INTERNAL

OINGO LAKE ECOLOGICAL MONITORING 2006

June 2007
EMI 0710
HBRC Plan No. 3950

HAWKE'S BAY
REGIONAL COUNCIL

159 Dalton Street + Private Bag 6006 + Napier
Telephone (06) 835 9200
Fax (06) 835 3601
Regional Freephone (06) 0800 108 838
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Environmental Management Group
Technical Report

Internal

Environmental Monitoring Section

Oingo Lake Ecological Monitoring 2006

Prepared by:
Andrew Lamason - Data Technician

Reviewed by:
Brett Stansfield - Scientist Surface Water Quality

Approved:
Murray Buchanan, Group Manager – Environmental Management

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OINGO LAKE ECOLOGICAL MONITORING 2006

Report prepared for Hawke's Bay Regional Council

Andrew Lamason
Data Technician
HBRC

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CONTENTS

Cover photo: Swamp Flax Fields (*Phormium tenax*) on the northern side of the lake.

INTRODUCTION

Regular monitoring of ecological condition and trend is built into the planned management of Oingo Lake, Hawke's Bay, by the Hawke's Bay Regional Council. The name Oingo Lake is used in preference to Lake Oingo, because it appears to be the more traditional name.

In late November 2002, a regime for monitoring the ecological condition and trend of the lake was set up on contract for the Hawke's Bay Regional Council by Geoff Walls. This was done using five years' experience gained in establishing a similar monitoring regime in Pekapeka Swamp and other wetlands in Hawke's Bay, including nearby Runanga Lake, a similar ecosystem. It also had the benefit of the local knowledge of adjacent landowners and Department of Conservation staff. Baseline surveys of vegetation and fauna were carried out at the same time.

The findings of the baseline survey and ecological monitoring establishment were reported on in Walls 2002b (Oingo Lake Ecological Monitoring 2002). A companion report provides more background information and forms a monitoring plan (Walls 2002a: Oingo Lake Ecological Monitoring Plan). The management plan commissioned by the Council (Cairns 2002: Lake Oingo Management Plan) includes the concept of ecological monitoring. The monitoring plan and the monitoring report are designed to do that job and to mesh with the management principles in the draft management plan. This report is a continuation of the protocols established in the monitoring report 'Oingo Lake Ecological Monitoring 2004'

In November 2006 the wetland was revisited and the monitoring was repeated. This document reports on the findings.

1. VEGETATION

1.1 Terrestrial vegetation

There were two aspects to monitoring of the terrestrial vegetation of the lake: mapping of the current vegetation cover; establishment of photopoints. A third technique used in other wetlands in Hawke's Bay, the establishment of permanent vegetation monitoring plots, was not considered necessary at this particular wetland.

1.1.1 Vegetation map

Method:

The patterns of terrestrial vegetation were mapped in late November 2002 using recent monochrome aerial photos. A copy of this map is shown in Appendix 1. Re-mapping is scheduled for 2007-8.

Observations:

Six major vegetation types and three minor types were identified and mapped (see below). No significant changes between 2004 and 2006 were noted.

W Willows dominant: forest and patches of trees, mostly crack willow but also much grey (pussy) willow and a few weeping willows. Stands at each end of the lake; smaller patches and strips elsewhere. Typically associated with cabbage trees, harakeke (lowland flax), raupo and sedges (particularly *Carex secta*, which forms a genuine understorey in places). Various exotic grasses and herbs beneath also. A stronghold of swamp nettle (*Urtica linearifolia*). Most areas periodically flooded; mostly accessible to stock.

R Raupo dominant: forming dense stands right around the shore of the lake; large tracts in places, also forming "islands" in open water. Rushes and sedges are present and form patches in places (e.g. *Juncus effusus*, *J. amabilis*, *Carex secta*, *C. geminata*, *Bolboschoenus fluviatilis*, *Eleocharis acuta* and *Schoenoplectus validus*). Mixed with harakeke and invading willows in places. Appears to be spreading into the lake in places. Regularly cleared in places for access, views and duck hunting.

H Harakeke (lowland flax) dominant. Typically associated with sedges and raupo and being invaded by willows in places. Large areas at the northern end; common elsewhere. This is probably the largest area of harakeke in Hawke's Bay.

P Pasture. Surrounding the lake. In constantly wet grazed turf are primarily glaucous sweetgrass (*Glyceria declinata*), creeping bent (*Agrostis stolonifera*), and Mercer grass (*Paspalum distichum*), along with various rushes and sedges. In dry grazed pasture, Indian doab (*Cydonon dactylon*) and perennial ryegrass (*Lolium perenne*) are particularly prevalent.

D Damp pasture of exotic grasses and herbs but with various rushes and sedges (mostly exotic).

O Open water.

The three more minor vegetation types that were identified and mapped in 2002 are:

- Manuka dominant: small patches on the NW side of the lake.

- Sedges dominant: *Carex secta* and *C. lambertiana* with raupo, harakeke and some willows at the northern end.
- Pines: two exotic plantations on the western side.

Whilst little is left of the vegetation present in pre-human times, these types mimic the natural patterns to a certain extent. In the past, the lake would naturally have been surrounded by dense forest, dominated by totara, ngaio, kowhai and kanuka on the hills and by tall kahikatea on the rich wet soils near the shore. Fringing that on the lake shore would have been cabbage trees, harakeke (lowland flax) and purei (tussock sedges). Further into the water still would have been areas of tall rushes and sedges, including raupo. Very wet peaty flats probably contained shrub communities that included manuka. A small amount of manuka still persists on the NW side of the lake.

Willows have been introduced to provide a replacement tree element in the system. Although this has created valuable habitat for fauna and flora, it has brought with it a significant problem. The willows are more tolerant of prolonged inundation than any native tree or shrub, and as a consequence are invading the entire shore area. This is exacerbated by fluctuating and artificially lowered water levels. It also makes the prospect of restoring natural shore vegetation a challenge. The Regional Council is proposing to control willows at each end of the lake, in what would be a major intervention. At least one landowner has done some willow control already. Substantial raupo control, for reasons that are not explicit or based on ecological analysis, are also proposed. Fencing the entire lake margin from stock, a key to vegetation and habitat recovery, is also proposed. Monitoring is required to assess the ecological consequences of fencing, willow spread, raupo dynamics and the effects of control. The vegetation map and photopoints are designed to do that job, and to follow the processes in the rest of the vegetation around the lake.

Next monitoring:

In three to four years' time (late 2007-8).

1.1.2 Photopoints

Method:

8 photopoints were set up in late November 2002. Because of stock sensitivity at the time, they were all on the eastern side of the lake, but were chosen to represent the spectrum of terrestrial vegetation types and situations around the lake. They were also selected to be readily relocated. No posts or tags were used; rather their locations were fixed using a hand-held GPS unit. Photos were taken from the standing position at each photopoint: mostly panoramas of the vegetation; some more localised and specific. A SLR camera with a 50mm lens was used. Film was Kodak colour print, 200asa. The method was repeated in November 2004. The photos, in order, are in the album that accompanies this document. In 2006 photos have been taken on a Cannon digital camera and stored as JPEG Images

The location of each photopoint is marked on the map (Appendix 1). It is also described on the photopoint recording sheet (one for each photopoint, Appendix 2). Also on each sheet is a description of the vegetation and the ecological patterns and processes occurring there.

