THE BENEFITS OF FORMALISED CONDITION ASSESSMENT PROGRAMMES FOR WATER UTILITIES BASED ON LESSONS LEARNED

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ABSTRACT

Understanding the health and performance of your assets is fundamental to effective planning for the management and renewal of the assets. It is also a significant challenge. Monitoring and inspecting assets is expensive and proactive condition assessment programmes are funded through limited OPEX budgets. With typically only a small amount of existing information on the condition of their assets, water utilities must face the questions of where the priorities for renewal of their assets are and what is the confidence in the available data for this prioritisation?

The funding available for condition assessment programmes, in general, is far smaller than the level of funding that is needed to fully understand asset condition. With limited funding it is essential that a risk-based approach is adopted, starting with the inspection and condition assessment of the Very High Criticality Assets, (VHCA) as a priority. The outcomes from these inspections provide several benefits including improved assurance that the expenditure directed to renewals and maintenance programmes is going to the right place at the right time. Even if capital budgets are not sufficient to quickly deal to all the poor condition assets, the information is improving the understanding of the risks faced by the utility and they are able to put in place contingency plans should assets fail. The knowledge gained from the assessment programme can be used for developing a better optimised future assessment programme that is targeted to where there are key data gaps.

This paper will set out the benefits for utilities of a formalised condition assessment programme based on the lessons learned from planning and implementing a large scale VHCA Condition Assessment Project in New Zealand. The discussion will include :

- Why condition assessment is an essential major toolbox item
- The processes and strategies implemented and adapted over the life of the programme as funding availability and priorities changed
- Insights such as the importance of detailed planning of the inspection programme
- The early establishment of relationships within the project team and technology providers.

KEYWORDS

Asset Condition, Inspection Programmes, Criticality, Pipeline Renewal Planning, Wastewater, Water, Stormwater

PRESENTER PROFILE

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Steve provides advice to Water Utilities throughout New Zealand on best practice strategies for assessing pipe condition, pipe performance and prioritising of renewals. He is an author of both the 3rd and current 4th Editions of the New Zealand Gravity Pipe Inspection Manuals and has been actively involved within the water industry supporting the development of training standards and course facilitation.

Steve is also currently involved as a Crown Infrastructure Partners Relationship Manager for the 3Waters Stimulus Fund and for the Crown Better-Off fund for Otago, Southland, and West Coast Councils. He was also SOLGM account manager for the 3Waters RFI programme.

Steve is a Past President of the Australasian Society for Trenchless Technology, and for the past 13 years has been a member of the WaterNZ Conference Programme and Technical Committees.

INTRODUCTION

Virtually every asset will deteriorate and eventually need replacement. The decision to replace, or not, is driven by some combination of level of service obligations, risk management, legislation, economic and/or strategic considerations.

In the water industry, the life of assets is generally long and intergenerational. The cost of replacing assets imposes a significant financial burden on the utility that must be recovered from current and future generations who will benefit from these assets. To service the generations to come, it is necessary that assets are maintained, whilst also understanding and planning for the service and capacity needs for the future. Long term financial planning requires anticipation of when assets could be expected to be renewed. Short term renewal planning can be disrupted very easily by unexpected asset failures. Surprises are not welcomed by the customers who pay for these services and least of all by the customers who experience the loss of service.

Having confidence in the organisation's understanding of asset condition and performance and the ability to determine which assets will need renewal, and when, is a core function of asset management. To have confidence in the remaining life of assets is a fundamental challenge for all asset managers. The Office of the Auditor General (AOG) has expressed several published audit reports comments such as "*If a public organisation does not have a good understanding of its most important assets, particularly the condition of those assets, it risks making poor long-term decisions. Long-term planning that is based on inaccurate information or poorly informed assumptions could result in costly or unsustainable decisions.*"[1]

However, in many cases water utilities do not have all the information they need to make accurate predictions on when assets will need to be renewed. This was also identified by the AOG summary of audits stating "*In our recent work, we have reported on the importance of accurate and reliable asset information and the need for councils to better understand the condition of their assets.*"[1]

Typically, utilities have a small amount of existing information on the condition and performance of assets. In many cases the confidence that asset managers have in the information that is available is low. The 2018/2019 WaterNZ National Performance Review report showed that 65% of participants stated the confidence in the asset condition information was uncertain or highly uncertain.

