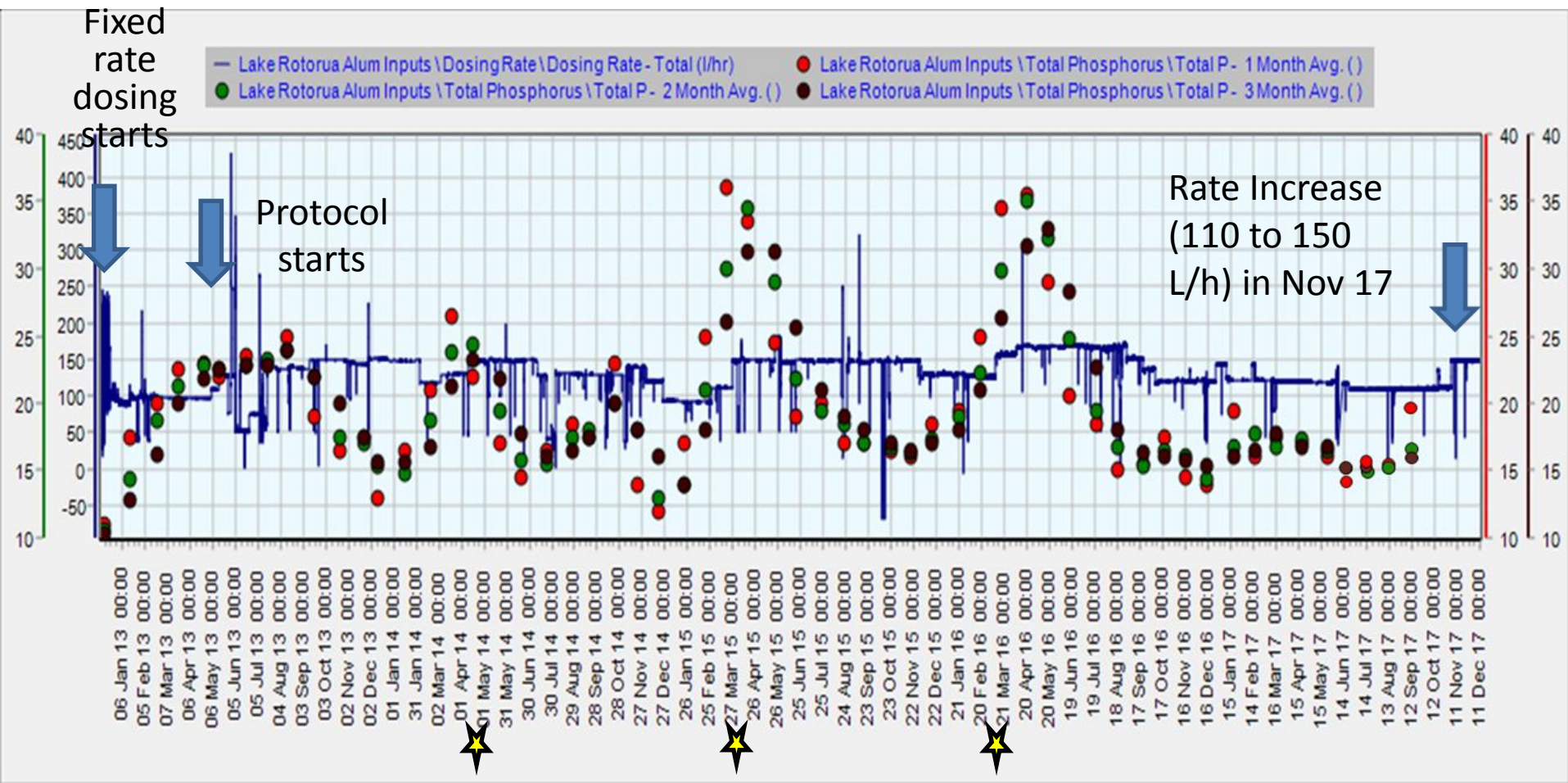


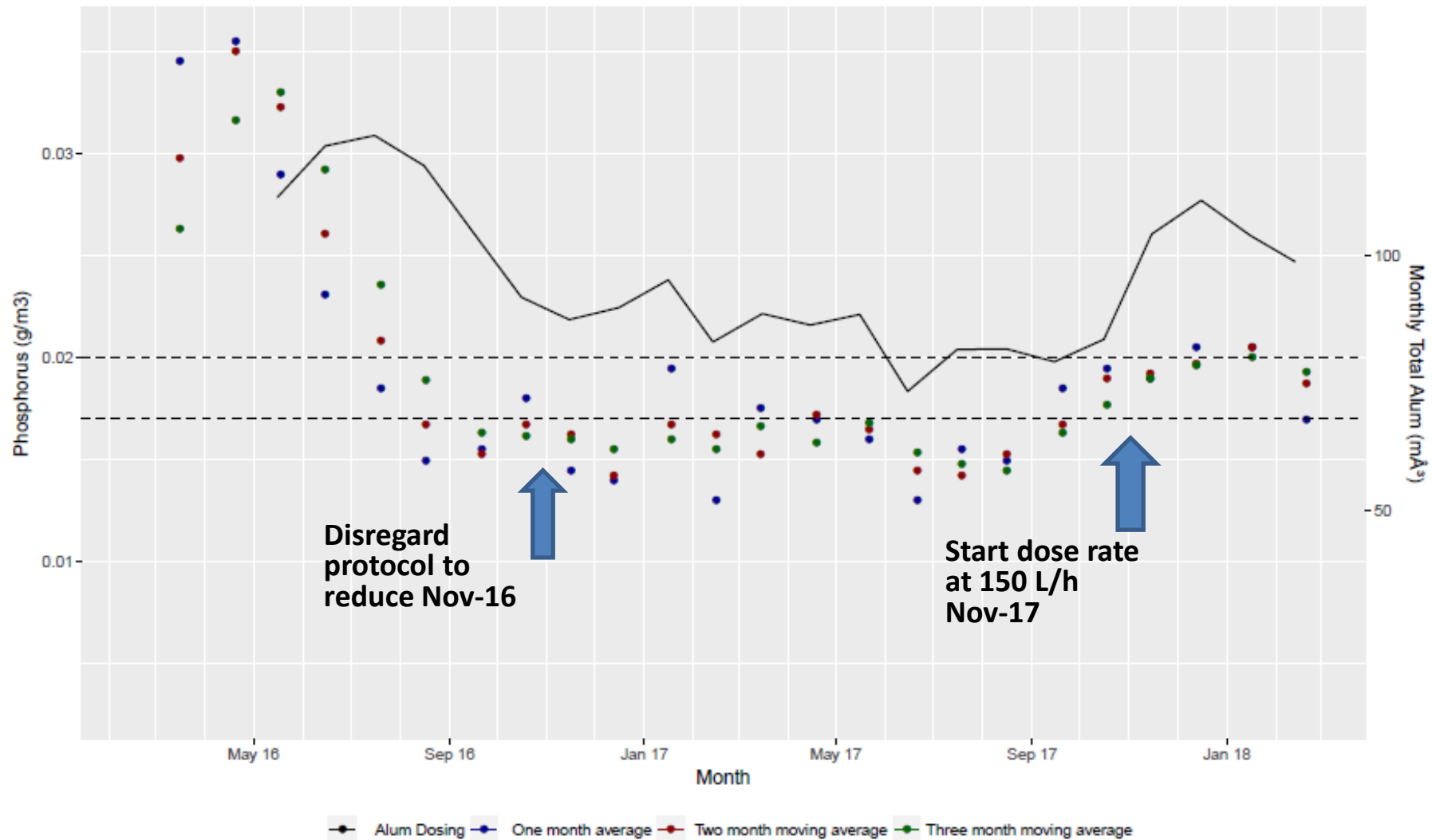
