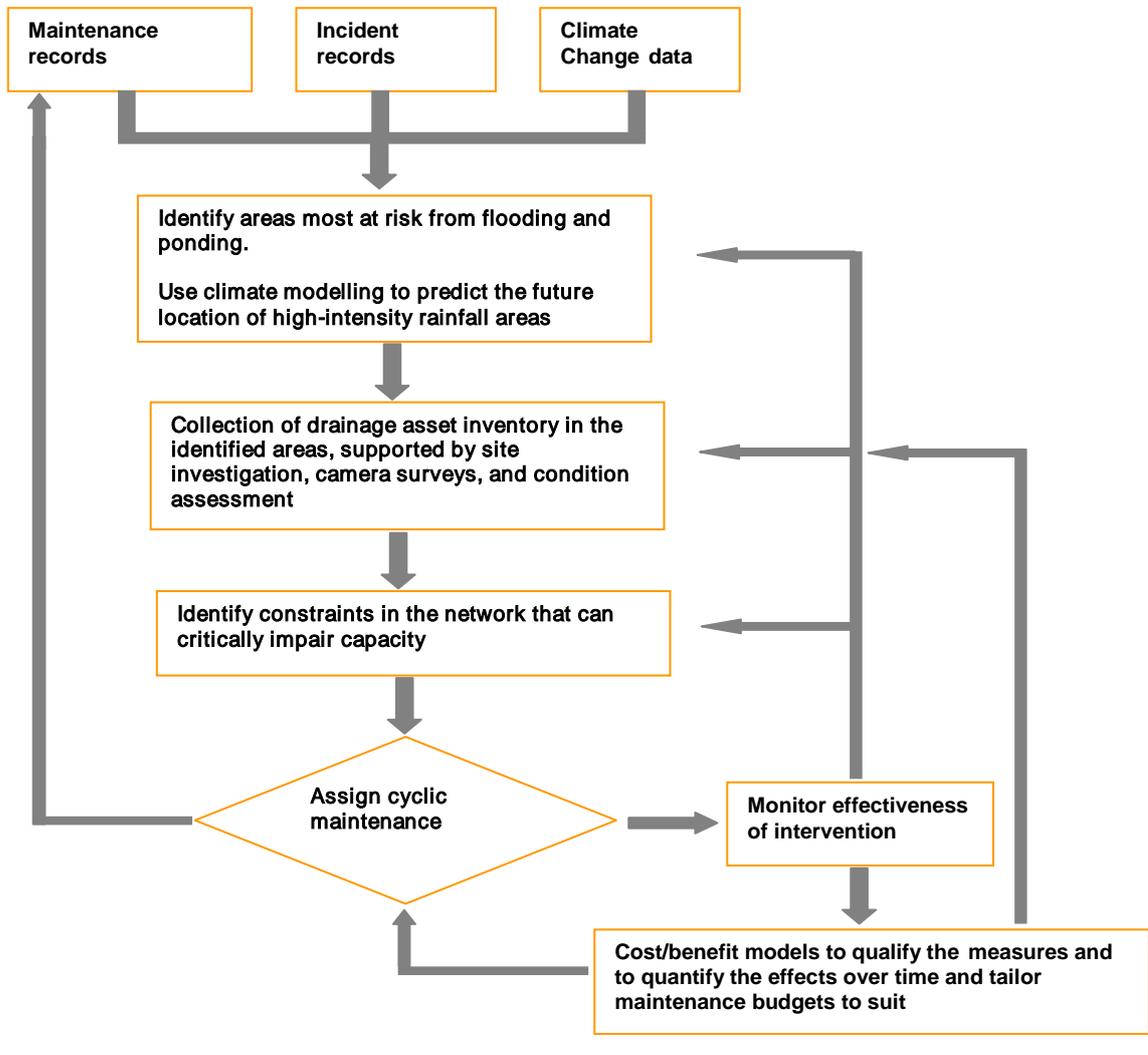
Table 2: Climate change effects on drainage asset management

Case study: Oxfordshire County Council

Understanding Climate Change

To help it understand and respond to climate change and the adverse weather events it can trigger, Oxfordshire County Council has entered into a partnership with the UK Climate Impacts Programme (UKCIP) to develop its response to climate change across the County Council's functions.

