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Memorandum

Groundwater Monitoring Data – 14/12/2020 to 30/3/2021

Broome RRRP – Site D2

To:	Jeremy Macmath, Shire of Broome	
CC:		
From:	Gray Ralph, Talis Consultants	
Date:	7 April 2021	

The purpose of this Memo is to provide results of ongoing monitoring for groundwater levels (GWL) at the proposed Broome RRRP Site D2 located at the corner of McGuigan Road and Broome – Cape Leveque Road, Broome Western Australia.

1 Groundwater Monitoring Wells

To understand the depth to water (DTW) and groundwater level response to rainfall across Site D2, seven groundwater well clusters (GW1-7) which consisted of one deep well 'D' and one shallow well 'S' were installed at each location during November 2020 as part of the Phase 1 Hydrogeological Risk Assessment (see Talis, Site Investigation Report, February 2021). Groundwater monitoring is undertaken on a quarterly basis to confirm the baseline conditions. Groundwater levels for the 'D' wells, screened across the groundwater table, are monitored daily using pressure transducers. The 'S' wells targeted the Pindan Plain Soils above the water table to allow future assessment of the significance of any temporary (wet season) perching of groundwater.

2 Groundwater Monitoring Well Locations

The groundwater monitoring wells have been placed at strategic locations across the site with particular focus on the proposed landfill footprint. The location of the monitoring wells is shown in Figure 1 and survey data is presented in Table 2-1 showing the elevation of the monitoring well top of casing (ToC) and ground level in meters above Australian Height Datum (m AHD).

Figure 1: Groundwater Monitoring Well Locations

Table 2-1 Survey Data

Well ID	Northings (m)	Eastings (m)	Top of Casing (m AHD)	Ground level (m AHD)
Deep ('D') wells				
GW1-D	422970.088	8023909.123	26.266	25.637
GW2-D	422358.031	8023781.215	21.204	20.629
GW3-D	422799.796	8024690.327	30.956	30.228
GW4-D	423072.993	8024303.778	29.422	28.804
GW5-D	423186.016	8024807.778	34.814	34.205
GW6-D	423274.26	8025258.931	38.555	37.943
GW7-D	422342.91	8025403.053	35.859	35.242
Shallow ('S') wells				
GW1-S	422971.259	8023910.04	26.349	25.7
GW2-S	422360.473	8023783.051	21.33	20.604
GW3-S	422801.247	8024688.765	30.957	30.251
GW4-S	423070.194	8024303.302	29.386	28.743
GW5-S	423187.529	8024806.568	34.899	34.178

Well ID	Northings (m)	Eastings (m)	Top of Casing (m AHD)	Ground level (m AHD)
GW6-S	423275.737	8025259.882	38.573	37.978
GW7-S	422343.137	8025404.397	35.909	35.266

3 Rainfall

The rainfall recorded during the monitoring period and long-term average rainfall for Broome Airport (Bureau of Meteorology station No. 003003) is presented in Table 3-1. During the groundwater monitoring period (December 2020 to March 2021) the actual monthly rainfall for December 2020 was above average and January and February 2021 were below average.

Table 3-1: Monthly mean rainfall 1939 – 2021

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall (mm)	192	179	97.7	25.4	27.4	18.2	6.5	2.2	1.4	1.4	8.9	62.4
Actual (mm)	59.8	61.6	90	-	-	-	-	-	-	-	-	220

4 Depth to Water

The Depth to Water (DTW) recorded during the monitoring period is summarised in Table 4-1. The results indicate the minimum and maximum recorded DTW across the site was 16m bgl and 32.5 m bgl respectively.

All 'S' wells were dry indicating no evidence of groundwater perching in the Pindan Sand and are not discussed further.

Table 4-1 Depth to Water (m bgl)

Well ID	Max	Min	Average	Range
GW1-D	20.9	20.7	20.8	0.1
GW2-D	16.2	16.0	16.1	0.1
GW3-D	25.7	25.2	25.3	0.5
GW4-D	23.6	23.6	23.6	0.1
GW5-D	29.1	28.9	29.0	0.1
GW6-D	32.5	32.4	32.4	0.1
GW7-D	30.4	30.1	30.4	0.3

5 Groundwater Levels

The groundwater levels (GWL) recorded at the beginning and end of the monitoring period are summarised in Table 5-1. The GWLs recorded from the pressure transducers (in m AHD) are presented

