Overview

In March 2014 Mark Worsfold, Chief Engineer at Ofwat, was asked by Infrastructure UK to carry out an independent peer review of the maintenance of the Environment Agency’s flood and coastal risk management (FCRM) assets.

The review has found that many aspects of the Environment Agency’s FCRM asset management delivery are leading edge, particularly the NAFRA risk assessment which focuses on understanding levels of protection and the impact of flooding.

The investment decisions and management of the flood defence assets on a day to day basis is primarily driven by asset condition which is an effective lag measure but does not improve knowledge, understanding or the ability to forecast service and expenditure requirements.

The review has identified a number of key areas around asset data and processes where improvements could be delivered.

In particular this has highlighted the need to improve investment planning processes and capabilities for modelling and predicting operating and capital costs. Such costs should be examined on the basis of lowest whole life cost and should start to be considered on a total expenditure basis (whilst recognising that operating cost and capital costs may be both defined and incentivised differently).

The report has identified thirty-three observations as part of the detailed benchmarking between the Environment Agency (See Appendix A) and the water sector. The observations are summarised in section 3 of this report and tabulated in Appendix D.

In order to respond to these observations, eleven key recommendations have been made which link directly to the thirty three observations. These are summarised and detailed in section 4 and tabulated in Appendix C. The recommendations have been set out to be part of a wider change programme to deliver a “2020 vision” for FCRM and to provide the Environment Agency with the recommendations that could lead to the same capabilities and efficiencies that have been achieved in asset management in the water sector.

The review would like to thank the Environment Agency and its staff for their cooperation and the open and constructive manner in which they have approached the review at a time when recovery from the flooding events of winter 2013-14 were challenging.
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Executive summary

This independent peer review was established to assess whether the Environment Agency can make improvements to its performance and achieve efficiencies in delivering its maintenance and investment programme in flood and coastal risk management (FCRM) assets. The Environment Agency directly manages about £20 billion of these assets and has oversight of a further £15 billion that are managed by others.

The review’s main conclusion was that many aspect of the Environment Agency’s asset management delivery are leading edge. But the management of flood defence assets is primarily driven by asset condition, which does not help the Environment Agency forecast service and expenditure requirements. The review also identified a number of areas where the Environment Agency could deliver improvements to its asset data and processes.

Background to the review

The review was commissioned following the flooding of winter 2013-14 by:

- HM Treasury;
- the Department for Environment, Food and Rural Affairs (Defra); and
- Infrastructure UK.

The review compared the Environment Agency’s asset management practices, policies and procedures with those of the water sector in England and Wales. Over the last 25 years this sector has delivered £121 billion of investment to successfully deliver service improvements in drinking water and the environment. It has also achieved significant improvements in efficiency. There are important differences between the water sector and FCRM; most obviously that the Environment Agency’s funding comes from the general taxpayer rather than the beneficiaries of its services (billpayers). This leads to both different incentives and to a different ‘customer’ relationship with the beneficiaries of the service.

The review was carried out between March and September 2014 by Mark Worsfold, Chief Engineer at Ofwat – the economic regulator of the water sector in England and Wales. Both Ofwat and the Environment Agency are members of Infrastructure UK’s client working group. This group involves client organisations from many industries who collaborate to identify improvements in management practices and efficiencies.
The review’s preliminary observations and recommendations were presented in April 2014 to a steering committee that included HM Treasury, Defra, Infrastructure UK and the Environment Agency.

Key recommendations

Improve customer legitimacy and deliver an outcomes focus

The expectations of communities impacted by flooding and the role and obligations of the Environment Agency do not appear to be in alignment. Defra and the Environment Agency should consider customer legitimacy in the management of FCRM assets. They should consider the tools applied within the water sector and how these can best be used.

Improve customer legitimacy within programme prioritisation

Defra and the Environment Agency should consider the extent to which public consultation should influence the prioritisation of investment. This should include potentially using customer preference approaches that are adapted for activities funded by government.

Improve governance and accountability

The Environment Agency should be clearer about the ownership and accountability of the FCRM investment programme.

The review supports the Environment Agency’s desire to seek accreditation for the processes and procedures within the FCRM programme. This could help improve governance and ensure processes are robust and maintained.

Improve asset management datasets

The Environment Agency should significantly improve the quantity and quality of its asset management data and information. It should do this through:

- targeted improvement programmes
- new systems and processes
- reviewing the effectiveness of existing systems; and
- determining how well existing systems support the asset management processes.

The review recognises the improvements the Environment Agency has already made in improving its datasets. It also supports their continued development.
Develop asset analytical and modelling capability

The Environment Agency should develop a centralised analytical and modelling capability to:

- improve its knowledge about its assets;
- support a move to a more asset focussed approach; and
- drive efficiencies in the way it targets assets for investment.

The Environment Agency is already undergoing significant changes, which will support this recommendation.

Develop risk-based programme optimisation capability

The Environment Agency should develop dedicated systems and resources capable of:

- supporting economic and efficient asset interventions; and
- forecasting future requirements.

The Environment Agency should develop annual, three-yearly, six-yearly and long-term plans. There should also be a clear link between them.

Optimise on the basis of whole life costs and benefits

The Environment Agency should use asset whole life costs and benefits to optimise its FCRM programme. This should inform budget setting and programme planning.

Develop contractual partnerships

The Environment Agency should consider the role that long term contractual partners can have in delivering the FCRM programme. In the water sector contractual partners have been key players in delivering dynamic and innovative investment programmes.

The Environment Agency should consider how partners can work alongside its own staff and how these resources can be deployed together in emergencies. Increased long term planning and funding will support long term partnerships and the delivery of efficiencies.
Improve procedures and processes for capital delivery associated with partnership funding

Partnership funding delivers benefits to the overall FCRM programme. Defra and the Environment Agency should improve the process and procedures in delivering investment funded by partnerships. The primary aim of this should be to:

• reduce perceived bottlenecks in delivering the FCRM programme; and
• establish how partnership funding could be balanced with programme contingency in order to maintain a pipeline of efficient delivery.

Improve conveyance processes

The Environment Agency should improve the conveyance procedures and processes associated with managing rivers and watercourses. This should:

• develop a better understanding of the data, costs and benefits of dredging and watercourse management; and
• establish a clear process and risk-based whole life cost for these activities.

The Environment Agency should carry out further public engagement to establish this process as an appropriate tool to use on the FCRM programme.

Clarify the role on third party assets

Defra and the Environment Agency should review the Environment Agency’s role in relation to assets owned by others (‘third parties’). They should clarify the responsibilities, processes and procedures around third party assets particularly where the assets support communities at high risk of flooding. Investment in third party assets to reduce flood risk in the high risk communities may be more cost beneficial than investment in Environment Agency assets in other areas.

A programme of change for FCRM

The Environment Agency and Defra should consider the delivery of the key recommendations in this report as part of a wider change programme to deliver a ‘2020 vision’ for FCRM. This would require separate funding above that already in place. The review estimates that the costs of delivering a change programme would be about £20 million. But the programme could deliver significant benefits. This includes 12-17% of efficiencies over a five year period across both revenue and capital spending.
The conclusions of this maintenance review should be considered alongside the high level funding and asset condition information to understand where improved asset information, planning and business processes could be utilised to ensure that a broader spectrum of serviceability metrics is in place and that these are being closely tracked and managed within the FCRM programme so that significant changes in condition are mitigated in the future.

Whilst neither the Environment Agency nor Defra consider that additional funding is currently required beyond that set out in 2014-15; given the observations and recommendations above, the reviewer considers that it would be difficult for the Environment Agency to provide an evidenced based justification for an increase in funding above 2014-15 levels. Conversely it is considered that levels of investment should not be lowered below 2014-15 levels due to potential risks around uncertainty and climate change.

The programme of improvements and key recommendations contained in the review are essential to improve both efficiencies and confidence in the targeting and benefits of the FCRM programme. Once delivered, forward forecasts from the programme should be evidence based, economic and efficient and should effectively inform the scale of future investment need and benefits.
1. Background

The review

1.1 The last 10 years has seen an increased awareness of the risk of flooding in England, and a developing debate about how to deal with this in the long term. Major national scale flooding in 2007, 2012 and the winter of 2013-14 has kept the issue in the public eye, while scientific assessments of risk have become more accurate and now identify about five million properties at risk of flooding either from rivers, the sea, or surface water.

1.2 During that time the Government, its advisers, the Environment Agency, and other Risk Management Authorities have reviewed and developed policy, strategy and plans for managing flood risk and coastal erosion; clarified organisational responsibilities, and learned important lessons from successive periods of flooding.

1.3 DEFRA, HM Treasury, Infrastructure UK and the Environment Agency are seeking an understanding of whether there are performance improvements and further efficiencies that can be delivered within the flood risk investment programme and the extent to which these can be underpinned by optimised asset management. This review of the Environment Agency maintenance processes was instigated in March 2014.

1.4 The review comprises a peer review of the asset management functions of the Environment Agency with regard to Flood and Coastal Risk Management (FCRM) assets.

1.5 The objectives of the review are;

a) to assess and quantify the asset management capability of the Environment Agency and assess to what extent the existing Environment Agency data and processes accurately predict the investment needs.

b) to examine and consider the degree of confidence and uncertainty associated with the investment needs.

c) to examine options to improve confidence and reduce uncertainty.

d) to develop short, medium and long term actions to improve the asset management capability of the Environment Agency.
1.6 To support this, an independent reviewer was sought from within the water sector from the membership of the Infrastructure UK client working group which involves client organisations from many industries who collaborate to identify improvements in management practices and efficiencies. The review was undertaken by Mark Worsfold, Chief Engineer at Ofwat. Both Ofwat and the Environment Agency are members of the IUK client working group.

The FCRM programme

1.7 The Environment Agency manages around £20 billion of flood and coastal risk management assets. They also have an oversight role on a further £15 billion of assets managed by others. They carry out a range of maintenance activities to ensure these assets continue to reduce the risk of flooding to people and property. This includes asset operation, preventative maintenance to reduce deterioration and works to manage channel conveyance.

1.8 Maintenance is important as it safeguards the ability of assets to protect people, property and the environment. It also ensures the operational readiness of assets to respond during flood incidents and if it is carried out in a timely manner it can extend the life of an asset. With the increasing pressure on the Environment Agency’s maintenance budget they have to demonstrate the benefit and value of their maintenance activities.

1.9 The Environment Agency have undertaken a detailed review of flood and coastal risk management maintenance investment to better understand the costs and benefits of their maintenance work. They believe that there is a strong economic case, backed by the evidence in the review to maintain or increase their investment in maintenance. The Environment Agency state that the average benefit to cost ratio of maintenance work is very good and increases to the current level of maintenance funding would provide even more benefits.
1.10 The Environment Agency KPI of asset condition (KPI962) monitors the proportion of structures and defences that are at their required condition. The Environment Agency consider that in a steady state, the combination of maintenance spend and capital replacement will hold asset condition stable. As 100% of assets approach their required condition, there will be increasing pressure on the capital programme to repair or refurbish assets quickly which will be inefficient in terms of work delivery. If asset condition falls, there will be an increasing number of assets below required condition, presenting an increasing flood risk and further deterioration as they await repair. The Environment Agency considers that an appropriate condition target to allow efficient work management yet minimise flood risk would be between 96% and 98%.

1.11 Whilst this is a reasonable assumption in terms of a target condition to allow time for projects to respond to issues of asset condition, it acts only as a target, the importance of the condition indicator for asset maintenance is the trend of the indicator over time and whether this maintains a stable position or is improving or deteriorating. Some natural variation over time can be expected as a result of events and impacts such as extreme flooding. A truer measure of success is that the performance is maintained in a stable trend usually oscillating around an agreed reference level and appropriate control limits.

1.12 KPI 965 quantifies the number of households that are at increased flood risk from assets that are not at their target flood defence condition (‘failing’ assets). In an ideal world all assets would be at target condition all of the time and the additional households would be at a lower risk. Obviously, it would not be economic to maintain all assets in a pristine condition all of the time. KPI 965 is therefore closer to an outcomes measure as it measures the impact of assets which are in a poor condition, it is better that such a target is applied as this allows decisions to be focused and protect the larger numbers of properties rather than the condition of the asset.

1.13 Both measures deliver value within a basket of measures for FCRM, one providing an indicator of asset performance and one measuring the impact of poor condition assets.
Programme funding

1.14 The following charts show the FCRM expenditure for the period 2008/9 to 2014/15.

Figure 1 – FCRM expenditure for the period 2005/6 to 2013/14.
1.15 Figure 1 shows that in general, the condition of high consequence assets has been maintained through the expenditure between 2005/6 and 2012/13. There is an obvious correlation between the increased expenditure between 2008/9 and 2010/11 and improvements occurring within the high consequence assets in target condition. Expenditure levels were lower in 2011/12 and 2012/13 with a slight reduction in target condition assets in 2012/13. This analysis infers a simple causal relationship between expenditure and condition, but there are many other factors which need to be taken into account such as economy and efficiency, asset deterioration and climate change effects. An example of this effect occurs between 2012/13 and 2013/14 where there has been a marked reduction in asset condition which is not aligned with the previous relationship between expenditure and asset condition.

1.16 Analysis of the asset condition surveys undertaken by the Army during March and April 2014 by Defra and the Environment Agency has established that the KPI962 reduction in 2013/14 is associated with the exceptional weather events in the winter of 2013/14. Whilst the flood defences reduced flood risk and protected properties; damage occurred through either overtopping or erosion affecting around 1000 assets reducing KPI962 by 2%. The Environment Agency were unable to enact repairs over the flooding period as resources were either committed on incident response or conditions were such that repairs were impractical or unsafe.

1.17 Additional funding has been set aside by Defra and Treasury to respond to these issues with an additional £145m of capital expenditure and £35m of revenue/operating costs. The KPI962 target for 2014/15 is 96.4%.

1.18 Defra and HM Treasury have reviewed this information and have increased funding allocations in 2013/14, 2014/15 and 2015/16 by £270m to compensate for deterioration and the impacts of the winter flooding in 2013/14 and to provide a maintenance budget of at least £170m for both 2014/15 and 2015/16. Defra and HM Treasury have set the Environment Agency a target of returning 97% of Environment Agency defences in high consequence areas to target condition as quickly and cost-effectively as possible. The Environment Agency is required to agree with Defra and HM Treasury the date by which this will be achieved by the end of November 2014.¹

1.19 The conclusions of this maintenance review should be considered alongside the high level funding and asset condition information to understand where improved asset information, planning and business processes could be utilised to ensure that a broader spectrum of serviceability metrics is in place and that these are being closely tracked and managed within the FCRM programme so that significant changes in condition are mitigated in the future.
2. The review

2.1 This maintenance review considers the applicability of the Environment Agency procedures to the management of FCRM assets and how these are considered in the development of investment needs for both operational costs and capital investment.

2.2 The review was undertaken over a short period of time during March and April 2014. The review comprised a desktop review of policies and procedures as well as discussions with staff within the Environment Agency at both a senior management level and from the experiences of area based staff within the asset management functions.

2.3 The review compares and contrasts the asset management practices, policies and procedures with those in place by the Water and Sewerage companies in England and Wales.

2.4 Over the past 25 years, the water and sewerage sectors in England and Wales have successfully delivered safe, secure drinking water and a much-improved environment. In that time:

- underinvestment in infrastructure has been turned around;
- basic customer service has improved; and
- bills – although increasing – have been kept down by the efficiency challenge of economic regulation.

2.5 Investment of more than £121 billion has been attracted to the water sector from private capital markets. So, this success has been achieved at no cost to the taxpayer.

2.6 In short, since privatisation the water sector has delivered significant improvements in efficiency and service improvements. HM Treasury, DEFRA and Infrastructure UK would like to consider how learning from the water sector since privatisation could be applied within the management of the FCRM investment programme in order to support the efficiency and service improvements that are sought within flood defence.

2.7 There are important differences between the water sector and FCRM; most obviously that the Environment Agency’s funding comes from the general taxpayer rather than the beneficiaries of its services (billpayers). This leads to both different incentives and to a different ‘customer’ relationship with the beneficiaries of the service.
Objectives

2.8 This peer review of the Environment Agency follows the flooding of the winter of 2013/14, he review was instigated by HM Treasury, DEFRA and Infrastructure UK in March 2014.

2.9 The review comprises an examination of the asset management functions of the Environment Agency with regard to Flood Risk and Coastal Management (FRCM) assets.

2.10 The objectives of the review are outlined below;

   a) to assess and quantify the asset management capability of the Environment agency and assess to what extent the existing Environment Agency data and processes accurately predict the investment needs.
   b) to examine and consider the degree of confidence and uncertainty associated with the investment needs.
   c) to examine options to improve confidence and reduce uncertainty.
   d) to develop short, medium and long term actions to improve the asset management capability of the Environment Agency.

Process and implementation

2.11 The review was undertaken over a short period of time during March and April 2014. The review comprised a desktop review of policies and procedures as well as discussions with staff within the Environment Agency at both a senior management level and from the experiences of area based staff within the asset management functions.

2.12 The review compares and contrasts the asset management practices, policies and procedures with those in place by the Water and Sewerage companies in England and Wales.

2.13 HM Treasury, DEFRA and Infrastructure UK would like to consider how learning from the water sector since privatisation could be applied within the management of the FCRM investment programme in order to support the efficiency and service improvements that are sought within flood defence.

2.16 The review considers the applicability of the Environment Agency procedures to the management of FCRM assets and how these are
considered in the development of investment needs for both operational costs and capital investment.

2.17 Preliminary observations and outline recommendations from the review were presented on 3 April 2014 to the steering group comprising members of HM Treasury, Defra, Infrastructure UK and the Environment Agency.

**Understanding economic maintenance demand**

2.18 At the heart of this review is the question of understanding the economic and efficient level of investment that is required in order to maintain the existing FCRM assets to provide an adequate and appropriate level of flood risk protection to land, people, properties, businesses and infrastructure in England.

2.19 Determining the economic and efficient level of investment is a complex optimisation task, which involves many different choices of investment. Any investment programme is based upon a series of judgments that utilise information and data that is both uncertain and is constantly evolving and changing.

2.20 Investment programmes have multiple objectives (or outcomes) turning many investment decisions into a complex optimisation task balancing the delivery effectiveness with the standards of service and protection to the end user or customer. Investment programmes are subject to funding constraints (both operating and capital costs) and are subject to efficiency challenges. Investment programmes are an evolving view of the investment need balanced against risk and form the foundation upon which effective and efficient judgments can be made.

2.21 Effective investment programmes should be risk based and use sound evidence to support the decisions being undertaken. Sound evidence should reflect the known asset information, asset performance, and forecast asset risk recognising the changing environment within which the asset is operating.

