NOTES: LAKE ROTOEHU WORKSHOP, 30 OCTOBER 2018

GHA – Boardroom, 1108 Fenton St, Rotorua, 9:30 am

Chair: Andy Bruere

Present: Adam Hartland, Andy Bruere, Chris Eager, Chris McBride, Clive Howard, Grant Tempero, Ian Kusabs, Max Gibbs, Paul Scholes, Penny MacCormick, Rob Donald, Robin Pieper, Stuart Corson, Troy Baisden, Gretchen Sveda, Piet Verburg, Ruth Keber, Anabella Vidal, David Bach, Mathew Allan, Justine Randell, Clive Howard-Williams, James Dare, Greg Manzano, Rosemary Cross.

Apologies: Joseph Butterworth, Alison Lowe, Piet Verburg, Rebecca Burton

Scribe: Karla Kereopa

Main workshop outcomes:

1. **Focus on confirming long term sustainable catchment loads. May require budget or modelling action,**
2. **Need to ensure any budget estimates are using comparable model estimates, esp. as Overseer has moved to version 6.3, and have regard for what the local attenuation may be,**
3. **Internal loads seem to be significant and could currently be equivalent to the loads coming from the catchment. Chris Eager's thesis and our discussions highlighted opportunities to better understand biogeochemical hotspots and hot moments controlling internal loading and the reasons it has not responded as expected to alum dosing.**
4. **Overall there is a need to get better estimates of all contributing nutrient loads including what is coming in from geothermal sources, stratification and cyano-bacterial blooms,**
5. **Stratification events due to a shift in climatic conditions in the last 3 years appears to be the driver for declining water quality. Unfortunately buoy data is not available prior to April 2011,**
6. **Monitoring data to calculate TLI is not continuous prior to 1990, and it was questioned whether the step change in the early 1990s was actually a natural TLI fluctuation or a step change as a result of declining water quality. Subsequent investigation of pre1990 WQ data indicates the lake was mesotrophic until about 1993. The current TLI target still seems appropriate,**
7. **Did implementation of the Lake Rotoehu Action Plan actions contribute to the improvement in water quality up until 2014?**
    a. **It appears that the operation of the alum dosing could be changed to become more effective at locking up P and there may be negative interactions with the natural locking capabilities of iron at high dose rates, a change in alum management is recommended for trial,**

   b. **The weed harvesting was successfully removing nutrients while it was available. Changes in the lake dynamics has shifted the lake from weed dominated to algae dominated. The reasons are still not clear but weed harvesting is likely to remain a useful tool to remove nutrients until land use change eventually has an impact on reducing lake loads,**
   c. **The load of nutrients coming from forestry conversion (from pasture) could take many years to reach the long term averages predicted by Overseer as legacy N and P is released from old farming practices continues to leach. Other in-lake interventions will still be needed while that takes place,**
8. **The Rotoehu Action Plan did not list sewage reticulation from the lakeside community as a key action. This meeting considers that reticulation of lakeside communities for better treatment of sewage nutrients must be a standard recommendation and that is has other benefits beyond nutrient reduction,**
9. **Monitoring for koura provides a useful perspective of the lake health with regard to native species. It appears the koura have a certain level of resilience to poor water quality but that continued decline in water quality may have a longer term negative effect. It is recommended that on-going monitoring is maintained to build this data set on Rotoehu,**
10. **Although we do not have detailed info regarding ground water ages this has not been seen as a priority for research, due mainly to the smaller size of the catchment compared to Rotorua and therefore likely shorter transit times.**
11. **Actions need to address both N and P in a similar way to Lake Rotorua,**
12. **Understanding issues with management of alum could also be useful for consideration of alum use on Lake Rotorua, to ensure in time we are not travelling down a similar pathway, where alum becomes ineffective.**

The workshop has identified a number of actions that will help to fill info gaps and identify the problems with the health of Lake Rotoehu. These actions, listed below, need to be prioritised and also will need to fit in with the research plan for other high priority activities such as Lake Rotorua Science Review and PC 10 and the Tarawera Lakes concept plan work.

