



## Memorandum

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Office	Whangarei
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Subject	Mangawhai Wastewater Renewals Options Assessment

## 1 Introduction

Kaipara District Council (KDC) engaged WSP to develop a hydraulic model for the Mangawhai Wastewater Network. The development of the model consists of 3 phases:

- Phase 1 - Network model build, which includes gathering and assembling all network information, including pipes, manholes, pumping stations etc. to build the layout of the system. This phase has now been completed.
- Phase 2 - Calibration of the model, which includes collection of network flow data and replicating these flows in the model for both dry and wet weather flow conditions. The flow monitoring programme is expected to be completed over the next 3 months, following which model calibration will commence.
- Phase 3 - Developing growth scenarios based on the Mangawhai Spatial Planning and identification of network upgrade priorities. This phase will be undertaken only after completion of Phase 2.

The calibration of the model (Phase 2) is expected to be completed no earlier than May 2020, due to the ongoing flow monitoring program. Additional work than will then be required (Phase 3) to assess future infrastructure requirements to service the rapidly developing catchment area.

KDC has funding allocated in this financial year (2020-2021) to undertake network renewal works.

A meeting was held on the 24 November 2020 between KDC, WSP and Ventia to discuss on potential renewal options based on the current information of the network. Four options were identified as potential renewal intervention as outlined below.

This memorandum presents a description and evaluation of the four network renewal options that have been developed with KDC staff and Ventia (network maintenance contractor).

Following acceptance of the preferred option, this will be assessed using the un-calibrated system hydraulic model, with consideration of anticipated flows from future development.

## 2 Option Descriptions

The following have been identified as possible network renewals:

- 1 Upgrade of the existing PS-VA rising main
- 2 Connect rising main from PS-VC into existing rising main from PS-VA
- 3 Construct PS-VE (new pumping station and rising main)
- 4 Construct PS-L (new pumping station and rising main)

The following sections provide details of the five network renewal options.

### 2.1 Upgrade PS-VA Rising Main

The current PS-VA rising main conveys all wastewater generated in the Mangawhai Village catchment directly to PS-OF. Under the current configuration there are three different sized sections of pipe that make up this rising main, including a DN 150 pipe from PS-VC, DN 200 from Sunlea Lane to approximately 150 m north of Hills View Lane and DN 250 through to the outlet to PS-OF (see Figure 1 below).

The PS-VA was fully reconstructed in 2019 due to internal corrosion (H<sub>2</sub>S) of the wet well. The new wet well was designed to host the existing pumps (pre -installation pumps) and to cater for bigger pumps in the future. At the time of the design it was identified the 150mm outlet to be the limiting factor to pump more flow to the PS-OF.

The proposed network renewal is to upgrade the whole or part of the upstream sections of rising main, such that additional flow can be conveyed to the PS-OF when new pumps are installed at the PS-VA .



Figure 1: Layout of existing PS VA Rising Main

The existing design flowrate for PS-VA is 20 L/s, with a planned capacity upgrade to 40 L/s under future flows (WSP 2018). Table 2-1 presents calculated rising main peak velocities under existing and ultimate flow conditions for all existing pipe sizes. Typically rising mains are designed to maintain a velocity between 0.6 and 1.8 m/s.

Table 2-1: Rising Main Velocities for existing pipe sizes

Pipe Section	Internal Diameter (mm)	Velocity at Existing Flow (m/s)	Velocity at Ultimate Flow (m/s)	Typical Design Velocity Value (m/s)
DN 150	143	1.4	2.4	06-1.8
DN 200	203	0.7	1.2	06-1.8
DN 250	253	0.4	0.8	06-1.8

Table 2-1 indicates that for the ultimate flow the rising main velocity exceeds typical design values, however it is within the range at the current pump rate. Furthermore, in the PS-VA Upgrade Design Report (Ventia 2017), the existing average wastewater flow is stated as 317 m<sup>3</sup>/day, which results in an existing rising main retention time of 6.2 hours with the upsized configuration having a retention time of 9.1 hours. A rising main retention time of in excess of 8 hours may lead to odour issues requiring additional controls.

