

*History, fauna and flora of Lake Linlithgow
(Jenawarra) and associated wetlands in
south-west Victoria*



Rod Bird, Steve Clark and Murray Gunn

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Cover picture:

Cape Barren Geese flying over Lake Kennedy in February 1967. Some of the birds were wearing yellow collars, indicating that they had been banded on the Neptune group of islands off South Australia.

As many as 112 birds were seen in 1967, but mostly in 10s or 20s at Lake Kennedy or Lake Linlithgow. Cape Barren Geese have not been seen by HFNC at either lake since 1977.

Picture by Graeme Pizzey (provided by John & Cicely Fenton).

Other photographs:

The images presented in this report are included as a pictorial record of the nature and changing environment of Lake Linlithgow and associated wetlands over time.

Images in Figures 22-30 were scanned from the late Lionel Elmore's photographic slide collection that is now held by the Hamilton Field Naturalists Club.

Diane Luhrs provided digital images of scenes presented in Figures 49-54.

David Munro provided the digital images for scenes presented in Figures 55 & 56.

All other images were provided by Rod Bird, scanned from photographic slides or prints, except for Figures 38(b) & 61-64 that are digital images.

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Authors:

Rod Bird (Patrick Rodney Bird), 1942-
Steve Clark
Murray Gunn

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Introduction

This report was produced for the Hamilton Field Naturalists Club's 50th Anniversary in October 2008.

HFNC had been active in observing waterbirds on Lake Linlithgow since 1958. Annual surveys in February of numbers of birds of each species present on Lake Linlithgow were made from 1987 to 2007, whilst the seasonal abundance of waterbirds was surveyed in a 5-year period from 1987 to 1992, a span of years in which the lake did not dry out over summer.

From 2006-08, HFNC members (with assistance from 3 members of the Portland FNC), also actively surveyed waterbirds on adjacent lakes and swamps, including Bullrush Swamp, Krauses Swamp, Lake Kennedy, Harnath Swamp, Soldiers Swamp and Tabor Swamp. The data from all the surveys, plus incidental records, are presented in Appendix 1 of this report.

Fifty-nine species of waterbirds have been recorded at Jenawarra (Table 2). Uncommon species such as Marsh Sandpiper, Pectoral Sandpiper, Glossy Ibis, Greenshank, Royal Spoonbill, Brolga, Cape Barren Goose, Freckled Duck, Blue-billed Duck and Crested Grebe are sometimes seen and, at times, many thousands of birds of other species were recorded (Tables 3-5).

HFNC has also been active from time-to-time since 1975 in revegetating the fringes of the lake, including a period from 2002-05 assisting Parks Victoria's John Harris whose work has been truly monumental in transforming the fringes of lakes Linlithgow and Kennedy. HFNC conducted a preliminary survey of the native flora after grazing livestock were removed from the fringes in 2002. The tree-planting activities and flora survey data are presented in this report.

A further objective of this report was to outline the history of the area since settlement, the geology and landscape features, historic water levels, salinity regimes, and future management issues.

Lake Linlithgow

Lake Linlithgow (*Jenawarra*) is situated 15 km east of Hamilton, towards Peshurst. The lake is a major resource for water birds, which also use four nearby State Wildlife Reserves (the very saline Lake Kennedy (210 ha) 1 km to the SW of Lake Linlithgow, the fresher Bullrush Swamp (155 ha) 400 m to the east and Krauses Swamp (27 ha) further to the east (on Mibus La), with Harnath Swamp (~12 ha) 400 m to the south of Lake Linlithgow (on Lake Rd). Three wetlands further away are also significant: the remnant of the drained Soldiers Swamp (on West Boundary Rd, off Hamilton Highway), Tabor Swamp (on McIntyres Ck, Tabor), and the drained 3,000 ha Buckley Swamp.

Lake Linlithgow lies on the volcanic plains and is 1,015 ha, or 1,477 ha with its foreshore and the Boonawah Ck flats (DCNR 1993). It is classified as a Lake Reserve/Public Park/fauna sanctuary. The southern half of the area (and the whole of the water area) is administered by the Shire of Southern Grampians, which acts as the Committee of Management, while Parks Victoria controls the banks of the northern half. The position and relative size of the wetlands is indicated in Fig. 1.

Linlithgow is a terminal lake with a catchment of about 140 km², fed mainly by Boonawah Ck. It is quite shallow in most years, usually less than 1.5 m, and not more than 4.9 m on the rare occasion when it overflows across Chatsworth Rd into the catchment of Muddy Ck and eventually the Grange Burn and Wannon River (SR&WSC 1977). Data from Thiess (Fig. 11) show that the depth of water in the lake for much of the period 1964-2004 was 0.5-2.5 m, with a seasonal variation of ~0.5-1 m.

On the volcanic plains, over 75% of the shallow freshwater wetlands have been lost or severely modified by drainage works (DNRE 1997). Linlithgow and nearby wetlands are very important – although degraded – remnants of the extensive former wetlands of SW Victoria that included the 3,000-ha Great Swamp, now the drained Buckley Swamp at Yatchaw, described by Bruni (1903) as '*the most remarkable feature in the district around Hamilton...the home of myriads of waterfowl*'

Figure 1. Location of *Jenawarra* (Lake Linlithgow) and the adjacent lakes and swamps.

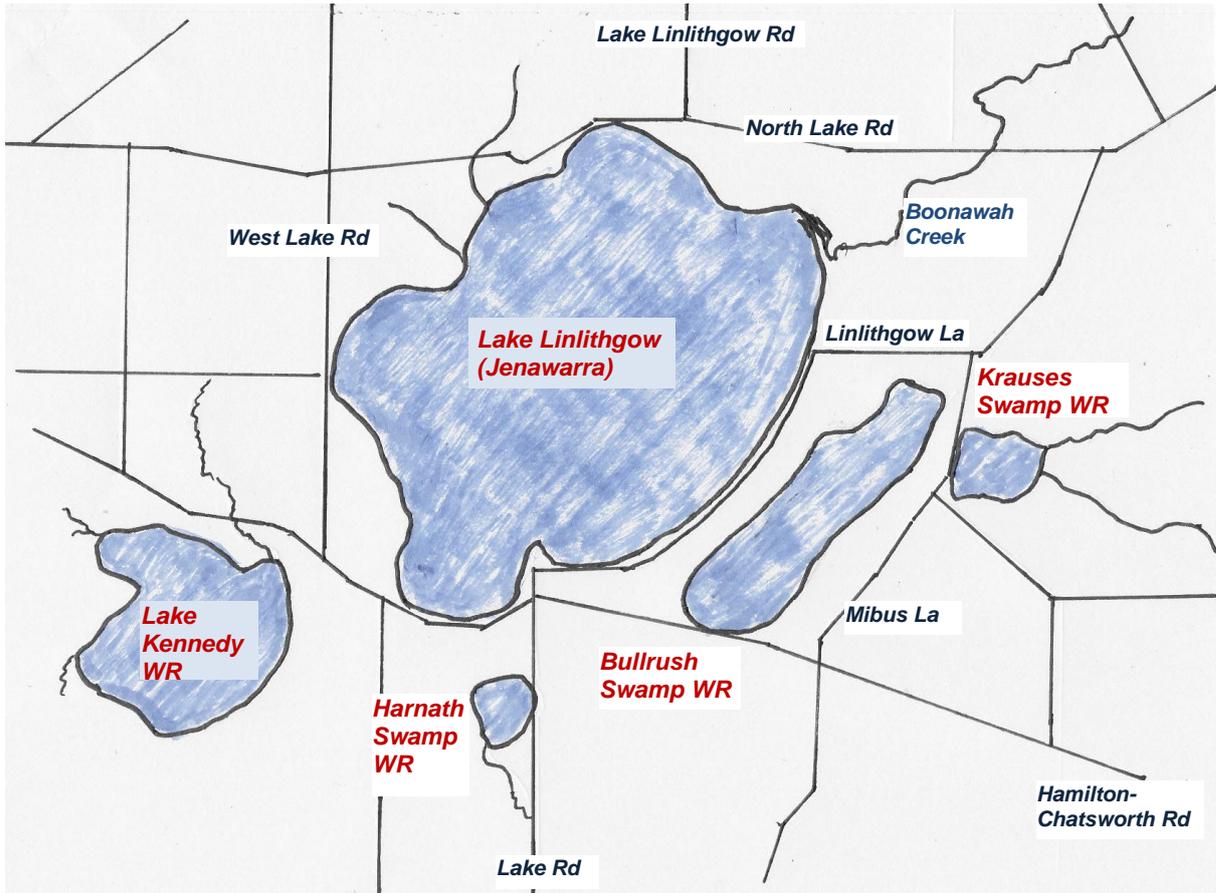


Figure 2.

Jenawarra (Linlithgow) in Dec. 2000, from Chatsworth Rd, at the southern edge of the lake.

Pine & Cypress on The Point, the ridge that juts into the lake, were planted by Wilhelm Habel in the 1870s.

Mt. Sturgeon (*Wurgarri*) & Mt. Abrupt (*Mud-dadjug*) of *Gariwerd* (Grampians) are seen to the north.



Figures 3 & 4. Boonawah Ck in Dec. 2000 (left picture), turning (top, left) to flow into *Jenawarra*. This is the only creek flowing into the lake. It drains a considerable catchment to the east. Boonawah Ck invariably ceases to flow during summer and may dry up in some years, as in Feb. 2000 (below,



Lake Linlithgow and nearby wetlands fell within the *Chap Wurrung* tribal language group (see Clark 1987 for the clan groups). James Dawson, one time of the Eumarella district, wrote of the Aborigines of SW Victoria (see Arkely 200, Dawson 1880) and said that as many as 2,500 Aborigines could have attended the many great meetings of the tribes, as at a large marsh called *Mirraewuae*, near the border between *Tjapwurong* and *Gunditjmara* territory. That may have been Buckley Swamp but more likely Condah Swamp since Robinson recorded the name *Ko.nung.i.yoke* for the NW part of the “Great Swamp” at Yatchaw (Presland 1977).

Since 1838 the lakes have been severely degraded, the foreshores and banks used for grazing and the water for boating and/or duck shooting. The Hamilton Field Naturalists Club, with assistance from the former Mt Rouse Shire, planted 1,000 trees in a 500-m block on the barren east bank from 1975-1991. Parks Victoria, with some assistance from HFNC, GreenCorps and other organizations, is now implementing a new plan for the lake and its Crown land surrounds. Grazing licences were cancelled in March 2002 and a program of tree planting started. A similar program was implemented on Lake Kennedy in 2001, where neighbors were consulted, grazing licences cancelled, fences repaired and some 9,000 indigenous trees and shrubs planted through the initiative of Greening Australia, Parks Victoria and Glenelg-Hopkins Catchment Management Authority (GHCMA).

The cessation of grazing in 2002 on the critical foreshore, bank, cliff, stream and saltmarsh areas has protected plants such as the rare Salt Tussock Grass (*Poa sallacustris*) and wildlife habitat in the Boonawah Ck. Removal of stock from these lakeside and creek fringes has also reduced nutrient pollution of the lake, a factor in algal blooms of past years. It will also allow the development of rush and reed habitat on the shoreline, and the protection and enhancement of important remnant native vegetation that exists on/near some of the cliff areas.

The banning of duck hunting and motor boats on Lake Linlithgow and the adjacent wetlands would further bolster the purpose and image of this area as a prime wildlife habitat in a region deficient in that nature conservation resource.

Early history

Major Thomas Mitchell

Mitchell only saw the lake from the summit of Mt Napier on 8-9 Sept. 1836, on his homeward journey through “Australia Felix” from Portland Bay. It was a very wet spring and the lake was full. The Great Swamp (Buckley Swamp), Soldiers Swamp, Tabor Swamp, Lake Kennedy and other wetlands (now drained) were also brimming and he had to divert his course west of the mount to the Grange.

Mitchell probably named Linlithgow after an associate from the Spanish Peninsula War (1808-14). His party passed to the west of the Mt Napier stones country, near present North Byaduk, and thence to The Grange. Stapylton’s diary (see Douglas & O’Brien 1971) also makes a mention of this lake:

“Mount Napier is a commanding hill and I see a beautiful forest land bare of timber eastward of the morass [Buckley Swamp]...A vast plain with a great lake in the centre was to be seen to the north east of Mount Napier...Were it only dry weather and seen in summer it must appear the most interesting grassy country that can be imagined”.

The first pastoralists

The Wedge brothers established a pastoral run at the Grange Station in 1838, occupying over 30,000 acres (Bride 1897, Garden 1984). Mt Sturgeon Plains station was occupied by Cameron and Mt Rouse Station by John Cox soon after (Garden 1984).

The entire district was occupied by 1840 and by 1851 there were 21 pastoral runs in place of the first 3 loosely held runs. These later runs included Croxton and Linlithgow Plains. There was violent frontier conflict during this period of Aborigine dispossession (see later discussion).

Surveyor CJ Tyers

Travelling from Mt. Rouse to the Grange on 7 Nov. 1839:

'Resumed our journey in hopes of finding a passage between The Great Swamp (mentioned by Sir Thomas Mitchell) and Mt. Napier...having discovered we were hemmed in on all sides by swamps and stony ranges we reluctantly returned to our old encampment...the only opening appeared to be between N and NE...we skirted lake Linlithgow and avoided the swamps...'

'Between Mounts Rouse and Napier is some fine country but the greater portion consists of swamps...an open forest of stunted banksia extends 6 miles to the northward of Mt Rouse. Open downs, for 2 or 3 miles in width, divide this from an open forest (chiefly of eucalypti) extending some distance east and west of Mount Sturgeon...'

George Augustus Robinson

Robinson was Chief Protector of Aborigines from 1839-1849. He described a trip on 7 May 1841 (Presland 1977) to the Grange (at Strathkellar) from Mt Rouse (named by Mitchell in 1836), otherwise recorded phonetically by Robinson as Calorer, Calorrer, Carlorrer, Collorrer, Colloruc, Cullor.rer, Colour or Colorer (Presland 1977, Presland 1980, Clark 1988):

'Took a route over the beautiful undulating downs to Forlonge's station, formerly Wedge's... through a beautiful undulating country covered with dwarf banksias, gums, cherry tree and well grassed...but without one drop of water...the absence rendering it useless for grazing purposes.'

'A short distance before reaching the lake, barbarously named Lake Linlithgow [by Mitchell in 1836], we passed over an elevation from which we had a magnificent view: Abrupt and Sturgeon 10 miles distant...the vast downs to the NW and NE, thinly studded with dwarf trees, was truly grand.'

'The dry hollow, called by Mitchell a very extensive lake...we found without the least drop of water...the bed white marl...slightly moist and the imprint of white man's shoes and black men's naked feet and dogs feet were numerous...To the south of this lake, separated by elevated land 3 or 400 yards across, and along which were old camping places of the natives where they baked roots, etc., there was a reedy swamp' [Lake Kennedy to the SW? Or was it Bullrush Swamp to the SE? There are now no reeds in Bullrush Swamp or Lake Kennedy. Given that Bullrush Swamp must have originally had reeds, to have invoked that name, it seems probable that Robinson was referring to the elevated bank that separates Lake Linlithgow and Bullrush Swamp.]

On 30 June 1841, Robinson travelled from the Grange to Mt. Abrupt, via Lake Linlithgow (Presland 1980). The land between Forlonge's outstation (near Strathkellar) and the lake was described as follows:

'...open downs, thinly studded with lightwood [Blackwood], banksia, cherry tree and well grassed...a park-like appearance. Mitchell's lakes [Linlithgow & Bulrush]...covered with thick and fine grass and I saw upwards of 100 turkeys [Bustards] feeding on it.'

Robinson recorded the name of Lake Linlithgow as *Tar.re.are.re* (or *Ar.re.yar.rer*). However, he expressed some doubt since his guide was from an eastern clan and not native to the area (Presland 1977). Brough Smyth (1878) listed Linlithgow as *Tunneyare* (and Mt Napier as *Tapook*, Mt Eccles as *Poythim* and Mt Rouse as *Coloro*). Since the first Lutheran settlers in 1850s knew Lake Linlithgow as *Jenawarra*, and that was also the name given to the Parish by the surveyor Clarke at that time, *Jenawarra* seems to be the appropriate local Aboriginal name for the lake.

Wilhelm Habel

Wilhelm Habel took up land at Lake Linlithgow in 1861, in common with a number of German settlers who had moved across from South Australia to farm the rich black earth as early as 1853. By 1862, all the land in the Tabor and Lake Linlithgow districts had been taken up (Janetzki 1976).

Habel's house stood near the intersection of Huf's Lane and Chatsworth Rd, between Lake Linlithgow and Lake Kennedy. There are several large River Red Gum (*E. camaldulensis*) and a Drooping Sheoak (*Allocasuarina verticillata*) at that site. Since the nearest River Red Gum occurs a few km to the north of the lake, and there are no others in the vicinity of the lake or further south, it is probable that Habel planted those at Huf's Lane.

Habel's homestead garden between the lakes contained many fruit trees. He loved trees and his dream was to plant the shores of Lake Linlithgow and Lake Kennedy, and to make Lake Linlithgow a sanctuary, preventing swans from being shot for their down or broilgas for sport. Irate neighbors pulled out the trees that he planted along the shores of the lake, for they used portions of the lake surrounds as their own common (Habel 1979). Wilhelm died in 1898 but his advocacy from 1875-1881, as a Shire Councillor of Mount Rouse, and that of his son Edward resulted in the lake being declared a Sanctuary for Wildlife in 1911. The Point was declared a Public Park and by the 1920s the area was further extended and a popular place for gymkhanas (Habel 1979).

According to the memorial sign in the trees near Chatsworth Rd on the southern bank of Lake Linlithgow, just west of the overflow, Habel planted Sugar Gum (*E. cladocalyx*) there in 1875-81. A few trees are still present, including some regeneration. Cypress (*Cupressus macrocarpa*) and Monterey Pine (*Pinus radiata*) were planted there and to the west in 1925, as a memorial to Wilhelm. These remain today. Habel may have planted the pines, cypress and a few Sugar Gums on The Point and east bank in the 1880s but the cypress extending along the boundary to the east was planted later, possibly in the 1940s.

Aborigines of the area

Lake Linlithgow was in the *Djab wurung* (*Tjapwurung*) clan territory, an area that included most of the Grampians and the land south to a line roughly between Mt Rouse and Mt Napier (see Clark and Harradine 1990). By 1861, only a few Aborigines remained in the area, most apparently having been murdered or chased away by the squatters who occupied the land from 1838. The history of violent dispossession has been well documented, notably in the journals of Robinson (Clark 1988, Presland 1977, Presland 1980) and books by Bonwick (1858), Bride (1897), Cannon (1973), Critchett (1992), Garden (1984) and Moodie (Palmer 1970). There were violent clashes between the Wedge brothers, their overseer Codd and the Aborigines (Arkely 2000, Garden 1984). Charles Wedge hinted at reprisals (Bride 1897) – '*...these degradations did not cease until many lives had been sacrificed*'. A swivel gun mounted near the station hut testified to intentions. John Wedge wrote in 1840 (see Garden 1984) that the squatters were '*... determined to exterminate the hostile tribe*'. Aborigine guerilla tactics caused Wedge to sell to Forlonge in 1841, but Robinson saw no natives at the Grange in 1841 (Presland 1977).

These, and other, accounts persuaded Governor Latrobe to set up a police station at the Grange to keep the peace between settlers and Aborigines. Its effect was to protect the settlers and see the demise of the Aborigines, for they had no recourse to justice (Arkely 2000, Presland 1977 & 1980). Their evidence was inadmissible and even perpetrators of massacres, such as the Whyte brothers of Koonongwotong, were not taken to court and punished. Retribution following deaths of shepherds (many who had interfered with the native women or insulted the men), or theft of sheep, was disproportionate and indiscriminate.

Robinson wrote (Presland 1980) '*...the settlers encouraged their men to shoot the natives because thereby they would sooner get rid of them...they did not kill them when there were many together, lest they should be known, but singly*'. Some settlers, or their workers, provoked the natives in order to justify murdering them. Others fired first and pretended that they had been attacked, while some distributed poisoned food. Robinson remarked in 1841 that the labouring men were mostly ex-convicts and that '*I have never met with a more lawless and infamous a set. They acknowledge no authority...it may be guessed what the fate of the poor Aborigines will be that fall into their hands*' (Presland 1977).

The Aborigine population fell from an estimated 6-7,000 in 1836 to a few hundred in 1858 (Arkely 2000). The impact of disease and murder was compounded by the squatters' prohibition of hunting or digging for yams on the pastoral runs, lest they frighten the sheep or deprive them of grass by burning the ground to reveal the tubers (Presland 1980). The squatters also occupied the waterholes and excluded the Aborigines from them (Clark 1988, Presland 1977). Robinson lamented in 1841, sickened by what he saw, "*Where are they to procure food? Or are they to live?*" (Presland 1980).

In 1861, only a few Aborigines remained in the Lake Linlithgow area (Habel 1979). Habel makes reference to a grisly tale of '*early squatters herding Aborigines along the lake bank, slaughtering them and cutting off enough ears to fill a sugar bag*'. If there was such a massacre it must have occurred before 1841, 10 or more years before Wilhelm Habel and other Lutheran farmers arrived to establish small farms around the lake and Pastor Schurmann arrived to minister to his Lutheran flock.

An Aborigine Protectorate was established at Kolor (Cox's Mt Rouse Station) in 1842 and lasted until 1850. Charles Sievwright was appointed Protector in 1839 and served briefly at Kolor in 1842. The settlers were hostile when he tried to perform his duties. Eventually they, Robinson and officials in Government forced him to resign (Arkley 2000). Meanwhile, Foster Fyans and his native police from the Geelong area, led by Dana, were brought to the district to curb the freedom fighter among the Aborigine tribesmen (Brown 1986). This they accomplished by 1845, after a short and bloody war centred around the Eumeralla-Lake Condah stones area. To that end, Dana also commented in 1844 (Garden 1984) that disease had stricken the natives '*...to such a frightful extent all over the country and they are dying very fast...a few seasons as fatal to them as this has been and they will cease to exist in the country*'.

The Tabor history (Janetzki 1976) states that there were two clans in the district – the Kolor clan around Penshurst and the Jenawarra clan. Clark (1987) lists *Kolorer Conedeet* (Mt. Rouse), *Toorac Conedeet* (Mt. Pierrepoint), *Tappoc Conedeet* (Mt. Napier), *Uelgal Conedeet* (Grange) and *Tillac Conedeet* (NW of Mt Rouse). The natives were said to be generally friendly, although after receiving gifts of food or tobacco there were instances when the men were away working when some natives returned to the camps and removed the contents. Janetzki (1976) states that '*Each clan contained some 150-200 people and they were said to congregate in main camps during the winter and disperse in small groups during the warmer months, camping near swamps and creeks. All had either died or left the district by 1870*'.

