FROM CATCHMENT TO CONSUMER – A WATER SAFETY JOURNEY

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ABSTRACT

Ensuing from the 2016 Havelock North water contamination event and the subsequent Government Inquiry findings, the Ministry of Health released an updated New Zealand Drinking Water Safety Plan Framework (Released 2018a) (Framework). It should be noted that to date nationwide only three Water Safety Plans had been approved under the new Framework (February 2021), one of which was a water supply scheme owned by Selwyn District Council (Council). The new Framework requires each supply's Water Safety Plan (Plan) to articulate application and management in alignment with the fundamental principles of drinking water safety.

To be approved under the new Framework Council were required to update their existing Plans. A review of the existing Plans against the new Framework highlighted a step change in information and evidence required to satisfy each component. The increase in inputs resulted in a more onerous update process than has previously been experienced. Due to the increased requirements it was important to gain efficiencies where possible. This was achieved through the use of a strategized approach which simplified the delivery of this project.

This paper includes a description of the key elements included in the update methodology for the plans. There is discussion on the strategy, lessons learned, and the key working relationships formed. The involvement of stakeholders was crucial, as each component required a significant level of input and had a direct impact on shaping the 'new ways' of day-to-day water supply management. Some of the changes do mean stakeholders have seen an increase in their roles and responsibilities.

The objective was to produce relevant, implementable processes and documentation which aids in improving the safety of the water supply, through lifting the standards of 'business as usual' with regards to drinking water management. Working through the update process also had an impact on aligning strategic planning with operations and maintenance, fostering strong relationships and working as a collaborative and cohesive inter-organisational team.

Development of the plans has provided a platform for clearer documentation, formalisation and ownership of many processes which were already occurring. Additionally, it allowed for the identification and filling of gaps, adding a robustness in adhering to each of the six fundamental water management principles. There has been a significant improvement to Council achieving the primary purpose, to provide potable water which is consistently and reliably fit for domestic consumption.

KEYWORDS

Risk assessment, drinking water, improvement planning, water management, water safety plan

PRESENTER PROFILE

Jessica is a Water Engineer, with experience in the water infrastructure sector. She is particularly passionate about drinking water and the way this industry is growing, evolving and changing in New Zealand. Jessica enjoys working alongside clients to develop solutions which are most appropriate for them and achieve the overarching goal of providing water which is fit for purpose. Qualifications include BE (Hons) Civil.

Marcia is a Civil Engineer with over 26 years' experience in the water, wastewater and civil construction industry having held positions on all sides of the business in Consultant, Contractor and Customer roles. Having key leading roles in the infrastructure rebuild of our second largest city following the Christchurch Earthquakes she is an eternal optimist who encourages her teams and clients to bet against the laws of averages – after all there are so many more ways in which things can go wrong than right in our business.

1 INTRODUCTION

The supply of safe drinking water is a necessity for good health. In 2016 Havelock North experienced a significant water contamination event. This event triggered a Government Inquiry (New Zealand Government, 2017) which focused on:

- How the water supply system became contaminated
- How this was subsequently addressed
- How local and central government agencies responded to the public health outbreak that occurred as a result of the contamination
- How to reduce the risk of outbreaks of this nature recurring

The inquiry highlighted that principles of drinking water safety have been developed internationally to address the basic problem for all suppliers:

"Supply systems are vulnerable in countless ways to contamination and a single vulnerability has the potential to cause widespread illness in consumers."

It was concluded that to address this problem in New Zealand, water suppliers must recognise the six fundamental principles for drinking water management, as they are ingrained in international good practice and should imbue our approach to drinking water. These principles are as follows:

- Principle 1: A high standard of care must be embraced
- Principle 2: Protection of source water is of paramount importance
- Principle 3: Maintain multiple barriers against contamination
- Principle 4: Change precedes contamination
- Principle 5: Suppliers must own the safety of drinking water
- Principle 6: Apply a preventive risk management approach

The Inquiry also considered any necessary changes to prevent or minimise similar incidents in the future. One of the key changes identified was an update of the New Zealand Drinking Water Safety Plan Framework (Framework) (Ministry of Health, 2018).

A Water Safety Plan is a public health risk-based assessment and management process that aims to ensure a safe and secure supply of drinking water for consumers (Ministry of Health, 2018). The Health Act 1956 (New Zealand Government, 1956) requires certain drinking water suppliers to have and implement a Water Safety Plan.