Rating information provided by KDC indicates that are currently 430 properties connected to the scheme in Mangawhai Village. Growth mapping provided by KDC indicates there are approximately 1500 potential additional connections in the Village catchment that are in the contributing area of PS-VA. This value is significantly higher than the 855 future properties indicated in the PS-VA Upgrade Design Report (Ventia 2017). More connected properties will decrease the rising main retention times calculated above.

## 2.2 Connect PS-VC Rising Main into Existing PS-VA Rising Main

Under the current network configuration, the PS-VC rising main outlets to PS-VA. This was intended as an in temporary connection, with the rising main from PS-VC ultimately planned to connect into the existing PS-VA rising main at the intersection of Old Waipu Road and Te Araroa Trail. The proposed rising main configuration is presented on Figure 2 below.

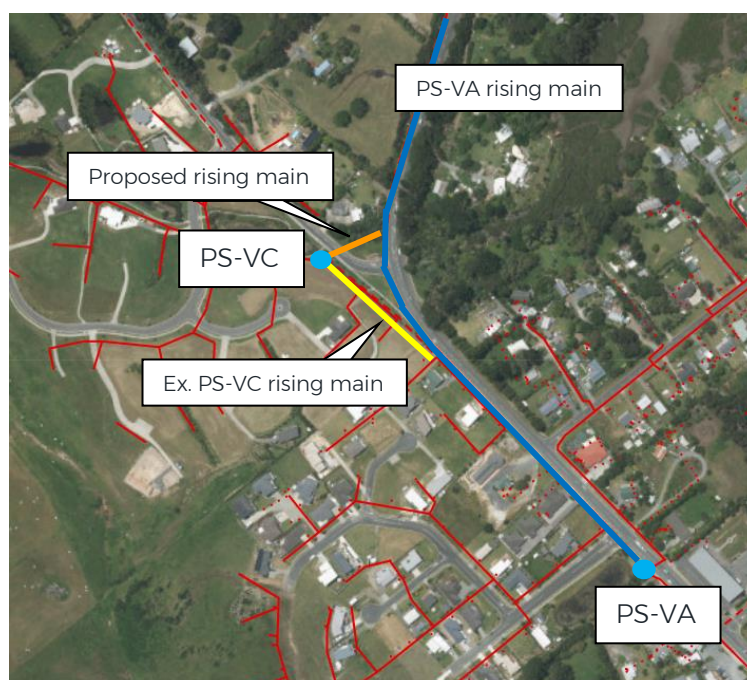


Figure 2: Location of Proposed PS-VA and SP-VC Rising Main Connection

Growth mapping indicates there are approximately 160 potential additional connections in the Mangawhai Village catchment that will contribute to PS-VC (assuming only development north of Wharuka Glade and west of Te Araroa Trail is within the catchment area).

### 2.3 Construct New Pumping Station (PS-VE)

The proposed new PS-VE pumping station will service growth in the western portion of Mangawhai Village (see Figure 3 below). Growth mapping indicates there are approximately 160 potential connections that could contribute to this pumping station, however timing of this development has not been confirmed.

