Karehana Bay – WaStop

Customer and stakeholder implications and benefits

The residents of Karehana Park catchment have concerns with the WaStop (stormwater outlet valve) hydraulic performance and are concerned that flooding is worsened with the WaStop acting a flow restrictor at the twin 900 mm diameter stormwater outlet pipes from Karehana Park catchment. The functioning of the WaStop is well demonstrated in the YouTube video link attached here. https://youtu.be/GJ02xL-ZOh4.

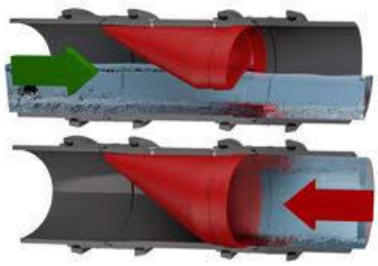
In addition, the residents are also concerned with the configuration of the stormwater inlets at Karehana Park (near 22 Airlie Road) and at the intersection of Cluny and Reserve Road (near 22 Cluny Road) which are fitted with screens and can become partially blocked with debris resulting in increased flooding and flood depth.

Background

WaStops

There are two WaStops fitted to the double barrel 900mm diameter concrete pipes at Karehana Park catchment stormwater outlet. The WaStops are bolted to the host pipe and cannot be easily removed or hoisted during flood events. The stormwater outlets along Plimmerton Beach have considerable beach sand and gravel movement which results in the blockage of the stormwater outlet pipes.

The advantages and disadvantages of the various outlet types in a coastal environment is summarised in the table below which has been shared with the Plimmerton Flood Action Group.

Outlet Options	Pros	Cons
WaStop (currently installed) 	Stops debris and sand from blocking up the pipe. Being inside the pipe it has some protection from waves.	Can become blocked by sand on the beach side. Requires additional water 'head' (pressure) to open Obstructs fish passage. Can accumulate sediment and debris in the pipe upstream of the WaStop which flushes in larger storms.

Flap Valve 	Similar to WaStops above	Vulnerable to being blocked shut or open and not functioning when needed. Generally, no longer used in stormwater networks. Requires additional water 'head' (pressure) to open Obstructs fish passage.
Duck Bill (Tide-Flex) 	Similar to WaStops but with improved self-cleansing of sand build up.	Can still suffer from sand blockage. Prone to damage and deterioration when exposed to the open coast. Requires additional water 'head' (pressure) to open. Obstructs fish passage.
Pipe Extension 	Removes the need for a valve to prevent debris and sand blockage.	Unsightly Difficult to consent Prone to wave damage

Removal of Valve	No restriction on pipe flow- as long as pipe is clear of sand and debris.	Pipe becomes easily blocked with sand and debris. Cost to clean the pipe would be $10k-$20k each time. This would need to be done regularly to reduce the risk of blockage during a flood and will be difficult to ensure that the pipe is clear immediately prior to a storm event.
Alternative Outfalls - Will be investigated as part of longer-term options.		

The accumulation of sand inside the WaStop as shown in the photo below requires additional head (hydraulic pressure, higher water levels in Karehana Park) to open the valve.

If the WaStop is removed, then sand is expected to migrate upstream into the pipe and settle to a considerable distance along the pipe due to its low gradient and tide levels. The outlet pipes are completely submerged in high tide. The accumulated sand in the pipe will impede flood flows and can result in higher flood levels in Karehana Park during storm events. The impact of removing the wastop and allowing the sand to buildup in the stormwater main is not fully understood. It is expected that sand will be mobilised with storm flows and would be scoured rapidly but the pipe capacity would be initially affected due to loss of flow area. The scouring of sand will also depend on how well it binds and becomes

interlocked with silt and any gravel from the catchment and the coastline. This has been shown to be a significant problem at another outlet at Beach Road in Plimmerton and a high-level outlet with flapgate has been installed to improve its efficiency.