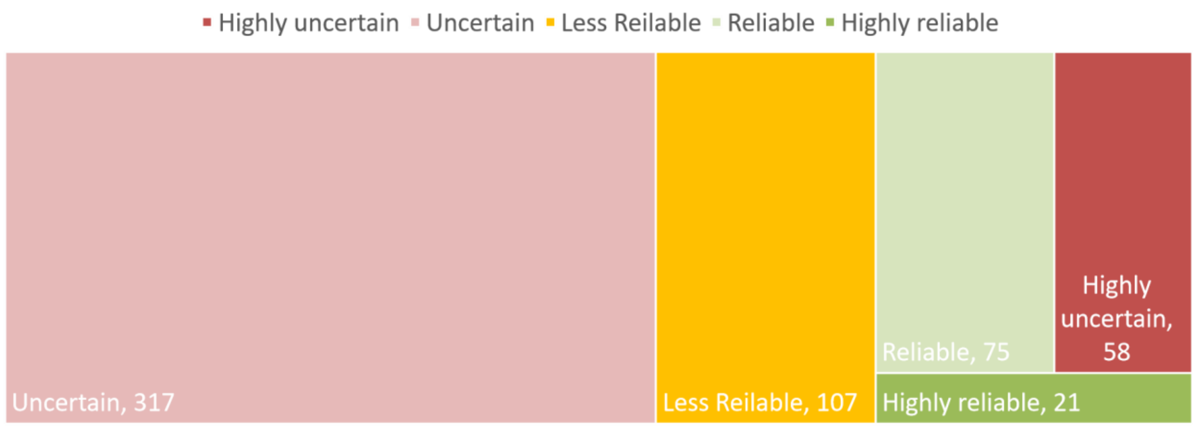

Figure 1: Confidence in Asset Condition Data Reported to the 2018/19 National Performance Review

Whilst information on the installation dates may be known for most assets along with a design, or 'book' life, there is general recognition that subsequent estimated renewal dates gained from this information are, at best, very rough estimates of what will actually occur. This will invariably reveal assets that have forecast renewal dates that are in the past, but not showing signs of distress, along with a renewal bow wave in the near future. As the actual life of a pipe is influenced by

[1] Managing stormwater systems to reduce the risk of flooding, OAG, 2018

many different factors there is limited ability to determine which individual assets will be subject to early failures, mean prediction failures or later failures.

Monitoring and inspecting assets is an expensive task and proactive condition assessment programmes are typically funded through limited OPEX budgets. Therefore, it is easy to avoid or put off condition assessment when there are increasing reactive cost pressures to be absorbed within an OPEX budget. Such a response is of course self-defeating because the chances of higher reactive costs become even higher without asset condition awareness.

The funding available for condition assessment programmes, in general, is far smaller than the level of funding that is needed to fully understand the condition of all assets. However, implementing a condition assessment programme, even with limited budgets provides increased understanding of the health of a utility's assets. The outcomes from these inspections provide several benefits including improved assurance that the expenditure directed to renewals and maintenance programmes is going to the right place at the right time. Even if capital budgets are not sufficient to quickly provide for renewal or rehabilitation of all the poor condition assets, the information is improving the understanding of the risks faced by the utility and they are able to put in place contingency plans should assets fail. The knowledge gained from the assessment programme can be used for developing a better future assessment programme that is targeted to where there are key data gaps.

Limited budgets, and not knowing where to start, can be barriers to undertaking a condition assessment programme. The following sections outline what Wellington Water has gained from their experience in implementing their VHCA inspection programme and this is intended to help Asset Managers successfully plan for a formalised condition assessment programme based on lessons learned.

2. BACKGROUND TO THE WELLINGTON WATER SITUATION

Wellington Water manages approximately 6,700km of pipelines, 16 treatment plants, 145 water storage facilities, 322 pump stations, and 29 km of tunnels on behalf of its council clients, Wellington City Council, Porirua City Council, Hutt City

Council, Upper Hutt City Council, South Wairarapa District Council and Wellington Regional Council. It has a total replacement value in excess of $8 billion.

In 2020 Wellington Water was confronted with a 3Waters pipe network renewal profile that is illustrated below:

