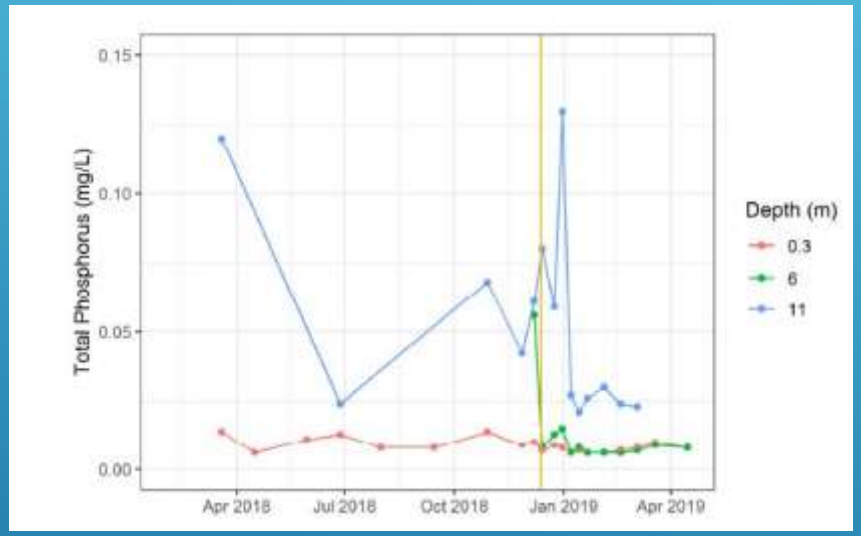
PHOSLOCK TRIAL

Including Evaluation of Management Options

PHOSLOCK TRIAL CONCLUSIONS

- little evidence of a reduction in phosphorus levels in this system.



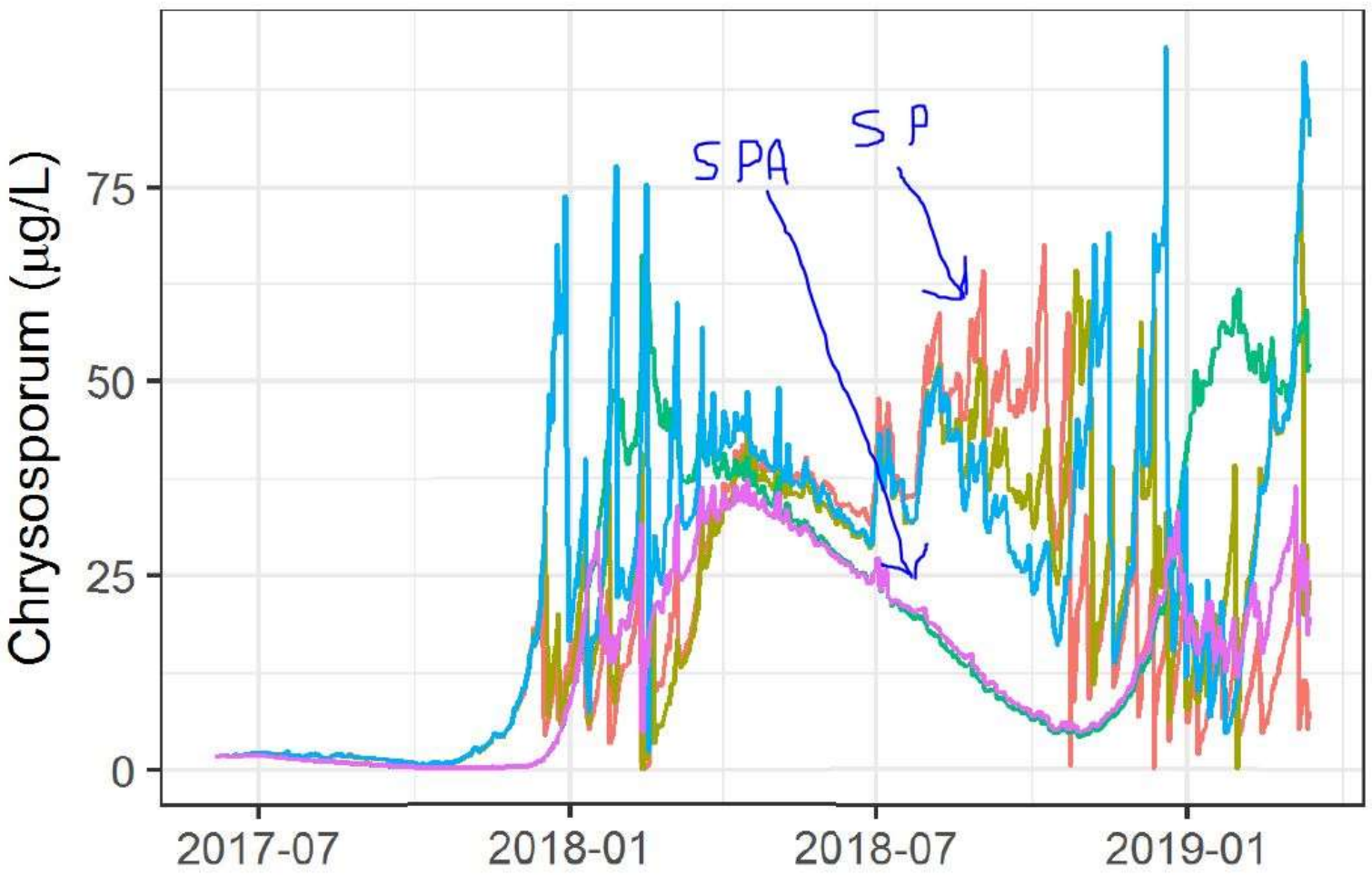
- duration of the bloom reduced from 9 months to 6 months.
- Impossible to conclude whether this change was a response to Phoslock