List of actions

1. McBride has formulated a pre-1990 TLI. 3.6 units. See attachment 1.
2. Estimate internal load. McBride suggested several options that need to be considered. Suggested internal load could be as high as the external load.
3. Recommend sewage reticulation as a key action.
4. Consider the compliance with NPSFW management targets.
5. Get out there and get a few samples in the Waitangi stream discharge.
6. Consider resuming stream monitoring to see how LUC is affecting inflows.
7. See if WQ decline coincides with forest harvest images.

8. Budgets based on Overseer suggest similar N Load, higher P loads, BUT load-to-take in uncertain due to unanswered questions regarding attenuation????
9. Load calculation by subcatchment, and comparison with Overseer estimates to estimate actual attenuation (recommence stream monitoring?)
10. More detailed analysis of likely geothermal load (and variability).
11. Detailed analysis of internal loading: Chris to consider options.
12. Separate the non-geothermal load from geothermal load estimate.
13. Calculate/estimate pre 1990 TLI (See attachment 1.)
14. Question was raised: has forest harvesting brought in a carbon load that could be affecting lake sediment DO. This could be tested by review of the lake buoy data.
15. Clarify the catchment area in the Action Plan.
16. Monitor the balance of the properties to see if current land use if compliant with Rule 11.
17. Benchmark/ allocate nutrient losses to the remaining land for more accurate catchment losses.
18. Keep numbers relative between science monitoring and future overseer changes.
19. Manage weeds to prevent blocking of flow and prevent pH increase from hornwort.
20. Turn dosing down to zero, or levels around 2013/14, using adaptive management and monitoring.
21. Determine spatial extent (sediment survey) and biogeochemical drivers of Fe-rich sediments releasing P (experimentation), including SO_4 monitoring.
22. Continue koura monitoring.
23. Check satellite images to see if WQ decline was related to harvest periods.
24. To better understand what changed TLI until 2014 then led to the decline since 2015 (this will be related to budget and modelling actions).
25. Update nutrient budgets, apply lake model if appropriate or redo budget.

Introduction

Andy introduced the workshop with discussion of the aim of the workshop and agenda. See agenda. Discussed TLI changes esp. around 1991 to 1993, where TLI jumped 1.5 units. Questioned what the pre 1990 WQ was like. Some research papers available to help with that.

Highlighted the questions circulated prior to the agenda:

The workshop has been initiated to bring together expertise to attempt to:

1. Clarify and understand why the lake nearly met it TLI in 2013 and 2014,
2. Why its TLI has rapidly declined since 2014,
3. Are the interventions that have been undertaken effective and appropriate to meet the TLI and nutrient target loads,

4. Do we need to adjust or discontinue any of the interventions
5. In particular are the land use nutrient targets still considered appropriate for the lake to meet its TLI over the long term?
6. Identify info gaps around the Lake Rotoehu programme that require further study to answer some of the questions above.

Emphasised this is not an alum workshop. Need to be evaluating all the Lake Rotoehu science including sustainable land use loads.

Presentations

a) Overview of actions from action plan

Powerpoint presentation given by Andy Bruere

- What do we know about the water quality pre 1990?
- What was the variability of that?
- Land use and management changes is the most important target
- Rotoehu Action plan (for Rotoehu Science W/S 30 October 2018):
- Reticulation of sewage – see Bruere report attachment 1.
- Reticulation of lakeside communities: No brainer
- Is sewage Reticulation a KEY action?