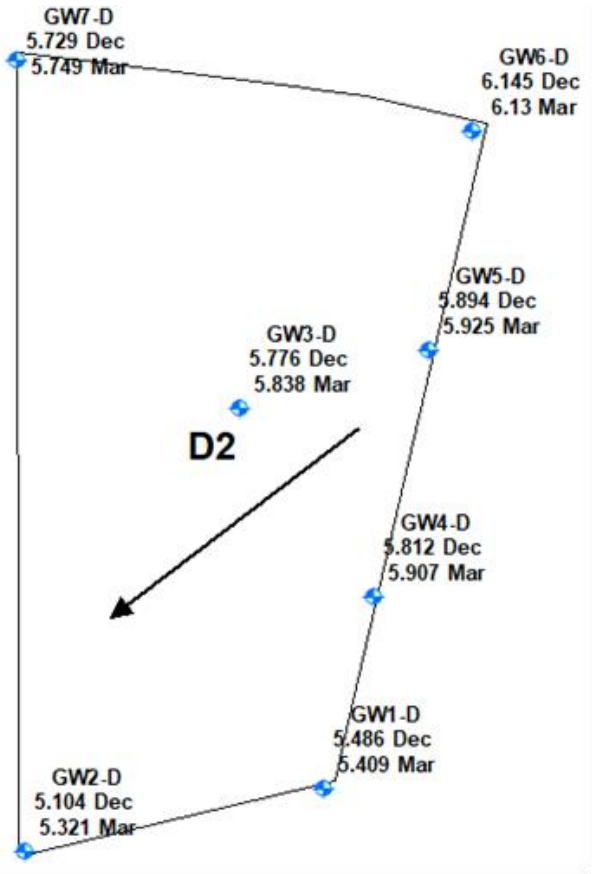
in graphs together with daily recorded rainfall. Figure 2 presents the groundwater contour plan showing flow direction.

Table 5-1 Groundwater Level (m AHD)

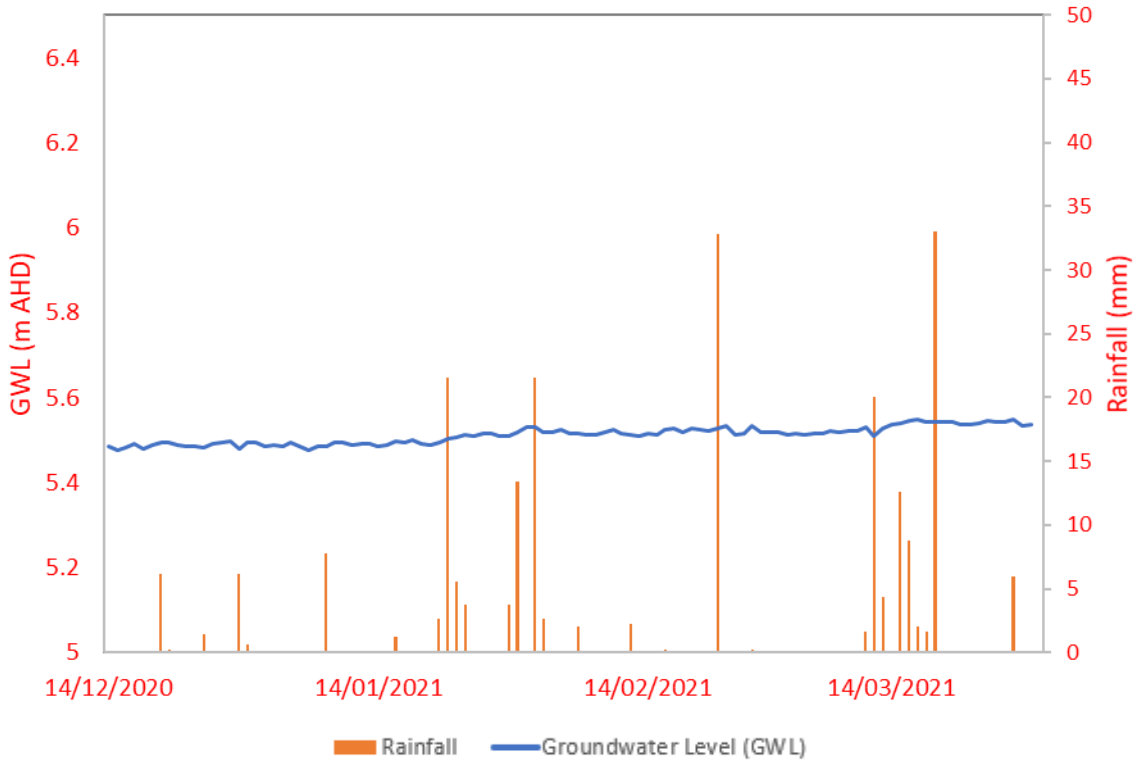
Well ID	14/12/2020	30/3/2021
GW1-D	5.486	5.409
GW2-D	5.104	5.321
GW3-D	5.776	5.838
GW4-D	5.812	5.907
GW5-D	5.894	5.925
GW6-D	6.145	6.13
GW7-D	5.729	5.749

