Appendix WWUQ8S- Iron Mains Programme 2026-31 Tier 2a

WALES&WEST UTILITIES

Contents

Appendix WWUQ8S- Iron Mains Programme 2026-31 Tier 2a

1.0 Summary Table

Name of Project	WWU Iron Mains Programme 2026-31 - Tier 2a		
Scheme Reference	WWU1		
Primary Investment Driver	Safety and environmental emissions		
Project Initiation Year	2026		
Project Total Installed Cost Estimate (£) Close Out Year	2031		
Total Installed Cost Estimate (£)	[redacted]		
Cost Estimate Accuracy (%)	Based on very detailed costing model - +-5%		
Project Spend to date (£)	[redacted]		
Current Project Stage Gate	Not started		
Reporting Table Ref	BPDT CV6.01, CV6.02, CV6.07, CV6.08,CV6.11 and M8.04		
Outputs included in RIIO-GD3 Business Plan	PCD for Tier 2a delivery. Shrinkage forecasts will reflect the planned replacement types and volumes		
Spend apportionment 23/24 prices	GD2	GD3	GD4
		[redacted]	

2.0 Executive Summary

The Health & Safety Executive (HSE) reviewed the iron mains enforcement policy in 2024. They raised concerns over the level of tier 2a iron mains in GDN's mains replacement programmes. This resulted in a review of the risk posed by these mains, supported by DNV GL analysis.

For Wales & West Utilities, this has highlighted 5 tier 2 iron mains that pass a risk action threshold and as such, require replacement in RIIO-GD3. This work is mandated by HSE and does not require a Cost Benefit Analysis (CBA) justification under Pipeline Safety Regulations 13a (PSR13a). We have included one for completeness.

Table 1 summarises the lengths, associated cost and a comparison to Tier 2a work in RIIO-GD2.

Price control	First Year Spend	Final Year Spend	Intervention Volume (km)	Investment Design Life	Total Installed Cost	Cost per m
RIIO-GD2	£0	£0	0.95	60+ years	£0.52m	£547
RIIO-GD3	[redacted]	[redacted]	2.25	60+ years	[redacted]	[redacted]

Table 1 – GD2 vs. GD3 cost comparison

The key difference in costs between the RIIO-GD2 pipe and the RIIO-GD3 pipes is traffic management. The RIIO-GD2 pipe was in a pedestrianised zone and traffic management was not required. All RIIO-GD3 pipes are in major highways with significant traffic management. Costs have been built up using recent experience of mains replacement in similar roads.

We have carried out a 'what if' analysis on our Tier 2 population to understand impact of future fractures and Gas in Buildings (GIBs) on risk of these pipes. This has shown a potential for the Tier 2a pot to increase to 7km in RIIO-GD3 if these events were to occur.

Our preference is for Tier 2a to be funded via a re-opener mechanism due to the unique costs associated with the locations of these mains. This would give appropriate scrutiny to costs, protecting both consumers and WWU from over/under funding of this mandatory workload.

3.0 Introduction

Wales & West Utilities own and operate a population of circa 33,000km of buried main (as reported in RRP for 2023), transporting gas to our consumers at pressures ranging from 21mbar to 7bar. There are 3 distinct operating pressure tiers; Low Pressure (LP) 21-75mbar, Medium Pressure (MP) 75mbar–2bar and Intermediate Pressure (IP) 2-7bar.

The IP network is subject to the Pressure Systems Safety Regulations 2000 (PSSR) due to operating in excess of 2bar pressure. These assets total 1,550km and are constructed in either steel or polyethylene (PE). As mandated by PSSR, the steel is protected by Cathodic Protection (CP) systems and well maintained. These assets rarely fail, and investment is primarily in maintaining the CP systems in good health. This investment is described in the Steel Distribution Pipelines Engineering Justification Paper.

The MP and LP networks total 31,400km and are a mix of PE, steel and iron. PE is very reliable and rarely fails. The steel and iron however, are at the end of or beyond their expected life and we respond to circa 7,000 leaks per annum from these assets.

Appendix WWUQ8S- Iron Mains Programme 2026-31 Tier 2a

There are circa 2.5m customers connected to the WWU network individual gas services. They terminate at an Emergency Control Valve (ECV) which is generally situated at the inlet to a consumer's gas meter. WWU's network ends at the ECV and we do not own or manage the gas meter.

Services are predominantly constructed in either Polyethylene (PE) or steel. PE services are incredibly reliable, and a leak is extremely rare. We have laid services in PE since the 1970s. Steel services were generally installed prior to this so they are mostly over 50 years old with many much older. They are at end of their life and we experience circa 7,000 leaks per annum.

A large proportion of our MP and LP iron mains are subject to a replacement programme mandated by the Health & Safety Executive (HSE). The Iron Mains Risk Reduction Programme (IMRRP) addresses the failure of 'at risk' iron gas mains (those pipes within 30 metres of buildings) and the consequent risk of injuries, fatalities and damage to buildings. The HSE developed a three-tier approach; Tier 1 pipes are up to and including 8" iron pipes, Tier 2 9" up to 17", and Tier 3 >=18" iron pipes. The IMRRP requires all Tier 1 mains within 30m of a building to be decommissioned by December 2032. This is a 30-year programme, and we have an excellent track record of delivering successfully since the formation of WWU in 2005. Tier 2 mains within 30m also have to be decommissioned, however only if they are above a risk-action threshold (a risk to life level, beyond which a pipe must be removed). These pipes are classified as tier 2a. Pipes that do not qualify as HSE mandated are considered for replacement based on a cost benefit assessment. This is classed as the 'non-mandatory' programme and is detailed in the 'Non-Mandatory Distribution Mains Replacement Programme' Engineering Justification Paper (EJP).

This paper sets out the tier 2a work we plan to do and the associated costs. It expands on the drivers for us to invest and the benefits of investment.

4.0 Equipment Summary

Category	Population forecast at start of GD3	Description	Investment driver
Tier 2*	952km	CI, DI and SI mains with a diameter of between 9" – 17" / 225mm – 425mm	Any main passing a risk threshold agreed across GDNs and with HSE are mandated to be replaced in a reasonable time frame. These are classed as Tier 2a. The remaining population are replaced if CBA or stakeholder feedback makes a compelling case. These are classed as Tier 2b

Table 2 – Asset details

This paper covers tier 2a only. Tier 2b is within the scope of our original non-mandatory mains IDP and supporting annex submitted with our draft determination response.

5.0 Problem/ Opportunity Statement

We are bound by legal obligations to manage and replace these mains. Our Tier 1 and Tier 2a replacement programme is mandated by HSE under the Pipeline Safety Regulations (PSR) section 13a. We have duties under the Pipelines Safety Regulations (PSR) to ensure that "a pipeline is designed, constructed and operating safely, provide a means of securing pipeline integrity, thereby reducing risks to the environment".

Our population of buried iron and steel distribution mains and services are nearing the end or are beyond their expected asset life. There are regular failures and we respond to, and repair circa 14,000 leaks per annum (7000 mains and 7000 service).