Janetzki stated further that '*there appeared to be no evidence of religion amongst these natives*'. That conclusion is understandable because the settlers had no means of comprehending the complex and vastly different spiritual life and religious beliefs of the Aborigine.

Geology and landscape

The local landscape consists of volcanic plains, rolling hills, "little mountains" and waterfalls (*see* Grimes 2000; Bennetts *et al.* 2003). The older landscape (1st Phase basalts) has a crust of basic lava 4-40 m thick, resulting from lava flows ~4 Ma ago, overlying Tertiary or Late Miocene sediments (limestone, sandstone and shales). Volcanic hills (e.g. Mt Pierrepoint – *Al.low.ween*) occur sporadically, with some (e.g. Gazette Hill) surrounded by second phase basalt. The second phase of volcanic activity occurred around ~2 Ma. Young soils have formed on the stony rises and scoria cones arising from third phase eruptions 32,000 years ago (Mt. Napier – *Tappoc*) to perhaps 500,000 years ago (Mt Rouse – *Collorer*). Lava from these eruptions flowed many km, that from Mt. Rouse extending past Port Fairy and that from Mt Eccles (*Budj.bim*) flowing past Narrawong to near the island of Lady Julia Percy.

While many have thought that the lakes on the basaltic plains were formed by local slumping of the lava crust, Bennetts *et al.* (2003a) consider that Lake Linlithgow sits on 1st Phase basalts and is surrounded by 2nd Phase basalt flows. Lake Kennedy lies between the 1st Phase flows from Mt Pierrepoint to the west and 2nd Phase flows to the east.

The weathered second phase basalt flow on the north end of Lake Linlithgow displays impressive spherical weathering of boulders at the base of the cliff (Figs. 5 & 6). The whitish splotches seen in the less-weathered basaltic rocks are felspar. The occurrence of quartz pegmatite in some rocks, and free quartz lying on the lake bed, may indicate relics of the deep bedrock that were ejected during the

eruptive phase, since quartz does not occur naturally in basaltic rock. However, the pieces of quartz may have been imported from the Grampians (*Gariwerd*) or Glenthompson area by Aborigines, for making scrapers and spear points. Flints and broken tools have been found from time-to-time on the edges of the lake.



Figures 5 & 6. – northern bank of *Jenawarra* in 2000, showing spherical weathering of basalt boulders and remnant native vegetation clinging to the cliff, beyond the reach of livestock. The fascinating pattern of weathering is shown in the smaller picture. Among the species that occur on these small cliffs are Sweet Bursaria, Scented Groundsel, Austral Pelagonium, Tree Violet, Australian Hollyhock, Blue Devils, Pink Bindweed and Bluebells.

Lunettes on the eastern margin of the lake rise ~ 4 m above the overflow level (Fig. 7) and comprise zones of clay nodules, ferruginous pisoliths and fine sands (Bennett and Webb 2004). In earlier dry epochs, fine particles of clay and sand were blown from the lake bed, perhaps covering weathered basaltic rocks of a similar form as the NW and western cliff areas. There is, or was, a lunette of sand in the Boonawah creek area. Much of this material was removed long ago for building construction purposes locally and, more recently (1970), by the Yacht Club to place on the beach near the boat ramp. Aborigines had a burial ground near Boonawah Creek.



Figure 7.

Jenawarra (Linlithgow) east bank lunette in 1982, showing *Billawyn* (Victoria Range) and *Wurgarri* (Mt Sturgeon) of *Gariwerd* (Grampians) in the background.

The HFNC tree blocks, planted from 1975 (back) to 1991 (front) are seen on the distant curve of the east bank.

Boonawah Ck lies beyond .

Except for the fenced tree blocks, the lake foreshore and banks were grazed until 2003.

The lake level remained fairly high in that decade.

Along the northern and western shores much buckshot gravel has also been removed for construction purposes by farmers and others who used it in earlier times as an ingredient in concrete. The presence of this seam is still obvious. The gravel was formed as a result of precipitation of iron salts from the weathered surface rock and deposition on the underlying clay during a former very wet epoch.

The lake may be on a presumed line of the original course of the Wannon River, from Dunkeld under Mt Napier and down Harman's Valley. Bores on the Lehmann's property on the western edge of the lake show three aquifer layers, the first at around 11 feet, in a seam of 'scoria', the second in another layer of 'scoria' below a band of harder rock at 38 feet and a 15 foot thickness of coal, and the third at 89 feet, below a 20 ft thickness of quartz and other solid rock (Allen Lehmann, pers. comm.).

Historic water levels at Jenawarra

Dry periods

The Protector of Aborigines, George Augustus Robinson, found that Lake Linlithgow was dry in 1841 (Presland 1977). Robinson also recorded that a part, at least, of Buckley Swamp was dry enough to walk on in 1841, but that may have been an exception since Bruni (1903) doubted whether anyone had ever crossed the morass before it was drained.

The "1877 drought" was widespread in Australia, with the worst affected areas being in SW Victoria and SW WA, where swamps dried up and even native trees died (Wallace 2003). Anon. (1882) recorded that in February 1882 '*Lake Linlithgow...is said to be drier now than has been for 15 or 16 years. In one little corner alone is clear water to be seen and even this is very shallow, probably not more than two feet at the deepest part*'. The rainfall recorded at Hamilton in the years 1877-1881 was 391, 677, 500, 671 and 681 mm (mean 584 mm), compared with the long-term mean (1869-2001) of 692 mm (Spectator 2001), and that accounts for the drying up of the lake.

Further information on the water history of the lake has been provided by Mr Allen Lehmann of 'Montrose West', Chatsworth Road. Allen's great grandfather settled at the Lake in 1861, and his father was born in the area in 1892. The lake collected water in 1887 and filled to a high level in 1890 and retained water for the next 15 years, drying up in the summers of 1902 and 1903 (Lehmann 1976). The "1902 drought", part of the dry period from 1885-1903, was regarded by some as the worst drought in Australia, however the Hamilton region was relatively little affected (Garden 1984), the annual rainfall being 637, 525, 589, 764, 742, 643 and 682 mm (mean 655 mm) for the years 1896-1902. The mean for the previous 5-year period (1891-95) was 781 mm, and 704 mm for the preceding 9-year period (1882-90). By comparison with recent history, that would not suggest that the lake should have dried out in 1902. Did Hamilton rainfall adequately reflect the rainfall in the catchment of Boonawah creek?

Long-time residents in the area state that the lake remained dry for most summers from 1902 to 1946, although a picture of a carnival scene taken in summer of 1918 shows some water in the SE area of the lake (Lehmann 1976), following quite wet years in 1915, 1916 and 1917 (736, 760 and 826 mm, respectively). The "1914 drought" was a part of another dry spell from 1911-1916 in Australia. The rainfall for the 3 years 1912-1914 at Hamilton was 622, 627 and 499 mm, respectively, so it would not be surprising if the lake was dry by Jan. 1915. The average rainfall in the preceding 9 years (1903-1911) was 734 mm so there must have been some water in the lake during winter and spring of those years. That surmise is strengthened by the fact that, in 1908-09, the Hamilton Progress Association began to develop facilities at the lake. '*An area of 83 acres was set aside, which huge working bees of residents of Croxton and Hochkirch ploughed, cleared and planted trees*' (Garden 1984). The area became the scene of a large annual gymkhana but Garden (1984) states that '*from 1920-1945 the lake was going through a dry period and no longer important a reserve as it had been*'.

From the early 1900s, cattle and sheep were grazed on the lake bed, where many fences were erected. Thus, in 1910, Lehmann erected a fence about two hundred metres out from the SW corner, adjacent to the frontage which they leased, in order to contain their stock. Linke did the same further to the north. These fences, and others, remained for many years, the last remnants on the SW bay being removed by the boating fraternity in the 1980s. The presence of those fences supports the claim that the lake was dry during summer and autumn for a very long period. Habel (1979) commented that there were '*...wild weekend fox hunts across the dry lake bed*'. Laurie Hermann (pers. comm. 2008) noted that '*In the 1940s drought big tussocks grew and a lot of spotlighting of foxes took place...*'.

The Lake Linlithgow School was located just west of the present entrance off Chatsworth Road, marked by a palm tree. Children from the western side of the lake would take a short cut across the dry lake bed to school. Allen, who started at the school in 1941, recalls that succulent vegetation grew on the lake bed and, where the plants grew, blown sand would accumulate, causing miniature

hillocks and a very rough lake bed. That effect was observed in May 2001, near the SW corner, where sand and clay particles drifted as far as the Chatsworth road. The vegetation is mainly the almost prostrate, succulent, Glaucous Goosefoot (*Chenopodium glaucum*), which the cattle enjoyed, together with Salt Marsh-grass (*Puccinellia stricta*) and other species.

Over the 43 years from 1903 to 1946, the range in rainfall was 499-862 mm; the mean was 690 mm, almost the same as the long-term average when, for long periods, the lake did not dry out. How can that be? Allen believes that Hamilton rainfall is not particularly relevant, because the Boonawah catchment is derived from the area between the lake and Woodhouse to the east, which has perhaps a little less rainfall. It is also possible that the early rainfall records were inaccurate.

The lake almost dried up in the drought year of 1967 (rainfall 365 mm), following a run of 5 dry years in 6 (571, 569, 546, 858, 478 and 576 mm for the years 1961-66), but retained some water over summer.

The lake dried out completely in early 1983, following a run of four dry years (621, 587, 651 and 436 mm for the years 1979-82) but filled again during 1983 when 864 mm of rain fell.

The lake did not dry out again until Feb. 2000, following 5 dry years out of 7 (644, 512, 701, 696, 496, 629, and 568 mm for the years 1993-99). Some water was regained during the winter of 2000 but the rainfall for the year was only 592 mm and the lake was dry by January and remained dry until Jul. 2001. Some water was gained in 2001, for 824 mm was received in that year. That was sufficient to maintain a low level of water in the lake throughout 2002 (Table 1 or Fig. 10).



Figure 8.

Jenawarra (Linlithgow) in Feb. 2000, from near the Habel Memorial on the south bank.

Gariwerd (Grampians) Victoria Range and Mt Sturgeon appear in the background.

The previous recent drying of the lake was in 1983. The lake also dried out in the early months of 2003-05 and remained dry through 2006.

The lake dried out again in Jan. 2003, but a film was present on 22 February as a result of 50 mm of rain over the previous 2 days – members of HFNC saw a fox trotting through the water away from the north side. That water soon evaporated and the lake remained dry until July but a max. depth of only 0.5 m of water was gained in 2003 (see Table 1) and the lake dried out again by Mar. 2004.

This pattern was repeated in 2005, when the water gained in the winter of 2004 (max. depth 60 cm at The Point marker) was lost to evaporation by Feb. 2005. Lake Linlithgow remained effectively dry throughout 2005 and 2006, when 541 mm of rain was recorded for 2005 and 493 mm for 2006. The lake gained a little water in 2007 (rainfall 685 mm), with the max. depth of 27 cm at the Point Marker on 16 Nov. following late spring rains, but it was dry by 9 Feb. 2008, and Lake Kennedy by 23 Feb.

Wet periods

During the 1870s the Hamilton Spectator urged the formation of a rowing and yacht club, but there was little interest. However, church picnic and community sports days were popular at the lake. A hotel operated at Lake Linlithgow at this time (Habel bought it and closed it down in 1882, ostensibly

to prevent the local Aborigines from becoming intoxicated and a nuisance to the community); rowing boats were provided for entertainment and shade trees were planted (Garden 1984).

There were some years in which the lake has overflowed across Chatsworth road to the south. The first time was in 1893 and 1894 (Lehmann 1976), when the rainfall recorded at Hamilton was 930 and 907 mm, respectively (Spectator 2001). Wilhelm Habel placed large stepping stones along the Chatsworth road to enable children to reach the Linlithgow School with dry feet (Habel 1979).

In 1946 the lake filled again when 1046 mm of rain fell, ending the 43-year period of almost annual drying out of the lake over summer. According to Lehmann (1976), more than 11 inches of rain was recorded at the lake in a few days in March 1946, putting a large volume of water into the lake via Boonawah Creek. The following 3 years were also wet (872, 704 & 677 mm), with farmers finding the land too wet for good crops.

The lake overflowed again in 1951, 1952 and 1956 (Lehmann 1976), when the rainfall was 851, 972 & 784 mm, respectively. Allen recalls picking up 3-4 pound Redfin left stranded in shallow water near the Chatsworth road. In 1960, when the rainfall was 875 mm, the lake almost overflowed. Perhaps the previous 3 drier years (640, 676 & 603 mm) had reduced the water level. Alternatively, the reconstruction of the Chatsworth Road in 1957 resulted in a slightly higher mound, thus preventing the water from overflowing. According to Habel (1979), floodwaters from Lake Linlithgow were diverted into Lake Kennedy in the 1950s. While the natural course would take flood waters from Lake Linlithgow into the then extensive swamps to the south of Lake Kennedy, thence into Muddy Ck, a drain was cut across the fields to prevent the flooding of a shearing shed.

A shallow sheet of water was evident on Lake Kennedy in early May 2001 when Lake Linlithgow was still dry, indicating that Lake Kennedy, at least, is responsive to groundwater. Groundwater levels in a bore near the Lake Linlithgow are given in Table 1.

Relationship between lake water level and recent rainfall

An intriguing question is the relationship between rainfall and the level of water in the lake. A good set of data for the years 1995-2005 enabled a preliminary analysis of factors that affected the change in water depth in the lake (Fig. 9). For these 10 years (94 data points), of the many variations (from 1 to 24 months) of monthly rainfall investigated, the current plus previous calendar month of rainfall (from PVI, Mt Napier Rd) gave far the best prediction of the change in water depth. Some 62% of the variation could be accounted for. The variation accounted for using rainfall in (i) the current calendar month, (ii) previous month, (iii) current plus previous month, (iv) current plus previous 2 months and (v) current plus 3 previous months was 40%, 44%, 62%, 54% and 40%, respectively. Less than 20% of the variation was accounted for when rainfall over longer periods was tested.

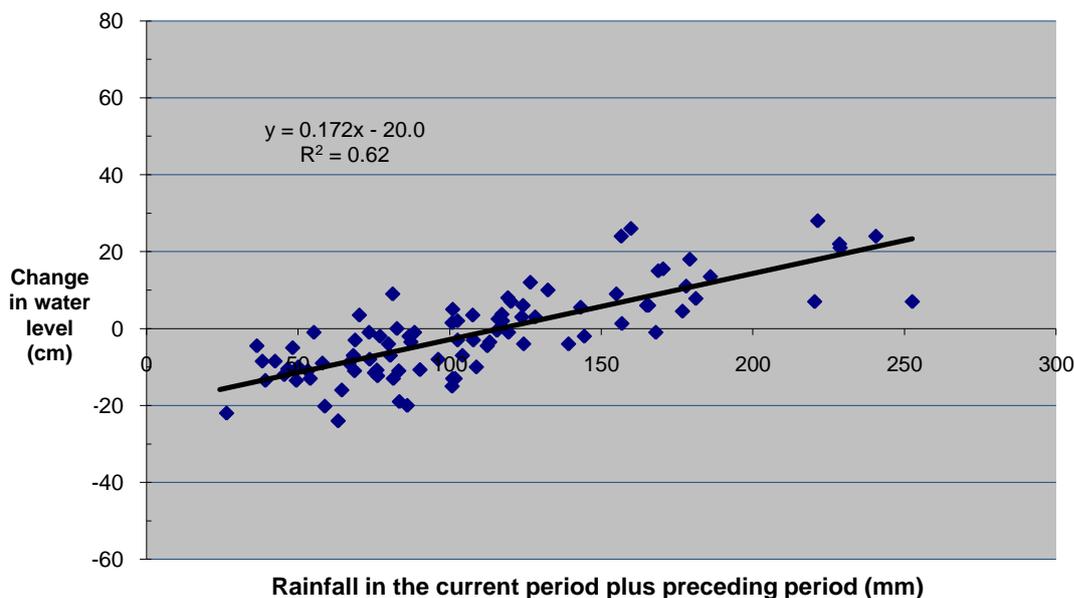


Figure 9. Relationship between rainfall in the month plus preceding month, and change in lake level, 1995-2005.

On average, the water level rises when rainfall in the 2 calendar months (month in which depth is measured plus the previous month) exceeds 115 mm. It drops 20 cm when no rain falls in that period.

On average, the water level rises 4.5 cm for each 25 mm (1 inch) of rain that falls (or 1.8 cm per 10 mm rain). Oddly, including summer/autumn & winter/spring rainfall as variables (approximate surrogates for temperature, evaporation & run-off potential) improved the prediction by only 2.5%.

A further analysis was made using the entire range of available data, from 1964-2005 (Fig. 10). The results were more variable but the same general conclusion was obtained – the slope and intercept of the regression line is virtually the same as in Fig. 9. The water level rises when more than 118 mm of rain is received in the current and previous month and it drops 20 cm when no rain is received. The water level rises, on average, 4.2 cm for every 25 mm of rain (or 1.7 cm for every 10 mm of rain).

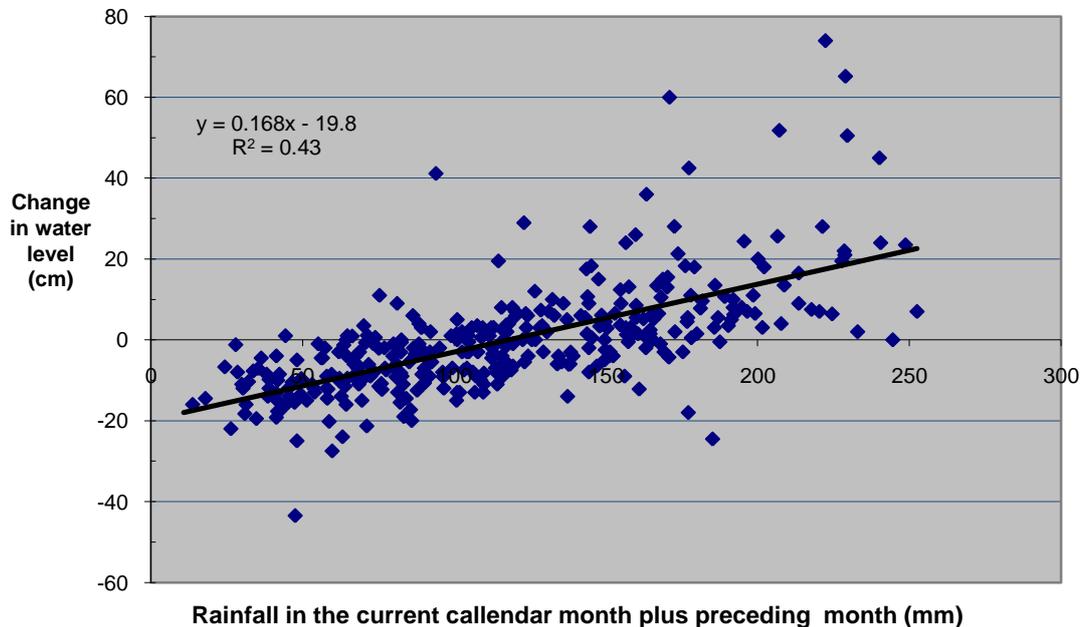


Figure 10. Relationship between rainfall in the monthly period plus preceding month, and change in lake level, 1964-2005.

The water level data recorded for Lake Linlithgow by SR&WSC (1964-95) were derived from gauges in the south bay near Chatsworth Rd. Thiess Services used a gauge in water off The Point (1995-). For the early records, one marker (no longer present) placed out in the bay indicated a near-dry lake when the water was at 1.35 m, the base of the gauge. One marker now reads 2.0 m at the ground. When the lake has water, that gauge gives the same surface water reading as the marker that was installed at The Point in 1995. However, the ground depression at The Point means that the base there is at 1.39 m, corresponding to a level at which the lake is almost dry. From observation and past records we assumed a gauge value of 1.30 m to represent the dry lake when calculating water depths (Fig. 12). Bennetts and Webb (2004) used a value of 1.15 m, giving 15 cm greater depths.

Salinity and water depth

Lake Linlithgow was fresh and Lake Kennedy was salty in 1876, according to Habel (1979). The salinity of Lake Kennedy water was 150 dS/m in 1964 (State Rivers & Water Supply Commission 1977). Thiess Services (courtesy of Senior Hydrographer Barbara Dworakowski) kindly provided data from the former SR&WSC files for the period 1964-1995, and data from Thiess collected from 1995-2005 (Table 1). These data are presented in Figs. 9-12. Lake levels ranged from 0-3.0 m. Lake pH (8.3-9.9), temperature (7-31°C) and turbidity are also shown in Table 1 for the 10-year period.

The data shown in Fig. 11 for water salinity can be related to the data for water depth in Fig. 12. When there is at least a moderate depth of water (>0.5 m) the salinity level ranges from about 5-25 dS/m. When the lake dries below 0.5 m the salinity can exceed that in sea water (50-60 dS/m).

One mechanism for the removal of salt from Lake Linlithgow or Lake Kennedy could be a massive outwash of salt on the rare occasions when the lake does overflow. Evidence that this happens is provided by historic accounts (Habel 1979) of regular salt harvesting on Lake Kennedy by farmers of the district, for home and stock use. Laurie Herrmann (pers. comm.) notes that ‘*My mother remembered salt being bagged in the 1914 drought on Lake Kennedy*’. Allen Lehmann (pers. comm.) also recalls local farmers bagging the salt in 1942 which, in parts, formed a crust several inches thick on the lake bed. Floods in 1946, 1951, 1952 and 1956 may be the reason there are no large deposits present now in that terminal lake.

Figure 11. Salinity (EC units, dS/m) of a spot-sample of water in Lake Linlithgow (1964-2005).

