# NOTES: WATER QUALITY TECHNICAL ADVISORY GROUP, 08 MAY 2018

*Bay of Plenty Regional Council – Te Wai Ariki, 1125 Arawa St, Rotorua, 9:30 am*

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**Chair:** Andy Bruere

**Present:** Troy Braisden, David Hamilton, Kit Rutherford, Tom Stephens, Kim McGrouther, Jo Butterworth, Michelle Lee (10:30am -12pm), Clive Howard-Williams (9:30am – 3:30pm), Keith Hamill, Annabella Vidal (10:00am – 12:00pm), Chris McBride, Alison Lowe (12:15pm onwards), Paul Scholes, Alastair McCormick, Rob Donald, Nicki Douglas (3:30pm)

**Scribe**: Abby Harding

**Action Summary:**

*Action 1 – Item 2(1) - Andy Bruere to follow up with one pager that went through Warwick Murray and the response from OVERSEER with solutions to points that are outstanding and circulate the one pager amongst the WQTAG.*
*Action 2 – Item 2 (7) - David Hamilton to discuss funding for Takiwa within the Lakes380 programme. (Completed)*
*Action 3 – Item 2 (9) – Andy to provide Nanobubbles reports to be circulated amongst WQTAG.*
*Action 4- Item 3b – Andy B/ David H to produce a one page executive summary of climate change statement document*
*Action 5 – Item 3b – Michelle Lee to provide link to the document open for submissions.*
*Action 6 – Item 3b - David Hamilton to add impacts with stratification on fauna (e.g. koura) and toanga species around how they may be affected by climate change and increasing surveillance for exotic species and the increased biosecurity risk*
*Action 7 – Item 4a – Max Gibbs/ Clive Howard-Williams to run some calculations on the influence of macrophyte decay on oxygen levels in Lake's Ōkāreka and Rotoiti.*
*Action 8 – Item 8 - Alison Lowe to coordinate a working group to look into water policies around volumes entering the WWTP.*
*Action 9 - Item2 (10)-Sediment TAG to address modelling actions for Ōkaro and Rotoiti.*

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**Item 1: Welcome, apologies and minutes**

Welcome to Tom Stephens. Tom will be covering for David Burger in the WQTAG.

**Apologies:** Piet Verburg, Warwick Silvester, Nicki Douglas, David Burger

**Item 2: Actions from previous session (11 DEC 2018)**

| Action No. | Action point | Action or person responding |
|---|---|---|
| 1 | Invite Caroline Reid to next TAG | *Andy (on hold)*<br><br>*WQTAG has previously met with Caroline.*<br><br>*Two things need to be discussed before Caroline comes to a WQTAG meeting:*<br>• *Revisiting the wetland module within overseer*<br>• *Simon Upton to do a review of Overseer – how can we review overseer in the environmental management field*<br><br>*Simon Upton is trying to find solutions to any issues with overseer. It is important that it is used in comparative manner which the OVERSEER team seem to have a handle on.*<br><br>• *Questions raised around issues not being followed up or outcomes being met following the last meeting with Caroline Reid etc. The strategy to address shortfalls and openness around the code came up in the meeting but still need to hear back what came of this. These discussions are being had throughout the country. It would be best to get a statement from overseer on their modelling solutions.*<br>• *Discussion around cloud based platform which is coming out May/June. From this time next year farmers will need to subscribe to OVERSEER. Decision made to wait for a statement from OVERSEER on this.* |
| 2 | Andy Bruere to follow up on Grant Tempero's phytoplankton limitation proposal as to whether it has been finalised (PC10). | *Completed* |
| 3 | Circulate brief of what work modules people are doing in relation to the requirements of the Science Review Terms of Reference (timeframe mid-late January). | *Completed*<br><br>*The brief has been reviewed by Warwick Vincent. A workshop will be held around July with the review being circulated before then.* |
| 4 | David Hamilton to provide Queensland WQ Network Good Modelling practise Document for circulation to TAG. | *Completed* |
| 5 | Joe Butterworth to pass Paul White's contact to Te Arawa Lakes Trust to help provide details of Waiotapu Lakes Management | *Completed* |
| 6 | Paul Scholes to look at nutrient analysis issues with respect to testing the made up samples, compare filtration and approach laboratories to notify regarding issues, add nitrogen samples to the comparisons, and, include the Rotorua Lakes Council lab in the comparisons. | *Paul Scholes*<br><br>*The laboratories are doing a suite of testing. The first round has come back good but they have identified a TP DRP problem and believe that silica may be interfering. N aligned really well. Silica very high in Lakes Rotorua and Rotoiti but low in Lake Tarawera where there are issues with results. Discussion around* |

