SOUTH WEST WETLANDS MONITORING PROGRAM REPORT 1977 – 2011

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Cover photograph: Moates Lake on May 21st, 2008. © A.Lorkiewicz & DEC. Lake Gardner, Two Peoples Bay and the Southern Ocean are conspicuous in the background. Angove Swamp is in the top, left hand corner. Goodga River enters Moates in the foreground.

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SUMMARY

This report presents 1977-2011 data from SWWMP, the South West Wetlands Monitoring Program conducted by the Western Australian Department of Environment and Conservation (DEC). Since 1997, this program has been funded under the WA Salinity Action Plan / Salinity Strategy as updated by the Government's response to the Salinity Taskforce report.

In this report we present all routinely-collected September and November water level, salinity and pH data to 2011. These data are presented in graphical form for 99 of the 101 currently-monitored SWWMP wetlands. Data concerning nutrients (not monitored beyond 2007) in these wetlands, and concerning water level, salinity, pH and nutrient concentrations in other, historically-monitored wetlands, may be found in Lane *et al.* (2009a). Administrative information concerning all 154 SWWMP wetlands, their map coordinates, the periods during which each has been monitored, their locations in terms of DEC Regions and Districts and Local Government Authorities (LGA's), and their tenure, is also presented.

This report provides an up-to-date overview of the data that have been collected over the past thirty-four years and ready-reference lists of the wetlands. This information will be useful for those with a responsibility or interest in the conservation and management of these and other wetlands in south-western Australia. Most of the monitored wetlands are within Nature Reserves or National Parks and DEC is responsible for their management. Some are also within Natural Diversity Recovery Catchments and 'Ramsar' Sites and many are 'Directory' (nationally significant) Sites.

Researchers will also find the report useful as it identifies wetlands that have long periods of systematic monitoring of physico-chemical attributes, knowledge which will assist in the selection of most-suitable wetlands for study. Pronounced year-to-year or longer-term variations or trends are readily apparent in the graphs of some wetlands, as is the absence of pronounced variations or trends in others. Thus the wetlands of SWWMP demonstrate a wide variety of hydrological responses to landscape setting, surface and groundwater catchment characteristics, local climates and, in some cases, management interventions.

Attention is drawn to a number of wetlands of particular interest or concern. These are Bambun, Broadwater, Byenup, Chandala, Clifton, Coomalbidgup, Corrigin 12900, Crackers, Davies, Dobaderry, Dumbleyung, Egret, Esperance 26410, Forrestdale, Gore, Guraga, Harvey 12632, Hinds, Jandabup, Jasper, Jerdacuttup, Joondalup, Logue, Maringup, McLarty, Mettler, Mortijinup, Muir, Nine Mile, Noobijup, Noonying, Pillenorup, Pleasant View, Powell, Shark, Taarblin, Thomsons, Toolibin, Tordit-Gurrup, Towerrinning, Unicup, Wannamal, Warden, Warrinup, Wheatfield, White (Narrogin), Yaalup, Yarnup and Yellilup. Regional, District and specialist branch staff of DEC are encouraged to examine the data for all wetlands in their respective areas of responsibility as other wetlands may also show changes of interest or management concern.

2011 was a year of exceptionally low rainfall throughout most of south-western Australia. Consequently, water levels were low and salinities high in many wetlands. Rainfalls in 2011 were generally higher than in 2010, but still below average across most of the south-west. Of the 24 wetlands with lowest-recorded September and/or November water levels in 2010, all but four increased in levels in 2011, while two wetlands that did not experience their lowest-recorded levels in 2010 did so in 2011. Thirty-two SWWMP wetlands were dry in both monitoring months of 2010, while 12 were dry in 2011.

Of the 28 wetlands that experienced their highest-recorded September and/or November salinities in 2010, all but nine decreased in salinities in 2011. Three wetlands that did not experience their highest-recorded salinities in 2010, did so in 2011. Eleven SWWMP wetlands experienced their lowest-recorded salinities in 2011. Seven SWWMP wetlands experienced their lowest-recorded September and/or November pH values in 2011 and two experienced their highest.

Since 1997, the bathymetries (lakebed and shoreline contours and inflow and outflow channels) of 19 monitored wetlands have been mapped under SWWMP, with DEC Regional and District funding support. This work enables water surface areas, water volumes and salt loads to be calculated from SWWMP water level and salinity data. This permits modelling of water and salt balances and will facilitate assessments of likely hydrological and ecological impacts of drainage, diversion, pumping and storage proposals, proposed land use changes and predicted climate change. All SWWMP wetlands known by the authors to have been bathymetrically-mapped are listed in this report, together with the years of mapping, methods employed, products and custodians / sources.

High resolution, low altitude, aerial oblique photography is useful for wetland vegetation mapping, condition monitoring, planning and conduct of biological surveys, and publicity. During the period 2008-2011, 138 SWWMP wetlands have been flown and photographed for these purposes. A sample of photos and enlargements is presented in this report. Copies of original, high resolution photographs in digital format may be obtained on request.

During the period 2009-2012, continuous water level recorders and tipping-bucket rainfall gauges have been installed on 12 south-west wetlands. This equipment will be kept in place for several years and then moved to other high conservation value SWWMP wetlands under threat. Collection of continuous water level and rainfall data will assist in the development of salt and water balance models for these and other south-western Australian wetlands and will thereby assist in their conservation management. These data will also assist in developing an improved understanding of the likely consequences of predicted climate change, particularly rainfall decline, on the wetlands of south-western Australia.

This report is the fifth in a series of annual reports aimed at putting most-recent SWWMP data in front of readers as soon as possible after data collection.

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1. INTRODUCTION

This report presents 1977-2011 data and other information from SWWMP, the South West Wetlands Monitoring Program conducted by the Western Australian Department of Environment and Conservation (DEC) and its predecessors over more than three decades. Since 1997, this program has been funded under the Western Australian Salinity Action Plan (Government of Western Australia 1996a) and State Salinity Strategy (State Salinity Council 2000a) as updated by the Government's response (Government of Western Australia 2002) to the Salinity Taskforce report (Frost *et al.* 2001). A detailed account of SWWMP, including analyses of data to 2000, may be found in Lane *et al*. (2004). A review of this and other programs under the Salinity Action Plan has been published (Wallace 2001).

In this report we present, in graphical form, all September and November water depth, salinity and pH data routinely collected from 99[1] of the 101[2] currently-monitored SWWMP wetlands. Data concerning nutrient concentrations[3] in most of these wetlands, and concerning water level, salinity, pH and nutrient concentrations in other, historically-monitored SWWMP wetlands, may be found in Lane *et al*. (2009a) and are not repeated here. The locations of all 154 current and historically-monitored SWWMP wetlands are shown in Figure 1. Administrative information concerning these wetlands, their map coordinates, the periods during which each has been monitored, their locations in terms of DEC Regions and Districts and Local Government Authorities (LGA's), and their tenure, is also presented (Tables 1-3).

The main purposes of this report are to provide an up-to-date visual overview of data that have been collected over the past thirty-four years and ready-reference lists of the wetlands. This information will be useful for those with a responsibility or interest in the conservation and management of these and other wetlands in south-western Australia. Most of the monitored wetlands are within Nature Reserves or National Parks vested in the Conservation Commission of Western Australia and DEC is responsible for their management. Some are within Natural Diversity Recovery Catchments (Government of Western Australia 1996a; Wallace & Lloyd 2008) and Ramsar Sites (Government of Western Australia 1990, 2000; Wetlands International 2002) and many are Directory Sites (Environment Australia 2001) (Tables 4 & 5).

Researchers will also find the report useful as it identifies those wetlands that have long periods of systematic monitoring of physico-chemical attributes, knowledge which will assist in the selection of wetlands most-suitable for study. Pronounced year-to-year or longer-term variations or trends are readily apparent in the graphs of some wetlands, as is the absence of pronounced variations or trends in others. Thus the wetlands of SWWMP demonstrate a wide variety of hydrological responses to landscape setting, surface and groundwater catchment characteristics, local climates and, in some cases, management interventions.

2. RESULTS

In order to make this report available in a timely fashion, statistical trend analyses to 2011 have not been performed on the physico-chemical data presented here. Trends to 2000 of 41 SWWMP wetlands (those monitored for 20 or more years at that time) have previously been reported (Lane *et al.* 2004) and readers may find it useful to compare the latest data with the results of that earlier work.

Without statistical analysis, it would be potentially misleading to present lists of wetlands that appear to show trends, as opposed to those that do not. On the other hand, it is considered useful to draw the reader's attention here to a number of wetlands of particular interest or concern. These wetlands follow below, with the relevant LGA's in brackets. The data referred to are presented in the relevant Graphs (page 51 onwards), which are also arranged alphabetically.

Bambun (Gingin): This is one of few SWWMP wetlands that have shown a persistent long-term decrease in salinity. It remained very fresh (<1ppt)[4] to 2009, whereas from 1979 (when monitoring began) to 1985 it was fresh (1<3ppt). Salinities were slightly elevated in the dry year of 2010 and slightly higher again in 2011, despite a small increase in water levels.

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[1] Not Yeagarup or Yeagarup South, as depth gauges have yet to be installed.

[2] Monitoring was discontinued at two wetlands, Hebitons and Goorly, at the end of 2009, thereby reducing the number of 'current' SWWMP wetlands from 103 to 101 and increasing the number of 'historical' wetlands from 49 to 51. At the end of 2010, monitoring was also discontinued at Blue Gum, Frasers and 'Esperance 27985', but in 2011 was resumed at Eneminga and initiated at Yeagarup and Yeagarup South, thus maintaining the number of 'current' SWWMP wetlands at 101 while increasing the number of 'historical' wetlands to 53.

[3] Total nitrogen and total phosphorus, both filtered and unfiltered. These parameters have not been monitored beyond 2007.

[4] In this report, the salinity categories 'very fresh' (<1ppt), 'fresh' (1<3ppt), 'brackish' (3<10ppt), 'saline' (10<50ppt) and 'hypersaline' (≥50ppt) are used, as in Lane *et al.* (2004). ppt = parts per thousand.