The aim of the new framework is to move from reactive to proactive drinking water management with a holistic system view and an increased focus on preventative measures, multiple barriers and continuous improvement. This updated framework requires the Water Safety Plan to articulate application and management in alignment with the six fundamental principles of drinking water safety.

2 PROJECT OVERVIEW

The Selwyn District has been a fast-growing district over the past decade, following the earthquakes that devastated large amounts of the Canterbury region. With over 66,000 people, Selwyn remains the third largest territorial authority area in the South Island by population, behind Christchurch City and Dunedin City. Rapid growth has also instigated change in the way some of the water supplies have been further developed and the overall drinking water management strategy.

Selwyn District Council (Council) are the owner and operator of 27 water supply schemes. The supplies provide potable water to 82% of the population of the Selwyn District which is equivalent to approximately 54,000 people. Like most other territorial authorities in New Zealand several of these supply schemes trigger the requirement under the Health Act to provide water and operate in accordance with a Water Safety Plan.

Council's existing Water Safety Plans were due (May – June 2020) for renewal under the five-year approval cycle. To have these Water Safety Plans approved in accordance with the Framework, Council were required to overhaul their current Water Safety Plans (Plans). A review of existing practices, documentation and Plans against the Framework alerted Council that there had been a step change in the information and evidence required to satisfy each component. It was also recognised that the update process would be resource intensive.

Jacobs New Zealand Ltd (Jacobs) were engaged by Council to provide additional resourcing and specialist advice throughout the update process. The scope of Jacobs engagement to work alongside Council in the development process was as follows:

- Confirm the Water Safety Plan approach
- Develop a template for the Water Safety Plan
- Carry out scheme reviews including reviews of data, water supply description, catchment assessments, risk assessments, existing preventive measures, existing operational procedures, verification and monitoring and management of incidents and emergencies
- Hold risk and stakeholder workshops
- Identify and agree scope and plan for improvements
- Draft Water Safety Plan updates
- Finalise Water Safety Plans

3 WRITING THE PLAN

3.1 ESTABLISHING THE DEVELOPMENT TEAM

The Plans were required to be developed in accordance with the Framework. This Framework provides components which are in alignment with demonstrating best practice drinking water management. In review and reflection of existing management practices within Council and the significant level of input required, it was recognised that these Plans could not be delivered through a typical transactional consultancy services manner or by a single organisation. A siloed approach simply would not work.

Therefore, one of the most important and influential parts of the project was the establishment of a Water Safety Plan Development Team (Development Team).

This team was formed to meet two key objectives:

1) Include someone from each organisation and business unit who is involved with drinking water management and will be a key contributor.

2) Hold a shared responsibility to drive the Water Safety Plan update process.

Table 1 shows the four organisations which formed the Development Team and summarises the responsibilities and specific contributions required from each. As the owner of the Plans, Council were in charge and led the Development Team. Many people from each organisation were involved at some point whilst the Plans were updated. This involvement was driven by the members of the Development Team from that organisation. Those members were responsible for facilitating engagement and gaining the required inputs from their respective organisations.

This multi-organisational Development Team reflects the importance of shared commitment to drinking water quality management across various organisations involved with the supply of water. The Development Team draws on the groups which are intimately involved with drinking water management and day-to-day operations and in other words are the key stakeholders with a vested interest in the inputs and outcomes from the Plan update process.

Table 1: Water Safety Plan Contributions

Organisation	Responsibilities	Team Members	Specific Contribution to Water Safety Plan
Selwyn District Council	Ownership of the Water Supply Networks and Responsibility to Ensure their Operation Delivery and adoption of Water Safety Plans	• Water Engineers • Water Quality Engineering Officer • Network and SCADA Engineer • Asset Manager – Water Services	• Sponsorship and ownership of all Plans • Resources and funding • Provide information, verification and review of all sections of the Water Safety Plan • Participation in risk workshops/assessments • Adoption of new processes and standards • Ownership and roll out of all Unit Process Control Procedures (UPCPs)
SICON Ltd	Management of Water Supply Networks	• Water Services Contract Manager • Water Services Operations Manager	• Provide information on all matters relating to water operation and maintenance • Ownership of all Operational Standard Operating Procedures (SOPs) • Ownership of all operation training plans • Participation in risk workshops/assessments • Adoption of new processes and standards
Food and Health Standards Ltd	Water quality sampling	• Environmental Health Officer	• Provide information on all matter relating to water quality sampling and water quality data management • Adoption of new processes and standards
Jacobs NZ Ltd	Advisory services Water Safety Plan Documentation	• Principle Engineer • Water Engineer	• Advisory services regarding the interpretation and application of the Drinking Water Standards for New Zealand 2008 (Revised 2018b) and Water Safety Plan Framework • Workshop and meeting facilitation • Documentation of Water Safety Plans