2.22 Effective programme decisions should also be risk based and should concentrate on the value being delivered in terms of both cost and benefit. There are two optimisation objectives that can be applied within investment programmes;
a) Cost benefit optimisations are most appropriate when considering the
decision to improve service provision and effectively choose between
competing projects to achieve an improvement. Decisions are focused
on selecting projects with the highest cost benefit ratio and
concentrate on constructing new assets to provide improved service
provision.

b) Cost effectiveness optimisations are most appropriate when
considering the decision to maintain service provision and effectively
choose the most economic solutions to achieve lowest whole life cost
and continue to deliver the benefit that has already been assumed
when the assets were initially constructed. Decisions are focused on
selecting projects to maximise the benefits of the assets that have
already been constructed and ensure they continue to deliver benefits
into the future.

2.23 Both cost benefit and cost effectiveness objectives are equally valid
optimisation techniques for the management of a diverse asset base and
should both be considered as part of any programme optimisation and
analysis.

2.24 ‘Economic’ decisions reflect the balance of these optimisations, whereby
the choices of action (or inaction) are understood and balanced against
the choices to maintain service, to improve service (where cost beneficial)
or in the active choice to let service deteriorate (the risk of service failure
increase). Economic decisions are therefore about the targeting of asset
interventions and ensuring these are delivering best value against the
duties and obligations of the client organisation.

2.25 ‘Efficiency’ is the delivery of these choices in the most cost effective
manner, through the application of resources and contractual mechanisms
to deliver value. Efficiency is therefore about improving the productivity of
delivery and delivering at lower unit rates. The action of not undertaking an
activity is an economic choice and should not be considered an efficiency
output (as no improvement in productivity has occurred).

2.26 It is important that the application of ‘efficiency’ is separately considered
and is factored into the economic choices that are applied through the
programme optimisation as improved efficiency creates either
outperformance or additional headroom for other benefits to be delivered.

2.27 Asset management client organisations (in this case the Environment
Agency) are accountable for the ownership and planning of the assets and
for ensuring these continue to deliver the services in accordance with the duties of the organisation. This includes managing the performance of the assets over time, planning and implementing interventions and investment, before then taking on board newly constructed or maintained assets and operating these in an economic and efficient manner in the future.

2.28 Given the scale of these investment programmes appropriate managerial and governance arrangements are very important to ensure the programme remains aligned with the outcomes and objectives whilst remaining economic and efficient.

Developing an optimised investment programme

2.29 In order to understand the scale of any investment programme, the first analysis should determine the expected investment need from the assets to achieve a stable level of service (as a minimum requirement). This should reflect the asset base that is being maintained, the role and duties of the organisation and the rates of deterioration of these assets. The investment programme should then be offset by efficiencies in asset targeting and ways of working, the benefits of improved data sets and delivery efficiencies. The Environment Agency have undertaken a first view of this as part of the recent report *Technical and legal background to our asset maintenance, February 2014*.

2.30 This first analysis of the investment programme should be based upon a cost efficiency objective. The optimisation would seek to deliver this objective at lowest whole life cost whilst maintaining a stable level of risk.

2.31 The programme should then be analysed to understand what impact external factors will have to the standards of service and to assess the most beneficial solutions to address the future risk. Examples of external factors on the asset base include new development growth, climate change and impacts of European legislation. Enhancement issues would generally be assessed against a cost beneficial objective.
2.32 Figure 2 shows the change forces that an asset in the FCRM arena faces which may change its risk profile.

![Diagram showing change forces affecting FCRM assets](image)

**Figure 2 – Change forces acting upon FCRM assets**

2.33 Asset deterioration and climate change increase the probability that a FCRM asset will fail. New development increases the numbers of properties that will be affected should failure occur (increasing consequence). Investment decisions such as maintaining or constructing new flood defences reduce the probability of flooding. Finally hazard warning and mitigation measures for flood risk properties reduce the impact and consequence of flooding should it occur.
3. Conclusions

Asset management delivery

3.1 The review has identified a number of very positive areas of asset management delivery where the Environment Agency would be considered alongside some of the best elements of the water sector in England and Wales. Of particular note are;

• the NAFRA modelling and risk assessment approach: This is very much at the heart of the Environment Agency’s ability to understand flood risk and predict how this may change over time. It allows detailed understanding of asset and property risk and for this to be presented through GIS overlays and flood risk maps.
• MEICA asset data and understanding: There is a mature asset data set and understanding around the MEICA asset base (pumping stations and mechanical equipment), the data set is quite mature and is being applied through the application of deterioration modelling and predictive maintenance scheduling.
• AIMS & SAMPS: The Environment Agency has recently invested in new asset systems for the asset inventory and to manage the diverse asset base through a catchment based approach. Both of these systems represent solid foundations of information that will inform asset management decisions going forward. The Environment Agency has recently commissioned the CAMC2 system in order to improve the information available on maintenance jobs, scheduling and asset performance data.
• Capital delivery process: The capital approvals process and management is mature with comprehensive gateways available for the approval and governance of the investment. There is a clear understanding of unit costs and how these are changing over time. The recently introduced Water and Environment Management (WEM) framework should support the delivery of future capital efficiencies through a strong commercial framework.
• Policies and procedures: There are well-developed standards, policies and procedures for area based asset management teams. The local teams are well aware of these policies and are generally delivering against these polices and standards. Although some work is required to develop further polices and procedures for conveyance and third party assets.
3.2 The review has identified a number of observations where there could be improvements to the asset management processes within the FCRM functions in order to improve the targeting of assets interventions and deliver in a more economic and efficient manner (see 3.11).

**Benchmarking results**

3.3 In benchmarking against the water company performance in 2009, it should be noted that the water companies had already been incentivised to apply the UKWIR common framework and had prepared their internal business processes and business plan submissions to be judged by the Asset Management Assessment. The review of the company scores also occurred over a two year period within the price review giving the companies additional opportunities to respond to the issues and provide additional information to influence their overall score. The Environment Agency has not had the same opportunities to respond to the benchmarking.

3.4 In reviewing the AMA scoring for the FCRM asset management, account has been taken of the analysis and observations highlighted in Appendix 1 of this report.

3.5 As can be seen in Figure 3, FCRM flood defence asset management processes are towards the mid to lower end of the water sector performance; this is primarily driven by the low level of performance data and operational information available to inform the decision and intervention processes. The CAMC2 system and its delivery into day to day processes will start to address much of these shortfalls in data, as long as additional systems and business processes are delivered to analyse and use this information to target asset interventions in a more economic and efficient manner.

3.6 The AMA scores shown for leadership and stakeholder engagement reflect the peer review of the level of engagement across the wider Environment Agency with regard to the whole of the FCRM programme taking into account the permissive powers of the Environment Agency. If these scores were considered with regard to just the maintenance and asset management duties of flood defence and MEICA assets then these scores would be lower as maintenance activities as not as well acknowledged with customers and internal staff.
3.7 Figure 4 details the same scoring for MEICA assets, here FCRM MEICA asset management processes are much closer to the water sector performance average and demonstrates the much more mature performance data that is available. Additional systems and business processes can be delivered to improve analysis of asset behaviour and whole life cost to target asset interventions in a more economic and efficient manner.
FCRM business process

3.8 The review has identified a number of observations where there could be improvements to the asset management processes within the FCRM functions in order to improve the targeting of asset interventions and deliver in a more economic and efficient manner.

3.9 Appendix A of this report covers the detailed review of the benchmarking exercise and a descriptive discussion of the review leading to 33 separate observations around the FCRM business process in comparison with asset management in the water sector.

3.10 These 33 observations have been used in the development of the eleven key recommendations identified in section 1 of this report. (these are cross referenced in section 1). Whilst these recommendations bring together the many different observations they may not fully encompass the observations. The Environment Agency should also consider the 33 observations separately to identify any further opportunities for improvement.

3.11 The observations are also included in Appendix D for convenience.

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<td>1</td>
<td>The Environment Agency’s duties towards properties and land at flood risk are different from those for the Water and Sewerage companies. There are no duties or obligations to provide flood defence assets to flood risk properties and land. Government funding for construction and maintenance of flood and coastal erosion risk management are based principally on the economic case, not a duty. The Environment Agency has no legal duty or obligation to maintain a flood defence asset once it is constructed, although it does have contractual obligations in certain circumstances.</td>
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<td>Whilst the common framework was developed for the water sector as a planning framework to support the price review process, the basic principles it applies in terms of understanding both past and current performance (Stage A) and using this information to forecast future service through deterioration and service modelling (Stage B) are just as valid for FCRM as they are for the water sector. The Environment Agency should consider the application of the common framework within its FCRM asset maintenance in order to understand and quantify future forecast investment needs for asset maintenance.</td>
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<td>There is no requirement for the Environment Agency to maintain a flood risk defence once it is constructed. Partnership funding has the potential to confuse this position when contractual arrangements are not clarified. In considering any increased clarity of expectations, consideration of the effective lifespan of the flood defence asset and over what period an economic benefit has been assessed within the original construction design life should continue to be taken into account.</td>
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<td>The Environment Agency should consider applying the principles within the Service Incentive Mechanism (SIM) customer experience across its customer engagement and front line staff interactions. Such an application should consider the experience of the customer and hand offs between different elements as part of staff interactions and how these maintain ownership and accountability within the organisation.</td>
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<td>The application of consumer preferences (such as WTP rather than the avoided damages approach) should be considered within the prioritisation of FCRM investment. This could potentially improve customer legitimacy of the investment programme. The application of this should be considered separately for both the creation of new flood defence assets and for the maintenance of existing assets. The interaction of these with the role of the RFCCs should also be considered.</td>
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<td>6</td>
<td>The benefits of customer driven outcomes for the FCRM programme should be explored and developed further, particularly being more explicit on the role of maintaining existing flood defences. An example would be “maintaining and improving the resilience of people, property and business to the risks of flooding and coastal erosion.” The outcome should concentrate on the benefit to the end user – for example KPI962 reflects asset condition rather than benefit to the end user (or beneficiary).</td>
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<td>7</td>
<td>The development of performance commitments and outcome delivery incentives (ODIs) for the FCRM programme will provide greater clarity of objectives and transparency with the end user or customer. Consideration should be given to the development of an appropriate incentive mechanism to incentivise innovation and positive management action by the Environment Agency.</td>
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<td>8</td>
<td>Benefits assessment for maintenance within FCRM using a consumer preferences approach could consider the use of alternative methods (for example WTP and WTA). Any surveys to gather consumer preferences data could be undertaken on a periodic basis (typically say once every five years) with the consumer preference data being applied within programme prioritisations. Maintenance schemes could be assessed on cost benefit ratios using for example WTA, whilst enhancement of new flood defences could use cost benefit ratios derived with consumer preference data.</td>
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<td>9</td>
<td>As part of the current reorganisation, the Environment Agency should consider governance and accountability processes for the review of both the expenditure and the delivery of outputs and outcomes across the investment programme between the programme management team, the Environment Agency Executive team and the Environment Agency Board. These governance and accountability procedures should be clearly documented and set out. Papers associated with key decisions should also be clearly documented, particularly to demonstrate whether the proposed programme meets the requirements and conditions set out by Defra and HM Treasury.</td>
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<td>10</td>
<td>The Long Term Investment Strategy for Floods and Coastal Risk Management due to be published in 2014 should be aligned with the 6-year investment and maintenance programme.</td>
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<td>11</td>
<td>The Environment Agency should consider reinforcing the line of sight between Government policy and the Environment Agency Long Term Investment Strategy as part of the update in 2014.</td>
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<tr>
<td>12</td>
<td>The Environment Agency should consider the roles and skills sets needed following the recommendations of this review and in particular in; • Asset performance and deterioration modelling • Asset targeting and risk management • Solution engineering and cost estimation, and • Investment prioritisation, optimisation and planning.</td>
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| 13 | The following procedures may need to be strengthened and developed;  
• Asset performance and deterioration modelling  
• Asset targeting and risk management  
• Solution engineering and cost estimation, and  
• Investment prioritisation, optimisation and planning.  
These procedures are not fully developed, may not reflect robust business processes or may require further development in order to be integrated into day to day operations. |
| 14 | Given the quality of existing standards, policies and procedures the Environment Agency should consider PAS55/ISO 55000 accreditation. Such accreditation will support many of the recommendations in this report and will provide third party accreditation and governance procedures that improvements have been put in place and delivered. |
| 15 | The CAMC2 system is essential to understand the performance of flood defence assets and this information will improve asset targeting. The implementation of the CAMC2 system is already approved and delivery is underway.  
This review supports the delivery of the CAMC2 system as it will support the delivery of further efficiencies and improvements in asset management through effective scheduling and targeting of asset and operational interventions.  
Consideration should be given by the Environment Agency of how to accelerate the delivery of CAMC2 earlier than 2017. |
<p>| 16 | The Environment Agency should review the available resourcing and business processes associated with verifying flood history information. A KPI should be introduced to reflect the time from a property being flooded to being recognised within the flooding history. The time period from a flooding event to being on the flooding history database within NAFRA should be no more than three months. |
| 17 | The Environment Agency should consider the development and implementation of asset deterioration and analysis tools to improve asset targeting and deliver whole life cost solutions. |
| 18 | Dedicated programme optimisation and management systems should be considered to support the ability to target asset interventions and deliver future efficiencies. |</p>
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| 19 | The Environment Agency should consider whether the existing financial systems are appropriate for the asset management needs of FCRM. Alternative financial systems (or modules) for FCRM may need to be considered which then align and integrate with the corporate financial systems for the Environment Agency.  
If these gaps cannot be addressed within the financial systems then they may need to be separately addressed through systems such as CAMC2.  
Alternatively modules may well be available from the financial system already in use and may be applicable to a number of government agencies (eg both the Environment Agency and the Highways Agency.) |
<p>| 20 | The Environment Agency should undertake a data improvement project for the FCRM datasets based upon critical information for asset management processes and deterioration modelling. |
| 21 | The Environment Agency should review the CAMC2/CAMC3 specifications to ensure that the data set supports the development of the asset deterioration and analysis tools. |
| 22 | The Environment Agency should develop serviceability metrics and a basket of measures to demonstrate stable serviceability of the FCRM asset base. These measures should be published in the public domain to give greater confidence to stakeholders that investment is being targeted appropriately. |
| 23 | The Environment Agency should capture operational costs associated with maintenance activities within CAMC2 and should use these costs, alongside the performance information to develop whole life cost models for the FCRM asset base. |
| 24 | The Environment Agency should further develop the risk based solution engineering procedures and processes within the SAMPS/CAMC systems. This should systematically and robustly determine maintenance benefits for all assets whilst also encouraging innovation and allowing greater choice of solutions and cost benefit to any programme optimisation. |
| 25 | Once the CAMC2 system is commissioned and the operational benchmarking exercises are completed, the Environment Agency should consider whether there are cost savings in either outsourcing or nationally procured services in comparison with the current DLO and local commissioned contracts. |</p>
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<tr>
<td>26</td>
<td>The Environment Agency should develop asset GIS and data mining tools as part of CAMC3 to both review historic information and use this information to predict future performance. Such tools should enable economic and efficient decisions leading to maintenance aligned with least cost whole life principles. Such tools would act to both improve historical targeting and to undertake deterioration modelling to identify future risks. The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.</td>
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<tr>
<td>27</td>
<td>The Environment Agency should develop risk based programme optimisation tools for the whole of the investment programme through CAMC3. The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.</td>
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<td>28</td>
<td>The Environment Agency should consider the application of the ‘Risk Matrix’ tool within the development of the investment planning and risk prioritisation tools for the FCRM programme. Expanding the granularity of the current risk consequence systems from ‘very low’ to ‘very high’ whilst moving from a systems based assessment to an asset based approach.</td>
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<td>29</td>
<td>Alongside the development of the risk based programme optimisation tools for the whole of the investment programme, the Environment Agency should consider the manner in which reporting of the investment programme will be delivered to give transparency and line of sight for stakeholders. This should be considered for the yearly, three yearly, six year and the long-term investment strategy.</td>
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<tr>
<td>30</td>
<td>DEFRA and the Environment Agency should improve the process and procedures around capital delivery associated with partnership funding. The primary purpose for the review would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process.</td>
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DEFRA and the Environment Agency should improve the policies, operational procedures and conveyance management processes associated with rivers and watercourses, to establish a clear policy and risk based whole life cost procedure for dredging and watercourse management. This should reflect the economic whole life cost associated with both flood risk management and the economic value associated with land drainage.

The risk based approach developed would benefit from being aligned with the risk matrix methodology set out in A.180. This would ensure compatibility and integration with the investment decisions and optimisations between maintenance and conveyance across the investment programme.

The Environment Agency should deliver a forward pipeline of maintenance projects of at least 3 years to delivery partners and use the feedback from delivery partners to identify efficiencies. Efficiencies should then be factored back into programme optimisations and target costs. Such a pipeline should reflect the six year forward capital programme and the commitments made by HMT/Defra.

The process by which the Environment Agency intervenes with regard to Third Party assets is unclear. The manner in which Third Party assets are assessed and included within flood risk assessments and project appraisals should be formalised and improved. The concern being that the existing process has a potential bias towards Environment Agency owned assets, whereas an investment in a third party asset through permissive powers may deliver a better cost benefit ratio and increased flood protection.
4. Recommendations

Summary

4.1 Overall the review has identified eleven key recommendations and suggestions for improvements to the end to end delivery of the maintenance processes of FCRM assets. A number of these recommendations align with change projects already underway within the Environment Agency, the review confirms the need and supports these individual projects and the direction of travel for the current programme overall.

