H Fraser Consulting
Contaminated Land and Hydrogeology

TECHNICAL NOTE

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DOLAU HOUSE ABSTRACTION LICENCE APPLICATION: CLARIFICATION OF ABSTRACTION QUANTITIES

1 HISTORIC USAGE

Historic maximum demand is shown in Table 1, using data supplied by the Client (Richard Watkins).

Table 1: Maximum historic demand (excluding washdown)

Yearly	Daily	Hourly	Peak	Max. duration
m^3	m^3	m^3	l/s	hr/d
12,200	75	not measured	not measured	24

A growing cycle is typically 48 days (38 days of growth followed by 3 days washing and then a 7-day rest period), so there are typically 7.6 cycles per year, with abstraction occurring 312 days per year.

2 SITE INVESTIGATION DATA

Water level loggers were installed into BH1, BH2, and BH3 for 18 days, between 07 July and 24 July 2023. The loggers were installed to cover the peak demand during the end of the growing cycle[1], as well as the rest period following the growing cycle.

2.1 Poultry drinking water usage

Water consumption during the growing period (i.e. not including washdown) is measured daily at each of the three boreholes, with the data summarised in Table 2.

Table 2: Average drinking water use during peak demand (8 to 17 July; days 22-36 of the cycle)

Measurement period	Unit	BH1	BH2	BH3	Total	Comment
Daily	m^3/d	8.6	17.1	17.1	42.8	Recorded by client
Equiv. hourly	m^3/hr	0.4	0.7	0.7	1.8	Prorated from daily
Equiv. instant	l/s	0.1	0.2	0.2	0.5	Prorated from daily
Equiv. annual	m^3/a	2,420	4,811	4,811	12,042	Total during growing period (38 days growing and 10 days' rest.)

[1] Growing cycle ran from 12 June to 18 July

The real instantaneous peak is likely to be much higher than instantaneous equivalent above, because the pumps switch on and off rapidly. Instantaneous flow rate from each borehole was estimated during the site visit on 7 July. The pipeline from each borehole to the sheds has a tap. Flow rate was measured at each tap by recording the time to fill a bucket. It is noted that flow rate tests on boreholes BH2 and BH3 during did not capture all the flow as some was going to the chickens so will have stayed in the pipe and not come out of the tap. Results are shown in Table 3.

Table 3: Instantaneous flow rates (approximate)

Borehole	Flow rate (l/s)
BH1	0.7
BH2	0.7
BH3	1.4
Total	**2.84**
Total assuming half of flow at BH2 and BH3 to chickens	**5.0**

2.2 Washdown usage

Water used during the washdown is not metered. Therefore the volumes and abstraction rates are not recorded. Instead, washdown use was estimated using groundwater level logger data (see Figure 1).

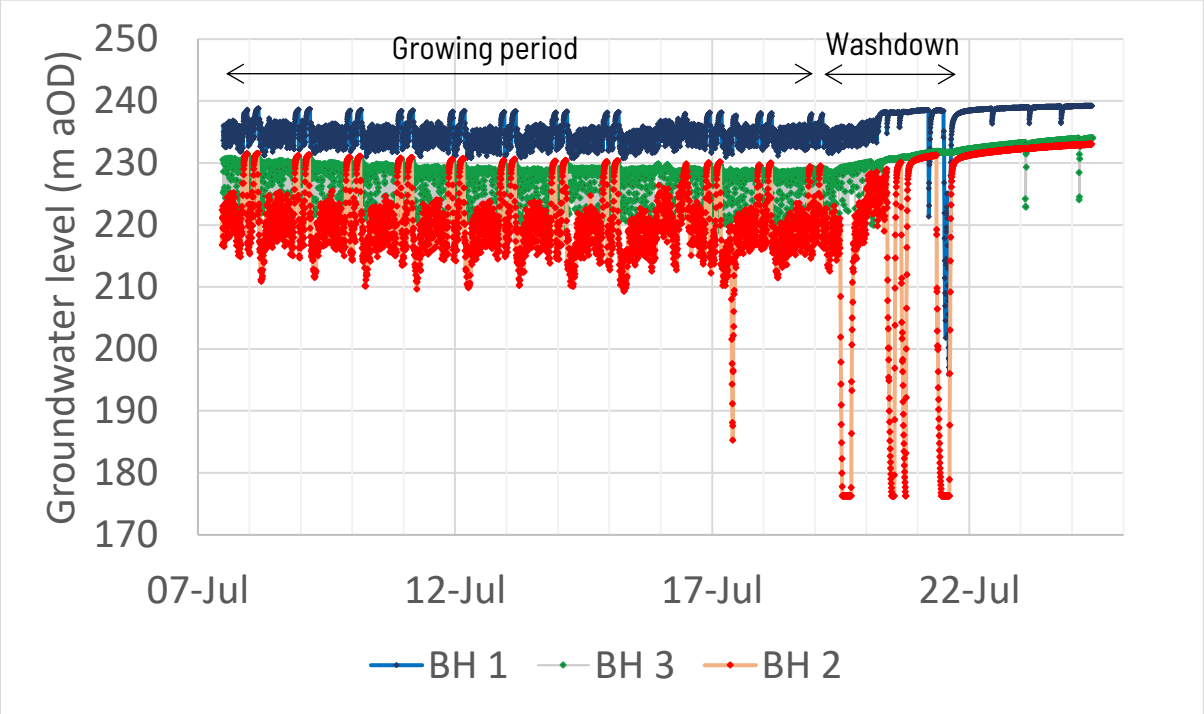

Figure 1: Groundwater level during test period

During the growing period, usage is fairly constant over the course of the day, and the pumps switch on-off frequently. During washdown usage occurs only during the day and BH2 appears to be pumping at full rate for hours at a time. Figure 1 shows that typical drawdown at BH2 during the growing period is around 10 m, but is around five times that value while washdown pumping is on. Assuming that pump rate is

proportional to drawdown, the instantaneous rate during washdown is estimated by multiplying the instantaneous rate during the growing period by 10 (to be conservative).

