

MEMORANDUM



To: TAG for 18/02/20133

From: John Paterson

Date: 07/02/2013

File Ref:

Copy To: Greg Corbett, Andy Bruere

Subject: **Completion of Lake Ōkaro Action Plan Works**

Summary

The principal 'Action Plan' works for Lake Ōkaro catchment have been mostly completed, and the budget allocation for this work terminated. However, one area of the original plan, "attenuation of high stream flows" has continued to be subject to further on-going investigation, innovation and planning by staff. This has recently been advanced with the collaboration and 'agreement in principle' of the catchment's principal landowner, Landcorp Farming.

This action is the provision of an additional Detainment Bund (DB) on the 'Northern Stream' immediately upstream from the Ōkaro Constructed Wetland. While one DB was installed in the upper reaches of this stream earlier (27/02/2009) in the programme, this effectively only buffers the storm pulse effects of less than half of the Lake Ōkaro catchment. It has become apparent over time and with increasing storm management and detainment expertise developed as an outcome of the Rotorua P-Project, that further storm buffering is essential at Ōkaro to ensure the efficient functioning and more sustainable working life of the Ōkaro Constructed Wetland and protection of the Council's capital investment in this existing structure.

This Memo requests TAG comment on the potential effectiveness of the proposed DB for improving the constructed wetland's performance and the efficiency of further capital expenditure on infrastructure associated with the existing constructed wetland.

Abstract of DB validation by D Clarke attached FYI.

Lake Ōkaro Action Plan

Of the six Key Recommendations in the 2006 Lake Ōkaro Action plan the proposed action to be completed is compatible with two of them:

- Action 4 - That Environment Bay of Plenty, in conjunction with landowners, investigate the adoption of best management practices to reduce nutrient runoff from pasture, and **attenuation of high stream flows to enhance wetland performance.**
- Action 5 - That Environment Bay of Plenty monitor and assess the ongoing nutrient load status of Lake Okaro and **the effectiveness of individual actions** to improve lake water quality.

Furthermore the Action Plan noted that: (6.2.3) "The constructed wetland could remove some nitrogen from flood flows if some form of upstream detention ponds lowered the flow peaks".

The Lake Ōkaro Constructed Wetland

The Lake Ōkaro Constructed Wetland was completed in 2006 on the Birchall farm and adjacent RDC Reserve. The project was initially (2005) estimated to cost \$520,000 however the final cost was considerably more than this. The BOPRC has funded on-going monitoring of the constructed wetland by NIWA and several reports have been received that focus on the “effectiveness” of this structure. Constructed wetlands have an expected life of 50 years with sediment and organic detritus accumulation rates of 5 – 10mm/year.

Some messages noted in these reports are:

- 1) Some storm water load nutrients reach Lake Ōkaro untreated during the rain storm flooding events that by-pass the Constructed Wetland
- 2) Around 80T of suspended sediment is accumulating in the constructed wetland per year – this accelerated sedimentation is degrading the annual performance of the wetland and will reduce its expected effective life cycle by approximately 10 years if it continues at this rate (J. Sukias NIWA pers coms)

These consequences are the direct result of “high stream flows” and the 2006 Lake Ōkaro Action Plan recognised that these need to be “attenuated” in order to “enhance wetland performance”

