LAND AND WATER FORUM IN ACTION
AN INTEGRATED APPROACH TO CATCHMENT PLANNING

John Paul Praat[1] and Alison Dewes[2]

[1]P.A. Handford and Associates Ltd, Te Awamutu
jp.praat@pahandford.co.nz
[2]Agribusiness Consultant, Cambridge
dewesam@gmail.com

Introduction

The report of the land and water forum (2010) recognises there are multiple uses for water and therefore multiple stakeholders are involved. This paper reports on actions and issues at a relatively small scale in the landscape but which are common to reducing contaminants reaching water bodies and achieving improvements in water quality at any scale. The New Zealand Landcare Trust (NZLCT) is currently coordinating a three year Sustainable Management Fund (Ministry for the Environment) project to involve communities in improving water quality of Waikato shallow lakes. Landowners surrounding such a lake, known as "Lake E", initiated interest in taking some action to improve the quality of their lake with NZLCT. NZLCT engaged our services to develop whole farm plans, and an overall catchment action plan for the Lake that integrated the required actions into an easy to use plan that was able to be followed by all parties on both farms. Two government organisations, Department of Conservation (DOC) and Environment Waikato (EW) were also involved as landowners, regulators and potential co-funders of some works. These parties represented a community of involvement in producing a community benefit. As a result farm plans were integrated as a catchment plan to guide "action-on-the-ground".

The Lake

Lake E (also known as Lake Tunawhaheke) is a small hypertrophic peat lake. It is one of 30 peat lakes in the Waikato, and is one of the more severely degraded ones. It is a lake that has undergone a wet – dry - wet regime, and water levels are low, averaging around 0.4-0.7 m deep. In very dry years, such as the summer of 2008, the lake may dry out completely. While there is no specific water quality data available, the lake has been listed as 35th among 50 Waikato lakes, with 1st being best. It is shallow, denuded of macrophytes, and invaded by grey and crack willow. There is little control over water levels at present, and in some areas, there is a very narrow buffer zone. One could argue that it is so severely degraded, it is past the point of remediation; however the surrounding landowners are motivated to make some attempts to both understand the status of the lake, make an effort give it some protection, and contribute to its improved health where they can.

The peat lakes of the Waikato are generally under threat from a range of factors. Lake E is specifically threatened by the shrinkage of the peat as a result of continual drain deepening within the catchment, the loss of open water habitat due to the invasion of willow and other weed species. It is also threatened by the treading and browsing damage from livestock encroachment, and nutrient enrichment of the lake from non point source runoff from the surrounding catchment.

We understand that many of these lowland lakes may be somewhat unresponsive to catchment management actions. This is a result of the following factors;

- The existence of a turbid, de-vegetated alternative stable state.
- The requirement for ongoing plantings and maintenance (eg; the clearing of silt traps, weed control) all which will contribute to reduced nutrient loads.
- The dominance of internal nutrient recycling processes over external nutrient loads. Internal sources arise naturally, especially from nutrient – enriched organic sediments.
- An increase in recent years in the use of soluble fertilisers and intensification of pastoral systems leading to increased nutrient loads to the lakes. (Collier, 2010)

Environment Waikato are about to embark on a five yearly water quality monitoring programme which will include this lake. Therefore there is an opportunity to measure progress for this lake. Figure 1 shows an aerial image of the lake, the catchment and the two farms (North and South) which border the lake. Note that the northern third of the lake (water exit end) is owned by the South farm and the southern two-thirds is owned by DOC as a reserve. This immediately shows that cooperation among all landowners will be needed for any remedial management programme to be successful. A commonly agreed approach and plan is therefore needed.