Observations:

Photopoint 1:

Sited on the hillside quite high above the pa site on the south-eastern side of the lake. A good vantage, chosen to follow the processes within the patterns of raupo, willows, harakeke and sedges around the lake. In 2004, the water level was higher than in 2002. Therefore raupo appeared to be lessened, although in reality probably not. Willows had grown somewhat larger and young ones were growing up in places. Otherwise the situation was similar to 2002. Willow control done opposite had been mostly but not completely successful. The pines opposite were key nesting habitat for black shags, substituting for kahikatea and other trees of the past.

In 2006 the water levels appear to be slightly lower with more exposed edge between the raupo and the dry margin. This has been exploited by cattle and the raupo is being heavily grazed but has generally thickened and extended outward following spraying in previous years. All mature willows are showing signs dieback with most now being dead on the western shoreline. More pines on the western shore are showing signs of shag induced dieback and this is becoming an issue of concern for the land owner.

Photopoint 2:

Sited down on the shore north of the pa site. Chosen to follow the dynamics of the raupo fringe that is subject to grazing and occasional burning. In 2004, the raupo fringe had been chewed back by stock but was regenerating. Some young willows were establishing in the raupo; readily controlled at this stage. Otherwise similar to 2002.

In 2006, this site is almost identical to the previous records for the site. The raupo is currently undergoing a grazing phase where little regrowth is evident adjacent to the land edge. However there has been some migration of the raupo out into area that have been sprayed and the fringe has generally thickened. Young willows are continuing to establish and are starting to overtop the raupo in places. *Potomageton cheesemanii* and *Urtica linaerifolia* were previously noted at this site but are no longer evident. This is possibly due to the lower water levels and grazing pressure. Carex secta in the area are showing the signs of severe damage caused by cattle grazing.

Photopoint 3:

Sited on the hillside above the SE end of the lake. Chosen to follow the processes within the patterns of willows (forest, treeland and invading fringe), raupo and harakeke. In 2004, young willows had grown considerably around the shore and unless controlled will form a continuous fringe around the SE shore of the lake. Also growing up in the magnificent harakeke was a raupo expanse at the SW corner. Both harakeke and raupo looked healthy. Since 2002, a QEII Open Space Covenant had been created in the SE corner, and considerable work done: creation of a channel for access and ponds for hunting and protection/enhancement of natural values. That meant that there was considerable structural diversity in the lakeshore vegetation and habitat for birds there now.

In 2006 the willow forest remains as the dominant structural component, with raupo continuing to thicken and crowd the harakeke fields. Carex spp in the lower SE corner are looking healthy and have no signs of grazing. Some raupo control has been undertaken previously but in general the raupo is in good health.

Photopoint 4:
At the NE end of the lake at the end of the access track. Chosen to follow the interplay of willows, sedges and dense harakeke. Willow control would alter the scene drastically. In 2004, young willows had rapidly grown up in the flaxland (harakeke) and become dominant. Stock still had access to the lakeshore vegetation: HBRC could help with fencing if requested.
In 2006, HBRC has funded fencing and willow removal but this needs to be continued by the landowner to have any effect. Young willow regrowth is prolific and will completely obscure any current progress in restoring the lake edge if not followed up. The flax fields are in excellent health where now free of shading from the mature willows and those still under the willow canopy are predicted to recover similarly if the overtopping trees are removed. Carex sedgeland is in good health with new recruits evident and adult plants in excellent condition.

Photopoint 5:
Sited on a small knoll at the NE end of the lake. Commands a good view of the expansive harakeke area, the willow patches and the raupo fringe. In 2004, there was surprisingly little change in the raupo. Harakeke looked healthy. The main change was that young willows had grown substantially on the edge of and within the harakeke. The willow control in the NW looked to have been only partially successful.
In 2006 the outer raupo edge is consistent with that of 2004. this is being pinned back by spraying (F. Kelly pers comm.). young willows appear to be colonising new areas amongst the flax and established plants continue to increase in stature. These have the potential to severely reduce the extent and health of the flax land. Many Black Backed gulls and Black Swans are evident from this point. Gulls appear to be using the lake as a rest station from feeding at the nearby by Omaranui landfill.

Photopoint 6:
Sited on the hillside 60m west of Photopoint 5, and an even better vantage. Chosen to complement the other photopoint and provide more detail. In 2004, the situation was that described for Photopoint 5.
In 2006, the raupo fringe is generally consistent with 2004. there have been areas of minor advance matched by areas of reduction to give and overall even balance of raupo cover to that of the previous survey period. The lake level appears to be lower as areas that previously showed a cover of azolla are now dry and have ephemeral terrestrial weeds species present. The large weeping willows have been removed and have been replaced by rank pasture grass and ephemeral weedy herbs.

Photopoint 7:
Sited on a broad spur at the NE end of the lake. A complement to Photopoints 5 and 6. Manuka areas opposite are visible from there. In 2004, the situation was that described for Photopoints 5 & 6. There had been surprisingly little change, though young willows had grown considerably and must be of concern now. Raupo was virtually exactly as in 2002, despite the lack of artificial control. Canada geese were seen there.
In 2006, the situation is consistent with that of previous years and the previous photo point. The willows continue to increase in area and stature and will be reducing the vigour of lower growing species such as flax and raupo in this unit. Large floating rafts of macrophytes are evident in the embayments amongst the raupo. As these rafts decompose they will possibly aid the expansion of raupo into these embayments. Willows at the base of the spur adjacent to the photopoint have thickened considerably as have the Carex spp on the landward edge that are now free from grazing.

Photopoint 8:

Sited on a knoll south of Photopoint 7. Has a good view of the inlet channel, manuka and raupo areas. In 2004, the willow control on the opposite shore had only been partially successful: willows there were growing back fast. Raupo was remarkably similar in distribution to that in 2002 (suggesting that the higher water levels have been sufficient to stop the advance into the lake), though it had thickened a little in places. Willows had become an invasive worry in the harakeke.

In 2006 it is evident that less than 20% of the original willow forest ahs been killed by spraying with the remaining 80% showing signs of vigorous recovery. The raupo has formed a complete buffer on the landward edge but is reduced to clumps of poor health. This probably reflects the use of sprays from boats. The raupo around the delta of the lake has been reduced also and this may be promoting the rate of influx of both sediment and nutrients into the lake as the stream now has a direct flow into the open water body.

Next monitoring:

November-December 2008; thence every second year. Photos to be repeated; recording sheets to be used.

Aquatic vegetation

Method:

The composition of the aquatic vegetation was assessed at two sites, chosen to represent the main parts of the lakeshore. Macroinvertebrate sampling was done at these sites too. The site locations are marked on the map (Appendix 1) and described on the combined aquatic vegetation and macroinvertebrate recording sheets (one for each site, Appendix 3).