The results show an approximately 1 m fall in GWL across Site D2 from the north-east corner to the south-west corner indicating a south-westerly groundwater flow regime. This is consistent with the regional data and including Water Corporations modelling discussed in Section 3.3.1 of the Site Investigation Report (February 2021). The results from pressure transducers plotted against rainfall show GWL respond rapidly to rainfall events indicating direct recharge to the aquifer from rainfall infiltration.

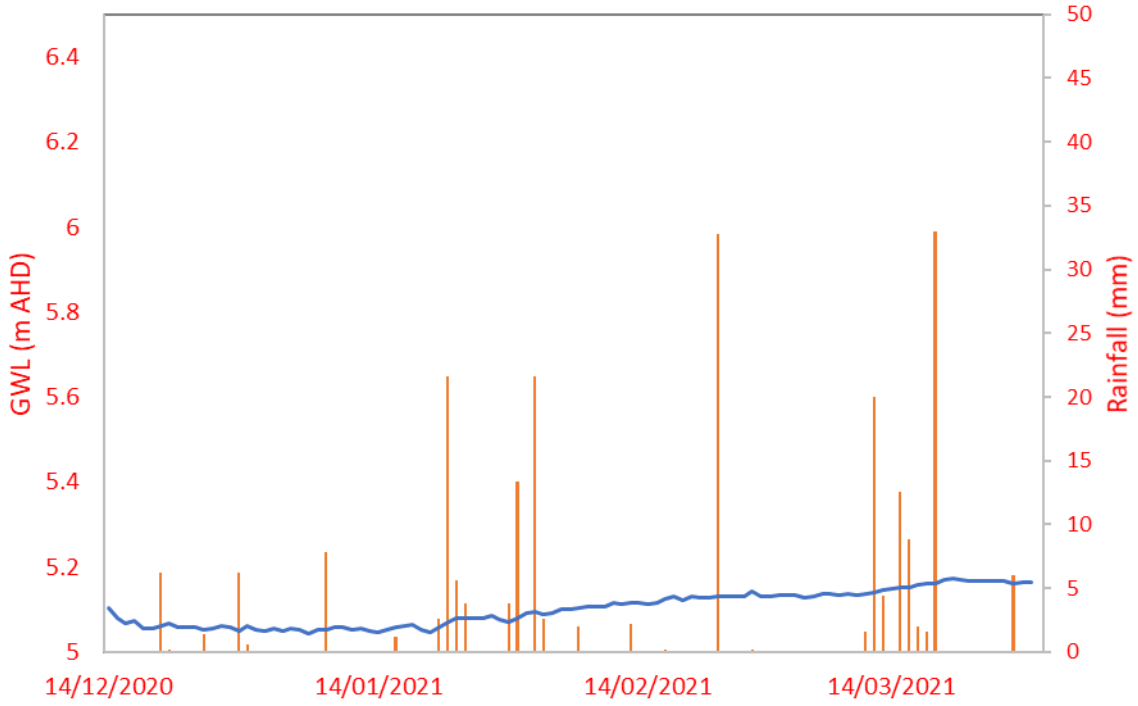
Figure 2: Groundwater Contour Plan (m AHD)