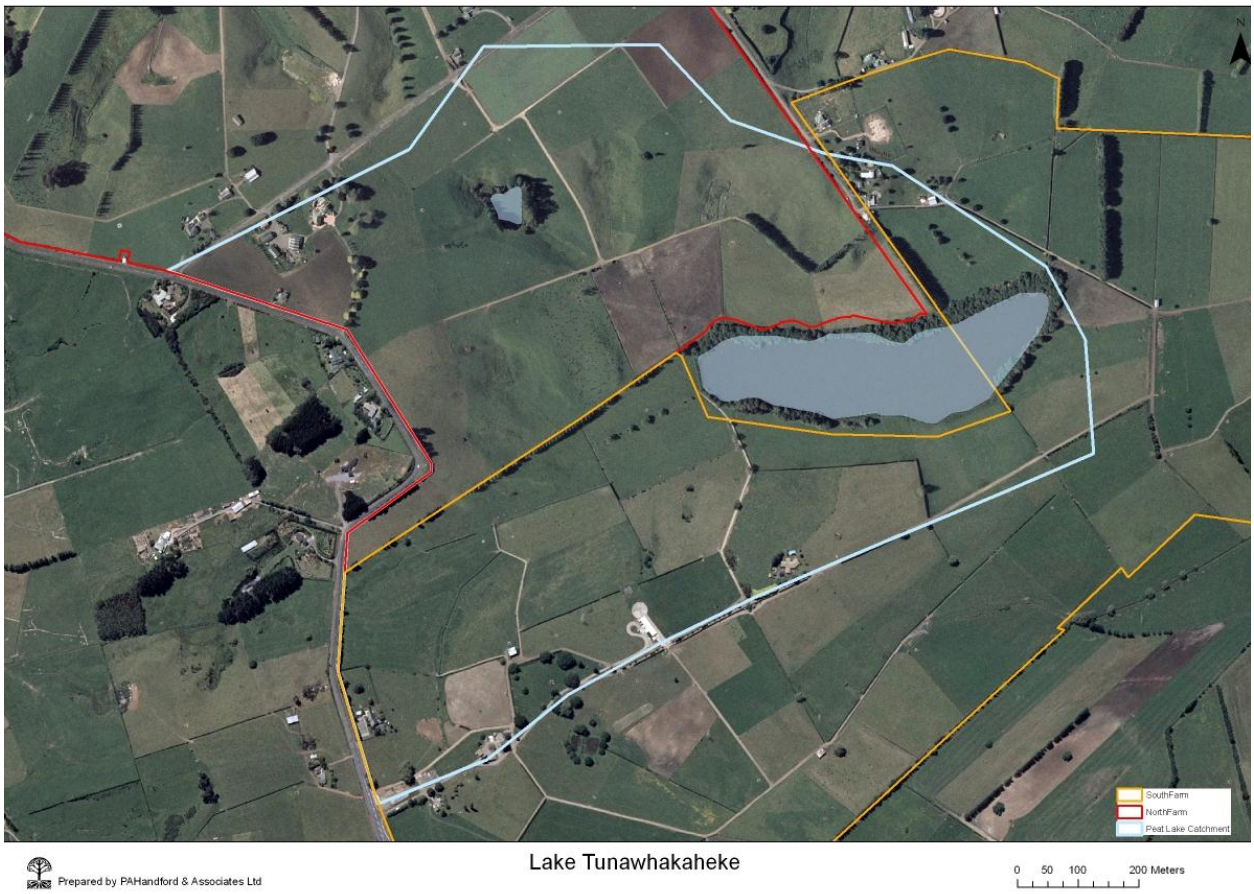

Figure 1 Lake E, the surrounding catchment and farm boundaries

Concept and process
The concept was to carry out both whole farm level planning as well as a catchment level planning to identify the key risks presented to the receiving environment of the lake. The process involved three main phases. Firstly the farms were visited to gather data and were toured to discuss the issues and brainstorm some ideas for change. This involved DOC and EW. Secondly farm and catchment plans were drawn up as drafts for review by all parties. Thirdly a meeting was held to go through the catchment action plan map to refine and agree on final version for implementation.

The two landowners are both dairy farmers, the Southern Farm has the major share of the lake perimeter, surrounding around two thirds of it. This farm is largely a Kaipaki Peat which is granular in nature, with rolling Hamilton Clay hills on the Western Boundary of the lake. The Northern Landowner, surrounds one third of the lake, and rolling Hamilton Clay runs down to the peat flats, that border the lake on the North Side.

Contaminants
Three sources of contamination were identified.

1. Direct entry from livestock (and ducks and swans!). Dung, urine and sediment from cattle grazing enters lake water with the lowering and rising of lake level. Lake level rises sufficiently at times to cover grazed pasture.
2. Run-off entering open drains which flow into the lake. Water running off grazed pasture and stock laneways into the frequent open drains, carry nutrients, sediments and faecal coliforms into the lake. All the drains entering the lake were already fenced to some extent, to keep livestock out so the focus was on reducing the contaminant in run-off water.
3. Diffuse entry via groundwater. Given the shallow nature of the lake, groundwater in the identified catchment beneath the two farms was unlikely to contaminate the adjoining lake. However, the health of groundwater is of general concern as it likely to feed into other open water bodies at lower elevations in the landscape.