Each leak requires our operatives to attend, make safe and then repair. Each leak results in emissions of methane to atmosphere which has a carbon equivalent impact 25x that of CO2. Total emissions from the UK gas networks are circa 1% of the UK's total emissions and mains failures are a significant contributor.

In addition, there is a significant safety risk, following a gas escape, of gas tracking underground and entering a building. The gas can collect and if volumes are significant enough and there is an ignition source, such as switching on a light, this can result in an explosion. There are many examples of this in the UK. Thankfully, these are now rare due to the success of the mains replacement programmes to date.

HSEs Enforcement policy for the iron mains risk reduction programme 2026 to 2031 requires that GDNs set a risk action threshold. For Tier 2 pipes, we have a methodology for setting this threshold which is described in Appendix 1. This methodology is underpinned by the Mains Risk Prioritisation System (MRPS), this is a risk model which calculates the likelihood of pipe failure, gas ingress to a property and subsequent ignition. This model and the coefficients within have recently been reviewed and updated by DNV. Details of the review are included in Appendix 2, part of which looked at a likely length of pipes that would pass the risk action threshold during the GD3 period. In WWU's case the report suggests a length upwards of 7km that would need to be decommissioned or replaced.

Our stakeholders have told us they want us to maintain the current levels of safety and reliability from our network and do not want to see this degrade. Stakeholders also want us to reduce methane emissions; this relies on older metallic mains being replaced with low emission Polyethylene. General consumers have told us they would like to see the mains replacement programme accelerated to improve safety and deliver environmental benefits. This is countered by feedback from local authorities who do not want an increase in replacement works due to the disruption the work causes. Our overall mains replacements plan balances these stakeholder requirements and tier 2a are a key element.

5.1 Narrative Real Life Example of Problem

This section provides a summary of our RIIO-GD2 tier 2a replacement projects, to demonstrate the challenges faced in managing these assets and the assessment process to arrive at a decision to invest.

Example 1 – Commercial Street, Newport

In GD2 our most significant tier 2 pipe above the risk action threshold was located directly through the central shopping street in Newport City Centre.