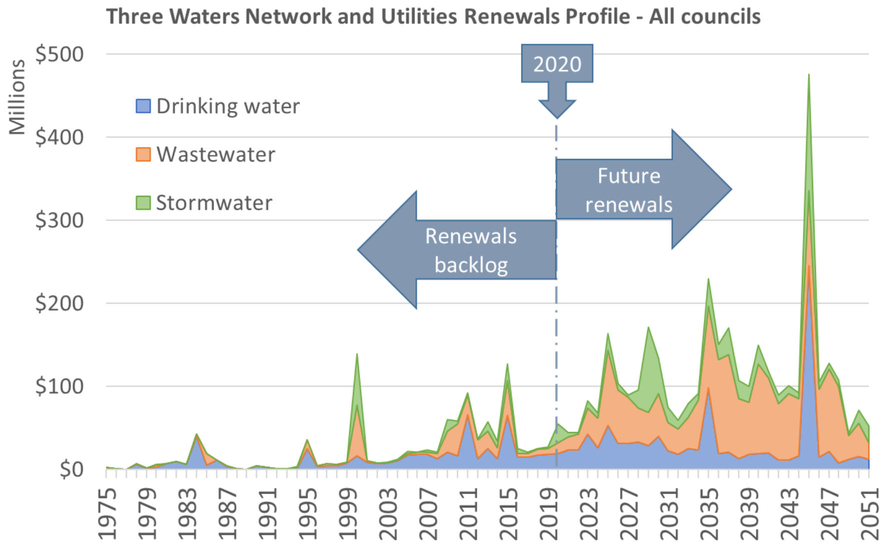

Figure 2: Wellington Water 3Waters Network & Utilities Renewal Profile

Not only was there a sizable backlog of assets for renewal there was also a significant classic bow-wave of expected renewals over the following 30 years.

Although it had collected a significant amount of condition data over time it was not in consistent formats, was stored in a variety of file locations or archives and, in many cases, was becoming dated, which all limited the information that could be used for renewal planning. Subsequently, the renewals profile was substantially determined based on the scheduled expected lives of the assets.

It is interesting to note that the predicted asset life varies between the different client councils which has the effect of indicating otherwise similar asset cohorts for renewal at different times.

Its asset management plans had already identified the need for more emphasis on consistently applied condition assessment but there was historically only a limited budget for this task of approximately $500,000 per annum allocated across the entire region to cover a pipe network totaling 6700km.

At a similar time, critical asset failures began to occur that became labelled in the press as "Wellington Water's Woes". There were numerous press headlines such as "Wellington Water chaos a warning for all",[2] "Windows broken as another

[2] Newsroom, 16/2/21

geyser on central Wellington street, capitals water woes continue"[3], "Billions down the drain: The overwhelming scale of Wellington's water pipe crisis"[4]

The New Zealand Herald published an article on the 20 January 2020 that quoted "A third of Wellington's wastewater pipes are either in poor or very poor condition, making them in the worst state of the largest centres across the country."

Photograph 1: A potable watermain bursts in Wellington City

Photograph 2: A burst water main caused a geyser and flooding in the Aro Valley in late January.[5]

Wellington Water's confidence in their understanding of their asset condition was low. While there was evidence from asset failures that at least some of the renewals backlog could be real, and some assets were needing to be 'nursed' along, no clear understanding of the actual extent of pipes that are in poor condition was confirmed, nor was there sufficient information to know how much of the future bow wave would happen and when.

There was some need to get ahead of the failures. It was clear to its asset managers, and now politicians, that more work was needed on condition assessment of its 3Waters networks. The number of asset failures, whilst having a negative effect on the community, raised the awareness of the issue and support for the importance of condition assessment.

Through a combination of increased LTP funding from its six councils as well as government stimulus funding Wellington Water could get serious at last about

[3] Dominion Post 05/03/21

[4] Dominion Post -05/10/20

[5] Wellington Water chaos a warning for all, Nikki Mandow, Newsroom, 16/2/21

condition assessment and could now design a $10M condition assessment programme.

It was clear that even with the budget now allocated there would need to be a focus on a limited portion of the asset base. While everyone accepted it must assess the condition of critical assets it was also recognised that it was even more essential to prioritise the "very high criticality assets" (VHCA) for inspection and assessment.

3. IMPLEMENTING AN INSPECTION PROGRAMME

The following sub-sections set out discussion on the Five Key elements for planning and implementation of a formalised pipe condition assessment programme gained from Wellington Water's experience.

3.1 UNDERSTANDING CRITICALITY

As discussed earlier, A 3Waters utility will not have an unlimited budget for undertaking inspections and therefore the planned inspection programme must be structured to optimise the value of the information that is being collected. This will require the selection of 'some' assets, rather than 'all' 3Waters assets. Fundamental to choosing the right assets to inspect is an understanding of the relative criticality of the assets within the network. It is entirely appropriate that assets with an elevated criticality are managed quite differently to those that are not considered to be critical.