The Process of Whole Farm Planning and shared learnings.
Both landowners are at least second generation farmers. They both share a desire to leave the land in better status for the subsequent generations. They also have an interest to improve the aesthetics of the Lake, with the consideration that in the future, there is likely to be increased urbanisation surrounding their properties. There are already a number of titles subdivided off these farms, and lifestyle blocks are common in this catchment.

A whole farm plan was undertaken with each of the landowners, and the staff on the farm. These plans included the following components

1. An analysis of the present farm system and the risks to the receiving environment based on observation, collection of data and the development of a typical year in FARMAX and OVERSEER.
2. Consideration of what aspirations were held by each of the landowners, with respect to their economic, social and environmental values.
3. A description of the present resources, infrastructure, and farm system along with a detailed description of the receiving environment, and the threats to it.

4. Scenarios to reduce the impact of the farm systems on the lake, were then developed that integrated the business, environmental and social values for these landowners.
5. A detailed economic analysis of the low impact scenarios, along with the baseline, or present farm system was presented. Rationale for the change was discussed in detail with the landowners at visits.

Although both farms operated slightly different farming systems, they both shared the same concerns, yet lacked direction in their planning. The Whole Farm Plan had the effect of crystallising a strategy forward for each of the landowners.

The key areas of concern and findings shared by both owners were

- Stocking Rate appeared too high, but there was a reluctance/fear of change to lower SR. Lower stocked models (-15%) in both cases was more economically viable.
- An increased reliance on bought in feeds was apparent on both farms, and this was a concern. The lower stocking rate model allowed the elimination of PKE, while continuing with maize, that they could control the costs and risk to the business.
- Effluent capture & storage facilities on both farms was at, or exceeding limits, due to increased stock numbers and feeding regimes. A strategy of how to address this, with the economic benefits of change was illustrated in the plan.
- Cropping areas, using full cultivation was being carried out on both farms. This accelerates peat shrinkage. Both landowners were open to using minimum tillage techniques, with the use of effluent that had been captured, and stored.
- Reactive nitrogen usage in winter was apparent in both systems as a result of continued feed shortages. A lower stocked model reduced the requirement for N use in the poorest response times of the year. This was also more profitable.
- In both models, the nutrient efficient models proved to be significantly more profitable. (see Table 1)

Overall, the whole farm planning process was a positive experience for both landowners. They have both committed to undertake more detailed analysis of their farm systems as a result of understanding what tools are available to them to do so. It is their intention to do more intense monitoring, and evaluation of their systems in the future. Changes are likely to have the following longer term effects:

- Continued development of lower footprint farm systems. *"Farming with the lake in mind."*
- Improved financial literacy of their businesses
- A more resilient farm system (to climatic and price volatility)
- The farm systems developed, are more aligned with their personal values: "*To ensure we operate our business in a way that has minimal impact on the environment. Our goal is to operate in a profitable, sustainable manner and ensure the assets are enjoyed by ourselves and protected and enhanced for future generations."(Farmer Vision)*

Table 1 Summary of Base situation and low leaching scenarios

	North Farm 2009-10	North Farm Low Leaching Scenario		South Farm 2009-10	South Farm Low Leaching Scenario
Eff Milking area	305	305		155	155
Total cows	920	800		530	450
MS/Ha	1098	1010		896	1140
MS/Cow	365	420		250	354
Pasture Harvested/Ha	13	13		13	13
Operating Profit/Ha ($6.50/Kg MS)	$2061	$3011		$1221	$2995
ROA	4.27%	5.8%		2.3%	5.5%
N Leached/Ha	35	24		31	20
N Conversion Efficicency	32	38			
Key Changes		15% drop SR No PKE required Improved Effluent Use/Crops. 30% Maize home grown.			15% drop SR, Less N and PKE required, Maize only as Suppl. Feed.

Summary of tasks identified for action

- Prioritising the effluent storage (ponds) and extending circulation – especially for re use on crops.
- Review stocking rate in preparation for 2011 – 2012 planning,(Labour, replacements, feed requirements, targets).
- Where possible, bought in maize is contract – grown at a known price for the subsequent season.
- Revise approach to fertiliser management. Aim to have more strategy and precision.