Sampling at each site was done by hand-pulling aquatic vegetation and "washing" it in white plastic trays for examination. The aquatic macrophytes present were identified, and their relative abundance was recorded. Macroinvertebrates were searched for in each sample (see 2.4), and their standard sensitivity scores recorded to give a measure of water quality.

Observations:

At both sampling sites, the aquatic macrophytes were dominated by the exotic species hornwort (*Ceratophyllum demersum*), a plant that appears to have arrived and proliferated within the lake in recent years. Floating plants were mainly natives: duckweed (*Lemna minor*), Pacific azolla (*Azolla filiculoides*) and watermeal (*Wolffia australiana*). The exotic purple-backed duckweed (*Spirodela punctata*), present in 2002, was not found, perhaps due to cool conditions. A gelatinous globular floating green alga was common. At the southern site three plants not noted in 2002 were found: water speedwell (exotic), *Potamogeton cheesemanii* (native) and *Myriophyllum triphyllum* (native). This dispelled the speculation of 2002 that the native submerged macrophytes had been largely displaced by the exotic species. At the northern site water speedwell, water pepper and water forget-me-not (all exotics) had appeared since 2002.

In 2006 the aquatic plant association has been much reduced in both diversity and extent. The lake water was highly turbid and this may have been disguising many of the plants. However at sights that culd be accessed through the raupo the benthic attached flora appears to have been heavily grazed and few plants other than fragments were identified. The free floating species are consistent with previous surveys.

Ceratophyllum demersum fragments were often encountered however substantial portions of this plant were not. This could either reflect a lack of vigour due to the increased turbidity, grazing pressure by birds, or simply seasonal fluctuations in cover.

Next monitoring:

November-December 2008; thence every second year. Sampling to be repeated; recording sheets to be used.

Weeds

Method:

Weeds were searched for during the survey and monitoring of both the terrestrial and aquatic vegetation (1.1, 1.2). Their presence and impact were noted.

Observations:

The following terrestrial weeds were regarded in 2002 as requiring surveillance. They still are.

Crack willow (*Salix fragilis*) and **grey or pussy willow (*Salix cinerea*)**, well established and capable of dominating the riparian vegetation right around the lakeshores; also considered aquatic weeds; should be prevented from spreading and controlled where encroaching on open water, streams and traditional access ways, but provide the only forest habitat around the lake, vital to the continued survival of several native birds (including the rare Australasian Bittern) and the only rare native plant (swamp nettle, *Urtica linearifolia*).
Blackberry (*Rubus fruticosus* agg.), forming patches on the margins of willow forest in various places. Not really an ecological problem; more of a nuisance.

The following aquatic weeds are regarded as requiring surveillance:

Hornwort (*Ceratophyllum demersum*), abundant and dominant, forming very dense beds.
Purple-backed duckweed (*Spirodela punctata*), present in smallish quantities. Could displace the native floating species.
Curly pondweed (*Potamogeton crispus*), not found but common and forming dense beds in nearby Runanga Lake, where it has already displaced most of the native macrophytes.
Canadian pondweed (*Elodea canadensis*), present in nearby Runanga Lake, capable of forming very dense beds.
Water buttercup (*Ranunculus trichophyllus*), present in nearby Runanga Lake, capable of forming very dense beds.
Raupo (*Typha orientalis*) is not considered an ecological problem at present, in fact precisely the opposite: it provides vital habitat for wetland birds, including the rare Australasian Bittern, Spotless Crake and NZ dabchick. It should be subject to limited control at traditional access ways only.
In 2006, no extra plants are considered to have weed potential at the lake. Willows continue to be the greatest issue in regards to ecological integrity, although raupo tends to be the plant most lake stakeholders have issue with.

Next monitoring:

November-December 2008, along with other vegetation monitoring; thence every second year.

1.2 Notable flora

Method:

Plants of note were searched for during baseline survey and monitoring set-up.

Observations:

To date, only one rare plant has been recorded from the wetland. It is swamp nettle (*Urtica linearifolia*), which is present in the willow forests around the lake. It is reasonably common (as it was in 2002), and will be informally monitored through general observation as it does not appear to be currently at risk. There is a photograph of swamp nettle in the photo album that accompanies this report.

The other rare plant that could turn up is a floating liverwort, *Ricciocarpus natans*. This uncommon species is common in nearby Runanga Lake. It is "found in swamps with a high dissolved organic content in the water" (Coffey and Clayton 1988). It has previously also been recorded from Horseshoe Lake in central Hawke's Bay.

Should any other notable plants be detected or introduced in future, extra monitoring will be needed.

In 2006 the sites previously chosen to show the progress of *Urtica linearifolia* no longer contained this plant but it was noted as being reasonably common in adjacent areas. Stock grazing has probably caused this reduction in extent. *Ricciocarpus natans* was not noted.

Next monitoring:

November-December 2008, along with other monitoring; thence every second year.

FAUNA

2.1 Waterbirds

Method:

Two methods were used:

1. **Directed searches**, whereby a number of sites around the lake were visited to listen and look for crakes, rails and bitterns.
2. **General fauna survey**, whereby waterbirds were searched for during other survey and monitoring activities.

During the survey, fifteen species of waterbirds were recorded from Oingo Lake. The list includes NZ Dabchick (an uncommon endemic) and Australasian Bittern (a rare native). Both are listed as threatened by the Department of Conservation (Hitchmough 2002). In both 2002, 2004, and 2006 Dabchicks were seen right around the lake, both pairs and juveniles, indicating that there is a strong resident breeding population, possibly increasing. In 2006, few Bitterns were seen or heard, but this is possibly more a reflection of climatic conditions, strong winds, than an actual indication of the population status. For these two species, Oingo Lake is clearly a Hawke's Bay stronghold, especially in conjunction with nearby Runanga Lake and an array of smaller wetlands. Spotless Crake and Marsh Crake, two regionally rare wetland birds and hard to detect, could also be present. A possible sighting of Spotless Crake was made during the 2002 survey. The dense raupo and harakeke, backed by willow forest, whilst not good for recreational hunters, seems to suit these rare birds well.

The other wetland birds included swans, geese, ducks, shags, Pukeko, Australasian Harrier, Welcome Swallow, Spur-winged Plover, Pied Stilt, Black-fronted Dotterel and gulls. Of these bird species, two 2004 observations are notable: Black Shags (also listed as nationally threatened) had established a nesting colony of at least 10 pairs in the pines on the SW shore of the lake; Canada Geese had begun to use the lake. In addition, NZ Shoveler was present (it was not noted during the 2002 survey). Black-fronted Dotterel was not detected in 2004. The swans, ducks and Pukeko are seasonally hunted in the wetland. Although it is the nature of waterbirds to be somewhat shy, they are quite wary, suggesting that hunting is making it difficult for them to feed, roost and breed in safety. In 2006 the Black Shag colony still persists although the landowner has attempted to disturb this colony with occasional shooting as they are destroying his pine plantation.

The full list of birds detected during the November 2006 survey and their estimated numbers is in Appendix 4.

Next monitoring:

November-December 2008; thence every second year.

