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PR19: Raw Water Distribution Maintenance

September 2018



Raw Water Distribution Maintenance

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Executive summary

Overview of the investment

The continual supply of clean water to our customers on demand is the expected level of service from our customers. Our raw water distribution assets play a key role in supplying raw water to our water treatment works. The asset base is comprised of raw water mains and ancillary assets, tunnels and pumping stations. Although the asset base generally performs effectively, when failures occur they are often catastrophic failures and rely on the resilience of our treated water storage and distribution network to minimise the effect on service for our customers. As a result long term interruptions to supply present a key risk for these assets which will have a significant effect on our performance, measured as Customer Minutes Lost (CML).

In previous investment cycles we have targeted our maintenance activities to reactively and proactively maintain pipes, ancillaries, tunnels and pumps to provide a stable level of service. During AMP 6 we have improved two of our key raw water pumping stations at Manorafon and Prioress Mill, inspected the Llyn Fawr tunnel and reactively repaired raw water mains when they have failed, and replaced the raw main that feeds the Garreglwyd treatment works

During AMP7 we are planning to further improve the understanding of our raw water distribution asset base through undertaking an increased level of condition assessments across our assets including tunnels and bridges for which maintenance activities are more complex and non-standard.

The investment

We propose to invest £25 million during AMP7 to deliver raw water distribution maintenance improvements across the company. This will be targeted at all raw water distribution assets including the refurbishment and replacement of pipelines, pumping stations and network ancillaries including air valves and pressure reducing valves. These investments will link with our other programmes of work to provide a stable level of service, which will allow our enhancement programmes to deliver service improvements to our customers. Our planned programme for delivery in AMP7, summarised by the main investment types, is in Table 1 below.

Investment Category	Total by Investment Category
Raw Water Distribution mains, investment category 116; Cross Hands / Crai tunnel survey and minor repairs and Maintenance, mains PCM renewals and maintenance (Raw Distribution), inspection, replacement of pipes, bridges and tunnels	£10.285m
Raw Water Distribution pumping stations, Investment Category 117; maintenance, refurbishment and replacement of all pumping station elements including pumps, MCCs, Buildings and Generators	£15.126m
Pre-Efficiency Programme Total	£25.411m
Post-Efficiency Challenge Programme Total	£23.153m

Table 1: Raw Water Distribution Maintenance Intervention programme for AMP7

Delivering for our customers

This work will contribute to the achievement of the following of our customer promises:



Clean, safe water for all: Improve the quality of the water provided to our customers through fewer interruptions to supply. Proactively maintain trunk mains, pumps and other network assets to return existing assets to their design capacity.



Put things right when they go wrong: Reduce the number and repair times for burst mains and leaks by improving our response times through improved monitoring and operational practice.



A better future for all our communities: Reduce the number of interruptions to supply and acceptability of water incidents for all our customers to bring our performance in line with industry averages. A proactive programme of maintenance will maintain current performance and provide a platform for further improvements.

Delivering for the future

In Welsh Water 2050, we identified future trends. The requirement for this investment is driven by the following trends:



Climate change: More extreme temperatures will increase the likelihood of burst pipes in the future.



Changes in customer expectations: Changing customer and societal expectations may require us to ensure that all customers have a minimum universal service standard.



Protecting essential infrastructure: Our ageing assets and cast-iron water mains present significant issues with reliability and water discolouration.

Delivering our strategic responses

In Welsh Water 2050, we set out to deliver eighteen strategic responses. This investment will contribute to the following:



Improving the reliability of drinking water supply systems: Providing more flexibility and capacity to deal with both short-term shocks and future trends.



Protecting our critical water supply assets: Provide greater reliability to water supply systems.



Addressing our worst served customers: Undertaking interventions to enable minimum service standards to be delivered to all customers.

Achieving our measures of success

For PR19, we will measure our performance based on measures of success (MoS). This investment will contribute to achieving the following MoS:

Measure of Success	End of AMP6 Position	End of AMP7 Position
Supply interruptions greater than three hours (expressed in minutes per property)	12	8

Table 2: Customer Minutes Lost Measure of Success

1 Delivering our customer outcomes

Need for investment

This investment is required to maintain our raw water distribution assets and underpin our plans to deliver improvements to the reliability and water quality of supply to all customers - as outlined within our long-term strategy, Welsh Water 2050.