3.2 GAP ASSESSMENT

With the establishment of the Development Team and clear definition of roles and responsibilities the next step was to take stock of Council's current ways of working and assess this against industry best practice. This exercise was completed as a gap assessment against the Framework.

The Framework outlines what is expected of water suppliers. The Framework is also supported by detailed interpretation of the requirements in the Handbook for Preparing a Water Safety Plan (Ministry of Health, 2019).

Undertaking the gap assessment involved a review of existing information to understand the current status of water management, compliance management and integration between and within organisations. The key findings of the gap assessment against the relevant Water Safety Plan components are summarised in Table 2.

Table 2: Water Safety Plan Component Gap Assessment

No.	Component	Actions Identified
1	Drinking-water Quality Management	• Engage a team with full and part-time resources with clear roles/responsibilities outlined to begin developing Water Safety Plans. • Review roles, responsibilities and training requirements and implement a way to monitor training records.
2	Assessment of the Drinking-water Supply System	• Prepare schematics to align with Plan requirements. These will require verification of existing equipment/processes. • Prepare scheme catchment hazard assessments building on existing knowledge/catchment maps and reviewing scheme specific hazards and mitigations. • Review source protection mitigations as part of risk assessment and multi-barrier approach. • Develop and agree risk methodology applied and develop new risk registers for each scheme.
3	Existing Preventative Measures for Drinking-water Quality Management	• Review of existing claimed protozoa log credits against log credits required from the Catchment Hazard Assessment. • Demonstration/assessment of each of the four barriers (1) preventing hazards entering the raw water; (2) removing particles and hazardous chemicals from the water; (3) inactivating pathogens in the water and (4) maintaining the quality of water in the distribution system. • Develop any additional preventive measures as part of risk assessment process.

No.	Component	Actions Identified
4	Operational Procedures	• Update Operations and Maintenance manuals against requirements of Plan Framework. • Document SOPs for the following categories of activities; general, instrumentation, operations and corrective actions. • Formalise and document Critical Control Points (CCPs) and Operational Monitoring Control Points – including target, action and critical limits. • UPCP similar to an Operations and Maintenance Manual. • Develop a detailed change management plan and provide training to staff who have access or authority to change the system parameters in adherence with the change management plan.
5	Verification and Monitoring Programme	• Review/update the Compliance Monitoring Plan and link to other processes. • Review/develop/practice transgression response plans to support consistent response and reporting protocols.
6	Improvement Plan	• Develop improvement actions as part of risk assessment process, as well as reviewing previous improvement actions for close-out. • Establish process for monitoring, roll-out and close-out of improvement actions. Ensure this is integrated with other action tracking, budgeting and work-planning.
7	Management of Incidents and Emergencies	• Prepare an integrated incident and emergency planning process that provides a framework for all types of emergencies that could influence the supply of drinking water.
8	Documenting and Reporting	• Review/implement a document management system for all drinking water documents. • Assign an owner to each of the Plan documents to maintain version control.
9	Investigations	• Undertake a review of water treatment process parameters, document development of these parameters and/when these should be reviewed/updated.
10	Oversight, Review and Continual Improvement	• Consider an internal auditing process to support improved drinking water management, • Consider the need for formal audits to support continuous improvement of the drinking water management system. • Develop/document the senior leadership review process.

The gap assessment identified actions required to gain approval of the Plans and management practices in relation to each of the Framework components.

These actions essentially formed a task list for the Plan update process which was expanded to identify update areas which would be more resource intensive. It provided useful insight for scheduling of resources.