2.2 Other birds

Method:

General fauna survey, whereby birds other than waterbirds were searched for during other survey and monitoring activities.

Observations:

Eighteen other species of birds were recorded at the lake in 2002. Four were common natives, whilst the remainder were common introduced species typical of the Hawke's Bay rural scene. The same species (with the exception of Shining Cuckoo), in similar numbers, were recorded in 2004. The full list is in Appendix 4. Bird names are according to Heather and Robertson (1996). 2006 recorded a similar bird species list but in generally lower numbers due to strong winds during the period of the survey.

Next monitoring:

November-December 2008; thence every second year.

2.3 Fish

Method:

Because of constraints of time and access, no fish survey was done during the baseline survey and monitoring set-up. In 2004, eel nets and minnow traps were set overnight at the two aquatic sampling sites. In 2006 the lake wasn't surveyed as part of the HBRC fish monitoring survey due to access and turbidity issues. However Common bully were noted at the aquatic vegetation sampling sites and the lake will be routinely surveyed each year as part of the HBRC program.

Observations:

Oingo Lake is known to be regionally significant for native freshwater fish, and is a traditional harvesting site for eels at least. In 2002, it was considered that the fish most probably present were:

- Longfin eel (*Anguilla dieffenbachii*): reported from the lake. Known to be in serious decline in the North Island because of uncontrolled commercial harvesting.
- Shortfin eel (*Anguilla australis*): reported from the lake, the basis of commercial eeling.
- Common bully (*Gobiomorphus cotidianus*): reported from the lake.
- Goldfish (*Carassius auratus*): erroneously known as carp (McDowall 2000); introduced to New Zealand; reported from the lake.

This was essentially confirmed by the 2006 surveying. Small shortfin eels (25-40cm long), and common bullies were abundant. Longfin eels are still present in low numbers in nearby Runanga Lake and there are probably some in this lake also.

Possibly also present are:

- Koi carp (*Cyprinus carpio*): introduced to New Zealand; anecdotal reports from the lake; may or may not be present.

Next monitoring:

November-December 2006; thence every second year.

2.4 Aquatic invertebrates

Method:

Macroinvertebrates (invertebrates big enough to see with the naked eye) were sampled along with aquatic vegetation at two representative sites (see 1.2; locations marked on the map, Appendix 1, and described in the aquatic vegetation and macroinvertebrate recording sheets, Appendix 3). Aquatic vegetation samples were gathered by hand, and "washed" into trays to dislodge invertebrates. Water and substrate (mud, etc.) samples were also gathered and examined with the use of trays and a hand lens. Invertebrates were identified using the Taranaki Regional Council guidebook (1997) and Parkinson and Cox (1990). Sensitivity scores, indicative of water quality, were assigned from the Taranaki Regional Council guidebook (1997). Species found and their scores are listed in the aquatic vegetation and macroinvertebrate recording sheets (Appendix 3).

Observations:

In both sites, the invertebrates found in 2002 had sensitivity scores ranging from 3 (low water quality) to 5 (moderate water quality; 10 is very high water quality). In 2004, a few more species were recorded at each site, including those with very low sensitivity scores. In 2006 this number reduced to pre 2004 levels. The ranges and averages of the scores are tabulated below. They show that at neither of the sites was the water of particularly good quality, although it should be pointed out that the scores are primarily for streams rather than still bodies of water such as lakes. The greater diversity of species found in 2004 could be due to higher water levels (and therefore better lake edge habitat for invertebrates).

	Number of species found		Range of sensitivity scores	
	2004	2006	2004	2006
Site 1	12	10	1-5	1-5
Site 2	12	8	1-5	1-5

Kakahi or freshwater mussels (*Hyridella*) and koura (freshwater crayfish, *Paranephrops*) may be present in the lake.

Next monitoring:

November-December 2008; thence every second year. Sampling to be repeated; recording sheets to be used.

2.5 Mammalian pests

Method:

General fauna survey, whereby signs of mammalian pests were searched for during other survey and monitoring activities.

Observations:

Nine mammals that can be regarded as pests in the wetland were detected during baseline survey and monitoring set-up (and re-confirmed in 2004):

- Domestic goat: a few.
- Domestic red deer, cattle and sheep: partly fenced out of the lake now, but still unimpeded in most places.
- Rabbit: present around the margins in moderate numbers.
- Hare: present around the margins in low numbers.
- Possum: present around the lake margins, in moderate numbers especially in the willow forests; should be controlled as a matter of urgency.
- Hedgehog: present around the lake margins.
- Feral cat: present around the lake margins; should be controlled.

Other mammalian pests probably present but not detected include:

- Ship rat and Norway rat: known predators of birds, lizards and invertebrates.
- Mouse: known predator of invertebrates.
- Stoat, ferret and weasel: known predators of birds, lizards and invertebrates; good swimmers.

Next monitoring:

November-December 2008; thence every second year.

2.6 Terrestrial invertebrates

Not deliberately surveyed or included in the monitoring plan, but worthy of attention during general survey. No noteworthy species were detected in either 2004 or 2006.

2.7 Reptiles and amphibians

Also not deliberately surveyed or included in the monitoring plan, but worthy of attention during general survey. No lizards or frogs were detected, either in 2002 or in 2004, but in 2006 the Common Stink *(Oligosoma nigriplantare)* was sited near site photo point 3 on limestone outcrop with blackberry cover. This suggests that the area is suitable habitat for this species and that the blackberry is potentially providing cover in the absence of traditional indigenous cover such as Muehlenbeckia spp etc. Restoration efforts may achieve greater biodiversity preservation goals if areas of the dryl;and system can be incorporated as well as the obvious wetland areas. Pest control works around the lake will no doubt benefit this group of animals as well.

Next monitoring:

General observation, November-December 2008; thence every second year.

CONCLUSIONS AND RECOMMENDATIONS

The monitoring regime has allowed a series of conclusions to be drawn about various aspects of the ecological condition and trend of Oingo Lake, and the efficacy of management. Out of these conclusions flow a consequent series of recommendations. They build on those from the 2002 baseline survey but are essentially similar.

1. Fencing and native vegetation restoration

Most of the lake is not fenced from stock, or is managed with a grazing regime. Fencing to exclude stock would allow the kind of recovery in native vegetation that is taking place in nearby Runanga Lake where some of the shore has been fenced off. Harakeke, raupo, sedges, rushes and cabbage trees would be likely to proliferate. However, so too would willows. There are several properties involved, and not all owners are in favour of Regional Council involvement. Managing the lake margins in such complex ownership is not straightforward. However, there is the possibility of the establishment of a community interest group for management of the lake and the Regional Council could offer coordination and active assistance if asked.

Because the native vegetation has become so depleted around the lake and in the surrounding landscape, deliberate planting would be helpful to create a dominant and self-perpetuating cover of native vegetation for the future. The Regional Council could usefully provide guidance and assistance in this restoration initiative as well.