Alum Plant Update

May 2018

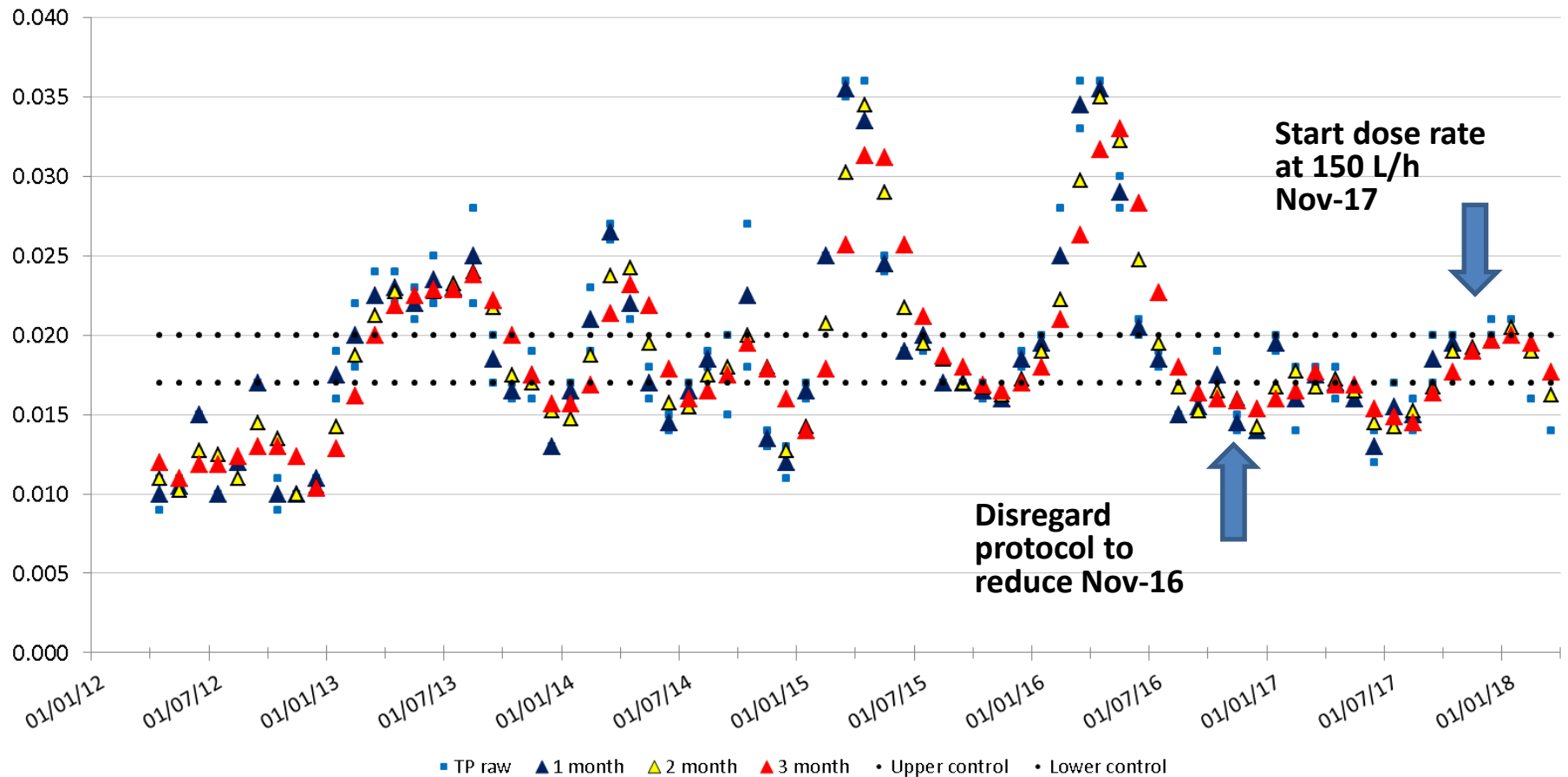
Historic up to Dec 17 – dosing rate and TP concentrations Lake Rotorua