A key element in this discussion is the separation of Critical Assets from Non-Critical assets. This is driven by the realisation that most networks will have a relatively small number of assets whose consequences of failure are significantly worse than the rest of the network, and therefore much less acceptable to a regulator and/or the community should they fail. These consequences might be measured in terms of health, injury, damage to environment, damage to property, impact on business and employment, interruption to service, disruption of other utilities, etc.

It is recommended that a high proportion of the assets to be inspected are critical assets to best understand the deterioration in condition that is occurring and be able to intervene before they fail. This group of pipes should have the highest priority for inspection in relation to available budget.

Inspections relating to low or Non-Critical assets would typically be undertaken on an opportunistic or sampling basis, with the intent for those inspections being largely focused on determining the general characteristics of asset cohorts e.g., by material, age, size, location, depth, etc.

Soon after the creation of Wellington Water in 2015, an asset management maturity pathway was created. The need for this was driven by the assimilation of inconsistent, fragmented and sometimes conflicting asset management approaches from the councils around the region that had come together to form Wellington Water. The first, and probably most significant, step on this pathway was the adoption of 12 service goals under three outcomes that would enable the definition of levels of service.

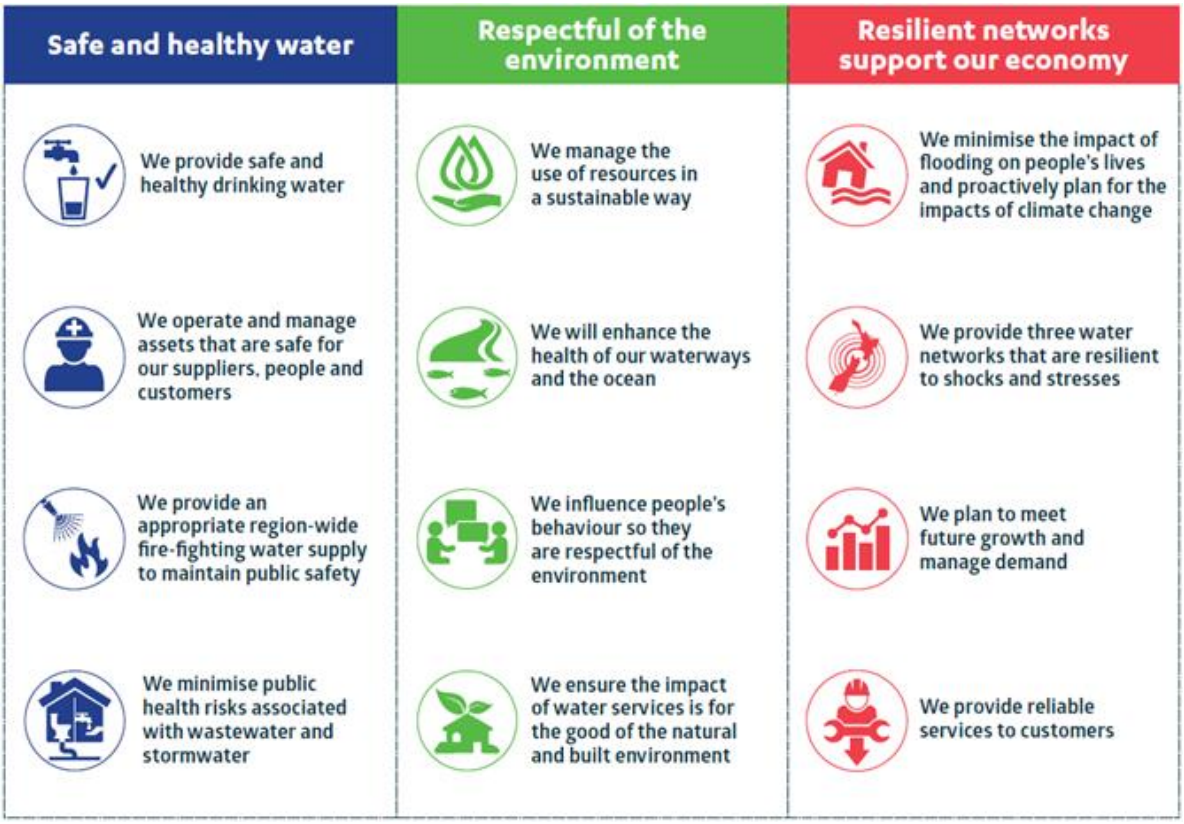

Figure 3: Wellington Water Defined Levels of Service

From that point all planning could be outcome based and integrated across the three waters.