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<tr>
<td></td>
<td>A programme of change for FCRM</td>
<td>The Environment Agency should consider the delivery of the key recommendations within this report as part of a wider change programme delivering a “2020 vision” for FCRM</td>
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</tbody>
</table>
| A   | Improve customer legitimacy and deliver an outcomes focus | Defra and the Environment Agency should consider the issue of customer legitimacy for Flood Defence and Coastal risk management. The expectations of communities impacted by flooding and the role and obligations of the Environment Agency do not appear to be in alignment. Investment decisions around the maintenance of existing flood assets are not as transparent as those associated with the creation or enhancement of new flood defences. Consideration should be given to the benefits and tools applied within the water sector and how these could be best utilised to improve customer legitimacy. These should include:  
  • An increased clarity of expectations of what the Government expects the Environment Agency to deliver by way of clear high level obligation statements and outcomes. | Addresses observations 1, 3, 4, 6, 7 |
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|     | • Application of community forums, including consideration of how Regional Flood and Coastal Committees (RFCCs) could be used for this purpose.  
• The role of outcomes, performance commitments and delivery incentives.  
• Enhanced communications to clarify the Environment Agency's role of flood risk management to the beneficiaries of the FCRM programme. | | |
| B   | Improve customer legitimacy within programme prioritisation | Defra and the Environment Agency should consider the issue of customer legitimacy for Flood Defence and Coastal risk management and the extent to which public consultation should influence prioritisation.  
This could include the potential application of customer preference approaches within the programme prioritisation; for example WTP/WTA data adapted for activities that are funded by Government. | Addresses observations 5, 8 |
| C   | Improve governance and accountability | The Environment Agency should be clear about the ownership and accountability of the investment programme between RFCCs, the Environment Agency, senior management, Board approvals and signoffs; improving governance and accountability across the FCRM programme for both expenditure, outputs and outcomes. Line of sight between the strategic Long Term Investment Strategy (LTIS) outcomes through to Environment Agency standards and procedures should also be improved.  
The review supports the Environment Agency’s desire to undertake PAS55/ISO 55000 accreditation for the processes and procedures within the FCRM programme, | Addresses observations 2, 9, 10, 11, 13, 14 |
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| D   | Improve asset management datasets | The Environment Agency should significantly improve both the quantum and quality of its asset management data and information. It should do this through targeted improvement programmes, new systems and processes (ie CAMC2), reviewing the effectiveness of existing systems and determining how well they support the asset management processes (ie financial systems). In particular focus should be placed on;  
  • targeted improvements to asset inventory datasets (such as date of construction etc)  
  • recording construction material (where not known)  
  • performance information on the assets  
  • maintenance and repair activities and associated costs  
  • timely information on flooding events and near misses  
  • overtopping, collapses and rodent infestations  
  • the development of serviceability metrics  
  • operational costs of asset management activities and interventions.  
The review recognises the improvements recently made on AIMS and CAMC2 and is supportive of the continued development of these datasets. | Addresses observations 2, 15, 16, 19, 20, 21, 22, 23 |
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<tr>
<td>E</td>
<td>Develop asset analytical and modelling capability</td>
<td>The Environment Agency should develop a centralised analytic and modelling capability to enhance the asset knowledge of the organisation and to drive efficiencies in the targeting of asset interventions. This can be achieved by applying historic performance data and asset information to identify asset behaviour of specific cohorts of assets and to use this knowledge to target focused asset interventions. Such resources would have skills in analytic data mining, GIS and deterioration modelling. Engineering expertise would also be used as part of effective solution engineering in order to establish innovative, economic and efficient interventions applied through a risk based framework. This capability would be at the heart of both targeted asset interventions and efficiencies in the short term and would also support the long term future forecasting capability of the asset base. The Environment Agency is already undergoing significant changes which will support this recommendation.</td>
<td>Addresses observations 2, 17, 24, 26</td>
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<td>F</td>
<td>Develop risk based programme optimisation capability</td>
<td>The Environment Agency should develop a risk based centralised programme optimisation capability with dedicated systems and resources capable of supporting economic and efficient asset interventions and future forecasting capability. This should be developed alongside a review of how the investment programme governance and reporting with stakeholders will be improved. The programme optimisation should be developed for yearly, three yearly, six yearly and the Long Term Investment Strategy horizons and there should be a clear line of sight between these programmes.</td>
<td>Addresses observations 2, 12, 18, 28, 29</td>
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<td>There should be a clearer treatment of contingency within the programme. A centrally managed contingency budget will provide greater flexibility for programme management rather than individual schemes including all risks sums.</td>
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<td>G</td>
<td>Optimise on the basis of whole life cost and benefits</td>
<td>The Environment Agency should look to consider the development of the optimisation of the FCRM programme on whole life cost and benefits, to inform budget setting and programme planning</td>
<td>Addresses observation 2, 27, 28</td>
</tr>
<tr>
<td>H</td>
<td>Develop contractual partnerships</td>
<td>The Environment Agency should consider the role that framework partnerships will have within the delivery of a holistic whole life cost and benefits FCRM programme. Long term delivery partners with incentives aligned to outcomes and delivered efficiencies are commonplace amongst the water sector, the benefits of these relationships cannot be underestimated and they are a key player in delivering a dynamic and innovative investment programme. The manner in which operating and capital partners will deliver economic and efficient interventions alongside internal staff and how these resources could be deployed as a single team during emergency responses should be given careful consideration. Forward pipeline visibility of the FCRM programme of at least two years (preferably 3 years) will support the delivery of efficiencies as the supply chain will be able to plan more effectively. Greater continuity of long term planning and funding through the six year programme will also support these long term partnerships.</td>
<td>Addresses observations 25, 32</td>
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<td>Ref</td>
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<tr>
<td>I</td>
<td>Improve procedures and processes for capital delivery associated with partnership funding.</td>
<td>The review recognises the benefits that partnership funding delivers to the overall FCRM programme. DEFRA and the Environment Agency should improve the process and procedures around capital delivery associated with partnership funding. The primary purpose would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process. Procedural and process improvements should be sought to mitigate where the approach either distorts economic delivery decisions or creates delivery inefficiencies.</td>
<td>Addresses observation 30</td>
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<tr>
<td>J</td>
<td>Improve conveyance processes</td>
<td>The Environment Agency should ensure there are clear operational procedures and conveyance management processes associated with rivers and watercourses. The Environment Agency should develop an understanding of the data, cost and benefits and should establish a clear decision process and risk based whole life cost for dredging and watercourse management. This should reflect the economic whole life costs associated with flood risk management. Further public engagement should be undertaken to establish conveyance as an appropriate tool within FCRM.</td>
<td>Addresses observation 31</td>
</tr>
<tr>
<td>K</td>
<td>Clarify the role on 3rd Party Assets</td>
<td>Defra and the Environment Agency should review the role of the Environment Agency with regard to 3rd Party assets in order to clarify the responsibilities, processes and procedures in use. In particular how the Environment Agency's permissive powers should be applied in order to provide protection to the system of assets for high risk communities.</td>
<td>Addresses observation 33</td>
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Timing of delivery of key recommendations

4.2 The delivery of many of the key recommendations is not going to occur overnight as many of the recommendations involve significant change management to be delivered in order to change the way asset management and investment planning is delivered within the Environment Agency.

A programme of change for FCRM - A 2020 Vision

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<td>Develop risk based programme optimisation capability</td>
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Feasibility/Design
Delivery and embedding in business processes

Figure 5 – Expected timeline for delivery of key recommendations

4.3 Typically, this change could be delivered within a five year time period, if it is supported with external input from outside the Environment Agency. Whilst it would always be desirable to deliver the change as quickly as possible there will be dependencies such as the asset management datasets and the rate of organisational change.

4.4 The programme itself would require separate funding over and above the funding allocations currently in place. Broadly, the estimated costs of delivery for the most expensive key recommendations are;
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<th>Recommendation</th>
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<th>Cost (£m)</th>
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<tr>
<td>A</td>
<td>Customer legitimacy</td>
<td>Taxpayer and beneficiary engagement and surveys</td>
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<td>D</td>
<td>Improving datasets</td>
<td>Manpower, resources and system development</td>
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<tr>
<td>E</td>
<td>Analytical and modelling capability</td>
<td>Manpower and resources</td>
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<td>F</td>
<td>Risk based optimisaion systems and capability</td>
<td>New systems and staff development</td>
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<td>Integration with existing Environment Agency systems</td>
<td>Systems, manpower and resources</td>
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<td>Change management and implementation of overall programme</td>
<td>Manpower and resources</td>
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# Recommendation D is seen as an intensive and focused improvement of the asset dataset over a two year period. Aiming to achieve the bulk of the asset data improvement with the remaining data improvements occurring over the longer term as data quality is improved on a day to day basis.

* The costs are based upon broad brush estimates from historic application of such programmes. A more detailed cost estimate would be required from the Environment Agency to reflect a greater business knowledge, implementation risks, system integration costs and indirect staff costs associated with change management and cultural change.

**Potential efficiencies and benefits**

4.5 Whilst the costs of such a change programme are significant, the benefits that such a change will deliver are also significant. The benefits are not just financial, as many of the improvements stem from a greater understanding of asset and service behavior that leads to more efficient and effective targeting and better asset management. In the short term this may lead to an increase in investment in order to recover and stabilise asset serviceability. But, in the longer term the improvements in asset management will deliver sustained savings, this has been demonstrated by both cost reductions and improvements in service within the water sector over the last 25 years.
4.6 In the short term it would be expected that such a programme of change could deliver 12-17% efficiencies over a five year period from a baseline of 2014/15 across both capital and revenue maintenance expenditure. However, these are based upon efficiencies within an RPI-X environment and RPI would also need to be factored into this assessment.

4.7 These efficiencies are covered by two areas;

a) Improvements in knowledge and asset targeting – delivering sustained savings across the maintenance investment programme of circa 8-10% over the five year period. (Key recommendations A-G)

b) Efficiencies in delivery - driven by new contractual arrangements and improved processes for partnership funding. Savings of up to 4-7% (Key recommendations H-I).

Early deliverables and quick wins

4.8 The following projects are considered by the peer reviewer to provide early deliverables and potential quick wins for knowledge transfer from the water sector to the Environment Agency.

- Supporting the piloting of the application of risk matrix functionality in presenting the current risk position and effect of the current investment programme in the development of a risk based programme optimisation (recommendation E). (see Appendix A, section A.180 for more details)

- Supporting the review of updated condition data from Army survey – supporting risk based prioritisation of investment through the risk matrix.

- Undertaking an efficiency review for the investment delivery process and an assessment of the benefits of alliance partnerships.

- Providing peer review support and challenge for the drafting of the LTIS.

- Providing peer review support for the CAMC2 system development and asset management system design

4.9 The Environment Agency should consider if there are other short term actions which could be delivered from this report.
Overall confidence in the FCRM programme

4.10 Consideration has been made by the peer reviewer to the overall confidence and uncertainty associated with the current investment programme and the confidence that would be assigned to the programme for the future.

4.11 Two of the objectives for the study were;

• to assess and quantify the asset management capability of the Environment Agency and assess to what extent the existing Environment Agency data and processes accurately predict the investment needs.
• to examine and consider the degree of confidence and uncertainty associated with the investment needs.

4.12 From the observations made in the review;

• The levels of service are broadly being maintained with the available investment funding suggesting a correlation between funding and asset condition (subject to efficiency challenges).
• The effects of the winter storms in 2013-14 impacted the condition of the assets
• Additional investment has been funded by Treasury and Defra to offset the effects of the winter storms in 2013-14
• The asset management benchmarking against the water industry has identified a number of improvement areas in process, data and capability across the FCRM programme.
• The forward forecasting capability of the programme could be improved, currently with limited asset deterioration forecasting. There remains uncertainty around the asset deterioration rates and investment needs.
• Uncertainty exists around many aspects of the investment programme such as climate change and growth forecasts as well as asset deterioration. Improving both the evidence base to inform these decisions and to develop a ‘no regrets’ form of decision making should be factored into forward forecasts to support effective decision making taking into account uncertainty factors.
• Forward forecasting capabilities are based upon high level macro assumptions rather than bottom up modelling and optimisation techniques.
4.13 Whilst neither the Environment Agency nor Defra consider that additional funding is currently required beyond that set out in 2014-15; given the observations above, the reviewer considers that it would be difficult for the Environment Agency to provide an evidenced based justification for an increase in funding above 2014-15 levels. Conversely it is considered that levels of investment should not be lowered below 2014-15 levels due to potential risks around uncertainty and climate change.

4.15 The programme of improvements and key recommendations contained in the review are essential to improve confidence. Once delivered, forward forecasts from the programme should be evidence based and could be considered more economic and efficient and will inform the scale of future investment need.
Appendix A: Benchmarking exercise and observations

The regulatory environment and duties

A.1 Whilst the water sector in England and Wales has similar business processes and activities to those undertaken by the Environment Agency FCRM, it is operating in both a different financial, legal and regulatory environment and has distinctly different roles and responsibilities.

Figure A1 – The regulatory environment for Water and Sewerage companies in England and Wales

A.2 The water sector in England falls under DEFRA as the sponsoring department (and with Welsh Government in Wales).

A.3 The water undertakers operate under the Water Industry Act (1991), with a clear duty to develop and maintain an efficient and economical system of water supply within its area under Section 37 of the act. For sewerage undertakers there is a general duty under Section 94 to provide a sewerage system (to effectually drain and treat the contents of the sewer).

A.4 These duties are overseen by an economic regulator (Ofwat) with both the Environment Agency and Drinking Water inspectorate holding the companies to account for compliance with environmental and drinking water legislation.
A.5 The water undertakers manage the relationship with their customers and deliver against these duties. There are defined penalties that the water undertakers must pay to customers if they deliver poor service. The economic regulator also operates a number of financial incentives to incentivise the undertakers to deliver more efficiently.

A.6 Under the Flood and Water Management Act 2010 water companies have a duty to co-operate with each other and other flood risk management authorities and to share data. A key theme of the Pitt Review was for flood risk management authorities to work in partnership to deliver flood risk management better to the benefit of their communities.

A.7 The Environment Agency FCRM roles and duties are distinctly different, FCRM (flood and coastal risk management) assets are structures, channels or natural features that reduce the risk of flooding to people and properties.

A.8 Under the Flood and Water Management Act 2010 The Environment Agency is responsible for taking a strategic overview of the management of all sources of flooding and coastal erosion. This includes, for example, setting the direction for managing the risks through strategic plans; providing evidence and advice to inform Government policy and support others; working collaboratively to support the development of risk management skills and capacity; and providing a framework to support local delivery.

A.9 The Environment Agency also manages FCRM assets on main rivers. A main river is a watercourse shown on a main river map. Main rivers are usually larger streams and rivers, but can also include smaller rivers. Unlike the water companies the Environment Agency don't have a legal obligation to maintain FCRM assets or construct new assets on main rivers. However they do have legal powers (permissive powers) allowing them to do work when it is for flood and coastal risk management. The Environment Agency does have a legal obligation to do a small amount of maintenance, such as work to maintain internationally designated sites, Health & Safety and contractual commitments.
A.10 The local authority, or internal drainage board (IDB) where it exists, manages assets on ordinary watercourses\(^2\). Their powers are similar to those the Environment Agency have on main rivers.

A.11 Under common law, the person who owns the land or property next to a river or other watercourse (known as the riparian owner) is responsible for maintaining the flow of water across their land and for their own flood protection. The Environment Agency can choose to exercise its permissive powers where it is in the wider public interest and undertake works or require the riparian owner to clear blockages. The Environment Agency usually has to give consent for works by the riparian owner so that they can make sure they are protecting the interests of others, such as their neighbours.

A.12 Unlike the water companies the Environment Agency doesn’t have a legal obligation to maintain FCRM assets or construct new assets on main rivers.

**Observation 1:**

The Environment Agency’s duties towards flood risk properties and land are different from those for the Water and Sewerage companies. There are no duties or obligations to provide flood defence assets to flood risk properties and land. Government funding for construction and maintenance of flood and coastal erosion risk management are based principally on the economic case, not a duty. The Environment Agency has no legal duty or obligation to maintain a flood defence asset once it is constructed, although it does have contractual obligations in certain circumstances.

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\(^2\) An ordinary watercourse is every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows, which does not form part of a main river.
The asset management cycle

Figure A2 – The asset management cycle

A.13 The asset management cycle is used by a number of the water and sewerage companies in England and Wales to describe the cycle of asset management activities they undertake. The cycle sets out how the assets are;

- operated to deliver the service,
- monitored to assess performance,
- compared with performance targets
- risk assessed and prioritised
- considered as part of a planning process for intervention
- modified with operational and capital interventions
- returned to operational status.

A.14 This cycle of operate, monitor, review, invest and operate, should be familiar to all asset management client organisations. Similar cycles are included in the ISO accredited asset management standards PAS 55 and
ISO 55000. (The Environment Agency is currently not accredited to these standards).\(^3\)

**The UKWIR Capital Maintenance Planning Common Framework**

A.15 Ofwat set out the need for improved, risk-based, asset management planning in MD 161: Maintaining serviceability to customers (April 2000). UKWIR subsequently published in 2002 the 'Capital maintenance planning – a common framework' (CMPCF or common framework)\(^4\). As part of the final determination to water companies in 2004, Ofwat set out that the water companies should develop and apply the principles in these two publications to capital maintenance by the 2009 price review.

A.16 The Common Framework for Capital Maintenance Planning has been developed by UKWIR (UK Water Industry Research) building upon the concepts outlined in MD161. The project involved wide consultation within the UK water industry and the active involvement and contribution of the economic and quality Regulators.

A.17 The Common Framework is founded on risk-based principles so that in most cases capital maintenance will be justified on the current and future probability of asset failure and the resultant consequences for customers, the environment and water service providers, including the costs arising.

A.18 An overview of the common framework is included in figure A3, this diagram shows that the common framework is considered in three stages;

a) Historical analysis: whereby the performance and maintenance costs of the assets are reviewed and the relationships between asset performance, maintenance and operational costs and service performance are established and trends are developed.

b) Forward looking analysis: whereby a risk based analysis of the assets is undertaken forecasting asset deterioration, the impact on future risk and service and identification of intervention options.

c) Conclusions: bringing together stages A and B, assessing the scope for efficiencies and presenting the case.

\(^3\) Details of PAS55 and ISO55000 can be found at https://theiam.org
\(^4\) www.ukwir.org - Capital maintenance planning: a common framework Ref: 02/RG/05/3 (ISBN 1-84057 265 5)
A.19 The common framework is being reviewed as part of the 2013-14 UKWIR research programme through a project entitled “Common Framework 2014 - Framework for expenditure decision-making”. The Environment Agency have been asked to contribute to the project as part of their interactions with the water sector as a quality regulator. But, input to this project would be just as valid from the Environment Agency as an asset manager of FCRM assets.

Figure A3 – The UKWIR Capital Maintenance Common Framework
Observation 2:
Whilst the common framework was developed for the water sector as a planning framework to support the price review process, the basic principles it applies in terms of understanding both past and current performance (Stage A) and using this information to forecast future service through deterioration and service modelling (Stage B) are just as valid for FCRM as they are for the water sector. The Environment Agency should consider the application of the common framework within its FCRM asset maintenance in order to understand and quantify future forecast investment needs for asset maintenance.

Water company asset management assessment

A.20 The Asset Management Assessment (AMA) approach was Ofwat’s process of independent assessment and judgment of the company final business plans and representations in the 2009 price review. It was a rigorous process and draws on the evidence from company and independent reporters. We applied the AMA approach to determine capital maintenance expenditure assumptions for final determinations. The AMA approach is based closely on UKWIR’s ‘Asset management planning assessment process – a methodology for self assessment’ (AMPAP).

A.21 More details of the AMA approach can be found at [http://www.ofwat.gov.uk/publications/pricereviewletters/ltr_pr0937_ama](http://www.ofwat.gov.uk/publications/pricereviewletters/ltr_pr0937_ama)

A.22 The AMA challenge process used Ofwat’s assessment of the quality of the technical data, the processes applied and the quality of the decisions that the water companies made in their final business plans for capital maintenance.