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| | | *arsenic potentially interfering with results, it was concluded that arsenic is already accounted for in the current testing. Suggestion of diluting out the silica to reduce the threshold.* |
| 7 | Troy Baisden concerned how they may be able to develop the Takiwa project funding and take the software forward. How can farming and community engagement be included? | *Takiwa was demonstrated at the previous meeting. (Closed item)*<br><br>*The Takiwa funding is finished. UoW need to think of ways to keep this software used and going. Who will be using this tool? Can we link in the Māori ownership layers?*<br>*Suggestion of tying in with the Lakes380 programme or using the Tarawera connectivity as an example.*<br><br>*Lakes380 is a 5 year programme to get baseline data for lakes before monitoring started. It is already in progress.*<br><br>*Questions as to whether funding is available in Regional Councils. Regional Councils already fund LAWA and may ask why Takiwa is not included in LAWA. Takiwa and LAWA have different audiences. What can Takiwa be used for in the Rotorua Lakes?* |
| 8 | At the next Sediment TAG meeting discuss Alum dosing options for Lake Rotoehu. | *See Agenda Item 9a* |
| 9 | Provide information on MicroNano bubbles to next TAG from Max Gibbs or the Auckland suppliers. (Andy). | *In progress.*<br><br>*Andy to talk to Max or the suppliers in Auckland. Quotes have already been obtained.*<br>• *Two Lakes costed were Lake Tutira and Lake Hayes*<br>• *Lake Hayes quoted $4.5 million*<br>• *The micro-nanobubbles stop phosphorus release by oxygenation of the bottomwaters.*<br>• *The bubbles are generated through the walls of a ceramic cone. They may be small enough that they are not buoyant and sink to the bottom where they are said to stop phosphorous release and oxygenate the hypolimnion.*<br>• *The largest issue is that if power is cut at all the generator cone needs to be removed for 7 days for it to dry out.*<br>• *Running costs are unknown at this stage. The structures do need continuous power supply so may need to put in additional infrastructure.*<br>• *Approximately $30-50K to run (estimate from literature)*<br>• *Currently used in Japan to control cyanobacteria in a harbour. They have never been used in a lake.*<br>• *Suppliers are in the early stages of testing equipment out on sewerage circulation.* |
| 10 | Andy Bruere to add Lake Ōkaro and Rotoehu to the next Sediment TAG Agenda - Discuss options around how Ōkaro can be managed and include the catchment and lake | *Ongoing item. Matt will be doing some modelling on this.* |

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| | modelling that Mat Alan is doing. | |
| 11 | Max Gibbs to scope a project to determine where the sediment source is for the Waitetī Stream. | *Discontinued* |
| 12 | David Hamilton to provide Jamie Puryer-Fursdon and Jonathan Abell's sedimentation research for circulation to the TAG. | *Completed* |
| 13 | David Hamilton to prepare draft paper on climate change and identify main points which can be taken to the councillors. This will form the next TAG statement on climate change and we will circulate it for TAG comment before the next TAG meeting. | *See Agenda item 3b.* |
| 14 | Andy Bruere to Invite Michelle Lee to the next WQTAG meeting to discuss climate change mitigations. | *Completed. See agenda item 3a.* |
| 15 | Alastair MacCormick to distribute report (Evaluation of options for nutrient reduction in Rotorua - Jo McQueen, Wildlands) for comment. Look at bringing in alignment with P. Put a table of the evaluation in the introduction (shift all of the rejected options into an appendix). | *Completed.*<br><br>*See agenda item 8.* |
| 16 | Alastair MacCormick to distribute Tarawera conceptual plan Excel model to the TAG. | *Completed* |
| 17 | Alastair MacCormick to talk to Troy regarding assistance from student for the Tarawera conceptual plan project. | *Troy/Alastair to discuss later* |
| 18 | Andy Bruere to add items to take to the next Sediment TAG Agenda: Lake Ōkaro, Lake Rotorua Sediment report and Lake Rotoehu. | *Andy to discuss at next Sediment TAG* |
| 19 | Project for the future: Update the Lake Rotoiti model to include inflows into the lake from leakage through the wall or with the wall removed. | *On-hold. Related to item 20 below.* |
| 20 | Andy Bruere and Troy Baisden to discuss options for creating a gate in the Ōhau Channel Wall to aid in aeration of the lake bottom waters at times. | *(On hold) need to undertake Rotoiti modelling first and assess $O_2$ depletion.* |
| 21 | Andy Bruere and Jo Butterworth to discuss water quality management around Lake Rotomā and other lakes. | *Completed* |

