DELIVERING WELLINGTON'S EMERGENCY WATER NETWORK

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ABSTRACT

A significant earthquake in the Wellington region will result in damage to the potable water network, and could result in parts of the region being without water for long periods. The Kaikoura earthquake in 2016 was a clear reminder of the risks facing the Wellington region should a large earthquake occur. To overcome this, Wellington Water Ltd (WWL) initiated the Community Infrastructure Resilience project. The goal of this project is to provide 20L per person per day of potable water within 1000m of their residence.

To achieve this resilience goal, a series of 22 community water stations were designed and built within a 15-month period. Two types of water sources were identified for use at these water stations; ground water bores and surface water sources, where surface water sources are typically small streams and rivers. These water stations are strategically located around the Wellington region to ensure all communities have access to an emergency water supply. The 35-year design period for the water stations is based on containerised water treatment plants that can become operational within 7 days following an earthquake.

This paper:

- Outlines the expected "water islands" concept that will occur within the Wellington region, and the temporary distribution network that will be set up to supply 20L per person per day within 1000m of their residence
- Provides an overview of the operational plan for these water stations, and how multiple stakeholders and the local communities were engaged
- Discusses the challenges that have been overcome in designing water treatment plants and an associated delivery network for emergency community operation and long-term readiness
- Details the implementation and operation of the containerised water treatment plants and the resilience network

By installing the 22 water stations and developing a temporary distribution network, the Wellington region has created a resilient water supply network that is well prepared for the next significant earthquake.

KEYWORDS

Resilience, Strategic Planning, Potable Water, Community Involvement, Containerised Treatment Plants

PRESENTER PROFILE

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Andy is an experienced project manager and has delivered a wide range of resilience projects. He has extensive experience in New Zealand and the UK where he was a member of the operational response team. He has on the ground project delivery experience in developing nations as well.

Nick Hewer-Hewitt, Wellington Water Ltd Service Delivery Facilitator

Nick has spent 26 years in the water industry. From a water resilience perspective he has been involved with the on-ground response to cyclones Bola and Ofa, the Samoan Tsunami response, the Christchurch earthquake and more recently assisting with the New Plymouth mains failure.

1 INTRODUCTION

A significant earthquake in the Wellington region will result in damage to the potable water network, and could result in parts of the region being without water for long periods. The Kaikoura earthquake in 2016 was a reminder of the risks facing the Wellington region should a large earthquake occur. To overcome this, Wellington Water Ltd (WWL) initiated the Community Infrastructure Resilience (CIR) project. The goal of this project is to provide 20L per person per day of potable water within 1000m of their residence, for a total of approximately 400,000 people in the Wellington region.

2 BACKGROUND

The strategy theorised that following a major earthquake the Wellington region would break into a collection of isolated islands, as transport links may be broken. For this reason, each 'island' must be self-sufficient until these links are restored. Some of the existing reservoir network and existing water sources are expected to survive, with assessments carried out to categorise these as 'resilient reservoirs'. In some islands the water supplied from these existing sources is not enough, and has to be reinforced by alternative water sources. Figure 1, below, shows the water 'islands' that the region is broken up in to, and the location of the water sources.

Figure 1 – Wellington Region Water 'Islands' and Water Sources

Alternative water sources were investigated to provide the 20L per person per day within these 'islands', and these included ground water sources, surface water sources and desalination. Ground water sources are bores and surface water sources typically refer to streams or small rivers.

For the ground water and surface water sources, they are capable of supplying a small, but continuous supply of raw water. Once the water has been extracted from the bores or collected from the surface sources, it will need to be treated to become a potable water supply. The treatment plants fit within 10 or 20-foot shipping containers called Water Stations that will house the downstream distribution equipment. Downstream distribution of the water will occur via bladders that can be moved offsite.

The water sources will be located through the Wellington region, and will vary in their accessibility and terrain (i.e. public parks, carparks, etc). It is proposed that members of the community will be trained and responsible for their operation with the overview of WWL.

For some parts of the region, there were no suitable ground or surface water sources nearby, so a third option of large scale desalination was investigated.

3 IMPLENTATION

3.1 KEY STAGES

The CIR Programme has been fast-tracked due to the increased importance of resilience initiatives underway in Wellington, and completed within a short time-frame. With the impact of the Kaikoura earthquake fresh in the minds of Wellington's regional Emergency Planners, local authorities, and Wellington Water, the implementation phase of CIR commenced on 1 July 2017. This came with a view of being completed by the end of June 2018, completed within a single financial year.

This programme is due for completion on 30 September 2018, as an extension of time has been negotiated between WWL and the Department of Internal Affairs (DIA), the central government funding partner. Despite the complexity of the programme, the project has been delivered through a number of phases, and is compliant with all current legislation. This includes adherence to Public Sector procurement rules, the Building, Reserves, and Resource Management Act.