Along with maintenance and incident records, Oxfordshire County Council uses climate change response modelling as a component in its asset maintenance planning based on an understanding of risks. In this way maintenance contracts may be focussed to the greatest need as illustrated below.



Case study: Highways Agency

Service delivery and risk management: Flood Severity Index

The Highways Agency has determined that, despite several incidents of flooding resulting from pluvial or fluvial inundation temporarily overwhelming drainage systems, the majority of incidents arise from avoidable causes. Such causes may arise from deficiencies in maintenance, under designed assets or structural failure of the assets due to age and deterioration.

The Highways Agency assesses potential flood risk by applying a Flood Severity Index to determine the severity of the impact caused by a flood on a carriageway. In this way managers can form a picture of flood distribution along its road network, formulate an understanding of the consequences of specific flood risk scenarios, and determine where best to expend resources in investigating and alleviating that risk.

The index is the product of the scores of the following four parameters:

- A - Road classification and size;
- B - Average Annual Daily Traffic (AADT) for one carriageway;
- C - Impact on traffic; and
- D - Duration of impact.

$$\text{Flood Severity Index} = A \times B \times C \times D$$

In order to maintain a precautionary approach, areas of uncertainty are allocated a high score.

This method provides managers with a robust tool for understanding and responding to flood risk on the road network without the need to resort to costly data collection and analysis methods.

It is slightly disadvantaged in that it offers a reactive approach but this is offset by its suitability for application in areas of poor to non-existent asset knowledge.

A worked example is given in Appendix C.

Recommendation 9

Understanding demand and service delivery requirements

Develop a clear understanding of the demand or service delivery level for the drainage asset, as this will clarify and focus activities and budgets to deliver efficient and effective service.

RESOURCING

3.36 This section is produced using excerpts from the Urban Highway Drainage Asset Management: [Good Practice Guide](#) produced by the 3 Cities asset management project. It highlights the skills that a local highway authority requires in order to manage highway drainage infrastructure within the context of its duties as the lead local flood authority.

Inventory

3.37 Inventory data collection can be carried out using a combination of inspections and operational staff undertaking walked or vehicle based surveys. Staff should be trained to recognise where highway drainage might be located based upon the experience of more senior or longer service colleagues.

3.38 Locating highway drainage infrastructure requires that staff understand how highway drainage infrastructure works and its relationships/inter-connections with water company assets and or other receiving environments such as watercourses.

3.39 In particular staff need to be able to know where to look for and correctly distinguish highway drainage



Inventory survey, Image courtesy of URS

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assets (such as manhole covers, outfall structures etc.) from a water company or other utility's assets.

Case study: Highways Agency

Using peoples knowledge: Field surveys

During the development of its rapid survey approach the Highways Agency analysed the experience of its agents who trialled this procedure. This showed that when the senior member of the survey or inspection team had experience of drainage maintenance and survey operations specific to the location under investigation, surveys were planned and executed in a much more efficient way.

The impact of operator experience was deemed so significant that the specification and methodology for Connectivity Surveys requires that at least one operator be an experienced member of the local operations team.

Recommendation 10

Use peoples knowledge

In many cases the organisation's employees are the best source of asset management information. Ensure local knowledge of drainage assets held by long service experienced staff is captured and incorporated into data records.

Gully Cleansing – Routine/Cyclic

3.40 In order to operate an effective gully cleansing operation it is important that the operators are suitably trained. The operators need to not only be able to operate the gully cleansing machine but to also be able to record the reasons why a gully is blocked and to correctly identify any further action is required.

Gully Cleansing – Reactive

3.41 Operatives carrying out reactive gully cleansing need to record the same information as for cyclic cleansing. These records are required to enable

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cross checking to ascertain if the problem should have been addressed from routine cleansing.

