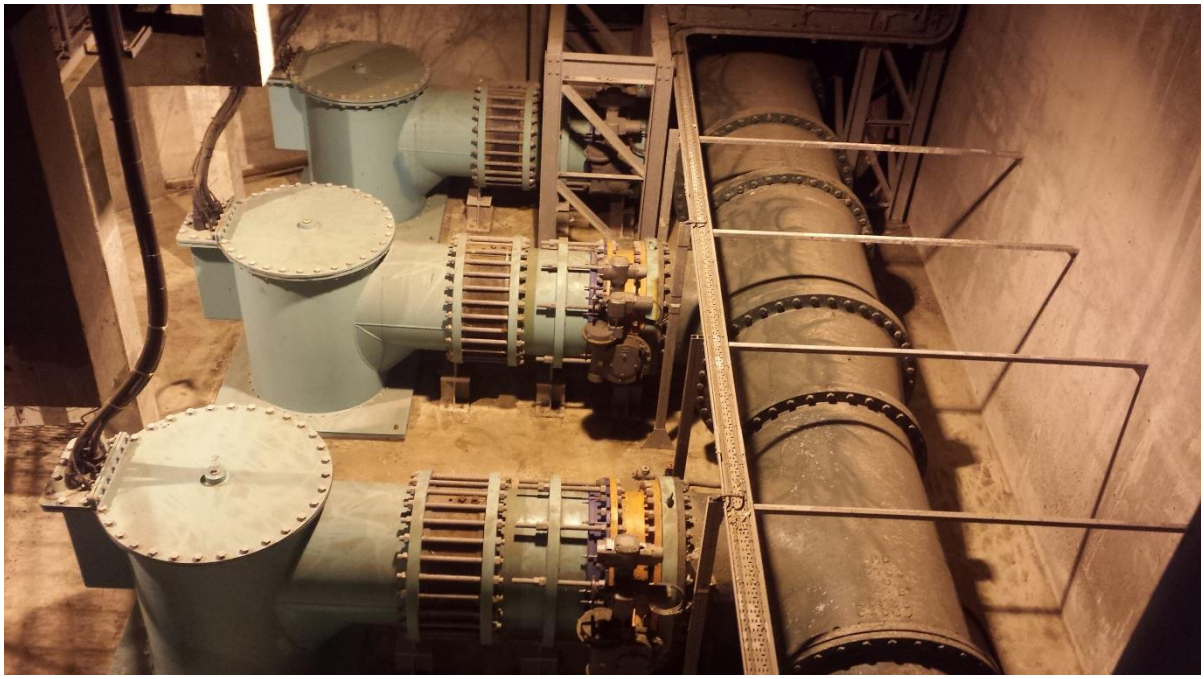
Dŵr Cymru Welsh Water

Ref 5.8M

PR19 IC: Wastewater Network Maintenance

September 2018



Wastewater Network Maintenance

Dŵr Cymru Welsh Water

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Executive summary

Driver for investment

Our business has a statutory duty, under Section 94(1) of the Water Industry Act 1991, to provide an effective system of public sewers and maintain our sewers to ensure effectual drainage. We do this by responsibly managing our sewerage collection system and numerous wastewater treatment works across Wales and parts of England.

Our sewerage collection assets operate in harsh conditions and are subject to service and structural deterioration over time, particularly as many are old. To fulfil our duty and protect customers and the environment, we need to demonstrate good asset stewardship by maintaining these assets. Asset failure brings unwanted consequences for our customers (for example, sewer flooding, and pollution) and can result in significant reactive maintenance expenditure.

Throughout our AMP6 and PR19 customer engagement programmes, tackling sewer flooding and protecting the environment were key themes where customers expressed strong views, on the issues themselves and how we manage them. This engagement programme reinforced to us how important these issues were to our customers.

On the basis of our customer and stakeholder views, we have set ourselves challenging performance commitments for AMP7. To meet these targets and deliver our promises to customers, we need to have the right expenditure plans in place. It is important that we not only focus on service improvements but also maintain our existing assets to maintain the service that our customers expect from us.

Legacy issues associated with the age, design, utilisation and maintenance of our wastewater networks have resulted in 'unwanted flows' within our systems. These result in significant challenges for our business, in terms of compliance with our permits, unwanted spills and significant energy costs associated with pumping and treatment.

We don't just care about today. A significant part of our strategy development and customer engagement looked at the future and how we need to stay a trusted and resilient business for future generations. Our strategic document Welsh Water 2050 sets out what the future may look like for our business and the importance of putting ourselves in the best shape to continue to deliver quality services to our customers. Through this work, we have identified future trends, which if not effectively managed, will have a negative impact upon our business and the services we deliver. Effective management and maintenance of our asset base in a sustainable and responsible way will provide a solid foundation to protect our business from these future trends.

Our investment proposals will enable us to deliver a cost-effective wastewater network maintenance programme that will contribute to fulfilling our statutory duties, proactively maintaining our assets before service failure, and meet the requirements of our customers in terms of service, value and protection of the environment, both now and in the future.

The investment

We propose to invest £241.63m (Pre-efficiency) / £219.66m (Post-efficiency) during AMP7 to maintain our sewer network assets (comprising of sewers and rising mains, intermittent discharges and tanks and sewage pumping stations), to contribute to the achievement of our AMP7 targets and reduce the risk to customers and the environment.

This investment will be delivered through investment categories and associated programmes of work shown in Table 1.

Wastewater Network Maintenance

Investment Category	Sub-Programme	£m (pre- efficiency)
Sewage Pumping Stations	Planned Capital Maintenance	23.4
	Forward Looking Capital maintenance and Reactive Capital Maintenance	24.3
	Sub-total	47.7
Intermittent Discharges and Tanks	Planned Capital Maintenance	61.7
	Forward Looking Capital maintenance and Reactive Capital Maintenance	4.9
	Sub-total	66.6
Sewers and Rising Mains	Planned Capital Maintenance	66.1
	Forward Looking Capital maintenance and Reactive Capital Maintenance	61.3
	Sub-total	127.4
	Total Pre-efficiency	**241.6**
	Total Post-efficiency	**219.6**

Table 1 – Overall proposed AMP7 expenditure for Wastewater Network Maintenance

Our strategy for maintenance investment is to understand asset risk, develop prioritised programmes of works to address those risks impacting on customers and service levels, and proactively manage the performance and condition of our wastewater networks before service failure, at the most cost-optimal point. We aim to minimise disruption to customers whilst maximising asset life at the lowest whole life cost. This investment will offset asset deterioration that would otherwise lead to deterioration in our performance measures.

Delivering for our customers

Our maintenance investment proposals will provide an underlying 'steady-state' to our wastewater network assets and help us meet our customer promises, in particular:

Safeguard our environment for future generations: Our proposed maintenance investment will ensure our wastewater network assets have minimal impact upon the environment by reliably operating as they were designed.

Put things right when they go wrong: Our customers are likely to become increasingly intolerant of failure. This investment will reduce the risk of uncontrolled failure (particularly from repeats) of our assets and avoid the unwanted customer impacts.

Fair bills for everyone: Using the latest Asset Management approaches we ensure that we manage our wastewater network assets in and efficient and effective way, paying regard to the affordability of our programmes and minimising the impact upon customer bills.

Delivering for the future

In our strategic Welsh Water 2050 publication, we identified future trends that would have an impact upon our business and the services we provide. This investment will help to address the impacts from the following future trends:

Change in customer expectations: Through our (and wider) customer engagement, customers are demonstrating and expressing less tolerance for negative impacts from the services they pay for.

Demographic change: Increasing urban creep is expected to result in greater inflows of rainfall into our wastewater systems, leading to an increased risk of sewer spills and sewer flooding incidents.

Climate change: Climate change will result in more extreme events such as drier, hotter periods and intense summer rainfall events, which could lead to an increased risk of sewer flooding and pollution.

Protecting essential infrastructure: Our ageing wastewater network assets present significant issues with reliability and service.

Delivering our Strategic Responses

In Welsh Water 2050, we set out to deliver 18 Strategic Responses in order to offset predicted future trends. This investment will contribute to the following Strategic Responses:

Strategic Response 7	**Working with customers and communities:** Continue our role in educating future generations and raise awareness about environmental impacts that our systems and the misuse of sewers have, and work to reduce these.
Strategic Response 10	**Addressing our 'worst served' customers:** A step-change in the way we communicate with those experiencing problems and work towards eliminating sewer flooding.
Strategic Response 16	**Cleaner rivers and beaches:** Not allowing the condition of our rivers or beaches to deteriorate. Investigate the opportunities for localised wastewater treatment (off-grid and community led) and explore the models of drainage asset ownership.
Strategic Response 17	**Protecting our critical wastewater assets:** Developing best practice resilience design (for example, RainScape) and operational standards.

Achieving our measures of success

For PR19, we will measure our performance against our MoS. The proposed expenditure in this Investment Case will contribute to the MoS identified in Table 2.

Ref	Measure of Success (short description)	End of AMP6 Position (number p/a)	End of AMP7 Position (number p/a)
En3	Pollution incidents from Wastewater	107	90
Rt1	Sewer flooding on customer property (internal)	300	273
Rt2	Sewer flooding on customer property (external)	4121	3,800
Rt3	Sewer collapses	Stable performance	
Rt6	Worst served customer for wastewater service	368	359

Table 2 Our Measures of Success relevant to this Investment Case and our performance targets for the end of AMP7

1 Delivering our customer outcomes

Need for investment

We collect and treat wastewater from 1.3 million properties, serving 3.2 million people and businesses. Our collection system is comprised of over 36,000km[1] of sewers and rising mains, 2,402[2] SPS, 2,795 intermittent discharges and 95 network storm storage tanks.