**Action 1 – Andy Bruere to follow up with one pager that went through Warwick Murray and the response from OVERSEER with solutions to points that are outstanding and circulate the one pager amongst the WQTAG.**

**Action 2 - David Hamilton to discuss funding for Takiwa within the Lakes380 programme.**

**Action 3 - Andy to provide Nanobubbles reports to be circulated amongst WQTAG.**

**Item 3: Climate Change**

**a) Climate Change in the Bay of Plenty**

*Powerpoint presentation given by Michelle Lee*

- Warmer climate expected in the Bay of Plenty Region
- The intensity of rainfall is what is of largest concern
- Concern for infrastructure and community resources
- Questions raised around the impacts of climate change on land use in relation to the lakes. Suggestion of adding Land Use impacts to David Hamilton's paper discussion.

**b) Paper Circulated (David H)**

*Discussion around the **"Statement on climate change, lakes and water resources, Rotorua Region"***

- The paper could be simplified as the terminology may not be quite right for the general public.
- Decision made to create a one page executive summary for the public and add more in depth information to David's paper.
- "Point 3: Rotorua is in a region of moderate rainfall, with climate change projections indicating small increases in annual rainfall intensity based on dry regions of New Zealand becoming drier and wet regions becoming wetter. Seasonality of rainfall is expected to change, reinforcing wet seasons (winter-spring) and dry seasons (summer-autumn), and there will be increased frequency of extreme (e.g., 1-in-100 year return period) rainfall events. The frequency of large-scale climate oscillations like the El Niño-Southern Oscillation (ENSO) may be altered by climate warming."
    - The distribution of rainfall is going to be vital in the Rotorua Areas
    - Are the record rainfalls climate change or random weather events?
- Cyclones appearing further south suggest unusual change in weather patterns.
- Current weather patterns could be a precursor for what is to come in future years.
- A council that is well prepared will be making a lot of investment into the future.
- John Paterson's detainment bunds could be used to mitigate issues in point 8 (see below). They held up well in last week's flood events. However, the overflow structures may need to be reinforced to account for large quantities of water.

  "Point 8: Floods increase sediment erosion and losses of particulate phosphorus. Their effect on nitrogen delivery is more variable but increased losses are also expected. Complicating factors include: how additional atmospheric $CO_2$ stimulates plant production and nutrient uptake; increased plant growth and microbial degradation rates from rises in temperature; and interactions of temperature with dissolved organic carbon delivery."
- Erosion due to lake level may be important too not just erosion on land
- Point 9 and 10 are important things that council may need to be more aware of and need to be highlighted. Targets will be more difficult to obtain with climate change.

Example of Lake Taupō given large deep lakes may have prolonged stratification. This would be confined more to Lakes with an oxic hypolimnion such as Taupō. Result in poor fish yields. Rotorua lakes probably don't fit the same mould except Rotomā and Tarawera. Annabella Vidal is currently implementing the New Fresh Water Policy statement. She is doing a stock take on what the state of the environment is and looking into Points 9 and 10 in particular.

"Point 9: The effects of climate change on lake ecosystems may be profound due to increased water temperature and vertical stratification. Shallow polymictic lakes (Rotorua, Rotoehu and Rerewhakaaitu) are most vulnerable because a warmer climate will bring about large relative increases in the duration of deoxygenation of bottom waters, leading to greater nutrient release from bottom sediments and stimulating algal growth. The deeper monomictic lakes will have longer periods of seasonal stratification but relative increases in duration of stratification will be smaller than in polymictic lakes."

"Point 10: Cyanobacteria (blue-green algae) have a number of physiological adaptations that provide them with a competitive advantage over other phytoplankton in a warming climate. For a given nutrient concentration it is likely that there will be increased incidence of blooms and toxin production by cyanobacteria. There are likely to be other 'winners' and 'losers' amongst the flora and fauna of aquatic systems under climate change. Several noxious alien invasive species (catfish, certain weed species, mosquito fish) are native to sub-tropical and tropical regions, and risks of their spread and growth are more likely in a warming climate. Increased surveillance, control and eradication efforts are likely to be necessary for these freshwater invaders. Conversely, habitat of trout may be diminished.