A.23 The assessment in the form of a score (the AMA score), by subservice, is carried out over a range of criteria that are based on CMPCF (common framework) and asset management planning assessment process (AMPAP) principles and informed Ofwat’s view of the overall strength of the companies’ proposals.
**Figure A4 – AMA analysis for Water Infrastructure**

<table>
<thead>
<tr>
<th>No.</th>
<th>High-level area</th>
<th>Number of components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stakeholder engagement</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Governance, policy and strategy</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Management</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Processes</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Systems</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Data</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Analysis</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Reporting</td>
<td>1</td>
</tr>
</tbody>
</table>
A.24 A more detailed overview of the AMA high-level areas and components can be found in Table E1 in Appendix E.

A.25 Ofwat’s assessment through the 2009 price review identified broad success against the implementation objectives within MD161 and the common framework, although this is not universal across all the companies and sub-services. The following table sets out the AMA scores achieved by each company at sub-service level for the final determinations in December 2009.

<table>
<thead>
<tr>
<th>FD09 AMA scores</th>
<th>Water infrastructure (WIRE)</th>
<th>Water non-infrastructure (WMNI)</th>
<th>Sewerage infrastructure (SIRE)</th>
<th>Sewerage non-infrastructure (SMNI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>3.80</td>
<td>3.72</td>
<td>3.63</td>
<td>3.59</td>
</tr>
<tr>
<td>Average</td>
<td>3.45</td>
<td>3.28</td>
<td>3.36</td>
<td>3.22</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.70</td>
<td>2.58</td>
<td>3.03</td>
<td>2.65</td>
</tr>
</tbody>
</table>

A.26 A water company specific view of the AMA scores can be found in Table E2 in Appendix E.

A.27 The AMA challenge process has been used to both benchmark the asset management capability of the water industry and to determine the level of investment that should be assumed in price limits for the final determinations.

A.28 Where the AMA score was strong there was evidence to justify the water company business plan and the company’s view was accepted within price limits (or could even receive a reward above that proposed by the company). Where the AMA score was weak, then levels of investment proposed by the company were not applied in price limits and were adjusted - the underlying business processes and data did not support the investment levels presented within the business plan. The AMA challenge
process therefore acted as an incentive mechanism to improve asset management processes and procedures in order that the business plan was accepted. Water companies responded to this incentive with a significant amount of effort over the period of the price review, improving the quality of the business processes and submissions by the water company and responding to feedback that was given by Ofwat on three separate occasions throughout the price review.

A.29 Whilst the AMA process has not been repeated for the PR14 price reviews, many companies have continued to apply the AMA scoring mechanism as a self assessment tool to demonstrate improvements in their asset management processes and capabilities to their Boards and to Ofwat.

A.30 As part of the maintenance review of the Environment Agency FCRM assets the AMA process and scoring has been applied to the business processes, data and procedures that have been reviewed in order to form an AMA score for the separate asset groups being managed by the Environment Agency.

Analysis and observations

Stakeholder engagement

A.31 Section 1 of this report has already discussed the duties of the Environment Agency for FCRM assets and has observed that;

A.32 The Environment Agency’s duties towards flood risk properties and land are permissive and different from those for the Water and Sewerage companies. There is no duty to provide flood defence assets to flood risk properties and land. FCRM assets are only constructed when they are the most cost beneficial solutions within the programme; similarly they are only maintained when they are the most cost beneficial. The Environment Agency has no legal duty to maintain a flood defence asset once it is constructed, although, it does in certain circumstances have contractual obligations.

A.33 The Environment Agency manages flood risk with permissive powers, which is a distinctly different duty to maintaining and providing a service for the water companies.
A.34 The absence of a duty to maintain a flood defence asset once it has been constructed is quite notable. As this relieves the Environment Agency (and hence the tax payer) of any commitment (or liability) to invest in the asset in the future.

A.35 The issue of concern is that by undertaking a construction project to create a flood protection asset, it could be argued the Environment Agency has created a legitimate implicit expectation that the asset will be maintained to those who are protected by the FCRM asset. This implicit expectation is contrary to the roles and duties that are currently set out for the Environment Agency.

A.36 In economic terms, the investment that has already occurred has been ‘sunk’ in the asset, based upon a series of assumptions of maintenance in order to secure the benefits of flood protection during future periods of high river flows. If the future maintenance is not secured then the potential benefits of the asset over its lifespan may not be delivered. Ultimately, this may undermine the basis of any cost benefit assessment undertaken at the time of construction.

A.37 Arguably this position is further exacerbated when partnership funding from third party sources is considered. This funding has been provided on the basis of the potential benefits being delivered. If a future maintenance regime does not occur and the benefits on which the original scheme is based are not delivered, then the basis of partnership funding is undermined. Such a scenario would undermine the customer legitimacy of partnership funding.

A.38 The Environment Agency are aware of this issue and are currently developing a national legal agreement for maintenance where contributors demand future commitments as a requirement of partnership funding. Whilst contractual arrangements for maintenance commitments are not currently commonplace, they will increase over time as contributors to partnership funding demand such commitments.

A.39 The dichotomy of this scenario is that contractual arrangements are entered into through partnership funding in order to secure third party funding, but no commitment is put in place to maintain when the scheme is fully funded by the taxpayer, even though the level of taxpayer commitment is higher and more substantial than through partnership funding.
A.40 There is no requirement for the Environment Agency to maintain a flood defence asset once it is constructed. There may be a clear difference of expectations between the choices of the Environment Agency and its ultimate customers, the tax payer, and the owners of properties and land at risk of flooding.

A.41 The definition of customer in the flood risk management context is distinctly different from the water sector where there is a direct relationship between water company and the customer who is also the bill payer. In the case of flood risk management the “customer” could be defined as the taxpayer or could be defined as Government (through Defra) who act as a proxy for the customer through elected Ministers. The owners of property and land at risk of flooding would be defined as the beneficiaries of flood protection.

Observation 3:
There is no requirement for the Environment Agency to maintain a flood risk defence once it is constructed. Partnership funding has the potential to confuse this position when contractual arrangements are not clarified.

In considering any increased clarity of expectations, consideration of the effective lifespan of the flood defence asset and over what period an economic benefit has been assessed within the original construction design life should continue to be taken into account.

A.42 A culture of service provision is essential to maintain legitimacy for flood defence both with stakeholders and with the general public. Front line staff during flooding events are to be applauded for their dedication, commitment and resolve in the face of significant flooding events and their dedication has been recognised by many political commentators since the flooding events in the winter of 2013/14. Water companies have also been undergoing a service provision transformation mainly driven by the Service Incentive Mechanism (SIM) which has focused the companies on understanding service provision from the customers perspective. The SIM concentrates on the customer experience across all interactions with the water company rather than metrics such as how quickly phone calls were picked up or how quickly letters were answered. Instead the customer experience deals with whether the customers issues were resolved and whether the customer is satisfied with the company response. The SIM journey has been quite transformative for the water companies who have looked closely at the processes and procedures for both front line and call centre staff and have examined the hand off between these groups as part of an overall customer experience.
A.43 In the context of this review it has been interesting to observe many of the same customer experience challenges within the flood defence staff interactions with customers impacted by flood defence activity. There are many areas where customer service interactions are similar and where the benefits of the SIM journey could be applied within the Environment Agency interactions.

Observation 4:
The Environment Agency should consider applying the principles within the Service Incentive Mechanism (SIM) customer experience across its customer engagement and front line staff interactions. Such an application should consider the experience of the customer and hand offs between different elements as part of staff interactions and how these maintain ownership and accountability within the organisation.

Engagement with customers and other stakeholders

A.44 Stakeholder engagement processes between the water sector and FCRM programmes are also very different, but both seek to deliver transparency of decisions and maintain the legitimacy of the service and outcomes being delivered.

For the water sector

A.45 Whilst past price reviews have sought to provide greater involvement and shape company business plans through Willingness to Pay (WTP) surveys and data, the price review in 2014 has sought to increase customer legitimacy in water companies' business plans:

- focusing more on the outcomes customers want;
- delivering for consumers, including current and future customers and the environment, in the long term; and
- taking more ownership of – and accountability for – what they deliver.

A.46 Ofwat has required that each company and its Board now have a Customer Challenge Group (CCG), which will challenge:

- the quality of their customer engagement; and
- how well their proposed outcomes, associated commitments and delivery incentives reflect their customer engagement, and wider consumers' views and priorities.
A.47 There are three stages to the process;

a) Company Boards will develop and propose outcomes and associated commitments and incentives that reflect their customers’, and wider consumers’, views and priorities.

b) The CCG will challenge the quality of companies’ customer engagement and the extent to which the business plans put forward by their Boards reflect their customers’ views, and wider consumers’, and provide an independent report to Ofwat at the same time as companies submit their business plans. The report may also include views from CCG, including the environment and quality regulators, on whether a company’s plan will ensure it meets its statutory obligations.

c) Ofwat will make the final assessment of companies’ outcome commitments as part of its risk-based review and if necessary, challenge companies’ business plans and use the views of each CCG as a key input into this.

A.48 A key benefit of the interaction between the company Boards and the CCG is the review of the customer surveys and how this willingness to pay information is used to shape the outcomes the company plan will deliver. This willingness to pay information is then used within the water company optimisations of the investment programme, which is in-turn, challenged by the CCG.

A.49 There must of course be adequate assurance processes and the water companies should be transparent with their customers on the delivery of outcomes and any financial consequences. This is essential to preserve the legitimacy in the sector around outcomes and this will continue to be a strong focus of Ofwat’s scrutiny going forward for PR14 and beyond.

For the Environment Agency

A.50 Regional Flood and Coastal Committees (RFCCs) help to provide governance for the Environment Agency Flood and Coastal Erosion risk management functions and cover all flood risks that are not the responsibility of the water companies. They have replaced the Regional Flood Defence Committees which previously existed. There are currently 11 Committees across England.

A.51 RFCCs have three main purposes:
a) to ensure there are coherent plans for identifying, communicating and managing flood and coastal erosion risks across catchments and shorelines;
b) to promote efficient, targeted and risk-based investment in flood and coastal erosion risk management that optimises value for money and benefits for local communities; and
c) to provide a link between the Environment Agency, LLFAs, other risk management authorities, and other relevant bodies to develop mutual understanding of flood and coastal erosion risks in its area.

A.52 Both the CCGs and the RFCCs have similar roles in providing challenge and to help shape the investment programmes within their respective regions. They play an essential role in maintaining customer legitimacy for both programmes.

A.53 The RFCC also influence the moderation of priorities and has the ability to raise and direct a local levy. The RFCC members represent local authorities and provide a democratic legitimacy.

A.54 The Environment Agency prioritisation process follows the FCRM project appraisal guidance (PAG) and Multi-coloured manual (MCM) that is an interpretation of the HM Treasury Green Book. This prioritisation methodology represents a national economic perspective in comparison with the willingness to pay information from the region being served by the water companies and CCGs.

A.55 The RFCC also “consents” the overall FCRM programme of work – so could theoretically refuse their consent to the programme. The FCRM programme is substantially funded from central Government so any proposal to allow an RFCC more flexibility to decide priorities assumes that an RFCC is allocated a block of money and gives priority within that funding.

A.56 This creates obvious tensions between individual RFCCs and the overall funding availability. Behaviourally this creates the potential for regional allocations of funding and bidding behaviours rather than business planning and needs appraisal. There is also the challenge that each region starts to set their own priorities leading to differential levels of risk allocation and tolerance across the regions.
There remains a risk that the national economic perspective of avoided damages may not represent the views of the regions on which the RFCCs are based and this could undermine the customer legitimacy of the current prioritisation process. Arguably this is the dynamic that drives partnership funding to fill the gap between national funding of avoided damages and local priorities through either a local levy or other funding sources.

In defence of the existing avoided damages approach, the application of willingness to pay to flood risk is technically challenging as flood risk is funded through general taxation rather than through a separate water bill.

The role of RFCCs in bringing customer legitimacy to new flood defences through a consenting of funding on cost benefit grounds or in the provision of partnership funding is very clear and well understood. However, the role of RFCCs around maintenance activity is less well understood, here the Environment Agency should have the freedom nationally to balance maintenance priorities and seek out the most economic and efficient interventions to maintain the asset base. The role of the RFCCs should be to hold the Environment Agency to account for the performance of the asset base as well as directing funding to the management of specific risks.

**Observation 5:**
The application of consumer preferences (such as WTP rather than the avoided damages approach) should be considered within the prioritisation of FCRM investment. This could potentially improve customer legitimacy of the investment programme.

The application of this should be considered separately for both the creation of new flood defence assets and for the maintenance of existing assets. The interaction of these with the role of the RFCCs should also be considered.

**Choice of planning objective**

Following privatisation, the water companies were initially regulated through inputs (ie. length of water mains renewed, number of treatment works constructed), then through specified outputs (such as drinking water quality and environmental compliance) with rewards and penalties directly linked to the achievement of the outputs.

For the 2014 price review, a key element of the methodology is that companies will develop with stakeholders and propose in their business plans the outcomes they will deliver rather than the outputs.
A.62 Outcomes are what customers value and want and need. They are likely to be longer lived than the current outputs, which are generally restricted to the five-year price control period. Companies will need to propose milestones and measures that should be used to monitor progress in delivering these outcomes.

A.63 Throughout the price review the water companies are developing outcomes through a process of consultation and engagement. By giving the companies responsibility and accountability for setting outcomes they should become less dependent on the regulatory framework to determine deliverables. This places decisions clearly with those that are best placed to take them, and should lead to better results for companies, the environment and customers.

A.64 By setting longer-term outcomes rather than short-term outputs, the water companies are incentivised to plan for the longer term. Holding the companies to account for delivering their outcomes rather than more detailed inputs or outputs gives them significantly more freedom to innovate and find more sustainable solutions.

A.65 The application of outcomes within the 2014 price review involves the development of an outcome, performance commitments and outcome delivery incentives (ODIs).

A.66 An example of an outcome could be to “Deliver safe, clean drinking water to our customers”, a performance commitment could be “to maintain 99.98% drinking water compliance from 2015 to 2020”, an outcome delivery incentive could be where the company could be rewarded to achieve 100% compliance or face financial penalties should compliance fall below 99.96%. The scale of rewards and penalties should be based upon the value that customers place on the outcome (as assessed through willingness to pay).

A.67 For the Floods and Coastal Risk Management programme, there are a number of conditions associated with the current budget commitments;

a) increased protection for at least 300,000 households between 2015/16 and 2020-21
b) meet agreed targets for the condition of high-consequence flood defences by March 2015, including the date by which 97% of these assets will be returned to target condition; and
c) provide the monitoring and assurance to ensure delivery of these outputs.
A.68 The first priority, is to ensure that the most critical defences are repaired and functional before the coming [2014] winter, followed by returning 97% Environment Agency defences in high consequence areas to target condition as quickly and cost-effectively as possible.

A.69 The conditions associated with the FCRM programme are defined at the level of outputs. Given the current priorities and level of development of the FCRM asset management processes, the specification of these conditions as outputs is entirely appropriate in the short term.

A.70 These outputs are focused on the physical condition of the Environment Agency high-consequence flood defence assets and how these deliver risk reduction. The inter-relationship between FCRM assets, third party assets and the Environment Agency’s operational response are not factored into these specified outputs. In short, they do not fully reflect the outcome to the properties at risk of flooding. Outcomes would capture the properties & people defended in given circumstances, compared to what would have happened had the Environment Agency not acted; and the reductions to damage as a result of people acting on these warnings. The Environment Agency does have ‘outcome’ measures within its corporate plan such as;

- continue to reduce the risks of flooding for more households
- increasing the resilience of people, property and businesses to the risks of flooding and coastal erosion

A.71 In considering improvements of the FCRM asset maintenance approach as part of this review, it is essential that there are clear and well understood outcomes, outputs and performance measures with coherency between them and a clear line of sight from outcomes to interventions on the ground. Delivering outcomes rather than more detailed inputs or outputs should give the Environment Agency significantly more freedom to innovate and find more economic, efficient and sustainable solutions.

Observation 6:
The benefits of customer driven outcomes for the FCRM programme should be explored and developed further, particularly being more explicit on the role of maintaining existing flood defences. An example would be “maintaining and improving the resilience of people, property and business to the risks of flooding and coastal erosion.”

The outcome should concentrate on the benefit to the end user – for example KPI962 reflects asset condition rather than benefit to the end user (or beneficiary).
A.72 Consideration should also be given to the development of a suite of performance commitments. These outcomes and performance commitments should encourage all of the flood risk authorities to work together and for the Environment Agency to deliver the full range of its functions and duties (eg. including duties around third party assets as defined under the Floods and Water Management Act.)

A.73 As part of the development of these performance commitments consideration should also be given to the development of performance incentives to encourage innovation and allow both the Environment Agency and the RFCCs greater choice around the reinvestment of efficiencies. These commercial incentives do not come naturally to the FCRM investment programme as it delivers a public good and therefore does not have the profit incentive of a commercial business, however, through the development of appropriate incentives these principles can be emulated. As an example, the development of a pain/gain mechanism could be used to incentivise positive management action to outperform through the reinvestment of efficiencies. Such incentives will encourage outperformance which will in-turn deliver further efficiencies and reduce the cost of future investments. Appropriate governance and oversight of such incentives will be essential.

**Observation 7:**

The development of performance commitments and outcome delivery incentives (ODIs) for the FCRM programme will provide greater clarity of objectives and transparency with the end user or customer.

Consideration should be given to the development of an appropriate incentive mechanism to incentivise innovation and positive management action by the Environment Agency.

**Valuation of service benefits**

A.74 The valuation of service benefits in the water sector for properties flooded with sewage is based on cost benefit. Willingness to pay research undertaken over the last ten years has identified a marked difference in the willingness to pay (WTP) for sewer flooding when compared with the willingness to accept (WTA) a reduced service level, this data suggests that customers prefer service to be maintained more than they are prepared to pay for new properties to have flooding alleviated (on a property by property comparison). Whilst this conclusion is based upon information on sewer flooding the comparisons with fluvial flooding and FCRM are obvious.
A.75 There tends to be a linear relationship between the alleviation of sewer flooding properties and customers willingness to pay for new properties, however, there is a much sharper reduction in the willingness to accept a reduction in service. In short, the valuation of these two functions is not symmetric, this relationship is important to recognise when planning maintenance expenditure in a cost benefit analysis.

Figure A5 – Willingness to pay, willingness to accept differences

A.76 This relationship comes into importance when you are considering not undertaking maintenance on a specific asset when compared with putting in place new flood protection for new properties. The relationship between WTP/WTA in the water sector implies that customer research suggests that the maintenance of existing flood defences is a higher investment priority than in comparison with providing flood defences for newly flooded properties. In short, the customer is articulating that “If you can’t afford to maintain the assets you’ve got, you should not be building new ones!”.

A.77 Figure A6 shows the actual data captured for this relationship as part of willingness to pay assessments by United Utilities in 2009. (Reference: http://www.eftec.co.uk/docman/envecon-2009/economic-valuation?limitstart=5)
Figure A6 – Willingness to pay, willingness to accept for sewer flooding within United Utilities in 2009.