ACTIONS:

- McBride has formulated a pre-1990 TLI. 3.6 units. See attachment 1.
- Estimate internal load. McBride suggested several options that need to be considered. Suggested internal load could be as high as the external load.
- Recommend sewage reticulation as a key action.

b) Lake Rotoehu

Powerpoint presentation given by Paul Scholes

- TLI and water quality trends
- In recent times there has been a steady increase of the TLI
- Monitoring of lake shows stratification events since 2015 driving WQ change. Internal loading may be greater than external loading (in previous estimates)
- Weeds not as prolific as past and unable to harvest currently,
- Issues to be considered with the NPSFW – for future

ACTION: Consider the compliance with NPSFW management targets

c) Review of Lake Rotoehu nutrient targets

Powerpoint presentation given by Chris McBride/Mat Allen

- Phytoplankton dynamics
- Areal nutrient budgets – are they still valid targets?
- Monitoring buoy and sample data suggest that recent poor water quality is likely to be driven by internal loading during strong and sustained stratification since 2015
- Internal load could be as high as the external catchment loads. We have info re sediment nutrients from Tolle and more latterly the Tempero report
- Remote sensing suggest possible recent impacts from land use e.g. forest harvesting
- Stream monitoring data show stable or improving nutrient concentrations, but data end c.a. 2012
- Consideration of temporal variation; Hydrology, Land use, e.g. forest clearance

ACTIONS:

- get out there and get a few samples in the Waitangi stream discharge
- Consider resuming stream monitoring to see how LUC is affecting inflows
- See if WQ decline coincides with forest harvest images.
- Budgets based on Overseer suggest similar N Load, higher P loads, BUT load-to-take in uncertain due to unanswered questions regarding attenuation????
- Load calculation by subcatchment, and comparison with Overseer estimates to estimate actual attenuation (recommence stream monitoring?)
- More detailed analysis of likely geothermal load (and variability)
- Detailed analysis of internal loading: Chris to consider options
- Separate the non-geothermal load from geothermal load estimate
- Calculate/estimate pre 1990 TLI (See attachment 1.)
- Question was raised: has forest harvesting brought in a carbon load that could be affecting lake sediment DO. This could be tested by review of the lake buoy data.

d) Land use changes achieved

Powerpoint presentation given by Penny MacCormick

- The Agreements have achieved a large proportion of the required reduction stated in the Action Plan

ACTIONS:

- Clarify the catchment area in the Action Plan
- Monitor the balance of the properties to see if current land use if compliant with Rule 11
- Benchmark/ allocate nutrient losses to the remaining land for more accurate catchment losses.
- Keep numbers relative between science monitoring and future overseer changes.

e) What is going on with alum, can we change/fix this?

Powerpoint presentation given by Chris Eager

- P in Waitangi spring is mainly associated with Fe colloids
- Fe colloids are deposited near Waitangi spring. One transect site shows a very strong signal of P release from Fe-rich sediment. Magnitude, timing and spatial extent of P release from this hot spot location is poorly understood.
- pH, 0_2, and DRP values increased with distance from the Waitangi Springs outlet (some patchiness was observed)
- Temperature, major ion concentrations patterns were quantified
- There is a lack of information on sulphur in water monitoring and sediment. It may drive P release by reducing Fe^{3+}
- Waitangi Spring may not necessarily have the capacity to distribute – not an ideal situation
- Reduction of loads is probably the best method at this point in time

ACTIONS:

- manage weeds to prevent blocking of flow and prevent pH increase from hornwort,
- Turn dosing down to zero, or levels around 2013/14, using adaptive management and monitoring
- Determine spatial extent (sediment survey) and biogeochemical drivers of Fe-rich sediments releasing P (experimentation), including SO_4 monitoring

f) Artificial destratification of Lake Rotoehu

Powerpoint presentation given by Grant Tempero

- Key findings of destratification trial: Concept, Deployment, Monitoring programme, monitoring results, outcomes
- Outcomes:
  - The concept proved effective at drawing water from the hypolimnion into the epilimnion
  - Modifications to destratification units improved performance
  - Some evidence for localised effects during phase 3
  - Machines not preventing de-oxygenation / need a lot more machines to affect more of the lake – 6 units?

g) Lake Rotoehu – Kōura Monitoring Programme (Report on koura study during aeration)