- 3.42 Appropriate supervision and quality control of these operations is essential as significant wasted effort can be generated if reactive cleansing amounts to rectifying a poorly controlled routine cleansing regime.

Recommendation 11

Resourcing

Allocate resources and funds to routes, sections, or specific assets where most needed. Monitor the maintenance of these assets and require contractors to provide details of the condition of assets; for example, gully cleansing records that detail the location of the asset and amount of material removed.

Identification of flooding hot-spots

- 3.43 A range of records will exist from which hot-spots can be identified. This will typically require the combination of records and data from various sources including public complaints, maintenance records, and flood risk maps. Skills are required in data manipulation and analysis and the detailed use of software such as spread-sheets, databases and GIS.

Investigation of flooding hot-spots

- 3.44 The on-site investigation of hot-spots requires a practical understanding of how highway drainage infrastructure works together with an interest in why problems exist at each location.

Delivering Solutions: Project Level

- 3.45 Deriving potential solutions to address drainage hot-spots/problems can be varied. These can range from improvements to basic maintenance practices to the design of drainage schemes. It is therefore important that the local highway authority staff developing potential solutions are capable of:
- Distinguishing between maintenance or renewal type solutions,
 - Commissioning the relevant surveys and investigations,

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- Understanding basic highway drainage design,
- Estimating the costs of remedial actions,
- Understanding the impacts and costs of not doing anything,
- Undertaking option appraisals, economic evaluations and benefit/cost analysis, and
- Undertaking design capacity calculations and or commission these.

Delivering Solutions: Network Level

3.46 There is a need to examine potential solutions on a network level as well as a project level.

3.47 This means having the ability to develop a strategic overview and to integrate this knowledge into information that supports asset management planning. The skills required to do this are:

- Ability to use GIS and to analyse and plot data,
- Analytical skills to interpret the results,
- Database skills to analyse data sets, and
- The ability to report findings and recommendations.

Recommendation 12

Solutions

Do not let the management tool become more important than the job deliverables and recommend simple solutions that do not require a great deal of maintenance or administration.

Network Modelling

3.48 In order to manage highway drainage infrastructure within the context of the lead local flood authority role, network modelling of flood risks services are required. For many local highway authorities these services will be procured as part of development of surface water management plans which typically include outputs of flood risk mapping.

- 3.49 It is likely that as knowledge develops of flood events and records of highway drainage management improve, there may be a need to revisit this mapping and to potentially examine new scenarios. It is important therefore that local highway authorities have the capability to carry out such technically specialist work.

ESSENTIAL TOOLS AND TECHNIQUES

- 3.50 This section provides an overview of good practice as identified by Stakeholders at the workshops held in Swindon and Loughborough and also offers examples of systematic approaches adopted internationally and by the Highways Agency.
- 3.51 A summary of the workshop outcomes is included in Appendix D of this report.
- 3.52 Local highway authorities should concentrate on developing a data driven approach to drainage asset management. Where this is in response to an external pressure/stimulus e.g. flood risk management, it will provide greater awareness of the relationship between owned and third party systems and may be used to support and inform partnerships with external bodies.
- 3.53 Assets should be grouped by type with common terms formalised around a common frame of reference e.g. gazetteer, database or GIS. It is important to note that asset data may be stored in simple schedules or databases; the important thing is that they are easy to understand and use.
- 3.54 Formal (field survey of assets) and informal (as built drawings or historic maintenance records) processes for collecting and communicating data should be developed in order to ensure the data collected offers as complete a picture of the asset as possible.



Gully maintenance, Image courtesy of URS

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- 3.55 Any new system or process should be carefully considered against current organisational practice. Systems should be simple to apply and not require extensive reworking of procedures or tools.
- 3.56 Rolling maintenance plans should be developed that focus on seasonal maintenance of surface assets in areas of the greatest sensitivity. In doing this costs become more predictable and service delivery may be monitored against requirements.

