



27 August 2022

10th PROGRESS REPORT

Seven Mile Beach groundwater monitoring update and recent flooding at the northeast end of Woodhurst Road

Monitoring update

On the 26 April 2022 the groundwater level loggers were downloaded at Seven Mile Beach. Prior to this the data loggers were downloaded on 30 April 2019 but no report was produced.

The last annual progress report was in 2017¹.

Figure 1 shows the results for the past 11 years or so of groundwater levels, since July 2011.

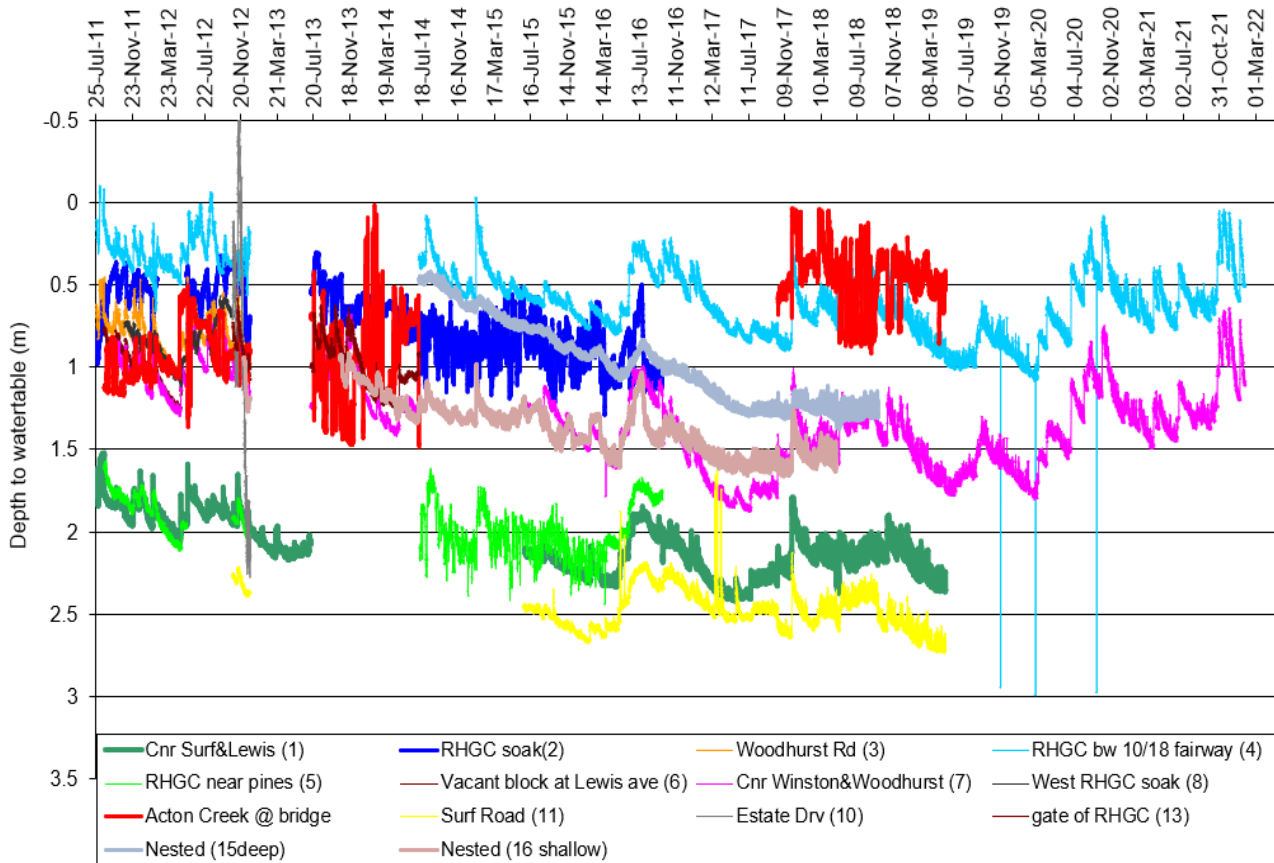


Figure 1. Groundwater logger records since July 2011

¹ Cromer, W. C. and Hocking, M. J. (2017). *Seven Mile Beach Groundwater Level Monitoring, 9th progress report, November 2017*. Unpublished report for Clarence City Council by William C. Cromer Pty. Ltd., 17 November 2017; 9 pages.