These service goals immediately enabled the creation of a Criticality Framework. Wellington Water particularly wanted the criticality of an asset to be an indication of an asset's relative importance for loss of service. For Wellington Water service was determined by assigning the relevant service goals above to an asset and determining the consequence of this service loss to its worst conceivable failure mode. The framework is agnostic to the asset type enabling a comparison between pipes, pumpstations reservoirs and treatment plant assets.

This paper does not discuss the Wellington Water Criticality Framework in detail but suffice to say that it was applied across Wellington Region to determine the very high criticality assets (VHCA) for all of the 3Waters networks. This then then quantified the development of the inspection programme for the pipe assets (the condition assessment of other asset types is not discussed in this paper).

Wastewater Pipes	231km
Stormwater Pipes	165km
Potable Water Pipes	77km
Total	**473km**

Table 1: Length of Very High Critical Pipeline Assets

3.2 IDENTIFY AND PRIORITISE ASSETS FOR INSPECTION

If a high inspection rate of the critical assets (i.e. those with high consequence of failure) is not considered to be affordable, or justified, then it is recommended that any available inspection programme is further weighted towards the assets that are expected to be exhibiting moderate to severe deterioration (i.e. those with high likelihood of failure). This focusses the inspections onto assets with the highest overall risk of failure, as this provides the most valuable information for renewal planning.

This requires that an evaluation or prediction of asset condition is undertaken. This prediction may simply be assessed on the age of the asset, based on the expectation that the oldest assets are more likely to fail in comparison to younger assets. Where organisational knowledge or information, such as repair or failure history is known, then this can also be applied to the risk evaluation.

If choices have to be made as to where to 'go looking', Figure 4 becomes a useful foundation, at a more granular level, for how best to identify and prioritise assets for inspection. The concept is based on improving the confidence in the understanding of condition and therefore service failure risk to communities. Where risk is the combination of criticality (an indicator of consequence) and condition, or likelihood of failure, (assumed to be driven at this stage by prediction or evidence available).

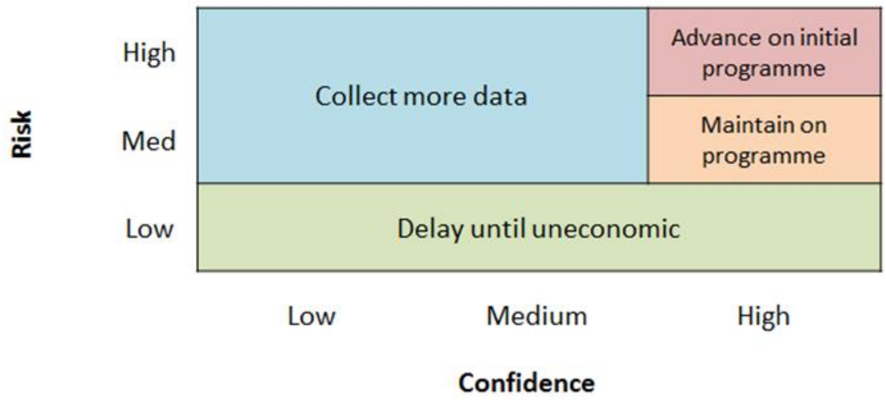

Figure 4: Risk Matrix

When inspecting critical assets, it is best to give priority to the assets that fit in the top left-hand corner of this diagram, where the risk is high but the confidence in the asset condition is lowest.

Applying a strategy to prioritise the inspections is important as this provides flexibility to adjust and complete more, or less, asset inspections as budgets or time available to complete the programme changes, whilst ensuring that highest risk assets are inspected first.

The Wellington Water pipeline VHCA programme set out three priority layers as described in Table 2.

Inspections were intended to be completed in decreasing order as shown in Figure 5. The highest priority for the VHCA condition assessment project would be to complete all the priority one inspections before the end of the programme. Following completion of priority one, the inspections would then commence with the priority two inspections with the intention of completing as much of these asset inspections as possible prior to the end of the programme as budget and time allowed. While these Priority 2 assets have a very high criticality, due to their relatively young age they were not expected to fail in the short to medium term. Any failures that may occur to the assets within the priority two list would not be expected to be due to age related deterioration. Any uncompleted Priority two inspections would be reprogrammed to be completed in the following financial years. Priority 3 inspections are the lowest risk assets and are intended to only be inspected once Priority 2 inspections had all been completed.

