

## **TAG Water Quality Minutes**

**16 October 2014**

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**BOPRC- Te Wai Ariki Room**

**1125 Arawa St.**

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**Chair:** Andy Bruere (BOPRC)

**Present:**

- NIWA: Max Gibbs, Chris Palliser, Piet Verburg, Kit Rutherford
- BOPRC: Paul Scholes, Niroy Sumeran (after lunch only)
- UoW: David Hamilton, Warwick Silvester, Chris McBride, Aroon Parshotam
- Lochmoigh: John McIntosh
- RDC: Allison Lowe (Late)
- Scion-Brenda Baillie
- DairyNZ- David Burger
- Other: Gloria Zamora

**Apologies:** Clive Howard-Williams, Rob Donald, Alastair Suren, and Paul White

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### **Action Summary for this meeting (To be completed)**

- Item 2(a) Howard-Williams and Hamilton: to finalize lake internal loads report by February 2015.
- Item 2(a) Andy Bruere: to add NIWA BOP Lake internal loads report to next WQTAG agenda.
- Item 2(a) Andy Bruere: to add Rotoehu de-stratification report to Sediment TAG.
- Item (2b) David Hamilton: to run model on Lake Rotoiti to see what will happen if the Ōhau Diversion Wall is removed.
- Item (3b) David Hamilton: to complete work for Rotokakahi and forward final monitoring information to Ian Kusabs, for further progression.
- Item 3(c) David Hamilton and Max Gibbs: to discuss INCA model potential implementation.
- Item 4(a) Paul Scholes: to begin to document any analytical changes in regards to TLI.
- Item 4(a) Paul Scholes & Chris McBride to go back through all raw data on Lake Tarawera and take it to conclusion.
- Item 4 (a) Andy Bruere: to circulate Tarawera phosphorus numbers. Need re-analysis across all the lakes to give more confidence. The contract with NIWA and UoW to update each lake nutrient budget will produce the whole programme analysis.
- Item 6(b): Aroon Parshotam: to gather facts ON SWAT project on Whakarewarewa and make sure key facts are in general terms; Kit Rutherford will compile the history bullet points and reviewed by David Hamilton.
- Item 7(a): Andy Bruere: to circulate report on Rotorua Modelling project for N & P and Alum impact for comment from TAG before finalising.

- Item 9(a) Andy Bruere: to add aquatic weeds and Lake SPI to next WQTAG meeting agenda.
  - Item 10(a) Andy Bruere to add David Burger report on Rerewhakaaitu to next WQTAG meeting agenda.
  - Item 11(c) Paul Scholes: to finish report on Okawa Bay weed spraying.
  - Item 11(e) Paul Scholes: to circulate plots with oxygen, Secchi etc. for Lake Tarawera to WQTAG.
  - Item 11(f) Paul Scholes to get pH logger; if it is a viable mechanism we look to how to incorporate in Okawa Bay and Otautu
  - Item 11(f) Andy Bruere to send data for Daphnia galeata for Piet Verberg to WQTAG.
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### **Item 1: Welcome & Apologies Andy Bruere**

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### **Item 2: Matters arising from last meeting- All other agenda items from previous meeting were completed.**

- a) Howard-Williams and Hamilton: NIWA BOP Lake internal loads report update
- Meeting held a few weeks ago to define the work that needs to be done and NIWA will be revising the proposal to determine load estimates from each lake, internal loading, gross loading, and volume outflow rate to aid in the report finalisation.
  - Will be an extension/revision of existing draft report.
  - NIWA and UoW will need to agree on the data sets as much of the previous work is outdated and it is important to document which data info will be used to calculate.
  - Report to be delivered end of February 2015.

**ACTION:** Andy to add NIWA BOP Lake internal loads report to next WQTAG agenda.

**ACTION:** Howard-Williams and Hamilton to finalize Lake internal loads report.

- McBride: Report back to next TAG with completed report on Rotoehu De-stratification
- This report has been deferred to next TAG Meeting
- Plan is month on, month off approach and doubling the airflow.
- Machine will be stationed next to monitoring buoy. Presentation of initial information will be via Sediment TAG.