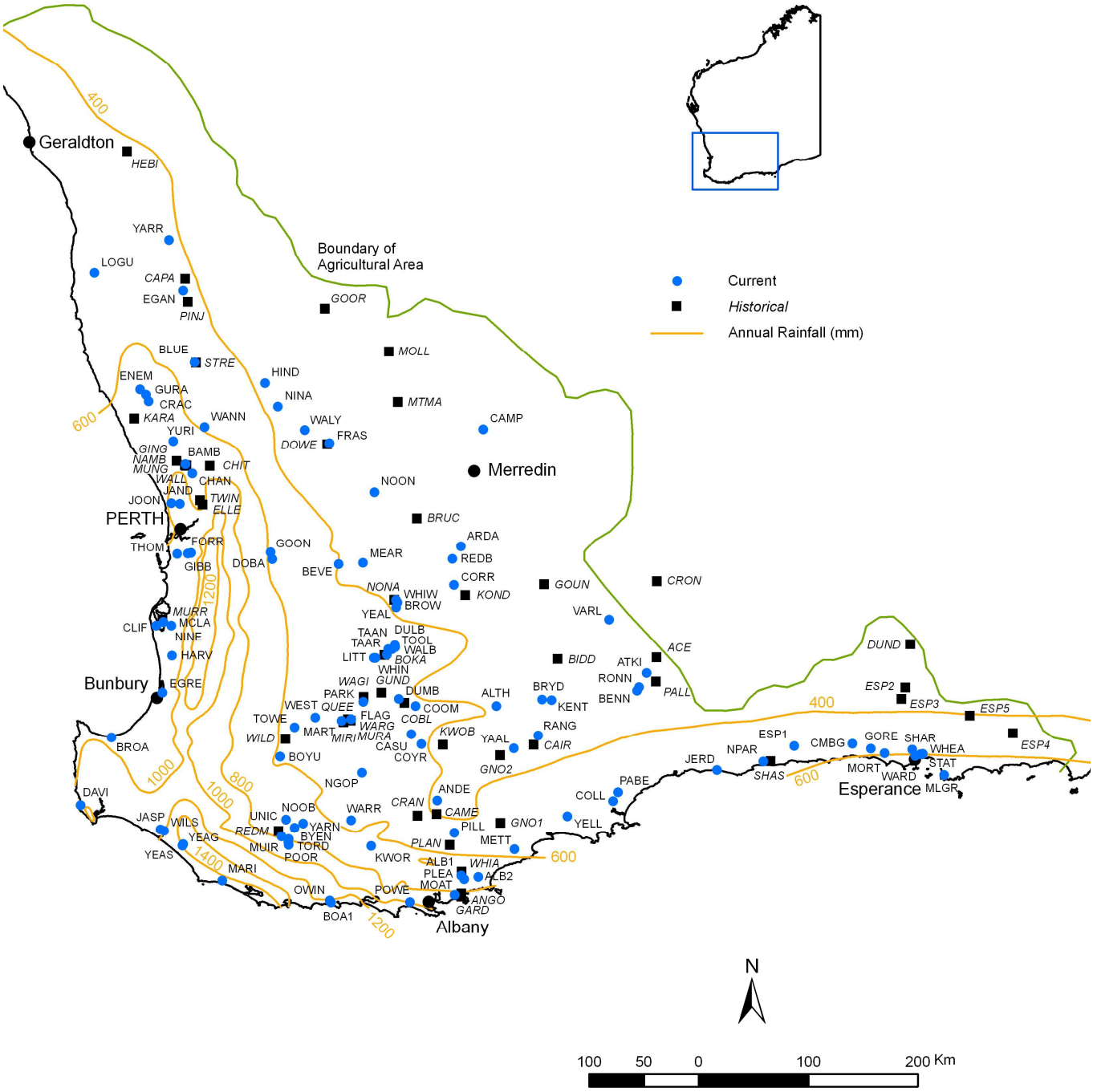

Figure 1. Wetlands currently and previously monitored under the South West Wetlands Monitoring Program

Broadwater (Busselton): The September (4.5ppt) and November (8.4ppt) salinities of 2006 were markedly higher than those of all other monitoring years (1985-2011), including years of similar or lower depths (1987, 2001 & 2010). A probable explanation is that, sometime between Nov 2005 and Sep 2006, seawater was allowed to enter the Broadwater via the New River by unauthorised opening of a drainage structure connecting the Vasse River Diversion Drain (VRDD) to the New River. Seawater enters the VRDD when tides in Geographe Bay are high and during summer-autumn when freshwater flows from the VRDD cease.

Byenup (Manjimup): As is the case with nearby (and hydrologically-connected) Tordit-Gurrup (see below), there is a pronounced inverse relationship between water levels and salinities, with levels lowest and salinities highest in 1987, 1995, 2001, 2002, 2007, 2010 and 2011. In addition to this inverse relationship, there appears to be a long-term trend of rising salinities even at similar depths.

Chandala (Chittering): September and November 2010 water levels were the lowest for at least 32 years (monitoring began in 1979), yet salinities and pH values were within the normal ranges of 0.5-1.5ppt and 6-8 pH units. In 2011, depths increased and all three parameters were once again within their normal ranges. This 120ha, spring-fed, melaleuca – eucalypt swamp previously supported thousands of nesting Straw-necked Ibis *Threskiornis spinicollis* and was considered a candidate for listing as a Wetland of International Importance under the Ramsar *Convention on Wetlands* (Jaensch & Watkins 1999).

Clifton (Mandurah): The trend of increasing salinities and salt loads in Lake Clifton from the early 1990s to 2000 (Knott *et al*. 2003) and onwards continues, with record and near-record high levels in September 2011 and November 2011 respectively. In November 2008 the authors initiated routine sampling at three fixed sites extending from near the shoreline to the end of the boardwalk (jetty), rather than one non-fixed site in this general area, as previously. In November 2008 (at water level 4.24m) the salinity values at these three sites were fairly similar, however in September 2009 (water level 4.14m) and November 2009 (water level 4.02m) the values were very different, due to the influence of freshwater seepage near the shoreline. Substantial salinity differences were also apparent in Sep 2010 and Nov 2011. Lower water levels prevented sampling at the 'inner sedge area' sampling site in both sampling months of 2010 and 2011 and at the 'outer sedge area' site in November 2010.

The pattern of water level change at Clifton is similar in appearance to that of 'Harvey 12632' (12 km south-east) and Nine Mile (11 km east).

Comparison of recent and historical data concerning the composition of the lake's internationally significant thrombolite community indicates a large reduction in relative abundance of cyanobacterial species believed to be fundamental for the thrombolite structure (Smith *et al*. 2010).

Coomalbidgup (Esperance): Depths have declined markedly from a peak of ≈3m in 2000 to <0.5m in 2006, 2008, 2009 and 2011. Salinities have risen dramatically over the same period. Similar changes in water levels and salinities have occurred to 2009 at Mortijinup (26 km south-east), but not at Gore (13 km south-east) where water levels have been consistently high for the past decade.

Corrigin 12900, also known as Paperbark Swamp (Corrigin): This wetland has now been dry in September and November each year for five years (2007-11). This is an exceptionally long period for Corrigin 12900, which has been monitored under SWWMP for almost three decades.

Crackers (Dandaragan): The statistically-significant upward trend in salinities from 1981 to 2000 (Lane *et al.* 2004) is continuing, with salinities from 2002 to 2011 being predominantly in the fresh (1<3ppt), rather than very fresh (<1ppt), category. Crackers' extensive lake floor vegetation could be under threat.

Davies (Augusta-Margaret River): Salinities have risen since 2000, after a period of eight years (1993-2000) of little change preceded by an apparent rise in earlier years (monitoring began in 1991). This wetland is now at the high end of fresh (1<3ppt). The possible causes of this rise, and the impacts on flora and fauna, have been the subject of work by Davies (2010).

Dobaderry (Beverley): Dobaderry was dry in both September and November of 2010, an event that last occurred in 1980. Much of Dobaderry's lake floor vegetation (≈1m high *Melaleuca lateritia*) appeared severely stressed in September 2010 (compare Photos 52 & 51) and indications were that this was due to drought. In 2011 the lake floor was inundated and by November 2011 the vegetation was recovering.

Dumbleyung (Dumbleyung / Wagin): Dumbleyung last overflowed in 1983, following the post-cyclonic rains (Cyclone Bruno) of January 1982 and heavy winter rains the following year. Since 1983, there have been only three substantial filling events, in 1988, 1993 and 2005. In most years the waters of Dumbleyung are hypersaline (≥50ppt), but in years of major inflow, September and November salinities may fall as low as 13ppt. In 2011, September and November water levels were very low (≈0.55) and salinities were again hypersaline. Bathymetric surveys arranged and assisted by SWWMP staff

in April 2001 indicate that Dumbleyung overflows at 4.42m (258.10mAHD), at which level the stored volume of the lake is ≈190 million cubic metres.

Egret (Harvey): The cause(s) of the exceptionally low (≈3) pH values of this swamp in some periods (1985-89) and some years (2009) has not been investigated. In most years Egret's pH values are mainly within the range 6-7 pH units. In 2011 they were ≈3.6.

Esperance 26410 (Esperance): This Flat-topped Yate *Eucalyptus occidentalis* lake has a narrow inner zone of dead trees, with some regeneration (Jaensch *et al.* 2009, Clarke *et al*. 2011). The deaths, which have not been mapped or aged, could be due to salinity or perhaps to prolonged inundation, as occurred for example in 1986-87 and 1989-90. 'Similar depth' salinity comparisons made previously (Lane *et al.* 2010) indicated a very substantial increase in the salt load of this wetland in recent years and salinities in 2009 were higher than all previous records. Water levels were markedly higher (≈1.9m) and salinities markedly lower (≈3ppt) in 2010 than in 2009, but again, 'similar depth comparisons' (2010 and 1986) show that a substantial increase in salt load continues. Water levels in 2011 were only slightly lower than in 2010, however salinities increased by an average of ≈53%.

Forrestdale (Armadale): September and November water levels have trended downwards since the early 1990s and salinities, though still mainly fresh (1<3ppt), appear to have trended slightly higher. Since 1998, pH values have mainly been within the range 9-10 pH units, whereas in preceding years (1983-1997) they frequently ranged lower, to ≈7 pH units. Lower water levels have facilitated the spread of bulrush *Typha orientalis* in shallow parts of the lake.

Gore (Esperance): September and November water levels have been more-consistently high during the past 15 years (1997-2011 inclusive) than in the preceding 18 years (1979-96 inclusive). Shark (to 2010) and Warden (to 2009), both 30 km to the east, have shown similar patterns of consistently high water levels since 1999, whereas Mortijinup (10 km east) has exhibited declining levels over the past decade. Gore's September and November salinities were relatively stable within the range 31-58ppt from 2002 to 2010, whereas in preceding years (1979-2001) they ranged 6-250ppt. In 2011 the September salinity rose to 72ppt and in November it was 57ppt.

Guraga (Dandaragan): September and November water levels have declined since their peak of ≈3m in 1999 and 2000 and have been consistently low (0.65-0.0m) for the past five years (2007-11). This is the longest period of continuously low water levels since monitoring began three decades ago.

Harvey 12632 (Harvey): Water levels have been trending downwards from a peak of ≈1.6m since the early 1990s and in September and November 2010 'Harvey 12632' was dry for the first time in at least 31 years . September and November salinities have been rising over the same period and in 2011 were both 'fresh' (1<3ppt) rather than 'very fresh' (<1ppt) for the first time. In September 2011 a marked change in vegetation was evident. Much of the fringing, wetland-dependent vegetation was stressed, dying or dead, however there were many well-established young shrubs growing on the shallowly-inundated, peaty lake floor (see Photo 53).

The pattern of water level change at Harvey 12632 since the early 1990s is similar in appearance to that of Clifton (12 km north-west). Nine Mile (27 km north) has shown a similar downward trend over a longer period.

Hinds (Wongan-Ballidu): There was an exceptional filling event (to >4m) in 1999 and it took 2-3 years for water levels to decline to 'normal' (for the period 1979-2011). There have been no major filling events since 1999. Note that this wetland was not monitored from 1992 (when recreational duck hunting in Western Australia was banned) to 1996 (when the WA Salinity Action Plan was launched) (See Section 2 of Lane *et al.* 2004 for the relevant history). The 2009-2011 September and November salinities of ≈335ppt are far above those of the flood year of 1999 (≈16ppt).

Jandabup (Wanneroo): September and November pH values returned to 'normal' (for the periods 1983-1997 and 2000-11) following their fall to low levels (pH 4-5) in 1998 and 1999. This temporary acidification initially followed (lag of one year), and then coincided with, a period of 2-3 years of lower water levels and prolonged drying of the lake bed and is thought to have possibly been due to the oxidation of sulfur compounds from one or more sources (Sommer & Horwitz 2001). Pumping of groundwater was recommenced in summer 1999-2000 (it had ceased in autumn 1996), because minimum water level criteria were not reached during the previous two summers. This prevented the wetland from drying in summer 1999-2000 (Sommer & Horwitz *op. cit*.).