Inspection Priority	Age Range	Comment	Quantity[1] (m)
Priority 1 (P1)	Pipe Assets older than 60 years old (or unknown age)	Oldest pipes, exceeding the design life, most likely to fail or with unknown age	194Km
Priority 2 (P2)	Pipe assets aged between 21 years old and 60 years old	Pipe within the design life and not expected to have a high probability of failure	242Km
Priority 3 (P3)	Pipe Assets younger than 20 years old	Young pipes that have not yet reached the age where a first health inspection is required.	37Km

Table 2: Priority for implementing Asset Inspections

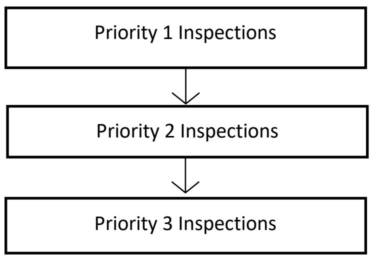

Figure 5: Decreasing priority order for completing inspections

3.2.1 WHERE INSPECTIONS HAVE ALREADY BEEN COMPLETED

In some cases, there will have been inspections that have previously been completed, even if they were many years ago. Where this is the case, further inspection may or may not be required, dependent on the confidence in the condition information. For critical assets where the condition is known to be poor then, as illustrated in Figure 4, the confidence in the condition data must also increase. Therefore, if the confidence in the pipe condition from previous inspections is not sufficient further investigation may be required. Otherwise, the asset could be removed from the inspection list. In general, a higher criticality justifies a greater level of assessment and data quality. An example of a basis to determine Levels of Data Confidence for inspection data is described in Table 3 which is adapted from the NZWWA Infrastructure Asset Grading Guidelines 1999 with additional application of inspection methods and information obtainable for illustration.

Confidence Grade	General Meaning	Type of Information
A	**Highly Reliable** Data based on sound records, procedures, investigations and analysis which is properly documented and quality assured. Recognised as the best method of assessment including verification on site.	• Medium/High Resolution screening inspection plus NDT/DT testing • Known pipe attributes including duty range, pipe class/wall thickness.
B	**Reliable** Data based on sound records, procedures, investigations and analysis which is properly documented and quality assured. Has minor shortcomings; for example, the data is old, some documentation is missing, and reliance is placed on unconfirmed reports or some extrapolation.	• Medium/High resolution screening inspections only • Known pipe attributes including duty range, pipe class/wall thickness.
C	**Uncertain** Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolation from a limited sample for which grade A or B data is available.	• Discrete Sampling (NDT/DT) only Or • Low resolution screening • Limited known pipe attributes
D	**Very Uncertain** Data based on incomplete information or of uncertain quality. May include unconfirmed verbal reports and/or cursory inspection and analysis and not verified by site checks.	• Visual or desktop review • Historical test result (where data confidence is not known) • Low Resolution analysis/probability of failure assessments

Table 3: Data Confidence Gradings including with a translation to the type/level of information required

Figure 5 was used by Wellington Water for the VHCA pipe inspection programme along with the approach outlined in Table 3 which sets out their recommended minimum confidence grades for critical pipes based on the expected or actual condition of the pipe. This shows that to achieve the necessary level of confidence for critical pipes additional investigations may need to be undertaken dependent on the expected pipe condition.

Condition Grade	Confidence Grade
5	A
4	
3	B
2	C
1	

Figure 5: Minimum Confidence Grades based on the condition grade required for very high critical pipe assets

3.3 UNDERSTANDING WHAT INFORMATION IS ALREADY KNOWN

Prior to finalising an inspection plan and before inspections commence it is logical to start with a review of what information is already known about the assets identified for inspection. This will generally include:

- ***Understanding any operational issues that may affect accessing the assets for inspection or restrict if, when or how the inspections can be undertaken***. In particular around issues such as the operation of valves, buried inspection points or whether assets can be taken out of service to be inspected. Operational and access issues significantly affect the cost of inspection, the technology required or the inspection programme. Understanding the reliability of the data is also important.
- ***Availability of historical inspections or assessment reports***. This would consider what information is available, whether they can be located and what confidence there is in the data. Historical inspections or assessments can provide substantial information and can reduce the potential programme cost or enable the scope to be extended.
- ***Peer-to Peer Workshops.*** Often there is a substantial amount of organisational knowledge of the assets, within the utility, or its contractors and consultants. Facilitated workshops involving cross-organisational participation can provide a wealth of information on failure and maintenance history as well as confirming asset attributes. These workshops can quickly enable a lot of information to be gathered that will provide more reliable assessment or prediction of asset condition for inspection planning as well as informing context to operational issues and historical inspections.

3.4 ANALYSIS AND INTEGRATION OF INFORMATION

Fundamental to the success of an inspection programme is achieving the intended purpose of the inspections. Most asset health inspections are intended to understand the condition and performance of the assets so that planning for renewal and growth can be undertaken. Key to this is the understanding of what data and information needs to be obtained and where that information will need to be stored, e.g., accessible within the Asset Management Information Software.