In common with the UK water industry our raw water pipeline system and pumping stations are steadily aging, which along with climate change could result in a greater number of burst mains and long term outages if maintenance investment does not continue.

Our raw water distribution network has a total length of approximately 470km of large diameter mains, of which around 80km or 17% are made of cast iron and 40km or 8% are made of Asbestos Cement. Both of these pipeline materials have reliability issues.

The raw water distribution pumping station asset base consists of 39 sites, of which 11 sites are within our top 20 largest pumping station sites with a capacity of greater than 400 kW.

Our maintenance programme will support the identification of assets that require maintenance before they fail, particularly those in pumping stations, large diameter mains, tunnels or on bridges where repair times and impact on our customers are at their highest. For example our Crai and Cross Hand tunnels contain a raw water pipeline and if the tunnel were to fail and damage the pipeline the time to repair this main or lay a new one would be several months. This would significantly reduce the volume of water that can be supplied by our biggest works, Felindre WTW. The potential impact would be long term interruptions to supply for up to 187,000 properties.

Climate also has a significant effect on our raw water distribution network as observed during the recent cold weather events in March 2018. Our raw water maintenance programme will include the replacement, calibration and maintenance of bulk meters and network ancillaries to minimise the effect of burst mains by providing an early warning of failures. Developing a greater understanding of

these assets and maintaining our water pumping station performance will reduce the risk of long term interruptions to raw water supplies to our water treatment works.

Views of our customers and stakeholders

We have undertaken extensive consultation with customers through our PR19 preparation programme, including our Welsh Water 2050 strategy consultation held in the summer of 2017, which engaged with 19,980 of our customers.

Within our Welsh Water 2050 document our customer promise for, "Clean Safe Water for all," was highlighted by our stakeholders as one of the most important aspects of our future plans, followed by providing reliability of supply and water quality^{i,ii}. Customers have stressed that they want stable water quality and a reliable supply, including resilience.

While the majority of our customers are generally happy with the current levels of serviceⁱⁱⁱ, customers have told us that long term interruptions of greater than 8 hours have a big impact and are considered to affect health and wellbeing and unacceptable. Infrequent interruptions of 3 to 6 hours resulting from situations outside of our control, for example the weather, are not regarded as a big problem.

Affordability of bills

We understand the importance of balancing the need for this investment with the impact on the bills that our customer pay. To help ensure that our bills remain affordable, we have identified a range of efficiency savings within the proposed investment programme. These efficiencies will allow us to deliver the improvements that we know are important to customers, but at a lower overall cost.

Wider benefits for Customers

We have put in place and will continue to develop tools with a wider benefit to our business. Having more of our network covered by hydraulic models means that we understand our asset base more

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fully and can respond more quickly to burst mains and other events. The models in addition to building new and replacing assets will make our network more resilient.

2 Investing for now and in the long-term

Future challenges

Our Welsh Water 2050 strategy identifies significant trends over the next 30 years and how these will impact on us and our customers. The most significant trends in terms of our customer minutes lost performance are set out below.

Climate change

We expect climate change to have an influence on our raw water distribution network. There will be increases in peak demands as well as larger variability of ground movement after freezing and dry weather periods. This will result in increased numbers of pipeline failures, resulting in low pressure and interruptions to supply for our customers. The recent cold weather event in March 2018 is an example of the impact of climate on our network and the knock on effect to our customers.

Changes in customer expectations

Changing customer and societal expectations may require us to ensure that all customers have a minimum universal service standard. This will mean that the service we provide our worst served customers will need to improve.

Protecting essential infrastructure

Industrialisation and urbanisation in parts of our region led to the rapid construction of water supply infrastructure in the late 19th and early 20th century. A growing number of physical assets constructed during this period are expected to reach or exceed their design life within the next 30 years.

Our ageing iron raw water mains for example are increasingly at risk of catastrophic failure. As well as their age and condition, climate change and increasing volumes of traffic where pipelines cross roads, dual carriageways and motorways are all contributing to the increased likelihood of mains failure and long term outages.

Land use change

Deindustrialisation in some of our supply areas means that our network is now oversized in places. When former industrial sites are developed there is an increased risk of damage to our trunk mains network during the demolition and development of brown field sites.

Legal duties

Our target to improve interruptions to supply (CML), Acceptability of Water (AoW) and Compliance Risk Index (CRI) performance is partly driven by the need to maintain and improve drinking water quality for our customers. Between 2015 and 2017 the DWI have issued notices to make improvements in the Llwynon catchment as well as 32 specific water supply zones. They have also highlighted the need for greater levels of storage or alternative supplies for Pengarnddu SRV to reduce the risk of long term outages resulting from failures at Pontsticill WTW.