- Impacts on cultural values need to be taken into account i.e. taonga species in this area (to add to point 10)
- Biosecurity on both land and water needs to be taken onto account.
- Questions raised around how the regional council is leading the way in Eco solutions (e.g. electric vehicles). Eco solutions will be looked into as part of the climate change action plan.
- In terms of BOPRC assets and resources, in a 2006 survey the highest energy use was in the pumping stations (diesel and electricity). There is potential for this usage to get a lot worse.
- Nationally, all councils are in the process of creating climate change action plans
- There is a Productivity Commission's draft report on transitioning to a low–emissions economy now available for submissions
- Troy Braisden also suggested reading his blog which discusses the above report around a low emissions economy

**Action 4 - Item 3b – Andy B/ David H to produce a one page executive summary of climate change statement document**

**Action 5 – Item 3b – Michelle Lee to provide link to the document open for submissions.**

**Action6 – Item 3b - David Hamilton to add impacts with stratification on fauna (e.g. koura) and toanga species around how they may be affected by climate change and increasing surveillance for exotic species and the increased biosecurity risk**

**Item 4: Model Updates**

**a) Lake Ōkāreka**

*Powerpoint presentation on "Water quality modelling of Lake Ōkāreka"*

- The Waitangi stream outlet has recently been upgraded to take double the capacity (Some temporary capacity).
- SWAT (Surface Water Assessment Tool) is the model used throughout the presentation. SWAT was developed primarily as an agricultural model for nutrient assessments of intensive land in the US. It divides the lake up into 13 sub-catchments and response units.
- Monitoring occurs sporadically at 3 streams near Millar Road, Summit Road and the Plane's Farm.
- The Land use change project resulted in approximately 80 ha of pine plantation being planted in the catchment.
- Discussion around the total phosphorous levels in Ōkāreka. Could Ōkāreka be one of the lakes where results are influenced by silica?
- The low in clarity in Lake Ōkāreka is not related to chlorophyll.
- Peaks of nitrate are found to be associated with high rainfall events
- Dissolved oxygen is low near the bottom for extended periods. This is concerning and will need to be carefully monitored. Stratification has been fairly consistent.
- Discussion around hornwort invasion from 2012-2013 where several sites in the lake were found to have 2-3 m high hornwort. A series of spraying operations were conducted to control this. Questions around whether spraying may influence the chemistry within the lake with marcophyte decay. Oxygen level comparisons made with Lake Rotoiti and the relationship with macrophyte decay (Max Gibbs and Clive Howard-Williams to do some calculations to look into this further). (Note: Hornwort was not detected in BOPRC 2017/18 surveillance).
- Discussion and comparison of models including SWAT, ROTAN, OVERSEER and INCA. Conclusion made that INCA is not worth investing in.

**b) Lake Tarawera**

*Powerpoint presentation demonstrating modelling of Lake Tarawera*

- Tarawera is fed by 7 other lakes. Most inflows are very stable in terms of discharge and nutrients.
- The highest inflows come in from Lake Rotomahana, near the isthmus.
- Lake Tarawera sits above its target TLI (set at 2.6)
- It is concerning that concentrations of phosphorous have been increasing in the lake since 2013-2014.
- Post 2010, inconsistencies have been identified in the lab analysis. Silica interference may be influencing results meaning phosphorous levels could be higher than indicated.
- Nutrient concentrations have been measured from inflows. It was noted that geothermal inflows have high concentrations of ammonium and nitrate.
- Differences in loads can be contributed to inflows into the lake
- Chlorophyll simulated well.

- TLI is able to be mapped yearly fairly accurately.
- Tarawera has very low nitrogen levels. Nutrient levels are so low that it is not an issue within the lake apart from occasional cyanobacterial blooms. Question is whether it is nitrogen or phosphorous limiting. Whether N or P should be targeted is an ongoing decision as the lake is already relatively oligotrophic. Going straight to reducing phosphorous may be negligible if the lake is not P limited.
- Notes on uncertainties with the model are noted within the presentation.
- Recommendations from modelling would include looking into the uncertainties around geothermal loading and the extent of geothermal input.
- Suggestion raised that it is more important to look at the trends in raw data to see which of those is driving the lake water quality. The TLI is a weighting in order to detect trends. Once trends have been detected you need to go back and look at the raw data in standard limnology.
- Suggestion of simulating the reduction of nitrogen with the Tarawera model

**c) Rotorua PC10**

*Powerpoint presentation giving an update of the PC10 Module 5: "*Review and re-run the Lake model*"*