A.78 The Environment Agency prioritisation process follows the FCRM project appraisal guidance (PAG) and Multi-coloured manual (MCM) that is an interpretation of the HM Treasury Green Book. The benefit assessment undertaken is based upon cost benefit but currently applies the same benefit for maintaining an asset as for the provision of new flood defences. The Green Book (Annex 2, paragraph 6 on page 57) is quite clear that WTA may be an appropriate valuation approach.

A.79 However, no specific data is available to describe the relationships between WTP and WTA for flood defence investment. Estimated values could be developed by either undertaking specific customer research or by translating the water sector experience and applying translation functions to flood defence benefits valuation.

Observation 8:

Benefits assessment for maintenance within FCRM using a consumer preferences approach could consider the use of alternative methods (for example WTP and WTA). Any surveys to gather consumer preferences data could be undertaken on a periodic basis (typically say once every five years) with the consumer preference data being applied within programme prioritisations. Maintenance schemes could be assessed on cost benefit ratios using for example WTA, whilst enhancement of new flood defences could use cost benefit ratios derived with consumer preference data.
**Governance policy and strategy**

**Governance**

A.80 Governance of the investment programme exists within the Environment Agency at a number of levels.

A.81 Defra and HM Treasury define both the funding and output conditions associated with the investment programme.

A.82 Governance of the programme within the Environment Agency is currently evolving as a result of changes in regional structures. The proposed governance arrangements are described in the following diagram.

**Proposed high level line of sight between National & Area**

![Diagram](image)

*Figure A7 – High level line of sight and governance between national and area structures within the Environment Agency*
A.83 The decisions around shape and overall content of the investment programme are supported by both regional flood committees (RFCC) and through an advisory group called the National Programme Board.

A.84 The review has examined board papers and progress reports from both the National Programme Board and those presented to the Environment Agency Board. Governance arrangements and processes have been reviewed for the individual projects and for the terms of reference for the FCRM Regional Programme Boards.

A.85 The papers and progress reports are generally concerned with the governance around expenditure allocations and funding, with some focus applied to the targets set in terms of benefits.

A.86 These papers appear to be at the heart of the decision making and governance processes within the FCRM programme. However, focus is generally around the management of funding allocations rather than whether the programme is delivering value and benefit. The style of the papers is a presentation of allocation and targets, with some tracking of progress, little is described of the full extent of delivery, progress throughout the year, risks to delivery and action plans for recovery if targets are at risk of not being delivered.

A.87 It is unclear how the members of these two boards can challenge and affect the shape of the programme given that risks and actions plans for recovery are not clearly articulated within these reports.

**Observation 9:**

As part of the current reorganisation, the Environment Agency should consider governance and accountability processes for the review of both the expenditure and the delivery of outputs and outcomes across the investment programme between the programme management team, the Environment Agency Executive team and the Environment Agency Board.

These governance and accountability procedures should be clearly documented and set out. Papers associated with key decisions should also be clearly documented, particularly to demonstrate whether the proposed programme meets the requirements and conditions set out by Defra and HM Treasury.
Policy

A.88 Policy for Flood and Coastal Risk management is defined by Defra, the polices for benefit assessment and for partnership funding and grant in aid funding are clearly set out and visible within the Defra website.

Strategy

A.89 Over the past two price reviews water companies have developed a clear line of sight between their long term strategies for the company (typically called their Strategic Direction Statements), through their individual five year business plans and then through to their yearly and day to day operations. As part of Ofwat’s risk based review of the company business plans we examine this line of sight to ensure that it is coherent and reflects the needs of the customer as well as the needs of the water company. The review of this line of sight is inherently part of the price review process to test the validity of the five yearly business plan in the context of the long term resilience and sustainability of the companies operations.

A.90 The Environment Agency last published its long term investment strategy for Flood and coastal risk management in 2009, a revision to the document is due to be published in 2014.

A.91 The strategy describes;

- the present scale of flood and coastal erosion risk, and the achievements in managing it so far;
- an analysis of the investment needed to adapt to climate change and manage the potential increased risk over the period 2010-2035;
- ways to manage flood and coastal erosion risk more efficiently;
- an analysis of the benefits of investment, and the potential to broaden the sources of investment

A.92 The strategy sets out the potential investment needs up to 2035 and identified a preferred investment scenario that sought increases in funding year on year up to 2035.
A.93 The strategy identified potential partnership funding to support this activity as well as potential efficiencies the Environment Agency could deliver through procurement and contract efficiencies.

A.94 Much has changed since the Long Term Investment Strategy was written in 2009, with a change of Government, times of austerity and budgetary reform, a number of aspects of the strategy are in need of review.

A.95 The Environment Agency has reacted to the changing political landscape since 2009 in the delivery of the investment programme. The nature of the investment programme over this period has necessitated a bidding and negotiating approach to secure funding rather than a planning approach to determine long term investment need. An updated Long Term Investment Strategy is currently being developed by the Environment Agency and Defra and is scheduled for publication in 2014.

<table>
<thead>
<tr>
<th>Observation 10:</th>
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<tbody>
<tr>
<td>The Long Term Investment Strategy for Floods and Coastal Risk Management due to be published in 2014 should be aligned with the 6-year investment and maintenance programme.</td>
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</table>

Alignment of policy, strategy and governance

A.96 A part of the review, it has been possible to see how the policy, strategy and governance of the Environment Agency has been applied and how these link back to the key documents. However, there is not a clear line of sight between policy, strategy and governance within these documents due to the rapid pace of change of these policies and positions in the intervening periods. It is suggested that as the strategy document is reviewed in 2016 that the line of sight between these documents and procedures is further reinforced and clarified.

A.97 A clear line of sight should exist between Government Polices, the Long Term Investment Strategy, Environment Agency procedures and targets and the investment programme. The LTIS should consider the long term outcomes necessary to protect flood risk properties, land and businesses, the linkage between the LTIS outcomes, the Environment Agency performance commitments and incentives and the procedures should be clear.
Observation 11:
The Environment Agency should consider reinforcing the line of sight between Government policy and the Environment Agency Long Term Investment Strategy as part of the update in 2014.

Management

A.98 The Environment Agency operates a people development process and management process for staff throughout the asset management arena. There are clear development roles and competences for front line staff against the processes and procedures in place.

A.99 Whilst these are clear and well developed for the roles and functions in place, consideration will be required for how these roles and skill sets will need to develop to respond to the recommendations within this review. In particular a strengthening series of skill sets in:

- Asset performance and deterioration modelling;
- Asset targeting and risk management;
- Solution engineering and cost estimation; and
- Investment prioritisation, optimisation and planning.

A.100 Water companies in England and Wales have invested in these areas in the last ten years and have developed efficient processes and skills for individuals involved in asset management, many of the skills and training put in place by the companies would be transferable for application within the Environment Agency.

Observation 12:
The Environment Agency should consider the roles and skills sets needed following the recommendations of this review and in particular in;

- Asset performance and deterioration modelling
- Asset targeting and risk management
- Solution engineering and cost estimation, and
- Investment prioritisation, optimisation and planning.

Processes

A.101 Throughout the review the Environment Agency have provided many detailed standards, policies and procedures associated with the areas of
review. These set out clear business processes associated with the current asset management approach. For the area teams these procedures are well documented and are clearly accessible and understood and delivered by front line teams. These have been documented to ensure consistency and application across the area structures of the Environment Agency. These are well developed and appear to be being applied within day-to-day operations, although due to the short period of this review it has not been possible to confirm they are being applied in all circumstances.

A.102 There are also clear procedures and policies in place around centralised functions such as the NAFRA, MECIA, AIMS and SAMPS, these are well developed and integrated into day to day operations.

A.103 As previously discussed, the following policies and procedures may need to be strengthened and developed:

- Asset performance and deterioration modelling
- Asset targeting and risk management
- Solution engineering and cost estimation, and
- Investment prioritisation, optimisation and planning.

A.104 The Institute of Asset Management has developed both the PAS55 and ISO 55000 standards to reflect the many governance, process and procedures that reflect the functions within asset management organisations. Accreditation against these standards is undertaken by number of bodies within the UK.

A.105 Many of the water companies in England and Wales have sought PAS55/ISO 55000 accreditation to demonstrate development of best practice in asset management and to provide a level of corporate assurance that the asset management activities are economic and efficient. The accreditation reflects both a basic level of asset management capability but also that the organization is seeking to attain continual improvement and development.
A.107 The Environment Agency have already started to prepare for a potential ISO 55000 accreditation with an initial review and assessment already completed. The review support the work undertaken to date and recommends that this proceeds further seeking full accreditation.

Observation 13:
The following procedures may need to be strengthened and developed;

- Asset performance and deterioration modelling
- Asset targeting and risk management
- Solution engineering and cost estimation, and
- Investment prioritisation, optimisation and planning.

These procedures are not fully developed, may not reflect robust business processes or may require further development in order to be integrated into day to day operations.

Observation 14:
Given the quality of existing standards, policies and procedures the Environment Agency should consider PAS55/ISO 55000 accreditation. Such accreditation will support many of the recommendations in this report and will provide third party accreditation and governance procedures that improvements have been put in place and delivered.

Systems

A.108 The systems in place within the Environment Agency for asset management closely reflect many of the systems in use within the water companies in England and Wales. Whilst there are some gaps in the system available there are many recent systems that are essential to efficient asset management. The recent creation of some of these systems reflects the asset management journey of the Environment Agency and further work is required to strengthen the data sets within these systems and the business processes associated with them.
A.109 These systems reflect the data layer within Figure A8 and act as the data warehouse for FCRM asset management. The water companies have very similar systems to these acting as asset inventory, performance data, deterioration modelling, risk registers and risk modelling tools. However the water companies have also developed a number of additional systems associated with the modelling of asset risk, asset targeting, solution engineering and programme optimisation and modelling tools.

A.110 The Environment agency has six key systems to support FCRM asset management AIMS, SAMPS, CMMS, NAFRA, UCD and CAMC2.

A.111 AIMS is the asset inventory for the asset dataset and has been recently implemented bringing together data sets from the regional datasets into a common single dataset for all FCRM assets. AIMS also holds the asset condition information for the assets.
A.112 SAMPS is the local asset team asset management tool and manages the local asset system strategies, actions and activities for the local asset management teams. It holds the risk associated with each system and the proposed solutions. Information within SAMPS is the basic risk information upon which the maintenance investment programme is based.

A.113 NAFRA is the risk assessment tool for all FCRM assets and provides probability and consequence information for each asset system, property and FRM system within the SAMPS tool.

A.114 UCD holds the capital unit costs of delivery for different construction activities and is updated based upon feedback from the capital delivery programme. This UCD information supports the basis of cost calculation for the costs of individual solutions (for asset replacement) held within SAMPS.

A.115 The CMMS system holds the inventory of Mechanical, Electrical, Instrumentation, control and automation (MEICA) assets. It also provides work management to plan issue and track the progress of work and record the cost and completion of work.

A.116 The CAMC2 system is currently under development and is due to be operational by 2017. This system will act as a work management system, recording specific operational tasks on each asset, supporting efficient delivery through work scheduling and task management of operational activities. Currently asset level cost information is not recorded on any national Environment Agency system.

A.117 These six systems represent the basic building blocks of information for an asset management organisation. Many of these systems are relatively new and reflect new information being available to the Environment Agency.

A.118 AIMS and CAMC2 systems capture and store the asset inventory, condition and performance information. A particular gap at this time is that the lack of visible work scheduling and performance information for flood defence assets, without this information it is difficult to target remedial capital interventions accurately or to assess the root cause of asset failure. Such information is also essential to calibrate deterioration modelling which would support the prediction of future asset risk. CAMC2 will deliver these requirements and is therefore critical to future investment planning.
A.119 Whilst this information is clearly missing for flood defence assets, MEICA assets have a separate work scheduling and performance system (CMMS) and therefore have a longer history of information on which to base remedial interventions, deterioration modelling and whole life cost asset management.

**Observation 15:**

The CAMC2 system is essential to understand the performance of flood defence assets and this information will improve asset targeting. The implementation of the CAMC2 system is already approved and delivery is underway.

This review supports the delivery of the CAMC2 system as it will support the delivery of further efficiencies and improvements in asset management through effective scheduling and targeting of asset and operational interventions.

Consideration should be given by the Environment Agency of how to accelerate the delivery of CAMC2 earlier than 2017.

A.120 SAMPS and NAFRA systems support risk management processes and reporting. SAMPS acts as a repository for the asset risks with NAFRA providing quantified probability and consequence information based upon broad scale modelling using asset data, property valuation and flood history, with NAFRA holding the flood history information. Flood history information is verified and quality assured by Area teams and analysed by the NAFRA team before being included in the system.

A.121 For flood risk to be appropriately calibrated it is important that ‘risk’ and flooded properties are reviewed on a regular basis. There is currently a historic backlog with a 2 year lag for flooding information to be checked and analysed within the NAFRA assessments. With this backlog there is a risk that the NAFRA calibrations do not reflect current events. Without an effective and timely review there is the potential that investment decisions may not be appropriately targeted at high risk properties.

**Observation 16:**

The Environment Agency should review the available resourcing and business processes associated with verifying flood history information. A KPI should be introduced to reflect the time from a property being flooded to being recognised within the flooding history. The time period from a flooding event to being on the flooding history database within NAFRA should be no more than three months.

A.122 Asset deterioration and analysis tools do not exist within the Environment Agency portfolio of systems. These tools take performance data from
systems like CAMC2, alongside asset inventory information in AIMS and analyse the performance of cohorts of assets to determine calibrated deterioration models and to determine the probabilities of asset failure. The use of such calibrated asset probabilities and risk alongside NAFRA data sets should allow more accurate asset targeting (especially when implemented through a GIS interface). Such systems greatly improve the ability to target asset interventions leading to well defined interventions at least whole life cost.

A.123 Such tools could either be developed in house or supplied from a number of different consultants such as ICS, SEAMS, Tynemarch or WRc who have all developed detailed deterioration modelling suites of software.

**Observation 17:**
The Environment Agency should consider the development and implementation of asset deterioration and analysis tools to improve asset targeting and deliver whole life cost solutions.

A.124 Programme optimisation and management systems do not appear to have their own dedicated systems with programme management being undertaken through Excel spreadsheets. Improvements in systems to support programme optimisation, scheduling and programming will support the delivery of further efficiencies and improved asset targeting by providing the ability to bundle assets and investment and maximise cost benefits.

A.125 Such tools could either be developed in house or supplied from a number of different consultants such as ICS, SEAMS, Tynemarch who have all developed programme optimization software to interact with the deterioration modelling suites described above.

**Observation 18:**
Dedicated programme optimisation and management systems should be considered to support the ability to target asset interventions and deliver future efficiencies.
A.126 The financial systems within the Environment Agency are developed alongside shared services from a number of government agencies. Whilst they are appropriate to support financial control of a government body, the system design and architecture may not be supportive of the needs of an asset management infrastructure body.

A.127 In particular, the financial system may provide costs associated with financial transactions and invoicing within the organisation but does not provide sufficient granularity of cost for individual assets or installations in order to be able to establish whole life costs for the assets or to monitor real time costs of operation.

A.128 Water companies in England and Wales have invested significantly in financial systems that hold both financial and performance information within the same system. Typically these financial systems are modular in nature and reflect the needs of the different elements of the organization (eg. SAP is a modular financial system delivering a number of different facets through a common system).

**Observation 19:**

The Environment Agency should consider whether the existing financial systems are appropriate for the asset management needs of FCRM. Alternative financial systems (or modules) for FCRM may need to be considered which then align and integrate with the corporate financial systems for the Environment Agency.

If these gaps cannot be addressed within the financial systems then they may need to be separately addressed through systems such as CAMC2.

Alternatively modules may well be available from the financial system already in use and may be applicable to a number of government agencies (eg both the Environment Agency and the Highways Agency.)

**Data**

**Asset observations**

A.129 The primary Environment Agency data set on assets is that within the asset inventory AIMS system, the review has examined the quality of the information in this system based upon its application within the common framework and has highlighted particular areas where data quality is good and other areas where data could be improved.
A.130 The AIMS data contains information concerned with the physical dimensional attributes of the assets such as flood defence height, width etc. This information is important for the modelling of rivers and channels and is essential to establishing the capability of flood defences to protect properties under different climate change and rainfall scenarios. This data is essential to establish good modelling through NAFRA regarding the hydraulic capability of the rivers, channels and culverts.

A.131 However, whilst a great deal is known about the physical attributes of the assets some essential information associated with the management of the assets is incomplete.

![Figure A9 – Asset information extracts from the AIMS system](image)

A.132 Figure A9 details an extract from the AIMS data set showing that information concerned with the date of construction is missing for between 83-89% of flood defence embankments and walls. With the asset material of 17% of flood defence walls being described as ‘other’.

A.133 Age and material information are key pieces of information within deterioration modelling as you need to examine the effect of time on the asset components, without this information it will not be possible to undertake forward looking risk based analysis and predict the future need for investment as a result of asset deterioration.
A.134 Figure A10 details a similar extract from the MEICA dataset, this shows a very different story, with a much higher level of data population around the age dataset for the MEICA assets (which generally have a shorter life span). The MEICA dataset therefore is much more capable of being used to undertake forward looking risk based analysis and deterioration modelling.

![Pump install and replacement years - Environment Agency](image)

**Figure A10 – MEICA asset information extracts on asset age**

A.135 A data improvement project should be undertaken on the AIMS data set to identify critical data issues (similar to the asset age issue highlighted above) and then to undertake a project to improve this data set. Activities to improve this could include:

- Updating from recent construction drawings (both design and as-built drawings as it appears recent construction information may not have been updated on the AIMS system);
- Use of historical maps from Ordnance Survey to identify the age of earth embankments and flood walls;
- Review of historical photographs taken of channels;
- Aerial photographs undertaken by both English and German forces from the second world war;
- Aerial surveys undertaken by the Environment Agency;
- Use of innovation technology such as drones for aerial surveys, condition surveying and monitoring of rodent infestations; and
- The application of age rules based upon construction material

A.136 The management and improvement of this data should be undertaken by a dedicated team with clearly defined ownership and accountability of the data and the remit and resources to analyse and improve the asset data set.

**Observation 20:**
The Environment Agency should undertake a data improvement project for the FCRM datasets based upon critical information for asset management processes and deterioration modelling.

A.137 The creation of the CAMC2 system has already been discussed in section 3.6, this system supports the collection of performance and cost information around the flood defence assets. The scope of the CAMC2 project has been based upon the collection of activity and performance information to improve operational efficiencies. As part of the system development for CAMC2 a review should be undertaken to consider whether this data set supports:

- the operational needs of the assets base;
- the processes to improve efficiency through improved scheduling and task management; and
- the information needs for the asset deterioration and analysis tools identified within this review.