Planning for the future

Long-term planning

This project links with our Water Resources Management Plan (WRMP) and our long-term strategy to improve the reliability of drinking water supply systems, protecting our critical water supply assets and achieving acceptable water quality for our customers.

Building on progress

Our proposals are not the start of our journey. Although we have made significant efforts in recent AMPs to manage our clean drinking water supply our raw water distribution network has not had the same level of intervention and enhancement. Our programme of work will provide a greater understanding of our raw water distribution assets and proactively maintain our pumping stations and network ancillaries, reducing the risk of significant raw water mains failure and the associated outages that would result.

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AMP6 Progress

The raw water distribution programme during AMP6 has focussed on the identification of leaks and burst mains and their repair and the full rebuild of our Prioress Mill and Manorafon raw water pumping stations at a cost of over £20m.

During AMP6 we have inspected the Llyn Fawr tunnel as well as inspecting and repairing leaks on a number of our raw water mains including the Usk to Bryngwyn and Llugwy raw water mains. The information obtained has been used to identify interventions during both AMP6 and AMP7.

3 Options

Background

To deliver maintenance investment we use a mix of reactive and proactive approaches. For the majority of raw water distribution assets catastrophic failure results in a significant outage due to their size, complexity and often remote locations of them.

As we develop our asset knowledge and analytical capability we will move to a more proactive approach but will always require some reliance on reactive investment. We have prioritised our proactive investment using a risk based methodology, taking into account the potential impact on customers.

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.

Our AMP 7 programme will both proactively identify and target assets at the highest risk of failure and reactively repair assets with minimal impact on our customers.

- Maintain and replace raw water distribution assets which are at highest risk of failure and causing service interruptions
- Maximise the availability of our monitoring and control equipment through proactive replacement and regular maintenance and calibration
- Target raw water losses between the abstraction point and the water treatment works
- Continually improve our asset knowledge through inspections, desktop studies and operator feedback using the latest technology including drones and hand held data capture devices where required
- Proactively target maintenance activities across the raw water distribution assets including bridges, water pumping stations and tunnels

Raw Water Distribution Mains

Our raw water mains asset stock is on average older than the expected asset life, for example AC mains are on average 60 years old and cast iron mains on average 99 years old. Of our total raw water mains length, 16% of the assets are Cast Iron and Asbestos Cement mains with an asset life greater than 100 years and 60 years old respectively. This highlights a growing risk of failure for our large diameter raw water pipelines. The recent failures on the pipeline from Usk Reservoir to Bryngwyn WTW has been an example of this.

Tunnels

There are ten raw water tunnels within our operating area, Figure 1 provides a map of all tunnels in the South East Wales area. We currently have limited information about the condition of these assets due to difficulty accessing them but any failures of these would have a dramatic impact.

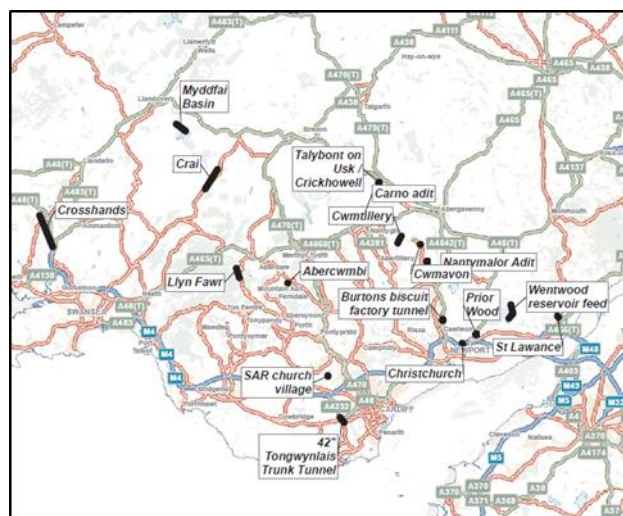


Figure 1 - South Wales tunnels on GIS

Raw Water Distribution Pumping Stations

During AMP6 the vast majority of work done on raw water pumping stations has been based on a reactive work programme. The two exceptions being Prioress Mill and Manorafon WPS. These two projects have had an investment of more than £20m. Maintenance at other sites was deferred to allow investment at these two sites because they needed a major rebuild to avoid catastrophic

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failure. Consequently a programme of condition assessments was undertaken on the largest 17 water pumping stations across our area which were not being worked on in AMP6. The largest pumping stations included 8 raw water distribution sites and the assessments defined maintenance requirements for AMP7 to reduce the risk of significant failures occurring.