Powerpoint presentation given by Ian Kusabs

- Changes in koura numbers recently – high numbers in spring, January 2018 none found then numbers returned in October 2018
- Question Max: What's the effect of temperature on the kōura? If you use destratification in any of these lakes you tend to lower the surface temperature and raise the temperature below
- Summary
  - Lake Rotoehu – abundant population of small sized koura, 2nd place behind Rotorua for numbers.
  - Polymictic: as lake DO drops below 5mg/L koura will move away and find better areas to occupy
  - Goldfish – abundant around Waitangi Stream

ACTION: continue koura monitoring

h) Rotoehu – Catchment Thinking (Recent forest harvesting view, overview of intervention success/failure, summary of issues)

Powerpoint presentation given by Troy Baisden

- Groundwater catchment, not likely to have a lot of old groundwater. Not seen as a research priority.
- Old topo maps are a useful source of info on land use history,
- Forestry harvest areas need to be considered and to look at effect during harvest period
- Nutrient budgets, useful budgets show dominance of pastoral inputs
- Useful hypotheses:
  - Null: It's all climate
  - Geothermal variability matters – relevant to setting TLI
  - Deposition zone and biogeochemistry of Fe-P matters, localised de-oxygenation?
  - Old groundwater probably not large, but groundwater catchment unknown? – Not an issue?
  - Land-use legacies in planted forest need evaluation
  - "Attenuation" in catchment may vary from NZ averages
  - N&P both need to be managed to achieve TLI
  - Progress in Rotorua and Tarawera N&P budgets can also be applied to Rotoehu: Methods ranging from simple table/spreadsheet budgets to more complex models can be interchangeable between lakes if we have a more standardised process for this.
  - Failure to respond to alum useful warning for Rotorua?

ACTIONS:

- Check satellite images to see if WQ decline was related to harvest periods.
- To better understand what changed TLI until 2014 then led to the decline since 2015 (this will be related to budget and modelling actions),

- Update nutrient budgets, apply lake model if appropriate or redo budget.

Other points of discussions

- Troy's slide 19 of 22 – referred to as an example Troy comments? There were overlapping interventions and it is difficult to reach insights. There's not been a comparison or stats analysis of relative timing. We finally have all the details, so stats could be looked at.
- Annabella – what strategies do we have in place to address climate change issues with all our lakes
- Troy – trying to monitor the effect of climate change on a system is difficult. Almost everything we know leans to needing some headroom in policy designed to "give regard to" climate change under s7 of the RMA. The freshwater sector has never really been picked up in terms of research. Note that the uncertainty in the lake loads may be more significant right now than the uncertainty in climate change for the future so address loads now and allow some headroom.
- Chris M – there are climate change studies available, for Rotorua and Rotoehu.
- What's the status of the action plan? It is expected to be reviewed every 10 years. Started an overall review of all action plans and there is a report on that. The process got intermingled with plan change 15 integrated freshwater programme. Looking to have a new document in combination with that. This science workshop will contribute to that.

Other discussion matters:

<u>Andy</u>

1. Complete notes from this meeting and identify actions.

2. Circulate them around to this group and then BOPRC and UoW prioritise ACTIONS

3. There is a perception that we were making progress until 2014 and then in the meantime when things started to go in the wrong direction you just think it's a bit of seasonal variation and then you get 2 bad years and then realise its more than just seasonal and then 3 bad years in a row and its going in the wrong direction. But in the meantime there's PC10 going on with Lake Rotorua and then people interested in Lake Tarawera. Need to consider Rotoehu priorities as well as how it fits in to the priorities on other lakes too (esp. Rotorua, Tarawera lakes).