Occasionally there is disruption to the smooth running of the collection system, and the wastewater cannot flow freely. Unfortunately in these cases, the wastewater finds the easiest point available to spill out of the network, through manholes, overtopping wet wells, or in an uncontrolled manner at designated overflow locations. These unwanted discharges may cause what is identified as "Other Cause" (OC) sewer flooding and / or pollution (This is distinct from that caused by Hydraulic Overload (HO) where flow in a sewer exceeds its design capacity). Equally, spill numbers alone from designated overflow locations can be an issue where they exceed the triggers under the requirements of Event Duration Monitoring (EDM)[3] as identified in the respective environmental permits. Disruptions to the free flow of wastewater can be caused by:

- Sewer blockages - caused by displaced joints, sediment build up or unsuitable items discarded down the drain such as nappies, fat, grease, cloths or wet-wipes
- Pump blockages - ragging caused by a build-up of solids (non-biological) around the pump impeller
- Screen blockages - ragging caused by a build-up of solids blocking the apertures
- Sewer collapses - which can be caused by heavy traffic or ground movement as well as structural deterioration through asset age
- Equipment failures - mechanical or electrical equipment failure (such as pump failure through power loss)
- Capacity challenges - increasing volumes of surface water carried by our combined sewers (urban creep) when it rains can lead to an overloading of the sewerage system.

All of these items can be avoided or put right when things go wrong by appropriate, targeted maintenance investment. However, blockages and collapses greatly influence our sewer flooding and pollution performance.

To some extent, the likelihood of disruption is dependent on the asset attributes, with some asset cohorts having a greater propensity to block or collapse than others. Historical analysis, deterioration modelling and proactive risk capture has highlighted a greater risk of failure in particular assets, asset types and /or materials.

Blockages have always been the major cause of internal flooding, external flooding and pollution incidents. They are hard to pin-point before they occur so we usually have to deal with the consequences rather than prevent the failure.

The performance of our wastewater network assets with regards to pollution and sewer flooding is monitored by our environmental and economic regulators respectively, and our performance is publicly benchmarked against other Water and Sewerage Companies (WaSCs).

We have developed challenging targets for AMP7 for sewer flooding and pollution. There is a need for capital maintenance expenditure to offset natural deterioration in structural condition and performance and support our performance improvement programmes.

Investment in our assets and their performance is also important as recently the industry has seen significant prosecutions and fines in relation to sewage pollution through company negligence.

[1] This length is composed of *circa* 53% legacy assets and 47% formerly private assets

[2] This includes formerly private SPS transferred to our ownership

[3] Event Duration Monitoring (EDM) is a relatively new requirement for the water industry. Welsh Government through their environmental regulator Natural Resources Wales (NRW) have set demanding regional requirements that are specific to Wales and Welsh Water. We also have the same duty in the areas of England that we serve.

Views of our customers and stakeholders

We have engaged with our customers and stakeholders throughout AMP6 to understand their expectations and preferences. This has included consultations on our Customer Dividend[4], Welsh Water 2050 and the PR19 business plan. Our Welsh Water 2050 strategy consultation was held over the summer of 2017 and engaged with 20,000 customers. We have also utilised wider industry and consumer research and assessed its implications for our region, our stakeholders and our future plans.

We have wide-ranging methods of engaging with customers to ensure that our feedback is representative of our entire customer base. For PR19, we have made particular effort to account for the views of customers who are traditionally hard to reach.

Through the wide ranging feedback to our Welsh Water 2050 consultation exercise, it became clear that there is overall strong support amongst customers for the need to invest to address long-term challenges.

One thing that was extremely clear in our PR19 Willingness to Pay (WtP) research was that customers had no appetite to see a deterioration in the key areas of service discussed during this phase of the research.

We will continue to act on feedback throughout AMP6 and AMP7 by working with the Customer Challenge Group and listening to focus groups. These groups may concentrate on understanding the requirements of customers who have flooded, business customers and vulnerable customers, amongst others.

All of this vital data has shaped our expenditure plans by identifying which service areas are most important to our customers and wider stakeholders, the value they place upon these services, and how we manage our business for future generations. Consequently, we have focused our AMP7 maintenance investment on those areas of service that our customers and wider stakeholders have told us are important to them.

Customers views on our service

Collapses (including rising main bursts)

Figure 1 shows our current performance for sewer collapses and rising main bursts (against AMP6 reporting definition). The 2015-16 peak reflects the inclusion of transferred private assets. Customers have expressed their understanding of the connection between service, asset health and the problems of managing ageing infrastructure.[i]

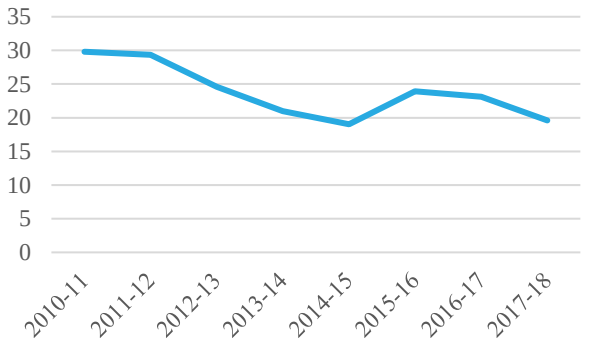

Figure 1 Sewer collapse and rising main burst rate per 1,000km of sewers and rising mains

Blockages

Through our analyses, we are aware of the significant role our blockage performance has on the number of incidents we have of OC sewer flooding and/or pollution. Our customers have also acknowledged this relationship during our customer research. Figure 2 shows our historic and current blockage performance rate. The peak in 2015-16 reflects the inclusion of the transferred private assets.

[4] Our 'customer dividend' is the re-investment of our profits made possible through our unique business model. In determining where this re-investment is directed, we have not only listened to over 12,000 customers as part of the Have Your Say consultation, but also to comments made by colleagues through our annual Employee Engagement Survey and at Employee Roadshows.

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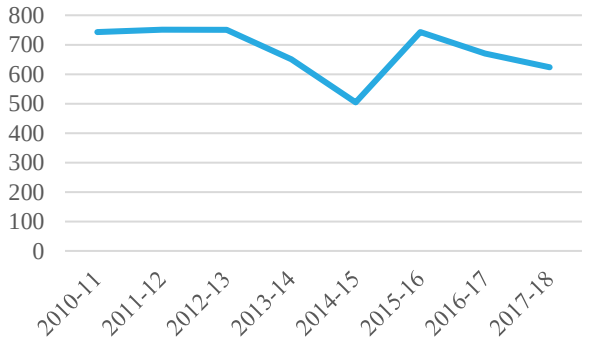

Figure 2 Sewer blockage rate per 1,000km of sewers and rising mains

Internal Sewer Flooding

Reducing internal flooding is consistently a high priority for customers, and is universally accepted by all stakeholders as the worst service failure to experience. Our current performance is shown in Figure 3, which again is influenced by the inclusion of the formerly private sewers in 2015-16. As part of our research, customers demonstrated a WtP for an improvement (reduction in risk) for internal sewer flooding. However, the number of customers who are impacted by internal sewer flooding is small compared to the total number of customers, with many customers expressing a preference for investment that will benefit the many, rather than the few.

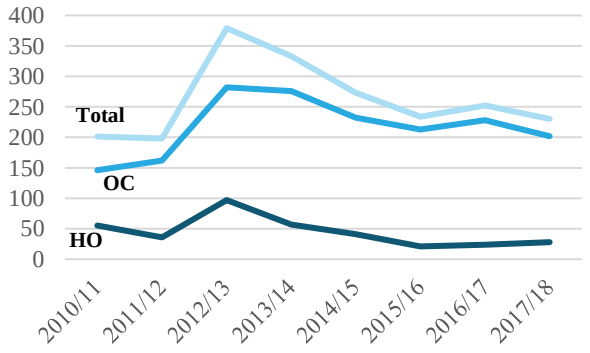

Figure 3 Total Internal sewer flooding incident performance[5] and contribution from OC and HO

External Sewer Flooding

Our research indicates that whilst external flooding is not seen as being as important as internal sewer flooding, both are recognised by our customers as having emotional, practical and health implications.

Figure 4 shows our current performance for external sewer flooding. Results from our WtP research indicate that customers support a reduction in external flooding, however, compared with internal flooding, this support is lower. To support capital investment, our customers (in response to our surveys and information) have suggested a combination of education, more pressure on manufacturers of 'flushables' to be responsible and encouraging the use of sustainable drainage on new developments. Our customers see behavioural change (for instance not flushing non-flushable items) as an important factor towards reducing the risk to our customers and the environment.