Jasper (Nannup): Jasper remains very fresh (<1ppt), however salinities have been higher (>0.25ppt) in most years since 2000, the end of a 13 year period of consistently high water levels and lower salinities (<0.25ppt). Similar-depth salinity comparisons (2009 with 1999 & 2000 and 2011 with 2002 & 1987) suggest that Jasper's salt load has also increased. The September and November 2011 salinities of 0.31ppt are the highest recorded since monitoring began in 1985.

Probing of a peat deposit in the south-east corner of Jasper in 1995 by divers with steel rods has revealed that Jasper is, by one estimation (Dortch 1996), at least 16m deep, not 9-10m. In our 1977-2010 report we stated that 'Whichever measurement / estimate is used, Jasper is the deepest of all SWWMP wetlands, the second-deepest being Maringup (Lane *et*

al. 2004)'. We have since discovered that this statement is perhaps incorrect. ARL (1992) reported a depth of 10.8m in Yeagarup Lake – without probing the lake floor.

Jerdacuttup (Ravensthorpe): Water levels (0.0-4.5m) and salinities (5-250ppt) of Jerdacuttup continue to oscillate markedly over 5-15 year time periods, there being a strong inverse relationship between these two parameters in this wetland. The 2011 water levels and salinities of ≈0.6m and ≈160-210ppt respectively are markedly different from the flood year values of ≈4.3m and 5ppt in 1989.

Joondalup (Joondalup): September and November water levels have been fairly stable around 2.5-2.7m since 1998 following earlier periods at ≈3.0m (1981-1990 and 1995-96) and ≈3.5m (1992-93). The September 2011 water level of ≈2.4m was the lowest September level for at least three decades and the September salinity of 1.0ppt was the highest (the November salinity was the fourth highest).

Logue (Carnamah): This wetland was dry in September and November 2011 and has been dry / near-dry in these months for seven of the past eight years. This is an exceptionally long period for Logue, which has been monitored under SWWMP for more than three decades. There has been no major input of water to this wetland since 1999, when it filled to ≈4.0m. Healthy *Casuarina* (predominantly) and *Melaleuca* small trees and saplings, previously restricted to the lake margins, have recently appeared in low numbers, widely scattered, on small areas of the lake floor.

Maringup (Manjimup): September and November salinities of this deep wetland have varied within a narrow range (≈0.2-0.3ppt) since monitoring began in 1993. September and November depths have oscillated between 6.0m and 6.6m, with no obvious trend.

McLarty (Murray): September and November water levels have fluctuated markedly during the period of monitoring (1993-2011) with the long term trend (not tested statistically) being downwards. Salinities are mainly <4ppt, with occasional values to ≈12ppt when water levels are lowest.

Mettler (Albany): Water levels have declined (from ≈1.9m to ≈0.3m) and salinities have increased (from ≈0.05ppt to ≈0.8-1.2ppt) in all years but one (2009) since water levels peaked in 2005. The November 2011 salinity of ≈1.2ppt was the highest recorded since monitoring began in 1982 and the September salinity (≈0.8ppt) was the second highest.

Mortijinup (Esperance): Depths have declined over the past eleven years of monitoring, from ≈3.3m in 2000 to ≈1.0m in 2011. Salinities have risen from ≈3ppt to ≥9ppt over this period. The significance of these changes in a long term (30+ years) context remains to be seen.

Muir (Manjimup): September (0.4m) and November (0.2m) 2010 water levels were the lowest in at least 32 years (monitoring began in 1979-80) and far below the level (≈4.0m) at which this 4,600 ha lake would overflow into the Deep River, an event that is thought to have last occurred around 1900-1901 (pers. comm. Ash Muir via Roger Hearn, 07 August 2009). In 2011 water levels recovered somewhat, to ≈0.6m.

As previously noted (Lane *et al.* 2004), from 1979 to 1989 SWWMP monitoring of Muir was undertaken at the northern end of the lake, near the discharge point of a seasonally-inflowing drain. From 1990 onwards all monitoring has been undertaken at a more satisfactory, deeper-water location near the eastern shoreline, away from surface drainage discharge points.

Nine Mile (Murray): The pronounced downward trend in water levels which began in 1984 has continued to 2011. Salinities, however, remain mainly within the range 0.2-0.5ppt and are thus 'very fresh'. 'Harvey 12632' (27 km south) has shown a similar downward trend in water levels since 1991 but, unlike Nine Mile, its salinities are rising.

Noobijup (Cranbrook): September and November depths (≈0.35m) and pH values (≈4.5) remained low in 2011. Similar declines (and recoveries) in pH have been observed at nearby Unicup and Yarnup (see below) and also at distant Jandabup (see above).

Noonying (Tammin): This wetland has been dry or very shallow (<0.2m) in most Septembers and Novembers for the past eleven years (2001-2011). This is an exceptionally long period for Noonying. From 1979 to 1990, and possibly to 1999 (there was a gap in monitoring from 1992 to 1996), Noonying water levels were often in the range 1.0-1.4m.

Pillenorup (Plantagenet): Over the past five years, water levels in this large and relatively pristine wetland on the south side of the Stirling Ranges have fallen, from a flood level of ≈2.7m in Sep-Nov 2005 to 0.0m (i.e. dry) in Sep-Nov 2010. As the water levels fell, salinities rose, from 0.2ppt in 2005 to 2.6ppt in 2009. The four or so years of continuous inundation resulted in extensive death of tall and low sedges (*Baumea* spp.?) on the lake floor. In September 2010 some sedge regeneration was occurring, mainly on shallower parts of the lake floor. Most of the melaleucas and eucalypts on the lake floor and margins appear to have survived the prolonged immersion, however some loss of vigour is apparent (Sep 2010).

Pleasant View (Albany): September and November water levels of Pleasant View have oscillated between 0.1m & 2.2m and salinities have mainly been within the range 0.2-0.9ppt (exceptionally to 1.6ppt) over the past 33 years (monitoring began in 1979). In 2011 water levels were low (≈0.6m) and salinities (≈0.4ppt) were within the normal range for this wetland.

Powell (Albany): Powell is unusual among SWWMP wetlands in that in most years its water level is higher in November than September. This is presumably a consequence of management arrangements for the surface water drainage network that it lies within. In 2011 the reverse was true.

Shark (Esperance): In our 1977-2010 report we wrote: 'This lake's water levels exhibit an unusual pattern … with considerable variation from 1979 (the start of monitoring) to 1999, and relatively little since'. In 2011 water levels dropped to near the lower end (≈1.75m) of the pre-1999 range and the trend of increasing salinities in recent years continued. Nonetheless, Shark remains fresh (1<3ppt). This wetland is an important freshwater habitat for waterbirds, including species particularly sensitive to the loss (which is limited at this site) of fringing and emergent vegetation (Jaensch *et al.* 2009, Clarke *et al*. 2011).

Taarblin South and Taarblin North (Narrogin): The 1983 filling (to 2.4m) of this large, formerly 'live-treed', now mainly 'dead-treed', lake near the northern (upper) end of the Blackwood River catchment was a 1 in 33 year – and possibly longer – event. For the remainder of the period 1979-2011, September and November water levels in the southern basin (Taarblin South) have mostly been within the range 0.0-0.5m (0.0m in 2011), though they did reach ≈0.9m in September 1996. Recent high resolution, aerial oblique photography shows long, narrow bands of living trees (Swamp Sheoak *Casuarina obesa*) on elevated ground within this basin. The northern basin (Taarblin North) receives pumped saline groundwater from bores in the bed of Toolibin (Durell *et al*. 2010).

Thomsons (Cockburn): Water supply to this Ramsar-listed wetland has been supplemented by diversion of surface drainage each winter-spring since and including 2004 (DEC 2009). Supplementation is intended '... to help ensure that water levels remain adequate for the protection of the reserve's Ramsar values and water bird habitat, and to enable the fledgling cygnets to survive at the lake until they are able to fly' (CALM 2005) and is subject to a specific plan (CALM 2004). Supplementation was from 15 July to 30 Nov in 2009, from 14 July to 15 Sept in 2010 and from 18 July to 19 Sept in 2011 (DEC 2012).

The level of public and private compliance with minimum water level criteria for Thomsons Lake, which is impacted by a variety of factors including rainfall, stormwater disposal and groundwater pumping from the Jandakot Mound, is reported annually by the Water Corporation to the EPA (CALM 2005).

Toolibin (Wickepin): This iconic wetland (Hooper & Wallace 1994) has now been dry / near-dry in September and November each year for 12 years (2000-2011). This in an unusually long period for Toolibin (at least in the past three decades) and is due to a combination of drier years and diversion of higher-salinity surface flows away from the lake (Jones *et al*. 2009).

Tordit-Gurrup (Manjimup): As is the case with nearby (and hydrologically-connected) Byenup (see above), there is a pronounced inverse relationship between water levels and salinities of Tordit-Gurrup. September (3.9ppt) and November (4.2ppt) 2011 salinities were the highest for at least 35 years (monitoring began in 1977).

Towerrinning (West Arthur): High water levels (3.0-3.5m) and relatively low salinities (5-10ppt) have been achieved in Towerrinning in most years since remedial engineering works were undertaken in 1993 and 1994 (see Lane *et al.* 2004, pp. 48-49 for more history).

Unicup (Cranbrook): pH values rose after the major filling event (to ≈2.1m) of 1988 and have consistently been within the range 7-9 pH units since 1991. Prior to 1988, values were generally within the range 4-6. Gibson *et al.* (2004) reported a 'major collapse' of Jointed Twig-rush *Baumea articulata* in a Unicup (and nearby Yarnup, see below) vegetation monitoring quadrat between October 1997 and October 2002, with cover abundance scores changing from 30-70% to 2-10%. These authors did not identify the cause of the collapse, but did point to 'a marked decline in water depth [to ≈1.0m] – and increase in salinity [to ≈10ppt] – of Lake Unicup in 2001 and 2002'. Water levels were ≈0.3m and salinities ≈11ppt in September and November 2011.

Wannamal (Gingin): September and November water levels of this wetland are within the range 1.2-1.6m in most years and salinities are usually <15ppt. The 2010 levels of ≈0.6-0.3m and 26-94ppt were the lowest and highest for at least 32 years (routine monitoring began in 1979). An appallingly nauseating odour encountered by JL while sampling Wannamal in November 2010 seemed to be coming from recently-exposed damp muds near the eastern shoreline. Happily, in 2011 water levels, salinities, pH values and odours were within their normal ranges.

Warden (Esperance): Water levels were unusually high (≈2.0-2.7m) from 1999 to 2009. This was an exceptionally long period for Warden and was due to a combination of catchment clearing (resulting in increased run-off and groundwater rise; Marimuthu *et al.* 2005) and extreme rainfall events (Kusumastuti 2006). Rises in groundwater levels started directly impacting the wetlands by prolonging inundation from about 1986 onwards (Robertson & Massenbauer 2005). Engineering works were considered essential to reduce Warden's water levels and thereby recover shorebird habitat and degraded riparian vegetation (Walshe & Massenbauer 2008). A pump station and pipeline to the Southern Ocean was proposed, however this is now under review. Water levels declined by ≈0.6m from Nov 2009 to Nov 2010 and this is thought to be partly due to artificial lowering of water levels in Wheatfield (see below), to which Warden is hydrologically-connected via Windabout and Woody Lakes (pers. comm. J. Lizamore, 05 January 2011). In 2011, September and November water levels declined further to ≈1.0m. Salinities increased to ≈140ppt.