Ian McAfee from Operations Team has summarised his experience of maintenance undertaken on the stormwater pipeline before WaStop installation between 1990 and early 2000. No previous documented evidence and data was available for this report. He stated:

(1) *"Maintenance of the pipeline included the use of fire hoses to blast sand, rocks and seaweed from inside the pipe at least 4 times a year.*
(2) *If we remove the Wa-Stops we will need to flush the pipeline weekly due to high tides and sand build up, the sand reaches the intake at Karehana reserve. Just an example the Beach Road Wa-stop at Plimmerton had been removed, and until we had a replacement fitted, we were flushing at least twice a week.*
(3) *Flows were restricted from the pipeline due to build up in pipeline causing flooding issues in Karehana Park.*

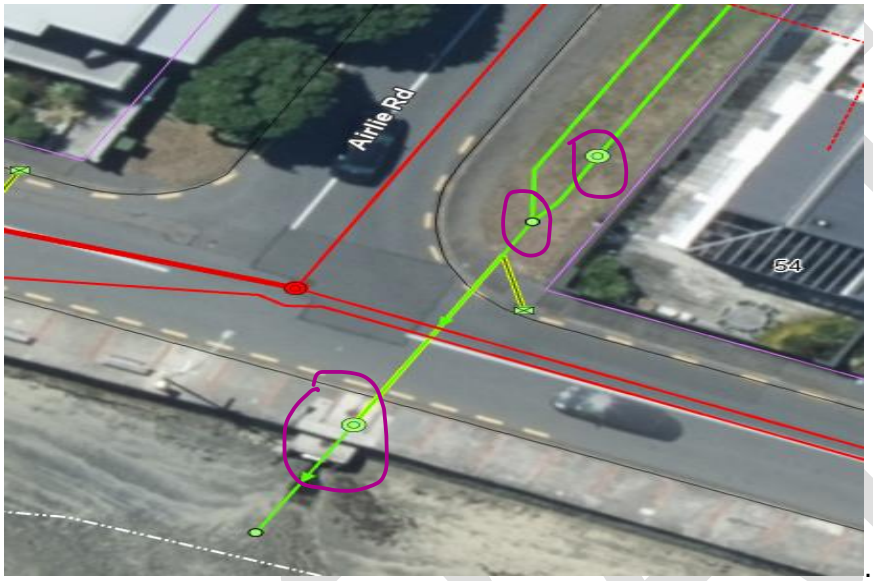
From an operational perspective I would not recommend the removal of the Wa-stops due to maintenance costs. "

The operations team has also advised that the cost of cleaning the pipeline can be in order of $50,000 for each cleaning round due to confined space entry requirements and time and equipment needed to flush the main.

Based on the information gathered to date and advantages and disadvantages of a WaStop it is recommended that Wellington Water can consider the two options outlined below and endorses a preferred option:

Option 1 – Remove the Wastops and monitor sand buildup in the main

This option will involve a short duration trial of removing the Wastop(s) (either one or both) and monitor the sand levels and its extent in the stormwater main. This will involve measuring the sand depths at several key locations along the stormwater main including the outlet, manhole in the footpath along Sunset Parade, at bifurcation point and the manhole along 1500mm diameter main in Airlie Road opposite 54 Sunset Parade (refer to network plan below for areas of monitoring).



If monitoring shows large quantities of sand buildup along the stormwater main over very short timeframe and would result in significant loss of capacity, then the WaStops can be quickly reinstated after cleaning the pipes. The data collected from this trial will inform the risk associated with sand movement into the stormwater main and would guide any modifications to the existing outlet and/or design of any new stormwater outlets.

The cost of this monitoring and associated cleaning of the main can be in excess of $50,000. There is no available operational budget for this trial.

Option 2 – Do not remove the Wastops

This option has merit based on past operational experience and high cost of cleaning the main which can be conveyed to the Karehana catchment residents as the basis for not undertaking the trial removal and sand buildup monitoring. This option does not require additional operational budget approvals. The weak point of this option is that there is lack of site-specific measured data to support the expected sand buildup in the main at this location.

Intake Screens

There are a few stormwater intake screens across the Karehana catchment with the primary purpose of arresting any debris and keeping the stormwater mains clear of blockage and to maintain its capacity. Intake screens also have a role in safety to prevent human entry into pipes.