**Observation 21:**
The Environment Agency should review the CAMC2/CAMC3 specifications to ensure that the data set supports the development of the asset deterioration and analysis tools.

**Serviceability data and associated costs**

A.138 Serviceability has been used in the water sector for over 15 years to describe the ability of the assets to deliver the flow of services to customers. Serviceability has been defined by a series of metrics for each sub-service; these contain a mixture of lead and lag indicators as well as both asset and service measures.
A.139 The objective set for each water company is to maintain all of these metrics in a stable condition and hence demonstrate they are complying with their Section 37 and 94 duties to maintain their asset bases for the water and sewerage services. A stable measure is one that is oscillating around a defined reference level within defined upper and lower control limits. Measures can also be classified as improving, marginal or deteriorating, where marginal is where a measure has moved from stable into failure for the first time, subsequent failures result in the measure being classified as deteriorating. Figure 3.7.2 provides an overview of reference levels and control limits. More detail on serviceability can be found at – http://www.ofwat.gov.uk/publications/pricereviewletters/ltr_pr0938_serviceability

A.140 Where a sub-service is classified as marginal or deteriorating the water companies are at risk of being shortfalled. This is where costs already funded are recovered and returned to customers regardless of whether the funding has already been incurred. This acts as a significant incentive on the companies to improve their asset management capability in order to maintain their serviceability as stable.

**Figure A11 – Serviceability reference levels and control limits**
A.141 The serviceability metrics are designed to provide information around the condition, performance and service delivered from the assets, as such, the serviceability basket of measures is more comprehensive in understanding whether an overall stable asset position is being achieved.

A.142 For FCRM structures and defence assets the primary KPI for measuring the performance of the assets is based upon asset condition grade. Asset condition is relatively basic and only reflects the basic structural integrity of the asset rather than whether the asset is capable of maintaining flood defence capability to the end customer. There are separate reliability metrics for MEICA assets and conveyance metrics are being developed for channels.

A.143 As no other asset performance metrics are currently collected, asset condition is the only measure currently available. The CAMC2 system will capture and record many other performance metrics that can then be used in association with the asset condition measure to determine whether serviceability of the FCRM asset base is stable. This broader serviceability basket of measures will give greater confidence to the Environment Agency management, Defra and other stakeholders that investment is being targeted appropriately.

A.144 In order to improve stakeholder transparency it is recommended that these metrics be placed in the public domain on a yearly basis once appropriate assurance and governance has been completed.

**Observation 22:**

The Environment Agency should develop serviceability metrics and a basket of measures to demonstrate stable serviceability of the FCRM asset base.

These measures should be published in the public domain to give greater confidence to stakeholders that investment is being targeted appropriately.

A.145 Cost data associated with operational maintenance is captured at a system level for specific activities and has not traditionally been captured for individual flood defence assets (such data is more routinely captured for MEICA assets). As such it is not possible to develop whole life cost approaches given the inherent lack of available information. With the implementation of the CAMC2 system, the Environment Agency will obtain both improved performance information and also a greater understanding of the operational maintenance costs associated with these activities. Currently the Environment Agency are undertaking a benchmarking
exercise (with support from EC Harris) to start to understand these operational costs.

**Observation 23:**
The Environment Agency should capture operational costs associated with maintenance activities within CAMC2 and should use these costs, alongside the performance information to develop whole life cost models for the FCRM asset base.

**Interventions, impact data and associated costs**

A.146 The source data for maintenance interventions comes from System Asset Management Plans (SAMPS) and from the decisions taken by the local asset teams regarding the maintenance interventions they deem to be appropriate.

A.147 SAMPS set out the activities needed to ensure that flood management assets provide the specified standard of service. The plans within the SAMPS provide costs for the maintenance of assets in each flood risk management system. The estimates in SAMPS are needs-based. The identified need is the cost for maintaining all assets to their target condition in accordance with maintenance standards. Minimum needs are also calculated. Minimum need is the considered lowest unavoidable cost of maintaining statutory compliance and operational readiness for a system. It is NOT what is required to avoid deterioration. Where only minimum needs are met, the efficiency of operation and reliability will suffer and accelerated deterioration could reduce asset life. In some systems the minimum need is zero in some years.

A.148 Examples of the SAMPS data set were considered as part of this review. Whilst, the Environment Agency have provided extensive procedures to guide the solution engineering undertaken by the local asset teams, there remains a risk that solutions delivered by one individual or area may differ significantly from those in another. This is evident by some area based benchmarking of maintenance costs by the Environment Agency.

A.149 The process of problem identification or identified need should be reviewed and developed further as the review does not consider this is systematically applied across all of the Environment Agency areas, the current process may contain a level of solution bias and may therefore overstate (or potentially understate) the current asset need.
A.150 Quite naturally, the issue of solution bias is also prevalent between individuals and areas, with some preferring more expensive robust solutions with greater longevity or benefit. However, the current constraints on available funding are also potentially incentivising behavioural and tactical choices by local area teams in the manner in which schemes are placed into SAMPS. Even though the process is needs based, the form of solution engineering applied could result in tactical bidding behaviours with either the costs being inflated or the benefits being overstated for solutions. Such issues are difficult to see at the programme level and may lead to bias in the selection approach.

A.156 Solutions are typically identified on a one to one basis between risk and solution. Limited optioneering is undertaken within the SAMPs and the cost benefit of alternative solutions is not generally considered. This is in part driven by the design of the SAMPS system that does not directly consider a one to many relationships between need/risk and solution.

A.157 The process of splitting between ‘needs’ (as defined risks) and ‘solutions’ is fundamental to understanding optimum whole life cost. For a programme to be considered optimum, it is important that the programme is presented with a series of choices, with different costs and benefits, which it can then compare to build an optimum programme of the most cost beneficial solutions to deliver a given service objective. The approach to capital scheme appraisal at an individual project or strategy level does consider a range of options to achieve the most cost effective delivery of benefits.

A.158 Improvements in the design of the solutions within SAMPS and the manner in which the database of needs and solutions is developed should improve the economic choices of any optimisation process and hence the overall economy and efficiency of the programme. The principle of need and solution optimisation to select the most cost beneficial programme should be at the heart of how investment planning is undertaken in the future.

A.159 The Environment Agency is already addressing some of this solution engineering bias within the current programme to encourage passive design. These principles should be considered further for all types of asset intervention (both operational and capital) to encourage innovation and deliver operational and capital interventions at lowest whole life cost.
Observation 24:
The Environment Agency should further develop the risk based solution engineering procedures and processes within the SAMPS/CAMC systems. This should systematically and robustly determine maintenance benefits for all assets whilst also encouraging innovation and allowing greater choice of solutions and cost benefit to any programme optimisation.

A.160 Capital cost assessment within the SAMPS system for individual solutions is linked to the UCD dataset. This data set contains 8 years worth of data based upon historic target cost data from previous capital schemes. The data set is maintained and supported by contracts with both Turner and Townsend and EC Harris.

A.161 As discussed in A.116 cost data associated with operational maintenance has not traditionally been captured on the flood defence assets (such data is more routinely captured for MEICA assets). As such, it is not possible to develop whole life cost approaches given the inherent lack of available information. With the implementation of the CAMC2 system, the Environment Agency will receive both improved performance information and also a greater understanding of the operational maintenance costs associated with these activities.

A.162 Currently the Environment agency is undertaking a benchmarking exercise (with support from EC Harris) to start to understand these operational costs.

A.163 Benchmarking and the use of econometric models should be considered alongside the CAMC2 data to understand the benchmark operational costs of each area and the factors that drive cost differences.

A.164 Currently, the majority of operational costs are incurred through direct labour costs within the Environment Agency (although some areas have up to 20% costs delivered through locally procured external service providers). As the CAMC2 cost and activity data and the benchmark costing data becomes available, consideration should be given to the balance of activity between DLO staff and external contracts in order to achieve the most efficient delivery. There could well be cost savings in either outsourcing or nationally procured services in comparison with the current DLO and local commissioned contracts.
A.165 Consideration would need to be taken of the availability of staff to respond to flooding events and how external contract partners could support flooding events.

Observation 25:
Once the CAMC2 system is commissioned and the operational benchmarking exercises are completed, the Environment Agency should consider whether there are cost savings in either outsourcing or nationally procured services in comparison with the current DLO and local commissioned contracts.

Analysis

Forward looking analysis

A.166 This element of the AMA approach is based around assessing the forward looking analysis undertaken. The AMA approach breaks this down into historical analysis, performance modelling, consequence modelling, forecasting service, system analysis and interventions.

A.167 From an analysis of the flood defence assets it is apparent that virtually all of the forward looking assessments are not that well developed within the Environment Agency business processes. The Environment Agency is starting to develop these through the first time application of deterioration modelling based upon expert panel judgments. Whilst this is a notable piece of work that informs a basic understanding of asset lives, the deterioration modelling is currently not sufficiently discriminating nor is it based upon any performance based information. As further historic evidence is gathered then the modelling can be enhanced to better understand the relationship between asset deterioration, investment and performance.

A.168 Due to the basic lack of performance information (which the CAMC2 system will start to address) it is not possible to undertake any form of cohort analysis to be able to understand basic asset behaviour over time and hence forecast future service. Some analysis of asset condition could be utilised but that would require a sufficiently long enough asset condition data set (in excess of 10 years of observations) to be able to model asset deterioration.
A.169 Asset condition remains the primary information source to inform asset judgments for maintenance investment across the FCRM asset base and whilst this is a useful measure, it is a lag measure and can only ever be used in a reactive decision making process. The army snapshot of condition across the whole asset base at the same moment in time could be a very useful dataset to assess the impact of the flooding in the winter of 2013-14.

A.170 The NAFRA system examines how aspects such as climate change and urbanisation will affect future hydraulic flows and hence establishes the level of flood defence needed in the future. But the asset component deterioration that establishes the structural capability of the flood defences to withstand these hydraulic conditions is not effectively modelled.

A.171 The NAFRA system is however very good at supporting the consequence modelling and aspects of the service forecast and so will be an essential tool within any future analysis that is undertaken.

A.172 As already discussed in section A.112 intervention analysis undertaken by the Environment Agency is driven by local asset management inputs within the SAMPS system. Section A.150 to A.159 discussed the potential solution engineering bias that may exist through this approach.

A.173 The analysis of asset data is an area in which the Environment Agency could learn from the water sector, particularly once the missing performance data gaps are available as the CAMC2 system is implemented. Such analysis through GIS and data mining tools would enable evidence based asset strategy approaches to be developed on distinct asset cohorts (groups of asset which are similar in nature). This level of information would lead to improvements in asset targeting and hence leading to more economically focused decisions for maintenance aligned with least cost whole life principles.
Observation 26:
The Environment Agency should develop asset GIS and data mining tools as part of CAMC3 to both review historic information and use this information to predict future performance. Such tools should enable economic and efficient decisions leading to maintenance aligned with least cost whole life principles.
Such tools would act to both improve historical targeting and to undertake deterioration modelling to identify future risks.
The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.

Optimisation and prioritisation

A.174 The final stage of development is around the optimisation and prioritisation of the investment programme. This is the most powerful tool within the asset manager’s toolkit and enables them to make effective and efficient programme planning decisions in a risk based manner. It would take inputs from all of the tools discussed into a single optimisation engine and would prioritise investments across the programme to meet a defined set of programme constraints.

A.175 These constraints could be funding (Opex or Capex), levels of protection as well as levels of risk. If designed correctly this tool can deliver both day to day programme planning support as well as strategic and tactical programme development over the long term.

A.176 Such a programme optimiser provides;

- improvements in asset targeting investment
- economic asset decisions supporting least cost whole life principles
- oversight of cost benefit decisions within the programme
- long term planning capability
- the ability to optimise within available funding constraints
- information to communicate with stakeholders around the shape and form of the investment programme (costs and benefits and why these decisions are considered to be optimum).
A.177 Such an optimiser would enable investment decisions from all areas of the programme to be compared against each other and the most cost efficient solutions selected for implementation. This would bring integration of the flood defence assets, MEICA and conveyance decisions into a single optimisation.

A.178 Such an optimiser is driven by a single end to end vision of asset management decision making with the organisation. It requires significant data, system, process and procedural changes across the organisation. This will require new skills and governance procedures to be developed across the Environment Agency.

A.179 Whilst this is a significant challenge for the organisation the benefits in enabling the Environment Agency to deliver the programme and make clearly defined asset decisions far outweigh the implementation issues.

**Observation 27:**

The Environment Agency should develop risk based programme optimisation tools for the whole of the investment programme through CAMC3.

The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.

**Prioritisation tools – ‘The Risk Matrix’**

A.180 One tool commonly used within the water industry to assist the optimisation process is the use of the ‘risk matrix’. A risk matrix is generally a five by five grid which can be used to examine the distribution of risk across the customer or asset base. Properties or assets are categorised into both high probability (or likelihood) and by consequence or impact. This five by five matrix is then used to understand the shape of risk across the customer or asset base. High risk (high probability and high consequence) properties and assets can then be targeted more effectively, the matrix allows quick and common categorisation allowing the decision makers to quickly target and focus on key risks.
A.181 An example of a five by five risk matrix is shown below with highlighted areas of Red, Amber and Green risks. Five by five matrices are generally employed in order to not make the data analysis too burdensome whilst also providing sufficient granularity to inform effective decision-making.

<table>
<thead>
<tr>
<th>Probability or likelihood</th>
<th>Consequence of impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very low consequence systems</td>
</tr>
<tr>
<td>Very High</td>
<td>Green</td>
</tr>
<tr>
<td>High</td>
<td>Green</td>
</tr>
<tr>
<td>Medium</td>
<td>Green</td>
</tr>
<tr>
<td>Low</td>
<td>Green</td>
</tr>
<tr>
<td>Very Low</td>
<td>Green</td>
</tr>
</tbody>
</table>

**Figure A12 – A typical five by five risk matrix**

A.182 The matrix can be populated with many different attributes, such as properties or assets or even investment choices. What is important is that they are all treated in a similar manner with the decision start and end risk positions being described in a consistent way, a related to a common view of risk and priority (Red, Amber and Green).

A.183 The basic planning premise is that no investment would be targeted towards the green area of the matrix with priority focused on the Red areas. The Amber area becomes the area of choice allowing some flexibility in decision making, particularly where an area of the matrix is moving rapidly towards the red area (eg. as a result of climate change or asset deterioration).
**Figure A13 – How movement can be tracked and applied on the risk matrix**

A.184 Figure A13 shows a number of examples of how a risk could move on the risk matrix as a result of either direct or indirect interventions. It shows how the same risk matrix can be used to assess the effectiveness of investment decisions in both the short, medium and long term.

A.185 Point A shows a risk to which targeted maintenance investment is occurring, the asset is in a poor condition and is being repaired so that it is no longer a risk. The consequence of the asset failure is unchanged but the probability of the asset failure is being reduced. In the example the length of the arrow moves the risk into the amber area, alongside it another solution to renew the asset reduces the risk even further and into the green area (represented by the dotted arrow). Each intervention would have its own cost and benefit, within an optimizer this would create choice for the optimization engine and it would be able to choose the most cost beneficial solution between these two solutions.

A.186 Point B shows a risk in the amber area, which would not be a natural choice for an investment decision. However, as a result of climate change and asset deterioration modelling it is known that within 10 years this risk will have moved from amber into the red area. This risk would therefore be a valid candidate for investment in a 6-10 year modelling scenario (assuming it was a cost beneficial solution).

A.187 Point C represents a risk catchment that is low risk and a low probability of failure. However, if new development comes along the catchment risk is
increased as a result of an increased impact within the catchment. The risk moves horizontally as a result of increased impact.

A.188 Finally point D represents a high risk to which there have been no cost beneficial solutions identified. But the matrix can also model the hazard warning and mitigation measures which can be applied to this risk until a more innovative and cost beneficial solution can be found. In this case the impact of the intervention is reduced although the probability of failure remains the same.

A.189 Examples A-D show how the risk matrix can be used to model risk across the FCRM programme and how this tool can be used within an optimization scenario. As part of the review an attempt has been made to display the current Environment Agency risk data in this format.

<table>
<thead>
<tr>
<th>Flood likelihood</th>
<th>SAMPS</th>
<th>%</th>
<th>Properties in low consequence systems (est.)</th>
<th>Properties in medium consequence systems (est.)</th>
<th>Properties in high consequence systems (est.)</th>
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<tr>
<td>High</td>
<td>2,189,798</td>
<td>89%</td>
<td>9,422</td>
<td>18,217</td>
<td>216,361</td>
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<tr>
<td>Medium</td>
<td>184,377</td>
<td>7%</td>
<td>19,424</td>
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<td>Low</td>
<td>95,362</td>
<td>4%</td>
<td>86,189</td>
<td>119,681</td>
<td>1,421,419</td>
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<tr>
<td>Very Low</td>
<td>0</td>
<td>0%</td>
<td>3,591</td>
<td>3,591</td>
<td>82,465</td>
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<tr>
<td>Total</td>
<td>2,469,537</td>
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**Figure A14 – FCRM properties shown on the risk matrix**
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<tr>
<th>Flood likelihood</th>
<th>No</th>
<th>%</th>
<th>Linear FCRM assets* in low consequence systems</th>
<th>Linear FCRM assets* in medium consequence systems</th>
<th>Linear FCRM assets* in high consequence systems</th>
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<tr>
<td>High</td>
<td>17,698</td>
<td>37%</td>
<td>2,072</td>
<td>4,169</td>
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<td>Medium</td>
<td>13,674</td>
<td>29%</td>
<td>861</td>
<td>1,615</td>
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<td>Low</td>
<td>7,338</td>
<td>15%</td>
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<td>309</td>
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<td>39</td>
<td>0%</td>
<td>1</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Unknown</td>
<td>9,204</td>
<td>19%</td>
<td>1,569</td>
<td>1,562</td>
<td>6,073</td>
</tr>
<tr>
<td>Grand Total</td>
<td>47,953</td>
<td>100%</td>
<td>4,777</td>
<td>7,674</td>
<td>35,502</td>
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**Figure A15 – FCRM assets shown on the risk matrix**

A.190 Whilst the data set from the Environment Agency can only display a 4 x 3 matrix, the example demonstrates some of the basic uses of the risk matrix. Highlighting the number of properties at risk of flood risk and that a large length of the FCRM linear assets are protecting this group of properties. Further granularity of the high risk area is required in order to understand the risks in the top right of this diagram and to help understand the benefits and risks of investment in this area. It would be suggested that additional categories are created for ‘very low’ consequence and ‘very high’ consequence systems as well as for ‘very high’ flood likelihood category. This should then create a sufficiently granular dataset to effectively use the risk matrix against.