Warrinup (Cranbrook): In the eight years prior to the filling event of 1988, September and November water levels did not exceed 0.3m. Since 1988, levels have generally been higher, frequently exceeding 0.4m and occasionally 0.8m, perhaps indicating a shift in the hydrological balance of this still 'very fresh' (<1ppt) swamp.

Wheatfield (Esperance): A gravitational pipeline constructed in Feb-Mar 2009 is being used to lower water levels in Wheatfield, which is hydrologically-connected (at various cease-to-flow levels) to Woody, Windabout and Warden Lakes. Since construction, the pipeline has been open from April 2009 to January 2010 and May 2011 to Feb 2012 (pers. comm. J. Lizamore, 04 July 2012). The September 2011 water level of ≈1.1m was the lowest since SWWMP monitoring began in 2000, however salinity at this time was mid-range.

White (Narrogin): The filling event (to ≈2m) of 1983 was perhaps a once in three decades event, like that of Taarblin, 7 km to the north-east. However, due to a gap in monitoring from 1985 to 1996, this is not known for certain. Since 1997, water levels in spring have not exceeded 0.2m and have mostly been 0.0m, as in 2011.

Yaalup (Kent): After a record (since 1982) four years of being dry or almost dry each spring, Yaalup's water level jumped from 0.0m (dry) on 13Sep2011 to ≈1.6m on 08Nov2011. Unusually heavy rainfalls were recorded at the nearby Pingrup South rainfall recording station during 23-26 October (42mm) and 4-6 November (55mm) 2011. The long term (1935-2011) median rainfalls for the entire months of October and November at this station are 22mm and 17mm respectively. The water in Yaalup in November 2011 was 'very fresh' (<1ppt).

Yarnup (Cranbrook): In 2011, Yarnup's water levels and salinities recovered somewhat after reaching their lowest and highest values respectively (since at least 1980) in 2010 (≈0.35m and 8-13ppt). Secondary salinisation of this formerly very fresh (<1ppt) wetland is evident from 'similar-depth salinity comparisons' (e.g. 1985 & 1990 with 2008, and 1984, 1991, 1996 with 2009). pH values, which are normally within the range 6-8 pH units, have been lower (3-5 pH units) during and immediately following some recent years (2001, 2007) of lower water levels. Despite record low water levels in 2010, they were within their usual range in spring of that year, but dropped to 3.8 pH units in September 2011 and then partially recovered to 5.7 pH units in November 2011, following unseasonal filling. Gibson *et al.* (2004) reported a 'major collapse' of *Baumea articulata* in a Yarnup (and nearby Unicup, see above) vegetation monitoring quadrat between October 1997 and October 2002, with cover abundance scores changing from 30-70% to 2-10%. These authors did not identify the cause of the collapse, but did point to markedly lower water depth [≈0.46m] and pH [≈4] in 2001, with pH remaining low in 2002, and higher salinities [≈6.2ppt and ≈3.6ppt] in both years. Rising acid saline groundwater is a threat to this and other wetlands in the Muir-Unicup catchment (Smith & Hearn 2006).

Yellilup (Jerramungup): Salinities have risen dramatically since the mid 1990s when water levels began to fall following the exceptional filling event (to >4m) of 1988. The waters of Yellilup Lake (not to be confused with nearby Yellilup Swamp) were predominantly fresh (1<3ppt) prior to 1992 but are now hypersaline (≥50ppt). Prolonged inundation (1988 to 1994 and beyond) is thought to have been the primary cause of the extensive death of Flat-topped Yates *Eucalyptus occidentalis* and melaleucas that once extended over a large part of the lake floor. These changes have had major consequences for use by waterbirds (Jaensch *et al.* 2009, Clarke *et al.* 2011).

Lowest and highest depths and salinities on record

2010 was a year of exceptionally low rainfall throughout most of south-western Australia and, as a consequence, water levels were low and salinities high in many wetlands. Twenty-four SWWMP wetlands experienced their lowest-recorded September and/or November water levels and 28 SWWMP wetlands experienced their highest-recorded September and/or November salinities (Lane *et al*. 2011).

Rainfalls in 2011 were generally higher than in 2010 (Figure 5), but still below average across most of the south-west (Figure 3 and, less evidently, Figure 4). Of the 24 wetlands with lowest-recorded September and/or November water levels

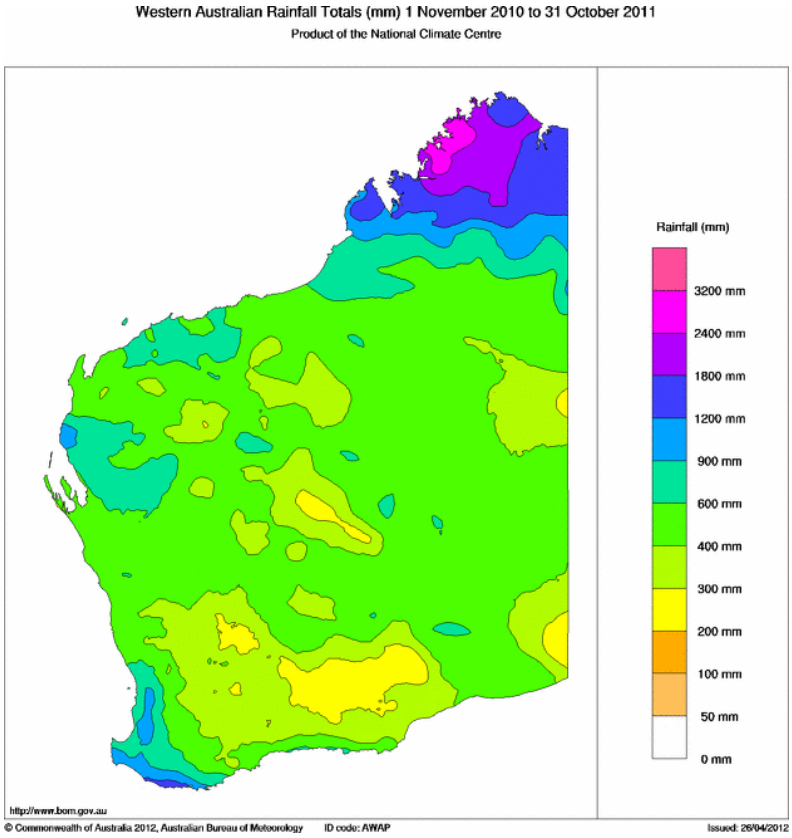

Figure 2. Rainfall (mm) recorded in the 12 month period from 01Nov2010 to 31Oct2011.

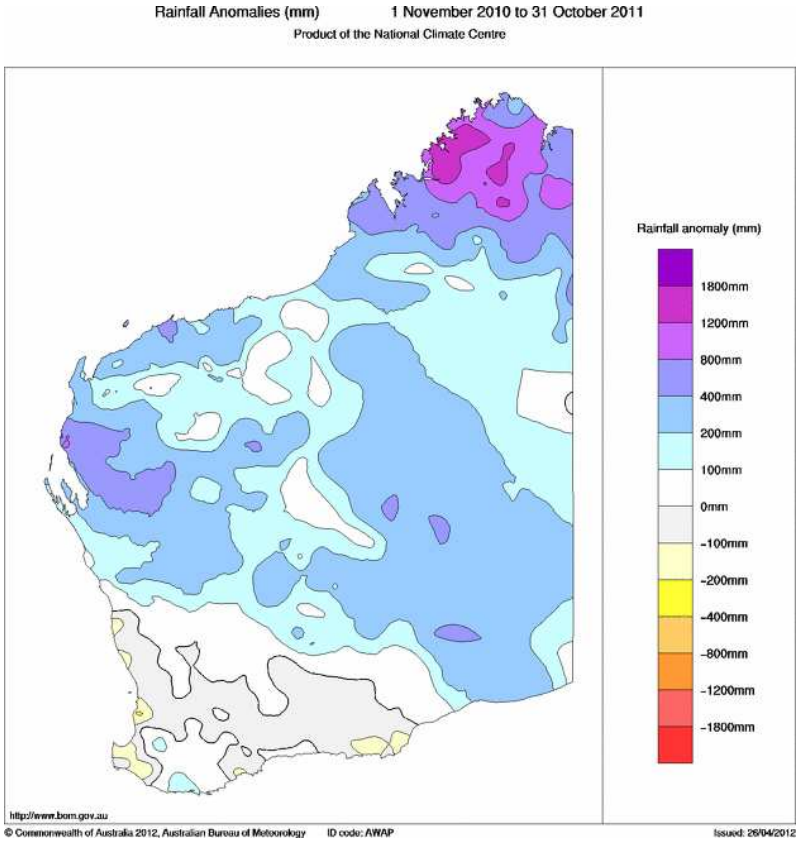

Figure 3. Rainfall anomalies (mm above or below average) in the 12 month period from 01Nov2010 to 31Oct2011.

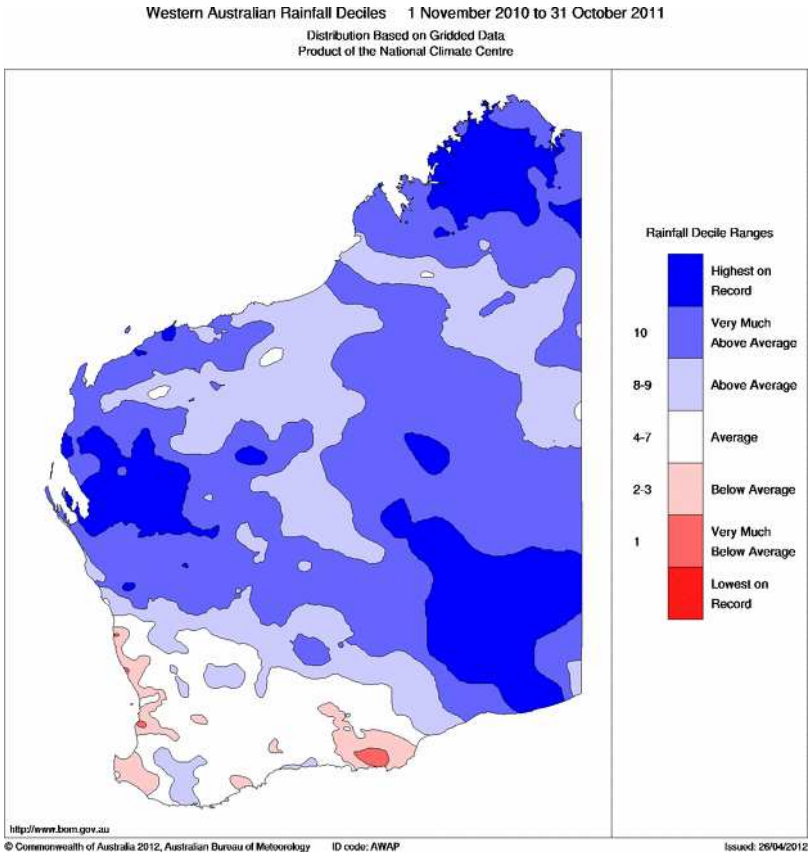

Figure 4. Rainfall deciles for the 12 month period from 01Nov2010 to 31Oct2011.