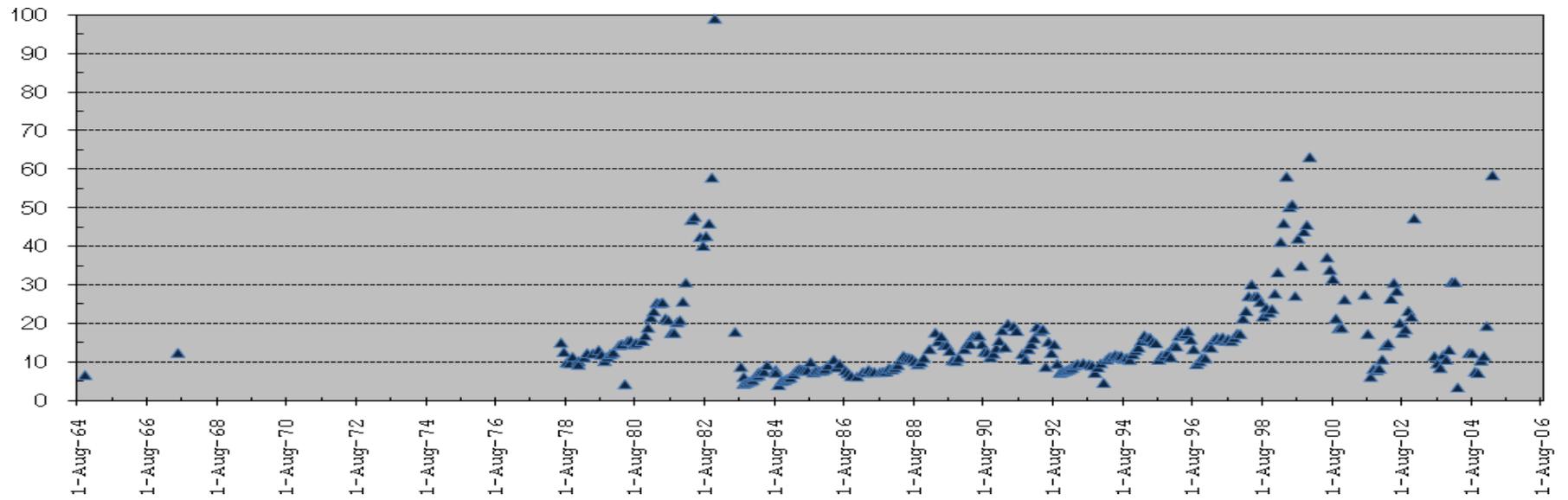


Figure 12. Depth of water (m) in Lake Linlithgow (1964-2005).

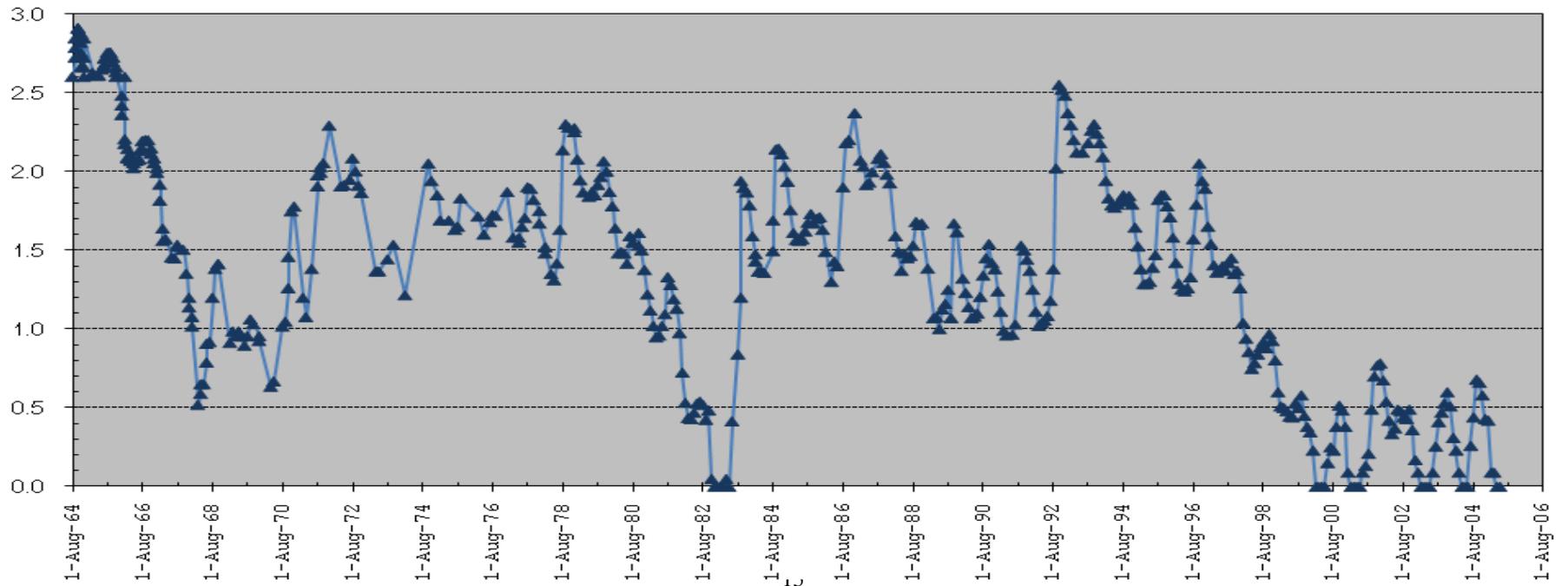


Table 1. Lake Linlithgow water data for the years 1995-2005 (Thiess Services).

Date	Water depth (m)	EC (dS/m)	Turbidity	Temp (°C)	pH	DO (mg/L)	PVI Rain (mm)	Water depth in bore (m)
11-Jul-95	1.38	14.77	200	8.5	8.8	10.7	110.6	
9-Aug-95	1.73	10.47	45	7.5	8.9	11	67.4	
13-Sep-95	1.76	11.56	120	13	9.2	9.3	56.4	
10-Oct-95	1.76	11.49	66	13.5	9.2	9.6	26.2	
14-Nov-95	1.69	12.25	29	19.5	9.2	8.9	42	
11-Dec-95	1.62	11.16	16	16	9.2	10.1	38.4	
8-Jan-96	1.49	13.88	31	19.5	9	6.9	43	
12-Feb-96	1.33	13.92	65	13.5	9	9.4	21.4	
19-Mar-96	1.2	16.64	215	14.5	8.6	9.6	32.6	-6.17
16-Apr-96	1.16	17.50	27	13.7	8.9	9.7	47.2	
21-May-96	1.15	17.10	34	13	8.9	9.7	8	-6.4
19-Jun-96	1.17	17.95	140	11	8.6	9.9	94.6	
15-Jul-96	1.24	15.68	26	7	8.9	10.9	125.8	
21-Aug-96	1.48	13.23	42	8.4	9	11.8	114.8	-6.35
16-Sep-96	1.7	9.32	98	11	8.9	10.2	113.8	
15-Oct-96	1.96	10.06	125	18	8.4	8.7	46	
19-Nov-96	1.85	10.95	22	17.5	8.8	9.4	22.6	-5.87
10-Dec-96	1.8	10.84	17	17	8.9	9.4	25.6	
22-Jan-97	1.56	13.78	36	25.8	8.9	8.4	37.6	
18-Feb-97	1.45	13.53	110	30.5	8.9	7	15.6	-6.05
24-Mar-97	1.315	15.60	95	13.8	9	9.1	23.6	
17-Apr-97	1.27	16.24	31	16	9	9.4	12.8	
15-May-97	1.285	15.72	13	11.2	9	9.4	88	-6.3
18-Jun-97	1.31	16.32	21	12.5	9	12.4	28	
15-Jul-97	1.28	15.45	215	8.5	9	10.5	40.8	
20-Aug-97	1.33	15.84	8	10.1	8.9	10.4	63.2	-6.41
17-Sep-97	1.36	15.26	25	15.5	9.1	11.4	68	-6.48
21-Oct-97	1.26	16.13	17	19	8.9	9.7	40.8	-6.53
19-Nov-97	1.28	17.22	39	14.1	9	8.9	76.6	-6.48
9-Dec-97	1.17	17.16	14	21.8	9	8.6	6.6	-6.53
20-Jan-98	0.95	21.12	28	16.5	9.1	9.1	19.8	-6.6
16-Feb-98	0.85	23.12	15	15.5	9	8.4	30.2	-6.62
10-Mar-98	0.765	26.95	14	17	9.4	7.3	12.2	-6.72
17-Apr-98	0.658	29.99	10	12.5	9.1	9.1	78	-6.85
12-May-98	0.695	26.86	17	10	9.1	8.5	39.2	-6.84
15-Jun-98	0.75	26.90	83	7	9.1	9.8	104	-6.9
16-Jul-98	0.795	25.46	9.1	5.5	9.1	10.2	72.8	-6.92
17-Aug-98	0.83	21.65	17	12	8.5	11.2	34.8	-6.91
15-Sep-98	0.79	24.00	130	9.5	9.2	10.6	89.6	-6.86
21-Oct-98	0.88	22.63	24	17.3	9.6	9.9	65.4	-6.93
17-Nov-98	0.835	23.60	17	15.5	9	8.2	47	-6.9
16-Dec-98	0.712	27.60	41	15	8.9	10	29.2	-6.94
19-Jan-99	0.51	33.15	5.1	17.5	9.2	7.1	29.6	-7.01
15-Feb-99	0.42	41.04	14	19.5	9	6	28.4	-7.04
22-Mar-99	0.41	45.89	50	12	9.1	8.5	60	-7.13
20-Apr-99	0.39	57.96	49	14.4	9.1	10.3	17	-7.21
17-May-99	0.355	50.03	24	5	9.1	12.7	70.2	-7.24
8-Jun-99	0.35	50.74	100	10	9	8.6	45.4	-7.28
19-Jul-99	0.44	27.00	300	7.5	9.3	9.2	35.8	-7.23
16-Aug-99	0.41	41.88	56	9	9.1	8.6	66.8	-7.3
21-Sep-99	0.49	34.80	94	12	9.2	10.1	52.4	-7.15
20-Oct-99	0.36	43.72	175	14.5	9	8.4	48.6	-7.32
15-Nov-99	0.29	45.43	170	12.5	9.3	8.2	55.6	-7.34
13-Dec-99	0.255	63.00	110	17	8.8	8.8	57.6	-7.4
19-Jan-00	0.14						17.6	-7.41
16-Feb-00	0						12.6	-7.5
22-Mar-00	0						11.6	-7.61
26-Apr-00	0						69.6	-7.69
17-May-00	0						104.4	-7.68
19-Jun-00	0.06	37.00	4	9	9.1	11.8	51.8	-7.61
19-Jul-00	0.16	33.80	16	8	9.3	11.1	80.6	-7.6
16-Aug-00	0.14	31.44	13	14	9.4	11.5	63.8	-7.6
19-Sep-00	0.29	21.18	360	14.5	8.8	9.9	105	-7.49
17-Oct-00	0.425	18.61	130	10.5	9.2	9.4	81	-7.4
22-Nov-00	0.395	18.75	275	15.5	9.2	7.5	26.8	-7.33
11-Dec-00	0.29	26.09	120	19	9.5	8.7	19.8	-7.31
17-Jan-01	0						12.8	-7.42
19-Feb-01	0						26.2	-7.55

20-Mar-01	0							65.2	-7.61
12-Apr-01	0							68.2	-7.68
14-May-01	0							28.6	-7.66
18-Jun-01	0							56.4	-7.65
17-Jul-01	0.042	27.31	18	8	8.8	9.7		38.4	-7.61
21-Aug-01	0.12	17.13	11	5.5	9.1	11.5		142.8	-7.49
11-Sep-01	0.4	6.00	55	12.5	8.8	8.3		78.6	-7.38
17-Oct-01	0.61	8.09	145	13.5	9.3	10.1		150.2	-7.11
15-Nov-01	0.68	7.76	36	14	8.9	10.8		102.4	-6.98
4-Dec-01	0.693	8.17	115	19	8.9	11.8		54.4	-6.94
10-Jan-02	0.585	10.55	30	27	9.1	14.4		21.6	-6.9
13-Feb-02	0.45	14.10	220	25.5	9	10		27.8	-6.91
7-Mar-02	0.33	14.67	70	20.9	9.2	9		17.6	-6.97
8-Apr-02	0.245	26.27	90	12.5	8.7	8.8		20.6	-7.04
8-May-02	0.28	30.42	210	17.5	9.2	9.2		49.6	-7.1
6-Jun-02	0.4	28.35	245	9	9.3	8.5		77	-7.12
16-Jul-02	0.39	20.00	326	7	8.9	10.6		91	-7.02
13-Aug-02	0.35	17.45	170	6.5	8.3	10.9		48.2	-6.83
19-Sep-02	0.34	18.38	250	12	9	8.8		71.2	-6.83
22-Oct-02	0.4	23.13	150	15	9	7.6		53	-6.79
13-Nov-02	0.27	21.60	330	10	9.3	10.4		48.8	-6.87
18-Dec-02	0.08	47.13	170	31	8.8	7.3		34.6	-6.95
27-Jan-03	0							43.8	-7.12
10-Feb-03	0							56.2	-7.16
11-Mar-03	0							63.2	-7.24
9-Apr-03	0							29.2	-7.24
9-May-03	0							23.2	-7.35
5-Jun-03	0							110.2	-7.31
8-Jul-03	0.165	11.40	23.5	9.5	9	10.6		76.4	-7.31
27-Aug-03	0.32	9.48	220	13	8.7	10.6		94	-7.19
16-Sep-03	0.38	8.32	463	13.5	8.8	10		71.6	-7
23-Oct-03	0.44	11.75	607	12	8.5	10.1		93.4	-6.87
3-Nov-03	0.51	10.48	96	14.5	7.9	10.1		26.8	-6.87
2-Dec-03	0.42	13.07	148	14	7.7	9.3		40	-6.94
21-Jan-04	0.22	30.62	1855	25.5	9	8.9		46	-6.89
12-Feb-04	0.14	30.64	148	30.5	8.7	10		27.6	-6.9
9-Mar-04	0	3.27	368	16	9.9	8.6		64	-6.96
29-Apr-04	0							39.6	-7.14
4-May-04	0							46	-7.15
7-Jun-04	0							138.6	-7.18
15-Jul-04	0.17	12.18	103	6.5	9.1	11.2		75	-7.1
19-Aug-04	0.35	12.13	660	10	8.3	9		104.2	-7.01
20-Sep-04	0.59	7.37	55.5	12	8.4	9.2		52.4	-6.74
5-Oct-04	0.57	7.04	47	17	8.8	10.5		34.2	-6.8
10-Nov-04	0.49	10.29	233	15	8.4	8.8		62	-6.65
1-Dec-04	0.34	11.42	345	18.5	8.4	8.5		38.8	-6.67
11-Jan-05	0.33	19.19	105	20	9.1	8.4		34.6	-6.78
3-Feb-05	0							68	-6.74
2-Mar-05	0	58.32	2133	22	9	6.3		15	-6.71
14-Apr-05	0	14.77						24.8	-6.89
12-May-05	0	10.47						25.2	-7.13

Bennetts and Webb (2004) describe Lake Linlithgow as moderately saline (median 12.7 dS/m) and alkaline. They conclude, from modelling studies, that there is limited removal of salt via leakage into groundwater in the Phase 1 basalt and that the most likely mechanism preventing an increasing accumulation of salt in the lake is the removal of dry salt from the surface by wind when the lake dries out.

A major mechanism, not considered by Bennetts and Webb, is the outwash of dissolved, accumulated salt when Lake Linlithgow and Lake Kennedy overflow, as in 1946, 1951, 1952 and 1956.

Water sports on Jenawarra

The lake has been used by motor boats and yachts. An early record was the 'Lady of Linlithgow', a sailing boat capable of carrying 20 passengers that was brought to the lake in 1890 and stayed there for about 7 years before it was wrecked in a storm and sank near Boonawah Ck (Lehmann 1976).

By the 1920s the lake was a venue for many gymkhanas. The sports included the Lake Linlithgow Cup for draught horses, catching the greasy pig, football in the lake waters, and diving for a wild duck whose wings had been clipped (Habel 1979). Laurie Herrmann recalls that race meetings were held under the auspices of the Hamilton Race Club and that one year his uncle won the draught horse cup.

After the flood of 1946, water sports returned to the lake. Laurie Herrmann noted (pers. comm.) '*When the flood came a sailing club was formed and big speed boat carnivals took place. Two boys were drowned when an aeroplane belly-tank was swamped in the wake of a speed boat*'.

Sheds were erected near The Point. In about 1958, weed developed in the lake and eventually caused the cessation of all boating. Attempts to remove the weed failed. However, in 1973 the weed disappeared and the speedboats and yachts returned to the lake (Lehmann 1976). During those wet years speedboats also used the shallow Bullrush Swamp, for a time called Lake Swallow by the boating fraternity when Swallow & Eriel sponsored a carnival.

In 1976 a boat ramp was constructed on the south shore, beside The Point, and the stone for the ramp came from Allen Lehmann's farm to the west of the lake. In June 1977, members of the Yacht Club carted sand from 2 pits on the bank near Boonawah Creek to put on the beach near the ramp. This work was suspended when an Aborigine burial site was found. The boat ramp on the north shore was built a few years later, after a conflict between users of power boats and yachts in the southern area.

Birds of Jenawarra and wetlands nearby

Anon. (1882a) describes Lake Linlithgow in Feb. 1882, then almost dry after a drought:

'...as for game, there are myriads of ducks, hundreds of swan, geese, plover, pelicans and during the morning and evening, native companions in great number. Unfortunately no shooter can get near enough to them to shoot'.

Anon (1882b) describes the scene 2 months later:

'During the last few weeks farmers in the Lake Linlithgow district have been busily engaged in burning stubble, and the burnt fields are now the haunt of native companions and plover. These can be counted by the thousand and can easily be brought in range by the sportsman creeping up to the bank of the lake. As the much talked of turkeys [Bustard] are conspicuous by their absence, and native companions, if properly bled, buried etc. are not bad eating, a profitable hour's sport can be obtained by those who would follow the directions given. In one flock of native companions seen on Thursday week, there could not have been fewer than a thousand birds'.

Anon (1882c) describes the scene after rain fell in April and May:

'...there are now several patches of water instead of one. These are covered with thousands of wildfowl, swans, geese, duck, teal etc who swim about in the greatest of safety, as owing to the slime and mud they cannot be approached either by boat or foot'.

The lakes are frequented by 12 species listed by either the **Japan Migratory Bird Agreement** (JAMBA) or **China Migratory Bird Agreement** (CAMBA): Red-necked Stint, Latham's Snipe, Cattle Egret, Great Egret, Greenshank, Marsh Sandpiper, Sharp-tailed Sandpiper, Common Sandpiper, Curlew Sandpiper, Bar-tailed Godwit, Pectoral Sandpiper and Glossy Ibis (DCNR 1993).

The HFNC has visited the lake in most years since 1962, usually in February, to view or to count the water birds and birds of prey. In the 1960s Murray Gunn provided the first systematic observation of birds on these wetlands. His records constitute a large part of Table 2 and the early club reports.

A summary of sightings made and reported by HFNC members is presented below for the years 1960-1984. For the years following 1984 more systematic data is available and is presented in Tables 4-6.

Notes on birds from the Minutes Book of HFNC are given below, for the period 1960 to 1984:

- Nov. 1960 – a flock of Aust. Pelicans flying between Lakes Kennedy & Linlithgow.
- Summer 1961 – 50-70,000 Black Swan, and a great number of Grey Teal, were seen on Lake Kennedy. The birds were feeding on Fennel Pond Weed (*Potamogeton pectinatus*), whereas Sea Tassel (*Ruffia maritima*), which infested Lake Linlithgow, was not so popular.
- Apr. 1961 – 10 Cape Barren Geese at Lake Kennedy. By June, Black Swan numbers shrunk to 25-30,000, together with ~20,000 Grey Teal, when there was green grass available elsewhere.
- Mar. 1962 – Cape Barren Geese were reported from Lake Kennedy.
- Apr. 1964 – Linlithgow still heavily stocked with waterfowl but Kennedy so low that Black Swans unable to use it.
- Dec. 1965 – a few Cape Barren Geese at Lake Kennedy.
- Feb. 1966 – 16 Cape Barren Geese at Lake Kennedy; 25 on 3 Mar. and 112 on 13 Mar. Some remained until July, with Sharp-tailed Sandpipers, Red-necked Stints and Red-capped Plover.
- Nov. 1966 – 12 Cape Barren Geese at Linlithgow, 4 with yellow collars from banding on the Neptune group of islands off South Australia [Laurie Herrmann (pers. comm.) saw 15 Cape Barren Geese near Boonawah Creek in about 1952, so the birds had been around for some time].
- Feb. 1967 – 12 Cape Barren Geese at Kennedy. 17 waterbird species were seen at Linlithgow; 12 White-faced Heron, 3 Whiskered Tern, 3 Red-capped Plover, 6 Straw-necked Ibis, 20 Black-fronted Dotterel, 20 Black-winged Stilts, ~50 Pink-eared Duck & ~20 Pacific Black Duck. Silver Gulls, Masked Lapwing, Hoary-headed Grebes and Aust. Shelduck 'very common'. Eurasian Coots, Black Swan, Australasian Shoveller and Grey Teal all 'common'. Raptors seen were Brown Goshawk, Whistling Kite, Brown Falcon and Nankeen Kestrel.
- Jan.-Feb. 1968 – '*Lake Linlithgow drier than ever seen*'. Birds seen included 1 Red-necked Avocet, 1 Curlew Sandpiper, 1 Double-banded Plover, 3 Cape Barren Geese, ~20 Brolga, 100s of Red-capped Plovers, 100s or 1000s of Sharp-tailed Sandpipers, large flocks of Aust. Shelduck but few other ducks and none of the Whiskered Terns or Black-winged Stilts seen in Dec. 1967.
- Dec. 1968 – 1 Cattle Egret seen at Linlithgow.
- Feb. 1969 – 2 Royal Spoonbill and 1 Yellow-billed Spoonbill at Linlithgow. At Lake Kennedy, 3-7 Cape Barren Geese were seen.
- Mar. 1969 – 20 species of waterbird at Linlithgow, with 12 Brolga and 2 Cape Barren Geese. Other species were Double-banded Plover, Red-capped Plover, Black-fronted Dotterel, Red-necked Stint, Chestnut Teal, Australasian Shoveller, Masked Lapwing, Aust. Shelduck, Black Swan, Grey Teal, Hoary-headed Grebe, White-faced Heron, Eurasian Coot, Black-winged Stilt, Whiskered Tern, Aust. Wood Duck, Pink-eared Duck, Pacific Black Duck. Raptors seen were Brown Goshawk, Whistling Kite, Swamp Harrier, Brown Falcon and Black-shouldered Kite.
- Apr. 1969 – 50 Double-banded Plover at Linlithgow.
- Mar. 1969 – 12 Brolga, 2 Cape Barren Geese and 18 other waterbird species seen.
- Mar. 1970 – 38 and 43 Brolga seen at Linlithgow on separate occasions
- Apr. 1970 – 1000s of Pink-eared Duck at Linlithgow; Australasian Shoveller, Hardhead and Blue-billed Duck also seen.
- Feb. 1971 – Cape Barren Geese, Double-banded Plover, Banded Stilt, Red-necked Stint and Blue-billed Duck at Linlithgow, with 2 Sharp-tailed Sandpiper at Kennedy.
- Feb. 1972 – waterbird numbers down on last year. Black-winged Stilts seen.
- Dec. 1972 – 40 Glossy Ibis at Linlithgow.
- Feb. 1973 – Pectoral Sandpiper at Linlithgow, with Aust. Pelicans, Double-banded Plover & Masked Lapwings; 4 Cape Barren Geese at Lake Kennedy.
- Feb./Mar. 1974 – 14 waterbird species present at Linlithgow – '*poorest year for species, with a low variety of duck*' – ~100 Pacific Black Duck, a few score Australasian Shoveller, 100 Aust. Shelduck, many Grey Teal, 1 Musk Duck and several Blue-billed Duck present. Hoary-headed Grebe and Eurasian Coot usually in 1000s but now only a few of each. Few waders there but 100s at Lake Kennedy, mostly Red-necked Stint. There were ~700 Black Swan, several hundred Silver Gull, 20-30 White-faced Heron, several Hoary-headed Grebe, ~20 Red-capped Plover and a few Double-banded Plover.
- Mar. 1975 – 16 waterbird species seen at Linlithgow – 50 White-faced Heron, 2 Yellow Spoonbill, 2 Crested Grebe, 2 Hoary-headed Grebe, 800 Black Swan, 200 Pacific Black Duck, 200 Shelduck, 3-400 Aust. Wood Duck, 500 Grey Teal, 2 Chestnut Teal, 100 Pink-eared Duck, 100 Australasian Shoveller, 300 Musk Duck, 100 Silver Gull, 40-50 Red-capped Plover, 2 Double-banded Plover.