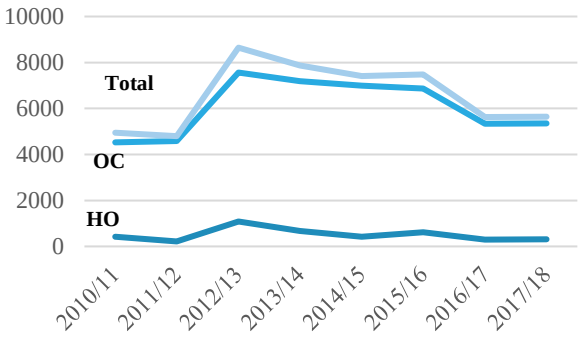

Figure 4 Total external sewer flooding incident performance[6] and contribution from OC and HO

Pollution

We found that our customers think that we should have a strong environmental conscience[ii]. They place great importance on clean rivers and beaches – both for their own pleasure, wildlife and for the tourism industry in Wales[iii]. The idea of sewage or industrial pollution in rivers is upsetting for many and seen as detrimental to local business[iv]. These attitudes were reflected in the WtP research. Therefore, minimising the risk of pollution (by controlling spills) and maintaining the quality of river and coastal waters in our region are important issues.

There is strong support for improvements in this area from Natural Resources Wales (NRW), the Environment Agency (EA), environmental Non-Governmental Organisations and the Welsh Government (WG). There is particular support by

[5] Hydraulic Overload (HO) investment is addressed in our Wastewater Enhancement Investment Case

[6] As per footnote 4

our customers of the need to prevent pollution at source, as this is seen as better for nature and wildlife. Figure 5 shows our current pollution performance.

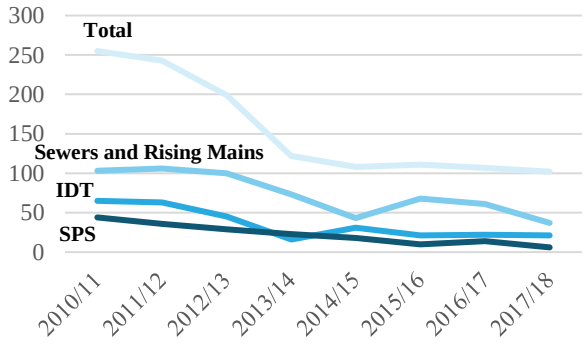

Figure 5 Total category 1, 2 and 3 pollution incident performance and contributing investment categories

In addition, engagement feedback showed that protecting our essential wastewater assets is critical to our customers, who recognise their importance for the continuation of our service provision. Our customers are keen for us to also consider innovative ways to improve the resilience of our assets to threats like climate change and flooding[v].

Benefits for our customers

The investment in this Sewerage Network Maintenance Investment Case will target the following key service failures:

- Sewer blockages: with the aim to maintain baseline performance and reduce blockage numbers (along with investment in the Sewerage Network Enhancement Investment Case)
- Sewer collapses and rising main bursts: with the aim to maintain stable performance.

Both of these service failures have a significant impact upon the risk of unwanted consequences for our customers (sewer flooding and pollution). Consequently, with the investment proposed in the Sewerage Network Enhancement Investment Case, the following benefits will be targeted:

- Maintaining the baseline of OC internal flooding incidents per year (mostly through blockage reduction), even with the inclusion sewer flooding incidents due to severe weather events[7], in conjunction with complementary enhancement expenditure improving performance
- Maintaining the baseline of OC external flooding incidents per year within property curtilage[8], in conjunction with complementary enhancement expenditure improving performance
- Maintaining the baseline of pollution incidents from wastewater network assets, in conjunction with complementary enhancement expenditure improving performance.

Blockages

To reduce the risk of internal and external sewer flooding and pollution, we will be targeting a reduction in blockages in our network assets. As part of this Investment Case (along with a minor contribution from the Wastewater Enhancement case), we will improve our performance by reducing the number of blockages to 18,270 per annum (p/a) at the end of AMP7 from a predicted AMP6 outturn of 21,276 p/a. This is normalised to a rate of 584.1 down to 495.7 (Figure 6).

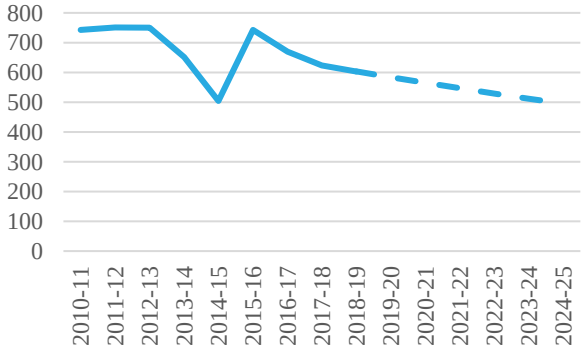

Figure 6 AMP7 performance for blockage rate per 1,000km of sewer

Collapses (including rising main bursts)

This year we have seen the introduction of a new reporting definition for sewer collapses for AMP7.

[7] There is a new definition introduced during PR19 for internal flooding reporting in AMP7 that will include (among other changes) reporting sewer flooding as a result of severe weather.

[8] There is a new definition introduced during PR19 for external flooding reporting in AMP7

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Our aim for sewer collapses and rising main bursts is for overall performance to remain stable during AMP7 as reported against the new definition (Figure 7).

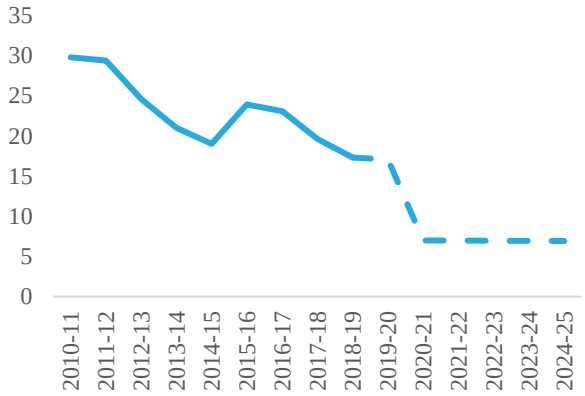

Figure 7 AMP7 collapse performance per 1,000km of sewer (including step change 2020-21 from revised AMP7 definition)

Managing our blockages and collapses performance will have knock-on benefits and support the improvement in performance set out in our enhancement investment case.

Affordability of bills

We understand the importance of balancing the need for this investment with the impact on the bills that our customers pay. Our PR19 Customer Research found that the majority of customers found our services were affordable and represented good value for money.

To help ensure that our bills remain affordable, we have identified a wastewater maintenance programme that takes consideration of risk and cost whilst delivering the services customers expect. We have done this through developing potential options for expenditure and assessing their effectiveness and costs. We have also challenged ourselves to identify efficiency savings within our preferred investment programme to ensure that we deliver our customer promise of 'fair bills for everyone'.

2 Investing for now and for the long-term

Over the last decade our wastewater network serviceability has remained stable, whilst service has improved. The aim of our proposed expenditure will be to continue this stable performance. However, we are still in the early stages of understanding the serviceability of transferred sewers and pumping stations (mostly due to the scale and the unknown nature of the below ground asset base) and these assets may provide new challenges to the achievement of our targets.

Future challenges

Along with this element of our asset base, our strategy, Welsh Water 2050, identifies further medium and long-term challenges that may impact our business, the services we provide and the customers and the environment that we serve. The future trends that provide the most significant challenge for sewer network maintenance are detailed below.

Changes in Customer Expectations

Continuing with recent trends, customer expectations are likely to change dramatically in the future. Customers will have greater desire for a more personalised service and control over their use of services. They are likely to have much less tolerance of service outages, particularly those that impact on them personally (such as sewer flooding). This will also be the case for business customers.

Our customers' lifestyles are changing, which is changing the way the sewerage network is being used, such as changes to the volume of water used in the household and in businesses, and the purpose of its use. Similarly, there has been an increasing trend of using wet wipes for all types of cleaning uses, which is causing problems in our sewer networks.

Demographic change

Population growth will lead to increased water demand in certain areas and an ageing population may lead to more customers in vulnerable circumstances.

Increasing urban creep and more urbanisation is expected to increase the inflow of rainfall into the system, leading to increased risk of sewer spills, pollution and sewer flooding incidents.

Similarly, more intense usage of transport routes and land above and around our assets may lead to more damage to our assets and the onset of premature and increased rates of deterioration.

Climate change

Climate change will result in more extreme rainfall events, which could lead to an increased risk of sewer flooding and pollution. Drier, hotter summers are projected, which could result in water supply deficits and periods of low flows in the network which may lead to more blockage formation. Significant changes between wet and dry ground conditions may also have implications for the structural integrity of our sewers (for example, displaced joints) in areas prone to ground movement.

Protecting essential infrastructure

Ageing infrastructure, a limited supply chain and cyber security are key concerns for future service provision. Technological advances could lead to significant efficiencies in the planning, delivery and operation of new assets. Many of our sewers are in close proximity to major transport routes. The disruption caused from a failure of our assets in these locations can have a significant impact upon people and the economy.

With a large proportion of our wastewater network assets reaching or surpassing their design life (Figure 8), there is an increasing risk of asset / service failure.