**Information Taken from Griffith Report*

FOUR POSSIBLE OPTIONS INVESTIGATED

1) aeration with bubble plumes to mix the water column (150 L/s)
2) Use of Phoslock™ and sand capping to reduce phosphorus release from bottom sediments to 30% of base case
3) Use of Phoslock™ to reduce phosphorus release from bottom sediments to 60% of base case
4) all three options in tandem, where the Phoslock™ would be applied to mop up residual phosphorus from the water column and any that persisted in the sediment layer after capping.

**Information Taken from Griffith Report*



Scenarios

- current state
- capping to 30% of release
- capping to 60% of release
- mixer: diffuser with 150 L/s
- combination: mixer and capping

SPA - Sand Capping, Phoslock and Aeration
SP - Sand Capping and Phoslock

**Information Taken from Griffith Report*

RECOMMENDED ACTION

- Of the scenarios tested with the model, the use of sand capping combined with PhoslockTM gave the greatest reduction in *Chrysosporum* blooms, but only after about 1.5 years.
- Therefore, based on the modelling, a trial with sand capping, monitoring its effectiveness, then following up with PhoslockTM seems the most promising management approach

**Information Taken from Griffith Report*

FURTHER TESTING REQUIRED BEFORE ANY ACTION PLAN IS DEVELOPED AND IMPLEMENTED. NO PLAN AS OF YET.

Areas Needing Further Testing/Research:

- Test the effect of salinity in limiting or preventing growth and bloom formation of Chrysosporum (found that growth did not slow at 50% seawater)
- Undertake small scale experiments with sediment cores and sand application (5-10 cm bottom layer) This will test whether sand will sink below the sediment
- Model predictions would be improved through better knowledge of the volume and composition of inflows, i.e., the saline groundwater intrusion and the stormwater inflows.
- 5 Ground water bores testing groundwater.

**Information Taken from Griffith Report*

ISSUES WITH AERATION

- aeration (alone) in scenario differed from the base case at times, with a reduction in *Chrysosporum*, but this was not consistent.
- aeration led to considerably higher concentrations of other non-toxic algal species (e.g., diatoms), so that the water may still appear green although surface blooms may be less prevalent.
- aeration will mix nutrients in the bottom waters into the surface waters, where they will be more available for algal growth
- Rotten egg gas smell from anoxic water coming to surface.
- Possible fish kills with sudden change in lake.

**Information Taken from Griffith Report*

POSSIBLE SOLUTIONS TO AERATION NEGATIVE EFFECTS

- Aerate for minimum time initially. 1 hour per day?
- Time aerating with windy conditions to disperse possible smell?
- Turn on aerators next lake exit to reduce effect (clarified later)?
- Time Phoslock treatement with aeration to limit algal growth?