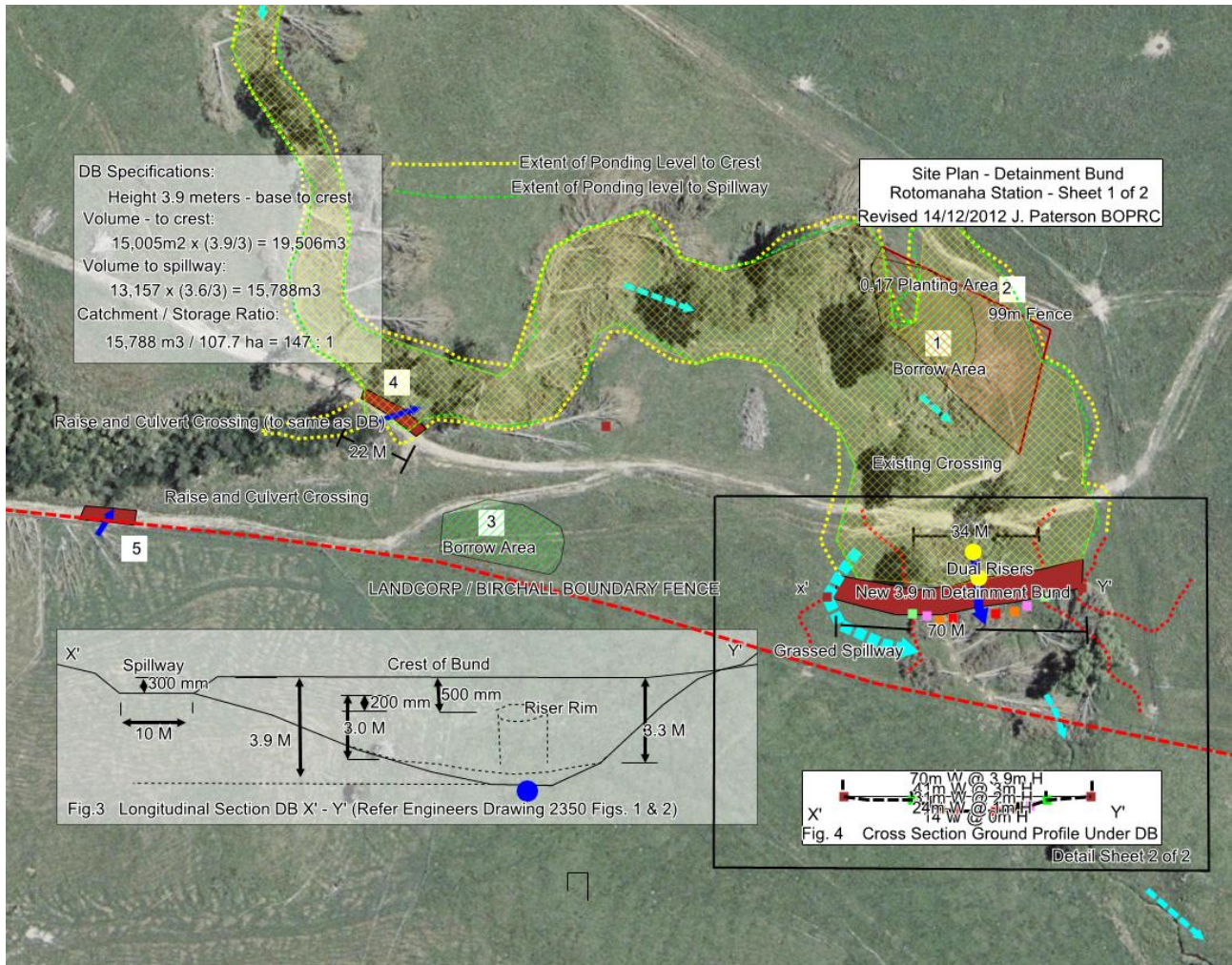
Proposed Detainment Bund

The bund is to be 3.9m high with a capacity to impound nearly 16,000m³ of storm water. (Refer DB Plan below).

This proposed impoundment volume (16,000m³) is similar to the excavated volume of the existing (2006) constructed wetland (20,000m³).