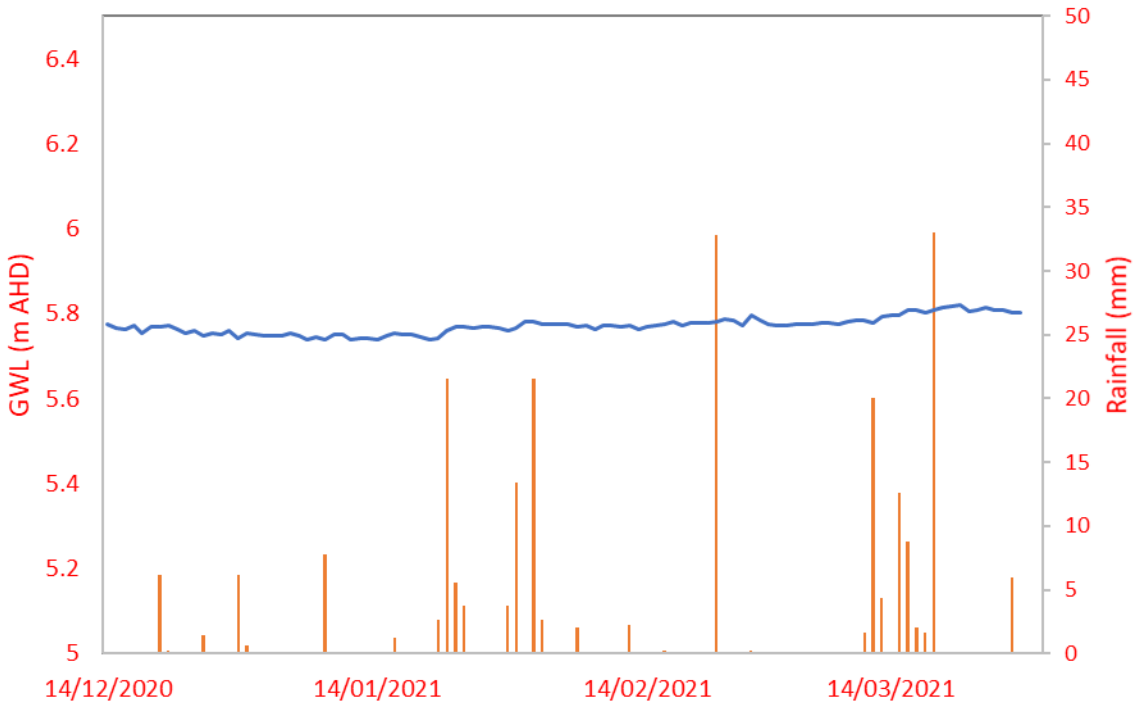
GW1-D


GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021
Rainfall
Groundwater Level (GWL)