The programme is made up of the following key stages:

- **Strategy** – Completed prior to July 2017, the strategy outlined the 'islands' concept, and the use of community based water sources to bridge the gap between the earthquake and the anticipated response times.

- **Investigation** – The search for water, through the assessment of streams and groundwater investigation bore drilling, were completed to confirm the water sources required to meet the service requirements of providing 20 litres per person per day.

- **Design** – Engineering design of the treatment stations including both the urban and civil design of the station, and the process design of the treatment equipment. This also included the design and specification of distribution bladders and ancillary equipment to support the treatment stations. To support the design process extensive community consultation was carried out to both inform the Wellington Community of the need for the project, raise awareness in community self-sufficiency and to reduce the risk of submissions on the publically notified sites.

- **Delivery** – The appointment of Contractors and Suppliers to deliver the programme.

These are in line with a standard project approach, however due to programme constraints, these phases of the programme have been carried out simultaneously to ensure the delivery targets were met.

These stages were also amplified six months into the programme by the addition of an Operational Planning work stream. The programme team worked with local Civil Defence, Emergency Management (CDEM), and Councils to create operational procedures under which the water treatment stations and distribution network could be activated and operated.

3.2 THE SEARCH FOR WATER

A staged process was taken to identify suitable alternate sources of water. These stages were;

1. Review of existing water sources

2. Establishment of 'island' boundaries

3. Review of available surface water sites for flow rate / water quality. A two stage investigation was undertaken; initially GIS based for all water sources of a moderate sustainable flow in the study area, then onsite verification of both water quality and flow rate.

4. Identification of suitable ground water sources in areas not served by surface sites or existing sources. Review of geology and topography to identify zone with suitable groundwater potential for the drilling of low-yield bores.

Once suitable areas for both groundwater and surface water were identified, specific sites were selected on a number of assessment criteria. These criteria were;

- Sources must have the potential for suitable water
- Water sources need to be close to the served population as possible
- Sites must have, or be near to, suitable open space
- Sites must be at resilient locations
- Sites should be associated with recognisable public buildings or spaces where possible
- Sites must not be on land with the potential for re-development for the next 35 – 50 years.

3.2.1 CRITERIA 1 – SOURCES MUST HAVE THE POTENTIAL FOR SUITABLE WATER.

Surface Water - Surface water sources must have a sufficient dry weather flow at a take point upstream of the main populated urban areas. It is likely that wastewater utility lines will be broken and disrupted following an event with consequential pollution of downstream freshwater. Adequate treatment of polluted water to a drinking water standard was considered onerous with a containerised emergency treatment solution.

Groundwater - The location of suitable groundwater sources was more complicated, as no aquifer exists under Wellington and Porirua. Instead, investigation bores are targeting water flows occurring within fractured greywacke. The land bore locations are based on geology, proximity to groundwater recharge and nearby population. Favourable geology is fracture zones within the greywacke (common name for the basement rocks of the North Island). Groundwater sits within the rock fractures and if there is good connectivity between these fracture zones and an area of groundwater recharge, a reasonable groundwater yield can be expected.

Groundwater recharge areas were chosen based on locations where surface water (rainfall or streams) can penetrate into near-surface fractured rock. The ideal recharge areas have limited housing, industry or agriculture, which could result in contamination within the groundwater. Because groundwater tends to follow topography, a valley area with hills covered in regenerating bush is an ideal location. The bore would then be position down-gradient of the valley to capture the groundwater flow.

Sites known to contain historic landfill or used for a purpose likely to have caused ground contamination were rejected.

The investigation bores being drilled into fractured rock have a high degree of uncertainty in terms of achieving water of a suitable quality and quantity. To improve this success percentage, geophysical survey is required at each of the sites to identify areas of fractured rock. To conduct geophysical survey an on surface traverse of approximately 100m is required to provide detail about the underlying rock features.

3.2.2 CRITERIA 2 – WATER SOURCES NEED TO BE A CLOSE TO THE SERVED POPULATION AS POSSIBLE.

The topography in Wellington makes the transport network vulnerable to seismic events. Movement after an earthquake is likely to be limited to either foot traffic or 4WD vehicles and therefore the selected emergency water source need to be close to a population served.

3.2.3 CRITERIA 3 - SITES MUST HAVE OR BE NEAR TO SUITABLE OPEN SPACE.

The provision of an emergency water supply source requires space for the extraction, treatment and distribution of potable water during an emergency. The configuration during operation is:

- Source
- Pump
- Treatment container
- 20,000 litre or larger water bladder
- Distribution taps accessible by the public
- Distribution point for vehicle mounted bladders and tankers.