Comments are;

- since 2019 there are now only two data loggers which are operational (after 2 more failures & 1 removal/loss of data). The operating loggers are in Winston Avenue, and between fairways 10 and 18 at the Royal Hobart Golf Club (RHGC).
- the barometric logger failed in Jan 2022, which means the data can't be corrected for atmospheric pressure (making the data collection of limited use).
- over the past 11 years, water tables in all loggers fell by about a metre until about mid-2017. Subsequently, the rate of fall tended to flatten out and then start to rise. In the two remaining loggers the rise has been by more than 0.5m, to levels comparable to those pre-2015 (and before Council's 2013 water level management with the pump at Woodhurst Road and the RHGC sump pump, both towards the southwestern end of the street).
- the current state of the groundwater monitoring network means that it is unable to monitor groundwater levels around Seven Mile Beach.
- residents of lower-lying parts of Seven Mile Beach are at risk of flooding due to the current relatively shallow water table.
- from data logger monitoring, the rising groundwater levels at Seven Mile Beach contrast with groundwater levels elsewhere in coastal sands in southeastern Tasmania. On Bruny Island, for example, there are suggestions from the loggers that the water table has been declining at about 0.05m/year since 2016.

Figure 2 compares the Bureau of Meteorology (BOM) daily rainfall from RHGC since January 2006 with the logger data. It shows the trend lines for some of the coloured loggers graphs, from July 2011, and the group of rain events in 2009 (red oval) which cause extended flooding at the southwestern end of Woodhurst Road.

Note that at least four daily rain events during this 15 year period were higher than the highest rain in 2009, but whether these caused flooding is unclear.

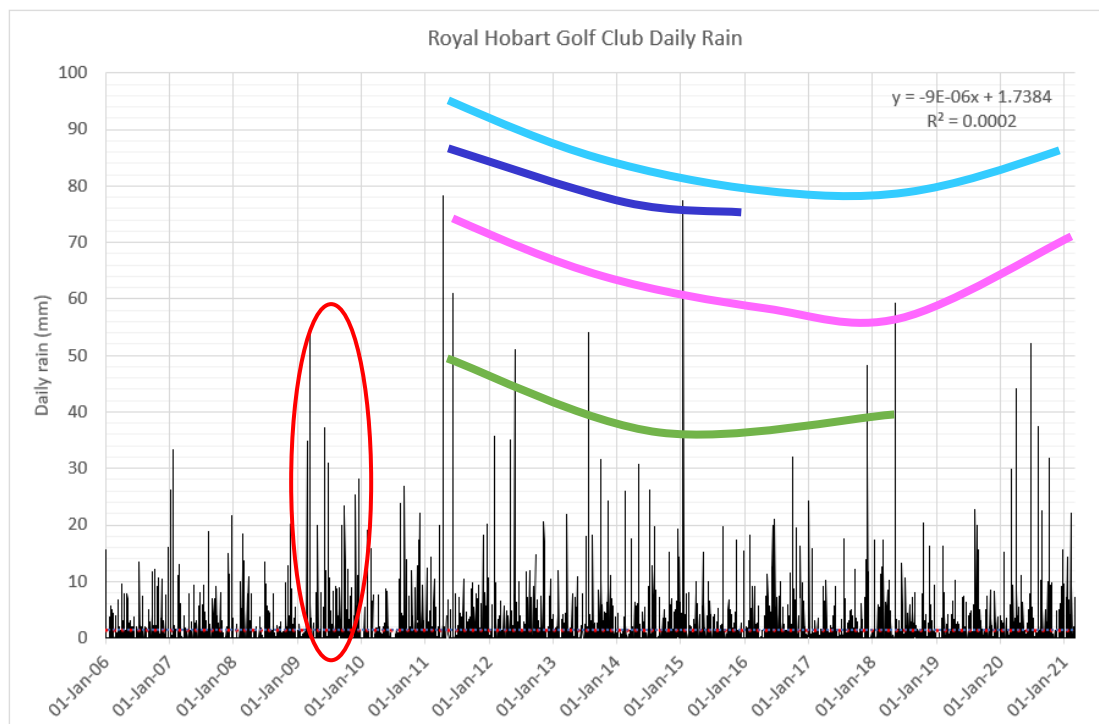


Figure 2. Daily rain at RHGC since January 2006. The coloured lines are the groundwater level trends from Figure 1.



