

# Bryn Posteg Chloride Report 2020

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**Potter Group**

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## Introduction

Water quality at groundwater monitoring point W1, located just inside the site entrance adjacent to the B4518 Llanidloes to Tywlch Road, has been consistently failing the permitted chloride limit of 69 mg/l for over 15 years. Indeed, there have only been three occasions since 1<sup>st</sup> January 2005 where this compliance level has been achieved (September 2006, June and September 2007 and October 2019). Every monthly sample taken, aside from the four mentioned, have exceeded the limit with typical ranges from 200 mg/l to 500 mg/l and a peak of 727 mg/l in March 2010. Chloride levels in adjacent groundwater boreholes have not shown any notable variation during the same time period.

A previous report, issued by Caulmert in April 2017, analyses the trends in Chloride, Sodium and Ammoniacal Nitrogen from 2005 to 2017. That report clearly shows that the borehole is not being contaminated from leachate as the ammoniacal nitrogen concentrations are not elevated. It also shows that there is a direct correlation between chloride and sodium levels over the time period, which led Caulmert to suggest that the elevated chloride level was as a result of contamination from road salt.

NRW rejected these suggestions, claiming that there was not enough evidence supporting the link to road salt. As such, further analysis has been completed which correlates the chloride, sodium, potassium and calcium levels in W1 and adjacent boreholes and shows their relationship with temperature.

## Analysis

Results from W1, the adjacent groundwater borehole W2, and the nearest leachate monitoring point LCP6 have been used as comparisons in this study.

In order to determine the relationship with chloride levels in W1 and a road salt source, a correlation graph was produced to show the effect of temperature on W1 chloride levels.

Figure 1: Correlation between temperature and chloride levels - Jan 2012 to June 2020