- 3 iterations of the document have been created
    - In 2012 'Predicting the effects of nutrient loads, management regimes and climate change on water quality of Lake Rotorua' focussed on nutrient loads and climate change.
    - Early 2015 'Assessing the effects of alum dosing of two inflows to Lake Rotorua against external load reduction: Model simulations for 2001-2012' focussed on alum and nutrient loading effects.
    - Late 2015 'Lake Rotorua Treated Wastewater Discharge: Environmental Effects Study' focussed on potential effects of additional wastewater loads.
- 2017 PC10 Science Review is using pre-alum loading levels (2001-2007) to calculate the influence outside the use of alum.
- The draft report will be available mid-June
- The GOT-PCLake model is more of a functional representation of the marcophytes and mircobiology.
- PC lake for Rotorua is up and running

**Action 7 – Item 4a – Max Gibbs/ Clive Howard-Williams to run some calculations on the influence of macrophyte decay on oxygen levels in Lake's Ōkāreka and Rotoiti.**

**Item 6: Alum Dosing**

**a) Rotoehu**

**i.** *Set up workshop at a later date to discuss this in depth (see item 9)*

***ii.*** *It was reported through Powerpoint presentation that*

- Bottom water oxygen levels decrease at the same time as in Lake Rotorua, however, mixing occurs much later than Rotorua meaning Lake Rotoehu is stratified for a longer period.
- Very low oxygen levels were recorded compared to previous years
- Dose rates were decreased to 20L/hr in Nov 2017. Alum dosing rates were reduced due to a lack of confidence in Alum being effective within the Lake this was evident as peaks in Phosphorous were present before alum dosing reduced. Wastage and unnecessary costs have been reduced by changing dose rates.
- This is related to Chris Eagers research
- There are two issues with controlling weed in the lake at present; high turbidity in the water effecting the diquat and shallow water levels make the weed harvester ineffective

**iii.** **Planning workshop on Rotoehu water Quality (trend effectiveness of actions)**
*(Workshops discussed in Item 9)*

**b) Alum dosing on Rotorua**

*i. It was reported through Powerpoint presentation that:*

- The previous protocols were disregarded and dose rates reduced in winter.
- This year started dosing at 150L/hr (November)
- Phosphorous levels haven't gone over 20 PPB levels since disregarding dose rates
- Stratification occurs in Lake Rotorua from November whilst mixing occurs at the end of February
- The Alum dose rate was reduced to 130L/hr in May 2018
- The control protocol has just been updated. If the protocol requires a reduction in dose rates, they will not be reduced over the summer stratification period.
- One third of the dosing for Rotorua goes into the Utuhina stream whilst two thirds goes into the Puarenga stream.

**Item 7: Sewage update**

*Sewage update given by Rotorua Lakes Council:*

- Rotomā wastewater treatment and reticulation is underway and should be complete next year
- RFP for the upgrade and design of the wastewater treatment plant should be rewarded by Christmas.
- During the flood event over the weekend of the 28th and 29th of April the wastewater treatment plant overflowed. RLC is unsure of the exact quantities however it is estimated that approximately 5000$m^3$ of raw sewerage overflowed at the head of the treatment plant. The network was highly affected by the storm event in relation to land drainage and large volumes of flood water going through the treatment plant.
- The treatment plant upgrade will mean that it will be able to handle this type of event throughout the network.
- RLC would like to see how they can work together with BOPRC to help drain water and mitigate peak flows coming from upper catchments also in built up zones. They suggested trying to hold water in the upper catchments and stopping it welling in flatter areas before it enters the lake.
- Suggestions given of research into stream and urban design. John Paterson's work using detainment bunds was brought up as an option to hold storm water and reduce sediment and phosphorous movement.

**Item 8: In-Lake N Reduction study**

*Wildlands report "**Evaluation of potential engineering options for reduction of nitrogen inputs to Lake Rotorua - Jo McQueen, Wildlands**" circulated from previous meeting with the discussion of potential options:*

- This report is around compiling engineering solutions to remove 50t N out of Lake Rotorua. Options were divided into options which are plausible and those which are not.
- It is accepted that technology is changing and whilst some of these options may be rejected at present we may be able to look into them again in the future
- Some of the plausible options may not be feasible. For example, constructed wetlands depend on land availability and the willingness of landowners.
- Discussions around ways to reduce the volume of water to the waste water treatment plant. Extra volumes of water make the treatment plant less efficient. Ideas given around low nitrogen water being separated out before it reaches the treatment plant. For example, instead of pool water entering the water treatment plant it could go through storm water instead. This suggestion was queried due to bacterial issues with pool water entering the lake. Could Rotorua Lakes Council and BOPRC align to manage issues like this?
- Te Arawa Lakes Trust offered their support with initiatives for future generations and collaboration with projects that other organisations may have the capacity to manage.
- Natural wetlands were suggested as a good starting point to get the community and iwi involved in Water Quality.