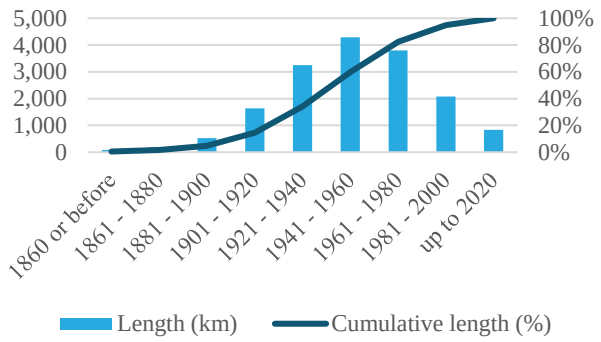

Figure 8 Sewer age profile (legacy assets)

Planning for the future

Although the nature of this Investment Case is the maintenance of our assets to manage and reduce risk now, we ensure that any investment now is considered in the context of the longer-term, whether it is opportunistic capacity planning on assets with long design lives, or making shorter term decisions investments that form part of a longer term adaptive pathway. Due to having such a large and aging asset base that operates in challenging conditions, there are no signs that the current maintenance requirement will reduce.

Results from the UK Water Industry Research (UKWIR) project 'Long term investment in infrastructure' (2017) show that under most scenarios, the rate of sewer maintenance expenditure will need to increase significantly both in the short term (2020 to 2030) and in the long term (2030 to 2070). If not, sewer blockages and collapses, and the resulting flooding and pollution are forecast to increase by 6%. Although our perception is consistent with the findings of the project, we have yet to see comprehensive and convincing evidence of this. However, we will also assess the impact of the UKCP18 climate projections (once available) to gain a fuller understanding of our future maintenance requirements.

Long-term planning

A key approach we use in AMP6 for the long-term planning of our wastewater network is our Sustainable Drainage Planning (SDP) programme. Based upon the 2013 (Ofwat / Environment Agency) Drainage Strategy Framework, our SDPs provide us with short, medium and long-term understanding of:

- The condition and performance of our wastewater network assets
- Risks to service
- Impact of future trends to maintain current service levels
- Optimal interventions to address issues both now and in the future.

Our complementary Wastewater Enhancement Investment Case sets out our plans to deliver Drainage and Wastewater Management Plans (DWMPs) in AMP7. Our DWMPs will play a key role in identifying major wastewater network maintenance schemes for AMP7, PR24 and beyond, that are aligned to our strategic aims set out in Welsh Water 2050. The DWMP approach will also provide an improved long-term planning structure where our future investments will be identified, developed and assessed in a collaborative framework with wider stakeholders.

Building on progress

Our proposals are not the start of our journey. We have invested £267.8m during AMP6 in the maintenance of our sewer network assets. During this time, we have continued to improve our knowledge of asset condition and performance, whilst improving predictive capabilities for future performance and risk.

During AMP6 we have undertaken investigations of several high risk SPSs, rising mains, trunk mains and IDTs in order to both understand the risk and inform our expenditure plans for AMP7. These investigations have varied from high level concept studies to the production of high definition, detailed feasibility reports.

We have also utilised the outputs from our AMP6 SDPs to understand risk and inform our in-AMP and future wastewater network expenditure plans. Due to their long-term nature, the outputs from each SDP provide a temporal aspect to investment planning where the benefits and dis-benefits of intervening earlier or later can be brought into our prioritisation. As part of our SDP programme, we have improved our understanding of the risk

associated with our IDTs. We have developed a catchment wide Red/Amber/Green (RAG) status for each CSO (Figure 9) based upon a comprehensive set of quantifiable risk criteria.

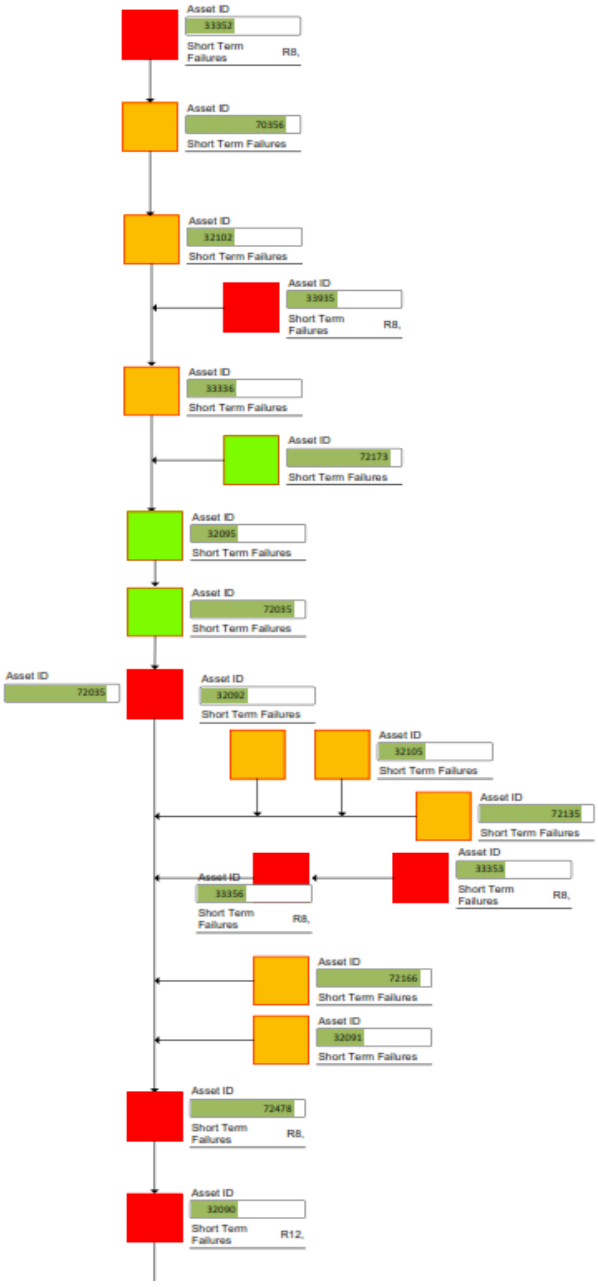

Figure 9 IDT RAG status on our Western Valley trunk main

Without investment, our infrastructure deterioration models predict an increase of ~ 3.1% in blockages (to 21,937 p/a) and a ~ 2.4% in collapses (to 637 p/a – current definition) by the end of AMP7.

Over AMP6 we have increased our efforts to reduce the overall number of blockages. We have invested (£0.14m) in a permanent training rig for our operators and contractors to both understand blockage attributes and develop their skills in blockage clearance. The rig allows operators and contractors to improve the use of existing techniques and apply new innovative tools that we have also developed to advance our blockage clearance capabilities.

We have also delivered improvements to our collapse performance, since experiencing an increase in numbers in 2015-2016 when transferred sewers were first included within the reporting definition (refer to Figure 2). A new industry-wide definition of collapse developed for PR19 will be adopted for reporting during AMP7. This change in definition will reduce our rate typically from ~ 20 down to ~ 7 per 1,000km of sewers and rising mains (Figure 7).

Reflecting the size distribution of our sewer assets, the majority of sewer collapses occur on small diameter pipes. Evidence to date also shows that collapses are similarly distributed between legacy sewers and transferred sewers (Figure 10).

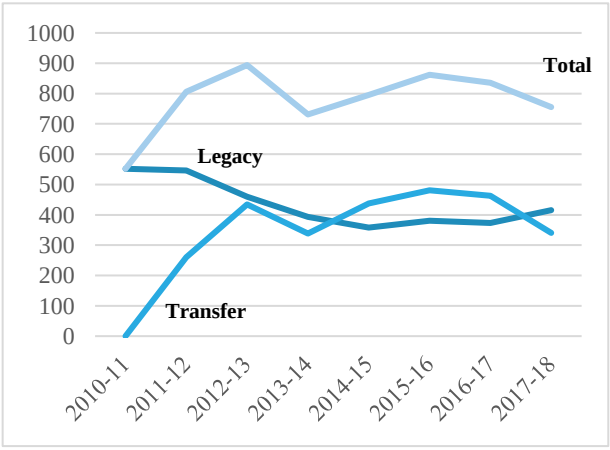

Figure 10 Total collapses and the contribution from legacy and transferred assets (going back to before private sewers were included in the reporting definition)

Our approach to proactive intervention on collapses is primarily driven by the risk severity and

probability of sewer flooding or pollution as a consequence of pipe failure.

During AMP6 we have delivered a major programme of EDM monitor installation on our permitted intermittent overflows as part of our AMP6 EDM obligations. In conjunction with this, we produce annually formal reports for our EDM spill performance.

Targeted expenditure on our network base maintenance and Pollution Reduction Strategy in AMP6 has consolidated our pollution performance (Figure 5). The contribution from our wastewater network assets has continued on a downward trend, in-line with overall pollution performance. A key area of focus in AMP6 (under the Pollution Reduction Strategy) has been a successful project to improve the resilience of communications from SPSs to support our ability to predict and address potential failures before service impacts materialise. This project assessed over 1,800 of our SPS.

We will continue to aim for zero serious pollution incidents (categories 1 and 2). However, where these do occur, all serious pollution incidents are followed up by a Serious Incident Review, the purpose of which is to gather and share information that in turn, may reduce the potential for future incidents. Since the implementation of these actions, we have seen a stabilisation in serious incidents performance due to our improved understanding.

Our performance has continued to improve across all of the key performance indicators (Figures 1 - 5), and we propose to maintain this baseline whilst bringing about incremental improvements in AMP7 through investment proposed in this Investment Case (Figures 6 – 10) in conjunction with the complementary investment in our Wastewater Networks Enhancement Investment Case.

3 Options

Background

The investment on the maintenance of our wastewater network assets (as identified in this Investment Case) will be undertaken in conjunction with investment proposed in our related Wastewater Network Enhancement Investment Case. Over AMP7 we aim to improve overall performance as identified in our MoS performance targets.