Figures 2 and 3, below, show an indicative layout of a surface water source and ground water source in operational mode

Figure 2 – Surface Water Source Operational Layout

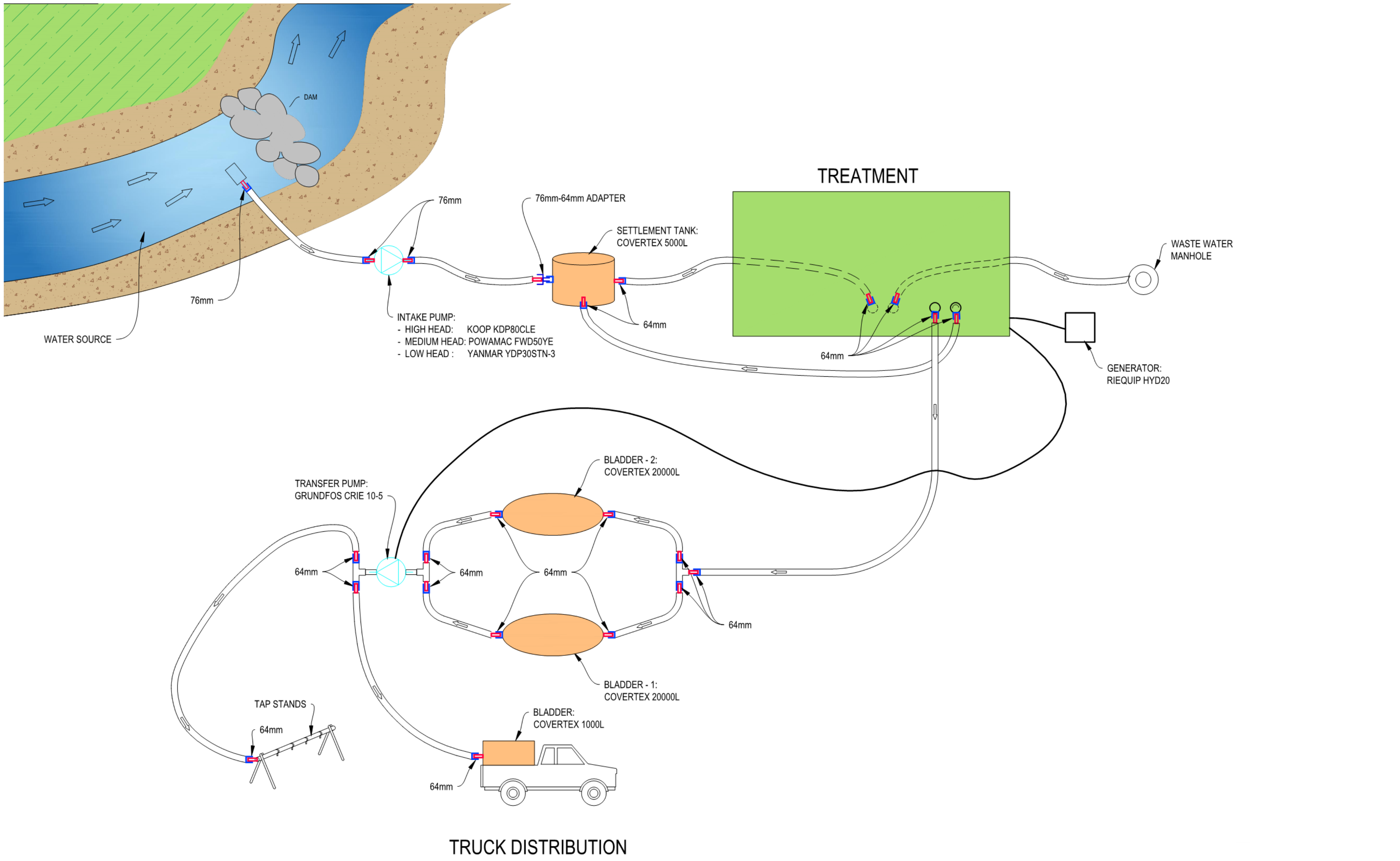
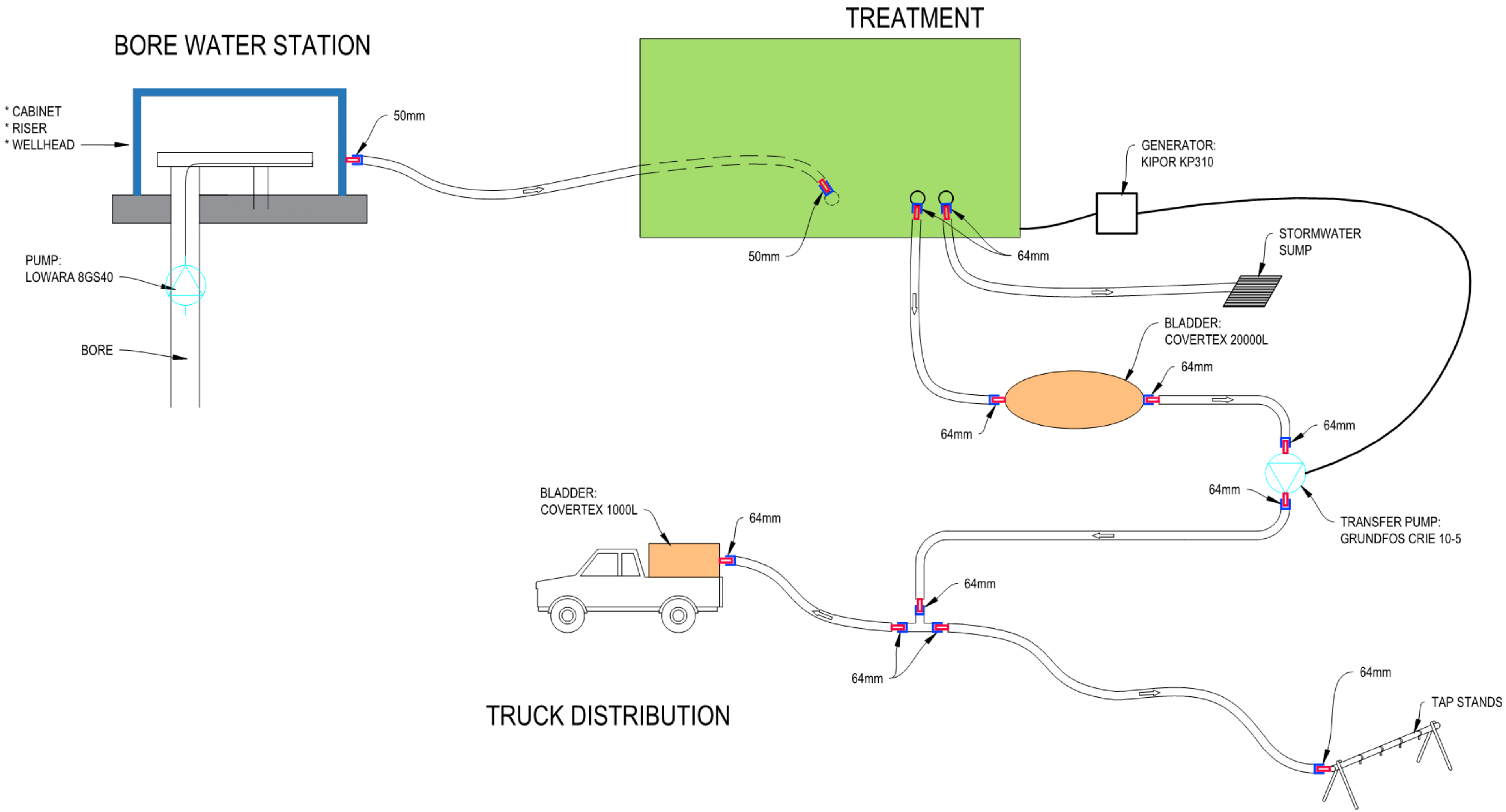