- Sept. 1975 – Aust. Pelicans over Linlithgow.
- Oct. 1975 – 6 Red-necked Avocets and ibis at Linlithgow
- Feb. 1976 – 6 Cape Barren Geese on west side of Linlithgow, 10 Red-capped Plover (and a nest).
- Nov. 1976 – Red-necked Stint and Curlew Sandpipers at Linlithgow.
- Feb. 1977 – not many birds seen. These included 26 Aust. Pelican, Pink-eared Duck, Black Swan, Double-banded Plover, Little Grebe, Cape Barren Geese, Musk Duck, Grey Teal, Aust. Shelduck, White-faced Heron & Silver Gull.
- Apr. 1977 – 2 Cape Barren Geese at Linlithgow and 2 Brolga at Kennedy.
- Feb. 1978 – 17 waterbird species seen at Linlithgow: Australian Shelduck, Musk Duck, Blue-billed Duck, Pink-eared Duck, Plumed Whistle-duck, Grey Teal, Black Swan, Little Grebe, Hoary-headed Grebe, Red-capped Plover, Eurasian Coot, Red-necked Stint, Masked Lapwing, Straw-necked Ibis, Silver Gull, Aust. Pelican & White-faced Heron.
- Feb. 1979 – 2 Common Sandpipers seen at Linlithgow.
- Feb. 1980 – 200 Crested Grebe milling together at Linlithgow & 2 Brolga near Bullrush Swamp.
- Mar. 1980 – thousands of waterbirds at Linlithgow (the most members could recall), including Pink-eared Duck (1000), Hoary-headed Grebe, Coot, Red-necked Stint, Freckled Duck, Aust. Shelduck (huge flocks), Black-winged Stilt, Double-banded and Red-capped Plovers. A Spotted Harrier, Swamp Harrier and Black Falcon were seen nearby. Also, 11 Brolga on Bullrush Swamp, along with 1000 Red-necked Avocet, and Yellow-billed Spoonbills on Krauses Swamp.
- Feb. 1981 – 16 waterbird species seen at Linlithgow (*‘the masses of birds from last year were missing but some notable birds were seen’*). These included 1 Common Sandpiper, 3 Curlew Sandpiper, 77 Aust. Pelican and Red-necked Stint, Double-banded Plover, Red-capped Plover, Little Grebe, Hoary-headed Grebe, Australasian Shoveller, Musk Duck, Black Swan, Masked Lapwing, White-faced Heron, Straw-necked Ibis and very large flocks of Aust. Shelduck. Notable raptors seen were Black Falcon, Spotted Harrier & Black-shouldered Kite.
- Nov. 1981 – Crested Grebe, Aust. Pelican and Red-necked Avocets at Linlithgow.
- Feb. 1982 – very low water level at Linlithgow and very few birds present, including a complete absence of Eurasian Coots. Birds seen were Aust. Pelican, Red-necked Avocet, Pink-eared Duck, and Chestnut Teal. A significant raptor sighted was an Aust. Hobby.
- Feb. 1984 – *“a Black Kite was the most interesting bird seen at Lake Linlithgow”*.

Figure 13.

Royal and Yellow-billed Spoonbills on the lake and Australian Shelduck and Black Swans flying in Feb. 2005.

View north from near the old windmill on the SE corner. The water level was very low.



Interesting bird sightings from 1985-2008 not noted in Tables 4 & 5

- Feb. 1985 – White-fronted Chat, Brown Thornbill, Yellow-rumped Thornbill, Grey Fantail, Willie Wagtail, Red Wattlebird, Little Raven, Richard’s pipit, Magpie-lark, Aust. Magpie and Welcome Swallow at Linlithgow.
- Feb. 1986 – 1 Restless Flycatcher & 2 Yellow-tailed Black-Cockatoo in Cypress at Linlithgow.
- Jan. 1987 – 2 Stubble Quail, 2 restless Flycatchers and a flock of Tree Martins at Linlithgow
- Feb. 1988 – Australian Raven, Welcome Swallow, Tree Martin, Richard’s Pipit at Linlithgow.
- Mar. 1988 – 1 Southern Boobook in a Cypress at The Point picnic area at Linlithgow.
- Apr. 1988 – 1 Flame Robin at The Point picnic area at Linlithgow.
- Feb. 1989 – dozens of Fairy Martins in paddocks at Linlithgow; Brolga and Yellow-billed Spoonbills on Krauses Swamp; Banded Stilt on Bullrush Swamp.

- Oct. 1989 – thousands of Tree Martins and a few dozen Fairy Martins around Linlithgow.
- Feb. 1990 – 2 Stubble Quail seen & others heard at Linlithgow. A Southern Boobook dead by road. 1 Golden-headed Cisticola in thistles on east bank of Linlithgow.
- Apr. 1992 – several female and 1 male Flame Robin on West Lakes Rd area.
- Feb. 1996 – at Krauses Swamp 1 Musk Duck, 200 Australian Shelduck, 200 Grey Teal, 2 Pink-eared Duck, 3 Australasian Shoveller, 12 White-faced Heron, 1 White Ibis, 1 Yellow-tailed Black-cockatoo and dozens of Welcome Swallow.
- Sept. 1997 – 1 Laughing Kookaburra on south edge of Linlithgow. Several Long-billed Corella, 2 Sulphur-crested Cockatoo, 1 White-fronted Chat and several Willie Wagtail, Richard's Pipit, Magpie-lark, Tree Martin, Welcome Swallow, Little Raven and Aust. Magpies seen.
- Jan. 1999 – 1 Brown Goshawk at Linlithgow.
- Feb. 1999 – Kennedy was dry but Linlithgow & Krauses Swamp had water. A few Grey Teal, Aust. Shelduck & White-faced Heron there.
- Nov. 1999 – 100s of Red-necked Avocet, a small group of Banded Stilt and large numbers of Whiskered Tern on Linlithgow.
- Jan. 2000 – 1 Australian Hobby on North Lakes Rd.
- Feb. 2000 – Musk Lorikeet, Purple-crowned Lorikeet, White-faced Chat and Magpie-larks in HFNC tree block. Linlithgow, Boonawah Ck, Krauses and Bullrush dry, the latter grass-covered.
- Nov. 2000 – several hundred Banded Stilt on western side of Linlithgow and small numbers of Red-necked Avocet on south side. White-plumed Honeyeaters in the HFNC's 1975 tree block.
- Dec. 2000 – Little Grassbirds seen on eastern bank and at Boonawah Ck and 600 Banded Stilt (most without chest band), 2 Black-winged Stilt, 16 Red-necked Avocet, 160 Black Swan, 80 Eurasian Coot, 97 Silver Gull, 44 Masked Lapwing, 1 White-faced Heron, 630 Aust. Shelduck, 40 Pink-eared Duck, 105 Grey Teal, 6 Australasian Shoveller, 8 Sharp-tailed Sandpiper, 26 Red-capped Plover, Horsfield's Bronze-cuckoo, Little Raven, Brown Songlark, Richard's Pipit, Whistling Kite, 2 Wedge-tailed Eagles, Yellow-rumped Thornbill and Magpie-lark at Linlithgow.
- Feb. 2001 – at Linlithgow, Red-rumped Parrot, Long-billed Corella, Yellow-rumped Thornbill, Australian Raven, White-fronted Chat, Yellow-tailed Black-cockatoo, Greenfinch, Aust. Magpie. At Krauses Swamp 2 Aust. Pelican, 30 Straw-necked Ibis, 200 Masked Lapwing, 6 White-faced Heron, 100 Pink-eared Duck, 2 Pacific Black Duck & 8 Silver Gull.
- Sept. 2001 – Pacific Black Duck (nest with 11 eggs), 2 Black-fronted Dotterel, several Red-capped Plover, 11 Red-necked Avocet, 1 Yellow-billed Spoonbill, Willie Wagtail, Magpie, Brown Falcon, Nankeen Kestrel, 2 Chestnut Teal, several Australasian Shoveller, several flocks of Grey Teal, Hoary-headed Grebe and a few Australian Wood Duck on Linlithgow.
- Dec. 2001 – 1 Glossy Ibis, 1 Blue-billed Duck, 1 Royal Spoonbill & 2 Yellow-billed Spoonbill on Krauses Swamp; 100s of Hardhead (most common), 100s of Pink-eared Duck, much fewer Blue-billed Duck, Aust. Wood Duck, Grey Teal & Aust. Shelduck, a few Purple Swamphen, Black-winged Stilt, Whiskered Tern, Red-rumped Parrot, Stubble Quail, Brown Songlark, Black-faced Cuckoo-shrike, Long-billed Corella, Galah, Yellow-tailed Black-cockatoo, Masked Lapwing, Silver Gull, Red-capped Plover and Black Swan (some with cygnets) on Linlithgow; several Freckled Duck on Salt Swamp, 1 Striated Fieldwren and some Banded Stilt at Kennedy.
- Jan. 2002 – several Black-tailed Native Hen and Black-winged Stilt on Salt Swamp; Purple Swamp Hen on Krauses Swamp.
- Feb. 2002 – several Black-tailed Native Hen on western shore and small groups of Red-necked Avocet on east shore of Linlithgow. Bullrush had >3,000 Aust. Shelduck, >200 Eurasian Coot, >200 Black Swan, 10 Black-winged Stilt and a few Pink-eared Duck & Australasian Shoveller.
- Mar. 2002 – Bullrush Swamp was particularly well frequented with waterbirds. 6,000 Grey Teal, 500 Pink-eared Duck, 500 Pacific Black Duck, 20 Australasian Shoveller, 8 Aust. Wood Duck, 2,000 Eurasian Coot, 250 Sharp-tailed Sandpiper, 50 Black-winged Stilt, 100 Silver Gull, 100 Masked Lapwing, 22 Yellow-billed Spoonbill, 3 White-necked Heron, 8 Aust. White Ibis, 20 White-faced Heron, 3 Red-kneed Dotterel.
- Sept. 2002 – 1 immature White-bellied Sea-eagle & 1 Pacific Golden Plover seen at Lake Linlithgow, at The Point boat ramp.
- Aug. 2003 – many Stubble Quail and Golden-headed Cisticola in grassland at Linlithgow.
- Jan. 2004 – ~200 Sharp-tailed Sandpipers at Linlithgow, 100s of Whiskered Terns over Bullrush Swamp and 2 Blue-billed Duck seen at Krauses Swamp (the first for years).
- 30 Jul. 2004 – 1 Eastern Curlew on Salt Swamp south of Linlithgow; it then flew to Linlithgow.
- Sep. 2004 – 74 Black Swan nests on Bullrush Swamp.

- Feb. 2005 – Little Grassbird & Golden-headed Cisticola on east bank of Linlithgow.
- Mar. 2005 – 1 Blue-winged Parrot seen near Boonawah Ck.
- Sep. 2005 – Black-faced Cuckoo-shrike, Golden-headed Cisticola, Red-rumped Parrot, Restless Flycatcher and Skylarks seen near North Lakes Rd, Linlithgow.
- Oct. 2005 – 1 Peregrine Falcon, 1 Collared Sparrow-hawk & 1 White-winged Triller, N Lake Rd; 1 Cape Barren Goose at Krauses Swamp (the last sighting in the area, at Linlithgow, was 1977).
- Feb. 2006 – Striated Fieldwrens at Boonawah Ck, among clumps of *Gahnia trifida*.
- Nov. 2006 – 2 Satin Flycatchers at The Point, Rufous Songlarks on east bank of Linlithgow; 16 Brolga at Bullrush Swamp which was dry.
- Jan. 2007 – Rufous Songlark calling at HFNC tree block on 30 Jan. A Spotted Harrier and 2 Wedge-tailed Eagles over the grassy lake bed. Kennedy had water on SE part, after recent 75 mm of rain, with 82 Aust. Shelduck and 60 Red-capped Plover. Krauses Swamp was dry.
- Feb. 2007 – 20 Red-capped Plover on Kennedy; 5 Blue-winged Parrots at Linlithgow, E bank.
- 23 Oct. 2008 – Linlithgow marker 1.50 m, lake green except parts of centre; ~ 150 swan nests, ~11,000 Grey Teal and a few Pacific Black Duck, Australasian Shoveller, Chestnut Teal, Hardhead, Straw-necked Ibis and Aust. White Ibis, ~1,400 Sharp-tailed Sandpiper, ~1,100 Whiskered Tern, ~2,000 Black-winged Stilt; 17 Black-tailed Native Hen at The Point & 4 Red-kneed Dotterel on swamp off N Lakes Rd. Bullrush & Salt Lake dry, Kennedy ~ full.
- 24 Oct. 2008 – 1 Marsh Sandpiper and 20 Red-necked Avocet on Linlithgow.
- 16 Nov. 2007 – Linlithgow marker 1.66 m (after 120 mm rain); Stilts, Teal & Whiskered Tern.
- 11 Dec. 2007 – Linlithgow marker 1.52 m – thousands of birds – >2,000 Whiskered Tern,, > 1000 Black-winged Stilt, ~400 Sharp-tailed Sandpiper, 250 Banded Stilt, 400 Eurasian Coot.
- 7 Jan. 2008 – Linlithgow marker 1.43 m - ~2,000 Black-winged Stilt, 600 Banded Stilt.
- 23 Jan. 2008 – 1 Black Falcon, 700 Black Swan, 16 Banded Stilt, 150 Whiskered tern, 300 Straw-necked Ibis at Linlithgow; 6 Glossy Ibis, 2 Yellow-billed Spoonbill at Krauses; ~3,000 Aust. Shelduck, 40 Grey Teal & 3 Blue-winged Parrots at Lake Kennedy.
- 25 Jan. 2008 - ~5,000 Sharp-tailed Sandpipers (and a few Pectorals) arose from Bullrush and settled on Linlithgow (Figs. 38 & 61-64). Also many Aust. Shelduck, Black Swan & Silver Gull.
- 29 Jan. 2008 – 22 Red-capped Plover, ~100 Black Swan & ~3,000 Sharp-tailed Sandpiper.
- 9 Feb. 2008 – Linlithgow dry; 8 Wedge-tailed Eagle & 1 imm. White-breasted Sea-eagle. Krauses Swamp had ~700 Aust. Shelduck, 2 Brolga and a few Grebes, Ibis, Lapwing and Swan.



Figure 14.

Pelicans on *Jenawarra*, Boonawah Ck area, in Feb.1992 – part of a flock of over 600 birds, the largest seen at the lake.

Murray Gunn, Rod Bird & Steve Clark listed 126 species for Lake Linlithgow for the period 1960-2008 (Table 2). This list includes 59 species of water birds. Since the maturing and flowering of the HFNC plantation, the bird list has expanded to include White-plumed Honeyeater, Little Lorikeet and Purple-crowned Lorikeet (year 2000 sightings). Rufous Songlarks were recorded there in 2006.

This list also gives an estimate of the relative rarity and the relative abundance of each species, to better indicate what one might expect to see. To take the extremes, species seen only once are rated ‘*extremely rare*’, while species for which there are >50 records on different dates are considered ‘*very common*’. However, that is only part of the story for it is possible to have few records of a particular species on different dates, but when the species is present it may be in great numbers. We have indicated this, for example, by marking (#) those species that may sometimes be seen in tens (‘*moderately abundant*’), hundreds (‘*very abundant*’) or thousands (‘*extremely abundant*’).

Table 2. Bird list for Lake Linlithgow (*Jenawarra*) and allied swamps 1960-2008.

Compiled from records of Murray Gunn, Steve Clark, Rod Bird and HFNC records

Water birds	Relative abundance								Other birds	Relative abundance							
	xr	vr	r	c	vc	ma	va	xa		xr	Vr	r	c	vc	ma	va	xa
Great crested grebe			*			#			Black-shouldered kite				*			#	
Hoary-headed grebe					*			#	Black falcon		*						
Australasian grebe		*				#			Black kite	*							
Australian pelican				*		#			Square-tailed kite	*							
Darter	*								Whistling kite			*			#		
Little pied cormorant			*						Brown goshawk	*							
Great cormorant			*						Collared sparrow-hawk	*							
Little black cormorant			*						White-bellied sea-eagle	*							
White-necked heron		*							Wedge-tailed eagle			*			#		
White-faced heron				*					Little eagle	*							
Little egret	*								Swamp harrier						*		
Cattle egret		*							Spotted harrier	*							
Great egret		*							Australian hobby			*					
Australian white ibis				*		#			Peregrine falcon			*					
Straw-necked ibis				*		#			Brown falcon				*		#		
Glossy ibis		*							Nankeen kestrel				*		#		
Royal spoonbill		*							Stubble quail			*				#	
Yellow-billed spoonbill		*							Southern boobook	*							
Black swan					*		#		Laughing kookaburra				*				
Plumed whistling duck	*								Welcome swallow				*			#	
Freckled duck				*					Tree martin			*					
Cape Barren goose			*						Fairy martin			*					
Australian shelduck					*		#		Australasian pipit				*		#		
Pacific black duck				*			#		Black-faced cuckoo-shrike	*							
Grey teal				*			#		Flame robin	*							
Chestnut teal			*						Grey shrike-thrush								
Australasian shoveller			*				#		Restless flycatcher			*					
Pink-eared duck					*	*	#		Satin flycatcher	*							
Hardhead				*		#			Grey fantail			*					
Australian wood duck				*		#			Willie wagtail			*					
Blue-billed duck				*			#		Golden-headed cisticola			*					
Musk duck					*	#			Brown songlark				*				
Black-tailed native hen	*								Rufous songlark	*							
Purple swamphen	*								Brown thornbill				*				
Eurasian coot					*		#		Yellow-rumped thornbill				*				
Brolga				*		#			Red wattlebird				*				
Masked lapwing				*		#			Yellow-faced honeyeater	*							
Pacific golden plover	*								White-fronted chat				*				
Red-kneed dotterel			*			#			Masked woodswallow	*							
Double-banded plover		*							White-browed woodswallow	*							
Red-capped plover					*	#			Australian magpie-lark				*				
Black-fronted dotterel			*						Australian magpie					*			
Black-winged stilt				*		#			Australian raven	*							
Banded stilt				*		#			Forest raven	*							
Red-necked avocet				*		#			Little raven					*	#		
Ruddy turnstone	*								White-plumed honeyeater			*					
Eastern curlew	*								Yellow-tailed black-cockatoo				*				
Marsh sandpiper		*							Sulphur-crested cockatoo				*		#		
Greenshank	*								Long-billed corella					*		#	
Common sandpiper		*							Galah			*					
Latham's snipe		*							Crimson rosella	*							
Bar-tailed godwit		*							Red-rumped parrot			*					
Sharp-tailed sandpiper				*		#			Blue-winged parrot			*					
Pectoral sandpiper	*								Musk lorikeet			*					
Red-necked stint				*		#			Little lorikeet	*							
Curlew sandpiper		*							Purple-crowned lorikeet			*					
Silver gull					*	#			Horsfield's bronze-cuckoo	*							
Whiskered tern				*		#			Shining bronze-cuckoo	*							
Gull-billed tern		*							Clamorous reed-warbler	*							
									Little grassbird				*				
									Striated fieldwren			*					
									Silvereeye	*							
									Common skylark				*		#		
									House sparrow			*					
									European goldfinch				*		#		
									European greenfinch			*					
									Common blackbird	*							
									Common starling			*			#		

* xr, extremely rare (1 record); vr, very rare (<5 recs); r, rare (<10 rec); c, common (>10 recs); vc, very common (>50 recs)
at times: ma, mod. abundant (often 10s); va, very large flocks (often 100s); xa, extremely large flocks (sometimes 1000s)

Table 3. Water birds & raptors seen in February on HFNC excursions to Jenawarra.

Count sum (1) Cypress (SW cnr), (2) The Point, (3) SE bank, (4) HFNC trees, (5) Boonawah, (6) N Lakes Rd, (7) W Lake Rd.