3.3 UPDATE STRATEGY

Council knew that there was a significant change in the new requirements and multiple gaps had been identified which would result in a far more onerous Plan update process than had previously been experienced. There were increased requirements not only with regards to documentation, but the update also involved the establishment of new processes and management practices and effectively was the beginning of an organisational change process. With a clearer picture now of where Council were at versus where they needed to be and the team established, the next part was to develop the 'how'.

The Water Safety Plan development strategy needed to achieve the following:

1) Be relevant and applicable to Council

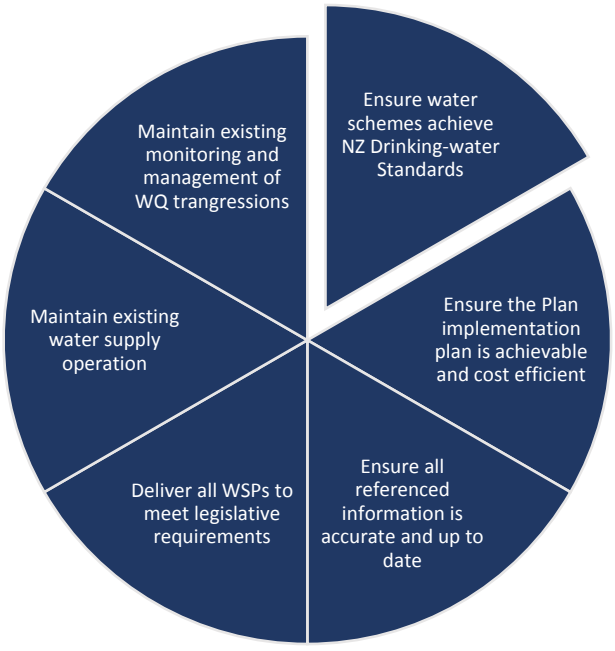
2) Optimise the use of people's time

3) Find efficiencies where possible without compromising the standard of inputs or outputs

4) Result in the production of relevant, useable and implementable processes and documentation

To emphasise the importance of points two and three, Council's Water Services Team compiled a list of the 'Top 6' priorities which they were required to balance throughout the update process. A summary of these priorities is depicted in Figure 1.

Figure 1: Water Services "Top 6" Priorities



Consideration of these variables resulted in a management system which distinguishes between the scheme specific and district wide elements. The separation of these elements meant that information which is relevant to the entire district only needed to be documented once and not replicated across each scheme specific Plan. This had multiple benefits in the form of timesaving and efficiencies, as well as more robust information control, while maintaining one source of truth.

The Council's Drinking Water Management System is shown in Figure 2, this shows the key documents which sit within drinking water management and how they interact.

Figure 2: SDC Drinking Water Management System.

In reference to Figure 2 the scheme specific documentation includes all documents which sit under the Scheme Water Safety Plan box in the left column. District wide documents include the overarching Drinking Water Framework and the other documents in the middle and right columns of the Management System.

With a continued focus on moving towards an approved Plan the content of the documents within the Management System was based around meeting each of the Framework components. The following sections provide a summary of purpose, scope and Framework components addressed in each document within Council's Drinking Water Management System.

Council's Drinking Water Framework

Purpose: Provide guidance on the drinking water management system, and the methodology that Council used in developing and implementing scheme specific Plans.

Scope: This document is overarching in nature and provides a roadmap to Council systems and processes which provide safe and reliable drinking water. This document covers the process, methodology and people involved in the development of Plans.

Drinking Water Compliance Monitoring Plan

Purpose: Fulfil the requirements of the Drinking Water Quality Compliance Monitoring Plan as required to meet Component 5 Verification and Monitoring Programme of the Framework.

Scope: This document is overarching in nature and provides district wide information on roles and responsibilities and competency and training in relation to compliance monitoring; DWSNZ compliance requirements; Council's compliance monitoring; Priority 1, 2 and 3 determinands compliance criteria and monitoring; radiological and viral compliance; water sampling; water quality evaluation and reporting and consumer satisfaction.

Drinking Water – Incident and Emergency Management Plan

Purpose: Meet the requirements of Component 7 Management of Incidents and Emergencies from the Framework. The purpose is to enable focused preparation of response specifically to drinking water related emergencies and incidents.