Figure 1 – street level view of the location of the main

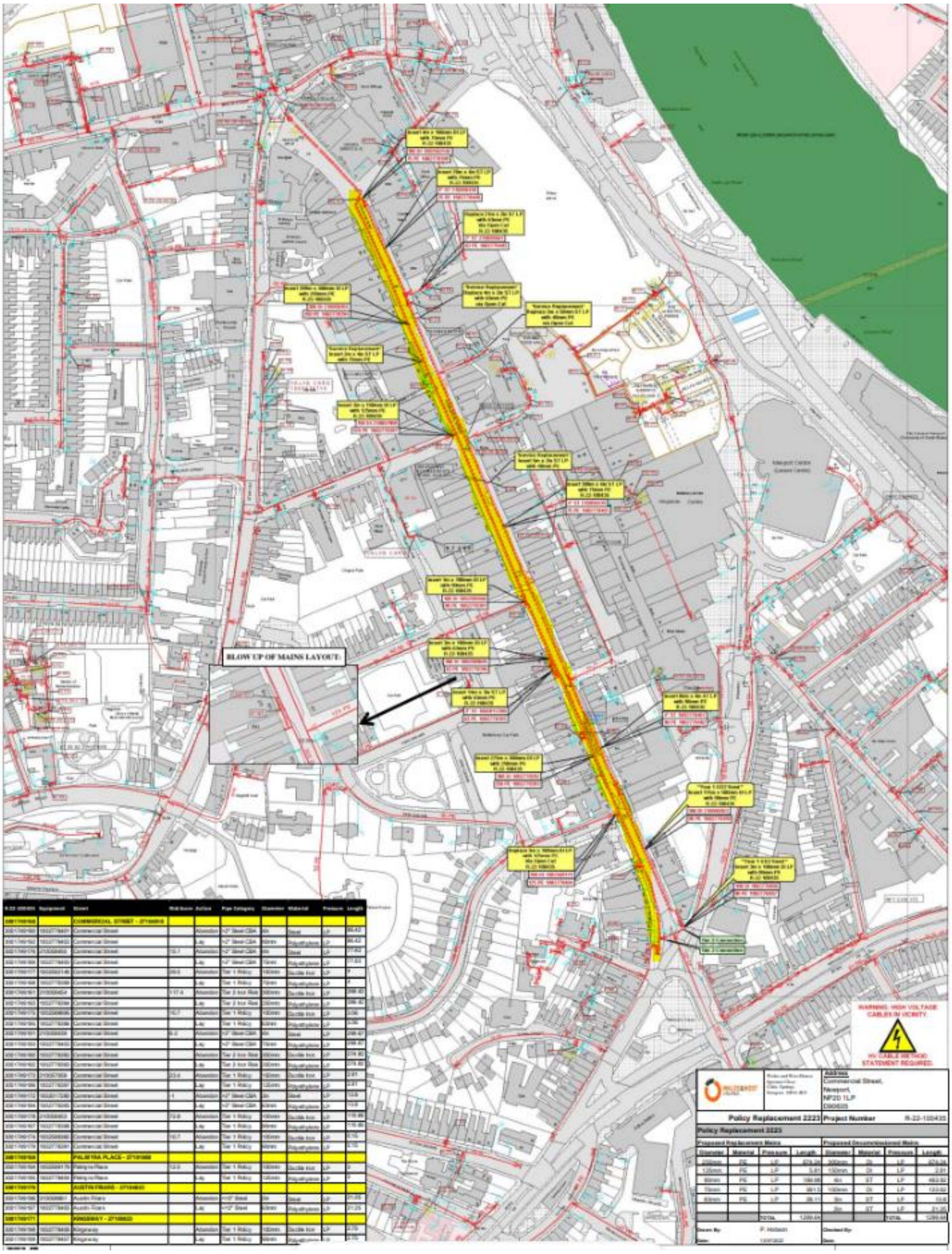


Figure 2 – GIS view of the pipes in the scope of the project

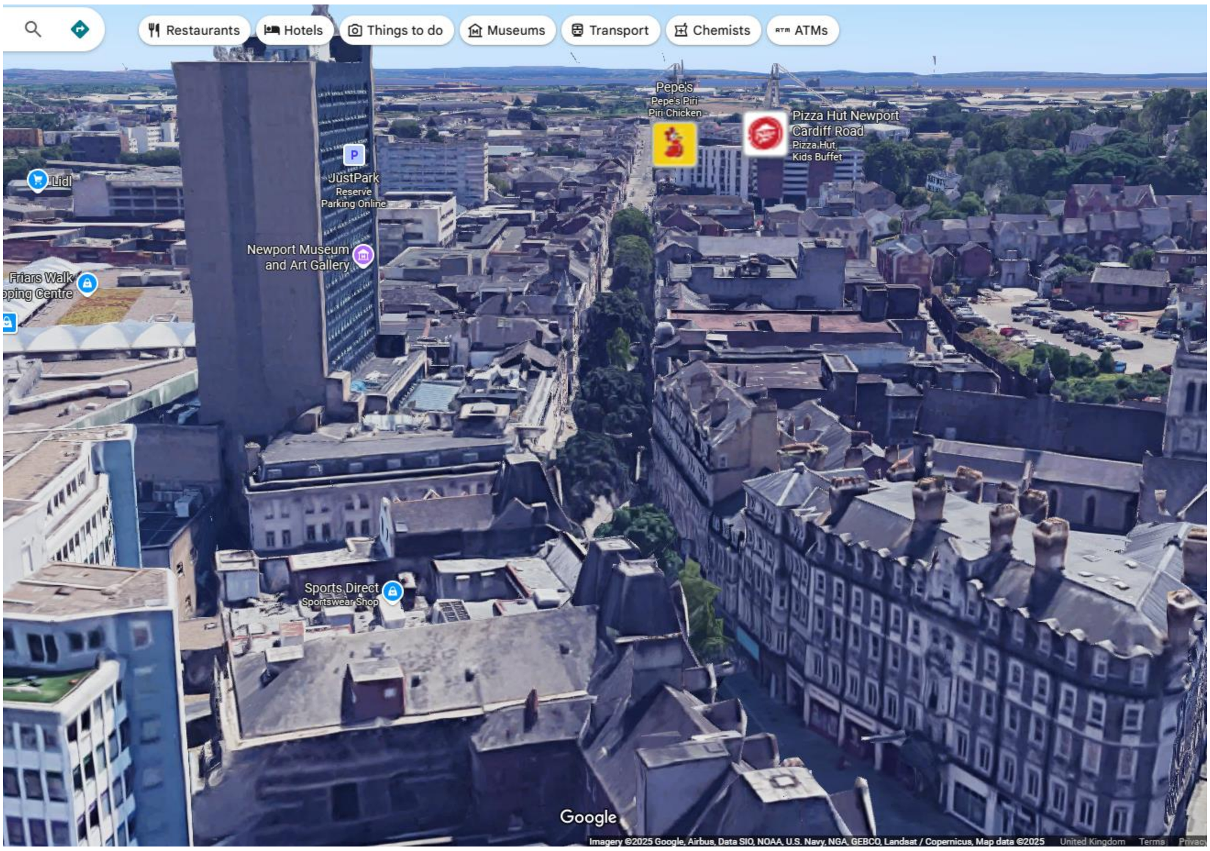


Figure 3 – aerial view of the location of the main

The case to consider intervention

The 300mm ductile iron main was above the risk action threshold so replacement was mandatory under the HSE iron mains enforcement policy.

The assessment process

A project was designed incorporating other connected mains, building out the length from 674 for the Tier 2a main to include other Tier 1 policy replacement mains, attached 2” steel, some >2” steel and associated services. The total length of mains to be abandoned as part of the project was 1,375m. This approach resulted in a project more efficient to deliver and contributing to our safety, reliability and environmental objectives and targets.

Scoping and Costing the scheme

The scope of the project was to replace the Tier 2a main and consideration or replacement of any connected mains.

To determine replacement sizes, we use network analysis modelling. Our models are an accurate reflection of the pipe network as it stands and are regularly updated with consumer demand data from Xoserve for every single gas meter in our region. This enables us to predict gas flows and pressures today and in the future.

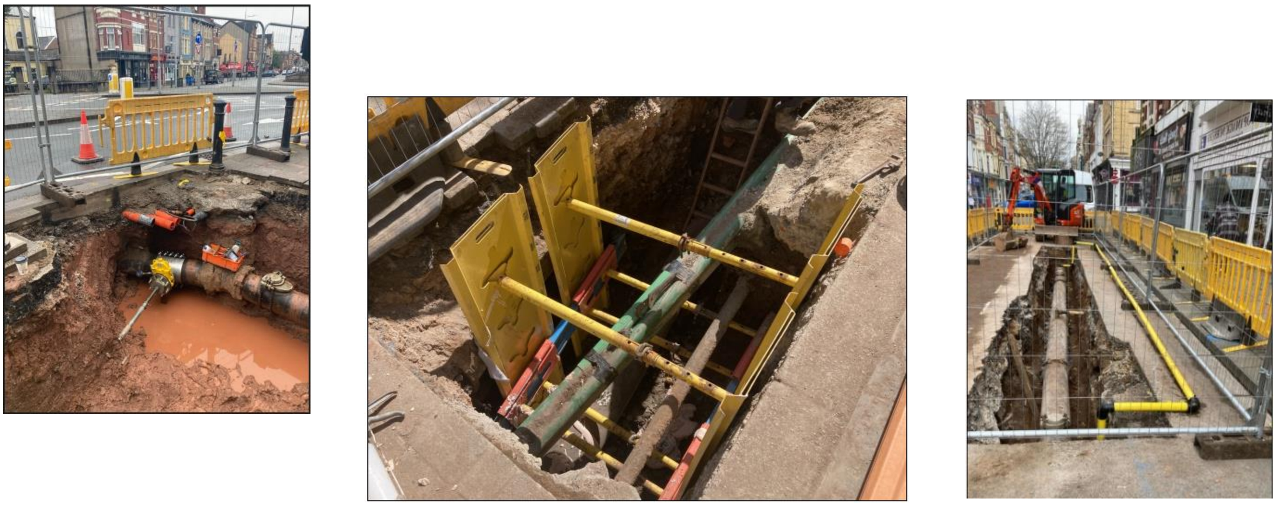
We can then make changes to pipes in the model and assess the impact on flows and pressure to ensure any changes do not create a capacity issue and compromise security of supply.

Our preference is to abandon a main with no replacement as this is lowest cost to consumers. This is only possible if a main has no services attached and if its removal from the network does not result in capacity issues and poor pressures. For these reasons, this is not often a credible option.

If a replacement main is required, the most efficient technique is mains insertion. This is a replacement technique where the new PE pipe is inserted inside the metallic pipe to be replaced. This avoids digging a long trench as the operation can be achieved by pushing the new pipe into the old using an excavation at both ends. The replacement is quicker, lower cost, results in lower methane emissions during the operation. There are also shorter planned interruption times for consumers using this technique and reduced excavations is considerably less disruptive to the public.

The challenge is that the new main must be smaller to fit, so capacity in the network is reduced. By carrying out network analysis we can assess whether this will create a capacity issue. If it does, we re-analyse with other diameters to find the optimum size.

We design a network that's fit for today and for the future. To do this, we estimate future network demand by interrogating Local Authority Development plans and by looking at other intelligence on future gas use. This process ensures the new main is future proof and avoids reinforcement as demand on the network



Tier 2 and 3 mains by their nature require larger excavations to have the required space to make connections.

Figure 4 – excavations on the replacement job

They are often located at a greater depth due to their size and there are additional costs associated with the deeper excavations to manage the significantly higher risk (see above).