**ACTION:** Andy to add Rotoehu de-stratification report to Sediment TAG.

- b) Hamilton Run Rotoiti model to determine the effect of weed spraying in Okawa Bay

**ACTION:** Hamilton: Run model on Lake Rotoiti to see what will happen if the Ohau Diversion Wall is removed.

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### **Item 3: Model Updates**

- a) Rerewhakaaitu- David Hamilton

- Report is nearly finished.

b) Rotokakahi – David Hamilton

- There is still a lack of understanding to the historical logging activity that has occurred around lake.
- Lake has gone through a lot of change and there is no info on stream flows at this time.
- Maybe too late to establish a monitoring regime
- DO measurements are very low and 75% of saturation in surface waters.
- Hamilton- it is hard to believe the numbers to have such low saturation. A lot of work needs to go into better quantifying the variability.
- Recommendation: that Council do some monitoring.
- Need to figure out how much detail around logging history to use to make some assumptions on what the P input was when the forest was harvested.
- Mc Bride- the scope was only to develop a model.
- Generally agreed by members of WQTAG that there is some uncertainty on the recommended requirements.

**ACTION:** Hamilton to complete work for Rotokakahi and forward final monitoring information to Ian Kusabs, for further progression

c) Ōkaro catchment modelling (David Hamilton/Ryan Mallet)

- An update was given on the detention bund project
- Background of INCA model
- Discussion of model scenarios

**ACTION:** Discuss INCA model potential implementation (Max and David)

d) Tikitapu report (Chris McBride)- THIS WAS TAKEN OFF THE AGENDA and will be added to next meeting when it is finalised.

e) Tarawera nutrient target and nutrient budget (Chris McBride ) see report circulated.\*\*

Note since meeting this report has been updated and will be brought back to the TAG at a later stage.

- Update given by DH
- Other lakes connected by groundwater (directly or indirectly) include Ōkātina, Ōkāreka, Tikitapu, Rotokakahi, Rotokawau, Rotomahana, Rerewhakaaitu
- Septic tank nitrogen reduction much lower than first thought from inner catchment
- It was noted that with high natural levels of P, it will be a challenge to gain additional reductions.

**Item 4: Ground water**

a) Tarawera update progress- Andy Bruere

- Ground water model development is due for completion in mid-2015
- Discussion on original TLI target (was it appropriate?)
  - i. In '94, the TLI was 2.6 this was adjusted to adapt to the change in Secchi depth method. Now TLI is 3.0.
  - ii. David suggested a review of the inflows and then a discussion on what the most accurate method to determine TLI would be?
    1. Target TLI may need to be adjusted. It will depend on how much confidence there is from the TN and TP data from the 1990s.
    2. We have to have documentation of any analytical changes so that the record of nutrient analysis is understood.
  - iii. There was discussion as to documentation of methods so that they can be re-run.
    1. Need to identify where all the P is coming from and options to remove it from the lake catchment.
  - iv. McIntosh advised that Paul White considered an extra 4 m<sup>3</sup> flow via groundwater to the outlet.
  - v. Need a chance to go back to the raw data and be thorough from taking it from raw data to conclusion.

**ACTION:** Paul Scholes: begin to document any analytical changes in regards to TLI.

**ACTION:** Paul S & Chris M to go back through all raw data and take it to conclusion

**ACTION:** Circulate Tarawera phosphorus numbers (Andy). Need re-analysis across all the lakes to give more confidence. The contract with NIWA and UoW to update each lake nutrient budget will produce the whole programme analysis.

#### **Item 5: Alum dosing protocol update**

- a) Update on Rotorua and Rotoehu alum dosing- Niroy
  - Rotorua
    - i. Currently sitting at the dosing rate of 130 litres/hr
    - ii. Prior to alum dosing there were very high P fluctuations in Lake Rotorua
  - Rotoehu
    - i. Currently dosing at the maximum amount of 45 litres/hr, Limited to this dose rate due to limited stream dilution available under summer flows.
    - ii. Lake is 1/10<sup>th</sup> size of Lake Rotorua and are dosing 1/3<sup>rd</sup> of alum and TLI is nearly to our long term target.
- b) Review the Rotoehu target? (Andy)
  - Given that we are near target: should be adjusting the protocol target?
    - i. Mc Bride advised that currently TLI is at 3.94 which is about 18 ppb and action plan says 34 ppb.
    - ii. McIntosh advised that the TLI should be on a controlled protocol. The goal is **not** to make the lake solely P limited.