EMERGING TOOLS AND TECHNIQUES

- 3.57 The focus is mostly data driven with a smaller reactive component and the main motivator is the efficient deployment of budgets and resources to deliver greatest gains.
- 3.58 Partnerships with external stakeholders should be developed, as these will facilitate a focussed approach and successful delivery. These partnerships should be based on clearly defined and agreed roles and responsibilities and should also allow for delegation, by agreement, of certain duties between partners.
- 3.59 Databases should be formalised and integrated into organisational systems and culture. Drainage data is collected from multiple sources such as schemes or fieldwork (survey or maintenance) and disseminated throughout the organisation by “user demand” via a common access point e.g. an intranet or web based application.
- 3.60 Map based systems that show the organisations’ own assets as well as those of its partners are useful (though not essential) for effective data sharing and coordination of activities.
- 3.61 Proactive and prioritised programmes are developed using asset condition data with clear procedures for implementation and audited for compliance. Results from these programmes should be reviewed over the medium to long term to benchmark their efficacy to support future budgeting activities.
- 3.62 Using a data led approach supported by formal management structures a “Future Picture” of risks and opportunities may be developed and used to support decision making.

ADVANCED TOOLS AND TECHNIQUES

- 3.63 The goal is a mature system that provides a framework to detail and examine management practices for drainage infrastructure and forms the basis of an improvement / replacement programme to progressively meet identified deficiencies.
- 3.64 Maintenance is no longer the sole concern of asset management and is dealt with as a single component of an overall strategy.
- 3.65 Data is collected at all stages of the asset lifecycle commencing with design through maintenance to decommissioning and used to improve existing knowledge. High data density facilitates informed planning against future necessity.
- 3.66 Databases should be comprehensive but simple to maintain through the provision of clear procedures and training. Databases should be regularly audited and improved where necessary.
- 3.67 Present and future demands are clearly understood and action is coordinated with wider non-drainage maintenance activities where possible.
- 3.68 Asset lifecycles are well understood, facilitating efficiencies through streamlined delivery of service levels.
- 3.69 Resources and budgets are closely aligned to current activities and future needs are anticipated well in advance.

HIGHWAYS AGENCY PRACTICE

Case study: Highways Agency

Drainage Asset Management Practice

Prior to 2011 the Highways Agency used 17 bespoke systems to manage various asset families on a functional basis with little or no integration between systems. The Highways Agency therefore decided to develop an Integrated Asset Management Information System.

The application used for drainage asset management is the Highways Agency Drainage Data Management System (HADDMS) which is a GIS based platform that offers a spatially located asset inventory with service and condition grades for all assets. As built drawings and asset survey reports including CCTV data are also stored.

The system also acts as a repository for the following Highways Agency's drainage asset management tools or assessment types:

- Flooding hotspots – an assessment of flood prone sections of the motorways network used for contingency planning and network availability management;
- Priority asset registers for Soakaways, Culverts and Outfalls that record the risk to the water environment (either pollution or flooding) posed by the asset and provide methodologies for assessment of asset risk; and
- Highways Agency Water Risk Assessment Tool (HAWRAT) - a practical assessment tool to understand potential runoff quality and its impact on the Water Framework Directive status of receiving water bodies.

Data stored on HADDMS is sourced from digitised and georeferenced drawings, field survey (CCTV and connectivity surveys) and maintenance records.

The system is hosted externally to the Highways Agency and is accessed via the internet. Access and editing privileges are carefully vetted and restricted to Highways Agency personnel, Area Managing Agents and nominated users. Users are required to access the system regularly in order to retain usage.

EXAMPLE OF INTERNATIONAL PRACTICE

Case study: Australia

Drainage Asset Management Plans (DAMPS)

Drainage asset management in Australia closely resembles practice in the UK and many features will be recognisable to local highway authorities. The Australian systems are more mature however and there is extensive experience in the successful delivery of formal asset management interventions that specifically focus on highway drainage systems. Systems have been developed using the process illustrated below in Figure 2.