SPECIES	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Great crested grebe	-			12	16	26			1	12		-				5									
Hoary-headed grebe	-	h	h	770	1320	825	2480	2260	160	3		30	240	1	24	20				140					
Australasian grebe	-	f																							
Australian pelican	-			4		6			610	2	-	1	1	1	25										
Little pied cormorant	-	f	f	f					1	1		-	-												
Great cormorant	-			1	f					2	10	-	10	1	6										
Little black cormorant	-	f	f						1			-				4									
White-necked heron	-			1								-													
White-faced heron	-	f	1	f		13	37	2	4	34		-	30	26	24	39	10							1	1
Great egret	-											-		1											
Australian white ibis	-	f		f	10							-													
Straw-necked ibis	-	f			2				2			-									185				
Royal spoonbill																								8	
Yellow-billed spoonbill	-	1							6			-												8	
Black swan	-	h	th	910	1240	2130	2020	350	140	90	-	50	32	20	100	10				600		2700	70		
Freckled duck	-	10	1					8				-													
Australian shelduck	-	h	10s	36	530	1240	530	930	890	431	-	600	470	245	680	350	0	0	350	20	425	270			
Pacific black duck	-	f		5	3	114		12	17		-	40	2	9	6							6	1		
Grey teal	-	th	10s	16	90	2240	410	1380	250	180	-	50	50	57	13	250	0	0	5500			1550	60		
Chestnut teal	-	f		5	4	5	3	2				-								2	2	5			
Australasian shoveller	-	f	h	12	40	14	970	600	6			-	6	2		10				100				5	
Pink-eared duck	-	f	h				330	450	355	6	-	350	8	70			5			750		250			
Hardhead	-	f	2				18	1				-													
Australian wood duck	-	f		10								-			10										
Blue-billed duck	-						13	98	135			-				2									
Musk duck	-	f	1	10	12	10	27	43	18	2		-	10	19	13	18									
Purple swamphen	-									5		-													
Eurasian Coot	-	th	th	130	810	965	1520	660	487	11	-	300	300	138	43				40		3000				
Brolga	-											-	20												
Masked lapwing	-	10s	h	h	200	148	172	217	134	67	-	100	75	96	250	160	50	0	60	25	60	165	14		
Red-kneed dotterel	-			2	2	2						-													
Double-banded plover	-	2										-													
Red-capped plover	-	3	1		3	1		3	11		-	2	6		7	36	6	23	45	20	25	20			
Black-fronted dotterel	-			3	5	4	4	6	1			-		3											
Black-winged stilt	-	10s		50		53	72					-				1								65	
Banded stilt	-											-	-	5		19									
Red-necked avocet	-							1				-							13					20	
Common sandpiper	-									1		-													
Sharp-tailed sandpiper	-					14						-												2	
Pectoral sandpiper	-											-													
Red-necked stint	-					1						-	5									250	450		
Curlew sandpiper	-											-													
Silver gull	-	10s	10s	210	100	560	291	117	76	447	-	100	200	125	117	450				15	1	60	135		
Whiskered tern	-		20	100		10	40					-									100				
WATER BIRDS				2600	4380	8230	9060	7120	3320	1310			1700	1440	810	1340	1310	56	23	7620	168	8516	1279	15	1
Black-shouldered kite	-	f	2									-		1		1	5	1	1	6		5			
Black kite	-	1										-													
Square-tailed kite	-											-													
Whistling kite	-	f	1	3		2	1	2	1		-	2		2	4		1		5	3		2			
Brown goshawk	-											-					1		1						
Wedge-tailed eagle	-	f										-				2		1	2			2	2	1	
Little eagle	-											-			1										
Swamp harrier	-		3			1		1	1		-		3	1			1		1			2		1	
Spotted harrier	-											-									2				
Peregrine falcon	-							1				-											2		
Brown falcon	-	f		20		19						-	5	6	10	3	11	11	14	5	6	5	6	2	6
Black falcon	-											-													
Hobby	-											-													
Nankeen kestrel	-	f						1				-						4			4			2	
RAPTORS		5+	6	3	20	2	20	5	2				7	10	14	9	12	23	16	15	21	5	19		
Previous year rain mm	431	848	759	775	774	610	608	742	701	664	868	673	582	701	695	499	622	567	645	824	561	728	728	541	493
water depth (m) in Feb.	0	1.58	1.76	1.64	2.20	1.74	1.22	1.38	1.26	1.26	2.45	2.09	1.53	1.33	1.45	0.85	0.42	0	0	0.45	0	0.14	0	0	0
fine, showers, rain	-	f	f	f	f	sh	f	f	f	f	f	-	f	f	f	f	f	f	f	f	f	f	sl	f	f
cloud cover: oc, s	-	s	s	oc	oc	oc	oc	oc	s	oc	oc	-	oc	s	s	oc	oc	s	oc	oc	oc	s	oc	s	s
windyness: c, b, w	-	w	w	b	w	c	w	w	e	b	w	-	b	w	w	b	b	c	b	c	c	c	c	c	b
temp: c, m, h	-	m	c	m	c	c	m	c	c	m	c	-	m	m	h	m	h	m-h	m	m	m	m	m	m	h

Bird numbers: f (few, e.g. <5), 10s (tens, 10-100), h (hundreds, 100-1000), th (thousands)

Temp: c (<15 degrees), m (15-30 degrees C), h (>30 degrees C)

Cloud cover: oc (>50%), s (<50%)

Windyness: c (calm), b (breeze); w (windy, >10 knot)

Table 4. Seasonal waterbird & raptor survey for *Jenawarra*, Oct. 1987 to Feb. 1993.

Steve Clark & Rod Bird

Birds seen	Date of Survey																							
	1987			1988			1989				1990				1991				1992				1993	
	Oct	Feb	Apr	Jun	Oct	Feb	Apr	Jun	Oct	Feb	Apr	Jun	Oct	Feb	Apr	Jun	Oct	Feb	Apr	Jun	Oct	Feb		
Great crested grebe	6	26	3		7		1							1		4	440	12	12	65	105			
Hoary-headed grebe	1000	1320	1410	45	220	825	765	39	60	2480	1200	1785	2260	190	205	230	160	135	405	8	3			
Australasian grebe			2																					
Australian pelican	3			3	1	6										15		610	135	53	2			
Darter																1								
Little pied cormorant	8	5	4	28								1	1			2	1	1						
Great cormorant	5											15				2	37	2		3	27	10		
Little black cormorant	10			1	1												4	1	3	9				
White-necked heron			10																		1			
White-faced heron	1	2	43			13	1			37	44			2	24			4	25	14	34			
Cattle egret							3									1								
Great egret																	1				1			
Australian white ibis		5	4		1																			
Straw-necked ibis	40	10	60				2	8										2						
Royal spoonbill																					1			
Yellow-billed spoonbill			3														3		6	16	9			
Black swan	1500	1240	1495	360	900	2135	2350	1260	680	2020	1950	1600	350	640	350	49	140	85	15	27	90			
Freckled duck							9			8						3	4							
Australian shelduck	50	530	1200	65	315	1245	265	200	205	530	200	160	930	560	30	25	890	325	30	85	480			
Pacific black duck	10		29	13	4	3	55	95		115	50	60		5			12		7		17			
Grey teal	400	95	400		29	2240	55	16	700	410	1200	95	1380	550	585	5	255	145	31		180			
Chestnut teal		5	1			4	1	50	8	5	15		3	1	7					2				
Australasian shoveller	200	40	165			14	355		105	970	2300	12	600	230	395		6	10						
Pink-eared duck	2						4			330	600	495	450	510	730	1040	355	1140	2360	610	6			
Hardhead	10								2	18	5	11				7	1							
Blue-billed duck										13	100	464	100	45	3	295	135	415	965	5				
Musk duck	10	12	9	53	24	10	19	39	14	27	26	112	43	24	18		18	8	14	2				
Purple swamphen																						1		
Eurasian coot	200	810	2190	400		965	1275	505		1520	1350	1990	660	205	95	235	485	95	8	1	11			
Brolga		2																						
Masked lapwing	10	200	205	4	23	150	285	25	24	170	250	30	215	170	34	12	135	24	6	5	65			
Red-kneed dotterel										2														
Double-banded plover				(30)									2			2			1	6				
Red-capped plover	10	3		2		1		4					8	3		4		11	7	8				
Black-fronted dotterel		5	10			4	4	2		4	10	9	6	2	1		1	2						
Black-winged stilt	100				15	53				72														
Red-necked avocet	12													(30)	75									
Ruddy turnstone																	1							
Common sandpiper																						1		
Sharp-tailed sandpiper	11	14																						
Pectoral sandpiper																				1				
Red-necked stint				4(50)		1		1	5			10							10					
Curlew sandpiper	1								2															
Silver gull	60	100	135	16	280	560	120	85	330	290	100	8	115	90	24	195	75	190	60	38	445			
Whiskered tern	100				500	10			15	40						250			3	18				
Whistling kite			10	3		2	15			1	3	3	2	6	1			2			1			
Collared sparrow-hawk				1																				
Swamp harrier														1								1		
Peregrine falcon													1	1										
Brown falcon		20	10	3			20			19		3		12										
Nankeen kestrel				5			1	3																
Rainfall prev. 2 mth*	85	49	39	151	113	62	74	155	171	92	99	92	107	62	126	105	46	131	150	207	103			
Lake water depth (m) †	2.22	1.74	1.52	1.60	1.81	1.22	1.23	1.28	1.82	1.38	1.22	1.25	1.26	1.11	1.11	1.65	1.26	1.19	1.23	2.70	2.45			
Lake fill #	7/10	5/10	4/10	4/10	5/10	3/10	3/10	3/10	5/10	3/10	3/10	3/10	3/10	3/10	3/10	4/10	3/10	3/10	3/10	8/10	8/10			

* Rainfall total (mm) at the Pastoral & Veterinary Institute, 12 km SW of the lake, in the current plus previous calendar month of the count (this indicates the likely change in the level of water in the lake – see Fig. 9).

† Actual depth of water at The Point marker – data of State Rivers & Water Supply Commission (supplied by Thiess Services).

Lake fill – an approximate 11-point indicator – 0/10 is dry, 5/10 is half full, 10/10 is the overflow level, etc.

Figure 15 – seasonal abundance of various waterbirds at Jenawarra, from Oct 1987 to Feb. 1992.

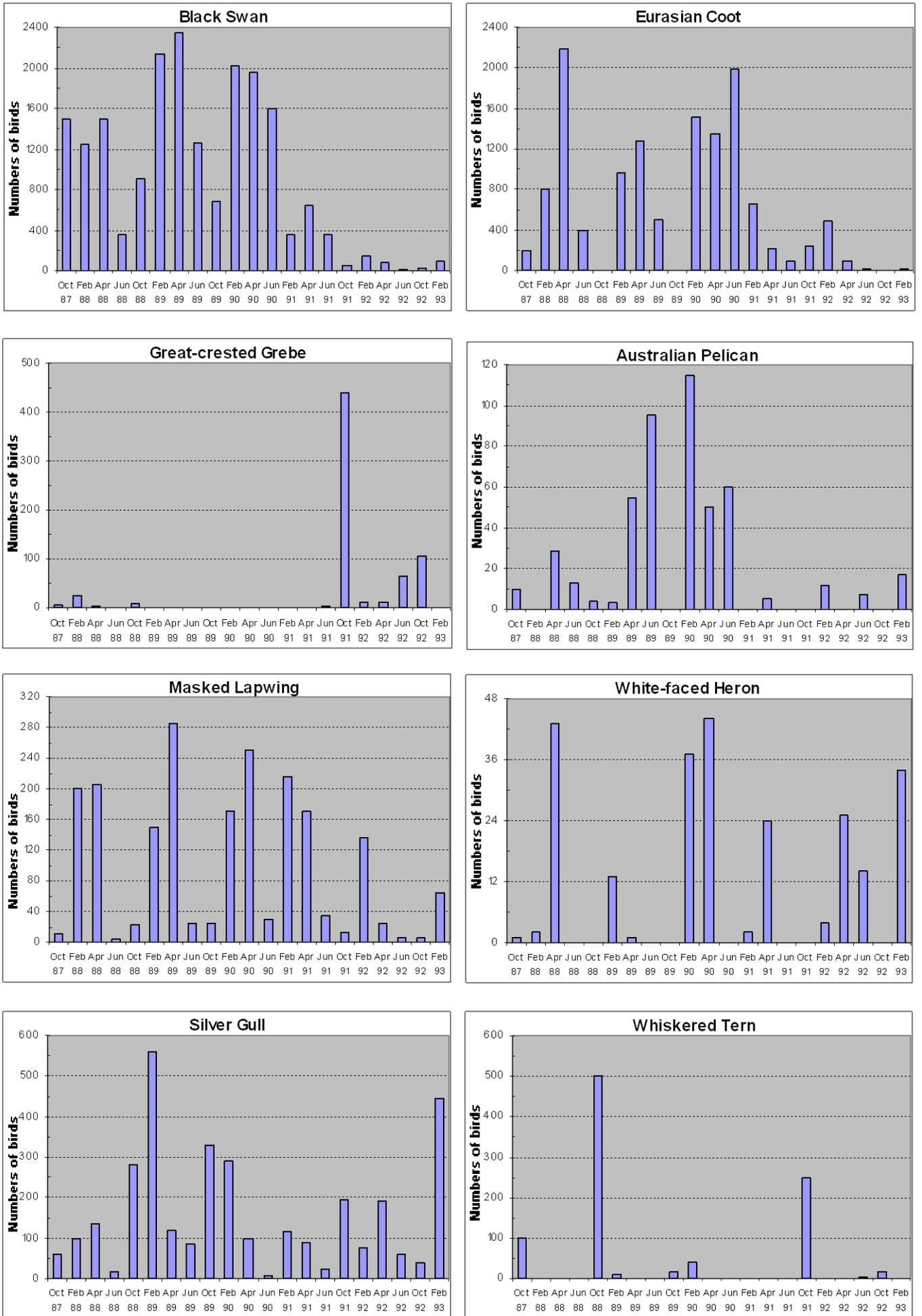
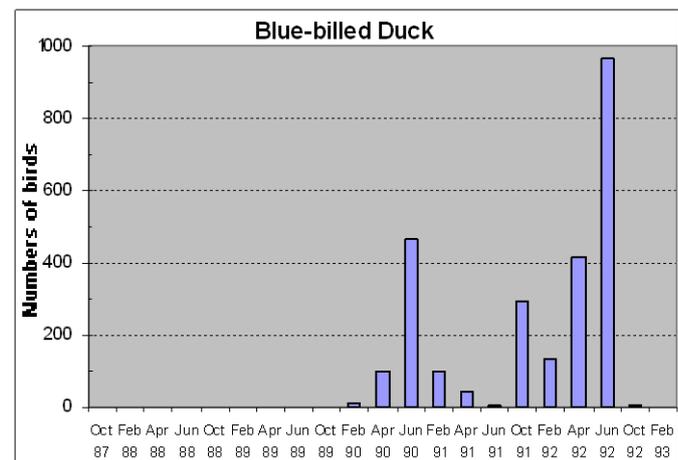
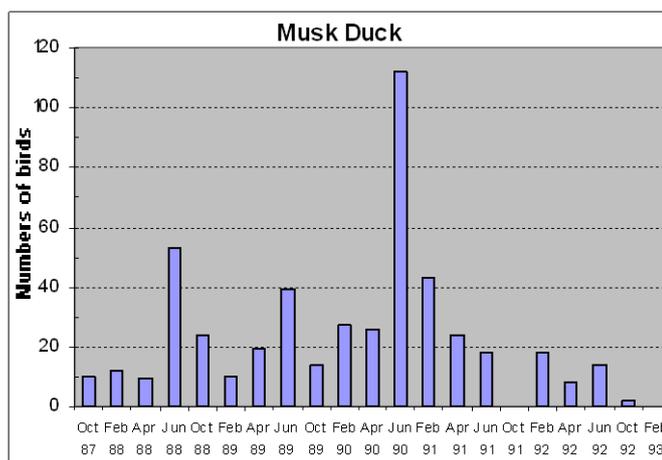
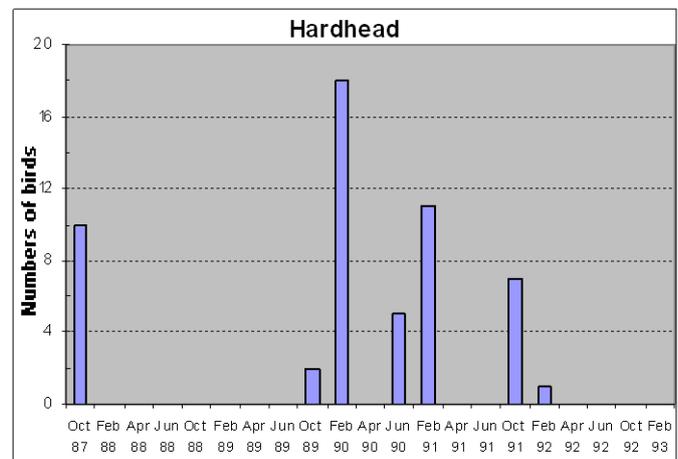
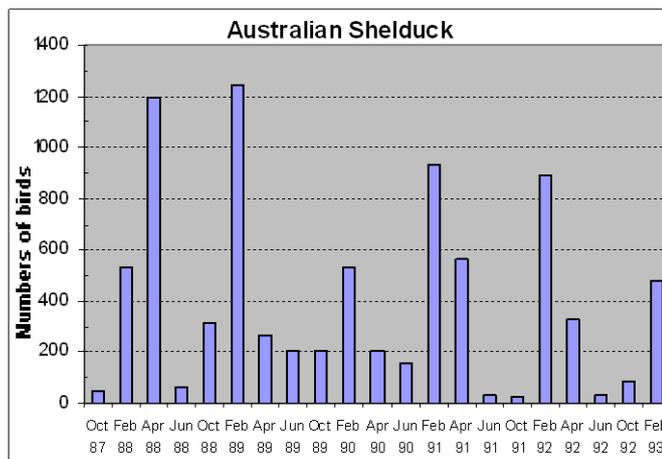
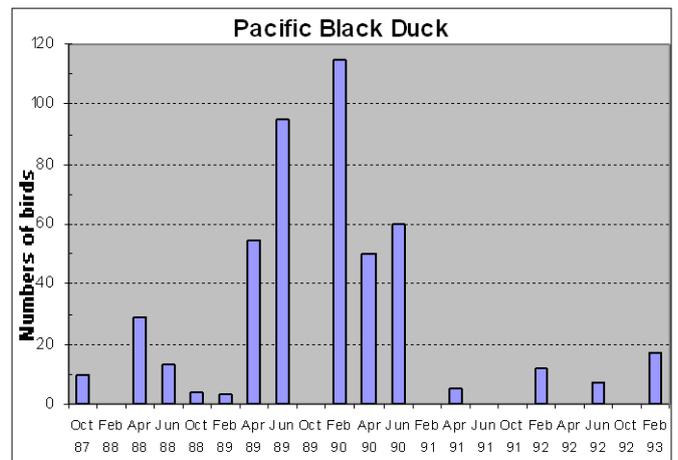
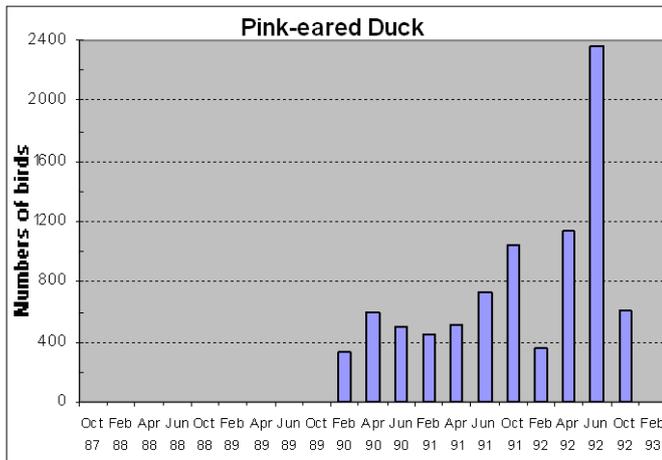
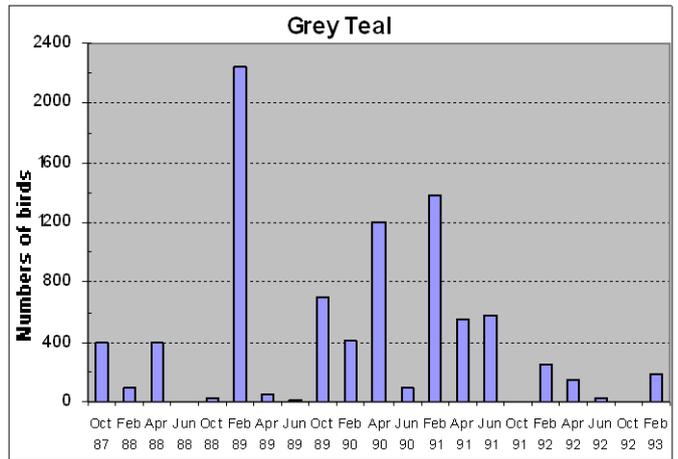
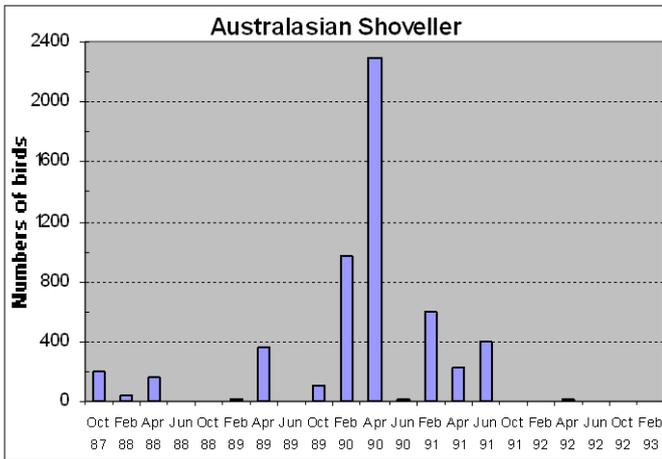


Figure 16 – seasonal abundance of various species of duck at Jenawarra, from Oct 1987 to Feb. 1992.



A detailed count of water birds and birds of prey was kept over the last 21 years (from 1985 to 2008 but excluding 1994), from visits made to the same points on the lake each February (Table 3). This period include droughts after which the lake dried up during summer for one or more years, including 2005-08. Counts were made of birds on the lake from 7 points around the lake, commencing at The Cypress corner (Chatsworth Rd) at 7 am and proceeding then to The Point and so on, anti-clockwise around the lake to the SE bank (near the old windmill), HFNC tree block established from 1975-91, Boonawah Ck, NW corner on North Lakes Road and mid-west on West Lakes Rd (at the unfenced road reserve). The survey generally finished by 11 am.