- iii. If we have achieved our level (below N and below P), why do we want to go any lower? TLI will potentially drop and community will set that as its new standard.
- iv. DH- if alum turns off in 5 years and we are not at equilibrium level that works with the land use change that has already been done then will be disappointments
- v. CMB- what you are saying natural state of lake is a low N:P ratio.
- vi. If the lake has met its TLI, why don't we turn off the alum? Or do we turn it down? Do we adjust the target 25-30 ppb for TP.
- vii. McIntosh advised to lift the protocol up to the 20-25 ppb and look at it at the next TAG meeting.
- viii. **Advice:** to change the protocol target range for TP from 20-25 ppb.
- ix. It was noted that the TLI doesn't respond quickly so you can't use it in a reactive way.
- x. Why is total P lower than the same period this year (13-14)?
  1. Belief is because the weed harvester released P by disturbing the bottom sediments as it recovered the weed.

#### Item 6: Rotorua sewage update

##### a) RDC sewage steering committees (Andy)

- Rotorua sewerage committee have had some issues around irrigation in the forest and have negotiated to be out of forest by 2019.
- There are 3 options being looked at: back to lake, piped out to the Kaituna, discharge to Puarenga.
  - i. UoW has been asked to put a proposal to RDC to look at options. However; given the delivery timeframe of Dec. 10 for community consult and Feb 15<sup>th</sup> for the final decision, it is more likely this can be completed by beginning of May.
  - ii. Rotomā /Rotoiti- still 3 options on the table that involve reticulation and there is a CIA being done by the iwi collective and decision has been delayed until Feb. 2015.
  - iii. RDC had no commitment at this point to reticulate Tarawera. Still sitting with the lakes community board and awaiting the Tarawera Action Plan.

##### b) SWAT project on Whakarewarewa (David Hamilton)

- A Draft report has been delivered to Alison Lowe and Andy Bruere.
- Around 30% of nitrate is removed in the forest.
- Blocks are irrigated differently to have better outcomes, some more and some less depending on the soil. Graph shows that P levels leaving the site increase during forest harvesting periods.
- SWAT model is comprised of the following: Land use, soil, slope, management practices, profiles of different soils and climate.
- Rutherford suggested that the WQTAG panel make a statement on land irrigation and the waste irrigation, a simple statement of information, i.e., This is what is

coming out of sewerage to lake currently. There is ongoing work which suggests that land irrigation maybe optimized.

- An MOU was signed between RDC and central north island iwi partners to get the irrigation out of the forest by 2019.
- **Advice:** start point would be to speak to the Chairman of the BOPRC and RDC first.

**ACTION:** Step 1- Aroon to gather facts and make sure key facts are in general terms; Kit Rutherford will compile the history bullet points and reviewed by David Hamilton.

- c) Sewage TAG (Alison)- covered above
- d) N isotope work progress (Warwick), deferred to next meeting as Warwick absent.
- e) Discharge location modelling for the RDC TAG (David) to be progressed with RDC and the Sewage TAG

#### **Item 7: Rotorua Modelling project for N & P and Alum impact- David Hamilton**

- a) A Draft report was delivered by David Hamilton
  - If you want any higher than 435 tN then you will have to manage P intensively and aggressively.
  - Questions to consider:
    - i. How much P control is needed in catchment?
    - ii. What N & P combos to meet the TLI?
    - iii. How much of that P comes from sources that we can manage?
    - iv. What combination of N and P loads follows from David's work?
  - Proposed alternative strategy: Alum dose every 5 years.
  - Calibration period was from 2001-2004 and was validated 2006-2007.

**ACTION:** Andy Bruere to circulate report for comment from TAG before finalising.

#### **Item 8: Nano-bubble trial**

- a) This item was referred to SAG

#### **Item 9: Aquatic weeds and Lake SPI**

- a) The position paper for this is on hold until next WQTAG meeting.
  - b) **Advice:** A position statement will be written after the symposium.
- ACTION:** Andy Bruere to add aquatic weeds and Lake SPI to next WQTAG meeting agenda.