Total Monthly alum dosed (m³) vs TP concentrations Lake Rotorua



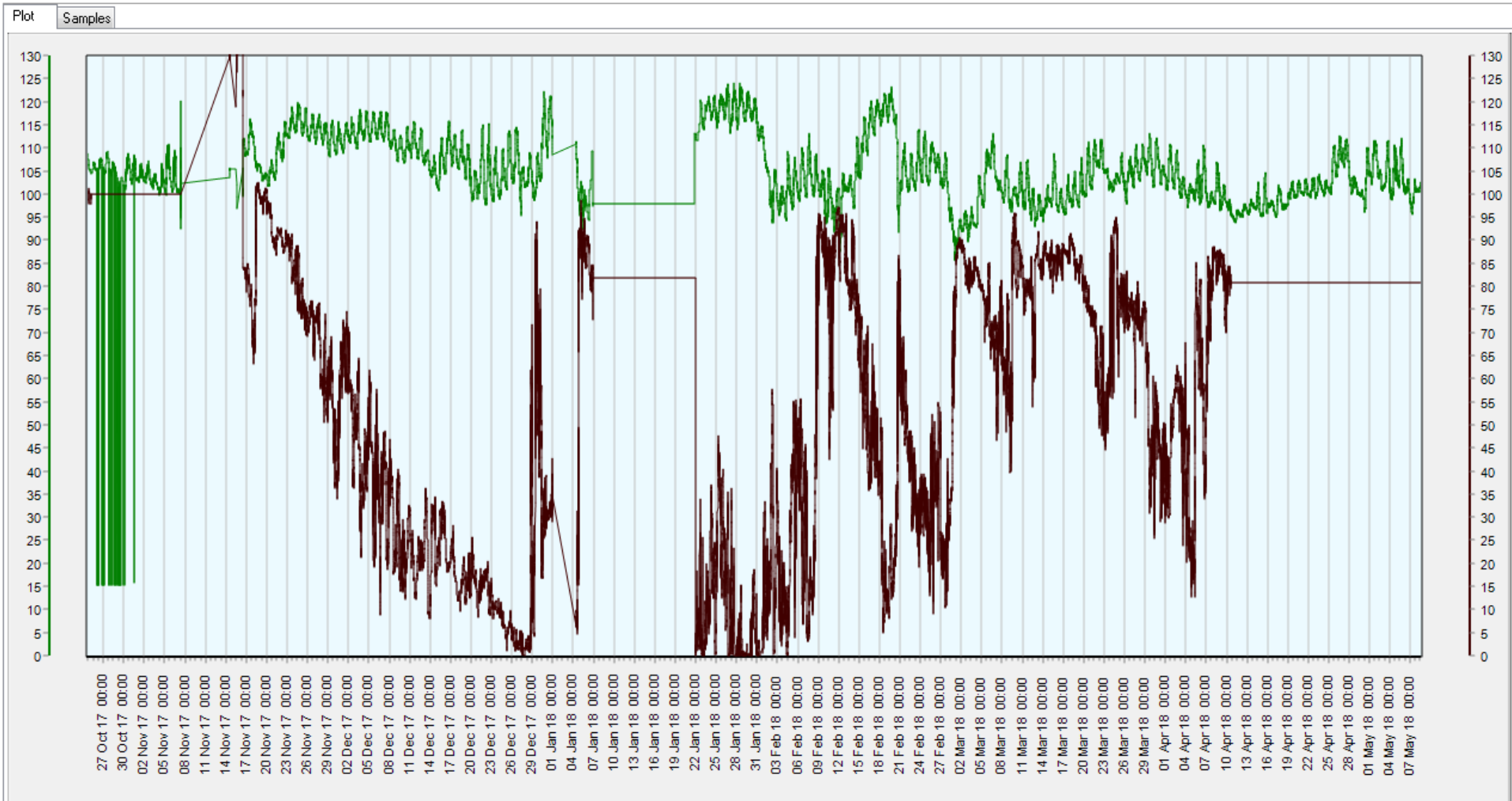
April 12 to current- Rotorua P concentrations vs control target