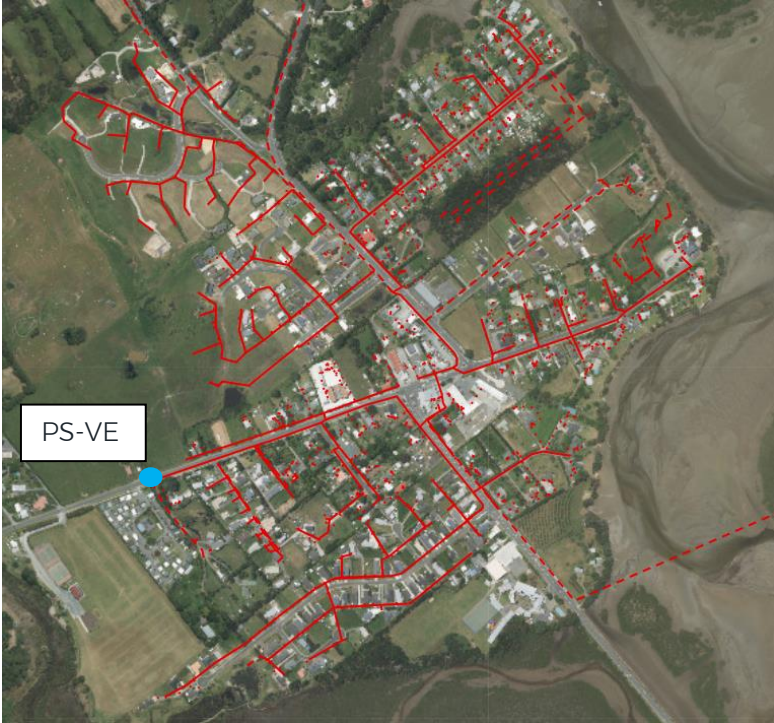


Figure 3: PS-VE Location

### 2.4 Construct New Pumping Station (PS-L)

The proposed new PS-VL pumping station will service growth in the north of Mangawhai Heads (see Figure 4 below). The intention for this pumping station is for interim flows to be directed to PS-K and pumped on to PS-OF. When the catchment area becomes fully developed the pumping station will be upgraded and a new rising main constructed discharging directly to PS-OF (bypassing PS-K).

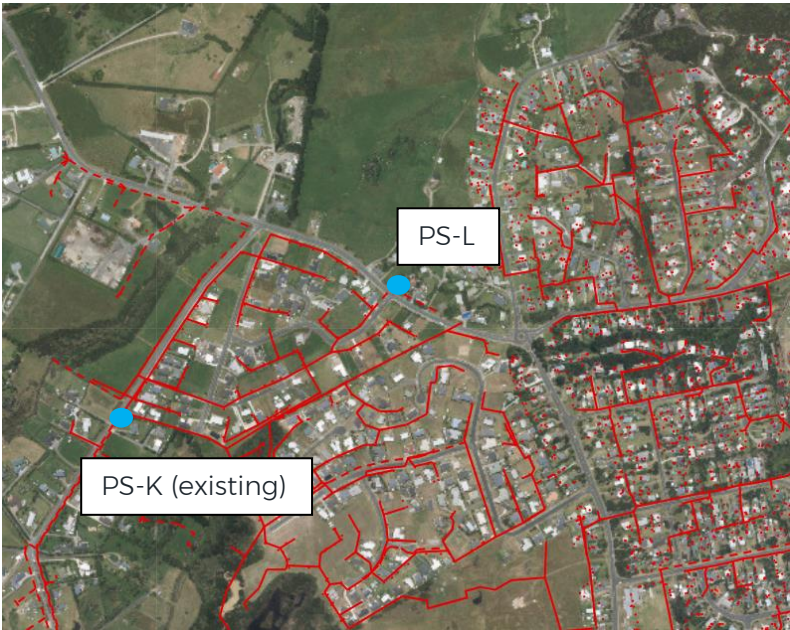


Figure 4: PS-L Location

Growth mapping indicates that there are approximately 580 potential connections that could contribute to this pumping station, however timing of this development has not been confirmed.

### 3 Evaluation Criteria

Each renewal option was evaluated against the below categories.

- **Upgrade urgency:** Timeframe that upgrade will be required to achieve level of service/network efficiency.
- **Tie in with existing network:** Implications of the proposed project elsewhere in the scheme, with consideration given to if the upgrade will trigger the need for improvements elsewhere in the network.
- **Future Proof:** Confidence that the proposed project will achieve future level of service requirements (as this assessment will be completed with an uncalibrated network model).
- **Programme:** Timeframes for project to be constructed (i.e. complexity).

### 4 Option Evaluation

Based on the information presented in Section 2, a multi-criteria assessment was completed to identify the most appropriate network upgrade for the current financial year. Table 4-1 presents the results of this assessment, with commentary on each of the scores contained in Attachment A.