Two members (Steve Clark and Rod Bird) also conducted a detailed seasonal survey over 6 years, from 1988-93, in order to indicate variations in populations of various species during the year (Table 4 and Figs. 13 & 14). That period did not include any years in which the lake dried out but neither did it include any period when the lake was very high. It may give a reasonable representation of species diversity and abundance in average runs of years when the lake has water. Graphs showing the seasonal abundance of various species are given in Figures 3-6. When comparing numbers recorded in February with those at other times (Table 5) it is apparent that peak numbers of many species are much lower in summer - e.g. Blue-billed Duck or Pink-eared Duck or Great Crested Grebe – but not so for Grey Teal, Pacific Black Duck or Australian Shelduck. Notable records were that of 2,240 Grey Teal in Feb. 1989, 2,190 Eurasian Coots in Apr. 1989, 500 Whiskered Terns in Oct. 1989, 2,480 Hoary-headed Grebes in Feb. 1990, 610 Australian Pelicans in Feb. 1992, 440 Great Crested Grebes in Oct. 1991, and 965 Blue-billed Duck & 2,360 Pink-eared Duck in Jun. 1992.

A disadvantage of only surveying the lake at one date, and only in summer, is that some species will not be recorded. Water levels may be low or the lake may be dry, so that birds may congregate elsewhere. On a particular day some species may be found primarily at Lake Kennedy, Krauses Swamp or Bullrush Swamp. For example, there can be a marked movement of Australian Shelduck or Grey Teal between any of these wetlands – that can happen when the birds are disturbed or for other reasons, such as windy weather. Counts of birds are thus rendered very approximate. A count on a different day and/or time could result in some species being present at Lake Linlithgow whereas they were not on the previous day. An extraordinary example is the sighting of some 5,000 Sharp-tailed Sandpipers at 3 pm on the 25 Jan. 2008, rising from Bullrush Swamp in 3 flocks and settling on Lake Linlithgow adjacent to a few pools of water (see Figs. 61-63), whereas none were seen on the morning of 23 Jan. The birds were seen again on the afternoon of 29 Jan. but were gone by 9 Feb. 2008.

The more saline environment of Lake Kennedy produces clearer water and, in theory, greater plant growth. That presumably would encourage more diving species to frequent that lake.

Until recently our club had not made a comprehensive survey of all of these wetlands on a regular basis, surveyed on the same day. In 2006, GHAMA contracted Birds Australia to examine a suite of wetlands in the CMA region, with a view to determining impacts of the wetlands on waterbird species and numbers. Members of HFNC were associated with that project, as volunteers who did the quarterly surveys. Lake Linlithgow and the associated adjacent lakes and swamps, including the private Soldiers Swamp off West Boundary Rd (south of the Hamilton Highway), form one group of wetlands. The survey started in late spring 2007, following the drought in 2005-06 that resulted in these wetlands drying up. Results for 8 periods (Nov. 2007-July 2008) are presented in the Appendix.

Duck Hunting

The HFNC has agitated for all of the 5 wetlands in this Linlithgow complex to be excluded from duck hunting. Our objective has been to remove duck shooting from this complex of wetlands, so that the birds on one area would not be disturbed by action at another area. For example, shooters would wait at a point between lakes Kennedy and Linlithgow to shoot birds disturbed on one lake and flying to the other. Shooting on any one lake in the area also makes all birds wary, difficult to observe and easy to disturb. These wetlands are too important for waterbird conservation to allow this to continue.

We began a campaign in 1975, with a submission to the LCC, re. Corangamite Study Area. That bore no fruit, for our recommendations appear to have been ignored.

The Wildlife Act was amended in 1976, and a technicality left Lake Linlithgow vulnerable to duck hunting, despite its status as a sanctuary since being proclaimed as such under the Games Act of 1928.

Unsympathetic shooters seized the opportunity and in 1985, or earlier, shot on this lake, together with Bullrush Swamp, Krauses Swamp and Lake Kennedy. A photograph in the local paper (Drew 1985) shows happy shooters with 40 ducks. Shooters were back at Linlithgow on duck open day in Feb. 1986, coinciding with our annual excursion to the lake. Ducks were scarce and the shooters did not fare well on that day, at least.

HFNC wrote to the Minister for Conservation, Forests and Lands (Joan Kirner) in May and in June 1985, protesting about this situation. The Minister responded saying that the LCC recommendations for the Corangamite Study Area were that Lake Linlithgow, Bullrush Swamp, Lake Kennedy and Krauses Swamp become Lake Reserves. Shooting of game species would be permitted in the proclaimed season. Lake Kennedy was not considered to merit Nature Reserve status but was reserved for management of wildlife in 1981 (it is now a Wildlife Reserve), but no action had been taken with the other reserves by 1985.

In Aug. 1990, HFNC submitted a proposal to DCFL to cancel grazing licenses in the Boonawah creek area and around to the 1975 tree block on Linlithgow. Nothing eventuated.

In Oct. 1992, HFNC commented to Dept. Conservation & Natural Resources regarding the Review of Wildlife Reserves 1992, with particular reference to Lake Kennedy. There was no response.

In Sept. 2003, HFNC wrote to the Minister for Environment (John Thwaites), providing background information on the lake-swamp complex, outlining the problem, and requesting that duck hunting be banned on all of the wetlands in this complex. No response was received and HFNC wrote again in 2004, again with no response.

In 2005, HFNC wrote to the Victorian Environment Assessment Council (VEAC), the successor to the LCC, renewing the case. After a further note in 2006 we were eventually informed by Department of Sustainability & Environment that our case was too small for VEAC to consider and that we should proceed through the regional office of DSE. To date we have had no response from DSE.

Mammals of Jenawarra Reserve

Habel (1979) noted that '*native spotted cats*', wallabies and bandicoots were once found near the shores of the lake, in the years before the settlers drastically altered the landscape through clearing of the understorey shrubs and cultivation. The 'spotted cat' was either the Spot-tailed Quoll (*Dasyurus maculatus*) or the Eastern Native Quoll (*Dasyurus viviparus*). The first is very rare now in Victoria and the latter was common at that time but is now extinct on the Australian mainland but quite common in Tasmania.

The skeleton of a Fat-tailed Dunnart (*Sminthopsis crassicaudatus*) was found by HFNC on the northern bank in Feb. 2001, while Swamp Rats (*Rattus lutreolus*) are common in the areas planted with trees where there is long grass. Black Wallabies (*Wallabia bicolor*) live in the trees areas and clumps of *Gahnia trifida* along the Boonawah Creek and occasionally an Eastern Grey Kangaroo (*Macropus giganteus*) is seen. In 1971, Lionel Elmore recorded in 1981 that a Mr E. Wiese of Hamilton '*had a barred bandicoot run up his sleeve while rabbiting near Boonawah Creek*' (HFNC notes). The Red Fox (*Vulpes vulpes*) also lives in the area.

Fish of Jenawarra

The lake has contained English Redfin from time to time. It has also contained eels. A commercial eel farmer (Skipton Eels) was licensed to stock the lake with eels during the wet years of the 1970s and 80s. HFNC reported 140 dead eels on the eastern shore in Aug. 1978 after the herbicide 2,4-D had been used to kill thistles nearby. The land adjacent to the lake and Boonawah Ck is intensively cropped and, since both the lake and creek also dry up periodically, it is a wonder that any small native fish survive the combined effects of pesticide and herbicide drift plus desiccation. Yet such must be the case if the presence at certain times of large flocks of Australian Pelican and Whiskered Tern is any indication.

Laurie Herrmann recalls '*In 1952 I saw a flock of about 50 pelicans beating in a line in the bay near the Boonawah mouth, driving the fish*'. Local fishermen also have been seen at times using drag nets in the shallows to capture minnows for use as bait elsewhere (Ian Holdsworth, pers. communication).

Flora of Jenawarra Reserve

The question as to what original tree vegetation was around the lake is interesting. We have not been able to obtain much information. Habel (1979) indicates that “*that across the plain there were no large gums, only scattered small Blackwood*”. However, that evidence is not entirely consistent with the reports of Robinson or of Tyers who saw the country in 1839 and 1841 before any clearing was undertaken. By 1861, when Wilhelm Habel arrived, the first German settlers had 8 years to clear away most of the vegetation to allow cultivation. According to Habel (1979), in 1861 the fringes of the lake were almost devoid of trees and therefore he began planting to beautify the surrounds.

The description of the country provided by Tyers in 1839 and Robinson in 1841, before any clearing had occurred, indicate that the plains around the lakes certainly contained Silver Banksia (*Banksia marginata*) and probably scattered Swamp Gum (*E. ovata*). There are still a few ancient Swamp Gum within a few km of the lake, and also a few Drooping Sheoak (*Allocasuarina verticillata*) which were widespread but sporadic in the early days. One specimen occurs near the Chatsworth Rd-Huffs lane, between Lake Linlithgow and Lake Kennedy, as do 6 specimens of River Red Gum (*E. camaldulensis*), although these appear to have been planted by Habel more than 100 years ago.

Blackwood (*A. melanoxylon*) occurs on the NW corner of the lake – there is a fine stand on North lakes Rd – and presumably was fairly common in the early days. Mr A. Krause’s parents were the first settlers on the gilgai flats to the east and NE of Lake Linlithgow and the late Lionel Elmore recorded Mr Krause as saying ‘*there were only occasional Blackwoods around the bases of the lunettes in that area*’. There were certainly Blackwoods of considerable size in the Croxton East and Tabor area, evidenced by beams from the Hernhutt Church that was demolished in 1897 (Fig. 17). That was 8 or 9 km SSE of Lake Linlithgow, and the trees taken by members of Krummow’s commune probably grew on the property.

Figure 17.

Blackwood beams, posts and boards seen in April 2005 at “Silvan Grove”, in the interior part of the woolshed off Mibus Lane, near Linlithgow. The structure is still solid. There has been an extension at the back of the shed, visible in this photograph.

The property is now owned by Rob & Jill Sinclair.



Trees in the vicinity of the lake – and for a considerable distance around – would have been prized as a source of firewood and for construction of buildings and fences. Apart from the timber demands of the settlers, the rich, black soil around the lakes produced fine crops of potatoes and this attracted town dwellers from Hamilton, who leased quarter-acre plots from the farmers. They built small huts around the lake to accommodate themselves when they came to dig the potatoes, and no doubt they exploited the reserves for any available wood. Little wonder that the lakeside vegetation became sparse!

Other trees/shrubs that would be expected to occur in the area are Tree Violet (*Hymenanthera dentata*), Sweet Bursaria (*Bursaria spinosa*), Black Wattle (*Acacia. mearnsii*), Hedge Wattle (*A. paradoxa*), Woolly Tea-tree (*Leptospermum lanigerum*), Cherry Ballart (*Exocarpos cupressiformis*) and Tree Everlasting (*Chrysocephalum dendroidium*). Of these, 30 Tree Violet still occur on the cliff tops at the NW corner of the lake, together with 3 remnant Sweet Bursaria clinging to the cliff. Also finding refuge on the cliffs, away from grazing sheep, are fine examples of Nodding Saltbush (*Einadia nutans*), Austral Pelargonium (*Pelargonium australe*), Australian Hollyhock (*Lavatera plebeia*) and Scented Groundsel (*Senecio odoratus*). The occurrence of these species at the lake is of great interest and the population must be protected by fencing out stock and the plants thereby encouraged to regenerate along the bank.

Several old Tree Everlasting occur along the high water line of the western edge of Bullrush Swamp.



Figure 18 – an ancient Tree Violet (*Hymenanthera dentata*) in Sept. 2005 on the north bank of Linlithgow, adjacent to North Lake Rd.



Figure 19 – Australian Hollyhock (*Lavatera plebia*) is pictured right, seen in Feb. 2003. This species occurs along Boonawah Ck and the north bank.

The absence of Black Wattle is a little surprising but that of Hedge Wattle not unexpected - this shrub was at one time declared a noxious weed, on account of its thorns. Clumps exist along the West Lakes Rd and on Chatsworth Rd. The rarity of Sweet Bursaria here is probably also due, in part, to the presence of thorns. However, the shrubs seen on the NW bank were free of thorns, as is sometimes the case with this species, and its scarcity may relate more to destruction by grazing livestock. There may have been Woolly Tea-tree and Prickly Tea-tree growing along the drainage lines, as still occur in some parts of the district. Woolly Tea-tree can tolerate quite severe salinity and waterlogged conditions, but does not enjoy harsh, dry conditions in summer where groundwater seepage is not available.

The complete absence now of Drooping Sheoak and Silver Banksia is probably due to their use for firewood (Banksia wood was also favoured for smoking eels), cultivation and the effect of rabbits and livestock in preventing regeneration. These species would certainly have grown along the well-drained parts of the lake, and particularly near the rocky banks on southern, western and northern sides. The parasitic Cherry Ballart was also once widespread but its absence now is not surprising, given the grazing pressure that it would have encountered in this area.

The predominant grasses in the better-drained parts of the Grange catchment would have been Kangaroo Grass (*Themeda triandra*), Spear Grass (*Austrostipa* spp.), Wallaby Grass (*Austrodanthonia* spp.), Red-leg Grass (*Bothriochloa macra*), Common Wheatgrass (*Elymus scaber*) and Weeping Grass (*Microlena stipoides*). In the wetter parts, White Tussock (*Poa labillardiera*) and Blown Grass (*Lachnagrostis avenaceae*) were dominant. These species, excepting perhaps Red-leg Grass, but adding the Five-awned Spear Grass (*Pentapogon* sp.), are present at Linlithgow.

The uncultivated surrounds to Lake Linlithgow contain some surprisingly fine examples of native grass communities. The best occur in and above the Boonawah creek wetlands and on the high NW parts of the lake surrounds. Subterranean Clover and other pasture species, including Phalaris, Sweet Vernal and Soft Brome, occur freely in paddocks such as that near the boat ramp on the north shore.

Severe summer grazing of the foreshore before 2002 temporarily obliterated most of the sedges and forbs, including the rare Salt Tussock-grass (*Poa sallacustris*). A luxuriant growth of Spear Thistle (e.g. *Cirsium vulgare*) and other weeds, such as Horehound (*Marrubium vulgare*), occur in drier areas that were heavily grazed. Thistles were noted growing vigorously on the bank near the school in 1876 (Lehmann 1976). Sharp Leaf-rush (*Shoenoplectus pungens*), Common Cotula (*Cotula coronopifolia*), Creeping Monkey-face (*Mimulus repens*), Lemon Beauty-heads (*Calocephalus citrinus*), Salt pratia (*Lobelia irrigua*) and Round-leaf Wilsonia (*Wilsonia rotundifolia*) survive on the foreshore and Boonawah flats. Swamp Weed (*Selliera radicans*), Austral Brooklime (*Samolus repens*), Milky Beauty-heads (*Calocephalus lacteus*), Glaucous Goosefoot (*Chenopodium glaucum*) and Salt Marsh-grass (*Puccinellia stricta*) occur in masses on the flats. Cattle on the reserve were seen in the 1960s foraging in the lake for Fennel Pond Weed (*Potamogeton pectinatus*) or Sea Tassel (*Ruffia maritima*).

Common Reed (*Phragmites australis*) occurs on Boonawah Creek downstream from the crossing on North Lakes Rd. Heavy grazing and increasing salinity may have removed it from the lower section of the creek. Sharp Leaf-rush is also heavily grazed by sheep. An additional serious threat there, and to the entire lake foreshore, is the presence of Tall Wheatgrass (*Thinopyron ponticum*) that has escaped down the Boonawah Ck from a planted area near the North Lakes stream crossing.

A significant species at Boonawah Ck is *Gahnia trifida* – a tall sedge that grows in a mass to 1.5 m. There are various patches of this plant on the expanse of flat adjacent to the creek. Field Wrens, Golden-headed Cisticola, Superb Fairy-wren, White-fronted Chat and Little Grassbird are particularly attracted to the *Gahnia* habitat. This species is not common in the region and is a suitable replacement for the nasty environmental weed, Spiny Rush (*Juncus acutus*) that is such a problem in SW Victoria. That pest species is beginning to show up around Lake Linlithgow and Lake Kennedy. Associated with the *Gahnia* are clumps of White Tussock (*Poa labillardiera*) (Figs. 20 & 21).



Figure 20 – *Gahnia trifida* and White Tussock (*Poa labillardiera*) at the winter-wet Boonawah Ck flats in Sep. 2003.



Figure 21 – White Tussock (*Poa labillardiera*) at Boonawah Ck flats in Sept. 2003.

A stand of *Gahnia trifida* can be seen in the right background, while other sedges occur in the middle ground.

Wurgarri (Mt Sturgeon) is seen to the north.

A comprehensive survey and listing of flora has not yet been made. An outcome of this project is to establish a list of plant species for the lake and surrounds. A preliminary list is given in Table 5. This includes “new” species found since grazing was terminated in autumn 2002 – Common Eutaxia (*Eutaxia microphylla*) and Austral Trefoil (*Lotus australis*) – both unusual occurrences in this region. Neither species were noticed when the foreshore was grazed.

The spikey, close-cropped Eutaxia plants must have persisted against the odds – their recovery and notable presence now on the shore from The Point to Boonawah Ck (see Figs. 52 & 53) has been the most significant result of removing grazing stock from the lake frontage. *Poa sallacustris* (Salt Tussock-grass) has also re-appeared and is now flourishing around the lake shore, especially the zone immediately above the high watermark. Tall Wheatgrass, Phalaris and Spiny Rush are the tangible threats to this rare species, for they dominate the same littoral zone.

Some idea of the condition of the lake and its surrounds (including Boonawah Ck) in the 1960s may be gleaned from a set of photographic slides taken by Lionel Elmore and reproduced below (Figs. 22-30). These also show the water levels that prevailed then and in the early 1970s. These pictures can be compared with those presented elsewhere in this report for later years.



Figure 22 – Lake Linlithgow from the boat ramp area near the Point in the 1960s.



Figure 23 – Cattle in the SE corner of Lake Linlithgow in June 1967 – thistles and dead swans on the shore.



Figure 24 – members of HFNC on the grazed east bank of Lake Linlithgow in March 1966.



Figure 25 – Boonawah Creek in flood in March 1966.



Figure 26 – Flock of at least 35 Brolga on the Boonawah Ck flat, March 1968. Sheep grazed the flats.



Figure 27 – NE side of lake from the edge of the present HFNC tree block to Boonawah Ck, Mar. 1968.



Figure 28 – SE corner of Lake Linlithgow in Jan. 1967, start of the drought year.
Note the thistles, grazing sheep on the shoreline & Silver Gulls.



Figure 29 – Shelduck and swans in the SE corner of Lake Linlithgow, from the Cypress bank in April 1969.



Figure 30 – SE corner of Lake Linlithgow on Lake Reserve Rd in Feb. 1971, before HFNC planting in 1975.

**Table 5. Native flora of Lake Linlithgow (*Jenawarra*) Lake Reserve
Nov. 2000-Feb. 2005.**

57 species

<i>Acacia melanoxylon</i>	– Blackwood (NW bank, North Lakes Rd and S end of West Lakes Rd)
<i>Acacia paradoxa</i>	– Hedge Wattle (on W bank road reserve)
<i>Asperula conferta</i>	– Common woodruff - N shoreline
<i>Austrodanthonia caespitosa</i>	– Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia duttoniana</i>	– Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia geniculata</i>	– Kneed Wallaby Grass (S peninsula)
<i>Austrodanthonia setacea</i>	– Bristly Wallaby Grass (NW and Boonawah Ck)
<i>Austrodanthonia pilosa</i>	– Velvet Wallaby Grass (NW and Boonawah Ck)
<i>Austrostipa bigeniculata</i>	– Kneed Spear-grass (coll. DF & DT)
<i>Bolboschoenus</i> sp.	– Sedge (coll. DF & DT)
<i>Bursaria spinosa</i>	– Sweet Bursaria (NW bank - 2 trees)
<i>Calocephalus citrinus</i>	– Lemon Beauty-heads (uncommon, Boonawah Ck flats)
<i>Calocephalus lacteus</i>	– Milky Beauty-heads (common, NW bank, shoreline and Boonawah Ck flat)
<i>Carex</i> aff. <i>bichenoviana</i>	– Sedge (abundant on the sand bank near Boonawah Creek)
<i>Chenopodium glaucum</i>	– Glaucous Goosefoot (dry lake bed and shore)
<i>Convolvulus erubescens</i>	– Pink Bindweed (Boonawah area and NW bank)
<i>Convolvulus remotus</i>	– Bindweed (Boonawah area and NW bank)
<i>Cotula coronopifolia</i>	– Common Cotula (Boonawah Ck)
<i>Crassula helmsii</i>	– Swamp Crassula (Boonawah Ck)
<i>Dichondra repens</i>	– Kidney-weed (Boonawah Ck area and NW Bank)
<i>Distichlis distichophylla</i>	– Australian Salt-grass (Boonawah Ck)
<i>Dysphania glomulifera</i> ssp. <i>glomulifera</i> .	– Globular Pigweed (coll. DF & DT)
<i>Einadia nutans</i>	– Nodding Saltbush (NW bank and The Point)
<i>Elymus scaber</i>	– Common Wheatgrass (NW and grassland at Boonawah Ck flats)
<i>Epilobium billardierianum</i>	– Variable Willow-herb (coll. DF & DT)
<i>Eragrostis infecunda</i>	– Cane-grass (Boonawah Ck flats)
<i>Eryngium ovinum</i>	– Blue Devils (NW bank)
<i>Eutaxia microphylla</i>	– Common Eutaxia (eastern shoreline and Chatsworth Rd shoreline)
<i>Gahnia trifida</i>	– Coast Saw-sedge (many large clumps on Boonawah Ck flats)
<i>Geranium solanderi</i>	– Austral Cranesbill (N shore bank area)
<i>Hymenanthera dentata</i>	– Tree Violet (NW bank - about 20 trees)
<i>Hypoxis</i> sp.	– Yellow Star (NW bank)
<i>Isolepis</i> sp.	– Club-sedge (coll. DF & DT)
<i>Lachnogrostis avenaceae</i>	– Blown Grass (fringing the lake)
<i>Lavatera pleibia</i>	– Australian Hollyhock (NW bank, NE shoreline and Boonawah Ck)
<i>Lilaeopsis polyantha</i>	– Australian Lilaeopsis (coll. DF & DT)
<i>Lobelia irrigua</i>	– Salt pratia (shoreline Chatsworth Rd and elsewhere)
<i>Lotus australis</i>	– Austral Trefoil (2 plants on shoreline, 400 m S of Boonawah Ck)
<i>Microlaena stipoides</i>	– Weeping-grass (NW and paddock on N bank of lake at Aquatic area)
<i>Mimulus repens</i>	– Creeping Monkey-face (Boonawah Ck and N shore boat ramp area)
<i>Pelagonium australe</i>	– Austral Pelagonium (NW bank and shoreline S of Boonawah Ck)
<i>Pentapogon quadrifida</i>	– Five-awned Speargrass (NW)
<i>Phragmites australis</i>	– Common Reed (Boonawah Ck below North Lakes Rd)
<i>Poa labillardiera</i>	– White Tussock (NW and Boonawah Ck flats)
<i>Potamogeton pectinatus</i>	– Fennel Pond Weed (growing in the water at Lake Linlithgow and Lake Kennedy)
<i>Poa sallacustris</i>	– Salt Tussock-grass (around the shoreline, particularly the S shore bay near Chatsworth Rd)
<i>Puccinellia stricta</i> var. <i>perlaxa</i> .	– Salt Marsh-grass (on the flats)
<i>Ranunculus (inundates or ampitruis?)</i>	– Small River Buttercup (Boonawah Ck)
<i>Ruffia maritima</i>	– Water Weed (growing in the water at Lake Linlithgow)
<i>Samolus repens</i>	– Austral Brooklime (Boonawah Ck flats and N shore)
<i>Sarcocornia quinqueflora</i>	– Beaded Glasswort (S shore, N shore and Boonawah Ck)
<i>Schoenoplectus pungens</i>	– Sharp Club-sedge (fringing the lake and on Boonawah Ck)
<i>Schoenus nitens</i>	– Shiny Bog-sedge (coll. DF & DT)
<i>Sebaea albidiflora</i>	– White Sebaea (coll. DF & DT)
<i>Selliera radicans</i>	– Swamp Weed (fringing the lake and at Boonawah Ck)
<i>Senecio odoratus</i>	– Scented Groundsel (NW bank)
<i>Themeda trianda</i>	– Kangaroo Grass (Boonawah Ck area)
<i>Triglochin striata</i>	– Streaked Arrow-grass (Boonawah Ck)
<i>Wahlenbergia tadgelli</i>	– Bluebells (NW bank)
<i>Wilsonia backhousei</i>	– Narrow-leaf Wilsonia (coll. DF & DT)

Species that may have been expected to occur in the area.