> *Recommendation: That the Regional Council assists in maintaining existing fences in stock-proof condition and that assistance to fence other parts of the lake margin be offered to owners if requested.*
>
> *Recommendation: That the Regional Council encourages the planting of native plants in the areas of former pasture from which stock are excluded, and that willows be controlled to allow this (see below).*

2. Willow control

Without control, grey (pussy) and crack willows will quite rapidly come to dominate the entire lake surrounds. However, the areas of older willows at each end of the lake are vital in providing habitat for swamp nettle and a number of native birds, and mimics the function of the former native forests that would have fringed the lake in the past. Those willows therefore should not be cleared before native forest vegetation is ready to replace them. With that in mind, containment of the willows but not eradication is preferable at this stage. Prevention of their spread is the greatest priority.

Willows are rapidly proliferating in places. Control is desirable before the task becomes great. The Regional Council could provide useful assistance in that regard. Aerial herbicide application is not necessary or desirable at Oingo Lake. It would be too crude and ecologically rough for such a wetland, and there would be consequent loss of much of the raupo and harakeke beds and tree cover that are so valuable as habitat for birds. Ground-based and boat-based control (cutting and poisoning) should achieve the desired ecological outcomes without the same costs.

Currently there are trials involving the establishment of desirable native species such as Kahikatea under mature willow canopies. This technique will use the existing willow forest to provide a suitable cover for the establishment of these species which is traditionally performed by establishing pioneer species in restoration projects. Allowing kahikatea to emerge from the Willow canopy will ensure that this tall forest structural component of the wetland is not put in jeopardy, the climatic extremes are avoided when establishing, and with an eventual evergreen canopy established the rate of willow recruitment will be reduced also. Landcare research ahs been contacted for up to date information as to the success of these trials at Lake Ngaroto in the Waikato. The results should be carefully assessed as they may provide a less destructive and invasive technique for restoration which may in tern shortcut the restoration process.

> *Recommendation: That willow control be confined at present to the younger growth spreading out from the older stands, and that if the older willows are cleared, that be done in modest stages with the ground they vacate being replanted in appropriate native trees and other wetland margin plants.*
>
> *Recommendation: That mature willows are under planted with native tree species such as Kahikatea and these trees allowed to reach the willow canopy before the willows are removed. Monitoring of current trials at Lake Ngaroto should be followed closely and/or small scale trials established under the canopy at Lake Oingo.*
>
> *Recommendation: That ground and boat-based control methods preferably be used to kill existing young willows and prevent their reinvasion.*

3. Raupo control

Substantial raupo control is proposed for each end of the lake in the Regional Council's management plan (Cairns 2002). This proposal does not appear to be based on any ecological analysis. It is my opinion that raupo is not an ecological problem at the lake at present, in fact quite the contrary: it is providing important habitat for rare and common wetland birds, and probably for fish and invertebrates as well. The remarkable lack of raupo spread between 2002 and 2006 suggests that so long as adequate water levels are maintained in the lake, raupo will not spread much and could be readily kept where it is by small-scale boat-based control.

In 2006, the situation for Raupo is consistent with previous years with little extension of its boundaries. The Raupo still shows the marks of previous control attempts, reflected in its patchiness and lower stature as those plant poisoned slowly recover. It is not possible at present to say if the elevated water levels are responsible for the lack of growth in the Raupo boundaries as spraying may be artificially adjusting this edge.

My opinion of the Raupo situation is similar to that of Walls 2004, in that Raupo is an important component of the lake supporting many of the rarer bird species as well as providing valuable habitat for aquatic life. If Raupo is deemed as a problem growth then this is probably symptomatic of other issues affecting the lake. Sediment and nutrient inputs into the lake probably need closer attention to limit the growth conditions for raupo. Treating the excessive plant growth is most likely treating a symptom rather than the cause.

> *Recommendation: That the Regional Council examines its rationale for raupo control, and focuses on monitoring alone until such time as control is deemed to be ecologically imperative.*

4. Water levels, flows and aquatic vegetation

The water level of the lake has been lowered in the past by artificially channelling the outlet channel. Inlet drains have also been dug. The lake is therefore probably now smaller and shallower than it was naturally, rendering it somewhat vulnerable as an ecologically healthy wetland. The mean water level should not be lowered further. There was a little more water in the lake in 2004 than in 2002, but this was lower again in 2006. The cause of these fluctuations is not clear. However prevailing climatic conditions reducing the amount of inflow may be influencing the level as much as any adjustments to control structures.

> *Recommendation: That the issue of long-term maintenance of lake water levels be placed on the agenda for discussion between the Regional Council and the Oingo landowners.*

5. Weeds

There are some terrestrial weeds present, and a few aquatic ones. Of greatest concern are grey and crack willows (see 2. above), and hornwort (which is difficult to control). Water net poses a serious potential threat to this shallow lake, and could easily arrive. Commercial eeling is being done in wetlands where it is prolific in Hawke's Bay, and may also be proceeding in Oingo Lake. It is highly likely that water net will appear in Oingo Lake and other wetlands in the vicinity by this means unless steps are taken immediately. Potentially troublesome terrestrial arrivals could be vines such as Japanese honeysuckle. They should be controlled as soon as they are detected.

> *Recommendation: That commercial eeling activities be either banned or placed under strict surveillance to ensure that water net and other aquatic weeds are not transported to Oingo Lake.*

> *Recommendation: That Japanese honeysuckle and other such newly arrived weeds be controlled wherever found in the wetland.*

6. Notable flora

Swamp nettle (*Urtica linearifolia*) is the only known rare plant in the wetland. It is currently flourishing and is fairly widespread. Willow forests seem to provide the habitat this plant requires currently, mimicking the role played by the native forest fringe in the past. The rare floating liverwort *Ricciocarpus natans* is currently quite common at nearby Runanga Lake and could turn up.

In 2006 no new notable flora were identified. Populations of *Urtica linearifolia* appear to be in good health but are very patchy in their distribution, with some previously identified patches now non existent but these have probably been replaced in other areas by new recruitment of plants.

> *Recommendation: That swamp nettle continues to be monitored, and that the older willow forest be retained for the interim to ensure there is habitat for the nettle.*

> *Recommendation: That the floating liverwort* Ricciocarpus natans *be looked out for, via the aquatic sampling sites.*

7. Water birds

The variety and numbers of water birds appear to be holding their own at present. Two nationally threatened species - Australasian Bittern and NZ Dabchick – are resident at the lake. In fact, Oingo Lake possibly holds among the best breeding populations of these birds in Hawke's Bay. A third nationally threatened species, Black Shag, has recently established a breeding colony in the pines on the SW shore of the lake. It is not known whether Spotless Crake, Banded Rail or Marsh Crake might still persist; they are notoriously hard to detect, especially after the breeding season. A specific search by experts in spring might reveal these birds. The continued hunting of waterfowl seems at odds with the restoration of a natural wetland. However, since the hunters are the prime users of the wetland at present it would be better to incorporate their energies and insights into restoration management rather than alienating them.