Other specialist contractors were needed as part of this project, where a crawler cam was used to survey the main to confirm location and types of connections. Contractors to cut the larger ductile iron pipe, and also for some associated multi occupancy buildings where the installation of new steel risers and laterals was needed.

for this project all the mains were able to be inserted reducing the number and impact of excavations and therefore minimising the impact on the centre of Newport. The project was delivered for [redacted].

5.2 Project Boundaries

The workload and associated expenditure proposed in this justification paper is for mains replacement in RIIO-GD3 for tier 2a only.

6.0 Probability of Failure

WWU, along with the other GDNs engaged DNV to carry out an analysis of the Mains Risk Prioritisation System (MRPS). This review focused on the coefficients in the model driving assessment of likelihood of pipe failure, gas ingress to a property and subsequent ignition.

This review considered significant data sets of pipe types and historic failures. It also pooled incident data across the UK to ensure the revised model was accurately representing risk associated with iron pipes.

The basic form of the MRPS model is shown below, the output is the risk of an incident occurring.

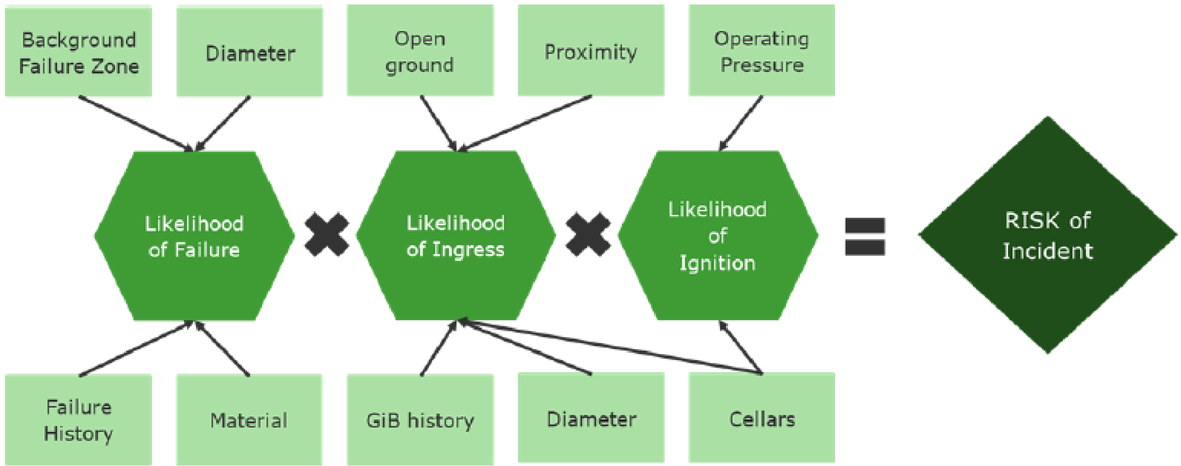


Figure 5 – components of the MRPS risk model

Detail on the recent work by DNV to review the model co-efficients and update the MRPS model are included in Appendix 2.

The probability of each pipe leaking, causing an ingress to property and subsequently an explosion is in table 3 below

Address	Pipe	Risk score (x10-6)
NINIAN PARK ROAD, CANTON,CARDIFF, CF	210021680	504
HIGH STREET, STAPLE HILL,BRISTOL, AV	361950172	174.7
COWBRIDGE ROAD EAST,CARDIFF, CF	210020825	423.9
COMMERCIAL STREET,MAESTEG, BD	210088769	338.4
ALBANY ROAD, ROATH,CARDIFF, CF	210011775	245.5

Table 3 – probability of incident for tier 2a pipes

7.0 Consequence of Failure

Specifically for Tier 2 pipes we use the consequence of failure to help calculate if a pipe is above the risk action threshold – this is closely linked to the MRPS risk calculation. This predicts a likelihood of failure, then following the failure the likelihood of ingress to a property, then finally the likelihood of an explosion. Our Tier 2 risk action threshold then considered the likelihood of an incident leading to a fatality following an explosion. Appendix 1 details the way we calculate the risk action threshold for Tier 2 mains.The 5 pipes highlighted in this paper all have a significant likelihood of fatality if there was an explosion. The risk of death to an individual is greater then 1:10,000 which is the 'must act' threshold in HSE's ALARP assessment.

8.0 Options Considered

In accordance with HSE Enforcement policy, Tier 2 pipes scoring above the risk-action threshold, will be selected to receive appropriate attention over the period of the approved programme. Appropriate attention means that Tier 2 pipes scoring above the risk-action threshold will either be decommissioned or, where a suitable and sufficient technique exists, assessed for continued use if found to be in good condition or remediated to allow for lifetime extension.

When looking at replacement options, we will first consider if the main can be abandoned. Due to the size and role these pipes play in the network, usually carrying enough gas to supply thousands of homes, abandoning these mains is not an option and they need to be replaced with PE (via insertion or open cut techniques).

We review each pipe and consider if the scope can be expanded to deliver efficient replacement of other iron mains that are part of the mandatory programme. When agreeing the scope we also look at the wider network and what is the most efficient way of enabling the replacement of the main. Which could include installation of additional pressure reduction stations if the whole life cost of that option outweighs the cost of having to replace the main via open cut.

The HSE iron mains enforcement policy does not allow for any flexibility on options for mains that pass the tier 2a risk threshold. They must be abandoned within the price control.

8.1 First Option Summary

N/A for tier 2a

8.2 Options Technical Summary Table

N/A for tier 2a

9.0 Business Case Outline and Discussion

The work described in this paper is derived through a HSE approved analysis of probability of failure and risk to life. We would not be compliant with the Pipeline Safety Regulations if we did not abandon these mains in RIIO-GD3.

9.1 Key Business Case Drivers Description

N/A for tier 2a

9.2 Business Case Summary

N/A for tier 2a

10.0 Preferred Option Scope and Project Plan

10.1 Preferred Option

As described previously, we have no option for tier 2a other than to abandon and replace. To not do this would not comply with the Pipeline Safety Regulations.

10.2 Asset Health Spend Profile

The expected spend profile of the preferred option is as follows:

Year	2026//27	2027/28	2028/29	2029/30	2030/31
Address	Ninian Park Rd, Canton, Cardiff, CF11 6HX	High St, Staple Hill, Bristol, BS16 5HD	Cowbridge Rd East, Cardiff,	Commercial St, Maesteg, CF34 9DH	Albany Rd, Roath, Cardiff, CF24 3RP
Total Cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 4 – spend profile

10.3 Investment Risk Discussion

Programme Risks

- The table below highlights other risks and mitigations associated with our proposed mains replacement programme.

