

## Memorandum

To	Eros Foschieri
Copy	Larey-Marie Mulder and Charlotte Mills
From	Mark de Lange
Office	Christchurch
Date	15 October 2021
File/Ref	1-14129.18
Subject	Mangawhai Thelma Road Pumping Station Level Data Review

## 1 Summary

The assessment detailed in this memorandum was completed to understand the ability of the existing pumps at Thelma Road pumping station (PS-OF) to convey peak flows. This assessment was completed by reviewing wet well level data from 15 December 2020 to 15 May 2021.

The data was assessed under various peak flow conditions, including peak summertime wastewater flows, and three rainfall events. Key conclusions of this assessment include:

- At no point during the assessment period were levels in the wet well recorded as being above the overflow to storage level.
- During peak summertime flows, inflows to the wet well regularly exceed capacity of the running pump, as is seen by a rise in wet well level. This is seen in particular during morning and evening peaks, however there is enough storage in the wet well to attenuate flows without causing any overflows or discharge to storage.
- For two of the rainfall events assessed, capacity of the running pump was exceeded, however again there was enough storage in the wet well to attenuate flows.

It is noted that the rainfall events used in this assessment are estimated to have a return period no greater than two years. This indicates that the peak flows conditions assessed may not represent a worst-case scenario that the pumps should be sized to.

## 2 Data Inputs

### 2.1 Wet Well Level Data

Wet well level data for PS-OF was provided for the period from 15 December 2020 to 15 May 2021 at one-minute increments. Figure 1 presents a plot of the complete dataset.

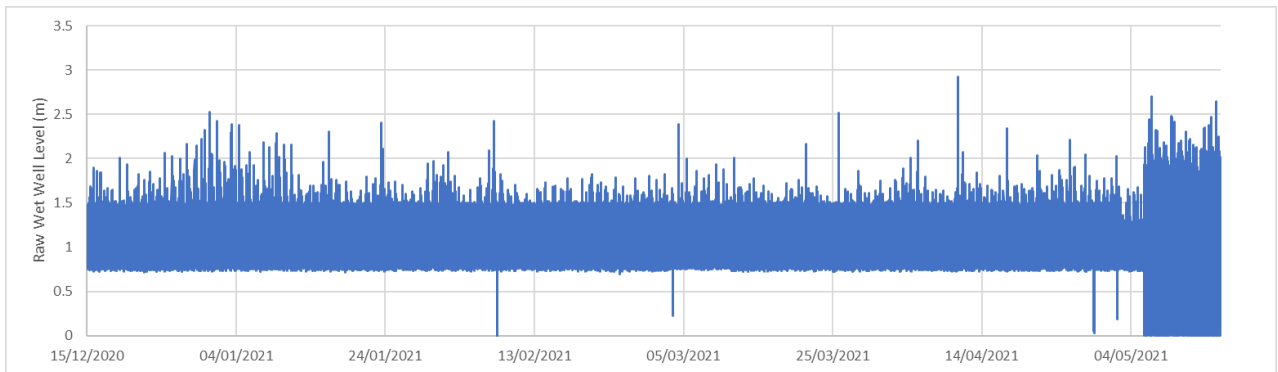


Figure 1: Provided wet well level data for PS-OF

From Figure 1 the following is noted:

- There are three distinct pump operating ranges in the data provided:
  - 15/01/2021 – 2/05/2021: Typical wet well levels range from 0.7 to 1.5 m, with regular spikes above this range.
  - 2/05/2021 – 5/05/2021: Typical wet well levels range from 0.7 to 1.25 m, with regular spikes above this range.
  - 5/05/2021 – 15/05/2021: Typical wet well levels range from 0 to 2 m, with regular spikes above this range.
- As the peak flow conditions assessed all fell within the 15/01/2021 to 2/05/2021 period, data from the two later flow periods (2/05/2021 onwards) was removed from the dataset.
- It appears level data has been recorded such that the lowest record in the dataset is 0. The dataset was shifted up such that typical maximum/ minimum levels match known pump operating levels.