Scope: This plan sets out the emergency and incident management planning processes as it relates to all drinking water schemes within the Selwyn District. This plan is complimentary to existing lifeline utilities and civil defence protocols and integrates with existing management planning, roles and responsibilities according to the Civil Defence Emergency Management Act (2002), the Lifeline Utilities Response Plan and Business Continuity Plan.

Drinking Water –Transgression Response Plans

Purpose: Meet the requirements to provide systematic processes for managing water quality transgressions.

Scope: This document sets out roles and responsibilities during a transgression event; triggers and response actions for possible transgression events; communication and reporting protocols, procedures for public notices and event reporting and investigation templates.

Standard Operating Procedures (SOP)

Purpose: Provide consistency and realise efficiency in standard operations and maintenance tasks. Minimise variability across the 27 water supply schemes.

Scope: Provide a library of SOPs relevant to all Council drinking water schemes which also feed into the Operations and Maintenance Contract.

Scheme Water Safety Plans

Purpose: Address all scheme specific elements of the Framework and provide a realistic picture of the current state of each water supply scheme.

Scope: Provide the unique information for each water supply scheme including: an assessment of the water supply system in relation to infrastructure, water quality, preventive measures, control points (critical and operational), vulnerabilities, planned projects and improvement actions.

Catchment Hazard Assessments

Purpose: Meet the requirements of Section 2.1.2 of the Framework and determine protozoal compliance criteria in Section 5 of DWSNZ.

Scope: Delineate a series of source protection zones, based on spatial criterion, to identify hazards that could potentially impact the water supply within each scheme.

Unit Process Control Procedure (UPCP)

Purpose: Describe the strategy for operating the unit processes of a water scheme and is prepared as an instructional and reference guide for the operator. This document supports the operational aspects of the Plan.

Scope: Describes what the operator expects to achieve in a unit process. Details how the operator is to monitor the process to assure the process is performing as expected. It also specifies what an operator is to do to keep the process performing properly. The UPCP is written based on an operator's first-hand knowledge for best operating practices for each unit.

Risk Assessment Registers

Purpose: Provide an overall residual risk profile for each water supply scheme.

Scope: Apply the chosen risk assessment methodology to each scheme. This should highlight areas where risk is not currently managed with existing preventive measures and/or where improvement actions are required to reduce the overall residual risk of the scheme.

3.4 PLAN DEVELOPMENT

Equipped now with a team and a strategy, the next step was to put pen to paper and start working through the actions identified in the gap assessment and begin populating the Plan documents.

There were four key steps taken to develop each component of the Plans these included:

1) Developing the methodology to be applied to that component
2) Gathering relevant inputs and populating the documentation
3) Refining and finalising the documentation
4) Collating and noting the improvement actions relevant to that component

An area of plan development which involved significant effort, iteration and refinement was completion of the scheme specific risk assessments. Development of this portion of the documentation provides a good example of how decisions were made throughout the development process and the engagement activities and other tools that were used. Given that a Plan is developed using a risk-based approach, the risk assessment portion is highly influential especially when it comes to informing the direction of future funding through the improvement actions associated with risks which are deemed 'unacceptable' or 'not managed'. Table 3 summarises the four development steps in relation to the development of the scheme specific risk registers and relevant improvement actions.

Table 3: Development of Scheme Specific Risk Assessments and Improvement Planning

Stage	Inputs	Outputs
Developing the Methodology	• Water Safety Plan Framework and Handbook requirements and examples (Section 2.3 and Appendix 3) • Advice from Jacobs risk specialists • Inputs from Council staff including Water Engineer, Water Quality Engineering Officer and Water Services Asset Manager	• Risk assessment methodology which had all components required by the Plan Framework and was in alignment with the examples provided in the Handbook.
Populating the Assessment	• Each scheme specific risk assessment was developed through a Risk Assessment Workshop facilitated by a risk specialist from Jacobs • Hazard guidewords were used to provide guidance in the process and to prompt consideration of risks in a consistent manner	• Identification of the hazards and hazardous events relevant to all parts of each water supply scheme. • Agreement on the raw likelihood, consequence, and risk relevant to each hazardous event with no preventive measures in place. • Comprehensive list of existing preventive measures • Strengthened inter-organisational relationships. These workshops provided a forum to discuss issues/niggle areas observed/experienced at particular schemes on a regular basis by the Water Services Delivery Team and Operations and Maintenance staff.