#### **Item 10: Rerewhakaaitu**

- a) Plan to get high-frequency buoy in Lake Rerewhakaaitu
  - Early November winch will go in and buoy will most likely be in before end of year.
  - David Burger to bring report to next WQTAG meeting on Rerewhakaaitu farmers projects.

**ACTION:** Andy Bruere to add David Burger report to next WQTAG meeting agenda.

#### **Item 11: Detainment bunds verification**

**ACTION:** John Paterson to circulate report on detainment bunds verification around. This should include general conclusions on potential P reductions per Ha, if possible to extrapolate.

#### **Item 11: Other Business**

a) Land TAG update

- Land TAG had its first meeting 8 October 2014 and has a second meeting 26 November. Mainly introductory material about the lakes programme.

b) SAG update (Andy)

- Andy mentioned that they going to take the Nano bubbles to SAG and discuss the timing of the next Ōkaro Alum dose, Rotorua benthic chamber work and sediment core efflux for Rotorua and Rerewhakaaitu.
- SAG hasn't had a meeting recently.

c) Weed spraying Okawa Bay (Paul Scholes)

- Indicated: 80-day window most nutrients released after spraying. Most of the P was in the biomass. 56 kg P in water column, 2 hectares sprayed around 21 kg P released in 80 days.

**ACTION:** Paul Scholes to finish report on weed spraying.

d) Inter-lab comparison progress (Paul Scholes)

- **Advice:** Message to labs should be 'we accept you have detection limits but result of the analysis should also be available and the record should clearly show what protocol was used in the database.'
- Problem is if value is less than detection limit it may get handled in one of several way; divided in two, write the detection limit or simply enter number as analysed.
- Lakes TP and TN show same pattern.
- Potential actions:
  - i. Laboratory to correct data at detection limits to actual data where possible.
  - ii. Run duplicate analyses of older methods with current FIA
  - iii. Problems sourcing someone to run old method and equipment.
  - iv. Won't solve the variation in the data but might give more continuity with average annual data.
  - v. Leave as is and explain changes as required.
  - vi. Numerical solution may be possible?
- CMB- First note when changes in methodology occurred.
- **Advice:** Duplicate testing has to be done #i, ii, and last resort iv

e) TLI report 2013/14 (Paul Scholes)

- Ōkaro- best reduction seen in long time. 7 metres clarity. Blooms earlier in year but went away quickly.
- Rotorua- lower ammonia concentrations.
- Rotoehu- best clarity in a long time.
- Rerewhakaaitu- decrease shown
- Ōkāreka- stable
- Tikitapu- stable
- Ōkātina- decreasing
- Tarawera- reasonably stable there is an increase in P
- Rotomā: stable minor fluctuation in TP
- Rotokakahi- 3 component TLI- doesn't have secchi.
  - How was target from Rotokakahi set?
    - Set by information from the 1990s.
  - Rotomahana is 3.9 and Rotokakahi is 3.2

**ACTION:** Paul S to circulate similar plots with oxygen, Secchi etc. for Lake Tarawera

f) Max Gibbs:

- Gibbs suggested there may be an edge-water pH effect due to photosynthesis by weed beds. He suggested to measure pH at peak of the day at 2 pm. Good testing sites would be Lake Ōkaro and Otautu weed beds.
  - i. When you get above pH 9.5 de-nitrification is stopped and ammonium released from the sediments is converted to toxic ammonia and the water can become toxic. When you have weed beds you can in turn have fish kills on the lakes edge.
- Possible mechanism to get pH loggers
- It is now peaking and ammonia is starting to be produced
  - i. Possible mitigation action is to harvest the top of the weed to reduce the rate of photosynthesis.
- It occurs in shallow zones first; however it can affect the whole lake, especially in shallow lakes.
  - i. Hypothesis is that high pH can cause iron-bound P release from sediments in the shallow edge waters and stimulate cyanobacteria growth. This is where the algal bloom is first seen and may have been mistakenly thought of as a wind drift rather than where the bloom begins.

**ACTION:** Paul to get pH logger. If it is a viable mechanism we look to how to incorporate in Okawa Bay and Otautu

- Piet Verburg- 7 out of 12 lakes have *Daphnia galeata* present (an invader which arrived in NZ between 1995 and 2000 and so far only found in the North Island).

**ACTION:** Andy Bruere to send data from Piet around.

Meeting finished at 4.45pm