To deliver maintenance investment we use a mix of reactive and proactive approaches. For many assets the impact of failure can be managed for a reasonable length of time due to the flexibility built into our network so a reactive programme is the most cost effective approach. As we develop our analytical capability we will move to a more proactive approach but will always require some reliance on reactive investment to ensure we have the most cost beneficial approach. We prioritise our proactive investment using a risk based methodology, taking into account the impact on customers and the environment, which our customers have told us is important to them. We have assessed the programme for AMP7 looking at individual investment classes separately then brought all the information together to take a balanced view of risk across the whole asset base. We will continue to review this through delivery of AMP7 and rebalance the programme to manage emerging risk.

Consequently, this Investment Case comprises proactive maintenance to address identified service risks prior to failure (for instance major refurbishment schemes) and forward looking capital maintenance (FLCM) and reactive capital maintenance (RCM) to address loss of service through unpredictable failure.

We have undertaken a high-level assessment of the risks held in our Investment Manager (IM)[9] tool to further refine the development and scale of our maintenance plans. We have applied an innovative approach to analysing all the wastewater risk data held within IM. Using this analysis we have been able to assess cost, benefit and residual risk positions of varying investment scenarios against our investment categories (Appendix 1).

The outputs of this analysis (Figure 11) can be seen in Section 4 providing the context for our proposed AMP7 investment.

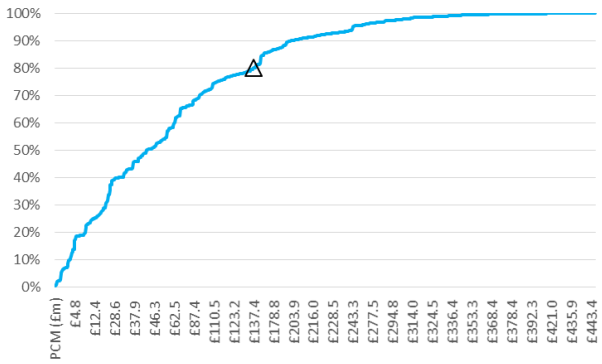

Figure 11 Example IM analysis of SPS known risk and expenditure required (£433m) to address 100%

However, we recognise that there will be risks (existing and new) that we are yet to capture on our risk systems, particularly those on buried infrastructure assets or those that carry continual full-capacity flows. We have factored this incomplete picture into our analysis, in that this approach has been used as one of a suite of contributing decision support sources, not as the single overriding influence.

Future Performance

We have incorporated forward-looking analysis into our planned maintenance planning by using our deterioration and service impact modelling tool, which utilises our asset inventory, cost models and historical failures in order to derive future projections with, and without intervention.

AIM (Asset Investment Manager) is a risk-based decision support tool targeting investment under multiple serviceability and budgetary constraints. It is a bottom-up investment planning tool, which allows the user to aggregate proactive investment needs, reactive costs, risks and investment benefits up to any level, including asset, cohort, superstring,

[9] Investment Manager is a decision support tool which caters for our investment planning requirements. It is the central repository for all our asset risks and interventions, and uses an optimisation engine to determine optimal programmes of investment.

and geographical area. The model makes use of historical data, and as such, reflects the predicted expenditure based on historical intervention.

This maintenance investment will support improved performance resulting from investment proposed in the Wastewater Enhancement Investment Case. The proposed outputs from this Investment Case will therefore be reviewed in conjunction with other proposals to ensure that we realise the potential efficiencies through; scheme delivery, data-driven decision making, embracing new and innovative approaches and a greater level of collaborative working with external organisations.

Further information on efficiencies are included in Section 5.

High-Level Options Appraisal

In the development of the Wastewater Network Maintenance Investment Case, we have taken on board the challenges, both internal and external, identified in section 2.

Our monitoring of business, regulatory and customer requirements has led us to develop and assess three plausible high-level options for expenditure and performance for AMP7:

- **Option 1 – Reactive only:** Defer any proactive intervention until AMP8 or beyond.
- **Option 2 – Decrease levels of maintenance investment:** Undertake reactive interventions and minimal proactive interventions.
- **Option 3 – Provide investment to maintain performance throughout AMP7:** Undertake reactive and proactive interventions with aim to maintain performance at end of AMP6 levels throughout AMP7.

Assessment of Options

Option 1 – Reactive Only

Option 1 has been informed by deterioration modelling, which takes in to account increasing risk due to deterioration of the network assets. Our approach would be to accept the deterioration of our assets and performance in AMP7 and defer proactive interventions until AMP8 or beyond. We would only react to asset failures.

Without investment, blockages are predicted to increase to 21,937 per annum by the end of AMP7 and collapses would increase to approximately 636 over the same period. The impact on service is that by the end of AMP7, there would be 5 more internal and 135 more external sewer flooding incidents as a result of the increase in blockages and collapses. The effect of this reduction would be long-lasting and it would take a number of years of over investment to recover performance levels.

Without investment, pollution from our sewers is predicted to deteriorate by an additional 2 incidents per year (from sewers only) by 2025.

Option 2 – Reduce level of maintenance investment

The impacts on flooding and pollution incidents would be dependent on the extent of investment proposed. However any reduction in investment would result in an increase in incidents.

Our customer research demonstrated that our customers had no desire for a deterioration in service and through WtP research showed an appetite for stable to improving performance as a minimum. Our stakeholders, including our economic and environmental regulators, respective Governments and their relevant departments also show no appetite for a deterioration in service.

In light of the above, both Options 1 and 2 are untenable.

Option 3 – Maintain performance

Option 3 investment is based on the aim to maintain the end of AMP6 performance with respect to collapses and blockages over AMP7. This requires investment to offset asset deterioration and identified service risks as well as addressing service failures. This investment is also aimed at maintaining compliance with our EDM obligations. Investment will restore those coastal water assets that breach their respective EDM trigger and those identified through the Storm Water Assessment Framework (SOAF) as high spilling back to compliant performance.

4 Preferred option

Our preferred option for AMP7 is Option 3. Table 3 sets out the type of measures this option will impact upon. It also identifies where the additional enhancement expenditure (from our Wastewater Enhancement Investment Case) will drive improved performance.

Measures	Option 3	Contribution from this expenditure	Improvement from wastewater enhancement expenditure
Blockages	✓	Stable +	
Collapses	✓	Stable +	
Internal sewer flooding	✓	Stable +	✓
External sewer flooding	✓	Stable +	✓
Pollution	✓	Stable +	✓
EDM trigger breach compliance	✓	New measure (permit compliance)	

Table 3 Measures contributed to

In the context of Option 3, our proposed wastewater network maintenance expenditure has been derived from consideration of the following:

- The assessed level of maintenance required for our wastewater network assets (SPSs, Network IDTs and Sewers and Rising Mains) having regard to expenditure and performance historically and over AMP6
- The level of risk the business is exposed to from the current and future operation of these assets
- The performance targets our business has set
- Investment in other Wastewater Investment Cases.

Our proposed (pre-efficiency) capital expenditure is shown in Table 4. This is split into the following investment categories:

- Network Intermittent Discharges and Tanks (IDTs)
- Sewage Pumping Stations (SPSs)
- Sewers and Rising Mains.

Investment category	Proposed capital expenditure (pre-efficiency)
Network IDT	£66.58 m
SPS	£47.70 m
Sewers and Rising Mains	£127.35 m
Total Programme (pre-efficiency)	**£241.63 m**

Table 4 Proposed Investment Case Expenditure

Our proposal comprises proactive maintenance to address identified service risks prior to failure. This would include maintenance and refurbishment schemes within the Planned Capital Maintenance (PCM) base maintenance expenditure, together with expenditure to address identified urgent service risks by our operational personnel through our forward looking capital maintenance (FLCM)). Reactive capital maintenance (RCM) is included to address loss of service that has occurred through unpredictable service failures.

For each investment category we have proposed similar levels of FLCM and RCM expenditure to AMP6 but have challenged ourselves with our programme of efficiencies.

The following provides further information regarding the basis of the proposed expenditure across the investment categories.

Network Intermittent Discharges and Tanks

We propose to invest £66.58m (pre-efficiency) during AMP7 to safeguard the environment by controlling our discharges in-line with their respective permits, whilst supporting the achievement of our pollution target. A breakdown of the expenditure is included in Table 5.

Maintenance is required to ensure that our assets deliver the level of service required whilst meeting

permit conditions, for example meeting pass forward flow requirements, spill frequency (EDM) and ensuring adequate screening is in place. Maintenance is also required on ancillary structures such as access roads, fencing, access structures and kiosks, which house instrumentation control equipment.

Investment category	Sub-programme	Expenditure (pre-efficiency)
Intermittent Discharges and Tanks	FLCM Programme	£0.97m
	RCM	£3.89m
	PCM base maintenance	£61.71m

Table 5 Breakdown of proposed IDT Expenditure

PCM base maintenance

We propose to invest £61.71m PCM during AMP7 on risk-based network IDT refurbishments. This has been validated by analysis of IM and historical performance and expenditure. The majority of the interventions will be to address poorly performing assets that carry a significant pollution risk or, present a major risk to EDM compliance or safety.