☒ ☒ ☐ Lake Rotorua Buoy \ DO Sat (0.5m) ☒ Raw Plot Period 8/05/2018 12:10:00 p 102.45 %

☒ ☒ ☐ Lake Rotorua Buoy \ DO Sat (20m) ☒ Raw Plot Period 8/05/2018 12:10:00 p 80.89 %

24/10/201 12:10:00 p.m. Fetch Data 8/05/201 12:10:00 p.m.



As a summary for Lake Rotorua:

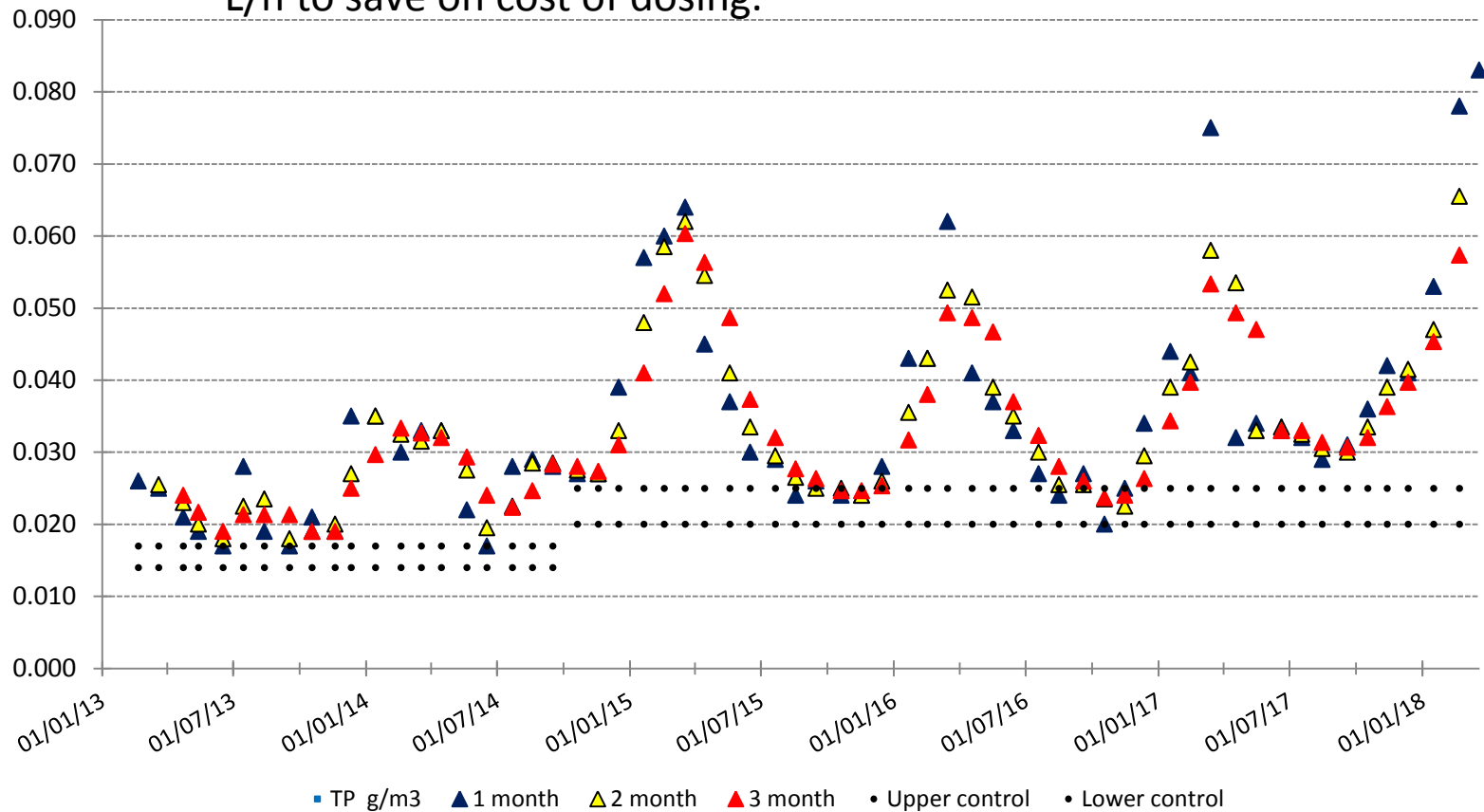
- December results would have increased dosing rate by 10 L/h to 160 L/h,
- Same for January results so dosing rate would have gone up to 170 L/h,
- February would have maintained the dosing rate at 170 L/h,
- March TP levels for 1 monthly and 2 monthly fell below < 0.017 mg/L so dose rate would have decreased to 150 L/h,
- Dose rate reduced to 130 L/h on the 4-5-18