> *Recommendation: That the populations of Australasian Bittern, NZ Dabchick and Black Shag be regularly monitored.*
>
> *Recommendation: That a specific search be mounted in spring for Spotless Crake, Banded Rail and Marsh Crake, using local Department of Conservation and Ornithological Society expertise.*
>
> *Recommendation: That hunters' energies and aspirations be incorporated into restoration management where possible.*
>
> *Recommendation: That the landowner with the pine block currently being used by the Shag colony is approached by Land Management staff to explore options for maintaining this roost site. Either purchasing the entire of part of stand, covenanting the land and stand or some similar approach may be needed to preserve this colony as the Landowner has indicated that he wishes to remove both the birds and the trees.*
>
> *Recommendation: That where possible members of the local branch of the Ornithological society are encouraged to undertake bird counts throughout the year. The point of time survey of the wetland system is insufficient in catching the populations of more cryptic species. Introductions between landowners and interested Ornithological society members.*

8. Land birds

Land birds use the wetland in considerable numbers. Most are exotic (introduced) species, but a few are natives. There is little available habitat for indigenous land bird species in the lake environs.

> *Recommendation: That land birds continue to be monitored routinely.*

9. Fish

The current status of fish in the lake is not clearly documented. It is possible that eels are being commercially harvested in an uncontrolled way. The catch of just small eels in November 2004 suggests past indiscriminate harvesting, in complete contrast with the careful selective harvesting in nearby Runanga Lake that is leading to a rapid building up of both the eel population and its size structure. The introduction of serious aquatic weeds such as water net is a dire probable consequence of uncontrolled fishing activity (see 4 above).

Recommendation: That a comprehensive fish survey of the lake be carried out.

Recommendation: That the practice of commercial eeling in Oingo Lake (if it is occurring) be reviewed in the light of apparently depleted eel stocks and the potential introduction of serious water weeds, and that MAF be formally approached with the suggestion that it reviews the way it grants commercial eeling licences in Hawke's Bay.

10. Aquatic invertebrates and water quality

Aquatic macroinvertebrates provide a useful measure of water quality and habitat condition. They indicate that the lake can support a considerable diversity of small animal life around its shores, but that the water quality is compromised both by low water levels and by artificial nutrient input. There are limitations to the technique though, because it was primarily developed for stream systems, and other measures of water quality are necessary for comprehensive monitoring of condition and trend. The Ecological Monitoring Plan for Oingo Lake (Walls 2002) proposes regular (monthly or quarterly) sampling of standard parameters. These included pH, conductivity, turbidity, colour absorbances, biochemical oxygen demand, dissolved reactive phosphorus, ammoniacal-nitrogen, nitrate-nitrogen, total phosphorus and total nitrogen. The Regional Council's management plan (Cairns 2002) also suggests such monitoring.

Recommendation: That aquatic macroinvertebrate monitoring continues.

Recommendation: That monitoring of other standard water quality parameters be seriously considered.

11. Mammal pests

Herbivorous mammal pests are a limitation on restoration of native vegetation. Domestic stock have been partly excluded by fencing, but have access to most shores. The main mammal threats otherwise are from possums and predators (cats, ferrets, stoats, weasels and rats). Particularly in view of the presence of a resident population of Australasian Bittern and NZ Dabchick, restoration management plans should include active on-going control of these pests. The readily accessible nature of the wetland lends itself to the maintenance of a system of traps and bait stations. The Regional Council could possibly help landowners with advice and resources.

Recommendation: That the landowners be encouraged to run an active programme of possum and mammal predator control for the wetland, with assistance from the Regional Council.

12. Archaeological sites

There are several regionally important archaeological sites, including pa sites, around the lake. Any proposed works, especially fencing, roading and building, should be highly cognisant of potential impact on the sites.

Recommendation: That consultation with local archaeological experts and tangata whenua be carried out prior to any proposed works being started.

13. State of the Environment (SOE) monitoring and reporting

Parameters used in this monitoring regime are directly applicable to State of the Environment (SOE) monitoring and reporting. Using a basic assessment of status (or condition) and trend for each parameter, they can be used as environmental indicators, and an overall condition and trend rating for the wetland as at November 2006 can be arrived at. It is demonstrated in the table below.

The conclusion is that the wetland is in a moderately natural state but is neither improving nor deteriorating overall at this stage. It is expected that restoration management will produce a marked improvement in status/condition in future.

Indicator	Status/Condition (**H**igh, **M**edium, **L**ow	Trend (**I**mproving, **S**table, **D**eteriorating)
Native vegetation	M	S
Native flora	L	S
Native birds	M-H	I
Native fish	L?	D?
Native macroinvertebrates	M	S-I
Water levels	L-M	S-I
Water flows	L-M	S
Water quality parameters	?	?
Weed control	M	D
Animal pest control	L	S
Human disturbance control	M	S
Overall ecology	**M**	**S**

Recommendation: That a similar tabulation of ecological condition and trend be used as part of the regular monitoring reporting for the wetland.

14. Monitoring techniques and frequency

In the light of seven years' experience in Pekapeka Swamp and other wetlands in Hawke's Bay, the suite of techniques being used to monitor the ecological condition and trend of Oingo Lake appears to be appropriate and valuable. The only issues are the difficulty of detecting rare water birds (see 6.) and the lack of monitoring of water quality parameters (see 4 and 9 above). In view of the relative stability of the wetland but some pressing management needs, monitoring at two-yearly intervals seems sensible.

Recommendation: That the current ecological monitoring programme be continued.

15. Information for and relationship with landowners

In November 2004, the landowners contacted were very helpful and interested in the ecological monitoring. More than one expressed the wish to obtain personal copies of the 2002 monitoring plan, the 2002 baseline survey and monitoring report and the 2004 monitoring report. This seems both appropriate and reasonable, given that the lake is entirely privately owned. The Regional Council would engender much goodwill by supplying the landowners with the reports.

Recommendation: That the Regional Council sends copies of the monitoring reports to the landowners.

ACKNOWLEDGEMENTS

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APPENDIX 1: Vegetation types and monitoring site locations, Oingo Lake, November 2006

Vegetation types

W Willows dominant
R Raupo dominant
H Harakeke dominant
D Damp pasture with rushes and sedges (grazed)
P Pasture (both grazed and rank)
O Open water

[Manuka
[Sedges
[Exotic pines

Monitoring sites

- Photopoints
- Aquatic sampling sites

APPENDIX 2: Photopoint recording sheets, November 2004

- Photopoint no. 1
- Photopoint no. 2
- Photopoint no. 3
- Photopoint no. 4
- Photopoint no. 5
- Photopoint no. 6
- Photopoint no. 7
- Photopoint no. 8

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 1**

Grid reference: V21/E2832707;N6175474

Establishment date: 28/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
On White/Potter boundary fenceline, 2 posts downhill from big strainer at top of rise.

Direction from marker/post (magnetic bearing): 6-photo panorama, S-W-N
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen because of a splendid vantage point from which to follow changes in patterns of raupo, willows, harakeke and sedges around the lake shore.