Table 4: Estimated washdown rate

Unit	BH1	BH2	BH3	Total
l/s	1.00	1.98	1.98	5.0
m^3/hr	3.58	7.13	7.13	17.8

These figures assume washdown pump rates to be ten times the hourly rate during the growing cycle.

The number of hours pumping at full rate during washdown is taken from Figure 1 and is shown in Table 5.

Table 5: Hours pumping at full rate during washdown

Date	Unit	BH1	BH2	BH3
19/07/2023	hrs	0	5	0
20/07/2023	hrs	0	5.5	0
21/07/2023	hrs	3	5	0
Total hrs pumping at max rate	hrs	3	15.5	0

Table 4 and Table 5 are used to calculate washdown volume and daily rate, shown in Table 6.

Table 6: Estimated washdown rates and volumes

	Unit	BH1	BH2	BH3	Total
Volume used during washdown	m^3	10.75	110.44	0	121
	m^3/d	3.58	36.81	0	40

There are 7.6 growing cycles per year, therefore the annual volume used during washdown is shown in Table 7.

Table 7: Annual volume used during washdown

	BH1	BH2	BH3	Total
m^3/a	82	840	0	922

2.3 Total usage during growing period and washdown

Total requirements, based on the above analysis of site data, are shown in Table 8.

Table 8: Usage during sitework period

Growing cycle	Duration	Usage	Usage	Volume per cycle
	days	m^3/d	m^3/hr	m^3
Growing period	38	42.8	1.8	1,626
Washdown	3	40	17.8	120
Rest	7	0	0	0
Sum	**48**			**1,746**

It is estimated that that 1,746 m^3 is used per growing cycle. This equates to an annual use of 13,280 m^3, with the equivalent daily, hourly and instantaneous rates shown in Table 9.

Table 9: Usage based on site data

Yearly	Daily average	Hourly average	Instantaneous average	Demand
m^3/a	m^3/d	m^3/hr	l/s	hr/d
13,280	36.4	1.52	0.42	24

These figures assume constant demand over the growing period and even use throughout the day.

The yearly value in Table 9 is higher than the historic (Table 1) because sitework (and usage records) are from the end of the growing period, when usage is highest. However, the daily average value in Table 9 is much lower than the historic maximum. The historic maximum may be from a much hotter day than occurred during our sitework.

3 REQUIRED ABSTRACTION QUANTITIES

Required abstraction quantities are explained in Table 10, with the items highlighted in green carried through to the summary table of required abstraction in Table 11.

Table 10: Required abstraction quantities (detailed)

Timescale		Value	Unit	How derived
Annual	Growing	13,420	m^3/a	Max historic plus 10% increase for climate change
	Washdown	922	m^3/a	Not recorded. Conservative estimate from groundwater graph
	Total	14,342	m^3/a	
		39	m^3/d	equivalent
Daily	Growing	83	m^3/d	Max historic plus 10% increase for climate change
	Washdown	40	m^3/d	Not recorded. Conservative estimate from groundwater graph
Hourly	Growing	3		Not recorded. Prorated from daily value
	Washdown	18	m^3/hr	Not recorded. Conservative estimate from groundwater graph, if all 3 BHs pumping at once (they are only on for a few hours per day)
Instantaneous	Growing	5.0	l/s	Not known. Estimated during site visit (from taps)
	Washdown	5.0	l/s	Prorated from hourly value

The maximum instantaneous rate is 5.0 l/s. This is equivalent to 432 m^3/d, which is much higher than requested maximum daily volume (83 m^3/day), because the pumps are not on continuously. Pumps cycle on-off continuously during the growing cycle, and water is only used for a few hours a day during washdown.

Table 11: Required abstraction quantities (summary)

Timescale	Value	Unit
Annual	14,342	m^3/a
Daily	83	m^3/d
Hourly	18	m^3/hr
Instantaneous	5.0	l/s

4 COMPARISON WITH INDUSTRY GUIDELINES

The annual required abstraction quantity is 14,342 m^3. This is similar to the annual water demand of 11,863 m^3, based on guideline water demands in "Optimum use of water for industry and agriculture: Phase 3" (Environment Agency, 2003) for 250,000 birds per growing cycle (Table 12).

Table 12: Estimated water demand using industry guidelines

Parameter	Value	Unit
No. birds	250,000	per cycle
Poultry fattening: Water demand per 100 birds[2]	13	litres/day/bird
Water demand total	32.5	m^3/d
	11,863	m^3/a

[2] Environment Agency 2003, OPTIMUM USE OF WATER FOR INDUSTRY AND AGRICULTURE: PHASE 3, p 134. ISBN 1 84432 065 0