Figure 3 – Ground Water Source Operational Layout



3.2.4 CRITERIA 4 – SITES SHOULD BE AT RESILIENT LOCATIONS.

The emergency water sources are designed to operate following a significant earthquake. They therefore must be able to withstand the effects of that earthquake. These sites must also not be at risk from secondary hazards such as:

- Tsunami
- Landslide
- Building collapse
- Fire
- Surface water flooding
- Liquefaction

3.2.5 CRITERIA 5 – SITES SHOULD BE ASSOCIATED WITH RECOGNISABLE PUBLIC BUILDINGS OR SPACES WHERE POSSIBLE.

Following a major event, it is envisaged that Civil Defence and local community based groups will be involved in the operation and distribution of water. As movement within the region is likely to be restricted, these sites must be in easily accessible locations that are recognisable to the public.

3.2.6 CRITERIA 6 – SITES MUST NOT BE ON LAND WITH THE POTENTIAL FOR RE-DEVELOPMENT FOR THE NEXT 35 – 50 YEARS.

The selected sites for both the water sources and surface infrastructure must have a degree of guarantee that accessibility with be maintained for the next 35 years. Areas of land that have existing protections to prevent future development were selected, including Reserve Land.

3.3 BORE DRILLING

Once suitable sites had been identified, the team conducted a programme of investigation bore drilling. Initially this involved conducting seismic surveys of the preferred sites to select areas of suitable fracturing to maximise the chances of finding a suitable water quantity. Following the analysis of the geophysical survey, drill sites were selected and investigation bores were drilled to a maximum depth of 100m into the fractured greywacke. They then underwent a two-stage test, beginning with an airlift test to confirm the presence of water, and then a 72-hour pump test was commissioned. All bores were drilled in accordance with NZS4411:2001 Environmental standard for drilling in soil and rock. In total the project drilled 15 investigation bores in Wellington City and in Porirua. Nine of which were deemed successful, i.e. capable of pumping at a sustained 1 – 2L/s rate through a 72-hour pump test. Figure 4, below, shows an investigation bore being drilled.