<u>Troy</u>

4. Doing things on the overall set of lakes is probably helpful for everybody involved. But the other side of it is what it means in terms of taonga species in terms of ecological health rather than "water quality" in trying to break these variables apart. The Lakes SPI report suggested that Rotoehu wasn't doing well in that context. But then Ian points out that it's doing quite well in terms of kōura. Trying to understand what we've got that's going well and what people actually value from the standpoint of what we're actually supposed to do in terms of supporting planning and

communities managing the water that's probably part of the process that we have to go through and understanding what can come unravelled. The future of lakes research will have to be about understanding what can unravel further and how much we should focus on that.

Climate change

5. Focus on lakes that are in relatively stable management regime and might be pushed out of the loop in 2050. In this lake we are having wild TLI swings in the time scale of 5 years. Climate change is something that is going to take 20 to 50 years to eventuate. It's not unreasonable to spend a little bit of time considering it, but I'd think more about whether it's going to push Rotorua out of its current regime of management before we get to a stabilisation about alum. I'd worry more about whether we need to account for it in Tarawera.

6. I think climate change at 2050 is within everything else we have to manage because our overall budgets are so uncertain for this lake.

7. It should be highlighted in the conclusion of this meeting that this is a bit of warning in terms of climate change and we should be thinking about that.

8. In addition to the scale of algal blooms last year it was Ian's zero point in the Kōura population is concerning because it's the one thing that's actually been going quite well in Rotoehu.

9. Trying to model the effect of climate change on a system renders the questions how big and what's the change you're going to get.

10. In terms of policy almost everything we know about climate change points to lakes and nutrients being harder to manage in the future so leave some headroom in policy rather than introducing some uncertain science.

The following discussion questions can now be filled in by BOPRC and UoW, and focus on priorities for action.

Discussion points and key issues to review:

a) **What is the status of the lake right now re N and P relationships?**
b) **What is going on with stratification and hypolimnium O2?**
c) **The expectations when LUC will take effect (GW age)**
d) **What is the relationship between OVERSEER estimates and the losses to the lake?**
e) **Can we make alum more effective (why is it not performing like Lake Rotorua?)**
f) **What's the status on land use change?**
g) **Is forest harvesting creating issues with quality?**
h) **Do we need to look at other interventions or do we just keep doing what we are doing?**

Actions going forward

a) **Do we have any recommendations on changes to any lake targets? (TLI, N or P?)**
b) **Can we make any recommendations when we expect LUC effects to start being observed?**
c) **What info gaps do we identify and what priority do we set on researching these?**
d) **What changes to actions do we recommend?**
e) **Are there any other matters that we need to consider in making recommendations to the lakes programme regarding recovery of Lake Rotoehu?**

Meeting finish: 4.30pm

Attachment 1: McBride estimate of Pre1990 TLI
Attachment 2: Report on Rotoehu Sewage to Strategy Group.

Rotoehu historical TLI ??

	Value	TLx			
CHL	1.9	2.92		White (1985)	
TP	20.7	4.06		White (1985)	
TN	305.1	3.87		White (1985)	
SECCHI	4.6	3.57		Jolly (1968)	
		3.60	**TLI**		

Jolly 1968

TABLE 6—Water transparency. Depth of disappearance of Secchi Disc (metres)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1952–1953												
Hayes	—	6.3	—	6.5	6.0	4.7	4.9	5.7	—	7.6	—	—
Kilpatrick	—	—	—	4.0	—	—	—	—	—	—	—	—
Manapouri	—	—	—	—	6.4	—	7.0	—	—	6.0	—	—
Moke	—	—	—	—	10.7	—	10.3	—	—	—	—	—
Te Anau	—	11.3	—	—	10.0	—	9.5	—	—	8.5	—	—
Wakatipu A	—	11.0	—	—	7.7	—	9.8	—	—	—	—	—
Wakatipu B	—	10.0	—	—	—	—	—	10.5	—	8.5	—	9.5
Wanaka	—	11.5	—	—	—	11.5	—	10.5	—	—	9.5	—
1955–1956												
Okataina	10.5	6.0	10.0	8.0	14.2	7.0	9.3	10.0	12.0	9.3	8.5	9.0
Rotoehu	3.6	4.0	5.0	5.6	5.0	5.0	4.3	4.0	5.1	4.5	4.3	4.3
Rotoiti	6.0	6.0	8.5	6.0	8.0	7.0	6.3	9.0	7.0	5.0	4.5	4.5
Rotorua	4.0	4.0	2.7	2.7	3.5	3.0	3.0	4.0	4.6	3.0	4.0	3.7
Tarawera	5.6	7.0	7.0	9.0	7.0	5.7	5.3	8.0	7.0	7.0	8.0	6.7
Taupo B	13.0	12.0	14.0		13.0	13.7	18.0	15.5	13.5	13.5	16.0	12.0