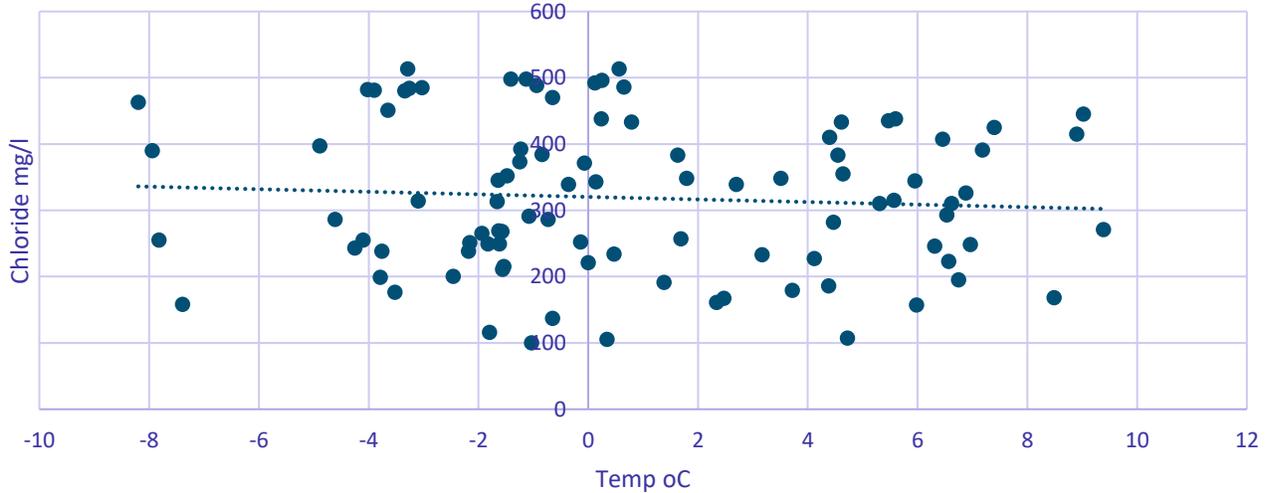
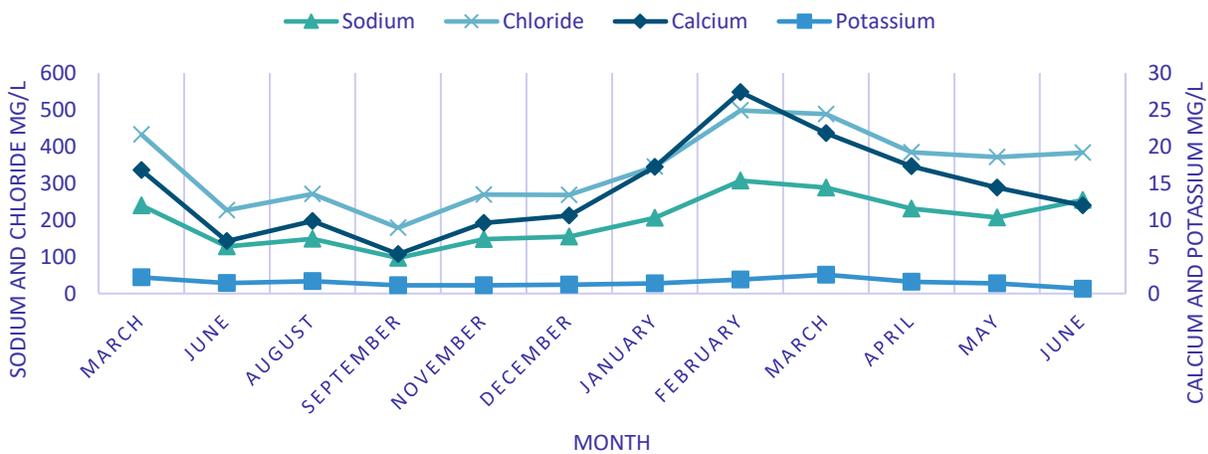
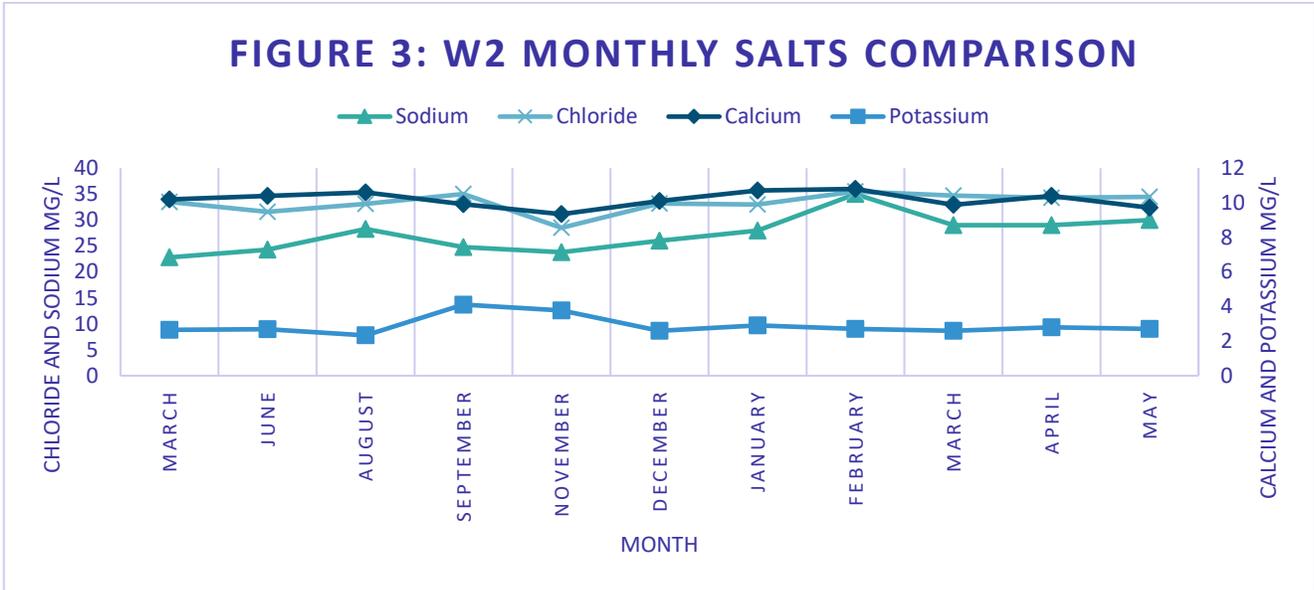


Figure 1 shows that the chloride levels are higher in colder weather than they are during the milder summer months, thereby suggesting that the rock salt, which is spread on the road during the colder winter months, is a likely source of contamination for this borehole.

FIGURE 2: W1 MONTHLY SALTS COMPARISON





Figures 2 and 3 compare the monthly patterns of chloride, calcium, potassium and sodium concentrations in W1 and W2. These graphs show that there is a strong relationship between chloride, sodium and (to a lesser extent) calcium in W1 with strong variations between summer and winter month concentrations. These variations and relationships are not apparent in the W2 results.