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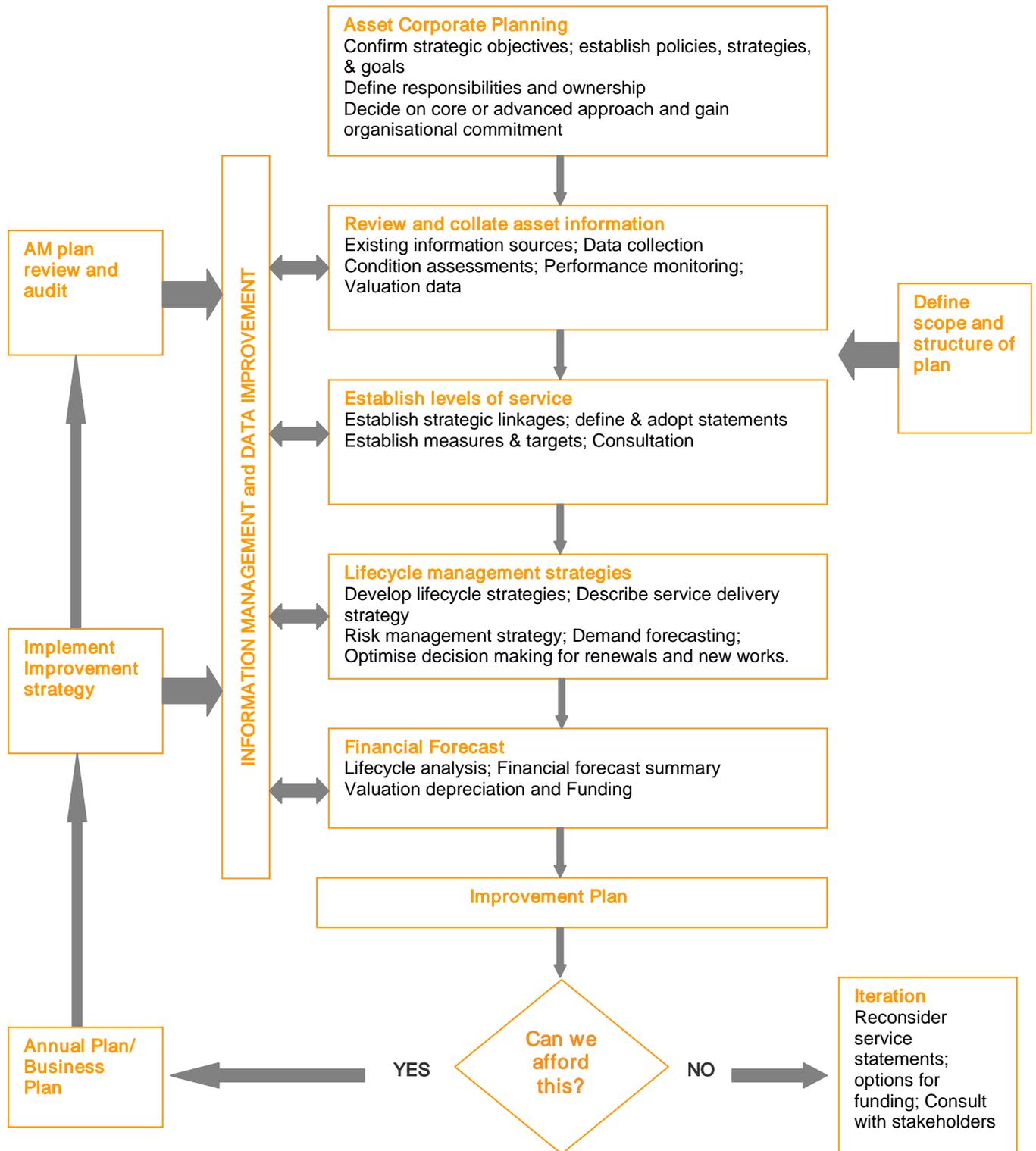


Figure 2 Roadmap for developing an asset management plan.