Secchi (all white disc) 3.5 – 5.6 m

White 1985: samples from 1982

Lake	Season	CHL	DRP	DOP	PP	NH_4^+-N	NO_3^--N	DON	PN
Taupo	Winter	1.22	0.60	0.00	1.20	1.85	0.65	54.35	17.55
	Spring	0.46	0.35	2.10	1.70	6.10	0.00	53.05	18.30
	Summer	0.33	0.65	1.10	1.45	2.00	0.00	53.95	13.40
	Autumn	0.29	0.25	0.00	1.20	2.25	0.00	56.30	11.40
Okaro	Winter	2.10	54.80	20.75	23.75	376.50	45.40	482.95	115.75
	Spring	17.36	31.00	13.10	48.20	262.20	108.60	397.60	264.35
	Summer	36.28	7.10	19.35	41.75	8.35	0.20	452.95	437.80
	Autumn	4.25	0.40	9.25	9.85	7.60	0.60	405.30	104.50
Rerewhakaaitu	Winter	10.58	0.55	1.45	6.50	8.60	1.45	434.25	145.10
	Spring	10.07	0.30	2.75	9.10	8.40	1.15	304.90	200.85
	Summer	9.28	0.50	2.60	8.70	8.60	0.90	363.35	240.90
	Autumn	10.73	0.20	2.55	6.80	12.10	1.40	373.20	271.50
Okataina	Winter	1.66	0.65	0.75	2.35	5.70	0.30	77.90	33.60
	Spring	0.49	0.50	1.80	1.60	3.90	0.10	64.80	15.80
	Summer	0.38	0.35	1.90	1.60	2.00	0.00	68.60	15.95
	Autumn	0.48	0.10	0.80	1.40	2.85	0.40	83.70	26.20
Tarawera	Winter	1.63	3.55	1.40	2.80	7.05	0.15	108.85	46.95
	Spring	0.53	2.25	2.15	2.45	4.75	0.00	80.00	24.00
	Summer	1.42	0.55	2.50	3.05	4.60	0.00	74.90	30.45
	Autumn	0.79	0.50	2.30	3.70	7.80	0.05	131.00	45.80
Rotoehu	Winter	1.94	1.05	7.85	5.10	4.55	4.80	179.65	49.35
	Spring	1.00	1.60	8.25	6.00	5.50	0.35	196.45	54.95
	Summer	2.51	6.50	11.60	10.00	10.15	0.00	229.00	85.75
	Autumn	2.09	6.05	9.10	9.85	24.30	25.15	258.35	92.20

Attachment 2: Report on Rotoehu Sewage to Strategy Group.

Report to:	Rotorua Te Arawa Lakes Strategy Group
Meeting Date:	08 September 2017
Report From:	Chris Ingle, General Manager, Integrated Catchments
RE:	Lake Rotoehu Sewage Reticulation

Executive Summary

This report is to request support in principle for the reticulation of Lake Rotoehu sewage. The Rotoehu community is located close to the Rotomā and Rotoiti communities currently earmarked for sewage reticulation and it would seem appropriate to consider whether the Rotoehu community could also be linked into the community scheme. Although the communities of Rotoiti and Rotomā have funding available for the planned reticulation, Rotoehu does not.