Of the largest raw water distribution pumping stations, 7 site were assessed. This followed the AMP6 need to re-build Prioress Mill pumping station at a cost in excess of £20m. The aim being to identify maintenance issues that should be addressed proactively, for example motor control centre replacement, instrumentation control and automation equipment replacement and pump maintenance. Of these 6 sites have been included within the programme, where the condition and maintenance reports provided an assessment of needs with defined timescales to undertake the work within one year, 5 years and over the next 10 years.

Analysis of future needs

Our raw water distribution mains and pumping stations programmes have been supported by deterioration modelling, investment manager, data analysis and operational intelligence from a range of teams across our business. We have made use of deterioration models to predict the pipeline and water pumping station failures.

This combination of deterioration modelling and detailed desktop network assessment has enabled us to build up a prediction of maintenance needs over the next five years, see an overview of the process used in Figure 2 below.

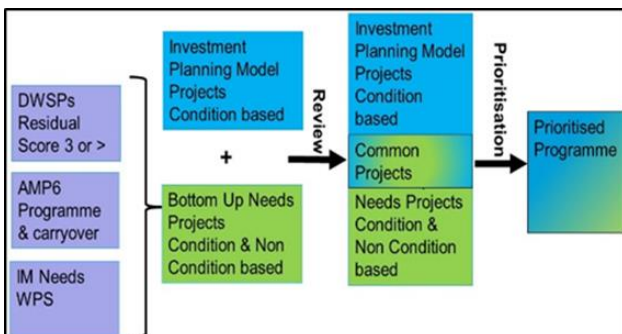


Figure 2-shows the process that was used to produce the raw and clean WPS programme

During AMP6 the majority of work done on water pumping stations has been based on a reactive work programme derived via IM. This has been demonstrated to be detrimental to the company’s pumping station performance with a greater level of reactive work required each year between 2006 and 2015. Figure 3 below indicates the number of reactive work orders for pumping stations has doubled over the 10 years from 2005 to 2015.

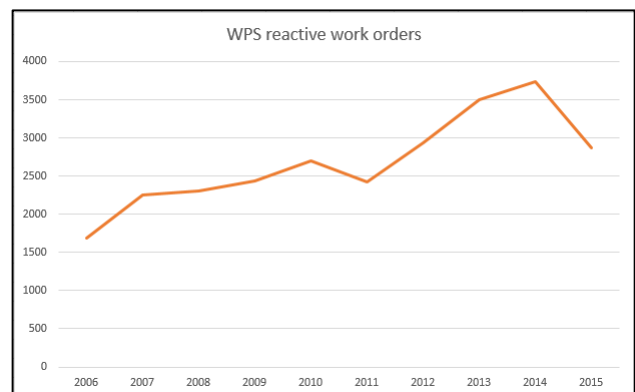


Figure 3 - reactive work order numbers over last 10 years

As demonstrated in Figure 3 with reactive maintenance work orders, Figure 4 demonstrates that if we continued with a reactive maintenance programme only the number of work orders would increase exponentially within 20 years.

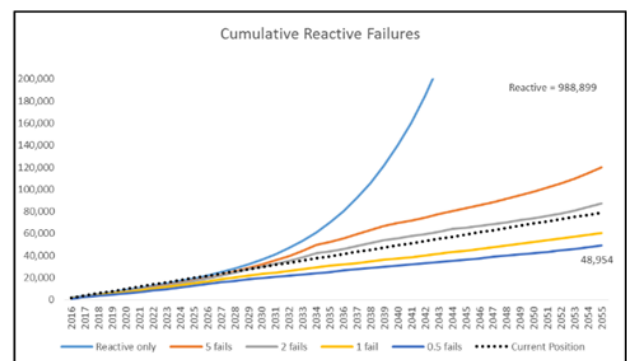


Figure 4 1– reactive work orders increasing over time

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High-level options appraisal

In order to provide a stable level of performance for our raw water distribution assets three investment options have been developed. The three high-level options considered in the development of this investment case were:

- Option 1: Reactive Maintenance only;
- Option 2: Maintain the current level of service and undertake prioritised proactive maintenance; and
- Option 3: Higher level of proactive maintenance to reduce risk

Further detail on these options is provided below:

Option 1 – Reactive Maintenance: only undertake reactive maintenance in AMP7.