Stage	Inputs	Outputs
Refining the Methodology and Assessment	• Multiple review and feedback sessions on the populated risk assessments from the Development Team • Multiple review and feedback sessions on the populated risk assessment from the DWA and an external risk expert engaged by the District Health Board	Review and feedback from all parties resulted in adaptations to the methodology provided in the Handbook for Preparing a Water Safety Plan. These adaptations were implemented to create a methodology which is relevant and applicable to Selwyn. The following refined definitions specific to Selwyn District from the example methodology were applied: • An additional boundary added for the 'Catastrophic' risk level to define the population affected. This meant for the consequence to be considered 'Catastrophic' greater than 5,000 people needed to be impacted. • An additional likelihood category of 'very rare' was added. This was for events which occur less than or equal to once every 20 years. • The descriptions for acceptable/not acceptable risks was changed to 'risk managed' or 'risk not managed'. Risk managed is when no additional actions are required to further reduce the risk. Risk not managed is when further actions are required. • There were specific scenarios when all preventive measures were in place and no practicable improvement actions were found which would result in a low residual risk. Therefore, resulting in a medium or high residual risk with no improvement actions as all practicable measures were already in place. In those cases, these particular hazard events were deemed 'managed'. These events and the criteria were explicitly described and included the following: source water contamination via catchment, cyanobacterial contamination, protozoal contamination. It should be noted that there was a great deal of debate ahead of agreeing the 'risk managed' status.

Stage	Inputs	Outputs
Improvement Planning	• Completed scheme specific risk assessment with all existing preventive measures in place and agreed residual risk ratings assigned • List of risks which were not currently considered managed	• List of scheme specific improvement actions which are required to be implemented to lower the residual risk through either a reduction in the likelihood or consequence relating to the hazardous event. These were also improvement actions which had through the workshops already been discussed and agreed in theory between the Water Services Delivery Team, Asset Management and Operations and Maintenance Staff. • Each improvement action was assigned the following: an owner, a deadline (priority rating), a budget and any associated short-term contingencies (if required).

The use of these four steps across the development of all parts of the documentation provided consistency and a methodology for the Development Team to follow. Stage 2 was particularly influential, the development process provided regular meetings with the Development Team which spanned Operations and Maintenance staff, Water Services Delivery staff, Asset Management staff and others.

It effectively created a platform for knowledge and idea sharing, especially in terms of closing the gap between strategic planning and operations and maintenance. Council have observed positive impacts in terms of the strengthening of relationships and functioning as a high performing inter-organisational team, as well as an all-round improvement in understanding the current state of their assets and the improvements required to maintain a cycle of continuous improvement.

Stage 3 which relates to refining the methodology was also particularly prominent. The Development Team soon learnt that refining the methodology and meeting the requirements of each component would be a process with multiple iterations. This did at times prove onerous and demanding as it required revisiting sections with a fresh approach and/or adding in additional information. As mentioned in Table 3 the risk assessment development process was particularly iterative and involved continued refinement of the methodology and the application of this. The process of refinement and iteration did result in more robust processes/methodologies as they were the result of in-depth review and had been challenged and adjusted many times over.

4 LEARNINGS

Working through this process has provided all involved with multiple lessons learned. The key lessons learned are as follows:

1) The updated Framework requires a step change in the Plan update process, especially with respect to the time and resources required to complete the update.

2) Documentation is substantial so, it is important to be efficient and maintain one source of truth by avoiding replication of the same information through multiple documents. This was achieved by referring to the source rather than replicating the information in each individual document.

3) This process is more than just documentation it's about management practices and processes and the update is not just to the documentation but to the practices and processes as well. The process needs commitment from CEO level to Operations and Maintenance.

4) It is vital to recognise there will be organisational change, processes being altered/deleted/replaced and roles/responsibilities being redefined. This change process requires careful management to be successful. Effective and timely communication is essential.

5) Must be delivered in collaboration by all those involved with drinking water management.

6) Development is an iterative process the Water Safety Plans will be updated as you learn and work through.

7) All Plans are not the same as the risks for each scheme are different. Whilst an overarching template has been developed, significant effort is required to fine tune this for each individual scheme.

8) Many robust processes were already in place but were light in terms of official documentation. This process provided a platform for the recognition, formalisation and documentation of these.