Members of the local community are pushing for support to join into the sewage reticulation scheme. This seems a logical step as a sewage scheme is likely to provide a better environmental outcome than individual OSET systems.

This request is the first step in moving towards a sewage scheme for Rotoehu. Additional steps will be to confirm community support and find the necessary funding to support the implementation.

Recommendations

That the Rotorua Te Arawa Lakes Strategy Group under its delegated authority:

1. Receives the report, Lake Rotoehu Sewage Reticulation;
2. Supports in principle the reticulation of sewage from the Lake Rotoehu community to the Rotomā – Eastern Rotoiti sewage scheme subject to appropriate funding being available;
3. Confirms that the decision has a medium level of significance as determined by the Council's Significance and Engagement Policy. Council has identified and assessed different options and considered community views as part of making the decision, in proportion to the level of significance.

Lake Rotoehu Sewage Reticulation

The Rotorua Lakes Programme is responsible for the development and implementation of each lake action plan. The development of action plans for each lake has been subject to close engagement with the local community during the development phase, to identify key sources of nutrients and explore actions that can be implemented to address these nutrient sources. The basis of each action plan is to identify catchment nutrient sources, evaluate the sustainable nutrient load to each lake and to identify viable actions that will help achieve the lake's sustainable nutrient load.

Generally, action plans for all lakes that have been developed have focussed on sewage reticulation as a key action. For a number of lakes, the reticulation of sewage has either contributed the total nitrogen and phosphorus reduction required for the catchment nutrient inputs to meet the sustainable load, or have provided a really significant part of the load reduction target and as required for the lake to be at its sustainable load. In these instances, the business case for sewage reticulation has been straightforward as a main contributor to the particular lake meeting its Water and Land Plan target TLI. The two most obvious examples of this are Lakes Ōkāreka and Rotomā where sewage reticulation will contribute 95%N, 25%P target and 192%N, 100%P targets respectively.

In contrast, for Lakes Rotoiti and Rotoehu, seepage from septic tank discharges is not the primary source of nutrient input to each of these lakes (1.6%N, 0.7%P and 1.1%N, 1.2%P respectively.) For Lake Rotoiti, sewage reticulation has been identified as a key action to help address attaining sustainable nutrient loads. However for Lake Rotoehu, it has not been identified as a key action. Lake Rotoehu's Action Plan was developed in 2007 using housing numbers based on 2003 information. A reassessment of both numbers of houses and occupancy has taken place since then and these indicate the levels of nitrogen and phosphorus loss from septic tanks could be between 40 and 250% higher than the Action Plan estimates.

The local Rotoehu community has pointed out this inconsistency and is requesting both councils to consider reticulation of sewage. As a result, a Rotoehu Sewerage Steering Committee has been set up to lead discussion on this within the community and to help navigate the community view on supporting a scheme.

In addition, and through the process of obtaining resource consent for the reticulation and treatment of sewage for Lake Rotomā and the southern and eastern parts of Lake Rotoiti, Rotorua Lakes Council has included the Lake Rotoehu community in the resource consent application. This does not guarantee that Lake Rotoehu sewage will be reticulated but it creates the necessary preconditions for that outcome.

The 2007 action plan for Lake Rotoehu is due for review. However, the process of review is yet to be established and could be linked in with the Bay of Plenty Regional Council development of the water quality standards under the NPS-FM process. As a result, any review that is reliant on the development of water quality standards under the implementation of the NPS-FM could create some delays in getting the action plan reviewed.

Rather than travel this route, it is proposed that the views of the PSG and the RTALSG are sought in respect of sewage reticulation and that the community view is sought via the Rotoehu Sewerage Steering Group that is already in operation.

Sewage Treatment at Lake Rotoehu

There are 160 subdivided lots with 132 houses at Lake Rotoehu. Including the two communities of Kennedy and Otautu Bays, which have 94 lots with 77 houses. Houses in these two bays are not included in any funded sewage reticulation scheme, although, as already mentioned, they are included in the resource consent application being sought for Rotoiti and Rotomā sewage.