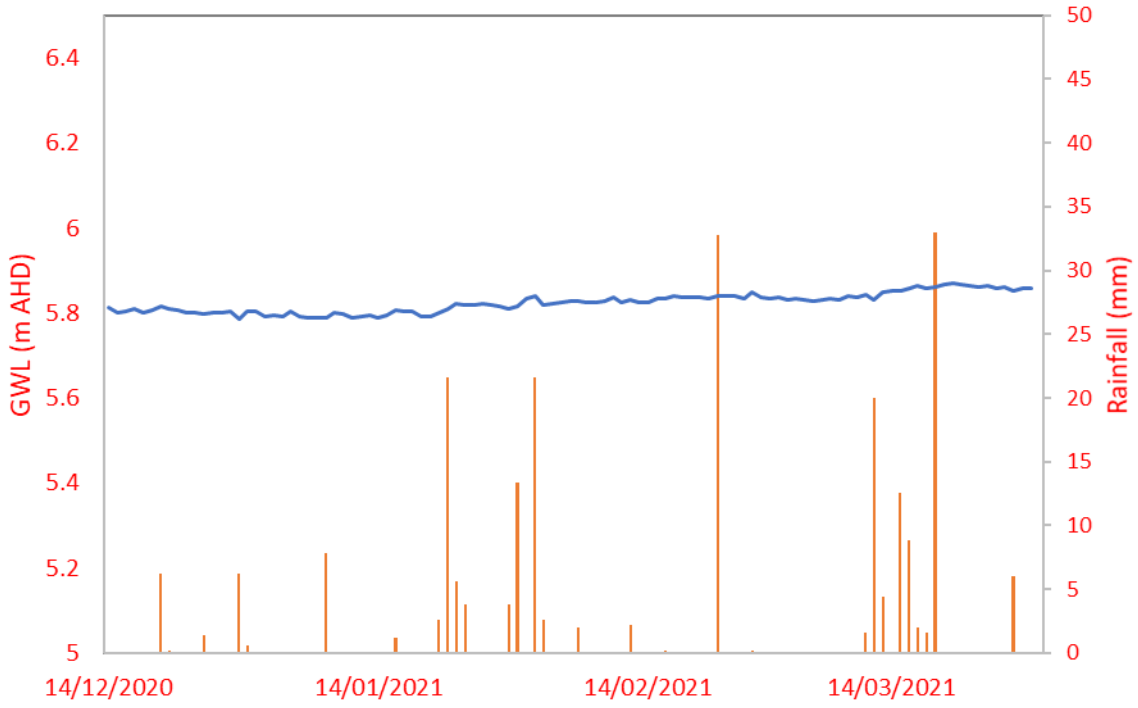
GW2-D


GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021

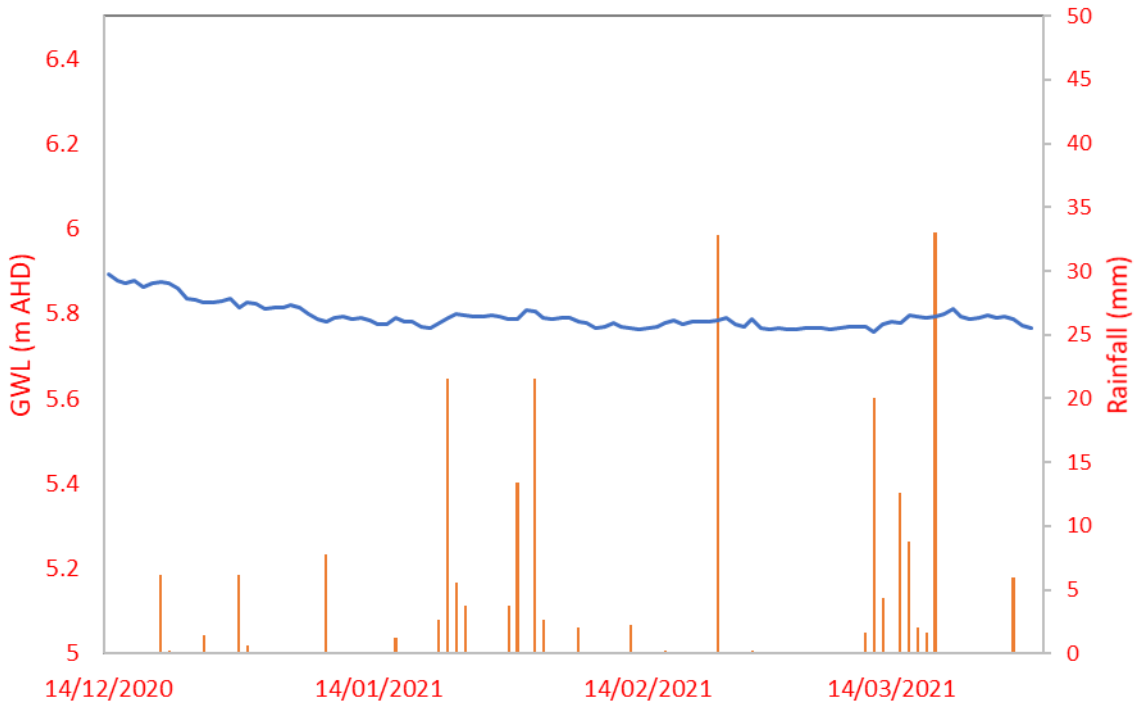
GW3-D


GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021

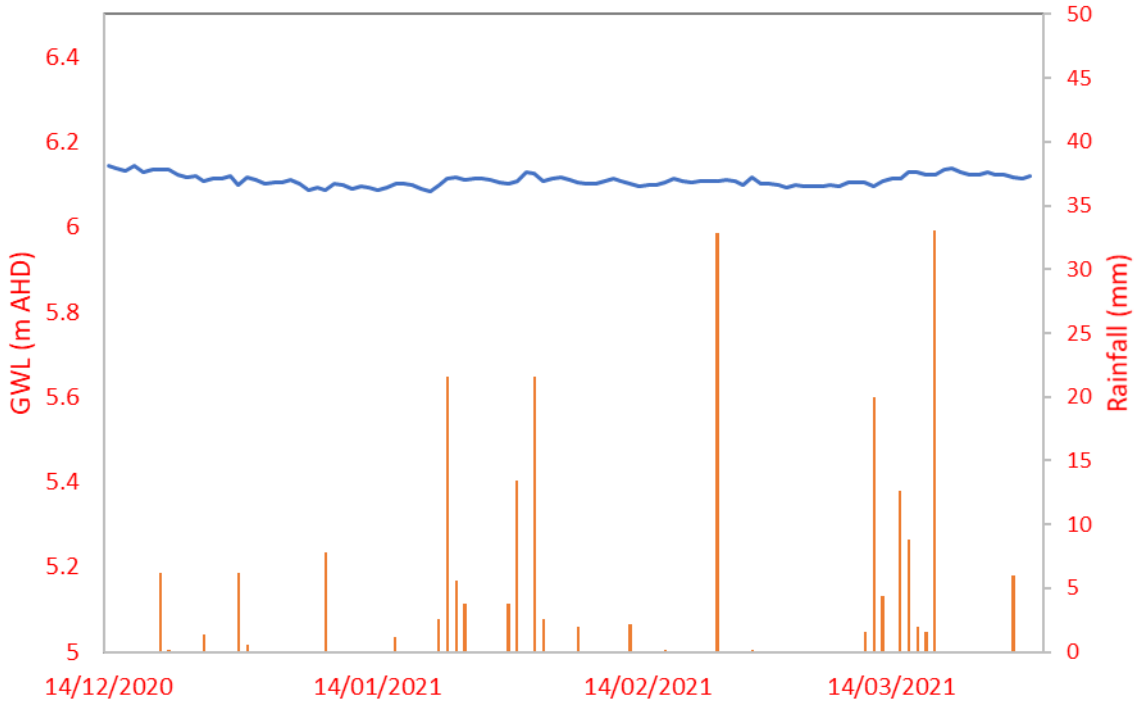
GW4-D

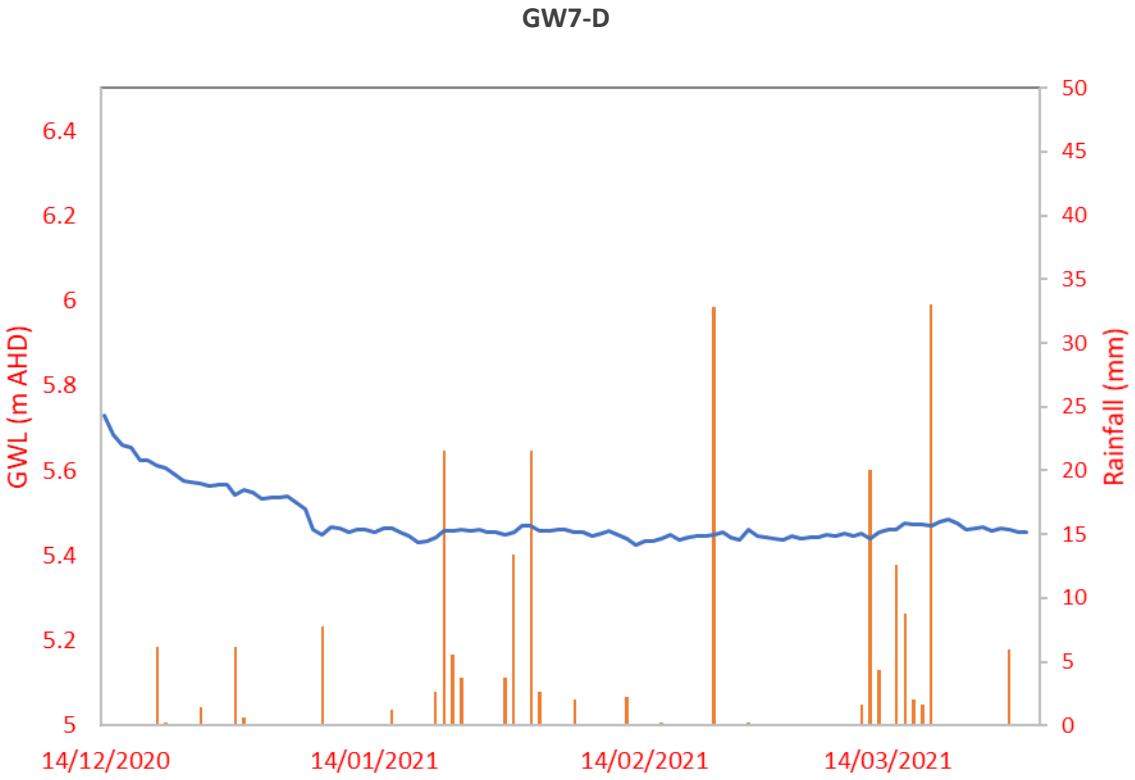

GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021

GW5-D


GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021

GW6-D


GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021


GW7-D
GWL (m AHD)
Rainfall (mm)
6.4
6.2
6
5.8
5.6
5.4
5.2
5
50
45
40
35
30
25
20
15
10
5
0
14/12/2020
14/01/2021
14/02/2021
14/03/2021