The Wellington Water VHCA health assessment programme for example intended that the outcomes would provide information that would inform:

- An updated maintenance programme
- A condition assessment programme
- An updated renewal programme
- Asset risk analysis
- Determine whether urgent repair or replacement was required.

In general, when planning an inspection programme consideration should be given to the following:

1. What type(s) of data is required to determine the structural condition, performance and asset attributes.
2. What constitutes the threshold of when some type of intervention (e.g., maintenance, repair or renewal) is required.
3. What inspection techniques provide the required data. A single or multiple inspection technique maybe required, including field inspection methods, along with desktop and peer to peer analysis. Efficiency of timing for data collection and cost to provide the highest data confidence possible, for the best value must also be evaluated.
4. What process is required to analyse the collected data to understand the asset health and make decisions for intervention.
5. How will the information be collected and subsequently transferred to where it needs to be stored and accessed.

Typically, when considering intervention thresholds, consideration of only the structural condition is applied, but in establishing an intervention threshold further consideration should be given. Asset failure is defined as an inability to deliver specified levels of service, which is when one of the following criteria is reached:

- Pipe does not provide required service levels, i.e., the defined Wellington Water service goals.
- Risk of such failure is above tolerable risk for the service levels.
- The cost of retaining the asset in service is no longer cheaper than replacing the pipe or it becomes uneconomical to retain the existing asset.

Levels of tolerance and defined service levels will vary dependent on the utility, and so individual criteria will apply to structural condition risk, service performance levels and levels of leakage etc. Note the condition assessment scoring considered pipe related failure modes (corrosion, defects etc.) and did not consider external influences such as the impacts of landslides.

3.5 SELECTING INSPECTION TECHNOLOGIES

The inspection techniques most suitable for the inspection of the selected assets are generally dependent on several factors. For pipe assets this could include factors such as:

- Pressure or gravity
- Pipe Material
- Size
- Length
- Operating pressure
- Flow depth (minimum flow depth)
- Whether pipe can be taken out of service or not
- Availability of access points
- Location of the asset to other services and structures

In a number of cases a single inspection technique may not be able to provide for all of the required data and more than one option will need to be available to ensure that the different assets within the asset class can be fully inspected to the required data confidence.

The process for selecting investigation techniques involves identifying suitable investigation methods for both Screening (rapid assessment of the full asset) and Secondary Investigations (discrete inspections intended to validate screening results).

Step 1 Review of the potential tools – What inspection technology is available in the marketplace.

Step 2 Review of output information – identify the types of information generated and how they correspond to the information required. For each technique what is the resolution and coverage (what materials can be inspected and assessment parameters with the same tool)?

Step 3 Determine the technical feasibility – identify the accuracy and reliability of the of information and does it have a demonstrated use/existing use of the tool in the sector (is it reputable, well understood, new technology-) ?

Step 4 Determine market availability – what is the availability of the techniques within NZ, within Australasia or further afield, with emphasis on whether it is available for use within the time frame required. Recent effects such as the COVID-19 border restrictions had an impact on the Wellington Water VHCA programme where some of the preferred inspection technologies or expert personnel were not able enter the country when they were needed.

4. LESSONS LEARNED – KEY CONSIDERATIONS TO AVOID FAILURE

At the completion of the Wellington Water pipeline VHCA programme a review was undertaken across the project team to review lessons learned that would feed into the development of future inspection programmes. Key relevant considerations are set out below.

Planning

- Evolving financing circumstances and contracting arrangements meant there were changes in scope to be accommodated. Changes to the scope during the inspection period has a ripple effect on planning, forecasting, execution and cost. Early contractor involvement and pre-inspection investigations to fully define the scope of assets to be inspected and accurately inform appropriate inspection technologies, quantities and any enabling works required, (e.g., installation of inspection points or tapings, civil works to enable access for inspections, shutdowns, and traffic management, etc.) is critical for achieving the programme and budget, particularly so for pressure pipes.
- Selecting the right type of contract for implementing and managing the programme is important for managing any change. NZS3910 can be suitable with a well-defined scope and specific defects period. A defects period can be short (at least 3 months) if only covering Quality Assurance of deliverables but would need to potentially be longer (2 years) if reinstatement of civil works within the road corridor is required.
- Do not under-estimate the power of peer-to- peer assessments when you get people with local knowledge, and experts with an understanding of materials behavior, and asset failure modes with international experience in a room together. The peer-to-peer approach later proved to be a very reliable indicator to what was found in the field for gravity pipes.
- Encourage the experts who provide oversight on the programme to develop predictor tools (i.e. refine the peer-to-peer approach based on new data) to enable the design of successive programmes and future maintenance programmes. This approach will help direct field assessment to where it provides most benefit