Acacia mearnsii – Black Wattle (found almost everywhere else in district)
Allocasuarina verticillata – Drooping Sheoak (Chatsworth Rd, near Huf's lane -planted there?)
Banksia marginata – Silver Banksia (once common on the plains, still present at Yatchaw railway line)
Chrysocephalum dendroideum – Tree Everlasting (found at Bullrush Swamp and elsewhere in district)
Exocarpos cupressiformis – Wild Cherry (found elsewhere in the district)
Eucalyptus camaldulensis – River Red Gum (Chatsworth Rd, near Huf's lane – planted?)
Eucalyptus ovata – Swamp Gum (found away from the lake, on farms and roadsides in the district)
Leptospermum lanigerum – Woolly Tea-tree (may have been present on Boonawah Ck)
Leptospermum continentale – Prickly Tea-tree (may have been present on Boonawah Ck)

Hamilton Field Naturalists Club (HFNC)

The HFNC has been actively interested in Lake Linlithgow and its nearby wetlands Lake Kennedy, Bullrush Swamp and Krause Swamp since about 1958, when the club was formed.

Committee of Management

In 1971, the Rev. Baulch, from Peshurst, represented HFNC on the Lake Linlithgow Committee of Management (then part of the Shire of Mount Rouse). In 1975, Rod Bird (President), Lionel Elmore and Max Greiner) were elected. The Committee reviewed the remuneration from the grazing licenses that were current and gave permission for the HFNC to plant trees on part of the eastern bank. The committee lapsed when this part of Mt Rouse Shire was absorbed by Dundas Shire several years later.

Revegetation activities 1975-77

In September of 1975, HFNC planted 180 trees on a 150 m section of the mid north-eastern bank of the lake. Mount Rouse Shire assisted this project by supplying and erecting the fencing on the bank, while HFNC erected fences into the water.

The following species were purchased from Forests Commission Nursery at Wail:

- *E. camaldulensis* (River Red Gum) – 10 planted (a few survive in 2000)
- *E. ovata* (Swamp Gum) – 20 (most survive)
- *E. viminalis* (Manna Gum) – 20 (most survive)
- *Allocasuarina verticillata* (Drooping Sheoak) – 20 (some survive)
- *B. marginata* (Silver Banksia) – 20 (a few survive)
- *A. melanoxylon* (Blackwood) – 20 (a few survive)
- *Leptospermum lanigerum* (Woolly Tea-tree) – 50 planted on the flat at each end of the block, near the highest water mark (some survive but have not established seedlings)
- *Leptospermum obovatum*, *L. scoparium*, *Melaleuca lanceolata*, *M. squarrosa* – total of 20 shrubs, planted near or above high water mark (not strictly local species). Luckily most of these species did not survive – we planted local provenance material thereafter.

Figure 31.

East bank of Jenawarra – preparing to plant trees in Sept. 1975. The view is south, towards Mt. Napier.

HFNC member, John Cayley, is pictured and children are playing at the waterside.

The area was fenced to exclude sheep (note fence that extends into the lake).



In April and August of 1977, another 89 trees, grown from local seed by Peter Francis of Coleraine and Peter Milne (HFNC), were planted. HFNC had just begun a policy of only planting trees and shrub species that were known to occur naturally in the area. That policy was now strengthened, to ensure that the local provenance was perpetuated, by insisting that our plants came from seed collected locally:

- *Banksia marginata* (Silver Banksia) – 13 on the slope
- *Allocasuarina verticillata* (Drooping Sheoak) – 13 on the slope
- *Eucalyptus viminalis* (Manna Gum) – 6 on the top
- *Leptospermum lanigerum* (Woolly Tea-tree) – 42 on the shoreline.



Figure 32.

A view in Feb. 1982 from within the tree block planted by HFNC on the east bank of *Jenawarra* in 1975.

Silver Banksia & Drooping Sheoak grew well on the slope, as did Swamp Gum & Manna Gum planted on the top of the bank, despite the adverse effects of exposure to wind, the sticky clay soil and early competition from thistles.

Revegetation activities 1989-91

Planting in 1989

In 1989, trees were planted by the Penshurst Primary School in a 350 m adjacent area along the bank to the south. This area had been fenced by Mt Rouse Shire and trees planted in the in two or three rows ripped along the top and similarly on the flat below the high water mark. However, of the trees planted (species and origin unknown) most perished due to poor follow-up weed control. Only 70-80 trees survived, mostly on the foreshore flat. HFNC weeded around the remaining trees in Aug. 1990, to give them a better chance of surviving.

Planting in 1990

In Aug. 1990, HFNC planted another 490 trees at this site. Strips were sprayed along previous years rip-lines with Glyphosate and Simazine, and spots were sprayed on the previously unplanted sloping bank. All trees planted were grown by HFNC from seed collected locally from species that occur naturally in the district. Eucalypts and Blackwood were planted mostly along the first and third row on the top of the bank; Drooping Sheoak and Sweet Bursaria in two rows on the sloping bank (planting spots there were cleared with a mattock) and also along the first and second ripped row at the top of the shoreline nearest the base of the bank. We did not plant any trees in the other rows closer to the water. In September we direct-seeded some trees (including Sheoak) in spots along the slope, but this was not very successful. Cracking, north or west-facing clay slopes are difficult.

The list of trees planted in 1990 was:

- *Acacia melanoxydon* (Blackwood) – 64
- *A. mearnsii* (Black Wattle) – 52
- *A. verticillata* (Prickly Moses) – 6
- *Allocasuarina verticillata* (Drooping Sheoak) – 100
- *Bursaria spinosa* (Sweet Bursaria) – 190 from seed collected near Hamilton
- *Eucalyptus camaldulensis* (River Red Gum) – 24 planted
- *E. ovata* (Swamp Gum) – 26
- *E. viminalis* (Manna Gum) – 24
- *Leptospermum lanigerum* (Woolly Tea-tree) – 4 planted on the flat

Despite the ideal wet conditions at planting, and good weed control, many of the trees HFNC planted in 1990 did not fare much better than those planted by the school. Unfortunately, in late spring of

1990, weed growth in the lake covered part of the fence in the southern end and allowed sheep access to the site. Someone had then pushed the fence down to let the stock out (the frontage to the south was leased for grazing) but had left it in that condition. Consequently, the sheep re-entered the block at will, pulled out some trees and defoliated others, killing perhaps two thirds of the trees we had planted, and many of those remaining from 1989. However, many of the Sweet Bursaria that we had planted on the steeper section of bank survived, as did some eucalypts. The tall thistles that initially colonised the area afforded the trees some protection against the sheep!

Figure 33.

HFNC members in Sep. 1990, planting trees in the “new” block adjacent to & south of the 1975 block of trees.

Rod Bird cleared thistles from spots to be planted on the bank, whilst Keith Cumming and others worked on the shoreline.

The thistles grew profusely for 2-3 years but largely disappeared once grass cover was re-established on the slope.



Planting in 1991

A further 100 trees was planted by HFNC in Sept. 1991.

- *Banksia marginata* – 80 grown from seed collected at Yatchaw
- *E. camaldulensis* – 20 from Hensley Park.

The Shire of Mount Rouse subsequently fenced the plantation along the foreshore, preventing stock from entering the block when the lake dried out in summer. This experience with the sheep on the leased area was an important lesson - where trees are concerned, stock cannot be adequately controlled with fences that project into the lake.

The Sweet Bursaria and eucalypts planted on the high water mark have grown very well, although the longer-term prospects may be uncertain, due to future salinity and waterlogging events.



Figure 34

HFNC tree block planted in 1990-91, as seen in Dec. 2000.

The trees in the contiguous 1975 block are at the back of the 1990 block.

Note the growth of thistles outside the block, in the grazed area, whereas there were much fewer inside the fenced area.

These plantings have provided good evidence of species and methods that work on this difficult, windy, clay site. The success of the planting confounded some of the locals who suggested that trees would not grow there.

Of interest in these plantings was the initial dominance of thistles prior to planting and their tremendous head-high growth in the early years thereafter. Thistles were suppressed by grass in later years, after stock were excluded, because little bare ground was available for them to re-establish.

Revegetation activities at Lakes Linlithgow & Kennedy, 2001-05

HFNC has assisted ParksVic to revegetate other parts of the surrounds of Lake Linlithgow. John Harris (ParksVic) responded to a letter from HFNC in 1999, and he proposed that funding for planting could be available under ParksVic's Volunteer Group Grants Program, with agreement from the Committee of Management (Southern Grampians Shire). HFNC was granted funding in 2000/01 (\$10,000) and 2003/04 (\$11,000), with ParksVic managing the projects (fencing, purchase of trees, site preparation and planting). HFNC grew selected local provenance trees and planted some areas.

Planting in 2001

ParksVic & GHCMA managed a Living Links project that saw the planting of about 9,000 trees at Lake Kennedy in Aug. 2001 (Anon. 2001). Preparation for this planting required ParksVic to negotiate cancelling of grazing licences, realignment of some boundaries and secure fencing of the frontage. Similar work began later at Lake Linlithgow, particularly in the Boonawah Creek area.

Planting in 2002

ParksVic organized a similar re-fencing, boundary re-alignment and cancellation of grazing licences on the northern half of Lake Linlithgow. ParksVic's team (Conservation Volunteers Australia) had a major planting effort on the NW foreshore, extending from midway on West Lake Rd around to North Lakes Rd to the Aquatic Club entrance. The middle, headland section just east of the sharp bend in North Lake Road was not planted, that being left for the HFNC in 2002. HFNC planted 10 *Bursaria spinosa* and 3 *Banksia marginata* (Yatchaw provenance) in that area in Sept. 2002.

Planting in 2003

ParksVic continued planting in the NE section of the lake around to Boonawah Ck.

HFNC planted and guarded 600 trees and shrubs on the North Lake Rd section on 13 Sept. These plants were grown by HFNC from seeds they collected locally. The species were:

- *Banksia marginata* (Silver Banksia) – Yatchaw source – 150
- *Bursaria spinosa* (Sweet Bursaria) – Linlithgow source – 370
- *Hymenanthera dentata* (Tree Violet) – Linlithgow source – 20
- *Lavatera pleibia* (Australian Hollyhock) – Linlithgow source – 60

Phalaris and other introduced weeds were spot-sprayed on this area and along the road. The planted area had been grazed by sheep and cattle for many decades and so most of the native species had vanished. The flora was dominated by pasture and weed species that flourished in the absence of further grazing. The only prospect for this area is dense planting, or subsequent regeneration, of trees.



Figure 35.

Members of HFNC on a wet day in Sep. 2003, just finished planting trees in the headland area adjacent to North Lake Rd.

Those pictured are Roger Thompson, Ken Grimes, Lyn Munro, David Munro, Glenys Cayley, Janeen Samuel & Diane Luhrs.

Planting in 2004

ParksVic resolved grazing license issues on the southern half of the lake. Planting continued on the eastern shore from Boonawah creek to The Point, and west from The Point to the midway point on West Lake Rd. Conservation Volunteers Australia worked with ParksVic staff on this project. Major funding was provided through the 'Revive Our Wetlands' initiative, a 3-year project funded by BHP Billiton. As in previous years, the trees and shrubs came from seed from local sources.

HFNC continued to spot-spray Phalaris clumps on the planted areas (175 L of spray was applied), and planted and guarded 210 trees, focusing on the North Lake Rd site (Sheoaks) and West Lake Rd: (Banksia)

- *Allocasuarina verticillata* (Drooping Sheoak) – seed from sites west of Linlithgow – 160
- *Banksia marginata* (Silver Banksia) – Yatchaw source – 50



Figure 36.

The area of tree planting adjacent to North Lake Rd in Sept. 2004.

Some members of HFNC shown here are Yvonne Ingeme, Reto Zollinger, Janeen Samuel (in background), Diane Luhrs & Ken Grimes.

Planting in 2005

The 'Revive Our Wetlands' project continued, with Conservation Volunteers Australia providing assistance to ParksVic. As in 2004, the volunteers were mainly young people from overseas. Areas targeted this year were Boonawah Ck frontage near the lake and foreshore areas along the SE bank.

HFNC continued to spot-spray Phalaris clumps on the planted areas (95 L of spray was applied). Also, clumps of Tall Wheatgrass were sprayed at Boonawah Ck near the lake. HFNC planted and guarded 130 trees, focusing on the North Lake Rd site (Sheoaks) and West Lake Rd: (Banksia & Sheoak):

- *Allocasuarina verticillata* (Drooping Sheoak) – seed from sites west of Linlithgow – 25 trees on West Lake area and 80 trees on the North lakes area
- *Banksia marginata* (Silver Banksia) – Yatchaw source – 25 trees on the West Lake Rd area.



Figure 37.

The area of tree-planting adjacent to West Lake Rd in Sep. 2004, when there was some water in the lake.

Ken Grimes, Janeen Samuel, Reto Zollinger & Yvonne Ingeme were part of the HFNC team who planted more trees here in Sep. 2005.

These works have substantially completed the tree planting project for Jenawarra and Lake Kennedy and could not have been achieved without the persistence and enthusiasm of John Harris from Parks Vic, and the massive injection of funds and volunteer labour he organized to accomplish the task.

Future management of Lake Linlithgow and adjacent wetlands

Victoria's Biodiversity Strategy (NRE 1997) has several Statewide key directions for the Volcanic Plains, including the following:

- Finalising management plans for significant wetlands (HFNC has argued for Linlithgow).
- Identifying sites of biological significance in the rural landscape and encouraging appropriate use of this information in local planning schemes.
- Focus revegetation and rehabilitation efforts on the riparian environments.
- Maintain appropriate water regimes for freshwater wetlands.

As early as 1960, HFNC recognized that the foremost of the wetlands requiring action on the basaltic plains was that of Lake Linlithgow, Bullrush Swamp, Krauses Swamp & Lake Kennedy. These were once major Eastern Barred Bandicoot, Cape Barren Geese & Brolga habitat areas and are important for a number of migratory and local species of birds. The entire reserve banks, flats and fringes of the lakes had been grazed for 150 years. Rarely have the needs for biodiversity been seriously considered and promoted in past planning of activities associated with usage of lakes – the lakes have been considered basically for recreational water sports and grazing, with duck hunting an optional extra.

HFNC had proposed several schemes to Mount Rouse Shire (Aug. 1990, Apr. 1991, Nov. 1991) who were responsible for the lake prior to council amalgamations, and DNRE & ParksVic (Aug. 1990, Oct. 1992, Feb. 1999), to improve the amenity, conservation and management of the lakes surrounds. To date, only the tree planting has attracted a positive response, with ParksVic resolving in 2000/01 to work with Southern Grampians Shire, GHAMA, DNRE, HFNC and other organizations to develop a management plan that would see parts of the foreshore fenced from grazing stock and regenerated (Anon 2000). However, we regard tree planting as the least important of the efforts that need to be made to improve the biodiversity value of the lake and its appearance. The grassland and shoreline sedges and other plants were neglected in years past. The critical issues for ParksVic in 2000 were the appraisal of grazing leases and revegetation. Ultimately a decision was taken to end the licences and to slash firebreaks along the boundaries of the reserve. Some re-alignment of boundary fences were made at Lake Kennedy and Boonawah Ck. and removal of old fencing along North Lake Rd.

Fencing and grazing

Livestock no longer have access to the lake and that policy must continue. The unsightly fences that project into the lake should be removed. Old fencing wire and garden refuse (including weeds) has been dumped over the cliffs on the NW corner and must be removed, together with other fencing that remains on the lake. The lake surrounds should be allowed to regenerate, either naturally (particularly in the case of the littoral fringe and grassland) or through some assistance (direct-seeding or planting). An exception is the picnic area at The Point where the exotic grasses & thistles need to be slashed.

At the Boonawah Ck, the property owner has, commendably, re-fenced part of the boundary opposite the mouth of the creek, to take the fence back from the saline, boggy fringe. Negotiations are required to continue that policy, with an extension further east, along the northern boundary of Boonawah Ck. Control of nutrient pollution of the lake depends on stock being denied access to these sites.

Some Crown land on the Boonawah frontage has been absorbed into crop land to the south. That area could have been planted with trees to provide a solid woodlot area for birds, without disturbing the important native grassland that it abuts. The adjacent grassland contains several species of wallaby grass (*Austrodanthonia*), including *Austrodanthonia setacea*, *pilosa*, *caespitosa* and *duttoniana*, and a number of other species. However, an arrangement has been made with the present landholder to exchange that land for an area of saline land to the east, adjacent to the important area of *Gahnia trifida* (Coast Saw-sedge), *Eragrostis infecunda* (Cane-grass) and White Tussock (*Poa labillardia*).

Drainage

Glenn-Hopkins CMA (2004) lists Lake Bulrush as part of a drainage scheme, on a catchment area of 1648 ha, and draining into Soldiers Swamp (another drainage area). That policy needs to be altered.

Revegetation policy

Excessive tree planting would not be in character with the original status of the lake, as determined from historical accounts, and therefore care must be taken not to disturb that balance. Some local residents, among them Rob Sinclair, have expressed concern about tree-planting where there were relatively few trees in the past. Continuous strips should not be employed.

HFNC recommended the following actions for re-vegetation when the 2001-05 project began:

- A limited planting of species that grew in the area, from strictly local seed or cuttings;
- The major species used on the banks should be Drooping Sheoak, Plains Silver Banksia, Sweet Bursaria, Blackwood and Tree Violet; parts of the Boonawah Ck could be planted with Woolly Tea-tree and perhaps Prickly Tea-tree (*Leptospermum continentale*).
- Trees and shrubs to be planted in targeted areas, particularly in weed-infested former stock camp sites, where such planting can reduce present and future problems with Horehound and thistle, or adjacent to remnant populations of the same species, but not in areas of good native grassland or saline wetland;
- Scenic vistas (Mt. Rouse, Mt. Napier and Grampians) should not be obscured – Pine, Cypress and Sugar Gum belts on adjacent farms define current view lines and visual gaps should be left open.

Recreational vehicles

Motor vehicles, particularly motor bikes, need to be prohibited from the foreshore, creek and bank areas of the lake. These areas are nesting grounds for birds such as the Red-capped Plover, which we observed recently nesting, whilst a four-wheel motor bike travelled repeatedly across the area. The noise and motion of these vehicles along the shoreline also disrupts the feeding and resting activities of a multitude of waterbirds either on the shoreline or in the water within 200 m of the shore.

Driving on the dried out lake bed, a popular recreational activity in periods of drought, perhaps does little damage. However, such activities must be restricted to periods when the lake is dry, and to areas other than the foreshore and banks of the lake, or the Boonawah Ck area. Undesirable vehicle activity has been noted on the Boonawah Ck flats in the dry times of recent years.

If/when water returns to the lake, power boating must be banned in these high-conservation waters.

Weed management issues

The greatest problem is the proliferation of Tall Wheat-grass, Spiny-rush and Phalaris. These species invade the littoral fringe. Phalaris, in particular, also spreads to higher ground. Tall Wheat-grass drifts from private property adjacent to Boonawah Ck. In summer 2008, ParksVic sprayed most of the clumps on the reserve but the problem remains. Lake Kennedy also has Spiny Rush emerging.

On 23 Jan. 2008, herbicide was applied by aircraft to Bullrush Swamp. This was apparently scheduled by the DSE (Portland Region) & ParksVic (Horsham) to reduce a landholder's perceived problem of "Fairy Grass" (Blown Grass). HFNC protested to the Minister for Environment because there may be long-term adverse consequences of aerial spraying of herbicides on wetlands.

Our objections and observations were as follows:

- The failure to mention herbicide application in the Fire Operations Plan for 2007 in the community consultation process is a serious omission, since we were not able to point out the obvious biodiversity negatives that flow from such treatment of Wildlife Reserves.
- Other much less expensive but more environmentally-friendly alternatives for managing "Fairy Grass" were apparently not considered, such as employing casual labour periodically to manually remove any bank of Blown Grass from sheds or house fences of the one or two landholders who could possibly have been affected.
- We observed in Feb. 2008 that a band of 10-20 m of herbicide spray had been applied near the western margin of Bullrush in 2006 or early 2007, apparently in preparation for burning the swamp. The effect of that was to remove the native vegetation and promote exotic plants, thistles in particular, on that sprayed area. It has severely damaged the flora on the site.
- A frog expert, Ray Draper, has stated at a public meeting run by GHCMA on 22 Feb 2008 that herbicide should never be applied to a wetland because it will kill frogs as well as the plants and organisms that they and other wildlife depend upon. The "bioactive" form of

Glyphosate is also a danger, particularly when there is surface water present; there was 5 cm or more of water over almost the entire swamp surface, concealed by the grass.