A.191 Once effectively deployed the risk matrix can be used as a risk prioritization tool alongside deterioration and climate change modelling, assessing the effects of new development as well as assessing the cost benefit of maintenance and hazard warning solutions. The tool also provides a visual representation of the benefits of different investment programmes for stakeholder engagement and work within the RFCCs.
A.192 A series of scenarios and analysis could be applied through the risk matrix to show:

- Flood risk across England without flood defences;
- Flood risk across England with flood defences;
- Actual flooding across England year on year allocated against predicted flood risk;
- Flood risk as a result of FCRM poor condition assets;
- Flood risk as a result of third party poor condition assets;
- Risk reduction as a result of hazard warning and risk mitigation; and
- Forecast flood risk given climate change, asset deterioration and new development (5 years, 10 years etc to 50 years).

A.193 Flood defence systems are made up of a number of individual assets some owned by the Environment Agency some are third party assets, each of which has its own probability of failure and potentially differing consequences of failure. At the current time the Environment Agency uses the consequence of the system of assets as the primary factor for determining the consequence risk prioritisation as it assumes all of the assets need to operate in order to protect the properties and businesses at risk.

A.194 The Environment agency has a desire to move to modelling each individual asset to assess its probability and consequence separately, the review supports this desire and recognises that this is an appropriate improvement to the existing processes. In order for this to be modelled correctly it will be necessary to model each asset system and establish a risk matrix of assets for each asset system (with their own probability and consequences) which can then be ranked against other assets and consequences. This could then be represented at a national level as either a asset system or as individual assets.

Observation 28:
The Environment Agency should consider the application of the ‘Risk Matrix’ tool within the development of the investment planning and risk prioritisation tools for the FCRM programme. Expanding the granularity of the current risk consequence systems from ‘very low’ to ‘very high’ whilst moving from a systems based assessment to an asset based approach.
Reporting

A.195 It has been difficult within this review to understand the line of sight between the SAMPS dataset and how this is developed into the investment programme proposed. Many of these decisions are taken through the RFCCs and are brought together as a collection of decisions. Cost benefit is used throughout but the selection criteria and decision-making constraints have not necessarily been transparent to the reviewer.

A.196 Review documents presented to DEFRA and HM Treasury are based on macro level understandings of the programme and historic deliverables rather than being based upon a bottom up accumulation of the individual projects being invested within. Given that the business process does not contain a single programme optimiser such an accumulation of costs and benefits is not easily delivered.

Observation 29:
Alongside the development of the risk based programme optimisation tools for the whole of the investment programme, the Environment Agency should consider the manner in which reporting of the investment programme will be delivered to give transparency and line of sight for stakeholders.
This should be considered for the yearly, three yearly, six year and the long-term investment strategy.

Balance and optimisation

A.197 The review has sought from an analysis of component parts to understand the processes the Environment Agency currently uses to develop its investment programme and for how it maintains its asset base.

A.198 The review has highlighted a number of challenging issues around:

- clarity of duties and customer legitimacy;
- outcomes and performance commitments;
- application of cost benefit between WTP and WTA;
- performance monitoring and asset inventory information;
- assessment of serviceability measures;
- asset deterioration tools and targeting;
- forward looking analysis;
- programme optimisation from component parts; and
- programme governance and signoff.
A.199 Given the range of areas in which improvement can be made it is difficult to say that the current programme is balanced and optimised, and there is insufficient line of sight between the asset needs and the benefits being delivered within the programme.

A.200 The investment programme has instead been balanced and optimised using current high level macro choices based upon historic cost benefit judgments. This is done using the information to hand and reflects the current data set.

A.201 The review highlights the scale of knowledge and identifies gaps within the current approach that need to be improved in order that a balanced and optimised programme can be delivered.

A.202 The review recognises the benefits that partnership funding delivers to the overall FCRM programme and is supportive to the role partnership funding delivers as it has a significant effect on the shaping and delivery of the programme. Partnership funding creates a key opportunity to secure funding from third parties during the feasibility stages of flood defence projects. Whilst this additional funding is welcome to the programme, it both supports and potentially distorts efficient delivery as:

- it provides additional funding from third parties to deliver benefits;
- it potentially promotes partnership funded projects ahead of other projects with better cost benefit scores but constrained partnership funding contributions;
- it creates complexity in the batching and grouping of schemes, potentially reducing efficiency opportunities; and
- it creates programme instability as individual projects remain uncertain until the partnership funding from third parties is secured.

A.203 Defra has undertaken an evaluation of partnership funding in April 2014, which concentrated on whether there were issues with partnership funding from the perspective of bias of application and priorisation. The review concluded that there was insufficient evidence at this time to reach any conclusions on whether the partnership funding approach contains any bias.

A.204 The evaluation did not examine whether the delivery of partnership funding generates any increased delivery risks and potential delivery inefficiencies.
A.205 DEFRA and the Environment Agency should undertake a review of the process and procedures around capital delivery associated with partnership funding. The primary purpose for the review would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process.

A.206 Procedural and process improvements should be sought to mitigate where the approach either distorts economic delivery decisions or creates delivery inefficiencies.

Observation 30:
DEFRA and the Environment Agency should improve the process and procedures around capital delivery associated with partnership funding. The primary purpose for the review would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process.

Summary of benchmarking findings

A.207 In benchmarking against the water company performance in 2009, it should be noted that the water companies had already been incentivised to apply the UKWIR common framework and had prepared their internal business processes and business plan submissions to be judged by the Asset Management Assessment. The review of the company scores also occurred over a two year period within the price review giving the companies additional opportunities to respond to the issues and provide additional information to influence their overall score. The Environment Agency has not had the same opportunities to respond to the benchmarking.

A.208 In reviewing the AMA scoring for the FCRM asset management, account has been taken of the analysis and observations highlighted in Section 3 of this report.
A.209 As can be seen in Figure A16, FCRM flood defence asset management processes are towards the lower end of the water sector performance; this is primarily driven by the low level of performance data and operational information available. The CAMC2 system and its delivery into day to day processes will start to address much of these shortfalls in data, as long as additional systems and business processes are delivered to analyse and use this information to target asset interventions in an economic and efficient manner.

**Figure A16 – AMA FCRM flood defence assets analysis**

A.210 Figure A17 details the same scoring for MEICA assets, here FCRM MEICA asset management processes are much closer to the average water sector performance and demonstrates the more mature performance data that is available. Additional systems and business processes can be delivered to improve analysis of asset behaviour and whole life cost to target asset interventions in a more economic and efficient manner.
Other comments

A.211 Two other areas have been highlighted as part of this review, whilst these are distinctly different from the direct FCRM duties of the Environment Agency they are intrinsically linked and should be considered further.

Conveyance

A.212 The Environment Agency routinely considers dredging and other types of watercourse management, such as de-silting and vegetation removal, to reduce flood risk. They spend over £20 million per year on dredging, de-silting, removing gravel and obstructions along with weed control to clear channels. As with all their work, it has to be prioritised and justified technically, environmentally and economically.

A.213 The Environment Agency are aware of concerns from some landowners and the public that they are not carrying out enough channel maintenance. It undertook a review in 2011 and reported on a summary of six pilot studies that was undertaken in consultation with local communities to test the Environment Agency’s understanding of the benefits of watercourse maintenance, in particular whether it reduces the probability and extent of floods and its cost effectiveness.
A.214 The pilots confirm that watercourse maintenance can reduce flood risk but will not be suitable in all locations.

A.215 The Environment Agency regularly reviews its work, plans and guidance to make sure that it is making best use of available information. As a result of the pilots, the Environment Agency are providing further guidance for their staff to support them as they work with others to create a better place for people and wildlife. The Environment Agency has ongoing communication with regards to the benefits and costs associated with conveyance relative to other flood risk interventions, whilst it is recognized that conveyance delivers benefits in certain circumstances the cost benefit of such work is low.

A.216 The report on the dredging pilots studies was considered as part of this review. Whilst the dredging pilots report is based upon limited information across five different watercourses, it is clear that the benefits of dredging and watercourse management are not clear and differ dependent on whether you are considering flood risk or land drainage objectives and outcomes.

A.217 The evidence suggests that flood risk benefits vary from location to location and by hydrology. Similarly the costs of dredging and watercourse management are very variable (particularly when considering the disposal costs of dredged silt). Overall, the benefits associated with dredging and watercourse management are difficult to gauge and careful consideration is required to judge the value of the activity. Where economically viable the benefits are generally both for flood protection and for land drainage in some rural communities.

A.218 The risk based approach developed would benefit from being aligned with the risk matrix methodology set out in A.180 This would ensure compatibility and integration with the investment decisions and optimisations between maintenance and conveyance across the investment programme.

Observation 31:
DEFRA and the Environment Agency should improve the policies, operational procedures and conveyance management processes associated with rivers and watercourses, to establish a clear policy and risk based whole life cost procedure for dredging and watercourse management. This should reflect the economic whole life cost associated with both flood risk management and the economic value associated with land drainage.
The risk based approach developed would benefit from being aligned with the risk matrix methodology set out in A.180. This would ensure compatibility and integration with the investment decisions and optimisations between maintenance and conveyance across the investment programme.

**Delivery partnerships, the supply chain and efficiencies.**

A.219 As discussed in A.164 and highlighted in observation 25, the Environment Agency should consider whether there are cost savings in either outsourcing or nationally procuring services in comparison with the current DLO and local commissioned contracts. It is recognised that part of this journey is already occurring as part of the current introduction of the Water and Environment Management (WEM) Framework.

A.220 The framework will deliver improved efficiencies through this partnership approach, this could also be extended to operational contracts and resourcing in order to deliver further savings.

A.221 From work that Ofwat and the water industry has already undertaken with IUK around ‘Smoothing investment cycles in the water sector’5, it is recognized that there are potential efficiencies that can be delivered through forward planning over longer time periods and through the communication of forward pipelines to delivery partners and the supply chain. Such communication and planning allows the smoothing of investment and the balancing of resources and reduces inefficient delivery.

**Observation 32:**

The Environment Agency should deliver a forward pipeline of maintenance projects of at least 3 years to delivery partners and use the feedback from delivery partners to identify efficiencies. Efficiencies should then be factored back into programme optimisations and target costs. Such a pipeline should reflect the six year forward capital programme and the commitments made by HMT/Defra.

**Third Party Assets**

A.222 Communities at risk of flooding are protected by a system of assets that acting together protect each community, the failure of any one asset within the group will place the community at risk of flooding. Each system of assets is a mixture of Environment Agency owned assets as well as third

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party assets. Ownership of the third party assets could be in private ownership (typically riparian ownership), local authority, Internal Drainage Board, utility company structure or transport structure (rail or highway).

A.223 The interaction of third party assets was highlighted as part of the Floods and Water Management Act and the Environment Agency were empowered to designate third party assets as flood risk management assets. Once designated the owner would then need specific permission to amend or alter these assets. The Environment Agency have delivered improvements in systems and review of third party assets since the Pitt review. National guidance has been produced to support staff within their interactions with third Party assets.

A.224 The Environment Agency also record the condition of the third party assets as part of the condition assessments undertaken and report the results of these surveys through KPI 962.

A.225 The concern of the review reflects how the third party assets are analysed and targeted through the assessment of flood risk. In the majority of cases, although the failure of the third party asset may present be at risk of flooding, it may not be considered for investment within the programme (as it would be a third party asset). The reduction of risk at this site may be far more cost beneficial than other schemes of maintenance. In such circumstances the use of permissive powers by the Environment Agency for third party assets should be intrinsically assessed as part of the maintenance optimisations. Without a clear understanding of these third party assets there is the potential that the exclusion of these assets is leading to either a bias in decisions or more likely an underestimation of flood risk.

**Observation 33:**

The process by which the Environment Agency intervenes with regard to Third Party assets is unclear. The manner in which Third Party assets are assessed and included within flood risk assessments and project appraisals should be formalised and improved. The concern being that the existing process has a potential bias towards Environment Agency owned assets, whereas an investment in a third party asset through permissive powers may deliver a better cost benefit ratio and increased flood protection.
## Appendix B: Document register

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Appendix C: Key recommendations

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<th>Ref</th>
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<th>Description</th>
<th>Comments</th>
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| A   | Improve customer legitimacy and deliver an outcomes focus | Defra and the Environment Agency should consider the issue of customer legitimacy for Flood Defence and Coastal risk management. The expectations of communities impacted by flooding and the role and obligations of the Environment Agency do not appear to be in alignment. Investment decisions around the maintenance of existing flood assets are not as transparent as those associated with the creation or enhancement of new flood defences. Consideration should be given to the benefits and tools applied within the water sector and how these could be best utilised to improve customer legitimacy. These should include:  
  • An increased clarity of expectations of what the Government expects the Environment Agency to deliver by way of clear high level obligation statements and outcomes.  
  • Application of community forums, including consideration of how Regional Flood and Coastal Committees (RFCCs) could be used for this purpose.  
  • The role of outcomes, performance commitments and delivery incentives.  
  • Enhanced communications to clarify the Environment Agency's role of flood risk management to | Addresses observations 1, 3, 4, 6, 7 |
<p>| | | |</p>
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<tr>
<td>B</td>
<td>Improve customer legitimacy within programme prioritisation</td>
<td>Defra and the Environment Agency should consider the issue of customer legitimacy for Flood Defence and Coastal risk management and the extent to which public consultation should influence prioritisation. This could include the potential application of customer preference approaches within the programme prioritisation; for example WTP/WTA data adapted for activities that are funded by Government.</td>
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<tr>
<td>C</td>
<td>Improve governance and accountability</td>
<td>The Environment Agency should be clear about the ownership and accountability of the investment programme between RFCCs, the Environment Agency, senior management, Board approvals and signoffs; improving governance and accountability across the FCRM programme for both expenditure, outputs and outcomes. Line of sight between the strategic Long Term Investment Strategy (LTIS) outcomes through to Environment Agency standards and procedures should also be improved. The review supports the Environment Agency’s desire to undertake PAS55/ISO 55000 accreditation for the processes and procedures within the FCRM programme, such an accreditation will provide the vehicle for governance improvements and provide third party accreditation that processes are robust and maintained.</td>
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<tr>
<td>D</td>
<td>Improve asset management datasets</td>
<td>The Environment Agency should significantly improve both the quantum and quality of its asset management data and information. It should do this through targeted improvement programmes, new systems and processes (ie CAMC2), reviewing the effectiveness of existing systems and determining how well they</td>
</tr>
</tbody>
</table>
support the asset management processes (ie financial systems).

In particular focus should be placed on;

- targeted improvements to asset inventory datasets (such as date of construction etc)
- recording construction material (where not known)
- performance information on the assets
- maintenance and repair activities and associated costs
- timely information on flooding events and near misses
- overtopping, collapses and rodent infestations
- the development of serviceability metrics
- operational costs of asset management activities and interventions.

The review recognises the improvements recently made on AIMS and CAMC2 and is supportive to the continued development of these datasets.

| E | Develop asset analytical and modelling capability | The Environment Agency should develop a centralised analytic and modelling capability to enhance the asset knowledge of the organisation and to drive efficiencies in the targeting of asset interventions. This can be achieved by applying historic performance data and asset information to identify asset behaviour of specific cohorts of assets and to use this knowledge to target focussed asset interventions. Such resources would have skills in analytic data mining, GIS and deterioration modelling. Engineering expertise would also be used as part of effective solution engineering in order to establish innovative, economic and efficient interventions applied through a risk based framework. This capability would be at the heart of both targeted | Addresses observations 2, 17, 24, 26 |
asset interventions and efficiencies in the short term and would also support the long term future forecasting capability of the asset base.

The Environment Agency is already undergoing significant changes which will support this recommendation.

<p>| | |</p>
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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>F</strong></td>
<td>Develop risk based programme optimisation capability</td>
</tr>
</tbody>
</table>
|   | The Environment Agency should develop a risk based centralised programme optimisation capability. With dedicated systems and resources capable of supporting economic and efficient asset interventions and future forecasting capability. This should be developed alongside a review of how the investment programme governance and reporting with stakeholders will be improved. The programme optimisation should be developed for yearly, three yearly, six yearly and the Long Term Investment Strategy horizons and there should be a clear line of sight between these programmes.

There should be a clearer treatment of contingency within the programme. A centrally managed contingency budget will provide greater flexibility for programme management rather than individual schemes including all risks sums. |
|   | Addresses observations 2, 12, 18, 28, 29 |
| **G** | Optimise on the basis of whole life cost and benefits |
|   | The Environment Agency should look to consider the development of the optimisation of the FCRM programme on whole life cost and benefits, to inform budget setting and programme planning |
|   | Addresses observation 2, 27, 28 |
| **H** | Develop contractual partnerships |
|   | The Environment Agency should consider the delivery role that framework partnerships will have within the delivery of a holistic whole life cost and benefits FCRM programme.

Long term delivery partners with incentives aligned to outcomes and delivered efficiencies are commonplace amongst the |
|   | Addresses observations 25, 32 |
Water sector, the benefits of these relationships cannot be underestimated and they are a key player in delivering a dynamic and innovative investment programme. The manner in which operating and capital partners will deliver economic and efficient interventions alongside internal staff and how these resources could be deployed as a single team during emergency responses should be given careful consideration. Forward pipeline visibility of the FCRM programme of at least two years (preferably 3 years) will support the delivery of efficiencies as the supply chain will be able to plan more effectively. Greater continuity of long term planning and funding through the six year programme will also support these long term partnerships.