Management

- Weekly meetings are helpful for tracking progress and maintaining good communication between the wider project team. Open collaboration and communication between all the project team ensure good outcomes.
- Discussion on project risk should be included within the weekly meetings to ensure that they are well understood by all parties and can be addressed to mitigate impact.
- All risks that can eventuate are identified early in the project (e.g., Covid-19, limited and difficult access to assets). Preparation of risk mitigation plans

can limit their impact. Approval of traffic management in busy carriageways proved a very challenging aspect of this project.

- Management of the scope is essential to ensure that priorities are maintained. Ensuring that the planed priorities are implemented as intended ensures that the assets with the highest risk of failure are inspected first.

Access to networks

- Early planning and 'buy-in' between project and client operation teams is necessary to ensure that any shutdowns and stand overs etc. that need to be accommodated can be programmed with sufficient time and the importance of the inspection is well communicated.
- Poor understanding of network access limitations and poor planning will have an impact on the success of the project. Time is needed to address this aspect before launching into a contract.

Skills

- Use of appropriately trained and experienced resources provides high quality outcomes. Inclusion of collaborative training prior to the start of the inspections and during the initial stages of the inspections, aimed to ensure all team members understand any specific workflows reduces quality assurance issues from the start.
- Managing inspection programmes such as the Wellington Water pipeline VHCA is complex and challenging and requires enough resources to project manage both the contract and the investigations. This needs to be accepted and funded appropriately for both the client (utility) and the inspection contractors. Consideration as to this aspect needs to be given when setting up and evaluating tenders.

Technology

- While most inspection technologies are available within New Zealand, some equipment may need to come from offshore or could have limited availability. As unforeseen situations or events could occur (e.g., a global pandemic) alternative technology or inspection methodologies should be considered as part of the inspection planning for contingency where this potential risk is identified.
- Inspection programmes generate a lot of information that will need to be accessed by people across the project team, checked, assessed and eventually imported into the relevant asset management system. Utilising an easily accessible but capable database to collect and process the information is important for ensuring a successful delivery, particularly for a complex multi-asset class inspection programme. The Wellington Water VHCA programme used a Microsoft based system call CriNITA that was specifically designed to collect and manage this type of data. A lot of resource needs to be assigned to this aspect of the programme.
- What deliverables are required to be supplied and any workflows for the deliverable submission should be clearly defined within the inspection contract and specifications. A data delivery specification was developed as this programme evolved.
- With large scale or complex inspection programmes the utilisation of a GIS/mapping solution to capture and report the inspection status of each asset and any issues (e.g., inaccessible nodes or incomplete inspections)

improves the management of the programme, reduces risk and provides clear communication to all stakeholders.

CONCLUSIONS - RESULTS AND BENEFITS

The VHCA programme at Wellington Water has been groundbreaking for many reasons. As Wellington Water moves into the design of condition assessment programmes with budgets that are approximately 25-30% of the ideal amount for sustainable renewals planning, it must optimise whatever it has learned.

Some of the key results and benefits to Wellington Water arising from undertaking a formalised condition assessment programme of work include:

- Limited funding has required a risk-based approach to asset management. As a result there has been a focus on where the perceived risks are greatest using criticality, asset history and external knowledge to derive this perceived risk.
- The scale of the project improved client council and Wellington Water staff awareness of the importance of asset condition data, how it influences asset management and operational decisions.
- Greater understanding and confidence of asset condition, risks and renewal priorities.
- Unexpected asset failure has reduced and Wellington Water has been able to be proactive in planning or implementing intervention prior to failure.
- Knowledge gained is informing the development of future inspection programmes and enabling better predictions of asset condition.
- A commitment to documenting intervention approaches for different asset classes has provided a foundation for programmes in the future. These have been called Intervention Guides at Wellington Water and can become controlled documents in any management system.
- With the right communication to support adverse publicity about asset failures, the importance of condition assessment can be recognised by the public and politicians as well as by asset managers as a good investment in risk management.
- Opportunistic inspection while doing operational business as usual will always be a powerful and cost-effective component to condition assessment. The opportunities will become more available if operational people are enthusiastic about the value of the information they can provide and the systems are set up to capture and utilize this information.

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