**Views of the LHM Care Group*

LHM CARE GROUP CONCERNS

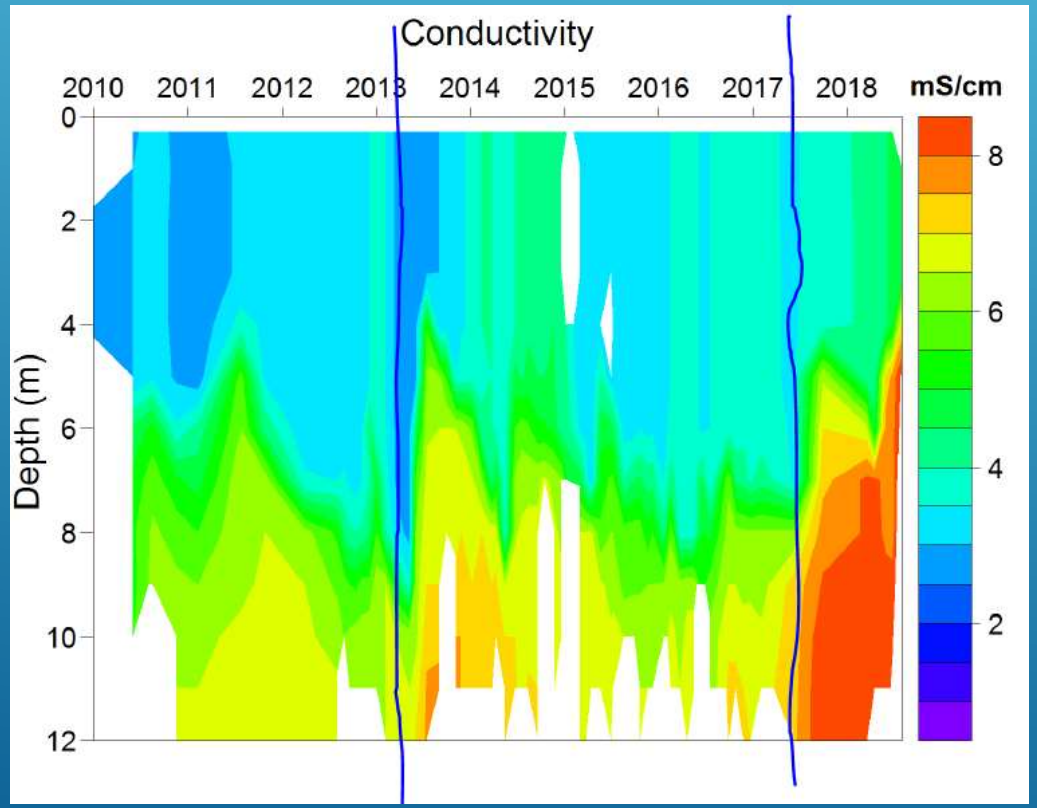
- Confirmation of timeline to run appropriate tests. How long before action?
- Concern over extended delays to test inflow of canal salt water. No more king tides this year so is testing delayed until next year?
- 10 Months of bore water testing –why no results?
- No mention or consideration over significant loss of underwater aquatic vegetation.

  Statement- There can be no lake recovery without underwater aquatic vegetation. Do you agree?
- Received verbal confirmation of plant loss due to salt increase. What is the plan for aquatic plant recovery?

**Views of the LHM Care Group*

HISTORY OF PLANT LOSS

- Plant loss reported to Council in Dec 2013.
- Recovery over the next few years but struggling to grow.
- Another loss in approx. 2017 (difficulty to pinpoint due poor visibility with algal blooms)