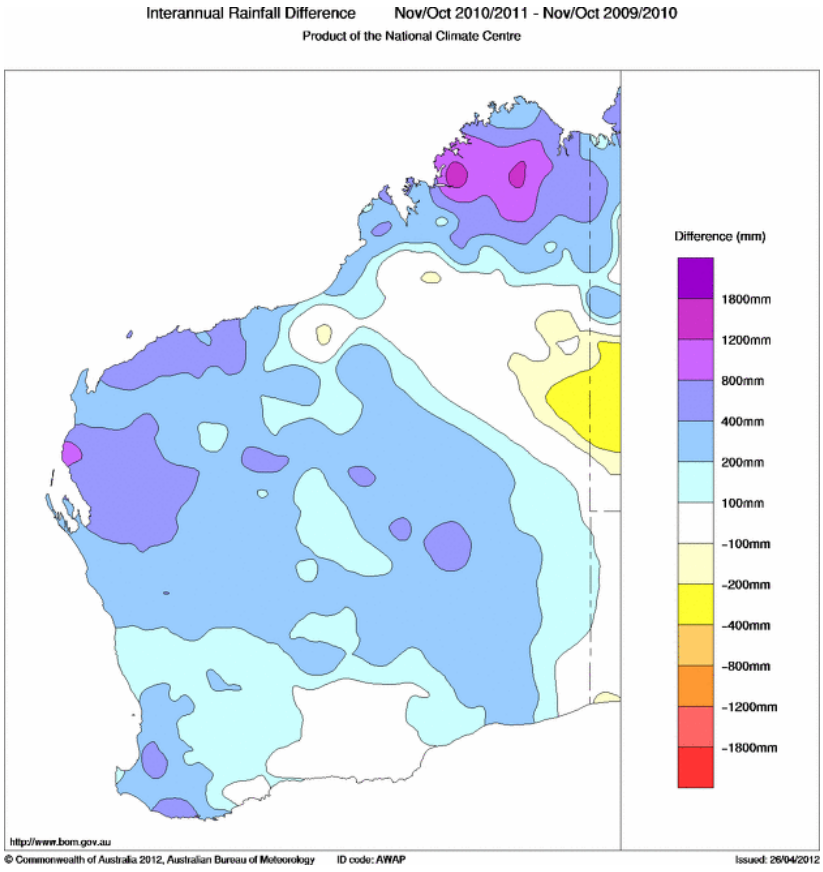

Figure 5. Interannual rainfall difference: 01Nov2010 to 31Oct2011 rainfall <u>minus preceding 12 months</u> rainfall.

in 2010, all but four (Joondalup, Mortijinup, Yellilup, Yurine) increased in water levels in 2011. Tordit-Gurrup (S31,N32[1]) and Wheatfield (S12) also experienced record low water levels in 2011. No SWWMP wetlands experienced their *highest*-recorded September and/or November water levels in 2011.

Twelve SWWMP wetlands were dry in both monitoring months of 2011, while 32 were dry in the same months of 2010.

Of the 28 wetlands that experienced their highest-recorded September and/or November salinities in 2010, all but nine (Clifton, Davies, Jasper, Joondalup, Mettler, Mortijinup, Ronnerup, Tordit-Gurrup, Yellilup) decreased in salinities in 2011. Three wetlands that did not experience their highest-recorded September and/or November salinities in 2010, did so in 2011. These were Coomalbidgup (S12), 'Harvey 12632' (S28) and Shark (S32). The following seven SWWMP wetlands experienced their *lowest*-recorded September and/or November salinities in 2011: Albany 27157 (N8), Ardath (N10), Boyup Brook 18239 (N18), Goonaping (N11), Range Road Yate (N6), Red (Bruce Rock) (N2) and Taarblin North (N6).

Lowest and highest pH values
Five SWWMP wetlands experienced their lowest-recorded September and/or November pH values in 2011. These were Clifton (N26), Gibbs (S18), Poorginup (S30), Range Road Yate (N6) and Thomsons (N28). Two SWWMP wetlands, Mortijinup (S12) and Taarblin North (N6), experienced their highest-recorded September and/or November pH values.

3. CONCLUDING COMMENTS

Readers are encouraged to view all Graphs (Albany 26385 toYurine) of this report for other changes of possible interest or concern and perhaps for reassurance that, thirty-four years since commencement of SWWMP, some wetlands clearly remain in good condition, at least in terms of the monitored key parameters.

Regional and District staff of the Department of Environment and Conservation may find it useful to refer to Table 2 in order to readily identify monitored wetlands in their areas of management responsibility. Requests for data should be directed to jim.lane@dec.wa.gov.au.

SWWMP depth gauges at the 53 historically-monitored wetlands (monitored under SWWMP at some time in the past but not currently; see Tables 1-3) are not maintained and many are now totally illegible or missing altogether. Readers with an interest in the resumption of monitoring at one or more of these wetlands, even for a short period, are encouraged to contact SWWMP staff to find out details of the legally-protected Landgate[2] Bench Marks (local survey datums) at each of these wetlands so that new depth gauges, if needed, can be installed to the same elevation as those previously installed. Water level data 'continuity' can thereby be maintained.

Since 1997, SWWMP staff, working with Landgate and contract surveyors, and with significant funding support from several DEC Regions and Districts, have mapped the bathymetry (lakebed and shoreline contours and inflow and outflow channels) of 19 SWWMP wetlands (Table 6). This enables water surface areas, water volumes and salt loads (tonnes) to be calculated from measured depths and salinities and thereby assists in water balance and salt balance modelling and the assessment of likely impacts on specific wetlands of drainage, diversion, pumping and storage proposals, proposed land use changes and predicted climate change. Requests for this mapping should be directed to jim.lane@dec.wa.gov.au. Funded requests to map the bathymetry of other SWWMP wetlands, particularly wetlands of high conservation value under threat, are welcome. SWWMP Senior Technical Officer Alan Clarke has considerable experience in organising, supervising and conducting work of this nature.

High resolution, low altitude, aerial oblique photography is useful for mapping wetland vegetation, monitoring vegetation condition, planning and conducting biological surveys and for publicity. During the period 2008-2011, 138 of the 154 SWWMP wetlands have been flown and photographed with specialised camera equipment to obtain photographs suitable for these purposes. A sample of low resolution prints and enlargements is presented in this report (cover photo and photos 17-24 & 32-50). Digital copies of original, high resolution photographs of any of the 138 wetlands (see Table 7 for a list) may be obtained by directing requests to jim.lane@dec.wa.gov.au

Commencing in June 2009, Alan Clarke has installed continuous water level recorders and tipping-bucket rainfall gauges on 11 SWWMP wetlands ('Albany 27157', Broadwater, Chandala, Crackers, Davies 'Esperance 26410', Maringup, McLarty, Nine Mile, Pillenorup, Pleasant View) and one proposed SWWMP wetland (Big Boom Swamp near Esperance). We

[1] Month and number of years of data of relevant parameter in parentheses.
[2] Formerly known as the WA Department of Land Information.

envisage this equipment being kept in operation at these locations for 2-3 years and then moved to other high conservation value SWWMP wetlands under threat. Collection of continuous water level and rainfall data in this manner will assist in the development of salt and water balance models for these and other south-western Australian wetlands and will thereby assist in their conservation management. These data will also assist in developing an improved understanding of the likely consequences of predicted climate change, particularly rainfall decline, on wetlands of south-western Australia.

This report has been prepared as the fifth in a series of annual reports aimed at putting the most-recent SWWMP data in front of readers in un-analysed form as soon as possible after data collection. Results and interpretations of statistical trend analyses are to be presented in other, less frequent reports covering the longer time periods required to assess such trends.

The authors of this report would like to draw readers' attention to the numerous reports and publications (e.g. Cale *et al.* 2004, 2010; Cale & Halse 2006a-u; Gibson *et al.* 2004; Halse *et al.* 2002; Lyons *et al.* 2007) concerning the fringing and emergent vegetation, waterbirds, aquatic invertebrates, groundwater and detailed water chemistry of the 25 SWWMP wetlands (shown in bold in Tables 1,2,4-8) that have been intensively monitored by other DEC scientists and collaborators under the State Salinity Strategy.

4. ACKNOWLEDGEMENTS

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Most SWWMP data have been collected by the principal authors of this report (Lane, Clarke and Winchcombe) and by G.B. Pearson (retired from DEC in Feb 2008) and D.R. Munro (retired from CALM in May 1991). Bill Muir, Brent Johnson and Sue Elscot each conducted a number of monitoring runs between 2000 and 2007 and their able involvement was vital. Keith Morris and Greg Keighery are thanked for making Brent and Bill available for this work.

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The Commonwealth of Australia's Bureau of Meteorology is the source and copyright holder of the rainfall maps presented in this report as Figures 2-5. These maps are presented with permission of the Bureau.

Photograph credits: Photos 1 & 3 were taken by volunteer John Winchcombe; 2, 4-9 & 51-54 by Jim Lane; 10, 16, 25, 26, 28 & 29 by Yvonne Winchcombe; 11-15 & 30, 31 by Alan Clarke; 27 by Saul Cowen. The cover photo and photos 17-24 & 32-50 were taken by Alf Lorkiewicz of DEC Bunbury and entirely funded under SWWMP and Jim Lane is custodian of these.

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PHOTOS

Photo 1: DEC depth gauge 'D' at Lake Muir on 18Sep2008 read 0.74m.

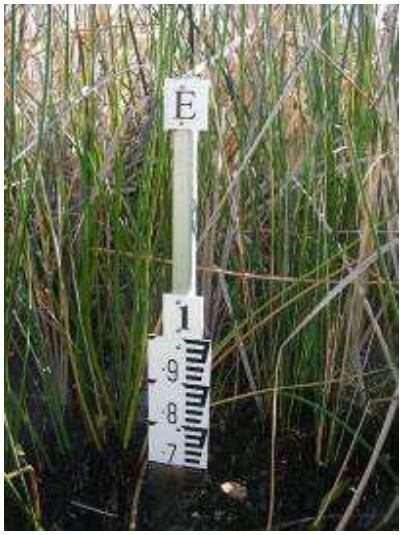

Photo 2: DEC depth gauge 'E' at Thomsons Lake on 04Aug2008 read 0.70m.

Photo 3: DEC depth gauge 'A' at Lake Wilson on 03Nov2008 read 3.85m.

Photo 4: DEC depth gauge 'A' at Parkeyerring Lake on 18Jul2008 read 0.40m.

Photo 5: DEC depth gauge 'C' at Lake Clifton on 13Sep2008 read 4.30m.

Photo 6: DoW depth gauge at Gibbs Road Swamp on 04Aug2008 read 24.59mAHD

Photographs 1-6: SWWMP Depth Gauges. Each depth gauge consists of one or more 1.00m metal or plastic gauge plates attached to a metal or wooden post. The gauge plate markings are in 0.01m increments, with labelling at 0.10m intervals. Labels 1, 2, 3, etc., at the top of each depth gauge indicate the height in metres (i.e. 1.00m, 2.00m, etc.) at the top of the uppermost gauge plate. Labels A, B, C, etc., where present, identify individual depth gauges at each wetland.

DEC gauge readings indicate the water depth at the deepest location in the wetland, even though gauges are usually not at the deepest location, but instead are closer to the shore, to facilitate viewing.

Readings are taken from Department of Water (DoW) gauges at several metropolitan wetlands. These DoW gauges indicate height above Australian Height Datum (mean sea level), which SWWMP personnel convert to wetland water depth.

Since 2007, the standard practice of SWWMP personnel when taking gauge readings has been to take a digital photograph of the gauge at the time of reading, so that all records may be checked and verified or corrected back in the office.