Option 2 - Maintain the current level of service and undertake proactive prioritised maintenance: programme of interventions to maintain current levels of service and at a similar level of spend to AMP6. This option includes undertaking targeted proactive maintenance at the highest risk sites

Option 3 – Higher level of proactive maintenance: undertake a proactive programme of interventions to address the known and predicted failures across the raw water distribution asset base:

- Maintain all the raw water distribution pumping stations to remove the issues highlighted in IM;
- Inspect and maintain programme of pipeline replacement;
- Inspect and maintain raw water tunnels
- These interventions will be in addition to the Option 2 maintenance required to maintain the current level of service.

We recognise that there are overlaps between the different intervention options and their impact on performance drivers. We have therefore developed this as an integrated investment case that considers

all problems together to generate an optimal programme of work.

Assessment

Our raw water distribution mains performance has been managed on a reactive only basis during AMP6 and our raw water pumping stations have been managed in a similar way. As a result the asset base has deteriorated over the last five years and a more proactive approach is required to reduce the risk of a catastrophic pipeline, tunnel or pumping station failure. Our surveys of the largest pumping stations have highlighted that should a motor control centre fail there will be a significant interruption of supply whilst alternative pumping arrangements are organised. The asset life of an MCC is on average 30 years old and at some sites these are 40 years old. It means that a planned replacement programme is required and Option 1 is not a realistic option.

Option 2 is the preferred option to take forward for implementation because it will maintain the current levels of performance, improve understanding of our asset base condition and develop a definition of interventions for tunnels and bridges in particular. The level of investment is comparable to our AMP6 investment programme.

Option 3 is considered to be a level of investment that will reduce the risk of service failure and will involve a significantly higher level of investment than Option 2. This option has not been chosen because of the significantly higher level of spend, the need to more fully understand the condition or our asset base and the limited benefit resulting from a reduction to the risk of a catastrophic failure without more information to target specific mains.

The main benefit of our chosen solution Option 2 is that it achieves stable service through a programme of targeted interventions and will provide an improved understanding of asset condition and information.

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4 Programme

Programme Overview

There are two individual investment categories which contribute to this maintenance investment case. The investment categories are outlined in Table 3 below.

Programme of work	Proposed programme total budget
Raw Trunk Mains	£10.285m
Raw Water Pumping	£15.126m
Total	£25.411m

Table 3: Summary of proposed budgets for the Raw Water Distribution Maintenance programme

Raw Water Distribution Mains

The raw water distribution mains programme will consist of a mixture of proactive and reactive maintenance. We plan to walk all of the raw water mains and undertake a visual asset condition assessment during AMP7.

The raw water maintenance programme will review the condition of raw water mains and, where required, undertake more detailed condition assessments, repair mains and replace mains as well as valves and other ancillaries including chambers and washouts.

The larger schemes include; Strata Florida to allow the main to be cleansed and a proposed scheme at Gwastadgoed for 4km of new main to be laid. These are at the early stages of the Gateway process so have high level costs.

The budget for reactive replacements is based on current failure rates. The programme also takes into account the development of our assets by walking the mains with 2 men walking 4km a day to identify issues and maintenance requirements.

Raw Water Distribution Tunnels

The majority of the work planned for the raw water distribution tunnels will be surveys and condition assessments. There are three tunnels in particular, Crai, Cross Hands and Llyn Fawr for which we will undertake a more in depth assessment to scope and cost the maintenance requirements.

With the exception of Crai and Cross Hands tunnels the budgets for the rest of the raw water tunnels asset base are included within the raw water distribution trunk mains investment programmes.

Crai and Cross Hands Tunnels

Although there is a wider tunnels asset base the inspection and definition of condition and required interventions for the Crai and Cross Hands tunnels is a defined maintenance scheme, due to significant concerns relating to condition, within the programme. The output from the inspections will be an understanding of the residual life, any required interventions including further visual, or detailed inspections to understand any interventions required in AMP8.

Llyn Fawr Tunnel

The Llyn Fawr tunnel contains the key raw water main supply to Tynywaun water treatment works. The raw water supply provides the majority of the raw water resource for the Rhondda valley.