<table>
<thead>
<tr>
<th></th>
<th>Improve procedures and processes for capital delivery associated with partnership funding.</th>
<th>The review recognises the benefits that partnership funding delivers to the overall FCRM programme. DEFRA and the Environment Agency should improve the process and procedures around capital delivery associated with partnership funding. The primary purpose would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process. Procedural and process improvements should be sought to mitigate where the approach either distorts economic delivery decisions or creates delivery inefficiencies.</th>
<th>Addresses observation 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improve conveyance processes</td>
<td>The Environment Agency should ensure there are clear operational procedures and conveyance management processes associated with rivers and watercourses. The Environment Agency should develop an understanding of the data, cost and</td>
<td>Addresses observation 31</td>
</tr>
</tbody>
</table>
benefits and should establish a clear decision process and risk based whole life cost for dredging and watercourse management. This should reflect the economic whole life costs associated with flood risk management. Further public engagement should be undertaken to establish conveyance as an appropriate tool within FCRM.

| K | Clarify the role on 3rd Party Assets | Defra and the Environment Agency should review the role of the Environment Agency with regard to 3rd Party assets in order to clarify the responsibilities, processes and procedures in use. In particular how the Environment Agency’s permissive powers should be applied in order to provide protection to the system of assets for high risk communities. | Addresses observation 33 |
## Appendix D: Observations

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Environment Agency’s duties towards properties and land at flood risk are different from those for the Water and Sewerage companies. There are no duties or obligations to provide flood defence assets to flood risk properties and land. Government funding for construction and maintenance of flood and coastal erosion risk management are based principally on the economic case, not a duty. The Environment Agency has no legal duty or obligation to maintain a flood defence asset once it is constructed, although it does have contractual obligations in certain circumstances.</td>
</tr>
<tr>
<td>2</td>
<td>Whilst the common framework was developed for the water sector as a planning framework to support the price review process, the basic principles it applies in terms of understanding both past and current performance (Stage A) and using this information to forecast future service through deterioration and service modelling (stage B) are just as valid for FCRM as they are for the water sector. The Environment Agency should consider the application of the common framework within its FCRM asset maintenance in order to understand and quantify future forecast investment needs for asset maintenance.</td>
</tr>
<tr>
<td>3</td>
<td>There is no requirement for the Environment Agency to maintain a flood risk defence once it is constructed. Partnership funding has the potential to confuse this position when contractual arrangements are not clarified. In considering any increased clarity of expectations, consideration of the effective lifespan of the flood defence asset and over what period an economic benefit has been assessed within the original construction design life should continue to be taken into account.</td>
</tr>
<tr>
<td>4</td>
<td>The Environment Agency should consider applying the principles within the Service Incentive Mechanism (SIM) customer experience across its customer engagement and front line staff interactions. Such an application should consider the experience of the customer and hand offs between different elements as part of staff interactions and how these maintain ownership and accountability within the organisation.</td>
</tr>
<tr>
<td>5</td>
<td>The application of consumer preferences (such as WTP rather than the avoided damages approach) should be considered within the prioritisation of FCRM investment. This could potentially improve customer legitimacy of the investment programme. The application of this should be considered separately for both the creation of new flood defence assets and for the maintenance of existing assets.</td>
</tr>
<tr>
<td>No</td>
<td>Description</td>
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<tr>
<td>6</td>
<td>The benefits of customer driven outcomes for the FCRM programme should be explored and developed further, particularly being more explicit on the role of maintaining existing flood defences. An example would be “maintaining and improving the resilience of people, property and business to the risks of flooding and coastal erosion.” The outcome should concentrate on the benefit to the end user – for example KPI962 reflects asset condition rather than benefit to the end user (or beneficiary).</td>
</tr>
<tr>
<td>7</td>
<td>The development of performance commitments and outcome delivery incentives (ODIs) for the FCRM programme will provide greater clarity of objectives and transparency with the end user or customer. Consideration should be given to the development of an appropriate incentive mechanism to incentivise innovation and positive management action by the Environment Agency.</td>
</tr>
<tr>
<td>8</td>
<td>Benefits assessment for maintenance within FCRM using a consumer preferences approach could consider the use of alternative methods (for example WTP and WTA). Any surveys to gather consumer preferences data could be undertaken on a periodic basis (typically say once every five years) with the consumer preference data being applied within programme prioritisations. Maintenance schemes could be assessed on cost benefit ratios using for example WTA, whilst enhancement of new flood defences could use cost benefit ratios derived with consumer preference data.</td>
</tr>
<tr>
<td>9</td>
<td>As part of the current reorganisation, the Environment Agency should consider governance and accountability processes for the review of both the expenditure and the delivery of outputs and outcomes across the investment programme between the programme management team, the Environment Agency Executive team and the Environment Agency Board. These governance and accountability procedures should be clearly documented and set out. Papers associated with key decisions should also be clearly documented, particularly to demonstrate whether the proposed programme meets the requirements and conditions set out by Defra and HM Treasury.</td>
</tr>
<tr>
<td>10</td>
<td>The Long Term Investment Strategy for Floods and Coastal Risk Management due to be published in 2014 should be aligned with the 6-year investment and maintenance programme.</td>
</tr>
<tr>
<td>No</td>
<td>Description</td>
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<tr>
<td>11</td>
<td>The Environment Agency should consider reinforcing the line of sight between Government policy and the Environment Agency Long Term Investment Strategy as part of the update in 2014.</td>
</tr>
</tbody>
</table>
| 12 | The Environment Agency should consider the roles and skills sets needed following the recommendations of this review and in particular in;  
* Asset performance and deterioration modelling  
* Asset targeting and risk management  
* Solution engineering and cost estimation, and  
* Investment prioritisation, optimisation and planning. |
| 13 | The following procedures may need to be strengthened and developed;  
* Asset performance and deterioration modelling  
* Asset targeting and risk management  
* Solution engineering and cost estimation, and  
* Investment prioritisation, optimisation and planning.  
These procedures are not fully developed, may not reflect robust business processes or may require further development in order to be integrated into day to day operations. |
| 14 | Given the quality of existing standards, policies and procedures the Environment Agency should consider PAS55/ISO 55000 accreditation. Such accreditation will support many of the recommendations in this report and will provide third party accreditation and governance procedures that improvements have been put in place and delivered. |
| 15 | The CAMC2 system is essential to understand the performance of flood defence assets and this information will improve asset targeting. The implementation of the CAMC2 system is already approved and delivery is underway.  
This review supports the delivery of the CAMC2 system as it will support the delivery of further efficiencies and improvements in asset management through effective scheduling and targeting of asset and operational interventions.  
Consideration should be given by the Environment Agency of how to accelerate the delivery of CAMC2 earlier than 2017. |
<p>| 16 | The Environment Agency should review the available resourcing and business processes associated with verifying flood history information. A KPI should be introduced to reflect the time from a property being flooded to being recognised within the flooding history. The time period from a flooding event to being on the flooding history database within NAFRA should be no more than three months. |</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
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<tbody>
<tr>
<td>17</td>
<td>The Environment Agency should consider the development and implementation of asset deterioration and analysis tools to improve asset targeting and deliver whole life cost solutions.</td>
</tr>
<tr>
<td>18</td>
<td>Dedicated programme optimisation and management systems should be considered to support the ability to target asset interventions and deliver future efficiencies.</td>
</tr>
</tbody>
</table>
| 19 | The Environment Agency should consider whether the existing financial systems are appropriate for the asset management needs of FCRM. Alternative financial systems (or modules) for FCRM may need to be considered which then align and integrate with the corporate financial systems for the Environment Agency.  
If these gaps cannot be addressed within the financial systems then they may need to be separately addressed through systems such as CAMC2.  
Alternatively modules may well be available from the financial system already in use and may be applicable to a number of government agencies (eg both the Environment Agency and the Highways Agency.) |
<p>| 20 | The Environment Agency should undertake a data improvement project for the FCRM datasets based upon critical information for asset management processes and deterioration modelling. |
| 21 | The Environment Agency should review the CAMC2/CAMC3 specifications to ensure that the data set supports the development of the asset deterioration and analysis tools. |
| 22 | The Environment Agency should develop serviceability metrics and a basket of measures to demonstrate stable serviceability of the FCRM asset base. These measures should be published in the public domain to give greater confidence to stakeholders that investment is being targeted appropriately. |
| 23 | The Environment Agency should capture operational costs associated with maintenance activities within CAMC2 and should use these costs, alongside the performance information to develop whole life cost models for the FCRM asset base. |
| 24 | The Environment Agency should further develop the risk based solution engineering procedures and processes within the SAMPS/CAMC systems. This should systematically and robustly determine maintenance benefits for all assets whilst also encouraging innovation and allowing greater choice of solutions and cost benefit to any programme optimisation. |</p>
<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
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<tbody>
<tr>
<td>25</td>
<td>Once the CAMC2 system is commissioned and the operational benchmarking exercises are completed, the Environment Agency should consider whether there are cost savings in either outsourcing or nationally procured services in comparison with the current DLO and local commissioned contracts.</td>
</tr>
<tr>
<td>26</td>
<td>The Environment Agency should develop asset GIS and data mining tools as part of CAMC3 to both review historic information and use this information to predict future performance. Such tools should enable economic and efficient decisions leading to maintenance aligned with least cost whole life principles. Such tools would act to both improve historical targeting and to undertake deterioration modelling to identify future risks. The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.</td>
</tr>
<tr>
<td>27</td>
<td>The Environment Agency should develop risk based programme optimisation tools for the whole of the investment programme through CAMC3. The Environment Agency should also consider the development of skills, processes and procedures that it will need to develop alongside the application of these tools. It would be likely that this would be a centralised function rather than an area based function.</td>
</tr>
<tr>
<td>28</td>
<td>The Environment Agency should consider the application of the ‘Risk Matrix’ tool within the development of the investment planning and risk prioratisation tools for the FCRM programme. Expanding the granularity of the current risk consequence systems from ‘very low’ to ‘very high’ whilst moving from a systems based assessment to an asset based approach.</td>
</tr>
<tr>
<td>29</td>
<td>Alongside the development of the risk based programme optimisation tools for the whole of the investment programme, the Environment Agency should consider the manner in which reporting of the investment programme will be delivered to give transparency and line of sight for stakeholders. This should be considered for the yearly, three yearly, six year and the long-term investment strategy.</td>
</tr>
<tr>
<td>30</td>
<td>DEFRA and the Environment Agency should improve the process and procedures around capital delivery associated with partnership funding. The primary purpose for the review would be to alleviate perceived bottlenecks in the delivery programme and establish how the partnership funding approach can be balanced with programme contingency in order to maintain an efficient delivery process.</td>
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<td>No</td>
<td>Description</td>
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<tr>
<td>31</td>
<td>DEFRA and the Environment Agency should improve the policies, operational procedures and conveyance management processes associated with rivers and watercourses, to establish a clear policy and risk based whole life cost procedure for dredging and watercourse management. This should reflect the economic whole life cost associated with both flood risk management and the economic value associated with land drainage. The risk based approach developed would benefit from being aligned with the risk matrix methodology set out in A.180. This would ensure compatibility and integration with the investment decisions and optimisations between maintenance and conveyance across the investment programme.</td>
</tr>
<tr>
<td>32</td>
<td>The Environment Agency should deliver a forward pipeline of maintenance projects of at least 3 years to delivery partners and use the feedback from delivery partners to identify efficiencies. Efficiencies should then be factored back into programme optimisations and target costs. Such a pipeline should reflect the six year forward capital programme and the commitments made by HMT/Defra.</td>
</tr>
<tr>
<td>33</td>
<td>The process by which the Environment Agency intervenes with regard to Third Party assets is unclear. The manner in which Third Party assets are assessed and included within flood risk assessments and project appraisals should be formalised and improved. The concern being that the existing process has a potential bias towards Environment Agency owned assets, whereas an investment in a third party asset through permissive powers may deliver a better cost benefit ratio and increased flood protection.</td>
</tr>
</tbody>
</table>
Appendix E: AMA scoring

Table E1  AMA high-level areas and components

<table>
<thead>
<tr>
<th>High-level area</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder engagement</td>
<td>1.1 Engagement with customers and other stakeholders</td>
</tr>
<tr>
<td></td>
<td>1.2 Choice of planning objective</td>
</tr>
<tr>
<td></td>
<td>1.3 Valuation of service benefits</td>
</tr>
<tr>
<td>Governance, policy and strategy</td>
<td>2.1 Governance</td>
</tr>
<tr>
<td></td>
<td>2.2 Policy</td>
</tr>
<tr>
<td></td>
<td>2.3 Strategy</td>
</tr>
<tr>
<td>Management</td>
<td>3.1 People Management</td>
</tr>
<tr>
<td>Processes</td>
<td>4.1 Integration into business processes</td>
</tr>
<tr>
<td></td>
<td>4.2 Planning processes</td>
</tr>
<tr>
<td></td>
<td>4.3 Information management processes</td>
</tr>
<tr>
<td></td>
<td>4.4 Quality safety and environmental management</td>
</tr>
<tr>
<td>Systems</td>
<td>5.1 Systems for capturing and storing asset performance and condition data</td>
</tr>
<tr>
<td></td>
<td>5.2 Systems to support risk management processes and reporting</td>
</tr>
<tr>
<td>Data</td>
<td>6.1 Asset observations</td>
</tr>
<tr>
<td></td>
<td>6.2 Serviceability data and associated costs</td>
</tr>
<tr>
<td></td>
<td>6.3 Interventions and impact data and associated costs</td>
</tr>
<tr>
<td>Analysis</td>
<td>7.1 Historical analysis</td>
</tr>
<tr>
<td></td>
<td>7.2 Performance modelling</td>
</tr>
<tr>
<td></td>
<td>7.3 Service consequence modelling</td>
</tr>
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</table>
### High-level area

<table>
<thead>
<tr>
<th>Component</th>
<th>7.4</th>
<th>Cost consequence modelling</th>
</tr>
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<tbody>
<tr>
<td>7.5</td>
<td></td>
<td>Forecast service</td>
</tr>
<tr>
<td>7.6</td>
<td></td>
<td>System analysis</td>
</tr>
<tr>
<td>7.7</td>
<td></td>
<td>Intervention identification</td>
</tr>
<tr>
<td>7.8</td>
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<td>Intervention impacts</td>
</tr>
<tr>
<td>7.9</td>
<td></td>
<td>Intervention costs</td>
</tr>
<tr>
<td>7.10</td>
<td></td>
<td>Intervention optimisation within asset group</td>
</tr>
</tbody>
</table>

### Reporting

| 8.1 | External reporting |

### Balance

| 9.1 | Overall balance and phasing of business plan |
| 9.2 | Overall approach to risk                     |
| 9.3 | Overall quality of the business case         |
| 9.4 | Programme optimisation                       |

### Table E2 Sub-service AMA scores by company

<table>
<thead>
<tr>
<th>Company</th>
<th>WaSCs</th>
<th>Water infrastructure (WIRE)</th>
<th>Water non-infrastructure (WMNI)</th>
<th>Sewerage infrastructure (SIRE)</th>
<th>Sewerage non-infrastructure (SMNI)</th>
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</thead>
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<tr>
<td>WaSCs</td>
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<tr>
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<td>3.02</td>
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<tr>
<td>Company</td>
<td>Water infrastructure (WIRE)</td>
<td>Water non-infrastructure (WMNI)</td>
<td>Sewerage infrastructure (SIRE)</td>
<td>Sewerage non-infrastructure (SMNI)</td>
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<td>Ave.</td>
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<td>3.28</td>
<td>3.36</td>
<td>3.22</td>
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</tr>
</tbody>
</table>
Appendix F: Glossary

**AMA:** The Asset Management Assessment (AMA) approach was applied through the final determination of 2009 to assess the asset management capabilities of each water company and to benchmark this across the water sector. The AMA scores were used as part of final determinations to determine the level of Capital Maintenance expenditure assumed within price limits in 2009.

**Capital funding:** This is the money spent on the construction, creation, purchase and improvement or replacement of assets.

**Cost-benefit analysis (CBA):** This measures the costs and benefits of a project in a common currency (preferably £s) over its lifespan, and assesses the balance between the two. Costs and benefits that cannot be monetised should still be considered. Whilst any project with a >1:1 ratio is viable, we should be looking for a greater return (1:5 as a minimum and 1:8 is quoted as the average return for FCRM investments).

**Flood risk categories:** There are four flood risk categories associated with outcome measures; they are:

- Low - 0.5% (200 to 1) chance of flooding each year or less.
- Moderate - Between 0.5% (200 to 1) and 1.3% (75 to 1) chance of flooding each year.
- Significant - 1.3% (75 to 1) chance of flooding each year or greater.
- Very Significant – 5% (1 in 20) chance of flooding each year or greater.

**Key performance indicator (KPI):** These are the Environment Agency’s corporate performance measures against which targets are set and agreed with Regions. They reflect progress towards achieving environmental outcomes. The Environment Agency report their position to the RFCCs on the key FCRM KPIs (962 and 965).

**Key performance indicator 962 (KPI962):** KPI 962 reports the percentage of assets that are at or above their target asset condition, known as ‘passing assets’. The Environment Agency reports on all Flood Risk Management assets on Main River, regardless of who owns or manages them. The national target is split by Region and, in Anglian, by the three RFCCs.
**Key performance indicator 965 (KPI965):** KPI 965 quantifies the number of households that are at increased flood risk from assets that are not at their target flood defence condition (‘failing’ assets). In an ideal world all assets would be at condition and, hence, the additional households at risk would equal zero.

Flood risk categories: There are four flood risk categories associated with outcome measures; they are:

- Low - 0.5% (200 to 1) chance of flooding each year or less.
- Moderate - Between 0.5% (200 to 1) and 1.3% (75 to 1) chance of flooding each year.
- Significant - 1.3% (75 to 1) chance of flooding each year or greater.
- Very Significant – 5% (1 in 20) chance of flooding each year or greater.

**Long Term Investment Strategy (LTIS):** This sets out the scale of the investment needed nationally to meet the FCRM challenges over the next 25 years. The current LTIS was published in 2009 and was called ‘Investing for the Future’ (it is currently being updated). It sets out:

- the present scale of flood and coastal erosion risk, and the achievements in managing it so far;
- an analysis of the investment needed to adapt to climate change and manage the potential increased risk over the period 2010-2035;
- ways to manage flood and coastal erosion risk more efficiently;
- an analysis of the benefits of investment, and the potential to broaden the sources of investment.


**MEICA (Mechanical, Electrical, Instrumentation, Control and Automation):**

The acronym for the regional team within the Environment Agency (that reports to an Operations Manager) and the type of assets that they look after. MEICA assets are typically pumping stations and other major assets with complex operational arrangements. The team also develops and manages the carbon reduction work.
**Partnership Funding:** Flood and Coastal Erosion Resilience Partnership Funding is Defra’s current policy. It provides a system of funding which applies to all Flood & Coastal Erosion Risk Management (FCERM) projects seeking FCRM GiA Capital funding in England. It is a way of increasing overall investment in flood and coastal erosion risk management by encouraging external contributions as a means to unlock GiA. GiA is capped based on the number of outcome measures a project will deliver, with each project having a Partnership Funding score as a means of prioritisation. The RFCC has a key role in working with partners and communities to maximise contributions and also raise and allocate local levy which can also be used as an external contribution.

**Revenue funding:** FCRM GiA Revenue funding is the money spent by the Environment Agency on day to day activities. These include salary costs of most staff, revenue projects (ie typically inspections, maintaining our hydrometric and telemetry network and quality assurance of flood modelling) and Revenue Maintenance (ie preventing assets falling below target condition). Revenue also pays for our incident response to flooding.

**RFCC:** Regional Flood and Coastal Committees.

**System Asset Management Plans (SAMPs):** These are long-term plans for each Asset System. They include information on the benefit of the system (ie what the system protects) and what the expected maintenance costs are for the assets in that system. We use SAMPS to hold the information on our revenue maintenance programme. Data from SAMPS is used by the National Allocation and Programme team to make an indicative and final allocation of FCRM GiA Revenue to each RFCC. Information in SAMPs is updated regularly by Operations teams.

**Target Condition:** The Environment Agency use a condition grading system (1–5) for our assets and each asset has a target grade against which we monitor (through asset inspections), report (through KPIs) and improve (via asset recondition/refurbishment).

**Whole life cost:** The net present cost of a project, or the asset provided by the project, to deliver defined outputs that includes the running and maintenance costs over an extended period. The period can include the replacement of the asset, and is not fixed. The period is usually taken as that where the discounted future costs are material to the net present cost.