Action 8 – Item 8 - Alison Lowe to coordinate a working group to look into water policies around volumes entering the WWTP.

**Item 9: Future TAG operation and workshop approaches (including crosscutting sediment/ land TAGs)**

*Suggested change to the format of the WQTAG meetings to have workshops that manage in depth discussions and get through key topics. See below for suggested workshop topics:*

a) **Rotoehu alum workshop when Chris Eager is available**
   - A current issue is that alum isn't working in Lake Rotoehu. Lakes Rotoehu and Rotorua have very different lake systems. Chris Eager developed a thesis as to why alum isn't working in Rotoehu. One of his reasons included different levels of iron and sulphate. Chris describes Rotoehu as a reverse estuary leading to its productivity and developing the high pH. It would be useful to come together as a workshop and discuss these ideas with Chris and Paul further.
   - Other suggestions to add to the Lake Rotoehu workshop:
     - Try to work out what is going wrong within the whole lake. Ian Kusabs identified that there are no koura within the lake suggesting that the dissolved oxygen is extremely low. Attendees will also need to think about what outcomes are required from the workshop. Water Quality TAG will need to develop a clear definition of who will need to attend these meetings.
     - Also the issue of how to manage the weed harvester better.
     - We need to consider whether Lake Rotoehu may be the canary for the other lakes. Although some may be similar structurally they are all very different chemically.

b) **Future of Overseer/ Clues/ Rotan type tools**
   - Next workshop topic on finding alternative models to OVERSEER. For example, SWAT or ROTAN
   - Lake Rotorua needs models (like OVERSEER) as BOPRC has a requirement for the catchment in order to monitor land use within the catchment
   - Questions around whether there is a requirement in Rotorua to identify and model flooding areas. This could be used to demonstrate ways to protect infrastructure. There is also the potential opportunity to reduce phosphorous and sediment loads by controlling flood waters.
   - Other TAGs haven't been meeting as frequently as WQTAG has. It could be useful to get more people together such as Land and Sediment TAG.

c) **Integrated buoy/ satellite** (some mixed in with i)

   i. **Joint with Lakes Resilience synthesis**
      - Discussion around remote sensing and practical uses of it, examples included phycocyanid sensing
      - Protocols are currently being developed around cyanobacteria and *E.coli* notifications for the public. Issues brought up around there being multiple different strains of cyanobacteria with some of them being non-toxic and the difficulties this brings when blooms occur.

- Discussion over research buoys included questions over what the data would look like and how they would be managed/ maintained. Timeframe of 18 months to 2 years given to clarify what is needed from these buoys as a research and management tool.
- Questions around whether if a protocol is developed who will implement it. Issue with district council resourcing. Suggestions around getting TALT involved they may be interested from a kaitiaki perspective.
- Using remote sensing may not be practical for Lake Tarawera at present the satellite on the public to alert us to any blooms as they occur.

**ii. Sediment work on Lakes Rotorua and Rotoehu**

- Report has just been completed on the fate of Alum in Rotorua (Lake Rotorua and Lake Rotoehu: Total and Non-crystalline Aluminium Content in Bottom Sediments) see link: http://www.rotorualakes.co.nz/vdb/document/1629
- This workshop can focus primarily on Rotorua but will be a useful summary on where the work is
- Current issue is that we can't find the Alum in the lake or near the sediments. Where does this happen if it not near the transects? How do we monitor this?
    - Suggestion of looking at the release of P from sediments rather than trying to measure Alum. Essentially looking back at David Burgers work.

**iii. Ōkaro modelling approach**

- Currently Lake Ōkaro is being Alum dosed twice a year. This is not cost effective in the long term.
- Would like to create the opportunity for individual landowners in the Lake Ōkaro Catchment to have some responsibility on managing the lake and making a difference to the water quality of the lake.
- There is potential to get the university to develop a model then BOPRC can approach the community with a workshop where we may be able to help them co-ordinate action within the Ōkaro catchment
- Discuss with the community on how they can help to reduce the P levels in the lake by altering land use rather than perpetually dosing the lake with alum.

**Meeting finish: 4.35pm**