Catchment Planning

The aim of the catchment plan was to develop the best approach land management planning and sustaining a range of environmental services such as biodiversity and water quality. The information required was gathered in conjunction with whole farm planning. The key principles of a catchment plan include:

- Matching land use to underlying land capability.
- Understanding the whole range of resources that make up the property (soil, land, livestock and management).
- Identifying key sources of contaminants to lake water.
- Identifying integrated approach to property management that sustains both economic returns and environmental services, a ‘win win’ approach.
- Formalise long term business and land management goals against which to assess day-to-day decisions so farm is left better condition for the future

We used digital mapping techniques to collate and display information. Also this system provides data that can be continually re-used in future management of the property. For example: in planning and operational control of fertiliser application. The mapping approach also provides visual information that is easily understood by landowners and the wider community.

Summary of tasks identified for action

A series of actions were identified in conjunction with the landowner for each farm in the catchment. Actions are listed in approximate order of priority by farm.

Lake E North-Farm

1. Agree a lake level with EW and DOC
2. Remove lake edge willows
3. Install new fence
4. Plant lake edge with native vegetation
5. Install sediment traps at drain outlets
6. Fence wet area and establish wetland vegetation

Lake E South-Farm

1. Upgrade Effluent sump storage capacity
2. Relocate track on lake edge
3. Install sediment trap below hill track and at drain outlets
4. Agree a lake level with EW and DOC
5. Remove lake edge willows
6. Install new fence
7. Plant lake edge with native vegetation
8. Install a constructed wetland at Eastern end of lake

These actions are identified on a Map (Figure 2) and on an action plan summary table for each farm. Landowners easily refer to these summary formats. A report was also drawn up to provide background detail on all aspects of the action plan.

Costs

It was estimated the cost of the action plan which focused on improved lake water quality was $57,800 for the North farm and $132,500 for the South farm. Costs were higher for the South farm due to a greater length of lake frontage, the main water flow to the lake crossed their land and dairy effluent system was situated in their part of the catchment.

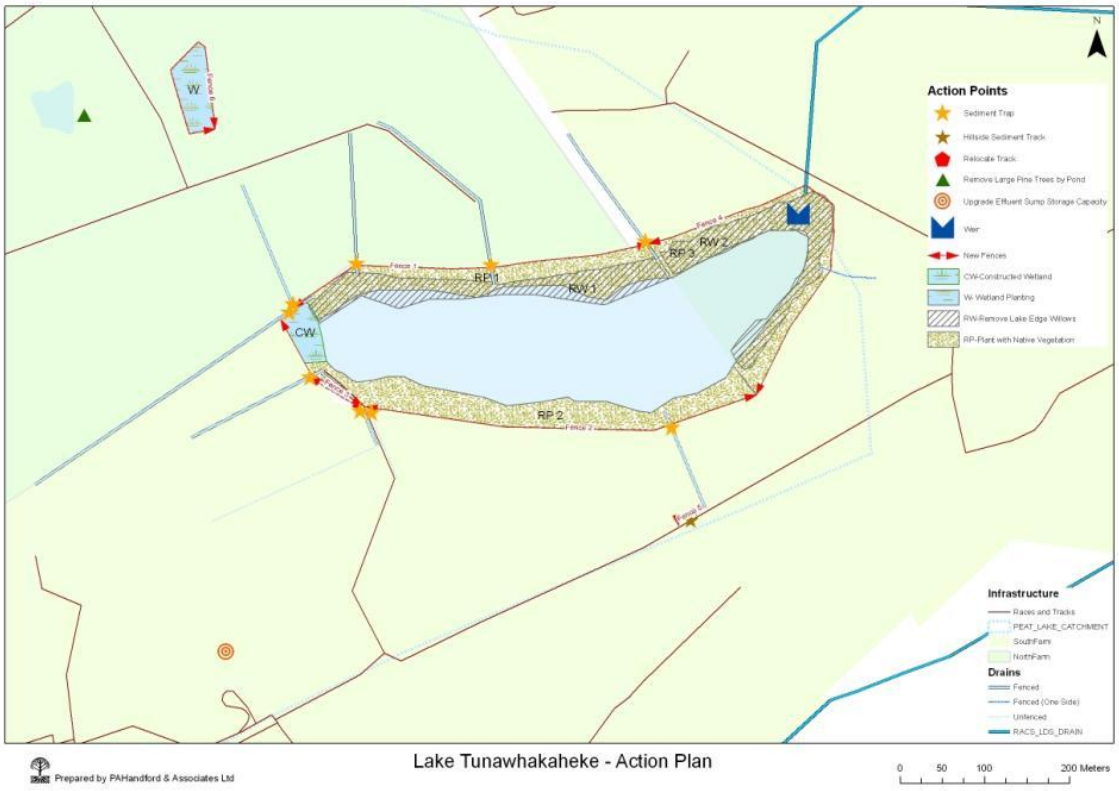

Figure 2 Action Plan Map

What are the Barriers to Implementation?