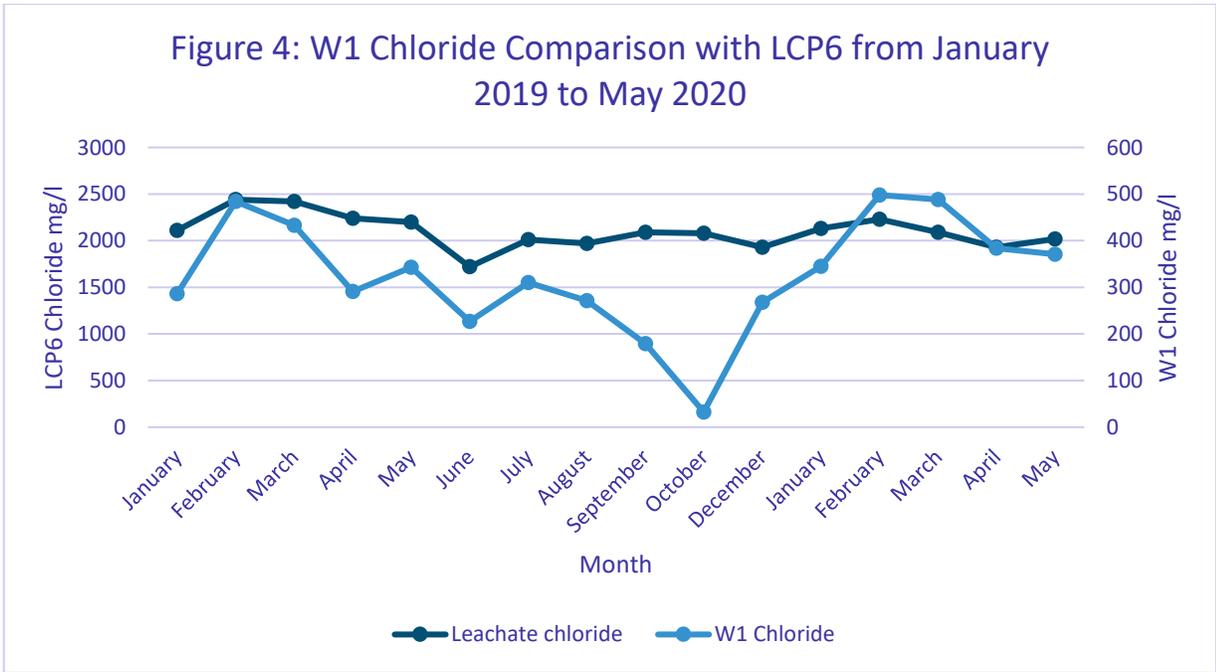


Figure 4 shows the relationship between chloride levels in LCP6 and W1. This graph clearly shows that there is no correlation between the two boreholes, therefore providing strong evidence that W1 is not contaminated from a source of leachate. This

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graph supports the findings of the Caulmert report, with regards to the comparison between ammoniacal nitrogen and chloride levels in W1 and Leachate.

### Ratios

A comparison of ratios between the four salts in W1 and W2 was also carried out. The results are shown in Table 1 below.

Table 1

Ratios	Calcium	Potassium	Sodium	Chloride
W1	5	1	100	200
W2	5	1	10	30

Ratios between chloride levels in W1, W2 and LCP6 was also completed with the results shown in Table 2 below.

Table 2

Borehole	LCP6	W1	W2
Chloride	33	7	1

These ratio calculations show that there is no obvious relationship between the chloride concentrations in the three boreholes (W1, W2 and LCP6).

### W1 construction

W1 was drilled and constructed at the in 1998. The construction log for W1 provides detail of the surrounding geology, with the first half a metre being topsoil, followed by 5.5 metres of grey clay with gravel, before merging with approximately 8.7 metres of mudstone, terminating at a depth of 15 metres. The drill log explains that the first six metres is plain pipe, followed by 9 metres of slotted pipe. There is a bentonite seal between 0.3 and 5.5 metres. The drill log details groundwater seepage at 4 metres.

### Conclusion

Figure 1 shows a definite relationship between colder weather and elevated chloride levels, however, there is a notable lag time between the onset of colder weather and the chloride levels reaching their peak levels. The data indicates that the peak levels are usually seen in February or March, thereby suggesting that the chloride is taking between 4 and 6 weeks to enter the groundwater, if road salt is the source of contamination. Due to the age of the W1 borehole and the use of over 5 metres of

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bentonite as a seal, it is possible that there is a track through this seal which has provided an entry route for road run-off. Alternatively, there may be a gravel lens through the adjoining clay, which provides a direct route from the surface to the groundwater. The borehole head itself is located approximately 0.4 metres below the level of the road, the edge of which is less than a metre away. It is proposed that the lag time occurs as the surface water is percolating through the adjacent gravel clay mix.

Figure 2 shows a very definite correlation between chloride and sodium concentrations, with a 2:1 ratio between the two salts. Calcium concentrations also show a similar profile, with a chloride:calcium ratio of around 40:1. In borehole W2 (Figure 3) there is no obvious correlation between the salts with the sodium:chloride ratio drifting to around 3:1 and the chloride:calcium ratio being around 6:1; however, there is more variation in these ratios over the measured 18 month period. In LCP6 (Figure 4), chloride concentrations have remained fairly constant at between 2000 mg/l and 2400 mg/l since January 2019. Conversely, the chloride concentrations in W1 have varied by a factor of 16 over the same timescale. This confirms that the source of contamination is not leachate.

### Proposal

There is significant evidence provided here that shows the contamination source is not from leachate. Whilst it is not possible to definitively say that the source is from road salt, the correlation with temperature is compelling. As such, it is proposed that Sundorne Products (Llanidloes) Ltd apply for a permit variation to increase the current chloride limit for W1 to 750mg/l. The highest measured concentration since 2010 is 727mg/l, so this limit would provide a small buffer.