Risk Description	Impact	Likelihood	Mitigation/Controls
Programme does not manage risk to required levels	WWU would not be meeting agreed targets for RIIO-GD3	<=10%	We have invested in data and analytics. Probability of failure and deterioration curves have been validated against reality. As long as the physical programme is delivered, this risk is minimal
Risk to delivery timescales	Increased cost to recover programme if falling behind. Benefits to consumers not realised in a timely manner. Wouldn't comply with HSE mandated requirements	<=10%	We have established processes in place to deliver programmes such as this and have successfully delivered in RIIO-GD2. We have a robust workforce resilience strategy as documented in our RIIO-GD3 workforce and supply chain strategy. Delivery of our investment plans are monitored at Exec / CEO level in our organisation
Risk to planned costs	Consumers and WWU paying more than planned for work making it less cost beneficial. If cost is below planned cost, then consumers and WWU benefit from Total Expenditure (Totex) sharing incentive	<=5%	We hold excellent data on these assets and replacement costs. We have used a very detailed cost component model to forecast RIIO-GD3 costs. This has been validated against experience in RIIO-GD2. We have an excellent track record in delivering programmes of this nature. Therefore, risk is minimal

Table 5: Summary of the risks and impacts of the delivery plan.

Cost Assumptions

- Costs have been calculated at as granular a level as possible. We have used quantity surveyors to cost each main. We have assessed the replacement size, the replacement technique, the location (road, verge, pavement), the number of services and even the number of excavations required and the types of connection to be made in these excavations. Due to this granular cost assessment, we have a high level of confidence in our forecasts

10.4 Project Plan

This is part of a programme of works that is a continuation of RIIO-GD2. There are hundreds of projects each year that are managed by a Project Management Office (PMO) function and tracked at Executive level. Design of work happens circa 18 months prior to delivery so the early RIIO-GD3 programme will be fully designed in 2025.

Appendix WWUQ8S- Iron Mains Programme 2026-31 Tier 2a

The following tables illustrate the communication and associated activities that happen before, during and after a typical project.

Communications prior to work start

What	Who -> Whom	When
High level 2 to 5 year works programme	Programme Controller (PC) / Design Team -> Highway Authority (HA)	Yearly
Forward planning notice - 1 year work	Design Team -> HA	Yearly
Coordination schedules - 1 year work	Planner -> HA	Quarterly
Manage external stakeholder risk / expectations (in discussion with HA, if required)	PC -> HA	Programme level basis - considered by PC, then discussed / agreed with HA
Pre-works site engagement with HA Inspector	PC / Operations -> HA inspector	3.5 to 4 months before work starts
NRSWA Notices, Permits & Lane Rental (3 months / 10 days)	Planner -> HA	Minimum of 3 months before work start
Identification of High Profile Projects (HPPs)	Programme Surveyor / PC -> Performance Improvement Officer (PIO)	HPPs identified by the Programme Surveyor and reviewed with PC
Identify addresses impacted and identify customers on Priority Service Register (PSR) Send GSOP13 advance notification of interruption letter	Planner via Design Team -> Customer	3 weeks prior to start.
Planning Notification sent to Customer Support Officer (CSO) to plan into workload	Planner -> CSO	3 weeks prior to start (via confirmation of letters sent email)
Booklet with step-by-step guide goes out with GSOP13	Planner via Design Team -> Customer	Sent with GSOP13 letter
HPP Drop-in Centre	PMO / Corporate Affairs (CA) -> Customer	typically 3-4 weeks before start but arranged months in advance
HPP project specific newsletter	PMO / CA -> Customer	Same as GSOP letter timescale
Any high impact traffic management, including road closure application	Planner -> HA	Minimum of 6 weeks, but checks must be undertaken with the individual HA
Projects impacting adjacent HA, e.g. due to diversionary routes	Planner -> Adjacent HA	Suitable time before work starts

What	Who -> Whom	When
HPP - Press releases / local radio/ social media	PMO / CA -> Press	Approximately 2 weeks before work starts
Traffic light (TL) applications	Planner -> HA	HA Specific - expected minimum of 1 month before start
CSO will pre knock affected doors with priority on PSR domestic customers and businesses	CSO	1-2 weeks before start
CSO to use xoserve data to obtain contact details and call PSR customers who were not in on pre knock	CSO	Day or two after pre knock / one week before works
HPP - Update of works on WWU website	PMO -> CA	At different stages of project cycle via HPP meeting
Weekly HPP meeting	PMO & CA	Weekly
CSO provides secure list of PSR customer details and needs to the FLM / Team	CSO>FLM	1 week before start
Provide info to EMS on reruns and u40+ etc.	Operations / CSO -> Emergency and Meterwork Services team (EMS)	At any stage of finding out individual property specifics

External communications onsite during work execution

What	Who -> Whom	When
Advance warning signs near work location, including any diversionary routes	Planner -> Operations	2 weeks before work start
Streetworks Permit Info Board (England only)	Streetworks team / Planner -> Operations	Prior to works start onsite
Information boards onsite about the works	PMO / CA -> Operations	For duration of project
48 hours card notice delivered by Team onsite	Operations	48 hrs before gas off
Alternative heating and cooking offered and supplied to customers	CSO / Operations	Before gas off
CSO will knock doors and speak to customers during the project	CSO	After project is live

What	Who -> Whom	When
Updates to information boards onsite	CSO / Operations	If there are any updates or change in works that needs communicating
Project signage on barriers explaining reasons for not occupying site	Operations	If site is unoccupied
HPP update & midpoint review	PMO / CA -> Press	Determined / reviewed by the PC (generally agreed pre commencement)

Communications following work completion

What	Who -> Whom	When
Post works joint site meeting with HA inspector	Operations -> HA inspector	If required, will happen in the last week, prior to site clearance
Post works customer feedback	Operations -> customer	Soon after work completion
Post door knock conversation. Check customers are back on gas and private excavations completed	CSO	After gas interruption and area made good
Formal Customer Satisfaction Surveys (postal)	Explain Market Research	4 weeks after work completion
Works stop notice	Planner -> HA	Within 2 hours of site clearance
Registration notice	Streetworks Team / Planner -> HA	Within 10 days of site clearance
HA feedback	PC -> HA	Within 2 weeks following works completion
Press release / key stakeholder letter (KSL) / Newsletter / social media following works completion	PMO & CA	Within 1 week of Works Completion/ site clear

10.5 Key Business Risks and Opportunities

Future Energy Scenarios

The future of energy in the UK is not certain over the long term. Future Energy Scenarios (FES) offer a number of pathways to 2050. We have considered these pathways when testing the robustness of our investment plan against future uncertainty, ensuring that it supports all credible pathways and avoids the risk of asset stranding.

The mains assets identified for proactive intervention have been tested using CBA. This gives a view on the time-period over which an investment pays back i.e. at what point in time it becomes lower cost to invest than to not invest. Our test is whether this point in time at which the investment pays back is within the useful lifespan of the asset. If an asset was expected to be needed as part of the UK energy network until 2040 but not beyond, investment paid back by 2035 remains beneficial to bill payers. If the investment didn't pay back until 2042 then we would consider options to extend asset life within the expectations on us to keep the public safe.