- While frogs may survive fire by hiding in cracks, there are also good reasons why wetlands should NOT even be burned. When wetlands recharge again after a 'dry' spell there is a prolific growth of organisms, and a resurgence in the population of waterbirds. Burning of the vegetation and litter will simply reduce the fertility of the site through loss of nutrients in the fire and the destruction of biota in the surface layers. The long-term biological consequences of continued burning of swamps has not been assessed anywhere, yet it is widely used by ParksVic. We know of no systematic survey of non-avian fauna, or of flora, on this swamp or adjacent wetlands – what species may we be compromising by this indiscriminate, broadscale use of herbicide or fire. For example, what frogs occur there?
- *Poa salacustris* (Salt Tussock-grass) – a threatened species known from only a few lakes in Victoria – has also been found on the margins of Bullrush. On 9 Feb. 2008 we found this species along a 1.5 km section on the western shore and it probably occurs all around the swamp. Clearly, any drift of herbicide from spraying would affect this species. No environmental assessment was made to see if any rare/endangered species were present.
- During the Feb. 2008 Birds Australia survey of shorebirds a mass of ~5,000 Sharp-tailed Sandpipers were seen flying from Bullrush to Lake Linlithgow (see Figs. 61-64). From time-to-time these wetlands support a remarkable population of birds. The possibility of long-term ill-effects of repeated herbicide application to Bullrush Swamp on the flora, and microfauna upon which the birds feed, has not been investigated.



Figure 38(a) & 38(b).

A few Pectoral Sandpipers have been seen at times at *Jenawarra* and Bullrush Swamp. Their bills have a pale base and their legs are more yellow. They are also a little larger, with longer necks, than Sharp-tailed Sandpipers and the markings on the breast are sharply cut off (Fig. 38a). Sharp-tailed Sandpipers are more common, sometimes in flocks of thousands on the shores of the wetlands (Figs. 38b & 61-64).

The birds migrate in March/April to breed in Siberia; adults have a stopover in China then and on return to Australia. However, the juveniles hatched in Siberia fly to the shores of SW Alaska to fatten up and then take a trans-Pacific route to Australia in September.

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**Bird Atlassing in Regions
2006-2008
Glenelg Hopkins Region
Western Wetlands of National Significance**

Birds can be considered as indicators of health of the environment, and changes over time indicate that the environment is changing. The Glenelg Hopkins CMA supported this project and their focus was on the influence of wetland condition on bird communities, and the value of wetland restoration.

Birds Australia managed this project (November 2006 to early January 2008). HFNC contributed to the seasonal surveys, concentrating on the wetlands in the area of Lake Linlithgow. HFNC made further surveys in April and July of 2008, to provide a more complete record but those data (and our January records) were not recorded in the final report for one year by Chris Sanderson, John Peter and Meghan Cullen (2008). We present the full Hamilton area results in the tables below.

The main target was waterbirds: Waterfowl (ducks, Black Swan, geese), herons, ibis and spoonbills, Australian Pelican, cormorants, and darter, gallinules (Eurasian Coot, Ducky Moorhen, Purple Swamphen, crakes and rails), shorebirds (resident waders such as Red-kneed Dotterels and Red-capped Plovers, and migratory waders such as Red-necked Stints, Sharp-tailed Sandpipers and Latham's Snipe) and gulls and terns.

A summary of Sanderson *et al.* Final Report for the overall project in the GHCMA Region follows:

- 121 species recorded from 70 surveys over 11 sites (5 'main' sites and 6 'satellite' sites).
- That total included 50 waterbird species, with a mean count of 16 species per survey.
- The wetlands with the most species of waterbirds were the coastal wetlands, Belfast Lough and Rutledges Cutting Swamps (33 species each).
- The inland wetland with the most waterbird species (26) was Lake Condah (note that this wetland will be restored in 2009 when a weir is placed on the Condah Drain).
- The 'main' wetlands were significantly richer in species than 'satellite' wetlands.
- The highest tally for a 'satellite' wetland was 16 species at both Soldiers and Krause Swamps.
- The lowest tally (2) was at Harnath Swamp, which was dry throughout the survey.
- The most frequently seen birds were Australian Magpie, Common Skylark, Little Raven and Masked Lapwing.
- Threatened birds recorded were Orange-bellied Parrot (on the coastal swamps), Magpie Goose, Great Egret, Little Egret, Brolga, Caspian Tern and Hooded Plover.

We have presented the seasonal data for the Linlithgow-area wetlands in the following pages, 2 sites per page, grouping the birds in 4 broad categories: waterbirds (34 species), raptors (10 species), other native birds (36 species) and introduced species (6 species). In total, we recorded 86 species from November 2006 until July 2008. Observations between seasonal surveys are not shown in the tables.

The wetlands we surveyed were dry for much of this time and that had an impact on bird numbers and species. For example, we recorded large numbers of Sharp-tailed Sandpipers, Whiskered Tern and Black-winged Stilts on Lake Linlithgow as the waters dried up in December 2007 and January 2008. Conversely, there were generally fewer diving birds, including no record of Blue-billed Duck, Great Crested Grebe, Australasian Grebe or Musk Duck. Lake Linlithgow had 24 species of waterbirds.

Significant waterbird or raptor sightings from our sites included the following:

- Brolga (2-4) at Lake Linlithgow, Bullrush Swamp, Krauses Swamp and Soldiers Swamp.
- Magpie Goose (10) at Soldiers Swamp
- Sharp-tailed Sandpipers in great numbers (5,000) at Lake Linlithgow and Bullrush Swamp.
- Whiskered Terns in great numbers (2,000 for a mid-period count on 11 Dec 2007) at Linlithgow
- Black-winged Stilt in very large numbers (2,000) at Lake Linlithgow
- Banded Stilt in large numbers (250 for a mid-period count on 11 Dec 2007) at Lake Linlithgow.
- Grey Teal (as many as 11,000 birds) at Lake Linlithgow
- Black Falcon at Lake Linlithgow
- Spotted Harrier over Lake Linlithgow
- White-bellied Sea-eagle over Bullrush Swamp and Lake Linlithgow.

Seasonal occurrence of birds at 6 wetlands in the Linlithgow area, November 2006 to July 2008

(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Lake Linlithgow (Chatsworth Rd)								Lake Kennedy (Chatsworth Rd)							
	19 Nov 2006	30 Jan 2007	13 Apr 2007	22 Jul 2007	23 Oct 2007	23 Jan 2008	23 Apr 2008	15 Jul 2008	19 Nov 2006	30 Jan 2007	11 Apr 2007	22 Jul 2007	23 Oct 2007	23 Jan 2008	23 Apr 2008	15 Jul 2008
Hoary-headed grebe																
Australian pelican						13										
Little pied cormorant																
White-necked heron	1			1												
White-faced heron					2	2										
Great egret																
Australian white ibis																
Straw-necked ibis					25	65		2		1						
Royal spoonbill																
Yellow-billed spoonbill																
Black swan				420	650	600		420				450				2
Australian shelduck					100	580		100	81		8	16	3100			
Pacific black duck				300				350			2					
Grey teal				300	11000			2450					500	50		700
Chestnut teal					10							12				180
Australasian shoveller					3							80				5
Pink-eared duck					2											
Hardhead																
Australian wood duck				6												
Purple swamphen																
Eurasian Coot													4			
Brolga				2												
Black-tailed native hen					17											
Masked lapwing		2		7	6	30		2	1	3		6	12	30		6
Red-kneed dotterel					3											
Red-capped plover						22				39		4	1	2		
Black-fronted dotterel																
Black-winged stilt					2000			12								
Banded stilt						16						7				
Red-necked avocet					30											
Marsh sandpiper					2											
Sharp-tailed sandpiper					1400	5000										
Silver gull				15	1	380		35		1			37	65		3
Whiskered tern					1100	150										
Black-shouldered kite	*	2		*		1		7		*						
Black falcon						1										
Whistling kite	*				1	3										
Brown goshawk			1													1
White-breasted sea-eagle																
Wedge-tailed eagle	*	2	*			1	1									
Swamp harrier					2	1			1					1		
Spotted harrier		1														
Brown falcon		4	*	*	1		2	3		*						
Nankeen kestrel		6	*	*	1			2								
Stubble quail							*									
Yellow-tailed black-cockatoo		*														
Galah						*						*				
Long-billed corella				*									*			
Purple-crowned lorikeet		*														
Crimson rosella				*												
Red-rumped parrot			*													
Blue-winged parrot		*	*	*				3			*			3		
Horsfield's bronze-cuckoo									*							
Shining bronze-cuckoo					*											
Striated pardalote																
Striated fieldwren																
Brown thornbill		*	*	*	*		*				*					
Yellow-rumped thornbill	*	*	*	*	*	*	*	2			*					*
Red wattlebird	*	*	*	*	*	*	*									
White-plumed honeyeater	*	*	*	*	*	*	*	6								
New Holland honeyeater			*									*			*	
White-fronted chat	*	*	*	*	*	*	*						*	*	*	
Grey shrike-thrush			*	*	*	*	*	1								
Satin flycatcher	*															
Restless flycatcher						*										
Maggie-lark		*	*	*	*	*	*	1			*	*				
Willie wagtail	*	*	*	*	*	*	*	2				*	*	*	*	2
Australian magpie	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*
Forest raven								*								
Little raven	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Australasian pipit	*	*	*	*	*	*	*	2	*	*	*	*	*	*	*	*
Welcome swallow	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tree martin	*	*				*			*							
Fairy martin	*															
Little grassbird																
Rufous songlark	*	*														
Brown songlark	*				*			*								
Clamorous reed-warbler																
Golden-headed cisticola		*	*			*		1								
Silverye								*								
Common skylark	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
House sparrow	*	*	*	*	*	*	*	20+					*			
European greenfinch	*				*											
European goldfinch	*	*	*	*	*	*	*	200	*	*	*	*	*	*	*	*
Common blackbird				*												
Common starling	*	*	*	*	*	*	*	*			*	*				
Water level (0=dry, 10=full)	0/10	0/10	0/10	2/10	3/10	<1/10	0/10	2/10	0/10	1/10	0/10	5/10	7/10	1/10	0/10	1/10

Seasonal occurrence of birds at 6 wetlands in the Linlithgow area, November 2006 to July 2008
(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Bullrush Swamp (Chatsworth Rd)								Krause Swamp (Mibus Rd)							
	16 Nov 2006	25 Jan 2007	11 Apr 2007	25 Jul 2007	24 Oct 2007	24 Jan 2008	23 Apr 2008	16 Jul 2008	16 Nov 2006	25 Jan. 2007	11 Apr 2007	22 Jul. 2007	23 Oct. 2007	23 Jan. 2008	23 Apr 2008	15 Jul. 2008
Hoary-headed grebe											9	11	25			
Australian pelican						7										
Little pied cormorant																
White-necked heron				1	4							12				
White-faced heron					1	70						1	2		1	
Great egret															1	
Glossy ibis														6		
Australian white ibis						1						12	33			
Straw-necked ibis					250	140						2	8			
Royal spoonbill																
Yellow-billed spoonbill						2										
Black swan											5				5	
Australian shelduck						2	250					5	12	20	63	2
Pacific black duck												5	80			
Grey teal											800	400	45	65	220	
Chestnut teal											2			4		
Australasian shoveller											4	5	20		1	
Pink-eared duck											4	500				
Hardhead											600	20		1	4	
Australian wood duck															2	
Purple swamphen													20	5		
Eurasian Coot											40	90	2			
Brolga						2								(4)	2	
Masked lapwing														116	7	
Red-kneed dotterel																
Red-capped plover																
Black-fronted dotterel																
Black-winged stilt											7					
Banded stilt																
Red-necked avocet														1	4	
Marsh sandpiper																
Sharp-tailed sandpiper							20									
Silver gull						2								4	156	3
Whiskered tern							100									
Black-shouldered kite				*											1	
Black falcon																
Whistling kite															1	
Brown goshawk																
White-bellied sea-eagle							1									
Wedge-tailed eagle			*				2									
Swamp harrier						1	1									
Spotted harrier																
Brown falcon				*							*			1		
Nankeen kestrel						1					2				1	
Stubble quail	*															
Yellow-tailed black-cockatoo											*					
Galah					*										2	2
Long-billed corella					*						*					
Purple-crowned lorikeet																
Crimson rosella																
Red-rumped parrot																
Blue-winged parrot																
Horsfield's bronze-cuckoo																
Shining bronze-cuckoo																
Striated pardalote																
Striated fieldwren																
Brown thornbill																
Yellow-rumped thornbill											*				*	
Red wattlebird											*					2
White-plumed honeyeater				*												
New Holland honeyeater																
White-fronted chat			*		*			12			*					
Grey shrike-thrush																
Satin flycatcher																
Restless flycatcher																
Magpie-lark					*	*		2						*	*	1
Willie wagtail					*	*	*		*	*	*	*	*	*	*	*
Australian magpie	*	*	*	*	*	*	*	5	*	*	*	*	*	*	*	*
Forest raven																
Little raven	*		*	*	*	*	*	24	*	*	*	*	*	*	*	*
Australasian pipit	*		*	*	*	*	*	1	*	*	*	*	*	*	*	*
Welcome swallow				*	*	*	*				*	*	*	*	*	*
Tree martin						*								*		
Fairy martin																
Little grassbird																
Rufous songlark																
Brown songlark					*											
Clamorous reed-warbler													*			
Golden-headed cisticola							*								*	
Silvereye				*												
Common skylark	*		*	*	*	*	*	80+	*	*	*	*	*	*	*	*
House sparrow					*				*	*	*	*	*	*	*	*
European greenfinch														*	*	*
European goldfinch					*	*		90+	*	*	*	*	*	*	*	*
Common blackbird																
Common starling									*	*	*	*	*	*	*	*
Water level (0=dry, 10=full)	0/10	0/10	0/10	0/10	2/10	<1/10	0/10	0/10	0/10	0/10	0/10	6/10	8/10	6/10	4/10	4/10

Seasonal occurrence of birds at 6 wetlands in the Linlithgow area, November 2006 to July 2008

(Surveyed by Jane Hayes and Mollie Herrmann, with occasional input from Rod Bird, Steve Clark, A-M Burgoine, Max & Lois Phillips)

SPECIES	Salt Swamp (Harnath on Lake Rd)								Soldiers Swamp (West Boundary Rd)							
	16 Nov 2006	25 Jan 2007	13 Apr 2007	25 Jul 2007	24 Oct 2007	24 Jan 2008	24 Apr 2008	15 Jul 2008	16 Nov 2006	25 Jan 2007	11 Apr 2007	22 Jul 2007	24 Oct 2007	24 Jan 2008	24 Apr 2008	16 Jul 2008
Hoary-headed grebe												6		1		
Australian pelican																
Little pied cormorant													1			
White-necked heron												6	2			
White-faced heron									1			2	4	5	1	
Great egret																
Australian white ibis												2	2			
Straw-necked ibis					1				22			4	60	40		
Royal spoonbill																
Yellow-billed spoonbill														17		
Maggie goose														10		
Black swan											69	17	10	9	30	
Australian shelduck						1					2	1	400	38	33	
Pacific black duck											1		70		10	
Grey teal											50		160	74	150	
Chestnut teal																
Australasian shoveller											24					6
Pink-eared duck											20					
Hardhead											2					
Australian wood duck													6			
Purple swamphen											3	40	150			4
Eurasian Coot											43	2	3			
Brolga													2			
Masked lapwing									2	8		3	6	44	128	39
Red-kneed dotterel																
Red-capped plover																
Black-fronted dotterel																6
Black-winged stilt													2			
Banded stilt																
Red-necked avocet																
Marsh sandpiper																
Sharp-tailed sandpiper																
Silver gull												9	1			
Whiskered tern																
Black-shouldered kite																
Black falcon																
Whistling kite									*							
Brown goshawk																
White-breasted sea-eagle																
Wedge-tailed eagle									*	*						
Swamp harrier									*			2	2			
Spotted harrier																
Brown falcon															1	
Nankeen kestrel																1
Stubble quail							*									
Yellow-tailed black-cockatoo																
Galah									*							
Long-billed corella																
Purple-crowned lorikeet																
Crimson rosella																
Red-rumped parrot																
Blue-winged parrot																
Horsfield's bronze-cuckoo																
Shining bronze-cuckoo																
Striated pardalote																1
Striated fieldwren												*				
Brown thornbill																
Yellow-rumped thornbill																
Red wattlebird																2
White-plumed honeyeater												*				
New Holland honeyeater																
White-fronted chat									*	*		*			7	
Grey shrike-thrush																
Satin flycatcher																
Restless flycatcher																
Maggie-lark												*		*	24	1
Willie wagtail											*	*	*	*	4	2
Australian magpie	*	*		*	*	*		3	*	*	*	*	*	*	6	11
Forest raven																
Little raven	*	*		*	*	*		1	*	*	*	*	*	*	*	22
Australasian pipit											*	*			4	4
Welcome swallow	*		*				*				*	*			20	20
Tree martin																
Fairy martin																
Little grassbird																
Rufous songlark																
Brown songlark									*							
Clamorous reed-warbler																
Golden-headed cisticola																
Silvereve															3	
Common skylark	*				*	*	*	*	*	*	*	*	*	*	*	2
House sparrow																
European greenfinch																
European goldfinch				*		*				*	*	*	*	*		1
Common blackbird																
Common starling	*			*	*				*			*			20	
Water level (0=dry)	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	1/10	3/10	3/10	1/10	<1/10	1/10	1/10

APPENDIX 2 Photograph gallery for the wetlands 1997-2008



Figure 39.

Sunrise from the south bank, looking east towards The Point from near Habel's memorial off Chatsworth Rd.

Photo taken in 1997, on HFNC's annual February excursion.

The lake at this time had a good depth of water.



Figure 40.

Roger Thompson is walking on the dry lake bed on another HFNC excursion

Scene from south bank near Habel's memorial in Feb. 2000.



Figure 41.

Lake Linlithgow from the west side of The Point on a HFNC excursion in Feb. 2002.

The lake held some water that summer (0.45 m at The Point in Feb.), the most observed over 8 years (2000-08). In Feb. 2004 the depth was 0.14 m but the lake was dry in Feb. of the other 6 years.



Figure 42.
Bullrush Swamp in Feb. 2002, from the SW corner off Chatsworth Rd.

The swamp at this time had a good depth of water and a host of waterbirds, among them at least 250 Sharp-tailed Sandpipers, 6,000 Grey Teal and 2,000 Eurasian Coots.



Figure 43.
Bullrush Swamp in Feb. 2002, also looking north, from the drain on Chatsworth Rd.

In 2004 there were 74 Black Swan nests on this swamp.



Figure 44.
Bullrush Swamp in Feb. 2002, looking SW from Mibus Lane, just north of Krauses Swamp.

Mt. Napier can be seen in the left background.



Figure 45.
A flight of Brolga over Bullrush Swamp in 2002.



Figure 46. Lake Kennedy, with *Tappoc* (Mt. Napier) beyond, taken from Chatsworth Rd in Feb. 1982. The lake was dry.



Figure 47. Eastern half of Lake Kennedy where the flats were once grazed by Cape Barren Geese in the summer and autumn. Scene from Chatsworth Rd in March 2001 when the lake was dry.



Figure 48. Eastern half of Lake Kennedy from just west of the entrance area off Chatsworth Rd., looking to *Kolor* (Mt. Rouse). Scene in March 2001 when the lake was dry and before tree planting began on the banks in Sep. 2001.



Figure 49. Lake Kennedy, west side in Feb. 2007. Note the growth of trees planted on the banks in 2001.



Figure 50. Lake Kennedy, dry in Feb. 2007. Note the trees planted from 2001-05 around the lake.



Figure 49. Lake Kennedy, eastern side, dry in Feb. 2007. Note the relatively poor survival of trees in saline areas. That was expected and will keep open the flight paths for swans and other waterbirds flying across to Lake Linlithgow. This saline area was once a prime site for Cape Barren Geese.



Figure 52. *Eutaxia microphylla* on the SE foreshore in Feb. 2007. The HFNC 1975-91 500-m tree block is top left.



Figure 53. *Eutaxia microphylla* on the SE foreshore in Feb. 2007. The plants were not seen when sheep grazed here.



Figure 54. Members of HFNC in Feb. 2007, in the shade of trees the club planted on the east bank in 1975. Pictured: Jane Hayes, John Cayley, Glenys Cayley, Rod Bird, Lyn Munro, Dave Munro. Diane Luhrs took the photo.



Figure 55. The southern foreshore in Nov. 2005. This is the overflow point. The rare *Poa salacustris* grows here.



Figure 56. Looking to the southern foreshore in Nov. 2005. Note the broad mound of wind and water borne silt.

Figure 57.

Looking past an old Cypress on Habel's Memorial bank in March 2007. The old Cypress are beginning to break down.

Tree-planting has been done along the SW bank, in this corner of Lake Linlithgow.

The lake was still dry, its bed in most parts a sea of grass, mostly *Puccinellia stricta* var. *perlaxa*. – Salt Marsh-grass.





Figure 58.

North bank adjacent to North Lake Rd, looking west through trees planted in 2002 by Parks Victoria. The HFNC's planted area (2004-2005) lies to the east of this stand, on the headland (see Fig. 36).

The trees include Blackwood, Swamp Gum, Black Wattle, Silver Banksia and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 60.

SW bank, from the edge of West Lake Rd, looking SE through trees planted in 2004 by Parks Victoria's groups of volunteers. The trees extend around to Habel's memorial stand, completing a remarkable planting effort.

The trees include Silver Banksia, Blackwood, Swamp Gum, Black Wattle, Sweet Bursaria and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 59.

West bank, adjacent to West Lake Rd, looking south through trees planted in 2003 by Parks Victoria's volunteers.

The trees include Blackwood, Swamp Gum, Black Wattle and Drooping Sheoak. The trees were grown from local seed.

Photo in March 2007.



Figure 61.

Three of 4 flocks of Sharp-tailed Sandpipers above the southern edge of Lake Linlithgow. A small flock of similar size to that on the left is not visible to the right. There is an overlap of 2 flocks in the centre.

These birds had risen from Bullrush Swamp at about 3 pm and probably numbered 5,000 or more.

Photo 25 Jan. 2008, taken from the centre of the lake and looking at the cypress to the south.



Figure 62.

A flock of Sharp-tailed Sandpipers about to land by the water pools on Lake Linlithgow.

As a result of a run of dry years, and a dry winter in 2007 before the late spring rains, there was a good cover of grass on the lake bed

Photo on 29 Jan. 2008, taken from the centre of the lake and looking at the pines and cypress to the south, again at about 3 pm.



Figure 64.

Sharp-tailed Sandpipers landed in or near shallow pools on Lake Linlithgow.

Photo 29 Jan. 2008.

Figure 63.

Part of a flock of Sharp-tailed Sandpipers high above the lake.

Photo 29 Jan. 2008.