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Front cover courtesy of FM Conway & Matt Chisnall, Architectural Photography

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Hertfordshire Highways	Chris Allen-Smith
Highway Term Maintenance Association	Dennis Parkinson
Leicestershire County Council	Peter Hosking
Westminster Council	David Yeoell
Staffordshire County Council	Paul Boss
Transport For London	Gary Sterritt

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GLOSSARY

AADT	Average Annual Daily Traffic
ADEPT	Association of Environment, Economy Planning & Transport
AM	Asset Management
CCTV	Closed-Circuit Television
CSS	County Surveyors Society
DAMPS	Drainage Asset Management Plans
DfT	Department for Transport
DGPS	Differential Global Positioning System
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
FRM	Flood Risk Management
GIS	Geographic Information System
GPS	Global Positioning System
HA	Highways Agency
HADDMS	Highways Agency Drainage Data Management System
HAPMS	Highways Agency Pavement Management System
HMEP	Highways Maintenance Efficiency Programme
HRS	Hazard Ranking System
IAN	Interim Advice Note
IDB	Internal Drainage Board
LA	Local Authority
LHA	Local Highway Authority
LLFA	Lead Local Flood Authority
NMEA	National Marine Electronics Association
SAB	SuDS Approval Body

GLOSSARY

SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
SI	Statutory Instrument
UKCIP	United Kingdom Climate Impacts Programme
UKRLG	UK Roads Liaison Group
WFD	Water Framework Directive

APPENDIX A – CONTRIBUTORS AND CONSULTEES

Cambridgeshire County Council
Construction Industry Research and Information Association
Cornwall Council
Derby City Council
Dorset County Council
Durham Council
Environment Agency
Gloucestershire County Council
Hertfordshire County Council
Highways Agency
Leeds City Council
Leicester City Council
Leicestershire County Council
London Technical Advice Group
Newcastle City Council
Nottingham City Council
Nottinghamshire County Council
Oxfordshire County Council
Swindon Borough Council
Warwickshire County Council
Wessex Water
Wiltshire Council

APPENDIX B – SCHEME PRIORITISATION MATRIX EXAMPLE (CORNWALL COUNCIL)

Route Maintenance Hierarchy for Cornwall Council

Function	Type	Principal Route (A Road)	Secondary Route (B Road)	Local Distributor (C Road)	District Council (D)	Footways (F) - remote from carriageway	TOTAL (Km)
2a Strategic Routes		221.9					221.9
2b Principal A Roads		340.9					340.9
3a Main Distributor			481.7	222.5			721.2
3b Secondary Distributor			103.1	661.3			872.7
4a Local Roads				558.0	0.3		685.1
4b Local Access Roads				874.5		0.5	2576.2
5a Minor Access roads				316.9			1375.9
5b Lanes				8.6			355.7
6a Tracks				1.8			113.5
6b Abandoned tracks							7.6

Scheme prioritisation matrix: Hayle Causeway, Cornwall Council

Maintenance hierarchy (15% weighting):

Hierarchy	2a/2b	3a/3b	4a/4b	5a/5b
Score	100	75	25	10

Hierarchy score = 11.25

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Safety (35% weighting):

Safety Classification	Accident history attributable to standing or running water on the carriageway	Standing or running water likely to cause an accident	Other minor safety issues	No safety issues
Score	100	75	25	0

Safety score = 26.25

Incidence of flooding (25% weighting):

Description	Frequent occurrence affecting more than one property	Frequent occurrence affecting a single property	Occasional occurrence affecting multiple properties	Occasional occurrence affecting a single property	No flooding to property
Score	100	90	60	50	0

Flooding score = 0

Structural effects (10% weighting):

Description	Major	Minor	No structural effect
Score	100	50	0

Structural effects score = 5

Traffic Speed (15% weighting):

Speed Band	50+	30-50	Less than 30
Score	100	50	0

Traffic speed score = 15

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Result:

Scheme score: $11.25+26.25+0+5+15 = \underline{57.5}$

Additional consideration could be given to maintainability issues and the potential of a scheme to eliminate costly maintenance to the existing drainage system

The scheme is then ranked alongside others, which have undergone a similar scoring exercise and those that score the highest become eligible for funding in the planned financial period. Those not immediately eligible are rolled forward to the next period but may be superseded by higher scoring schemes.