There are also houses at Morehu Loop Road, Manawahe Road, including the Rotomā School and Waitangi Soda Springs and on SH30 which will be reticulated with Lake Rotomā sewage. If sewage reticulation is not commissioned at Rotoehu, these communities will be required to upgrade their septic tanks to an advanced treatment system or obtain resource consent for some other system. This is a requirement of the Bay of Plenty Regional Council On-site Effluent Treatment Plan (OSET.) The approximate cost of upgrading is $16,000 per property.

The use of the advanced systems has some potential and location specific problems:

- Not all sections at Lake Rotoehu are large enough to provide for the required disposal area.
- While the advanced systems typically address nitrogen, the treatment of P is not addressed to any particular standard with these systems. Although the advanced treatment systems will improve effluent quality, local disposal of OSET treated waste water will still result in residual N and P reaching the lake. Staff from both Bay of Plenty Regional Council and Rotorua Lakes Council consider that the reticulation of sewage for the Lake Rotoehu communities is the most logical and equitable option.

There are a number of points that support this:

- There is a level of nutrient loads coming from the community. Whilst calculations to estimate the amount of N and P coming from houses in the catchment are readily available these can be subject to a level of uncertainty in terms of actual occupancy and behaviours within this community. It is highly likely that the loads, as stated in the 2007 Action Plan are understated. As this area is a lake holiday area, it is more likely that there are very high occupancy rates at times that septic tanks and even advanced treatment systems are not capable of treating satisfactorily. Councils have no practical control on occupancy, and homes that have been holiday baches can easily be rented out as full time residences simply due to an event such as the Edgecumbe flooding where a local community has been displaced.
- It is uncertain what the future loads coming from sewage will be, if for example additional subdivision in the area takes place, without a sewage reticulation system, this will add additional nutrient load to the lake.

- Septic tanks and OSET systems can have a localised effect on water quality. This has been most recently experienced in Okawa Bay of Lake Rotoiti, where reticulation of this community rapidly improved the water quality of the bay. There is likely to be a similar effect for Ōtautū Bay where a number of houses are concentrated. Reticulating lakeside communities takes this source of N and P away from lake side disposal where it naturally and rapidly leaches to the lake causing eutrophication.
- Even upgrading to an advanced treatment system can have residual impacts. It is more likely that a reticulated sewage system will provide a better level of treatment will cater for fluctuating loads and will be subject to technological advances as they emerge, than the OSET systems that each house holder would be responsible for.

There is a raft of other benefits to sewage reticulation such as better public health without treatment and disposal on the house section, reducing bacteria discharge to the environment and potentially to the lake, management of the system lies with the council not individual ratepayers with no knowledge of the system, section area available for other activities.

To date, sewage reticulation systems in the Rotorua Lakes Programme have attracted substantial subsidy support. OSET systems typically do not attract any support and must be funded completely by the rate payer.

The availability of connection to a well-designed and established reticulation provides easier development of new homes and subdivisions. Note that estimates of sewage impact on the receiving environment are subject to various assumptions, which creates some uncertainty. Frequently this leads to an underestimate of the impact of septic tanks and OSET systems as it is very challenging to gather definitive data from these applications.

Analysis of Options

The only other feasible options are the application of the advanced treatment system or obtain resource consent for some other system. The implications of this have been presented at section 2 above.

Community Views

Some sections of the community are requesting council support for sewage reticulation. Additional consultation will be undertaken to confirm this support across the community as the project progresses.

Long Term Plan Alignment

This work is not planned within the long term plan. This report is not requesting funding it is requesting support in principle to progress on sewage investigation for this community, including getting a clear indication from the community that the majority support it.

Current Budget Implications

This work is outside the current budget for the Sustainable Water Activity in the Long Term Plan 2015/25.

Andy Bruere
Lakes Operations Manager for General Manager, Integrated Catchments
1 September 2017