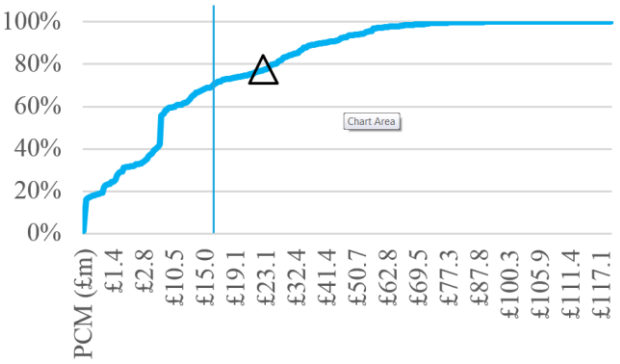

Figure 12 IM analysis of 483 IDT risks, affecting 95 sites (Δ = the point where cost benefit ratio falls below < 1)

Figure 12 shows the results of our innovative analysis of risks on our IM system (Appendix 1) related to our IDT assets. Our proposed PCM expenditure (£16.65m – excluding EDM[10]) is identified by the vertical blue line along the x axis. This shows that theoretically, approximately 70% of the known cost beneficial risk held upon IM could be addressed with the level of expenditure, subject to the order of delivery (See Appendix 1).

We have used a well-developed risk-based asset management approach and it is accepted that there will be residual risks as our proposed expenditure does not address all risks on IM. However we will manage these risks through the continued monitoring of our performance and assets, and supporting the proposed capital expenditure through the on-going development of operational improvements such as our MaRS and LEAN projects (refer to Section 5). This principle also applies to our proposed expenditure across the SPSs and Sewers and Rising Mains investment categories.

As we have a lot of these assets we need to retain flexibility in our programme so have not identified a fixed programme for AMP7 at this stage.

Our investment in IDTs will support Strategic Response: 16 - cleaner rivers and beaches.

Sewage Pumping Stations

Many of our SPSs are in constant use and subject to harsh environmental conditions. As a result, the structures and mechanical and electrical equipment are prone to significant wear and deterioration. Any failure within this asset base may result in sewer flooding, pollution or flows not receiving adequate treatment.

AMP7 SPS maintenance expenditure of £47.7m (pre-efficiency) is proposed to ensure the reliability and ongoing integrity of the civil structures and Mechanical, Electrical and Instrumentation (ME&I) equipment associated with our SPSs, in order that our assets (including those recently transferred to us) deliver a high level of service to our customers, whilst meeting their stringent environmental permit conditions. A breakdown of the proposed expenditure is included in Table 6.

[10] At the time of writing EDM performance was not captured as a risk upon IM. This was is a new requirement that requires a thorough investigation (12 months +) to be undertaken to verify the spill frequency and confirm the root cause.

Investment category	Sub-programme	Expenditure (pre-efficiency)
Sewage Pumping Stations	FLCM Programme	£7.0m
	RCM	£17.3m
	PCM base maintenance	£23.4m (includes £0.52m on transferred SPSs)

Table 6 Breakdown of SPS expenditure

PCM base maintenance

We propose to invest £23.4m PCM during AMP7 on proactive SPS refurbishments. This expenditure will address major prioritised SPS service risks identified through our IM system, and has been validated by analysis of historical performance and expenditure. Initial risk screening from the first stages of our Capital Gateway Process has selected priority sites for further development for PR19. Table 6 shows the risks identified for one of the priority sites, Queensferry SPS, and the monetised value associated with each need (see SPS Case Study below).

Figure 13 shows our analysis of IM risks for SPSs. This identifies that a capital expenditure of £444.4m would be required to address recorded risks (100%). Our proposed PCM expenditure (£22.9m) would address approximately 30% of the known cost-beneficial risk (Appendix 1).

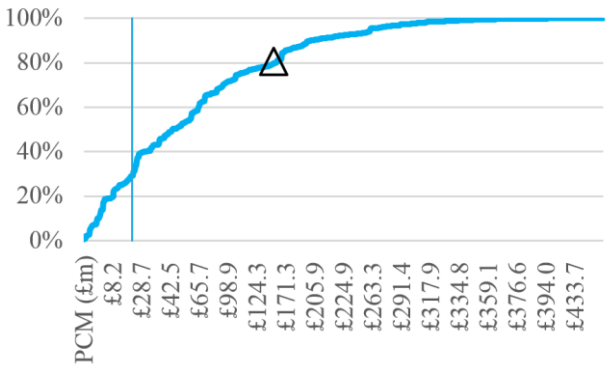

Figure 13 IM analysis of 2,306 SPS risks, affecting 91 sites (Δ = the point where cost benefit ratio falls below < 1)

Our proposed SPS expenditure will support Strategic Responses: 10 - worst served customers; 16 - cleaner rivers and beaches; and 17 - protecting our critical wastewater assets.

Case Study SPS PCM

Queensferry SPS maintenance scheme (£1.22m CAPEX pre-efficiency) – IM optimisation reward (£7.6m)

Queensferry SPS is one of a number of critical SPS that feed Queensferry Wastewater Treatment Works in Deeside North Wales. It receives flow from a local population of circa 7,250. The SPS was built in 1972 and has not undergone refurbishment or had any significant replacement of assets / equipment (other than pumps and associated mechanical/electrical) in the intervening years.

IM Need Ref	Need Title	Root Cause Confirmed (Y/N)	Annual Risk Exposure
N71673/2	Security fence line and gates	Y	£2,349
N71674/2	Ground surrounding the asset subsiding	Y	£158
N71675/2	Grating over the wet well	Y	£304,545
N71676/2	Storm pumps	Y	£760
N71681/2	DWF pump3 mechanical electrical and instrument	Y	£3,596
N71683/2	Flow meter	Y	£12,230
N84840/2	Building condition	Y	£5,158
N84841/2	Electric panels	Y	£35,347

Table 7 Queensferry SPS risks and risk exposure from IM

Our IM optimisation software selected the Queensferry SPS scheme (based on 'reward') from a group of SPS schemes identified for possible inclusion in the AMP7 programme. The performance and likelihood of failure of the site is also evidenced within the reactive work that the site has generated (Figure 14).

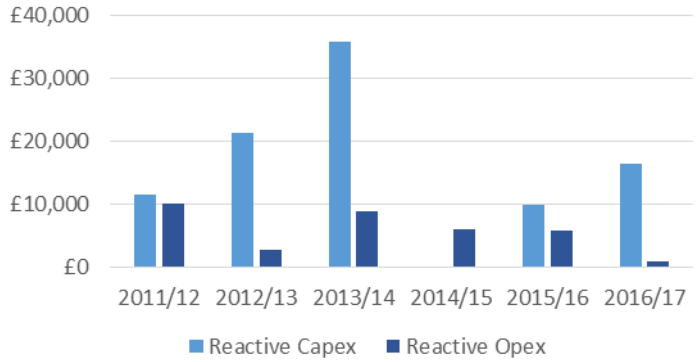

Figure 14 Queensferry SPS Reactive Capital Maintenance and Operational Maintenance costs

In preparation for PR19, our Capital Delivery Alliance carried out investigations at the site to validate the risks, confirm the root cause/s and propose high-level intervention scope and costs.

Figure 15 Images from Queensferry SPS PR19 investment need verification and site visit

Our conclusion was that the site is in need of major capital maintenance. The risks that our proposed scope will address are consistent with the findings of our risk capture process using IM (Table 7).

As the majority of the scope is the replacement of deteriorating equipment (i.e. general maintenance), no other options were assessed at this stage. However, at the feasibility stage where more detailed information is derived, alternative options may be developed and assessed where appropriate.

The Queensferry SPS high-level scope consists of:

- *Replacement of boundary fence (existing in poor, unsecure condition)*
- *New access arrangement (current access road subsiding)*
- *New replacement of steelwork (such as covers and flooring) due to significant corrosion (Figure 15)*
- *Replace storm pumps (existing are unreliable)*
- *New 3rd foul pump and replacement of degassing pipework (existing in poor condition)*
- *New flowmeter*
- *Structural repairs on building and building infrastructure (Figure 15)*
- *Replace current Motor Control Centre (MCC) as the current installation does not meet our specifications*
- *New electrical cabling, containment lighting and electrical building services as existing are in poor condition.*

Sewers and Rising Mains

Our proposed (pre-efficiency) expenditure of £127.4m in PR19 for sewers and rising mains is broadly in line with forecast AMP6 expenditure. A breakdown of the expenditure is included in Table 7 and comprises both reactive, forward looking and planned maintenance for our legacy assets and former private sewers now under our ownership.

Our overall estimate of the required expenditure for the sewer rehabilitation and cleansing programmes is based on an assessment of the output predicted from our deterioration and service impact modelling and IM, and is validated by analysis of historical performance and expenditure.

Our proposed expenditure will support Strategic Responses: 7 - working with customers and communities; 10 - worst served customers and 17 - protecting our critical wastewater assets.

PCM base maintenance

We propose to invest £54.0m during AMP7 on major risk-based sewer and rising main refurbishments and programmes of minor works (Table 8). This is based on an assessment of the output predicted from our deterioration and service impact modelling, supported by a 'bottom up' assessment of risks held upon our IM tool and historical expenditure.

A major scheme identified for AMP7 is along the Gwent SECS Main that passes through a Site of Scientific Special Interest (SSSI). The current rising main has been subject to significant internal wall corrosion from H2S, causing it to suffer repeat bursts and a loss of structural integrity. Our proposed investment (£20.4m) will reduce the risk of further impacts to the SSSI by addressing those sections most at risk over AMP7.