Table 1 further explores the 2009 BOM monthly rain for RHGC to see what combination of rain intensity and frequency caused the flooding that year. There were bunches of events. Interestingly,

- five monthly rain totals in 2009 were higher than the "BOM "highest daily rain months"
- in 2009, the total rain was 701mm, 230m over the mean annual total. June was by far the wettest at 139mm (the wettest June ever recorded), four times the monthly mean (the previous month was below average, and the following month was about average). June had 17 rain days. Very high daily rain events were not needed to cause flooding, as shown by the daily rain records (mm) for the month:

0 0 0 12 37 3 15 0 7 8 12 0 0 7 0 0 0 0 0 0 0 0 0 0 4 31 1 1 1 0

Figure 3 compares annual rain and mean monthly rain to mean annual rain for the period 2000 – 2022. Comments are in the caption.

Figures 4 shows monthly rain for the year 2009 compared to monthly rain for the years 2014 – 2022. Comments are in the caption.

Table 1. Monthly rain at RHGC for 2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Mean	41	39	39	44	43	38	46	49	43	49	48	53	531
Highest Daily	77	65	61	78	59	61	64	55	48	69	41	61	739
Year of highest daily	2015	1964	1983	2011	2018	2011	1967	1981	1967	1973	1977	1993	
2009 monthly rain	9	43	69	48	22	139	43	58	109	45	57	59	701
2009 above mean		4	30	4		101		9	67		9	6	230

Recent flooding at the northeastern end Woodhurst Road

The recent flooding at the northeastern end of Woodhurst Road (Plate 1) was caused by about 46mm rain over 14 and 16 August. Again, it doesn't take a single heavy rain event to cause flooding: the daily rain records (mm) for the first 26 days of the month (records for 1, 4 and 5 August were missing) were:

_ 2 0 _ _ 5 2 0 0 0 0 0 2 26 13 7 1 0 1 1 0 2 0 0 0 0

Discussion

Some comments, in no particular order, are

- Council's pump installed about 2012 at the southwestern end of Woodhurst Road is designed to relieve the road of flooding. If it is still working effectively, it explains why the location did not flood in August 2022, and presumably did not flood at earlier occasions when the northeastern end of the road apparently did.
- The sump pump at RHGC is designed as a longer-term fix, to slowly lower the water table over a relatively large area and provide a storage for infiltrating rain. It is serviced every four months. It would be very useful to compare groundwater levels and flooding with the dates and hours the pump is operating, and the volume of groundwater removed.





Plate 1. Flooding at the northeastern end of Woodhurst Road, August 2022.
Photo sent to CCC by the resident at 26 Loudon Street.