Lake Rotorua P-locking Control Protocol

	Control Chart	Alum Dose Rate	Cumulative Alum Dose Rate	Explanation
Increase	Monthly average TP > 0.020 g/m ³	plus 10 L/hr	plus 10 L/hr	Use control chart in next tab and look at 1 month data
	Two monthly average TP > 0.020 g/m ³	plus 10 L/hr	plus 20 L/hr	Use control chart in next tab and look at 2 month data
	Three monthly average TP > 0.020 g/m ³	plus 10 L/hr	plus 30 L/hr	Use control chart in next tab and look at 3 month data
	TP trending upwards or static and the 3 statistics above TP > 0.020 g/m ³	plus 10 L/hr	plus 40 L/hr	This should only be considered if the month after all 3 monthly averages have past the upper control. This means the second consecutive month with all 3 monthly averages above and trending upward would constitute for the additional 10 L/h.
Decrease	Monthly average TP < 0.017 g/m ³	reduce by 10 L/hr	reduce by 10 L/hr	Use control chart in next tab and look at 1 month data
	Two monthly average TP < 0.017 g/m ³	reduce by 10 L/hr	reduce by 20 L/hr	Use control chart in next tab and look at 2 month data
	Three monthly average TP < 0.017 g/m ³	reduce by 10 L/hr	reduce by 30 L/hr	Use control chart in next tab and look at 3 month data
	TP trending downward and the 3 statistics below TP < 0.017 g/m ³	reduce by 10 L/hr	reduce by 40 L/hr	This should only be considered if the month after all 3 monthly averages have fallen below the lower control. This means the second consecutive month with all 3 monthly averages below and trending downward would constitute for the additional 10 L/h reduction.
Summer Protocol	Changes to protocol	Occurs when?		
	Start at 150 L/hr (combined dose)	1st November		Protocol further solidified at WQTAG on 11 Dec-2017 where it was agreed dosing will start at 150 L/hr on 1st Nov.
	Ignore protocols call to reduce dose rate	1st November - 1st April		It was discussed at WQTAG (2016-10-07) that due to the lag time as we approach summer the protocol may call for a reduction in dose rate in Nov-Jan and doesn't call for a dose rate increase until Feb-March. Because of this we may miss opportunities to control phosphorus or be more efficient with the product. It was agreed that if the protocol calls for a reduction in dose rate after Nov we would ignore until April.

Feb 13 to current- Rotoehu P concentrations vs control target

Dosing rate reduction on the 6th November from 45 L/h to 20 L/h to save on cost of dosing.