REPHOTOGRAPHY DETAILS:

Date	Observer/ Photographer	Comments (changes, processes, etc)
12/11/04	Geoff Walls	Water level higher than in 2002. Therefore raupo appears to be lessened, although probably not. Willows have grown somewhat larger and young ones are growing up in places. Otherwise similar to 2002. Willow control done opposite has been mostly but not completely successful. The pines opposite are key nesting habitat for black shags, substituting for kahikatea etc of the past.
28/11/06	Andrew Lamason	Lower water level than 2004, possibly due to climatic conditions. Raupo boundary is consistent with 2004. Willows on the opposite shore all dead bar a few exceptions. Pines in the Shag colony are showing signs of stress and some dieback. This is causing concern for the land owner who admits to trying to shoot the shags to cause them to move on.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 2**

Grid reference: V21/E2832414;N6175756

Establishment date: 28/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
To north of pa site at shore, just past a small bay with a maimai. 10m uphill from an angular fence post (not tagged).

Direction from marker/post (magnetic bearing): 2 photos, N and S
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen to monitor a raupo fringe that is grazed and burnt on occasion.

REPHOTOGRAPHY DETAILS:

Date	Observer/ Photographer	Comments (changes, processes, etc)
12/11/04	Geoff Walls	Raupo fringe has been chewed back by stock but is regenerating. Some young willows establishing in the raupo; readily controlled at this stage. Otherwise similar.
28/11/06	Andrew Lamason	As above. Grazing of Raupo obvious. *Urtica linearifolia* is still persistent but its supporting Raupo has been reduced somewhat. Carex spp are showing signs of grazing stress with those on the landward wedge being severely grazed. Juveniles willow are evident throughout the raupo margin and are beginning to overtop the Raupo.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 3**

Grid reference: V21/E2832873;N6174972

Establishment date: 28/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
On a terraced spur (part of a pa site), directly uphill from a hut and a silver willow tree. On fenceline (deer fence) at stayed post where the spur flattens off. White peg at post base.

Direction from marker/post (magnetic bearing): 6-photo panorama, S-W-N (50mm); 4-photo panorama (35mm).
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen because of a splendid vantage point from which to follow changes in patterns of raupo, willows, harakeke and sedges around the lake shore. A complex interplay of these vegetation types, and willow and raupo control proposed.

REPHOTOGRAPHY DETAILS:

Date	Observer/ Photographer	Comments (changes, processes, etc)
12/11/04	Geoff Walls	Young willows have grown considerably around the shore and unless controlled will form a continuous fringe around the SE shore of the lake. Also growing up in the magnificent harakeke is a raupo expanse at the SW corner. Both harakeke and raupo look healthy. Since 2002, a QEII OSC has been created in the SE corner, and considerable work done: creation of a channel for access and ponds for hunting and protection/enhancement of natural values. There is considerable structural diversity in the lakeshore vegetation and habitat for birds here now.
28/11/06	Andrew Lamason	Wilows remain as the dominant structural component in this unit. Raupo continues to expand with Harakeke becoming less evident but still in good health nonetheless. Many Carex spp are present and in excellent health with no grazing pressure.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 4**

Grid reference: V21/E2832046;N6177017

Establishment date: 29/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
At NE end of lake where access track reaches shore. At big double gates.

Direction from marker/post (magnetic bearing): 3-photo panorama, S-W
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen to examine dense flaxland with a fringe of sedges and flanks of willows. Stock have access at present, but fencing and willow control planned.

REPHOTOGRAPHY DETAILS:

Date	**Observer/** Photographer	**Comments (changes, processes, etc)**
12/11/04	Geoff Walls	Young willows have rapidly grown up in the flaxland and become dominant. Stock still have access to the lakeshore vegetation: HBRC could help with fencing if requested.
28/11/06	Andrew Lamason	The large willows have been removed and the riparian fringe has been fenced to exclude stock. Juvenile willows are becoming a prominent feature amongst the flax. New Carex secta recruits are evident amongst the rank grasses and ephemeral adventive species.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 5**

Grid reference: V21/E2832202;N6177001

Establishment date: 29/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
Top of small knoll above limestone rocks. Access via farm track from saddle to N.

Direction from marker/post (magnetic bearing): 4-photo panorama of visible lake
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen because of a good vantage point from which to follow changes in patterns of raupo, willows, harakeke and sedges around the lake shore. Raupo perhaps advancing into lake, forming islets. Some willow control has been done in NW. Fencing and substantial willow and raupo control planned.

REPHOTOGRAPHY DETAILS:

Date	**Observer/** Photographer	**Comments (changes, processes, etc)**
12/11/04	Geoff Walls	Surprisingly little change in raupo. Harakeke looking healthy. The main change is that young willows have grown substantially on the edge of and within the harakeke. The willow control in the NW looks to be only partially successful.
28/11/06	Andrew Lamason	The raupo boundary appears to be consistent with that of previous surveys. The raupo is being 'pinned back' in areas accessible by boat (F.Kelly pers comm.) Young willows are well established amongst the flax and will begin to displace them.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 6**

Grid reference: V21/E2832148;N6176974

Establishment date: 29/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
60m towards lake from Photopoint 5, on end of spur.

Direction from marker/post (magnetic bearing): 4-photo panorama of visible lake
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen because of a good vantage point from which to follow changes in patterns of raupo, willows, harakeke and sedges around the lake shore. Raupo perhaps advancing into lake, forming islets. Some willow control has been done in NW. Fencing and substantial willow and raupo control planned. A slightly better view than from Photopoint 5, providing more detail.

REPHOTOGRAPHY DETAILS:

Date	Observer/ Photographer	Comments (changes, processes, etc)
12/11/04	Geoff Walls	As for photopoint 5.
28/11/06	Andrew Lamason	Very little change in the raupo boundary. Raupo has some minor areas of advance (i.e. panorama shot 2 of sequence), matched with areas of retreat (i.e. panorama shot 1 of sequence). Large weeping willows have been removed and the pasture is now rank with many ephemeral adventive species. The area in 2004 that was covered by Azolla is now dry suggesting a significant lowering in the lake level with the consistent current climatic conditions of sun and strong winds.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 7**

Grid reference: V21/E2832183;N6176676

Establishment date: 29/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
On broad spur south of Photopoint 6.

Direction from marker/post (magnetic bearing): 5-photo panorama of visible lake
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Chosen because of a good vantage point from which to follow changes in patterns of raupo, willows, harakeke and sedges around the lake shore. Raupo perhaps advancing into lake, forming islets. Some willow control has been done in NW. Fencing and substantial willow and raupo control planned. Manuka patches on opposite shore visible.

REPHOTOGRAPHY DETAILS:

Date	**Observer/** Photographer	**Comments (changes, processes, etc)**
12/11/04	Geoff Walls	As for Photopoints 5 & 6. Surprisingly little change, though young willows have grown considerably and must be of concern now. Raupo is virtually exactly as in 2002, despite lack of artificial control. Canada geese seen here.
28/11/06	Andrew Lamason	The pattern of raupo with some advances and some retreat continues at this site as it did for Photopoint 5 & 6. Embayments amongst the Raupo are infilling with rafts of macrophytes and other floatsam possibly aiding the expansion of the raupo when they decompose. No geese were recorded but other water fowl in large numbers.