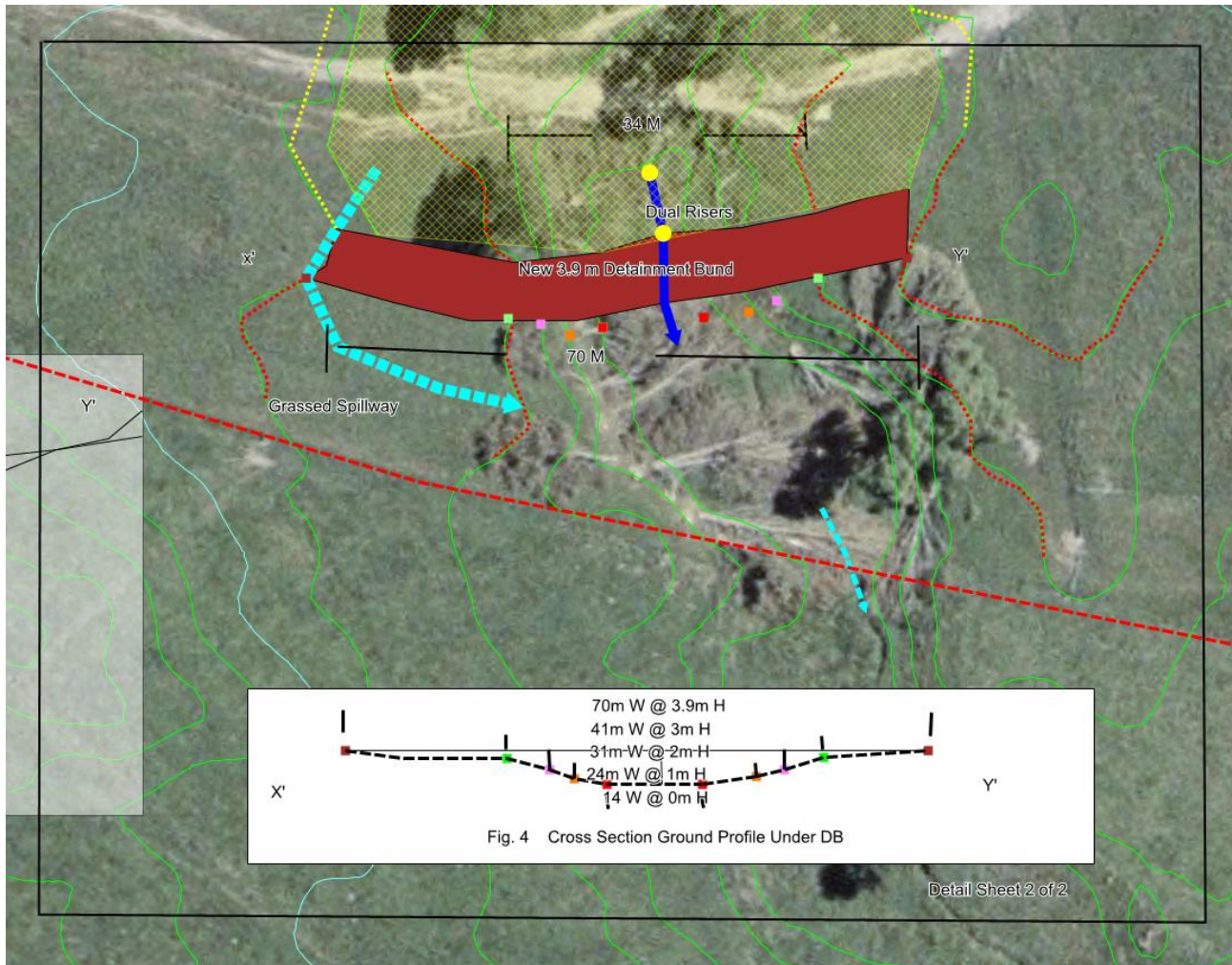
A BOPRC Resource Consent will be required however as the structure impounds less than 20,000m³, it is not classified as a ‘Large Dam’ and a building permit is not required.

The addition of this proposed Detainment Bund will significantly increase the residency and treatment time of nutrient and sediment laden water in the fully integrated treatment system of the Detainment Bund pre-treatment coupled with the existing constructed wetland.



Site Plan (1 of 2) – Proposed Detainment Bund on Rotomanaha Station, Ōkaro

Note this site is approximately 500M directly upstream of the existing constructed wetland.



Site Plan (2 of 2) – Detail section

Funding of the Detainment Bund

As the proposed structure is an integral amendment to the original constructed wetland and was signalled in the 2006 Action Plan it was proposed to the land owner on the same basis as the constructed wetland i.e. funded by the Council with the land owner contributing the land that is to be inundated.

As the ‘treated’ catchment area is entirely within the Landcorp property boundary and the sediment loads and some of the phosphorus load is generated by Landcorp’s farming activity it may be reasonable to allocate some of the cost of the proposed structure to the property owner. However a funding precedent has been set by earlier Action Plan works.

The gross estimate for the cost of the structure is \$80,000 not including BOPRC staff time. (A detailed cost table and works schedule is completed). The preliminary consultancy work (site investigation / geotech) has already been completed and paid for and the Landowners have offered some ‘In-Kind’ services towards the proposal.

Rotorua Lakes Technical Advisory Group (TAG)

At its last meeting (6/9/2012) the Rotorua Lakes Technical Advisory Group (TAG) also noted that Ōkaro water quality has returned to 5.5 TLI (TLI target is 5.0) and a “possible way forward” (TAG notes 3(b)) included:

- Assess impact of other actions including detention bunds which are yet to be completed

Pending Recommendations for BOPRC decision

- 1 That the Lake Ōkaro Action Plan work, relating to ‘attenuation of high stream flows’ entering the Ōkaro constructed wetland, be completed with the construction of a 16,000m³ Detainment Bund on Landcorp Farming property.
- 2 That a total of \$80,000 (plus staff time) be allocated to the Ōkaro Detainment Bund proposal.