The tunnel has subsided in sections because of the collapse of mine shafts beneath the tunnel. An expert assessment of condition and potential solutions is required to define a solution to stabilise the tunnel. A desktop assessment will be undertaken to look at alternative routes of supply for the raw water main to Tynywaun to identify whether there is a viable alternative route for the raw water main.

Raw Water Distribution Pumping Stations

Table 4 below outlines the investment for raw water pumping stations for the coming AMP which will consist of mostly capitalised maintenance projects as well as increasing the understanding of

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our assets and increasing the modelling of our assets.

Programme	Budget
WPS – PCM for Raw Water Pumping Stations	£14.579m
WPS – RCM for Raw Water Pumping Stations	£0.547m
Total Programme Pre-efficiency	15.126m

Table 4: Raw Water Distribution Mains proposed programme

The raw water distribution programme has been chosen to proactively maintain the pumping stations including 12 raw water pumping stations, including SOR 1/2/3 as a single pumping station. The RCM element of the programme is planned for failures associated with smaller pumping stations which need to be repaired reactively. Our analysis demonstrates that we should experience some improvements in the number of reactive failures for the programme that we have designed.

5 Cost efficiency and innovation

Cost efficiency

We are proposing to deliver this programme with £2.3m of cost efficiencies, as shown in Table 5 below.

We will deliver these savings by challenging our Alliance partners to improve efficiency and by maximising opportunities to innovate.

Programme of work	Proposed programme total budget
Total programme (pre-efficiency)	£25.411m
Total programme (post-efficiency)	£23.153 m

Table 5: Proposed cost efficiency

Our Capital delivery governance process means that projects will be reviewed and the best value solution is chosen for implementation.

Summary of innovation in this project

Tunnel Inspections

The development of a new method to assess the condition of our tunnels is planned. The traditional approach of walking through tunnels will be preceded where possible using drones or ROV's. This will reduce the health and safety risk to inspection engineers as well as providing an initial view of condition which will highlight whether there is a significant risk of a catastrophic failure.

In the case of the Llyn Fawr tunnel an innovative solution will be required to avoid either re-routing the pipeline that located within the tunnel or to resolve the subsidence issue due to mine shafts beneath the tunnel. An innovative approach to stabilising the tunnel and mineshaft will be required to safeguard the future of the existing tunnel.

The overall benefit of our tunnel inspection approach will be to provide an improved understanding of tunnel condition using a consistent approach. This will also highlight the

future monitoring requirements for our tunnels and minimise the risk of catastrophic failure in future.

Technology development

Using the lessons learnt from the clean water network an increased use of abstraction meters and inlet meters as well as pressure monitors in targeted locations will be trialled to proactively identify burst mains.

We are also undertaking raw water mains cleansing to remove the build-up of peat and sediment from our raw water mains at specific locations and return the capacity of mains to design levels.

We will also continue to invest in training staff so that they can be more sensitive when operating our raw water distribution assets. We know that by operating valves too quickly can cause discolouration or scouring events on raw water mains which could cause air entrapment or large changes in pressure which could increase the risk of burst mains.

We created a training rig at Sluvad WTW and Glascoed WTW, see Figure 5, so that staff can see how to manage valves with real time data feedback which shows the staff how to operate valves without causing a detrimental effect on the network. We have also trained the emergency services so that when they need to use the network they can operate it without causing issues, we did this for free as well as helping them understand the challenges we are having so they understand why this is important.



Figure 5 – Sluvad Training Rig

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Partnering and co-creation

Working closely with our partners is essential to the way we plan to work in the future. Our 2050 strategy highlights this through identifying partners for each of our programmes of future work.

We aim to undertake this work in partnership with customers and communities, the Customer Challenge Group as well as the Drinking Water Inspectorate and Environment Agency/ Water Resources Wales.

The Brecon Beacons Mega Catchment project is one example of this which will lead to raw water quality improvements and reduce the levels of sediment entering and settling within our raw water distribution mains and reducing their capacity.

6 Value for money and affordability

Impact on customer bills

We understand the importance of balancing the need for investment with the affordability of our bills. We believe the investment will help to deliver the level of service our customers and regulators expect, and represents an optimal approach for sustained long term improvement.

Value for money

We recognise the need to demonstrate value for money in everything that we do. In arriving at the proposed investment, we have closely considered the costs and benefits of different approaches to make sure that the investment represents long term value to our customers.