Figure 4 – Investigation Bore

3.4 DESALINATION

The investigation into suitable water sources identified a shortfall in the most populous area of the region, Wellington CBD and central. Reservoir supplies provide some, but not all, emergency water and an alternative method of supply is required. The ‘search for water’ did not identify either suitable surface water or groundwater potential based on the criteria described in above. Existing sources such as groundwater bores around the SH1 expressway tunnels and small bores at Moore Wilsons were considered but not found to be suitable.

Given this part of the region’s proximity to the ocean, large scale desalination was considered as an option. Desalination technology is not prevalent in New Zealand and the programme team considered examples from across the Tasman. The costs to establish and maintain a desalination plant of sufficient output was considered not economically viable so a priority rental agreement with a leading supplier was investigated as an alternative.

WWL is establishing a Priority Rental Agreement for a desalination plant. A priority rental agreement is where upfront consideration is provided to secure priority supply of desalination plant(s), within a certain timeframe, following an emergency in Wellington.

The plant is intended to support Wellington City in the days and weeks following an earthquake, through the provision of drinking water. The main elements of the contract are:

- Supply and commissioning of a desalination plant or plants capable of producing a minimum of 1.2 million litres of treated water per day.

- Have the plant operating at full capacity within 20 days of receiving a request to supply the desalination plant(s) provided a suitable airport is operating and able to receive aircraft

- Supply trained operators, chemicals and other necessary parts and equipment to maintain continuous operation of the desalination plant(s) for up to 200 days.

4 DESIGN

4.1 DESIGN APPROACH

The design and delivery phases of the programme were broken into components; water stations for both bore sites and surface water sites, distribution bladders, and the desalination supply contract. The desalination supply contract is described in section 3.4 and is not concerned with the delivery of physical infrastructure. For the treatment stations and the bladders, a series of key design principals were established;

- **Low maintenance** – All elements of the network (bladders and treatment plants) must be low maintenance, in terms of exterior finish, process equipment, and storage requirements.

- **Operationally focused** – The network is designed to operate post a major earthquake. All elements of the network must be robust, capable of operating with minimal power, and with unskilled operators.

- **35-year design life** – The system is designed to fill the gap between the completion of Wellington Water's resilience upgrades, which are scheduled to take 30 years to fully complete. Consequently the system must be operational for 30 years.

- **Sensitive to the environment –** It is recognised that the stations will be situated in parks, reserves, and in close proximity to residences. The stations must be suitably sympathetic to their surroundings, through mitigation measures, cladding or other design solutions.

- **Flexible –** The network must be capable of operating in a variety of forms, and situations. The strategy was worked around a magnitude 7.5 earthquake, but the risk to Wellington is such that the event can be much larger and may affect different parts of the region to differing degrees. An element of mobility was a requirement of central government allowing the network, or parts thereof, to be re-deployed if the event requires it.

- **Resilient –** The network is designed to be operational following a major earthquake. The treatment stations and equipment must survive the event. They must be not at risk of any secondary hazards such as flooding, landslides, or tsunami.

In response to these conditions the programme team specified containerised treatment stations. By utilising a naturally resilient structure, which allowed the capacity to re-deploy the network if required, the above criteria could be met.

4.2 ENGAGEMENT

With the design parameters established and the search for water continuing, the programme team engaged with landowners, communities, and local authority officers, particularly in the Parks, Sports, and Recreation departments, to agree a suitable form and final siting of each treatment station.

Community groups and resident's associations were engaged with to explain the background behind the programme, the need, and the network that was being established. Realistic visualisations were produced to provide communities with a picture of what the finished station could look like. Figure 5, below, shows the visualisation for one of the surface water stations.

Figure 5 – Surface Water Station Visualisation

5 DELIVERY

To meet the challenging programme, a number of contractors and suppliers were required. The following were the contractors and suppliers involved:

- 2 bore drilling contractors
- 2 civils contractors
- 1 treatment contractor
- Multiple ancillaries' equipment suppliers

5.1 MULTIPLE CONTRACTORS

By engaging a large number of different contractors and suppliers, the delivery of the project was able to be accelerated, with a projected completion date of 30 September 2018, which would achieve a timeline of just 15 months from project initiation to construction being complete. The decision to engage multiple contractors and suppliers in lieu of one main contractor was made by the project governance team, as completing this project to an accelerated programme was the highest priority. It was considered that if one overall contractor had been engaged, the project programme would not have been achievable. Additionally, by separating the project into multiple sections, the overall project cost was able to be kept lower as each section involved a lower level of risk than if the project had been awarded as a whole.