Table 4-1: Multi-Criteria Assessment of Network Renewal Options

Option No.	Option	Upgrade Urgency	Tie in with Existing Network	Future Proof	Programme	Total	Rank
1	Upgrade PS-VA Rising Main	6	1	3	3	13	1
2	Combine PS-VA/ PS-VC Rising Mains	6	6	3	6	21	2
3	Construct PS-VE	9	3	3	9	24	3
4	Construct PS-L	9	6	3	9	27	4

Score	Description
1	Ideal
3	High
6	Medium
9	Low

### 5 Recommended Option

The options assessment detailed above has resulted in the upgrade of the PS-VA rising main (option 1) being selected as the preferred option. Design flow values from previous reporting indicate that the rising main is not currently undersized, but will require upgrade to service future flows. As part of developing this option, it is recommended that the timing and number of future properties be confirmed.

## 6 References

Trility. 2017. Mangawhai Community Wastewater Scheme PS-VA Upgrade.

WSP. 2018. Mangawhai Pump Station PS-VA Design



## Attachment A: Multi-Criteria Assessment Scoring Details

Option No.	Option	Upgrade Urgency	Tie in with Existing Network	Future Proof	Programme
1	Upgrade PS-VA Rising Main	<ul style="list-style-type: none"> <li>No known operational issues under existing network configuration.</li> <li>High velocity in rising main under ultimate pump rate.</li> <li>Existing changes in pipe size over the length of the rising main not ideal.</li> </ul>	<ul style="list-style-type: none"> <li>Pipe replacement, will tie in at existing start/ end points.</li> </ul>	<ul style="list-style-type: none"> <li>Pipe will be sized to accommodate all anticipated future flows from Mangawhai Village catchment.</li> </ul>	<ul style="list-style-type: none"> <li>Pipe upgrade following existing alignment, anticipated to be quick programme.</li> </ul>
2	Combine PS-VA/ PS-VC Rising Mains	<ul style="list-style-type: none"> <li>No known operational issues under existing network configuration, however part of long term servicing plan for Mangawhai Village.</li> <li>Will need to be re-assessed with consideration of new distribution within the Mangawhai Village catchment</li> </ul>	<ul style="list-style-type: none"> <li>Challenging to assess interaction of proposed rising main connection, recommend the calibrated network model used for this assessment when available.</li> </ul>	<ul style="list-style-type: none"> <li>Some uncurtaining surrounding distribution of development with the Mangawhai Village catchment.</li> </ul>	<ul style="list-style-type: none"> <li>Recommended that this assessment be completed when the calibrated network model is complete.</li> </ul>
3	Construct PS-VE	<ul style="list-style-type: none"> <li>Construction will be triggered by development within future catchment.</li> </ul>	<ul style="list-style-type: none"> <li>Final Mangawhai Village pumping station to be sized to accommodate future flows.</li> </ul>	<ul style="list-style-type: none"> <li>Pumping station and rising main will be sided to accommodate all future flows within the catchment</li> </ul>	<ul style="list-style-type: none"> <li>Time required for design of pumping station and rising main, plus assessment of options for tie in to existing network.</li> </ul>

				area (likely to be phased as development occurs).	
4	Construct PS-L	<ul style="list-style-type: none"> <li>• Construction will be triggered by development within future catchment.</li> </ul>	<ul style="list-style-type: none"> <li>• Uncertainty surrounding tie in to existing network. Flows could be directed to PS-K, or direct to PS-OF.</li> </ul>	<ul style="list-style-type: none"> <li>• Pumping station and rising main will be sided to accommodate all future flows within the catchment area (likely to be phased as development occurs).</li> </ul>	<ul style="list-style-type: none"> <li>• Time required for design of pumping station and rising main, plus assessment of options for tie in to existing network.</li> <li>• Recommended and assessment be completed to determine the appropriate tie in to the existing network.</li> </ul>