APPENDIX C – FLOOD SEVERITY INDEX (HIGHWAYS AGENCY)

Event description

Road Type	All purpose dual carriageway
AADT	20, 000
Flood effect	Closure of 1 lane
Duration	30 minutes

Index calculation

Parameter A - Road classification and size:

Class of road	Motorway	All purpose trunk road dual carriageway 3 lanes or more	All purpose trunk road dual carriageway 2 lanes	All purpose trunk road single carriageway
Score	1.0	0.9	0.8	0.7

Parameter B - Average Annual Daily Traffic count (AADT) for one carriageway:

AADT	More than 25,000	15,000 – 25,000	Less than 15,000	Unknown
Score	1.0	0.8	0.6	0.8

Parameter C - Impact on traffic:

Impact	Total closure	At least 1 lane closed	Hard shoulder closed	Congestion only	No impact	Unknown
Score	1.0	0.9	0.6	0.7	0.0	0.8

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Parameter D – Duration of impact:

Impact	More than 2 hours	Between 1 & 2 hours	15 minutes to 1 hour	Less than 15 minutes	Unknown
Score	1.0	0.9	0.8	0	0.8

Flood severity index for event is:

$0.8 \times 0.8 \times 0.9 \times 0.8 \times 10 = 4.6$ – rounded up to **5**

In order to maintain a precautionary approach, areas of uncertainty are allocated a high score.

Events may then be aggregated to determine the existence of a flooding hotspot that describes the vulnerability of a section of road to flooding.

APPENDIX D – GOOD PRACTICE IDENTIFIED BY STAKEHOLDERS

During the review of the Department for Transport Element 2 funded projects and consultations with stakeholders, a number of examples of good practice have become known that are summarised in the tables below.

This is not an exhaustive list; examples have been included based on their suitability to wider adoption and cover a number of topics under the categories of management approach and resourcing:

Category: Asset Management Approach

Element	Item	Description
Collaboration	Procurement and management	Several local highway authorities have collaborated in developing and delivering systems which has led to a smaller individual cost to each authority.
Focus	Risk based data collection	Programmes have been developed to radiate out from areas of known risk of flooding or system failure.
Focus	Wider risks	Awareness of wider risks such as asset theft and an understanding of the effects of these on the system priorities and asset management scope.
Standards and quality	HD43 (and IAN 147)	DMRB Standard for drainage asset recording. Provides a good framework for ensuring coverage.
Standards and quality	Transferability	Ensure data collected by partners is on a common format to ease sharing between stakeholders.
Collection	Sources	Asset data may be available from multiple sources not immediately associated with drainage. For example Building control, flood risk management, or environmental departments. Asset managers investigate all possible sources to piece together as dense a picture as possible.
Collection	Appropriate type	The method of data collection is determined by the quality and quantity of information required. CCTV

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Element	Item	Description
		should be used as a last resort
Collection	Tracked gulley cleansing	This is a good source of spatial data however gulley cleansing in difficult areas is infrequent and leads to knowledge gaps.
Systems	Integration	Conduct thorough review of existing IT systems to ensure any new systems are compatible.
Systems	Evolution	In many cases there are existing systems in use. Review these first to establish their continued usefulness and adapt if necessary. "Build on what you know".
Storage	Simple or complex	Many local highway authorities advocate the use of GIS based systems for recording and sharing data. While these are very good they are very expensive to develop and not essential. Simple tabular systems are a good point of departure; they cost little, require few specialist skills and can be incorporated into more complex systems at a later date.

Table 3: Good management practice identified by local highway authority practitioners

Category: Resourcing

Element	Item	Description
People	Information retention	Ensure local knowledge held by long service 'gurus' is captured and incorporated into data records.
Funding	Long term planning	5-10 year investment plans required to offset political pressures constantly reprioritising issues.
Funding	Defensible budgets	Asset knowledge provides a firm footing for preparing and defending budgets for maintenance and improvement.
People	Roles	Clear role definition and lines of communication.

Table 4: Good resourcing practice identified by UK local highway authority practitioners