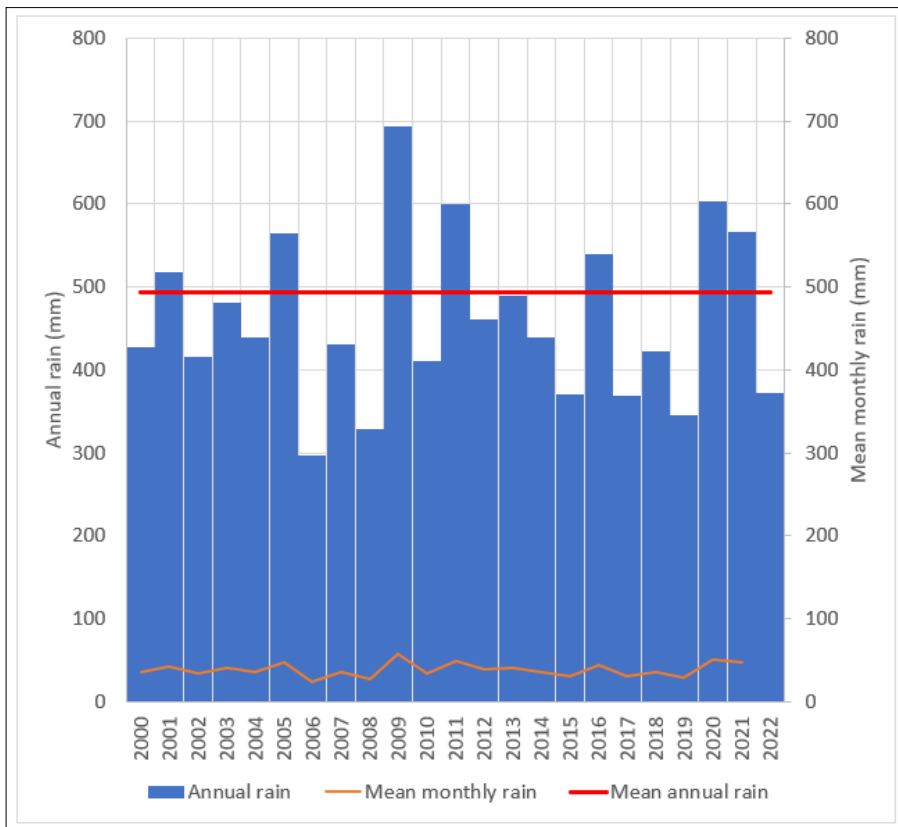


Figure 3. Annual rain and mean monthly rain compared to mean annual rain at Hobart Airport for the period 2000 - 2022. Above-average annual rain occurred in seven years: 2001, 2005, 2009, 2011, 2016, 2021 and (already) 2022. Source: Bureau of Meteorology.