Investment category	Sub-programme	Expenditure (pre-efficiency)
Sewers and Rising Mains	FLCM Programme	£9.0m
	Programme - sewer cleansing programme	£11.0m
	PCM Grouped sewer rehab programme	£54.0m (includes £5.2m on transferred sewers/ rising mains)
	PCM Rising main ancillary items (air valves / washouts) programme	£1.1m
	RCM Sewers / chambers / ancillaries programme (for example washouts / air valves) (Below Ground)	£47.5m
	RCM Street furniture programme (such as S81 notices)	£4.8m

Table 8 Proposed expenditure sewers and Rising Mains

Figure 16 shows our analysis of IM risks for all sewers and rising mains (legacy assets). This identifies we would require £537.1m to address all risks (100%).

Our proposed PCM expenditure of £48.8m (excluding private sewers) would address approximately 63% of the known cost beneficial risks.

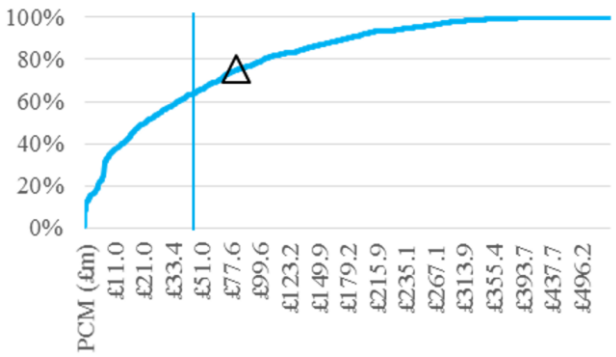

Figure 16 IM analyses of 2,843 Sewer and Rising Main risks (Δ = the point where cost benefit ratio falls below < 1)

Figure 17 shows our analysis of IM risks for the former private sewers and rising mains now under our ownership. This identifies that a capital expenditure of £50.9m would be required to address recorded risks. Our proposed PCM expenditure (£5.2m out of the proposed £54m) would address approximately 60% of the known cost beneficial risk.

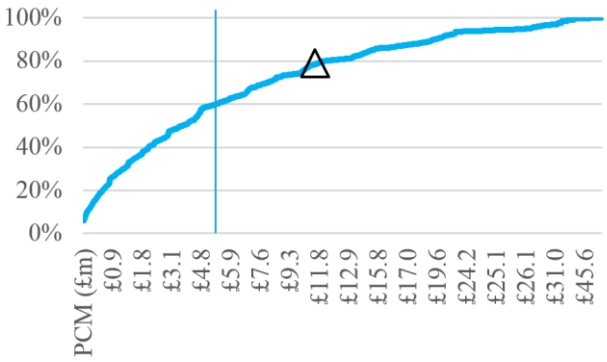

Figure 17 IM analyses of 172 former Private Sewer risks (Δ = the point where cost benefit ratio falls below < 1)

Sewer Cleansing

During AMP6, we have continued to develop our knowledge of flooding and pollution risks as a result of sewer blockages. We propose to invest £11.0m over AMP7 on our programme of proactive sewer cleansing having regard to AMP5 and AMP6 expenditure. Our performance has shown our previous investment in AMP5 and AMP6 has been effective in managing blockages.

Comparison with AMP6

Our AMP6 interventions have continued to support good performance. The forecast AMP6 outturn expenditure for the comparable areas of wastewater network maintenance is £267.8m (Table 9).

PR14 proposed expenditure	AMP6 forecast outturn expenditure	PR19 proposed expenditure (Pre-eff.)
£250.5m	£267.8m	£241.6m

Table 9 PR14/ AMP6 Outturn and PR19 expenditures

This is slightly more than the expenditure proposed for PR19, due to the following:

- There was additional expenditure on transferred SPSs and sewerage systems to make them “safe and serviceable”. This has

reduced expenditure requirements over AMP7 (~£13.5m)

- Selective re-investment from our Customer Dividend on maintenance within the equivalent AMP6 investment categories.

General

The planned investment on our wastewater network assets has to be considered in a longer-term context, noting the benefits of investment are distributed throughout the long-life of such assets, particularly within the infrastructure assets. Current and proposed expenditure is proportionate to offsetting a deteriorating risk profile, as demonstrated by achievement of stable serviceability as a minimum with measured incremental service improvements.

However, to achieve our performance targets the proposed capital expenditure will need to be supported by continued monitoring of our performance, assets and the on-going development of operational improvements through the effective implementation of our MaRS and LEAN projects (Section 5).

5 Cost efficiency and innovation

Cost efficiency

Initiatives are proposed over AMP7 to deliver cost efficiencies in our capital programme delivery. As identified in Table 10, we will deliver £21.97m of cost efficiencies, reducing proposed investment to £219.66m.

We will deliver these savings through improved efficiency in the delivery of schemes by our Capital Delivery Alliance partners and supply chain. We will also seek to include opportunities for new and innovative ideas in the delivery of our schemes. We will also seek opportunities to reduce costs by identifying and developing interdependencies between investment categories. For example, Dry Weather Flow non-compliance at Wastewater Treatment Works (separate Investment Case) could potentially be addressed by sewer rehabilitation in the network.

Investment category	Proposed programme total CAPEX expenditure
Sewers and Rising Mains	£127.35 m
IDT	£66.58 m
SPS	£47.70 m
Total Programme (pre-efficiency)	£241.63 m
Total Programme (post-efficiency)	£219.66 m

Table 10 Efficiency Saving

We will also seek to identify synergies between the other related wastewater investment cases (such as our Critical Wastewater Asset Resilience and Quality programme) in our AMP7 business plan.

To achieve our performance targets our capital investment will be supported by operational improvements resulting from internal business reviews. Examples include our Maintenance and Reliability Support (MaRS) and Lean projects.

Our MaRS project will deliver a more effective and efficient approach to maintenance over AMP7 and deliver significant savings as it is becomes embedded into our business. This project was developed from an Initiatives are proposed over AMP7 to deliver cost efficiencies in our capital programme delivery. As identified in Table 10, we will deliver £21.97m of cost efficiencies, reducing proposed investment to £219.66m.

We will deliver these savings through improved efficiency in the delivery of schemes by our Capital Delivery Alliance partners and supply chain. We will also seek to include opportunities for new and innovative ideas in the delivery of our schemes. We will also seek opportunities to reduce costs by identifying and developing interdependencies between investment categories. For example, Dry Weather Flow non-compliance at Wastewater Treatment Works (separate Investment Case) could potentially be addressed by sewer rehabilitation in the network.

Independent expert assessment of our current maintenance capabilities and their effectiveness. From this we have identified a programme of improvements related to the collection and use of asset condition data and predictive analyses to enable more proactive and efficient maintenance. Application of Lean and MaRS projects will help us develop the following:

- A more proactive approach to maintenance with reduced reactive activities
- The reduction of equipment failures through increased monitoring to identify reductions in performance and potential failures more quickly
- Improved operator engagement to include increased multiskilling and hence reduced costs
- The increased implementation of planned preventative maintenance activities, developed through the application of reliability centred maintenance and the analysis of predictive maintenance / condition monitoring.

These projects, along with other initiatives will also ensure we identify and address the root cause of reliability failures to ensure a reduction in the likelihood of a repeat.

Wastewater Network Maintenance

We will continue to work with our supply chain and academia to develop cost effective solutions to our wastewater network maintenance issues. Specific innovations relevant to this Investment Case that we will be trialling, installing or developing during the latter parts of AMP6 and during AMP7 include (but are not limited to):

- Self-cleaning screen that will avoid flows backing up in the network and overtopping the screen
- Thermal mapping on river lengths to proactively and cost-effectively identify uncontrolled discharges to watercourses
- Testing the validity of a data driven approach for the prediction of discharge/spill problems when compared to current hydraulic modelling approaches
- Collaboration with Non-Governmental Organisations to bring about wider support for any 'softer' catchment based solutions

Summary of innovation in this project

We will continue to work with our supply chain and academia to develop cost effective solutions to our wastewater network maintenance issues. Specific innovations relevant to this Investment Case that we will be trialling, installing or developing during the latter parts of AMP6 and during AMP7 include (but are not limited to):

IDT

- Self-cleaning screen that will avoid flows backing up in the network and overtopping the screen
- Thermal mapping on river lengths to proactively and cost-effectively identify uncontrolled discharges to watercourses
- Testing the validity of a data driven approach for the prediction of discharge/spill problems when compared to current hydraulic modelling approaches
- Collaboration with Non-Governmental Organisations to bring about wider support for any 'softer' catchment based solutions
- Trialing of a large capacity inspection camera to remove some of the obstacles to carrying out a man-entry survey of storage tanks
- Load measurement from IDTs to determine if a spill is environmentally significant.

SPS

- Developing a multi-variant risk model to determine the worst performing SPS
- Utilising the data generated from SPS to automate and manually interrogate data to generate intervention reports
- Pump de-ragging/blockage protection that will reduce call outs and pump component wear along with providing pump performance analytics to enable more effective preventative maintenance
- Radar sensor that uses Bluetooth technology to reliably record levels in SPS wet wells, storage tanks and overflows.