In the Karehana catchment the geology (loose rocks and highly erodible soils) and vegetation cover (trees) plays an important role as it generates a large amount of gravel, rock and plant debris movement from the upper catchment. This results in significant sediment and rock accumulation in the waterways and debris at stormwater intakes.

Wellington Water maintains the intakes, outlets and pipes for the stormwater system. It does not maintain the upstream channels where it passes through reserve land and private property. In the Karehana catchment the stream passes through private properties. Although some residents have blamed lack of maintenance as the cause of this event, the sheer volume of debris laden water means that no amount of prior maintenance would have prevented blockage of the intake grill.

Wellington Water operations team screen maintenance actions include regular inspections and clearing and checks prior to intense storm forecasts.



The design of these intake screens means that manual cleaning of these intakes during an event is a safety risk and unadvisable. Our hydraulic model suggests that for 29 November 2020 high intensity rainfall over a very short period there was nearly 8m3/s coming into the Karehana basin, with the capability of the network to discharge only 4.8m3/s. Some residents have tried to clean the screens during flood events without Wellington Water permission and/or appropriate equipment and training and therefore are at potential health and safety risk.

The issues that require further attention are:

1. Screen design – the existing design is hydraulically inefficient and can result in debris blocking the pipe entry resulting in increased flooding. Key factors to consider in design are bar type

(rectangular is preferred), bar spacing and angle. Horizontal cross bars should be minimized to avoid debris accumulation.

2. Intake structure platform for cleaning can present a health and safety risk to those clearing the screens especially during flood event. Consider the platform type and its dimensions and any fall prevention measures.
3. There is no clear signage to prevent the public from entering and undertaking high risk debris and rock clearance works during flood events at the intakes. Consider appropriate signage requirements to keep untrained and unauthorized persons from undertaking debris clearing works.

It is recommended that the design of these screens is reviewed and where appropriate they are upgraded to meet the current standards and practices. The Karehana catchment stormwater improvements project presents the opportunity to incorporate this work in the design of long-term solutions and is included in the project brief.

Recommendation

That the committee considers the two options (Remove the Wastops and monitor sand buildup in the main or do not remove the Wastops but rely on previous operational experience) outlined in this report and endorse a preferred option.

That the operational efficiency of the WaStop is considered to improve the outlet design as part of the catchment stormwater improvement project.

That the Karehana catchment stormwater intakes screen design is reviewed as part of the catchment stormwater improvement project to ensure they meet current day standards and safety requirements.

Tips for authors and reviewers

- It is recommended that this paper be no more than 4 pages in length.
- Aim to discuss the key issues in context of the 'bigger picture' and where possible, keep out of the detail of the technical issue. Technical information should be attached for reference only.
- Your report should tell a story of the problem and/or the opportunity, the service goal it links to, and the wider benefits (cost, community, other projects etc.)
- Consider how GIS maps, photos and/or other graphics could be used to support your paper's message

Checklist for authors and reviewers

Author/reviewer

- Primary and secondary service goals identified and how activity links to this shown ☒ ☐
- Problem/opportunity identified ☒ ☐

- Current and future performance measure or level of service identified in relation to the primary service goal ☒ ☐
- All options considered are identified including the consequence of doing nothing ☒ ☐
- Risks have been identified and addressed, including consequential risks of doing nothing ☒ ☐
- Funding source identified, whole of life (capex, opex, 3rd party) costs identified ☒ ☐
- Legal implications identified ☐ ☐
- Consultees identified including Service Planning, Chief Advisors, budget holder (for funding approval) and any affected team ☒ ☐
- Customer and stakeholder implications/benefits identified ☒ ☐
- Communications plan required and provided ☒ ☐
- H&S implications and mitigations identified ☒ ☐
- Ensure the recommendations tie back into what has been discussed in the main body of the paper ☒ ☐
- Ensure relevant people are invited to the 3WDMC to support paper ☒ ☐

RECORD OF FLOOD EVENT

Date	Time arrive	Time leave	People on site	Signature	Comments