- The barriers were mainly to the move away from conventional tillage systems, yet there was little or no resistance to making better use of effluent, especially for summer crop growth.
- There was little resistance to changes or manipulations to the farm system, as this was perceived to be of positive economic benefit, and would lower the risk profile of both farms. Reducing fertiliser (N & P) usage, and being more precise about ensuring only what was needed is applied, was seen as an opportunity rather than a barrier.
- Getting the most appropriate information at the right time was perceived as a barrier (in relation to farm system design, effluent system design, and fertiliser information).
- Cost is a barrier to major works such as fencing, clearing weeds and planting. This can be reduced as DOC and EW have funding programmes to support initiatives around improving water quality. Also volunteer groups can provide plant material and help with planting which also reduces cost. Sharing costs with the community is fair given the range of stakeholders downstream who benefit from improved water quality.

Other potential barriers include the continued support of landowners and land managers. For example a sharemilker has different (shorter term) goals than landowners so potential conflicts may arise around issues such as nitrogen use and growing crops for supplementary feed and require thorough understanding. Detailed whole farm planning and catchment planning has facilitated this understanding as these goals have been identified and discussed with agreed outcome in terms of management strategies going forward.

Ongoing Improvement

The plans developed are considered living documents which provide a platform for ongoing improvement. They should be reviewed at least annually or when significant changes and actions take place. Also additional information could be incorporated. For example, more characterisation of soil quality using farm scale landuse capability mapping and high accuracy topographic information (0.5m contours) from a LIDAR (Light Detection and Ranging) survey (which EW have conducted) could be added. Visual Soil Assessment (VSA, Shepherd, 2009) can be used to establish existing soil quality and catalogue the benefits which should accrue as stocking rate is reduced and soil management is adjusted with time. To improve the precision with which fertiliser is applied aspects such as fertiliser type, timing of application and application technology need to be considered. The latter is often overlooked but can have a large impact, especially on farms with frequent shallow open drains often associated with peat soils. For example while a fertiliser spreader may travel at 16 metres between runs or "bouts", depending on the product used, the spread pattern of fertiliser may extend beyond this distance. Therefore fertiliser granules may end up directly in open drains. The driving and spreading patterns used in the application of fertiliser should be assessed in relation to this.

The Value of Strategic Plans: Addressing Environmental Issues at a Catchment Level.

A formal plan with an action map to work from has been developed with the aim of improving lake water quality. Importantly sources and type of contaminants have been identified along with the required remedial actions. In particular the catchment plan, which has been agreed among the various stakeholders, provides a structured platform for all parties to work from. In this way common goals can be achieved. The alternative piecemeal approach whereby individual stakeholders attempt small scale actions is unlikely to achieve the same level of success. The plans highlight priorities so implementation can be managed in line with other stakeholder priorities and as opportunities arise.

Whole farm and catchment plans have quantified the intuitive direction which land managers feel will take them along the path of farming with the lake in mind. The associated formal analysis provides the confidence to take the plans forward in a coordinated stepwise fashion. For example lower impact, more profitable farming systems have been identified for implementation to capture on-farm benefits and the support of external partners such as DOC and EW are recognised to provide community benefits (aesthetics and water quality).

While not the complete answer, these structured plans provide evidence of how economic, environmental, social and cultural issues associated with the land are managed. This can be a valuable way to demonstrate to regulators and markets that high quality environmental management is in place. Effective quality assurance of this type potentially provides a way to distinguish New Zealand farms and their produce in discerning overseas markets.

References

Collier K., Hamilton D., Vant W.N. and Howard-Williams C., 2010: Waters of the Waikato. *Publ. by* Waikato University's Centre for Biodiversity and Ecology Research and Environment Waikato.

Land and Water Forum. 2010. Report of the Land and Water Forum: A Fresh Start for Fresh

Water at *http://www.landandwater.org.nz/land_and_water_forum_report.pdf*

Shepherd, T.G. 2009: Visual Soil Assessment. Volume 1. Field guide for pastoral grazing and cropping on flat to rolling country. Second Edition. Horizons Regional Council, Palmerston North, New Zealand.