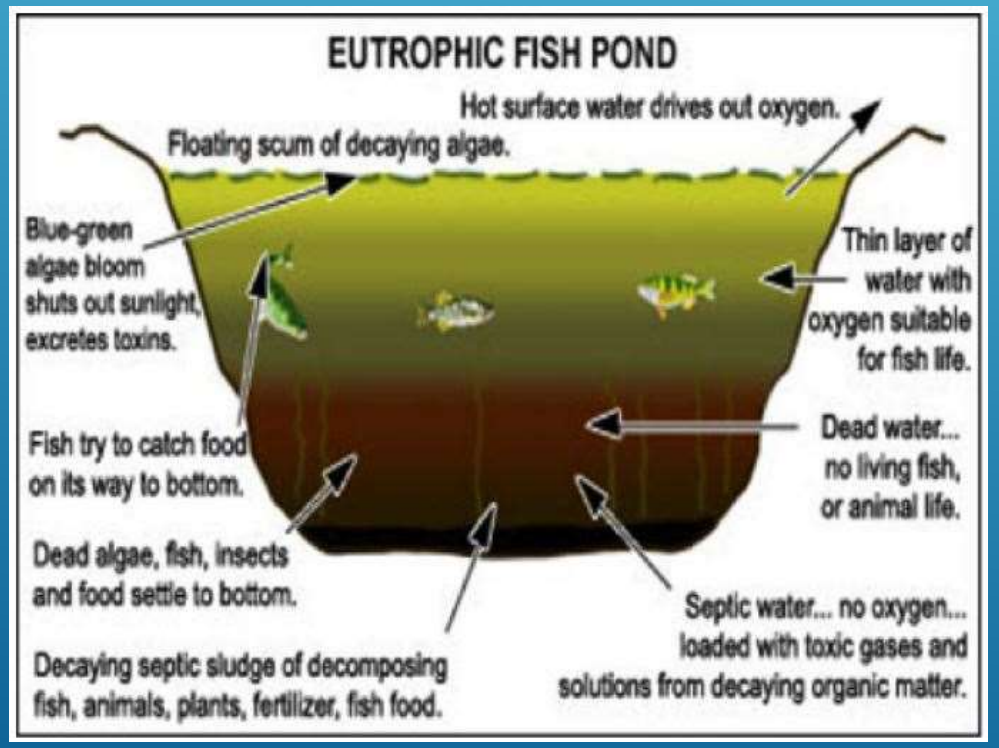


Approximate High Rainfall Events

- Increase in salt and reduction in water quality favouring sporadic growth of Pricky Water Nymph.
- Highly undesirable in a swimming lake- wire like fronds and clumping growth to surface.
- Nutrient recycling far less that original blanket cover.

*Views of the LHM Care Group

- Proposed treatment will have NO effect on the serious stratification issues.
- Over half the lake volume on the west side has no oxygen – dead.
- No recycling of nutrients leading to ongoing increase anoxic water and gases.
- No water circulation. Salt water entering the lake sinks to the bottom, fresh water straight to exit without effective lake flushing.
- Major fish fills if lake flips.
- What action is planed to resolve stratification issues?



*Views of the LHM Care Group

- All models and testing are on the West side of the lake. Considering the East side of the lake has the majority of users, why no consideration of this area?
- Issues with aeration are associated with the stirring up of high nutrients in deep areas of the West Lake.

  Question?: Why has aeration not been considered as an option in the East Lake, which does not have these high nutrient issues?
- Considering cost constraints and reduced bottom sediments, will the East Lake receive sand capping or just the West Lake that has the considerable nutrient issues? If sand is not applied to the East Lake, there will be NO improvement to the current condition, other than a future Phoslock top up that has had little evidence of success so far.

*Views of the LHM Care Group

AERATION BENEFITS TO BE CONSIDERED

- Test case –What if aeration was installed in the last rain event in 2017?
- Lake height 74 cm above overflow. This water exiting **the rear lake only** equals **92,000 cubic meters**.
- Model indicates aeration increases salt in surface water by 50% -This results in a significant reduction in Salt through the outflows!
- Circulation of bottom nutrients to surface would also mean a significant removal of nutrients –no other option can deliver nutrient removal !
- Many missed opportunities to reduce salt and nutrients in past high rainfall events.

**Views of the LHM Care Group*

POSSIBLE AERATOR TRIAL

- Can be turned on during lake overflow to minimise negative effects.
- Minimal impact while testing due to location- nutrient upheaval restricted to small area, and then transported to adjacent overflow drain.

*Views of the LHM Care Group

COUNCIL REVIEW ON REMOVAL OF REED BEDS

> Although our study did not directly examine floating reed beds in LHM, we also believe that given their biomass, they are insufficient to have any significant effects on reducing nutrient levels in the system. The consultants, GHD (as consultants for City) also concluded that removal of FRBs from this system would not reduce water quality.

**Information Taken from Griffith Report*

- Reed beds are now an important habitat for wildlife that is severely lacking.
- Removal while wildlife is suffering due to the poor condition of lake is unacceptable.
- Consideration of small refuge island in lieu of reed bed removal (with positive feedback from community consultation).

**Views of the LHM Care Group*

LAWN VEGETATION STRIP TO PREVENT RUNOFF

Griffith Study of Management Options report recommends reestablishment of Riparian vegetation. A 2 m strip located as close to lake edge and in problem areas of parks should be considered.

- Council not willing to mow with catcher due to cost.
- Can be trimmed when height preventing view of lake (safety issue).
- Nil/Low initial cost. (compared to mowing with catcher).
- Quick results.
- Cost effective.

**Views of the LHM Care Group*

PARK WORKS ON NON URGENT AREAS

- A clear need to prioritise improvements in areas that make the most difference.
- Why no review of Catchment Management issues?

*Views of the LHM Care Group