Photo 7: 'Munro Datum' (3.00m) at Lake Logue in Sep 2008.

Photo 8: 'Landgate' Bench Mark HZ929 at Thomsons Lake in Aug 2008.

Photo 9: 'Landgate' Witness Plate at Goonaping Swamp in Sep 2008.

Photo 10: 'Landgate' Bench Mark and Witness Plate at Cranbrook 25812 in Nov 2008.

Photographs 7-10: SWWMP Datums and Bench Marks. Depth gauges installed prior to 1997 were surveyed to a nearby 'Munro Datum'; a block of concrete installed by (then) SWWMP Senior Technical Officer Don Munro (dec.) for data security. Numbers on top of these Datums indicate the height (m) above the deepest location in the wetland.

Since 1997, legally-protected 'Landgate' (WA Department of Land Information) Bench Marks (BM's) have been installed at each wetland and the gauges and Munro Datums have been surveyed to them. All of these BM's have since been surveyed to Australian Height Datum (mean sea level). BM installation and survey has been a cooperative program of DEC and 'Landgate'.

Photo 11: An amphibious vehicle is used to traverse the long distances involved in bathymetric survey of large dry or very shallow lakes. Steven Lowth, Lake Campion, 24May2004.

Photo 12: Vegetated lake beds and banks are traversed on foot. Brian Hugessen of Landgate, Byenup Lagoon, 26Mar2009.

Photo 13: Deeper wetlands are traversed by flat-bottomed punt. Lindsey Schuiling of Landgate, Byenup Lagoon, 22Mar2009.

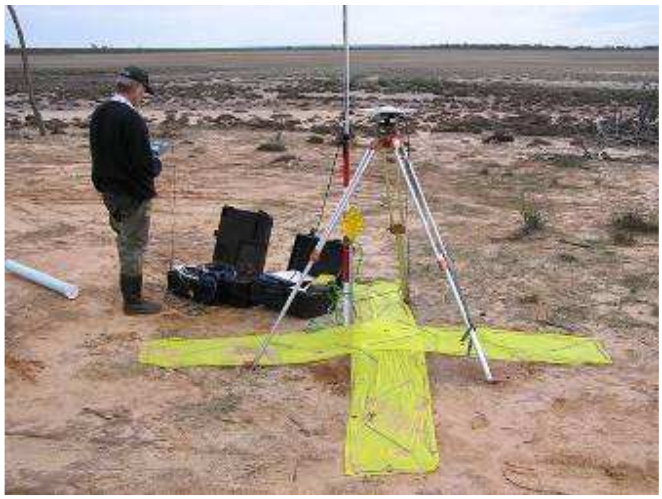

Photo 14: Photogrammetric surveys require targets (e.g. yellow crosses) with accurately-known positions and elevations. Doug Hardman of Landgate, Mollerin Lake, 16Jun2004.

Photo 15: Thick vegetation may pose a challenge for surveyors. Brian Hugessen of Landgate, Byenup Lagoon, 30Mar2009.

Photo 16: Unconventional flotation devices may be needed to reach depth gauges at large flooded wetlands accessible only on foot. Alan Clarke, Pillenorup Swamp, 22Mar2007.

Photo 17: Lake Jasper (Nannup Shire) is the deepest of all SWWMP monitored wetlands, except perhaps Lake Yeagarup. Photo 20May2008.

Photo 18: Yarnup Swamp (Cranbrook) values are threatened by salinisation and acidification. Photo 24May2008.

Photo 19: Boat Harbour 1 Lake (Denmark) water levels and salinities have been more variable since 2000. Photo 20May2008.

Photo 20: Lake Muir (Manjimup) is thought to have last overflowed into the Deep River around 1900. Photo 20May2008.

Photo 21: Yellilup Lake (Jerramungup) trees were killed by continuous flooding from 1988 to 1994. Photo 21May2008.

Photo 22: Nine Mile Swamp (Murray), once open water, is now covered by bulrush due to several decades of declining water levels. Photo 19May2008.

Photo 23: Lake Warden (Esperance) water levels were too high for shorebirds and fringing vegetation for more than a decade. Since 2009 they have been lowered by engineering. Photo 16May2009.

Photo 24: Jerdacuttup Lakes (Ravensthorpe) water levels and salinities oscillate markedly over 5-15 yr time periods. Photo 16May2009.

Photo 25: Depth gauge installation. Alan Clarke, Yurine Swamp, 02Jun2010.

Photo 26: Water level logger, support tube and supporting angle iron. Nine Mile Swamp, 04Aug2009.

Photo 27: Telemetric download of water level logger data to laptop. Alan Clarke, Lake Pleasant View, 10Aug2010.

Photo 28: Tipping bucket rainfall recorders have been installed on twelve wetlands. Alan Clarke, 17Jun2009.

Photo 29: Reading the gauge and collecting water samples. Volunteer John Winchcombe, 'Albany 26385', 07Nov2006.

Photo 30: A kayak is the most efficient method of accessing the water level logger at 'Albany 27157'. 09Aug2010.

Photo 31: Amphibious vehicle and laptop used for downloading data from the Crackers water level logger. 13Oct2009.

Photo 32: Lake Bambun (Gingin) is one of few SWWMP wetlands to have shown a persistent long-term decrease in salinity. Photo 06Jun2010.

Photo 33: Chandala Swamp (Chittering) is a freshwater, melaleuca – eucalypt swamp that, at times, supports thousands of nesting Straw-necked Ibis *Threskiornis spinicollis*. Photo 06Jun2010.

Photo 34: Crackers Swamp (Dandaragan) salinities are trending upwards and its extensive lake floor vegetation could be under threat. Photo 07Jun2010.

Photo 35: Taarblin Lake (Narrogin), though secondarily salinised, has bands of young, live Swamp Sheoak *Casuarina obesa* on elevated ground in the southern basin. Photo 26May2010.

Photo 36: Mortijinup Lake (Esperance) water levels have been falling and salinities rising in the 11 years since monitoring began. Photo 16May2009.

Photo 37: Forrestdale Lake (Armadale) depths have trended lower since the early 1990s, facilitating the spread of the introduced bulrush *Typha orientalis*. Photo 06Jun2010.

Photo 38: High resolution aerial oblique photos, e.g. of Atkins Yate Swamp (Lake Grace) are suitable for enlargement. Photo 17May2009.

Photo 39: Enlarged section of Photo 38 (Atkins Yate Swamp), showing vegetation banding, structure, composition and vigour. Photo 17May2009.

Photo 40: Shallowly-inundated eastern floor and distant shoreline of Dumbleyung Lake (Dumbleyung / Wagin). Photo 26May2010.

Photo 41: Enlarged section of Photo 36 (Dumbleyung Lake), showing shoreline vegetation structure, composition and vigour. Photo 26May2010.

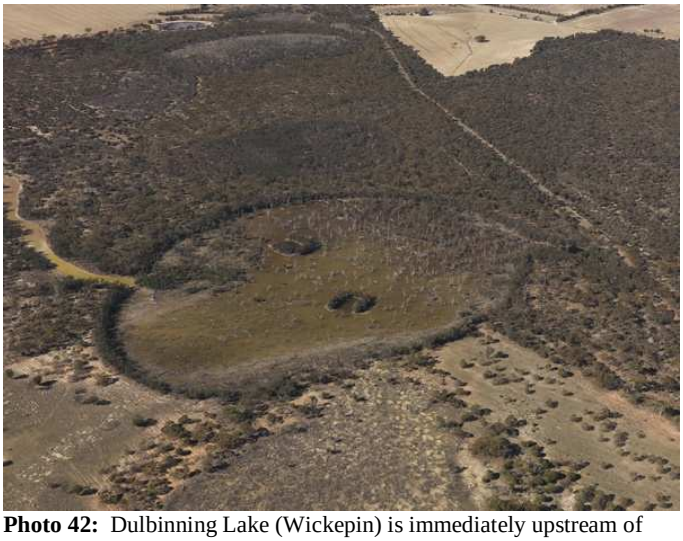

Photo 42: Dulbinning Lake (Wickepin) is immediately upstream of Toolibin and has also been affected by secondary salinisation. Photo 26May2010.

Photo 43: Enlarged section of Photo 42 (Dulbinning Lake), showing live *Casuarina obesa* on elevated banks of old dam and dead trees on lake floor. Photo 26May2010.

Photo 44: 'Harvey 12632' (Harvey Shire) water levels have trended lower since the early 1990s. Photo 19May2008.

Photo 45: Towerrinning (West Arthur) water levels have been higher and salinities lower since flow diversion and other works in the early 1990s. Photo 24May2008.

Photo 46: Egret (Harvey) is the rectangle of trees in foreground, adjacent to Leschenault Inlet. Egret's pH values have, at times, been very low (≈3 pH units). Photo 19May2008.

Photo 47: Red (Bruce Rock) is usually very shallow or dry, hypersaline and acidic (pH 3-4). Photo 07Jun2010.

Photo 48: Joondalup (Joondalup) water levels in Sep and Nov 2010 and 2011 were the lowest recorded for 30+ years. Photo 06Jun2010.

Photo 49: Jandabup (Wanneroo) was temporarily acidic (pH ≈ 4) after water levels declined in the late 1990s. Photo 06Jun2010.

Photo 50: Wannamal (Gingin) produced a nauseating odour when the water level was exceptionally low in Nov 2010. Photo 06Jun2010.

Photo 51: Dobaderry (Beverley) lake floor vegetation (*Melaleuca lateritia*) appeared healthy in late 2009. Photo 13Nov2009.

Photo 52: Dobaderry vegetation (same photo site and direction as in Photo 51) was drought-stressed in 2010. Photo 16Sep2010.

Photo 53: Shrubs are establishing on the floor of 'Harvey 1632' following two decades of declining water levels. Photo 14Sep2011.

Photo 54: Casuarinas and melaleucas are advancing onto the floor of Logue (Carnamah) following a decade of drought. Photo 16Sep2011

TABLES

Table 1. Monitored wetlands, codes, coordinates, tenure, Local Government Authorities and monitoring periods. This Table includes all wetlands ('current' and *'historical'*) regularly monitored at any time since commencement of the South West Wetlands Monitoring Program in 1977, sorted alphabetically by wetland name.