9) These are living documents and require regular updates to remain relevant and useful.

5 OUTCOMES

The key outcomes of the Plan update journey are summarised in Table 4. This includes a comment on how and why each outcome was achieved.

Table 4: Key Outcomes from Updating the Water Safety Plans

Outcome	Comment
Approved Hororātā Water Safety Plan and Increased Safety of Water Supply	This was achieved through the development and application of the process explained throughout this paper and in accordance with the Framework. The following was required: 1) A Water Safety Plan Development Team 2) An Update Strategy 3) An initial Gap Assessment Production of the required documentation and evidence of robust drinking water management
Relevant, Implementable Processes and Documentation with clear Roles and Responsibility	Development of the documentation was overseen by the Development Team. This destined that inputs were received from the right people, at the right time. This approach meant that each person who would be directly impacted by the content and outcomes of the documentation and processes was involved in the process of developing it. This created a sense of ownership, a vested interest and ensured that the inputs to the process were true and accurate. Each document clearly defined the associated roles and responsibilities through assigning a single point of ownership to each action.
Alignment between Strategic Planning and Operations and Maintenance	Working through the development process involved many meetings, workshops and ongoing conversations between all members of the Development Team this resulted in the strengthening of relationships between both organisations and between staff involved with drinking water management. The interactions and communications provided the opportunity for all involved to be fully up to date with the current status of each water supply scheme. This was especially valuable for individuals who do not necessarily visit the scheme frequently as part of their role but are involved in decision making relating to water supply.
Updated Operations and Maintenance Contract	The process helped form the basis of the Infrastructure Management Contract with SICON Ltd. There was an increased scope in relation to drinking water management. It was important to capture this through the Plan documentation but also through any contractual documentation.

6 CONCLUSION

Council were required to update their Plans in accordance with the revised Framework to meet their obligations under the Health Act as a water supplier. The update process proved to be more involved and resource intensive than what had previously been encountered. To achieve the outcome of an approved Plan, Council with the assistance of Jacobs led a delivery strategy which involved establishing a Development Team, completing a gap assessment against the Framework, developing a management system and populating the Plans. The result was an approved Plan which was underpinned by relevant, implementable processes and documentation with clear roles and responsibilities. With the flow on effect of alignment between strategic planning and operations and maintenance, and an update to the Operations and Maintenance Contract.

Working through the update and implementation process provided the opportunity for reflection on the outcomes. A key reflection relates to the amount of documentation associated with achieving an approved plan. The outputs were document heavy. This can reduce the practicality or the use of these documents in practice due to information overload and challenges in efficiently finding the information required. It also presents the risk of Plans becoming outdated due to the laborious and time intensive process of regularly updating these. This highlights the requirement to maximise on precise information management and the benefits of publishing a document through a software which can be linked to live data (i.e. link to GIS services map and water quality platform) and therefore automatically updates to provide current information. Council have implemented this for their Activity Management Plans and may proceed with a similar approach for the Plans.

In the same manner that the Plans are living documents the regulations which set the minimum requirements for the contents of the Plan are also exposed to changes and updates as the industry evolves. Given that in the water industry in New Zealand there is currently a new regulator being established and a water reform underway there is a high chance that additional changes in regulations will be observed in the near future. For example, there are likely to be more stringent measures required with regards to management, of source water and the need for existing Catchment Hazard Assessments but also Catchment Management Plans which are over and above what has already been completed. This highlights that drinking water management is not something that is done once. There will be ongoing changes and revisions to both the Plans and management practices.

Regardless of what is to come in the future the Plans have provided a platform for clearer documentation, formalisation and ownership of processes adding a robustness in adhering to each of the six fundamental water management principles. This demonstrates Council's commitment to providing drinking water which is consistent and reliably fit for purpose.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the contributions of the entire Selwyn District Council Water Services Delivery Team, Murray England the Selwyn District Council Asset Manager – Water Services, Gareth Morgan the Selwyn District Council Service Delivery Manager Murray Washington the Selwyn District Council Group Manager Infrastructure, the SICON Operations and Maintenance Team, the Jacobs Team and Harriet Bond from Bond Consulting Ltd. They have been integral in the success and collaborative implementation of the Water Safety Plan updates.

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