## 2.2 Rainfall Data

Rainfall data used for this assessment was recorded at a temporary rainfall gauge installed at 182 Thelma Road North. Data from this site is available from 21 December 2020 to 3 May 2021, as depth at 5-minute increments.

## 3 PS-OF Operation

Our understanding of the current operation of PS-OF is as follows:

- Discharges to the PS-OF wet well include the PS-K rising main, PS-VA rising main and a DN 375 gravity line on Thelma Road (servicing a portion of Mangawhai Heads).
- There are two pumps installed that operate under a duty-standby configuration.
- Both pumps are Sulzer ABS XFP 80C-2011G, however the impeller of one pump has been modified resulting in a reduced flowrate.
- Drawdown testing of both pumps was completed on 23/10/2020. At full speed the pumps were determined to have flowrates of 65 and 30 L/s.
- The pump switch on level is 1.0 m above the wet well base and the, the pump switch off level is 0.2 m above the wet well base (reported during 2021 drawdown testing).
- Key wet well levels include:
  - RL 14.82: wet well lid
  - RL 13.53: overflow to storage (2x 3 m diameter storage tanks)
  - RL 9.27: wet well base
- Pump on/off data was not provided with level data. Without this data it was not possible to determine which of the pumps were operating during each of the flow periods assessed.

## 4 Analysis

Peak flow scenarios that were considered in this assessment are presented in Table 1 below. These include peak summertime flows (five consecutive days with the highest inflows recorded at the wastewater treatment plant), and three rainfall events.

Table 1: Summary of Peak Flow Assessment Periods

Period	Start Date/ Time	End Date/ Time	Total Rainfall Depth (mm)	Peak Intensity (mm/hr)	Event Duration (hrs)	Estimated Return Frequency
Peak Dry Weather	29/12/2020	3/01/2021	8.6	31.2	5 days	N/A
Wet Weather Event 1	07/01/2021 23:30	08/01/2021 12:15	16.6	16.8	12.7 hours	< 2 years
Wet Weather Event 2	14/02/2021 19:55	15/02/2021 14:20	31.8	7.2	18.4 hours	< 2 years
Wet Weather Event 3	09/04/2021 22:35	11/04/2021 05:40	61	26.4	31.1 hours	< 2 years

Figure 2 presents wet well level for the entire assessment period, while Figures 3 to 6 present wet well level data for the four assessment periods in Table 1.