Wetland Name[1]	Code	Easting[2]	Northing[2]	Zone	Tenure[3]	Local Government Authority	Period monitored[4,5,6]
Ace[7]	*ACE*	*758029*	*6344741*	*50*	*CCWA*	*Lake Grace*	*7/80 - 5/85, 4/00*
Albany 26385[8]	ALB1	606041	6148594	50	CCWA	Albany	5/81 - 5/85, 9/98 onwards
Albany 27157	ALB2	618826	6147490	50	CCWA	Albany	3/80 - 5/85, 9/08, 9/09 onwards
Altham[9]	ALTH	634562	6302593	50	CCWA	Kent	7/80 - 11/91, 4/00 onwards
Anderson	ANDE	588666	6217158	50	CCWA	Tambellup	5/81 - 3/92, 9/00 onwards
Angove	*ANGO*	*605850*	*6132590*	*50*	*CCWA*	*Albany*	*11/79 - 5/85, 9/90, 4/00*
Ardath	ARDA	609068	6448377	50	CCWA	Bruce Rock	9/99 onwards
Atkins Yate	ATKI	750023	6330530	50	Private	Lake Grace	4/00 onwards
Bambun	BAMB	394880	6522829	50	CCWA	Gingin	5/79 onwards
Bennetts	BENN	742440	6314572	50	CCWA	Lake Grace	9/92 onwards
Beverley[10]	BEVE	514297	6432612	50	CCWA / LGA	Beverley / Brookton / Quairading	6/78 onwards
Biddy	*BIDD*	*682152*	*6344888*	*50*	*CCWA*	*Lake Grace*	*7/82 - 5/85, 9/91 - 1/93, 4/00, 7/09*
Blue Gum	*BLUE*	*401231*	*6615183*	*50*	*Private*	*Moora*	*11/99 – 11/10*
Boat Harbour 1	BOA1	508245	6124962	50	CCWA	Denmark	8/91 onwards
Bokan	*BOKA*	*549253*	*6349883*	*50*	*CCWA*	*Narrogin*	*7/79 - 5/85,11/08*
Boyup Brook 18239[10]	BOYU	469777	6257199	50	CCWA	Boyup Brook	9/80 onwards
Broadwater	BROA	341176	6273426	50	CCWA	Busselton	11/85 onwards
Brown	BROW	559606	6397735	50	CCWA	Corrigin	7/79 - 11/91, 9/97 onwards
Bruce Rock 30969	*BRUC*	*575133*	*6473941*	*50*	*CCWA*	*Bruce Rock*	*5/82 - 5/85*
Bryde	BRYD	669625	6308051	50	MWR	Kent	6/79 onwards
Byenup	BYEN	476449	6182437	50	CCWA	Manjimup	6/77 onwards
Cairlocup	*CAIR*	*662520*	*6266817*	*50*	*CCWA*	*Kent*	*9/80 - 5/85, 4/00, 5/09*
Camel	*CAME*	*588033*	*6204762*	*50*	*CCWA*	*Cranbrook*	*8/80 - 5/85, 4/00*
Campion	CAMP	627676	6554227	50	CCWA	Nungarin / Merredin	3/79 - 11/91, 5/99 onwards
Capamaura	*CAPA*	*393132*	*6691441*	*50*	*CCWA*	*Carnamah*	*7/80 - 5/85, 3/90, 11/09*
Casuarina	CASU	569525	6277315	50	CCWA	Katanning	5/78 onwards
Chandala	CHAN	400545	6514425	50	CCWA	Chittering	5/79 onwards
Chittering	*CHIT*	*414089*	*6521328*	*50*	*CCWA*	*Chittering*	*4/78 - 11/86*
Clifton	CLIF	374037	6376139	50	CCWA	Mandurah / Waroona	11/85 onwards
Coblinine	*COBL*	*564476*	*6306117*	*50*	*CCWA*	*Dumbleyung*	*6/79 - 11/91*
Collets Road	COLL			50	CCWA	Jerramungup	9/01 onwards
Coomalbidgup	CMBG	349163	6267892	51	LGA	Esperance	11/99 onwards
Coomelberrup	COOM	573060	6303130	50	CCWA	Dumbleyung	5/78 - 5/85, 3/93, 9/97 onwards
Corrigin 12900[10]	CORR	603415	6413294	50	CCWA	Corrigin	7/82 onwards
Coyrecup	COYR	577072	6268374	50	CCWA	Katanning	5/78 onwards
Crackers	CRAC	365586	6579519	50	CCWA	Dandaragan	7/80 onwards
Cranbrook 25812	*CRAN*	*573707*	*6203482*	*50*	*CCWA*	*Cranbrook*	*8/80 - 8/85, 4/00, 11/08*
Cronin	*CRON*	*760036*	*6413700*	*50*	*CCWA*	*Kondinin*	*4/81 - 5/85, 11/95, 4/01, 07/09*
Davies	DAVI	318852	6211560	50	CCWA	Augusta-Margaret River	4/91 onwards
Dobaderry	DOBA	463077	6437224	50	CCWA	Beverley	9/80 onwards
Dowerin	*DOWE*	*505689*	*6541494*	*50*	*LGA*	*Dowerin*	*6/79 - 5/81, 9/99*
Dulbinning	DULB	557418	6359015	50	CCWA	Wickepin	7/79 onwards
Dumbleyung	DUMB	560071	6309876	50	CCWA / LGA	Dumbleyung / Wagin	6/79 onwards

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
Dundas 33113	*DUND*	*391998*	*6359382*	*51*	*CCWA*	*Dundas*	*11/79 – 11/91, 4/00*
Eganu	EGAN	391567	6680556	50	CCWA	Coorow	7/78 onwards
Egret	EGRE	379666	6314855	50	CCWA	Harvey	5/85 onwards
Ellen Brook	*ELLE*	*408758*	*6486521*	*50*	*CCWA*	*Swan*	*7/79 – 11/84*
Eneminga	ENEM	358697	6590178	50	CCWA	Dandaragan	7/80 – 11/91, 09/08, 9/11 onwards
Esperance 26410	ESP1	304849	6265010	51	CCWA	Esperance	11/81 onwards
Esperance 27768	*ESP2*	*388786*	*6319769*	*51*	*CCWA*	*Esperance*	*6/81 - 5/85, 4/00*
Esperance 27985	*ESP3*	*385963*	*6309342*	*51*	*CCWA*	*Esperance*	*6/81 – 11/91, 4/00 -11/10*
Esperance 32128	*ESP4*	*471180*	*6278570*	*51*	*CCWA*	*Esperance*	*7/82 - 5/85*
Esperance 32776	*ESP5*	*438274*	*6294596*	*51*	*CCWA*	*Esperance*	*6/81 - 5/85, 4/00*
Flagstaff	FLAG	523642	6291467	50	CCWA	Woodanilling	6/79 – 11/91, 9/97 onwards
Forrestdale	FORR	400062	6442240	50	CCWA	Armadale	11/77 onwards
Frasers[10]	*FRAS*	*507236*	*6542443*	*50*	*Private*	*Dowerin*	*11/99 – 11/10*
Gardner	*GARD*	*605828*	*6129943*	*50*	*CCWA*	*Albany*	*5/81 - 5/85, 9/89, 9/90, 4/00, 9/08*
Gibbs	GIBB	397627	6441667	50	CCWA	Armadale	9/92 onwards
Gingin 31241	*GING*	*387922*	*6525676*	*50*	*CCWA*	*Gingin*	*6/79 - 5/85, 9/08*
Gnowangerup 26264	*GNO1*	*636100*	*6196278*	*50*	*CCWA*	*Gnowangerup*	*3/80 – 11/91, 9/08*
Gnowangerup 26569	*GNO2*	*636830*	*6257497*	*50*	*CCWA*	*Gnowangerup*	*7/82 - 5/85, 4/00*
Goonaping	GOON	461797	6443309	50	CCWA	Beverley	11/99 onwards
Goorly	*GOOR*	*503350*	*6664801*	*50*	*UCL*	*Dalwallinu*	*9/00 – 11/09*
Gore	GORE	363166	6263536	51	CCWA	Esperance	11/79 onwards
Gounter	*GOUN*	*672878*	*6413022*	*50*	*CCWA*	*Kondinin*	*7/80 – 11/91, 5/98, 7/09*
Gundaring	*GUND*	*546974*	*6315587*	*50*	*CCWA*	*Wagin*	*5/78 – 11/91*
Guraga	GURA	363476	6585412	50	LGA	Dandaragan	9/82 onwards
Harvey 12632	HARV	386550	6348919	50	CCWA	Harvey	8/80 onwards
Hebitons	*HEBI*	*345831*	*6806160*	*50*	*Private*	*Mullewa*	*9/00 – 11/09*
Hinds	HIND	456859	6596884	50	CCWA	Wongan-Ballidu	6/79 – 11/91, 9/97 onwards
Jandabup	JAND	390937	6486982	50	CCWA	Wanneroo	4/78 onwards
Jasper	JASP	379737	6190394	50	CCWA	Nannup	11/85 onwards
Jerdacuttup	JERD	246655	6241791	51	CCWA	Ravensthorpe	11/79 onwards
Joondalup	JOON	384352	6487435	50	CCWA	Joondalup	4/78 onwards
Karakin	*KARA*	*354428*	*6563848*	*50*	*WRC*	*Gingin*	*5/79 - 5/85, 9/87*
Kent 29020[10]	KENT	676818	6307259	50	CCWA	Kent	9/80 - 5/85, 4/00 onwards
Kondinin	*KOND*	*612045*	*6404006*	*50*	*CCWA*	*Kondinin*	*6/79 – 11/91, 4/00*
Kwobrup	*KWOB*	*593500*	*6267648*	*50*	*Private*	*Kent*	*6/79 – 11/91, 4/00*
Kwornicup	KWOR	538575	6176168	50	CCWA	Plantagenet	11/79 onwards
Little White	LITT	541357	6347281	50	CCWA	Narrogin	7/79 – 11/91, 9/97 onwards
Logue	LOGU	321114	6695888	50	CCWA	Carnamah	5/79 onwards
Maringup	MARI	426553	6144690	50	CCWA	Manjimup	6/91 onwards
Martinup	MART	516363	6289934	50	CCWA	Woodanilling	6/79 – 11/91, 9/97 onwards
McLarty	MCLA	379489	6379596	50	CCWA	Murray	11/93 - 11/94, 9/96 onwards
Mears	MEAR	533098	6433941	50	CCWA	Brookton	6/78 – 11/91, 9/97 onwards
Mettler	METT	646369	6172015	50	CCWA	Albany	9/82 onwards
Miripin	*MIRI*	*518066*	*6288832*	*50*	*CCWA*	*Woodanilling*	*6/81 - 5/85, 5/92, 9/09*
Moates	MOAT	600908	6131536	50	CCWA	Albany	11/79 onwards