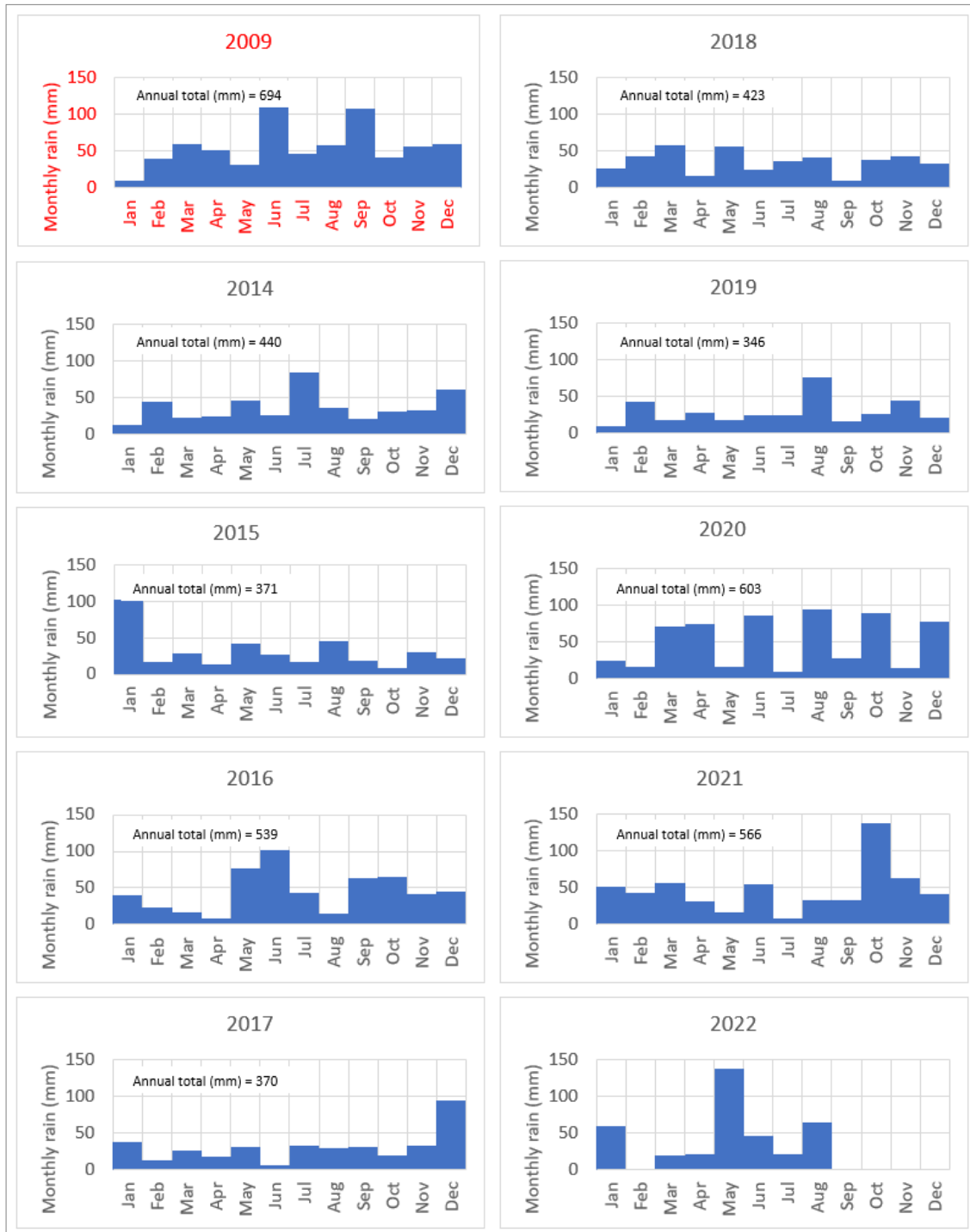


Figure 4. Monthly rain at Hobart Airport for 2009 (red type) and the years 2014 - August 2022). The June to September 2009 period spanned the months when the southwestern end of Woodhurst Road was flooded. The rains in August 2022 which caused the flooding of the northeastern end of Woodhurst Road were not particularly unusual. Monthly rain in May 2022 (136mm) and October 2021 (138mm) were much higher but its not clear whether they caused flooding. Source: Bureau of Meteorology.

- Historically,





- Seven Mile Beach houses used rainwater tanks for domestic use; wastewater disposal was (as it is now) in-ground, on-site at each house.
 - The net water balance, and infiltration to the water table, was simply rain input, unchanged compared to the time when houses were absent.
 - As houses were added, their footprints prevented natural evapotranspiration (and downpipes directed point discharges to ground).
 - Sealed roads further reduced evapotranspiration.
 - More recently, reticulated TasWater water from outside has been added to the district, but the town remains unsewered, so that each house now has rain+imported water infiltrating to the water table. After accounting for evapotranspiration and evaporation, the effect should be seen as rising water tables, perhaps buried in a broader pattern of declining water tables as seen elsewhere in southeastern Tasmania.
 - When monitoring started in 2011, the northeastern end of Woodhurst was vacant land on the RHGC side. Since then, the area has been built up, so that rain+imported water (not just rain) goes to ground.
- It would be useful to investigate to what extent imported water irrigated onto golf club land affects the water table across the township.
 - As streets were sealed, the water table along and immediately adjacent to Woodhurst Road (and every other street in the town) became artificially raised due to direct rain runoff from the bitumen surfaces.
 - It is understood that the stormwater system of unconnected gratings along the roads is designed to allow direct infiltration of rain runoff from the roads to the water table. As the water table rises close to road level, this system becomes progressively ineffective (Plate 2).
 - The flooding issue is not going to go away at Seven Mile Beach, and it will be repeated elsewhere in low-lying parts of southeastern Tasmania, in Clarence Municipality and others. The flooding is entirely rain-related, and independent of sea level rise from climate change (although sea level rise will produce flooding from progressively lesser rain events).

Recommendations

It is recommended that council re-invest in the groundwater monitoring network at Seven Mile beach by;

- 1) Install a replacement bore and logger along Surf Road (#1).
- 2) Replace the failed barometric logger for Seven Mile Beach.
- 3) Replace additional failed loggers along Surf Road (#11) and in the RHGC sump,
- 4) Water level management/pumping of the RHGC sump be reviewed to help reduce the risk of domestic flooding. The pump should be fitted with a flow device to keep track of discharge volumes). Install other loggers elsewhere over the course, to partly replace the original monitoring system.
- 5) Install extra loggers on either side of the northeastern end of Woodhurst.
- 6) Recommence 6-monthly logger download and annual progress reports.
- 7) Recalibrate the numeric computer model and keep it up to date.
- 8) Consider controlling the whole system remotely. It should be possible to track flood risk on a daily basis.





- 9) After reviewing the renewed monitoring program, consider groundwater (and stormwater system) management options.



Plate 2. Looking northeast along Woodhurst Road past Leyden Avenue (right middleground) on 20 August 2022 after most of the flood waters had evaporated, and slowly infiltrated the subsoil via stormwater gratings. Compare with Plate 1. The water level in the gratings was at ground level, indicating the water table in the immediate vicinity of the line of gratings is at surface, but it may not be at surface further from the road.

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Principal