Sewers and Rising Mains

- Drone detection of pipelines and crossings using thermal imaging cameras
- Ice-pigging cleansing of rising mains to improves system performance and power costs
- Instant pollutant tracing equipment in order to detect sewer misconnections
- Suite of innovative tools to aid blockage removal to reduce the requirement to excavate
- Reliable 'live' monitoring in the sewer to detect blockage formation and allow quicker removal
- Electro-scan detector of sewer defects
- Detection of anomalous events in water and wastewater networks using Artificial Neural Networks and Fuzzy Logic technology
- Passive gate (flushing device) installed in sewer manholes upstream of locations subject to blockages due to Fats, Oils and Greases, sags in the line, or solids deposited due to low flow velocities
- Pipeline renovation using newer materials such as HDPE Plastic Pipe or our Polyurethane based resin systems to repair wastewater pipelines
- Non-contact flow monitors providing the ability to install without having to enter the flow within the sewer, particularly large diameter sewers

- Forecasting system that will provide operational staff with information that will allow them to predict and address problems before customers are affected
- Real-time monitoring of data loggers using analysis algorithms to generate alarms from reason based level deviation
- Public relations campaigns around sewer abuse and blockage reduction
- Operation productivity analyses to improve blockage clearance techniques identified through another blockage 'best-practice' project
- Novel silt scoop to effectively deal with silt removal in small diameter pipes
- Project looking at a means of removing or treating micro pollutants at source
- Machine learning from CCTV to identify sewers most at-risk of blockage.

Partnering and co-creation

We are aware that some of the issues that our wastewater networks face cannot be addressed by us alone if we are to continually provide improving and affordable services. Working closely with others will be key to us delivering our future aims. For example, we will continue to work with customers, communities and schoolchildren through our education teams to raise awareness of the causes of sewer blockages and the role they can play in helping us and protecting themselves from sewer flooding and pollution.

Over 15% of the cost of replacing sewers is associated with surface reinstatement and traffic management. As part of providing best service to customers, we will look to increase the co-operation with councils and highway owners, to align our replacement programme with their resurfacing programme and/or our water pipe replacement programmes, to ensure efficiencies and reduce customer impact.

6 Value for money and affordability

Impact on customer bills

We have ensured that there will be no adverse impact on customers' bills through our proposed investment in wastewater network maintenance. Due to our unique not-for-profit ownership model, the cost savings accrued in the future will be passed on to our customers through affordable bills and our Customer Dividend.

Value for money

We understand the need to demonstrate value for money in everything that we do. We will therefore continue to take a risk-based approach to our capital maintenance expenditure and strive to deliver efficient solutions; in that:

- Projects are prioritised by the risk they represent
- Projects pass through our Capital Investment Gateway process and receive significant challenge along the way
- Projects deliver the benefits valued by customer and stakeholders
- Delivery costs are at the same level or lower than those planned for.

7 Delivery

Procurement

Due to the nature of this investment (regional maintenance), this investment does not meet the criteria for Direct Procurement for Customers (DPC).

Significant maintenance schemes in AMP7 will be delivered through our AMP7 Capital Delivery Alliance, as they have been in AMP6. Minor works will be delivered through the local Wastewater Asset Management Teams and Operations through their respective framework contractors.

Programme

A risk-based AMP7 delivery programme will be developed in years four and five of AMP6 in conjunction with the wider wastewater programmes and having regard to the overall benefits associated with proposed interventions.

The various AMP7 sub-programmes and projects associated with this Investment Case will be managed or overseen by our Wastewater Assets team, with scope and programme adjustments being made to meet emerging priority issues. MoS and budget performance will be monitored monthly over AMP7, to enable timely and effective response to any emerging signs that planned benefits are not being delivered and to identify opportunistic interventions.

Risk mitigation and customer protection

Where we have undertaken high-level scheme development as part of PR19, we have sought to understand and document the key risks associated with the planning and delivery of the projects. This and further information identified during the development of AMP7 schemes / projects will feed into programme risk registers that will be used and developed throughout the delivery of the AMP7 programme to actively identify and manage risks. Application of the SOAF process will provide a backdrop of sound scientific evidence to the need for EDM driven maintenance investment. Public, formal reporting of EDM performance also provides assurance that our investment programmes are targeting the correct assets.

8 Assurance

Board assurance

Our current approach to asset management, including our approach to maintenance expenditure is endorsed by our Executive team and Board. Our Board will carry out a final review of proposed PR19 investment across all investment cases, prior to the submission of the business plan in September 2018.

We have a gateway approval process that all capital projects must pass through to ensure there is sufficient scrutiny and challenge from senior management.

There are six stages of the capital investment process and a gateway between each stage. The gateway defines the requirements that are to be met before a project can be approved to move to the next stage. The five gateways are as follows:

1. Commit to risk
2. Commit to feasibility
3. Commit to solution
4. Commit to delivery / start on site
5. Commit to handover.

Our Capital Programme Board (CPB) has the delegated authority to approve projects through the gateways. The approach provides strong governance for approving investment decisions and is transparent and fully auditable.

We will continue to apply these effective governance systems for our proposed AMP7 investment programme.

Cost assurance

Where we have undertaken high-level scheme investigations we have used our Unit Cost Database (UCD). Our UCD holds the historical costs associated with delivering projects in the current and previous investment programmes (AMP 4 through to and including AMP6) and has been independently benchmarked for PR19. The underlying cost models are updated annually to ensure the latest costs are applied.

Where we have budgeted for our programmes we have used our latest forecast expenditure costs (based upon actual outturn) from AMP6 to inform our plans.

Customer consultation assurance

We have taken measures to ensure that our customers can have confidence in the results of our PR19 Customer Research. We have commissioned an independent peer review of the Willingness to Pay (WtP) research methodology and its findings by a subject matter expert.

We have also contributed to an industry-wide comparative review of the WtP results from PR19 WtP research from across the WaSCs to provide assurance that our WtP results are not over or understated in comparison with the rest of the industry. For the areas of WtP relevant to this Investment Case, the comparative review showed that our results were not outlying values and were generally towards the middle of the pack, giving us confidence that our cost benefit methodology where based upon WtP will be consistent with others in the industry.

We have also presented our approach and results from our PR19 Customer Research to our Customer Challenge Group.

Measures of success

The MoS and their targets in this Investment Case are all commensurate with the preferences our customers, expressed in our AMP6 and PR19 engagement.

Future assurance

We have strong governance procedures for the planning and delivery of our capital investment. We will make sure that the required processes are in place to assure the successful delivery of our maintenance projects. As per PR19, we will also have strong Governance structure around PR24 to ensure that we develop and deliver affordable investment plans that have been influenced by our customers and key stakeholders.

Appendix 1: Analysis of risk data

IM analyses

As discussed in Section 3, we have developed and applied an innovative approach to analysing all the wastewater risk data held within IM (~18,000 live risks), to provide the type and quantum of risk, and the cost of addressing all of the risks individually or at a site level. Using this analysis we have been able to assess cost, benefit and residual risk positions of varying investment scenarios (Appendix 1). This has provided key information for the development of our PCM proposals within this investment case.

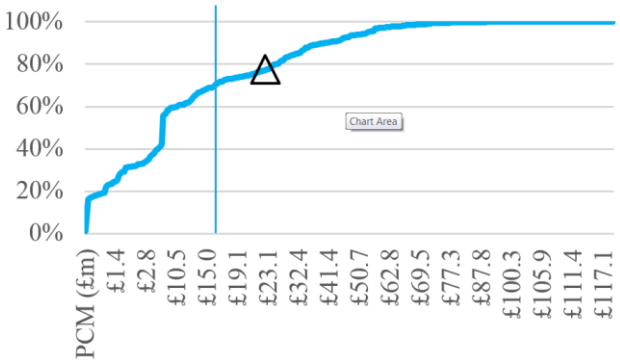

Figure 18 Example output of IM analysis showing expenditure scenarios (x axis) and percentage risk addressed (y axis)

Figure 18 shows our analysis of risks on our IM system related to our IDT assets. The blue curve shows the percentage of risk (by monetised value) along the y axis that would be addressed through various expenditure scenarios identified along the x axis. In this example, a total estimated capital expenditure of £118.8m would be required to address all known risks (100%).

The expenditure made is ordered by risks with the highest Benefit to Cost Ratio (BCR) being addressed first. The black triangle represents the point where the BCR associated with addressing a risk would be less than1 and hence it would not be cost beneficial to address the risks beyond this point.

An example of proposed PCM expenditure (£16.65m) is identified by the vertical blue line along the x axis. This shows that theoretically, approximately 70% of the known cost-beneficial risk held upon IM could be addressed with this level of expenditure. However, this is only achievable if risks are addressed in the order of BCR ranking. Although this would be our aim, this represents an idealistic approach to delivery and our experience to date is that reality may dictate a different programme. For example, where we propose to undertake a scheme to address a significant risk at a site, we may take the opportunity to address other risks / defects at the same time to maximise the efficiency of our investment. These principles apply to all of the IM analysis presented in Section 4.

References

[i] Welsh Water – Measures of Success Performance Testing Research, July 2017
[ii] WTP Qualitative research, Welsh Water Consultation, September 2016.
[iii] Water2050 Qualitative, Welsh Water consultation, July 2017 & Performance targets qualitative, Welsh Water consultation, July 2017.
[iv] Performance targets qualitative, Welsh Water Consultation. July 2017.
[v] Performance targets qualitative, Welsh Water consultation, July 2017.