5.2 CONSULTANCY INVOLVEMENT

As a result of engaging a large number of contractors and suppliers, the project was required to be very actively managed. Since no lead contractor was engaged, the project consultancy took on the role as overall project manager. This role involved coordinating the various contracts, contractors and suppliers, organising and supporting community engagement events and development, developing the operational planning strategy and managing the overall project delivery. By having a consultancy take such an active role in the project delivery, this increased the overall contract management cost to be a significant portion of the overall project cost. However, due to the lower contractor costs because multiple contractors were engaged, the overall project cost was still lower even with the increased consultancy cost.

5.3 CLIENT & ENDUSER INVOLVEMENT

As with any infrastructure project the involvement of the end-user was considered critical to the success of the work. Throughout the design and development representatives from WWL's Operations team was involved allowing the stations to be developed to be user-friendly, low maintenance and suitable for operators of low skill, as anticipated in an emergency to operate. WWL's input into the design, commissioning, and site testing has been invaluable to the design team throughout the project.

6 TREATMENT PROCESS

6.1 DESIGN APPROACH

The overall design approach for the treatment stations was that they were compact, mobile and simple to operate. In order to achieve this, it was decided that the treatment stations would be housed in shipping containers, as these are compact, robust with a long design life, and can be easily transported around the region. The treatment equipment housed inside the container had to meet the key objectives of; being simple to operate, robustness of construction, low reliance on chemicals (except for example for pre-oxidation, chlorine residual disinfection), and reliable start-up performance under low/no routine. Additionally, a 'low-tech' approach was taken to the design, as no PLC was incorporated and minimal electrical controls were used.

The general approach to the design of both the surface and ground water treatment stations was the same, however the specific equipment used for the different water sources varies. Both sources are treated to the intent of the Drinking Water Standards New Zealand 2005 (Revised 2008) (NZDWS) to ensure a safe supply of water is provided.

6.1.1 SURFACE WATER

A total of 13 surface water stations were designed and are in the process of being built. The design flow rate for the surface water stations is 6L/s, with three having a reduced flow rate of 2L/s. The basic installation at each surface water site includes a surface water source, an intake screen, an intake pump, a settlement tank, a surface water treatment process, a boost pump inside the container, treated water storage and distribution of the treated water to the community. Each of the surface water treatment containers is installed on its designated site with the capability of being moved to a new location should it be required, but none of the other equipment, such as intake pumps or screens, will be installed prior to an event.

The treatment process that was selected consists of a coarse screen filter, fine screen filter, pre-chlorine oxidation dosing, activated carbon filter, absolute cartridge filtration, UV disinfection and residual chlorine disinfection. This treatment process was selected based on its ease of use, low maintenance requirements, 'low-tech' approach, and ability to be stored without use for long periods of time. Figure 6, below, is a completed surface water container showing all of the equipment installed:

Figure 6 – Surface Water Treatment Station

6.1.2 GROUND WATER

A total of 9 ground water stations were designed and are in the process of being built. The design flow rate for the ground water stations is 1-2L/s as the production of each bore varies slightly. The basic installation at each bore water site includes a preinstalled submersible bore pump, wellhead works, water level sensor and transmitter, a ground water treatment container, treated water storage and distribution of the treated water to the community. Each of the ground water treatment containers are installed on their designated sites and have the capability to be moved should it be required. The bore pumps and wellhead works would have to be re-established at a new site should it be required.

The treatment process that was selected consists of a coarse screen filter, fine screen filter, absolute cartridge filtration, UV disinfection and residual chlorine disinfection. Provision has been made in each of the treatment containers to allow for the future installation of an additional treatment step should it be determined that this is required. Similar to the surface water stations, this treatment process was selected based on its ease of use, low maintenance requirements, 'low-tech' approach, and ability to be stored without use for long periods of time. Figure 7, below is a completed ground water container showing all of the equipment installed:

Figure 7 – Ground Water Treatment Station

6.2 DRINKING WATER STANDARDS

Both the surface and ground water treatment stations are designed to produce water that meets the intent of the NZDWS, however the water produced does not meet the full compliance requirements of the NZDWS. It was decided to not use online monitoring of the treatment stations as this added a high degree of complexity to the design and operation of the water stations, and they are only intended for emergency use. To ensure the intent of the NZDWS are met, the process design includes 5 log reduction with the absolute cartridge filter and UV disinfection. Additionally, handheld sampling instruments are included in each treatment station as well as multiple sample points, therefore it is still possible to verify the water quality being produced while the plants are operating.

6.3 DESIGN AND CONSTRUCTION IMPLEMENTATION

The design implementation was undertaken in three phases; pilot trial, site acceptance testing, and treatment station and downstream distribution set up.