Request to TAG:

Incorporating the other tabled Ōkaro related reports (NIWA Ōkaro performance review and John MacIntosh’s report) please comment on:

- **the soundness of this 16,000m³ Detainment Bund proposal for improving nutrient interception at Lake Ōkaro including**
- **The role of the proposed DB in enabling the maximum flow rate through the constructed wetland to be reduced from 180L/s to 100 L/s (as proposed in JM’s report).**

John Paterson 7/02/2013

Appendix 1 – Summary Cost Table

Summary Cost Table					
121214 DB Cost Table Updated 13th Dec 2012					
DRAFT Cost Estimates table (GST exclusive)					
Total estimate of Costs already incurred and paid for					\$5,451
Startup Expenses Total plus 10% contingency				8,860	\$9,746
Earthworks - Main 3.9M Bund Total				34,000	
20% contingency - overruns due to unforeseens e.g. weather dependency					\$40,800
Total Materials: plus 10% contingency				14,886	\$16,375
Total Estimate for two ancillary earthworks plus 10% contingency				\$7,746	\$8,521
Site Reinstatement					
Total 'In-Kind' contributions by Landcorp Farming Limited (LFL)					\$3,670
Re-vegetation					
Total of site remediation / revegetation plus 10% contingency				\$3,220	\$3,542
Total Estimate for BOPRC and Landcorp Farming Ltd respectively					
				\$78,983	\$3,670
				BOPRC	LFL (in-Kind)

Appendix 2 - Schedule

Task	Who	Deadline
Earthworks Completion - 29th March*.		
(* - timelines are weather dependent)		
LFL sign MOU	JP	19/12/12
BOPRC sign MOU	W Murray	21/12/12
Wrks. Contr. Drafted	JP, AW	21/12/12
3x Pref. Contrs. Adv.	JP	19/12/12
Tenders out	AW, JP	21/12/12

Permit Lodged	AW	07/01/13
Consent lodged	AW	07/01/13
Tenders Close	JP	21/01/13
Consent approv	BOPRC	07/02/13
Permit approved	BOPRC	07/02/13
Tender Selection	JP, GC	07/02/13
Wrks. Contr. Signed	AB	11/02/13

Upper dam siphon in	JP, GE	14/03/13
Earthworks Start		18/03/13
Pipes Delivery	JP	19/03/13
Earthworks Finish		29/03/13
Seed bed prep	LFL	01/04/13
Grass sown	LFL	08/04/13
Fencing complete	LFL	12/04/13
Reveg area prep	JP	26/04/13
Planting	JP	28/06/13
Releasing	JP	25/10/13

Note – this schedule no longer applies as there is now inadequate lead in time to complete approvals and consents for the earthworks before winter. If approved, the works will be completed in February / March 2014.

Abstract – embargoed prior to FLRC presentation Massey Feb 2013

Overview of Detainment Bunds for mitigating diffuse-source phosphorus and soil losses from pastoral farmland

D Clarke¹, J Paterson², D Hamilton¹, J Abell¹, R Moore⁵, M Scarsbrook³, K Thompson⁴ and A Bruere²

1. Environmental Research Institute, University of Waikato, 2. Bay of Plenty Regional Council, 3. DairyNZ, 4. Land Transport NZ, 5. Dairy farmer, Rotorua.

New Zealand relies upon phosphorus (P) to sustain agricultural productivity. However, P loss from farming systems to freshwater ecosystems can promote eutrophication; a global problem. Most P and sediment is transported from farm systems to freshwaters via ephemeral streams which flow for short periods of time in response to intense rainfall and runoff events. The objective of this MSc research was to quantify performance of a new type of detainment bund (DB) being trialled to specifically attenuate P and sediment loss from pastoral farms in the Lake Rotorua catchment, Bay of Plenty. The DBs have been initiated in collaboration with Bay of Plenty Regional Council, DairyNZ and Rotorua catchment farmers and consist of low profile earth bunds (c. 1.5 m high) designed to temporarily pond ephemeral storm flows across high quality farmland without compromising pastoral production. The structures have a choked riser outlet to regulate water storage and control residence time. A storage capacity of at least 100 m³ per hectare of catchment was used in the design of DBs. Pounded water is released slowly, with the aim of promoting settling of suspended sediments and associated particulate P in the DB basin (on the pasture), thereby enhancing soil fertility. Deposited sediment was sampled by deploying synthetic turf mats and sediment trays across the ponding area. Grab samples of in- and out-flowing water were collected at various stages during storm events and analysed for suspended solids, particle size distribution, total P, dissolved reactive P, and dissolved inorganic nitrogen. Water level was recorded to help derive a mass balance of water, sediments and nutrients for two different DB systems. Results show steady decreases in total suspended solids in the ponded water over time and retention of P in the deposited sediments (mean total P = 1998.95 mg P kg⁻¹). This research will contribute to refinements of the DB design for P-mitigation purposes and a code of 'best management practice' for the use of similar DBs on farms. If results confirm that specifically 'sized-to-catchment' DBs are effective P mitigation tools then there may be opportunities for widespread and collaborative on-farm implementation in the Lake Rotorua catchment and in agricultural landscapes throughout New Zealand.