The ongoing role of the gas network and the importance of maintaining resilience and security of supply is widely recognised beyond government, even taking longer term uncertainty into account. For example, all Future of Energy (FES) 2024 scenarios involve at least 20% of homes still on natural gas in 2045, even as many transition to electrification or hydrogen4,5 and NESO's Clean Power 2030 advice on the required gas generation capacity referenced above. As the gas system needs to meet peak demands, substantial infrastructure for safe, reliable supplies will be required even in scenarios where annual throughput may have significantly dropped.

All Future Energy Scenarios show a decrease in gas volumes albeit over different time periods and to different scales. If 50% of consumers in a street disconnected from the gas network, the pipes feeding the street would still be required to service the other 50% of consumers, as would the district governors feeding the street, the higher pressure pipes feeding the governor, the PRIs feeding the higher pressure pipes and so on.

This challenge is exacerbated by government policy and approach to electrifying heat, where the decision is left to consumers rather than a mandated approach targeting regions. With this approach, it is incredibly unlikely whole areas will leave the gas network in the short and medium term. If it does happen, it will be a much more sporadic move from gas, resulting in a requirement to operate our assets until the last consumer in a region makes a decision to transfer.

Another challenge is that FES gives UK wide pathways and does not provide a view or data on the individual GDN regions. This presents significant limitations in its usefulness with very broad assumptions required to influence regional plans.

- The chart below shows how previous FES scenarios have not reflected the experienced reality

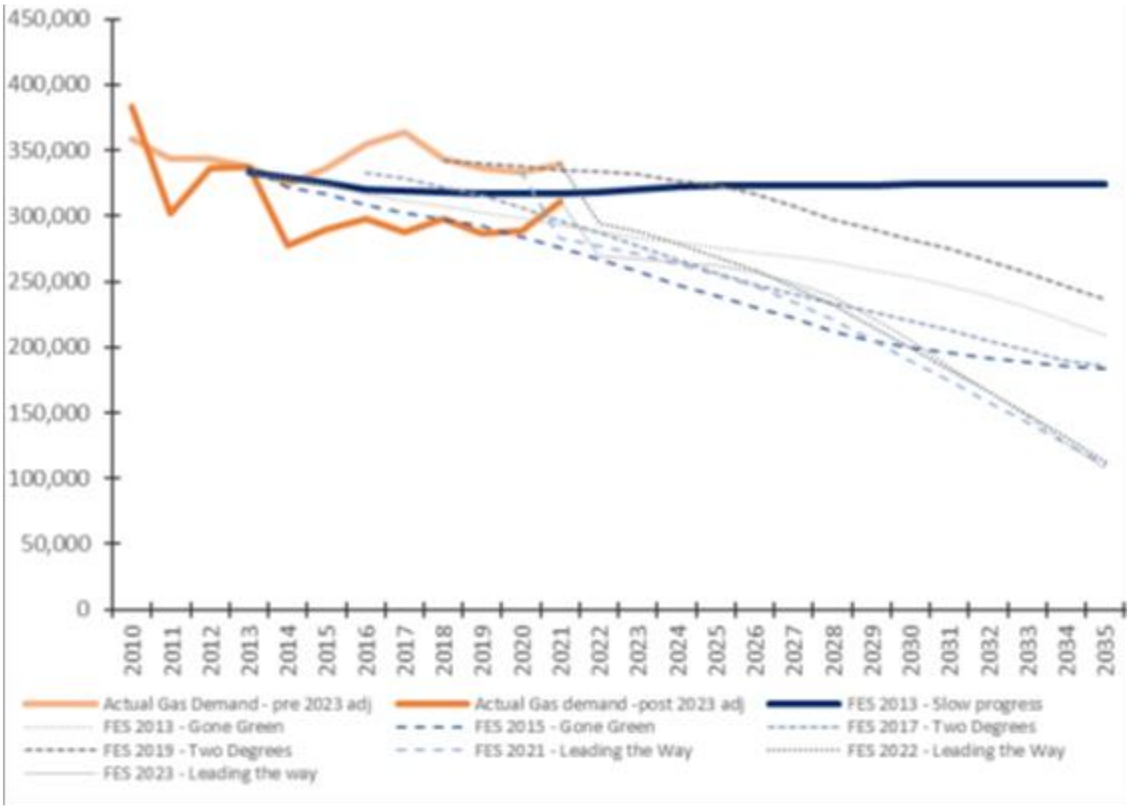


Figure 15 historical residential gas demand against the most optimistic scenario in every 2nd year of publication dating back to 2013

It should be noted that in the 2023 FES scenarios there was an adjustment to historical gas demand figures, as such we have shown historical data both before and after the adjustment to maintain comparability with the original 2013 forecast. *What is noticeably clear from these graphs is that, to date, the most accurate forecast appears to be the 2013 slow progress. As such it is difficult to have confidence that future forecasts will be any more reliable.*

Due to slower and geographically dispersed take-up of heat pumps, and whilst we wait for the Heat Policy decision, moving to a short payback period cut-off for investments is not compatible with ensuring a safe, resilient, and efficient gas network while we transition to Net Zero. The gas sector collectively believes 25 years as a payback period is more realistic across all scenarios and prudent given the sector's legislative duties.

To manage sensitivities in delivery costs and benefits, we are using a prudent 20-year period to assess cost and benefits. This means investments paying back within this period can be justified with a high level of confidence.

Our mains replacement programme is built up of Tier 1 pipes required to be decommissioned by 2032 and pipes to be justified by CBA.

- Tier 2 and Tier 3 iron mains and services in our proposed programme pay back in 2047 and 2051 respectively. These assets are the feeder mains in towns and cities so in an electrification scenario would be the last pipes to be decommissioned. Most of the pipes selected are attached to Tier 1 projects and enable us to clear areas of metallic pipes. This prevents us from having to return to areas to fix leaks on single pipes after residents and the public have been already had disruptions from a large replacement project in their area.

- Steel pipes in our proposed programme all pay back <5 years due to significant environmental benefit.

These payback periods are well within the most pessimistic views on the future requirement of the gas network. As such, investment in replacement offers value for money and extremely low risk of stranded assets.

10.6 Outputs included in RIIO-GD2 Plans

There are no outputs for delivery in RIIO-GD2 that will not be delivered in the period and that require deferral into RIIO-GD3.

11.0 Costing Tier 2a mains replacement

Each of the 5 pipes requiring replacement has been individually costed by our Quantity Surveyors (QS's). They have visited site, collecting data on relevant cost drivers. All pipes have undergone Network Analysis to determine replacement sizes and techniques.

Significant traffic management required on these pipes. They are in major highways and recent experience has shown significant requirements from Local Authorities (LAs). This includes manned traffic lights with 7 day working.

Traffic management costs have been based on experience on our recent project in Albany Road. One of our RIIO-GD3 Tier 2a pipes is in this road, in close proximity to the RIIO-GD2 project. The figure below is a summary of this project and costs of traffic management. This has been used for our RIIO-GD3 Tier 2a pipe costing, adjusted for length and therefore project duration.