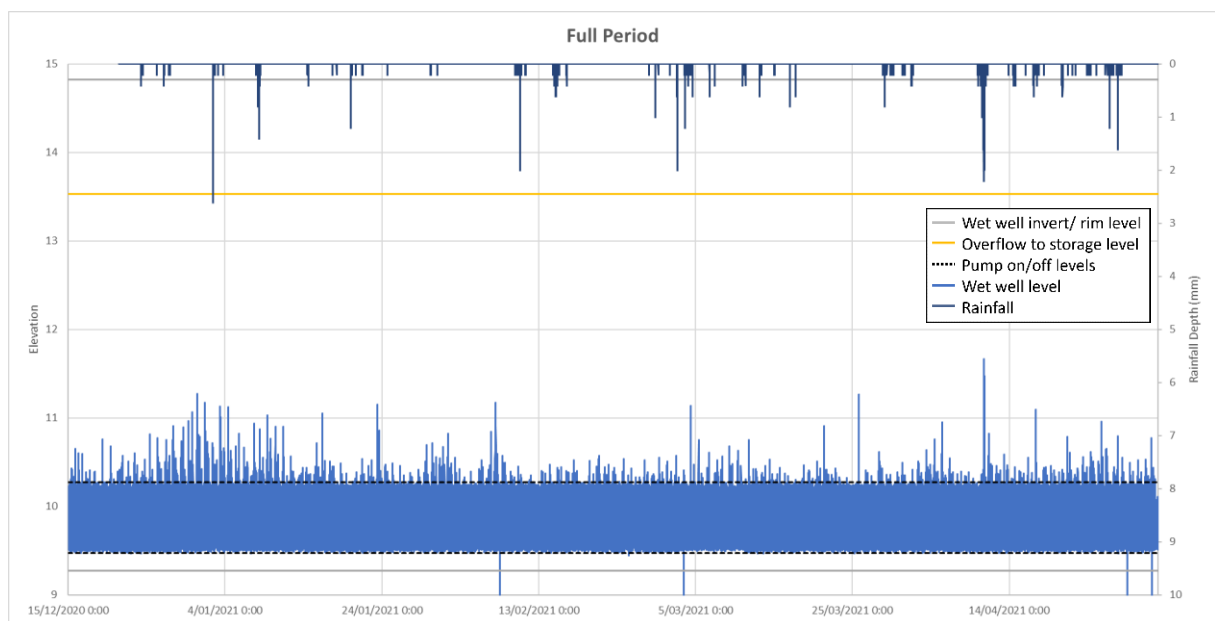


Figure 2: Corrected wet well level data for entire assessment period (15/01/2021 – 2/05/2021)