Lake Rotoehu Buoy \ DO Sat (0.5m)

Raw

Plot Period

8/05/2018 1:00:00 p.

97.57 %

Lake Rotoehu Buoy \ DO Sat (10m)

Raw

Plot Period

8/05/2018 1:00:00 p.

91.88 %

24/10/201 12:10:00 p.m.

Fetch Data

8/05/201:12:10:00 p.m.

Plot Samples

The graph displays two data series: Lake Rotoehu Buoy \ DO Sat (0.5m) in green and Lake Rotoehu Buoy \ DO Sat (10m) in dark red. The x-axis represents time from 27 Oct 17 00:00 to 07 May 18 00:00. The y-axis represents DO Sat levels from 0 to 150. The 0.5m depth series shows higher DO levels, generally between 80 and 145, with a peak of 116.37 @ 08 Jan 18 22:50. The 10m depth series shows lower DO levels, generally between 0 and 90, with a peak of 47.94 @ 18 Jan 18 22:50. Both series show a sharp drop in late December, reaching near zero.

Date	DO Sat (0.5m)	DO Sat (10m)
27 Oct 17 00:00	100	90
30 Oct 17 00:00	105	85
02 Nov 17 00:00	100	80
05 Nov 17 00:00	105	85
08 Nov 17 00:00	100	80
11 Nov 17 00:00	105	85
14 Nov 17 00:00	100	80
17 Nov 17 00:00	105	85
20 Nov 17 00:00	100	80
23 Nov 17 00:00	105	85
26 Nov 17 00:00	100	80
29 Nov 17 00:00	105	85
02 Dec 17 00:00	100	80
05 Dec 17 00:00	105	85
08 Dec 17 00:00	100	80
11 Dec 17 00:00	105	85
14 Dec 17 00:00	100	80
17 Dec 17 00:00	105	85
20 Dec 17 00:00	100	80
23 Dec 17 00:00	105	85
26 Dec 17 00:00	100	80
29 Dec 17 00:00	105	85
01 Jan 18 00:00	100	80
04 Jan 18 00:00	105	85
07 Jan 18 00:00	100	80
10 Jan 18 00:00	105	85
13 Jan 18 00:00	100	80
16 Jan 18 00:00	105	85
19 Jan 18 00:00	100	80
22 Jan 18 00:00	105	85
25 Jan 18 00:00	100	80
28 Jan 18 00:00	105	85
31 Jan 18 00:00	100	80
03 Feb 18 00:00	105	85
06 Feb 18 00:00	100	80
09 Feb 18 00:00	105	85
12 Feb 18 00:00	100	80
15 Feb 18 00:00	105	85
18 Feb 18 00:00	100	80
21 Feb 18 00:00	105	85
24 Feb 18 00:00	100	80
27 Feb 18 00:00	105	85
02 Mar 18 00:00	100	80
05 Mar 18 00:00	105	85
08 Mar 18 00:00	100	80
11 Mar 18 00:00	105	85
14 Mar 18 00:00	100	80
17 Mar 18 00:00	105	85
20 Mar 18 00:00	100	80
23 Mar 18 00:00	105	85
26 Mar 18 00:00	100	80
29 Mar 18 00:00	105	85
01 Apr 18 00:00	100	80
04 Apr 18 00:00	105	85
07 Apr 18 00:00	100	80
10 Apr 18 00:00	105	85
13 Apr 18 00:00	100	80
16 Apr 18 00:00	105	85
19 Apr 18 00:00	100	80
22 Apr 18 00:00	105	85
25 Apr 18 00:00	100	80
28 Apr 18 00:00	105	85
01 May 18 00:00	100	80
04 May 18 00:00	105	85
07 May 18 00:00	100	80

As a summary for Lake Rotoehu:

- We decreased dose rates on the 6/11/17 to 20 L/h,
- Latest TP levels are 0.083 mg/L. Highest since 2013,
- TP levels have not been within control band since Nov-2016.