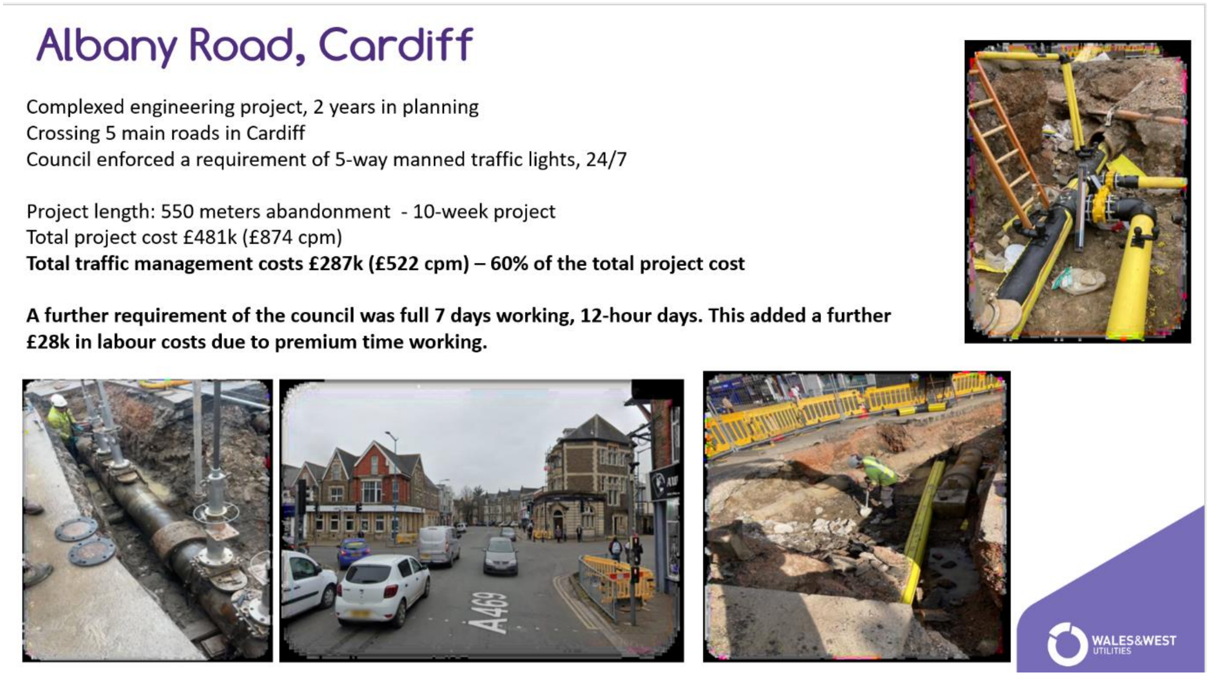


Figure 1 – example of recent traffic management costs associated with mains replacement in major roads

Appendix WWUQ8S- Iron Mains Programme 2026-31 Tier 2a

Resulting cost forecasts for the RIIO-GD3 workload are in table 2

Address	Ninian Park Rd, Canton, Cardiff, CF11 6HX	High St, Staple Hill, Bristol, BS16 5HD	Cowbridge Rd East, Cardiff,	Commercial St, Maesteg, CF34 9DH	Albany Rd, Roath, Cardiff, CF24 3RP
PON	210021680	361950172	210020825	210088769	210011775
Lot	South Wales	Bristol	South Wales	West Wales	South Wales
Lay Length	455	592	391	585	231
Lay Diam.	250mm	250mm	250mm	250mm	180mm
Lay Method	Insertion	Insertion	Insertion	Open Cut	Insertion
Abandon Diam. mm	300mm	300mm	375mm	250mm	225mm
Abandon Diam. Inch	12in	12in	15in	10in	9in
Material	CI	CI	CI	CI	CI
Pressure	LP	LP	LP	LP	LP
Relays	66	70	24	60	21
Transfers	66	70	24	60	21
Main	22	15	17	11	11
Bend	-	-	-	1	-
Cap	-	-	-	1	-
Total Cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CPM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Domestic Relays	33	35	12	30	11
Domestic Transfers	33	35	12	30	11
Non-Domestic Relays	33	35	12	30	10
Non-Domestic Transfers	33	35	12	30	10
Planned Year	2027	2028	2029	2030	2031
Site Specific Costs	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Main Laying	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Services	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Direct Cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	-	-	-	-	-
Main Laying Cost %	73%	71%	89%	80%	71%
Services Cost %	27%	29%	11%	20%	29%
Traffic Management	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Cost	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CPM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 2 – T2a pipe replacement costings

12.0 Appendices

12.1 Appendix 1 – Assessing ALARP risk to identify qualifying pipes

WWU's starting analysis is based on a common methodology, which was jointly developed by all Gas Distribution Networks:

$$1:1\text{ million x Risk Threshold (MRPS Risk Score)} = \frac{1:1\text{million x No. Of Properties}}{\text{No. of fatalities per incident}}$$

This calculation was developed in order to estimate the 'broadly acceptable' risk of fatality for the population of Tier 2 iron pipes, being 1 in 1 million, in line with HSE guidance, coupled with the data that is currently available for iron pipes.

Currently all Gas Distribution Network's use MRPS to assign a risk score to an individual iron pipe, however the risk score relates to the likelihood of an incident occurring and does not indicate the consequence of the incident in either fatalities or any other terms.

WWU's Approach

WWU agrees with the principles of the national threshold calculation for the population and recognises that it provides a method of assessment of risk until a full risk model is developed. A full risk model is a model that considers both likelihood and consequence of failure, rather than just likelihood of an incident, which is the basis of the current MRPS model.

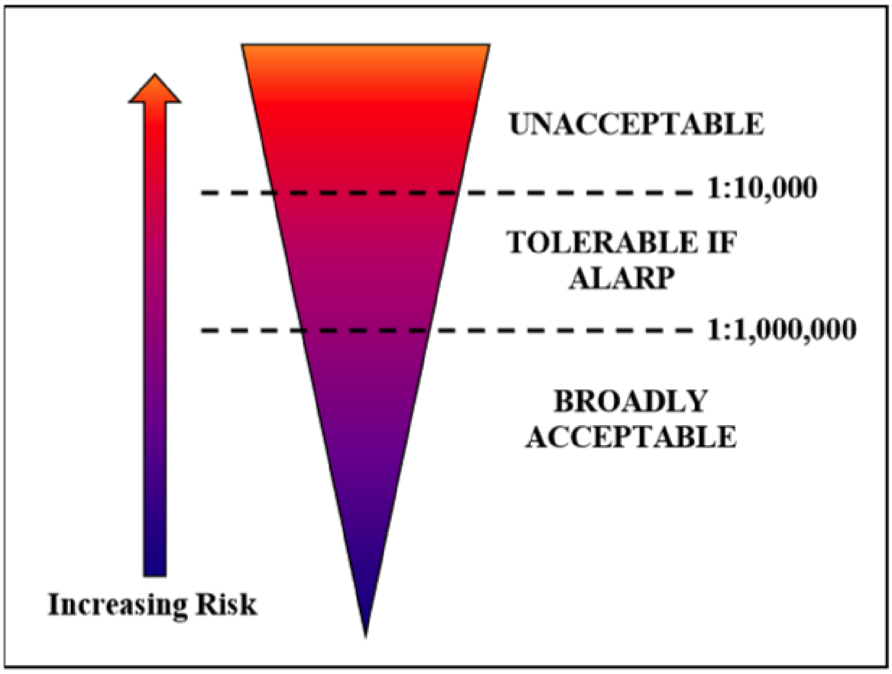
Using a single mandatory threshold for all pipes implies that an individual has a 1:1 million chance of being a fatality, regardless of the population density in the area surrounding the pipe.