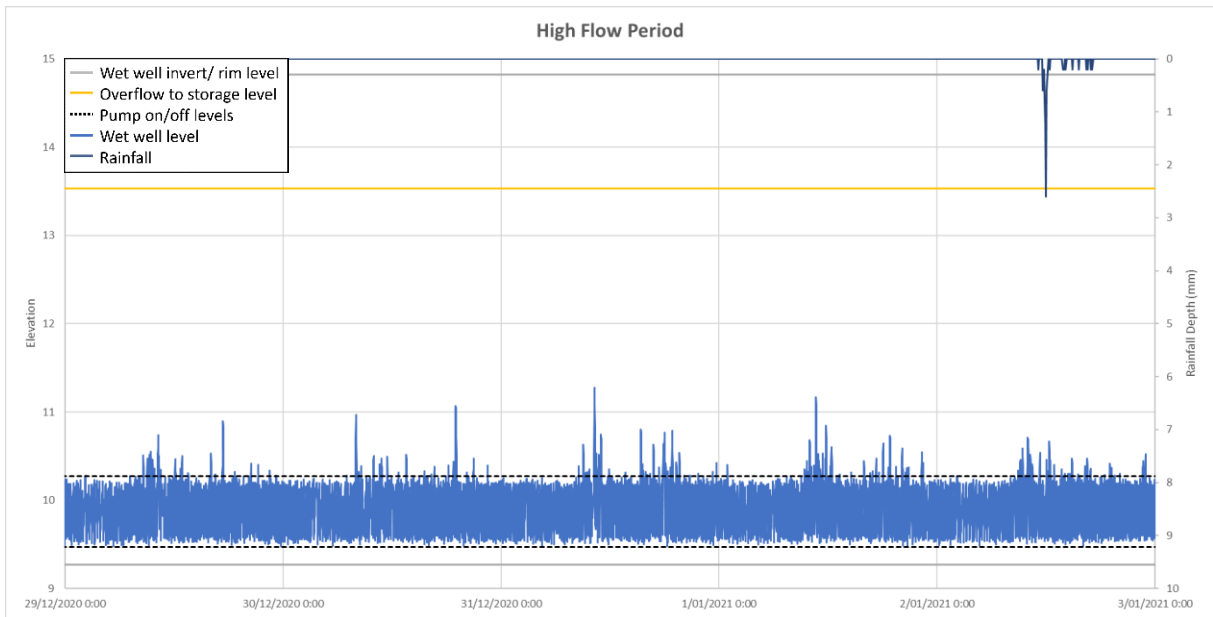


Figure 3: Corrected wet well level data for summer high flow period

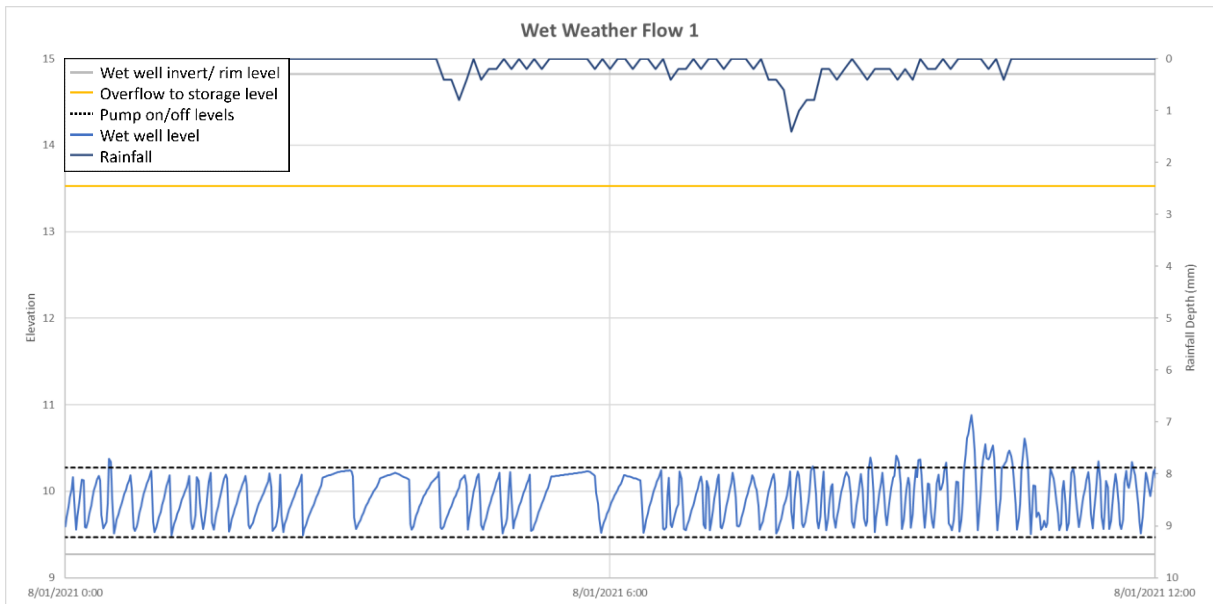


Figure 4: Corrected wet well level data for wet weather flow 1

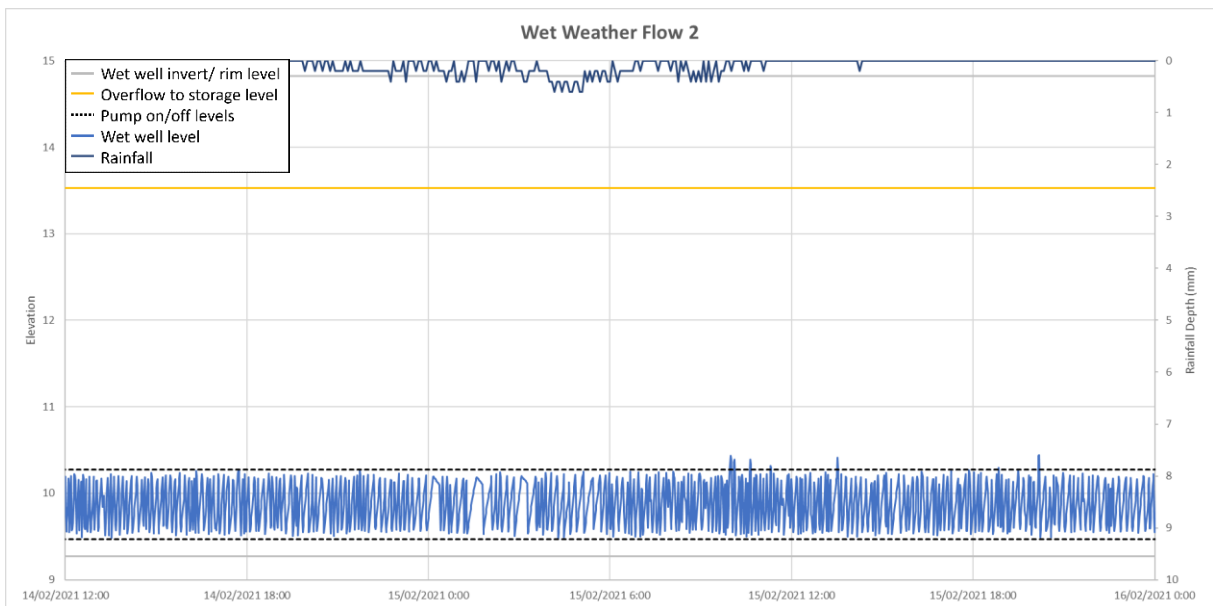


Figure 5: Corrected wet well level data for wet weather flow 2

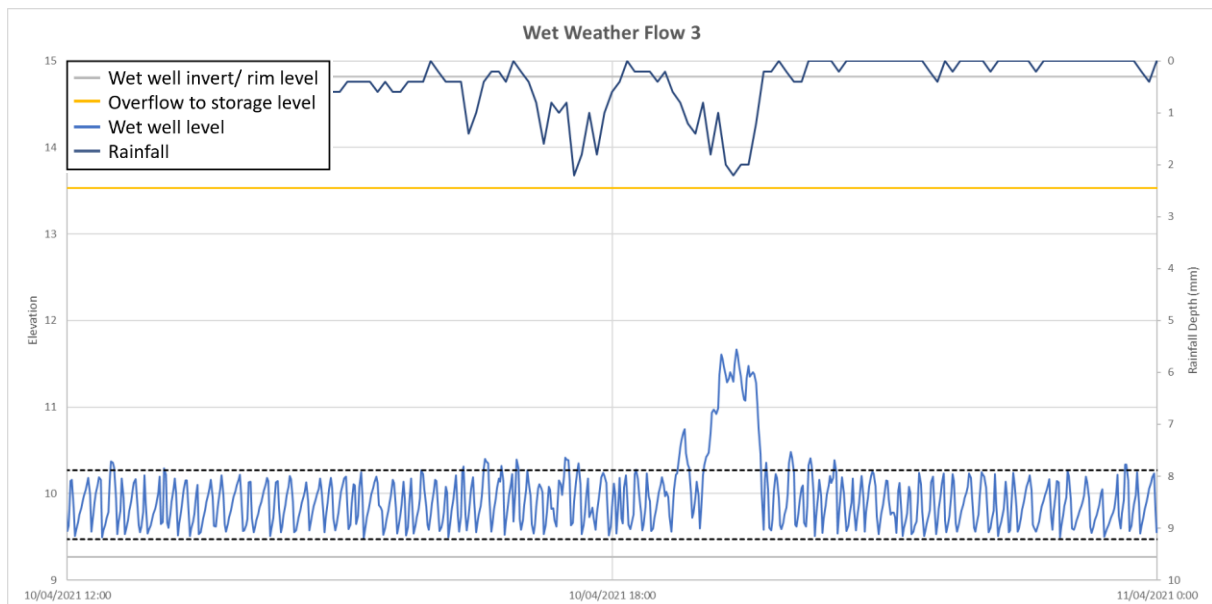


Figure 6: Corrected wet well level data for wet weather flow 3

Based on the above graphs the following is concluded:

- At no point during the assessment period were levels in the wet well recorded as being above the overflow to storage level.
- Figure 2 shows the capacity of the running pump is exceeded at PS-OF is regularly exceeded during peak summertime flows, particularly during morning and evening peaks. This is seen by the level in the wet well increasing beyond the pump on level.
- A wet weather flow response is seen for all rainfall events as is noted by an increase in the frequency of pump cycles. However, the capacity of the running pump is only exceeded for wet weather flow events 1 and 3 where the rainfall intensity and volume are greater.

It is noted that the rainfall events used in this assessment are estimated to have a return period no greater than two years. This indicates that the peak flows conditions assessed may not represent a worst-case scenario that the pumps should be sized to.