6.3.1 PILOT TRIAL

In order to prove the process design and build quality of the treatment stations, a pilot trial was completed for both a surface water and groundwater station.

The surface water pilot trial was undertaken at a site that was capable of producing 6L/s, and where the site layout could remain compact as the water source was close to the water station location. The purpose of the surface water pilot trial was to demonstrate the efficiency and operational performance of the treatment station, and had the following specific objectives:

- Demonstrate the surface water station capability to produce a flow of up to 6L/s
- Demonstrate the surface water station performance to produce water that meets the quality requirements of the NZDWS
- Demonstrate ease of maintenance and operation of the surface water station
- Demonstrate the surface water station build quality.

The pilot trial was run for four weeks under various conditions (i.e. heavy rain and dry weather) and ultimately the treatment station was proven to successfully treat the water using the basic set up. A final outlet treated water sample was taken and laboratory quality testing showed that the water quality met the intent of the NZDWS.

During the pilot trial, the largest issue encountered was excessive sediment being introduced in to the system. To combat this, the use of a 2.5mm intake screen and inlet settling tank were introduced to the system which removed a large portion of the sediment that had been entering the treatment system. Additionally, a variety of coarse and fine filter sizes were used to optimise each stage of the process to suit the specific water conditions.

The original disk filter size of 55 microns was too small, therefore this was replaced with a 130 micron filter which greatly improved the process performance. The original bag filter size of 10 microns proved to be too large as the downstream cartridge filter was blinding up too quickly. This was replaced with a 5 micron bag filter which also greatly improved the process performance.

The bore water pilot trial was undertaken at a site that was capable of a sustainable flow rate of 1L/s based on the bore report that was developed during the investigation stage of the project. Similar to the surface water pilot trial, the purpose of the groundwater pilot trial was also to demonstrate the efficiency and operational performance of the treatment station, and had the following specific objectives:

- Demonstrate the bore water station capability to produce a sustained flow rate of 1L/s
- Demonstrate the ability of the bore pump control system to interface with the bore pump and level sensor; specifically, the control system should automatically shut off the pump under a low level scenario
- Demonstrate the surface water station performance to produce water that meets the quality requirements of the NZDWS
- Demonstrate ease of maintenance and operation of the surface water station
- Demonstrate the surface water station build quality

The pilot trial is currently in progress, but it is anticipated that the above goals will successfully be met.

6.3.2 SITE ACCEPTANCE TESTING (SAT)

The SAT process for the surface and ground water stations were different due to the different requirements of the stations. For the surface water stations, each of the stations underwent SAT at the same location before being delivered to its designated site. For the bore water stations, each of the stations was required to undergo SAT at its designated site since the bore pump and headworks were required for SAT.

SAT of the surface water stations consisted of pressure testing the piping and valves, verifying the UV unit are functional, backwashing the carbon filters, testing of the installed boost pump, and chlorine dosing pumps and associated speed dials. After this process was complete it was determined that the treatment stations were operational once they arrive at their designated sites.

SAT of the ground water stations consisted of pressure testing the piping and valves, verifying the UV unit is functional, verifying the well level sensor is programmed and reading accurately, verifying the pump speed dial is set up properly with the bore pump VSD, and testing the chlorine dosing pump and associated speed dial. After this process was complete it was determined that the treatment stations were operational since they were already at their designated sites.

6.3.3 DISTRIBUTION SET UP

The main purpose of the treatment stations is to produce potable water that can then be distributed to downstream users. After concluding the treatment stations were working from a process perspective, they still needed to be tested from a distribution perspective. The downstream distribution consists of one or two 20,000L treated water storage bladders (depending on the site) which is then used to fill 1,000L and/or 5,000L transportable bladders. These bladders are then used at community distribution points to fill 5,000L drum bladders which provide water to the communities via tap stands. Figures 8, 9 and 10, below, are a 20,000L treated water storage bladder, a 1,000L transportable bladder and a 5,000L drum bladder being used:

Figure 8 – Filled 20,000L Treated Water Storage Bladder

Figure 9 – Filled 1,000L Transportable Bladder

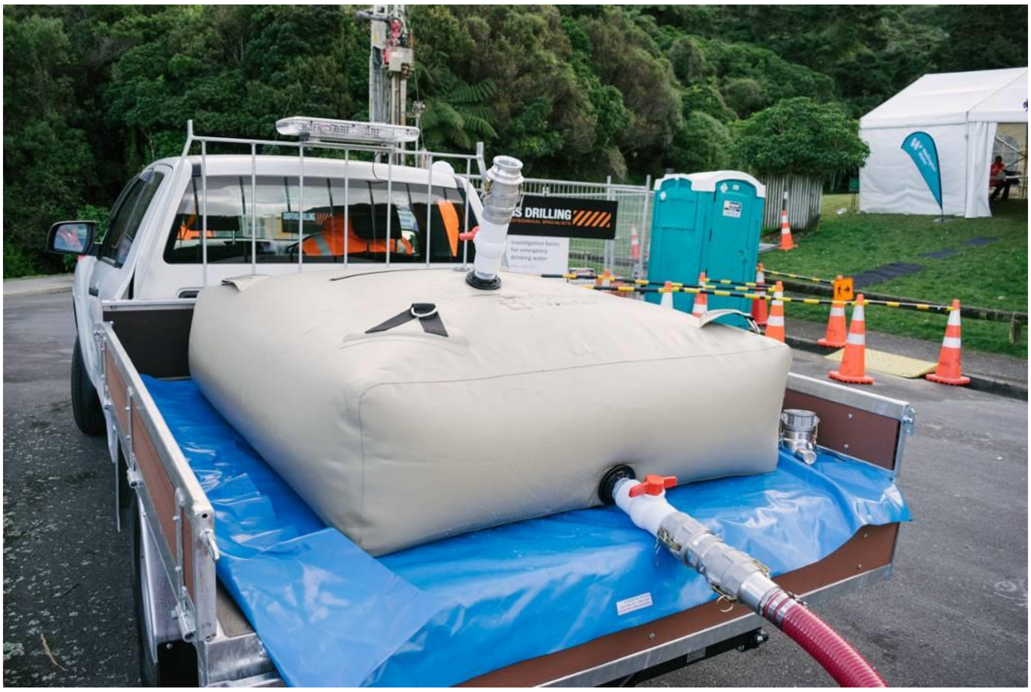


Figure 10 – Filled 5,000L Drum Bladder

Each site required its own unique operational layout that took in to account specific site geography and terrain, and the overall operational plan (i.e. hose connections and routes, bladder locations and filling points). The treatment station set up consisted of ensuring the treatment stations were capable of filling the 20,000L bladders without any additional pumping assistance (i.e. the outlet pressure from the treatment station is required to be sufficient to fill a 20,000L bladder). Depending on the geography of the treatment station, some require a transfer pump to move the water from the 20,000L storage bladder to the transportable bladders. The treatment station is required to power this transfer pump whilst the other equipment inside the station is also operating.

6.4 SITE SPECIFIC TESTING (SST)

Currently, each water station has undergone or is undergoing SST for proof of performance. This determines that the treatment process at each site is performing as required, since the inlet water quality varies. It also trials the non-treatment equipment such as intake pumps and settlement bladders. The SST is additional to the SAT that the contractor is required to complete for each water station.

The objectives for the surface water stations SST are to demonstrate the following at each site:

- The ability of the intake screen at each site to minimise the amount of sediment drawn in to the settlement tank
- The ability of the settlement tank to settle out any sediment or solids that do enter the tank

- The ability of the surface intake pump to provide the required flow rate at each site
- Appropriate disk and bag filter sizes are available to optimise the performance at each site
- Verify acceptable chlorine levels at the outlet, with both the pre-chlorine and disinfection chlorine dosing pumps operating
- The treated outlet water meets the quality requirements of the NZDWS.

The objectives for the ground water stations SST are to demonstrate the following at each site:

- Verifying the low-level switch automatically shuts off the bore pump under a low-level scenario – the bore pumps have to be run at a higher speed to force this scenario. In order to mitigate risk to the pumps, the level is closely monitored and the pump is manually shut off if it does not automatically switch off.
- Verifying the bore pump cannot restart until the set minimum water level is reached. A low-level set point is programmed into each level sensor which should inhibit the restart of the pump until that level is reached.
- Verifying the design flow rate of each bore can be achieved (i.e. design flow rate does not trigger a low-level)
- Appropriate disk and bag filter sizes are available to optimise the performance at each site
- The treated outlet water meets the quality requirements of the NZDWS.

During the SST for both the surface and ground water stations, the lessons learned from pilot trials are being implemented. The most significant operational lesson learned is around the combination of disk and filter bag sizes, and the need to optimise this combination so the filters do not blind up too quickly. Disk filters were made available at each site in 55 micron, 130 micron and 200 micron sizes. Bag filters were made available in 5 micron and 10 micron sizes.

7 CONCLUSIONS

The Community Infrastructure Resilience Project in on track to meet the goal of providing 20L of water per person per day within 1000m of their residence for the entire Wellington region. This was accomplished by using an innovative strategy when approaching the water distribution network, and focusing on realistic technology that could be easily implemented around the region.

There are many other regions in the world that are prone to natural disasters which can disrupt the potable water network for some time. This type of holistic resilience strategy which incorporates the local communities and regionally available water sources could be implemented in other regions of New Zealand or across the globe.

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