PHOTOPOINT RECORDING SHEET

Location/Area: Oingo Lake **Photopoint no: 8**

Grid reference: V21/E2832149;N6176369

Establishment date: 29/11/02 **Observer/Photographer: Geoff Walls**

Photopoint relocation notes:
On knoll at end of spur south of Photopoint 7.

Direction from marker/post (magnetic bearing): 3-photo panorama W-NW
Camera info (lens, film, etc): 50mm, 200asa colour

Vegetation (composition, structure, patterns, processes):
Looking up cut inlet channel and to each side. Vegetation as for Photopoints 5-7. Raupo is the main focus for this photopoint.

REPHOTOGRAPHY DETAILS:

Date	**Observer/** Photographer	**Comments (changes, processes, etc)**
12/11/04	Geoff Walls	The willow control on the opposite shore has only been partially successful: willows there are growing back fast. Raupo is remarkably similar in distribution to that in 2002 (suggests that the higher water levels have been sufficient to stop the advance into the lake), though has thickened a little in places. Willows are an invasive worry in the harakeke.
28/11/06	Andrew Lamason	Willow control on the opposite shore adjacent to the cut channel has been patchy at best. Less than 20% of the willows appear to have died with strong recovery evident amongst the remaining trees. Raupo on the near shore fringe have maintained a near complete buffer but the outer edge clumps are much reduced possibly due to spray activity. This is also occurring in at the delta with strong dieback of the raupo. There appears to be strong competition for roost sites amongst shags at this site.

APPENDIX 3: Aquatic vegetation and macroinvertebrate recording sheets, November 2006

- Site no. 1
- Site no. 2

AQUATIC VEGETATION AND MACROINVERTEBRATE RECORDING SHEET

Location/Area: Oingo Lake **Site no: 1**

Grid reference: V21/E2832525;N6175517

Establishment date: 28/11/02 **Observer: Geoff Walls**

Site notes (location details, vegetation, etc):
Small bay just north of pa site. No post or tag.

SAMPLING DETAILS
Date: 28/11/06 **Observer: A Lamason**
Sampling methods/notes: Tray and hand lens; samples taken from water's edge

AQUATIC VEGETATION PRESENT			**COMMENTS**
Species	**Relative abundance***		
	2004	2006	
Hornwort	M	S	
Lemna minor	S	S	
Azolla filiculoides	S	S	
Wolffia australiana	S	S	
Spirodela punctata	A	A	Present in 2002 not recorded since
Globular green alga	M	S	Has reduced somewhat
Raupo	S	M	Has thickened considerably
Potamogeton cheesemanii	M	S	Isolated patches only
Myriophyllum triphyllum	M	A	Not recorded in 2006
Water speedwell	S	S	

*** estimated % or: a = absent u = uncommon/rare s = some m = much**

AQUATIC VEGETATION AND MACROINVERTEBRATE RECORDING SHEET

MACROINVERTEBRATES PRESENT				**COMMENTS**
Species	**SENSITIVITY SCORE (1-10)**	**2004**	**2006**	
Copepod	5	P	P	.
Dytiscid beetle	5	P	A	
Daphnia (water flea)	5	P	P	
Xanthocnemis damselfly larva	5	P	P	
Potamopyrgus snail	4	P	A	
Gyraulus snail	3	P	P	
Physa snail	3	P	P	
Flatworm	3	P	P	
Hirudinea leech	3	P	P	
Microvelia bug	3	P	P	
Chironomus midge larva	1	P	P	
Beetle larva	?	P	P	

AQUATIC VEGETATION AND MACROINVERTEBRATE RECORDING SHEET

Location/Area: Oingo Lake		**Site no: 2**	
		Grid reference: V21/E2832073;N6176628	
Establishment date: 29/11/02		**Observer: Geoff Walls**	
Site notes (location details, vegetation, etc): NE edge of lake by old derelict hut. At end of boardwalk. No post or tag.			
SAMPLING DETAILS **Date: 28/11/06** **Observer: A Lamason** **Sampling methods/notes: Tray and hand lens; samples taken from water's edge**			
AQUATIC VEGETATION PRESENT			**COMMENTS**
Species	**Relative abundance***		
	2004	2006	
Hornwort	M	S	Has reduced somewhat
Creeping bent	S	S	
Lemna minor	S	S	
Azolla filiculoides	M	S	
Wolffia australiana	M	M	
Globular green alga	M	S	Has reduced somewhat
Raupo	S	M	Has thickened considerably
Carex secta	M	M	Some new plants established
Water speedwell	M	M	Not recorded in 2006
Water forget-me-not	S	S	
*** estimated % or: a = absent u = uncommon/rare s = some m = much**			

MACROINVERTEBRATES PRESENT				**COMMENTS**
Species	**SENSITIVITY SCORE (1-10)**	**2004**	**2006**	
Daphnia water flea	5	P	P	Generally low numbers of macro invertebrate species.
Copepod	5	P	A	
Dytiscid beetle	5	P	P	
Xanthocnemis damselfly larva	5	P	P	
Mite	5	P	A	
Gyraulus snail	3	P	P	
Physa snail	3	P	P	
Backswimmer	3	P	P	
Water boatman	3	P	P	
Microvelia bug	3	P	P	
Flatworm	3	P	P	
Chironomus midge larva	1	P	P	

APPENDIX 4: Bird lists, Oingo Lake, November 2004

Water birds			Other birds		
Species	**Est. Nos.**	**Breeding (yes/no)**	**Species**	**Est. Nos.**	**Breeding (yes/no)**
Native species			**Native species**		
Black shag	25	y	Fantail	10	?
Little shag	30+	n	Silvereye	20	?
Black-fronted dotterel	-	-	Riroriro	5	?
Spur-winged plover	20	y	Shining cuckoo	-	-
Black-backed gull	100+	n	**Introduced species**		
Pukeko	30	y	Skylark	20	y
Welcome swallow	100+	y	Starling	30	y
NZ kingfisher	10	?	Blackbird	15	y
Australasian harrier	10	?	Thrush	15	y
Australasian bittern	4	?	Redpoll	20+	?
NZ dabchick	15	y	Greenfinch	15+	?
Spotless crake	-	-	Goldfinch	30+	?
NZ shoveler	6	?	Chaffinch	10+	?
White Faced Heron	2	?	Yellowhammer	20+	?
Introduced species	10	?	Pheasant	5	y
Mallard	120+	y	Magpie	10	y
Black swan	9	y	Myna	20	y
Mute swan	9	?	Dunnock	10	y
Canada goose	25+	y			
Domestic goose					

APPENDIX 5: Other animal lists, Oingo Lake, November 2004

Species	Est. Nos.	Breeding (yes/no)	Species	Est. Nos.	Breeding (yes/no)
Introduced mammals (detected)			**Native reptiles**		
Rabbit		y	Common skink	1	
Hare		y			
Domestic deer		y	**Introduced frogs**		
Domestic cattle		y			
Domestic sheep		y			
Domestic goat		y			
Cat		y			
Hedgehog		y			
Possum		y			
Introduced mammals (probably present)					
Stoat		y			
Ferret		y			
Weasel		y			
Ship rat		y			
Norway rat		y			
Mouse		y			