HSE have communicated the requirement to have a pipe-by-pipe assessment basis throughout the safety threshold development; our methodology meets that principle.

WWU has developed a pipe specific calculation based on the consequential risk of that pipe and the probability of a fatality. WWU will use this methodology to prioritise its Tier 2 mandatory pipes for abandonment.

This methodology gives a greater representation of consequence of risk, where increased population proportionally affects probability of a fatality. This considers both the number of buildings and the population of these buildings. This approach is a significant innovation and improvement which will demonstrably improve risk identification and justification of intervention at a pipe level. This is supported by data from the Health & Safety Laboratories (HSL).

WWU use an ALARP calculation of the risk, imposed by a Tier 2 pipe of a fatality caused by a release of gas from the main. The acceptable levels of risk are shown below.



The calculation of this risk is done by using the following equation.

Fatalities per year = Probability of an Incident x Fatality Factor

This equation is broken out into the following components.

Probability of an Incident
= MRPS risk score (incidents per year) x length (km)

The MRPS survey includes all buildings within 30m of the main on either side and then determines which side has the most risk at any given point and calculates an overall risk score for the pipe.

Fatality Factor
= Fatalities per Incident x Population Density Factor x Building Density Factor

The Industrial Statistics Research Unit of Newcastle University have calculated that the number of fatalities per incident is 0.45, based on a 99% confidence. This is based on historic incident and fatality data for Great Britain. This fatality factor is flexed up and down depending on the number of people within the building and the number of buildings affected. It is important to note that the number of people or number of buildings does not affect an individual's chance of being killed by an incident. Any increase in the people affected increases the number of fatalities, not the probability of it being an individual. It does however affect the probability of it being any individual and is therefore used to scale the 0.45 depending on the number of people and/or buildings affected.

The population density factor has been calculated as the number of people in each building divided by the average number of people in each building.

This has been done using the Topographic ID (TOID) and National Population Database (NPD) analysis. The TOID analysis carried uses a geospatial query to buffer each Tier 2 main and count the number of buildings within the buffer. The NPD analysis carried goes one step further and calculates the population within these buildings. Together they allow the calculation of people per building.

The building density factor has been calculated as the number of buildings per km divided by the average number of buildings per km. The TOID analysis uses a geospatial query to buffer each Tier 2 main and count the number of buildings within the buffer. This part of the calculation considers the impact of the number of buildings on the probability of ignition, the ignition factor.

The population and building density factors are scaled back to the national fatality average (0.45).

So, in its full form, the equation is

Fatalities per year = risk score x length of main (km) x 0.45 x building density factor x people density factor

The probability of a fatality is expressed as a ratio. Those that have a greater chance than 1:10,000 are to be replaced at the earliest possible opportunity. Those between 1:10,000 and 1:1,000,000, are to be reduced in risk as low as reasonably practicable.

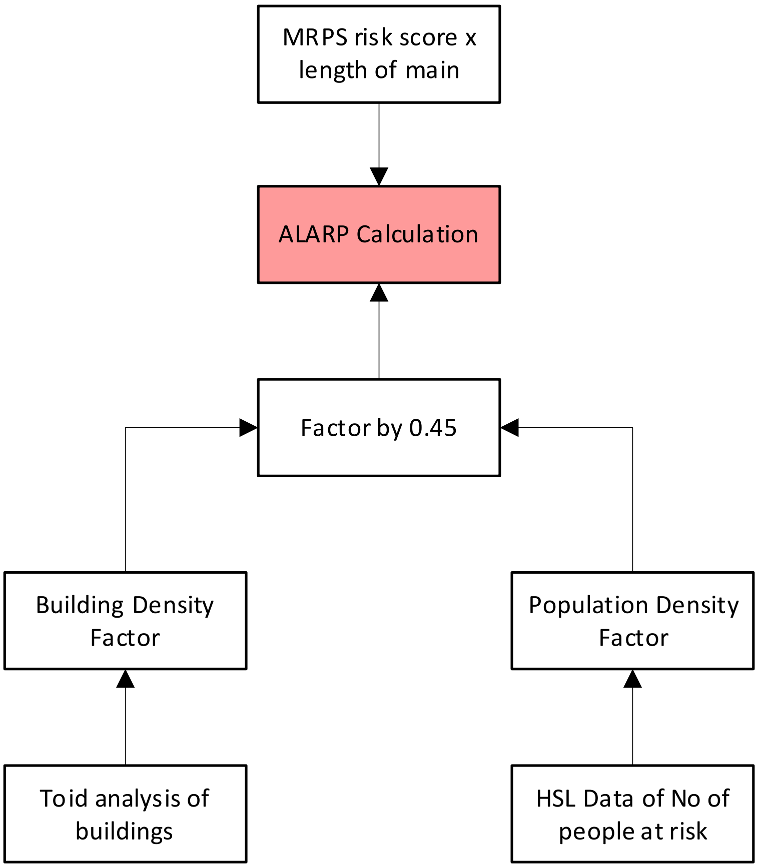


Diagram 1: ALARP Calculation

12.2 Appendix 2- The DNV analysis

WWU, along with the other GDNs engaged DNV to carry out an analysis of the Mains Risk Prioritisation System (MRPS). This review focused on the coefficients in the model driving assessment of likelihood of pipe failure, gas ingress to a property and subsequent ignition.

This review considered significant data sets of pipe types and historic failures. It also pooled incident data across the UK to ensure the revised model was accurately representing risk associated with iron pipes.

A 'what if' analysis which considered the impact of future failures and ingress showed there was a potential for this length to rise to 7km in RIIO3. This is subject to those failures and ingress events occurring.

The following DNV documents detail the process and results for failure, ingress and ignition review and coefficient revision

Appendix T

Appendix WWUQ8T- Likelihood of Failure Report

Appendix WWUQ8T-
Likelihood of Failure F

Appendix U

Appendix WWUQ8U- Likelihood of Ignition Report

Appendix WWUQ8U-
Likelihood of Ignition

Appendix V

Appendix WWQ8V- Likelihood of Ingress Report

Appendix WWQ8V-
Likelihood of Ingress