The projects within the network maintenance investment case have been developed so that they are delivered in conjunction with other programmes of work. For instance, the raw water distribution mains condition assessments will be planned to be undertaken to highlight and resolve any issues prior to the completion of the water pumping stations which supply them with water.

As outlined in the previous section of this document, we will also seek to ensure value for money by promoting innovation throughout delivery, by learning lessons from the work we have delivered to date, and by working closely with our partners to encourage best practice and incentivise efficiency.

7 Delivery

Procurement

We have undertaken an assessment of the applicability of direct procurement for all of our projects. The nature of these projects is such that we consider a direct procurement approach would not be in the best interests of customers.

The various projects will be managed by our Water Assets team throughout AMP7 with scope and programme adjustments being made to meet current operational and other issues. We will monitor performance month by month so that we can respond quickly to emerging signs if we are not getting the benefits we have projected.

Programme

An initial prioritised programme of work is being developed prior to AMP7 with large schemes identified and prioritised. This process will continue to review current operational issues and prioritise the pumping station and large main programmes linked to the costs and associated benefits of investments.

The tunnels and mains condition assessment programme will be undertaken across the five years of AMP7 with the three tunnels Crai, Cross Hands and Llyn Fawr prioritised for completion within

years one and two. The pumping station programme has been prioritised on cost benefit, condition and need and this will continue across the five years of AMP7.

Risk mitigation and customer protection

We will deliver our programme in a modular fashion so that the benefits of lower cost assets, for example valves, can be seen in terms of their effect on reducing the number of burst mains before going ahead with the replacement of a main. This approach will be used across our raw water distribution mains.

During AMP6 our larger raw water distribution pumping stations have had their condition assessed. This has highlighted the maintenance requirements and the level of risk for each site. The replacement of motor control centres, pumps and other assets including control equipment will all reduce the risk of a catastrophic failure as well as returning the capacity to pumping stations to their original design levels.

8 Assurance

Governance

Our current raw water distribution maintenance programme has been agreed with the Water Assets team and approved by the Dŵr Cymru Executive. The group meets on a monthly basis and is chaired by the Managing Director of Dŵr Cymru. This helps to ensure that the full focus of the business is directed at this investment.

A key metric of raw water distribution assets performance is CML which are targeted in the monthly Water Quality meetings chaired by the Head of Distribution. These meetings are attended by key stakeholders including the Water Services Science team and Water Assets team.

On a daily basis our current performance is shared internally to ensure that emerging trends and problem areas are targeted quickly. There is also strong awareness of our commitment to improve our CML performance following the recent cold weather events and regular updates during our company-wide monthly team brief.

Our investments to reduce the customer minutes lost are reported to our Quality and Environment Committee (QEC) on a six-monthly basis. QEC checks the improvement progress against our Strategic Objectives and is provided with the key risks and mitigation measures.

We will continue to apply these effective governance systems for our proposed AMP7 investment programme. The board will carry out a final review of this investment in detail prior to the submission of the business plan in September.

Cost assurance

We have undertaken a high-level feasibility studies for the eight large water pumping stations. However, further detailed feasibility will be required to define the final scope and cost of each

project. Our target for savings during AMP7 will be to achieve a 6% improvement on the delivered costs for AMP6 through efficiencies identified within our delivery alliance. These efficiencies are outlined in the 'Cost efficiency and innovation' section.

Customer consultation assurance

Our customers have indicated that investments to reduce interruptions to water supply is key and would be concerned if interruptions greater than eight hours were a recurrent problem^{iv,v}.

Measures of Success

We are continuing with our measure of success (MOS) to monitor the benefits that our CML interventions bring – the 'Customer Minutes Lost' MOS. Our target for improvement to this MOS over AMP7 as a result of our proposed investment is shown in Table 7.

Measure of Success	End of AMP6 Position	End of Investment Position
Supply interruptions greater than three hours (expressed in minutes per property)	12	8

Table 7: CML MOS improvement predicted

Future assurance

We have strong governance procedures for the planning and delivery of our capital investment. Our Board will continue to provide the high level overview and governance to ensure that we deliver these much-needed improvements in the interests of our customers.

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References

i WW2050 Qualitative Debrief, 2017- engaging with 108 customers

ii Summer Consultation, Welsh Water 2050,2017

iii Performance targets qualitative, Welsh Water consultation, June 2017

iv WTP Qualitative research, Welsh Water consultation, August 2016

v WTP Qualitative research, Welsh Water consultation, August 2016