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
Mollerin	*MOLL*	*554214*	*6625482*	*50*	*CCWA*	*Koorda*	*7/80 – 5/85*
Mortijinup	MORT	373710	6259469	51	CCWA	Esperance	4/00 onwards
Mount Le Grand	MLGR	419066	6240163	51	CCWA	Esperance	9/00 onwards
Mount Marshall 26687[10]	*MTMA*	*560937*	*6579648*	*50*	*CCWA*	*Mt Marshall*	*7/81 – 11/91, 5/99*
Muir	MUIR	471032	6185028	50	CCWA	Manjimup	11/79 onwards
Mungala	*MUNG*	*395151*	*6521364*	*50*	*CCWA*	*Gingin*	*6/79 – 5/85*
Murapin	*MURA*	*517681*	*6289397*	*50*	*CCWA*	*Woodanilling*	*6/81 – 5/85*
Murray 24739	*MURR*	*378784*	*6382052*	*50*	*CCWA*	*Murray*	*9/80 – 5/85, 8/08*
Nambung	*NAMB*	*394607*	*6521821*	*50*	*CCWA*	*Gingin*	*6/79 – 5/85*
Ngopitchup	NGOP	531747	6242644	50	WRC	Broomehill	4/00 onwards
Ninan	NINA	467029	6575597	50	CCWA	Wongan-Ballidu	7/78 – 11/91, 9/97 onwards
Nine Mile	NINE	385536	6376505	50	CCWA	Murray	6/81 onwards
Nonalling	*NONA*	*557243*	*6400132*	*50*	*CCWA*	*Corrigin*	*7/79 – 5/85*
Noobijup	NOOB	480867	6192653	50	CCWA	Cranbrook	9/99 onwards
Noonying	NOON	542507	6497744	50	CCWA	Tammin	6/79 – 11/91, 9/97 onwards
North Parriup	NPAR	281562	6250268	51	CCWA	Ravensthorpe	4/00 onwards
Owingup	OWIN	507258	6126756	50	CCWA	Denmark	7/91 onwards
Pabelup South	PABE	725800	6222286	50	CCWA	Jerramungup	4/00 onwards
Pallarup	*PALL*	*756890*	*6322416*	*50*	*CCWA*	*Lake Grace*	*7/80 – 11/91, 4/00, 11/08, 7/09*
Parkeyerring	PARK	533156	6307263	50	CCWA	Wagin	5/78 – 11/91, 9/97 onwards
Pillenorup	PILL	601412	6187773	50	CCWA	Plantagenet	4/00 onwards
Pinjarrega	*PINJ*	*395416*	*6670552*	*50*	*CCWA*	*Coorow*	*5/79 – 11/91*
Plantagenet 25386	*PLAN*	*597710*	*6176617*	*50*	*CCWA*	*Plantagenet*	*11/79 – 5/85, 11/93 – 11/96, 6/98, 11/08*
Pleasant View	PLEA	608357	6145314	50	CCWA	Albany	11/79 onwards
Poorginup	POOR	476447	6177128	50	CCWA	Manjimup	6/77 onwards
Powell	POWE	567497	6125091	50	CCWA	Albany	6/81 onwards
Queerearrup	*QUEE*	*521251*	*6291518*	*50*	*LGA*	*Woodanilling*	*10/78 – 5/85, 9/88, 11/08*
Range Road Yate	RANG	666083	6275186	50	MWR	Kent	4/00 onwards
Red (Bruce Rock)	REDB	602548	6437065	50	CCWA	Bruce Rock	7/81 – 5/85, 9/00 onwards
Red (Manjimup)	*REDM*	*468592*	*6189580*	*50*	*UCL*	*Manjimup*	*11/81 – 11/91, 4/00, 9/08*
Ronnerup	RONN	744169	6317786	50	CCWA	Lake Grace	4/00 onwards
Shark	SHAR	394568	6263073	51	CCWA	Esperance	11/79 onwards
Shaster	*SHAS*	*287219*	*6250710*	*51*	*CCWA*	*Ravensthorpe*	*11/79 – 11/91, 5/09*
Station	STAT	402615	6259237	51	CCWA	Esperance	3/80 onwards
Streets	*STRE*	*402493*	*6614985*	*50*	*Private*	*Moora*	*10/78 – 11/91, 9/08*
Taarblin North[11]	TAAN			50	CCWA	Narrogin	9/04 onwards
Taarblin South[11]	TAAR	551258	6350395	50	CCWA	Narrogin	5/78 onwards
Thomsons	THOM	389516	6441482	50	CCWA	Cockburn	11/78 onwards
Toolibin	TOOL	557650	6357248	50	CCWA	Wickepin	5/78 onwards
Tordit-Gurrup	TORD	476135	6179406	50	CCWA	Manjimup	6/77 onwards
Towerrinning	TOWE	480708	6283950	50	CCWA	West Arthur	12/77 onwards
Twin Swamps N-W	*TWIN*	*406579*	*6490175*	*50*	*CCWA*	*Swan*	*7/79 – 11/84, 7/09*
Unicup	UNIC	474399	6200082	50	CCWA	Cranbrook	9/80 onwards
Varley	VARL	722520	6379843	50	CCWA	Kulin	9/81 – 11/91, 4/00 onwards

Table 1 continued.

Wetland Name	Code	Easting	Northing	Zone	Tenure	Local Government Authority	Period monitored
Wagin 2088	*WAGI*	*533281*	*6311808*	*50*	*CCWA*	*Wagin*	*7/82 – 5/85*
Walbyring	WALB	555534	6355214	50	CCWA	Wickepin	7/79 onwards
Wallering	*WALL*	*395706*	*6521624*	*50*	*CCWA*	*Gingin*	*7/81 – 5/85, 9/08*
Walyormouring	WALY	488021	6554454	50	CCWA	Goomalling	7/78 – 11/91, 9/97 onwards
Wannamal	WANN	409642	6556691	50	CCWA	Gingin	7/78 onwards
Warden	WARD	396947	6257428	51	CCWA	Esperance	11/79 onwards
Wardering	*WARG*	*523381*	*6290253*	*50*	*CCWA*	*Woodanilling*	*5/78 – 11/91*
Warrinup	WARR	523495	6199485	50	CCWA	Cranbrook	3/80 onwards
West Arthur 5456	WEST	496510	6293047	50	CCWA	West Arthur	8/80 – 11/91, 9/97 onwards
Wheatfield	WHEA	401069	6258818	51	CCWA	Esperance	11/99 onwards
White (Albany)	*WHIA*	*606407*	*6152434*	*50*	*CCWA*	*Albany*	*6/81 - 5/85, 9/98, 9/08*
White (Narrogin)	WHIN	542630	6347335	50	CCWA	Narrogin	6/81 - 5/85, 9/97 onwards
White Water	WHIW	558770	6399914	50	CCWA	Corrigin	6/81 - 11/91, 9/97 onwards
Wild Horse	*WILD*	*473637*	*6273462*	*50*	*CCWA*	*West Arthur*	*6/81 - 5/85, 4/00, 9/09*
Wilson	WILS	382325	6189429	50	CCWA	Manjimup	5/91 onwards
Yaalup	YAAL	647443	6263830	50	CCWA	Kent	7/82 onwards
Yarnup	YARN	487368	6196543	50	CCWA	Cranbrook	9/80 onwards
Yarra Yarra	YARR	379957	6726980	50	CCWA	Carnamah	7/81 - 5/85, 9/97 onwards
Yeagarup	YEAG			50	CCWA	Manjimup	9/11 onwards
Yeagarup South	YEAS			50	CCWA	Manjimup	9/11 onwards
Yealering	YEAL	558587	6393389	50	LGA	Wickepin	6/78 onwards
Yellilup	YELL	686899	6201353	50	Private	Jerramungup	11/85 onwards
Yurine	YURI	385171	6543598	50	CCWA	Gingin	5/79 - 11/91, 5/09 onwards

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number (e.g. Albany 26385).
2. Coordinates (eastings and northings) are of depth gauge Bench Marks (local survey datums). These have been installed on higher ground at or near the edge of each monitored wetland, close to the depth gauge or gauge 'cluster' of that wetland. The accuracy of the coordinates of most (all coords except those highlighted in gray) has been improved from approx ±100m to approx ±5m in 2008-09 and subsequent years, principally by re-survey with hand-held GPS units (Garmin GPSmap 60Cx), using theWGS84 world datum, which for practical purposes equates to GDA94. The Taarblin North, Colletts Road, Yeagarup and Yeagarup South Bench Marks have not yet been installed.
3. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land); WRC (Water & Rivers Commission). DEC has management responsibility for wetlands vested in CCWA.
4. 'Period Monitored' is described by the first and last records, for any parameter, of discrete periods of monitoring.
5. Routine monitoring was conducted every second month (Jan, Mar, May, Jul, Sep, Nov) from May 1981 to May 1985 and twice-yearly (Sep, Nov) prior to and after that four-year period and, in the case of the 101 'current' wetlands (i.e. those not shown in italics above) is ongoing.
6. A few wetlands (e.g. Forrestdale, Clifton) have been monitored more frequently (than at two-month intervals) for varying periods.
7. The 53 SWWMP wetlands shown in *italics* have been monitored under SWWMP at various times in the past, but are not currently monitored, not at least under SWWMP. They are additional to the 101 'current' wetlands.
8. Wetlands not shown in italics are the 101 'current' SWWMP wetlands being routinely monitored by the authors for surface water depth, salinity, pH and (until 2007) nutrients, under the State Salinity Strategy. These include 23 of the 25 Intensively Monitored wetlands shown in bold.
9. Wetlands shown in **bold** are the 25 SWWMP wetlands Intensively Monitored by other DEC scientific staff under the State Salinity Strategy for potential changes in plant and animal communities, shallow groundwater levels and detailed water chemistry.
10. Beverley Lakes is also known as Yenyenning Lakes; Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp, Frasers Lake as Maisey's 1 or Maisey's A; Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.

Table 1 Notes continued.

11. Taarblin North and Taarblin South refer to the northern and southern basins respectively of one wetland (Taarblin).

Table 2. Monitored wetlands by DEC Regions and Districts, with tenure, Reserve No. and Name.

See Table 1 for the coordinates (eastings and northings) of each wetland.

No.	DEC Region	No.	DEC District	No.	Wetland[1]	Tenure[2]	Reserve No.[7]	Reserve Name[3, 7]
1	*Midwest*	*1*	*Geraldton*	*1*	*Hebitons*	*Private*	-	-
2	*Midwest*	*2*	*Moora*	*1*	***Blue Gum***[4]	*Private*	-	-
3	*Midwest*	*3*	*Moora*	*2*	*Capamaura*[5]	*CCWA*	A 24618	Capamauro NR
4	Midwest	4	Moora	3	Crackers	CCWA	28558	Namming NR
5	Midwest	5	Moora	4	**Eganu**	CCWA	A 25210	Pimjarrega NR
6	Midwest	6	Moora	5	Eneminga	CCWA	A 27394	Eneminga NR
7	Midwest	7	Moora	6	Guraga	LGA	31223	-
8	Midwest	8	Moora	7	**Logue**	CCWA	29073	Lake Logue NR
9	*Midwest*	*9*	*Moora*	*8*	*Pinjarrega*	*CCWA*	*A 25210*	*Pimjarrega NR*
10	*Midwest*	*10*	*Moora*	*9*	*Streets*	*Private*	-	-
11	Midwest	11	Moora	10	Yarra Yarra	CCWA	A 26442	Yarra Yarra Lakes NR
12	South Coast	1	Albany	1	Albany 26385	CCWA	26385	-
13	South Coast	2	Albany	2	Albany 27157	CCWA	27157	Cheyne Road NR
14	*South Coast*	*3*	*Albany*	*3*	*Angove*	*CCWA*	*A 27956*	*Two Peoples Bay NR*
15	*South Coast*	*4*	*Albany*	*4*	*Camel*	*CCWA*	*A 26161*	*Camel Lake NR*
16	South Coast	5	Albany	5	Collets Road	CCWA	-	Fitzgerald River NP
17	*South Coast*	*6*	*Albany*	*6*	*Cranbrook 25812*	*CCWA*	*A 25812*	-
18	*South Coast*	*7*	*Albany*	*7*	*Gardner*	*CCWA*	*A 27956*	*Two Peoples Bay NR*
19	*South Coast*	*8*	*Albany*	*8*	*Gnowangerup 26264*	*CCWA*	*26264*	*Mailalup NR*
20	South Coast	9	Albany	9	Jerdacuttup	CCWA	A 40156	Jerdacuttup Lakes NR
21	South Coast	10	Albany	10	Mettler	CCWA	26894	Mettler Lake NR
22	South Coast	11	Albany	11	Moates	CCWA	A 27956	Two Peoples Bay NR
23	South Coast	12	Albany	12	Pabelup South	CCWA	-	Fitzgerald River NP
24	South Coast	13	Albany	13	Pillenorup	CCWA	-	Stirling Range NP
25	*South Coast*	*14*	*Albany*	*14*	*Plantagenet 25386*	*CCWA*	*A 25386*	*Chillinup NR*
26	South Coast	15	Albany	15	**Pleasant View**	CCWA	A 15107	Lake Pleasant View NR
27	South Coast	16	Albany	16	Powell	CCWA	A 25809	Lake Powell NR
28	*South Coast*	*17*	*Albany*	*17*	*White (Albany)*	*CCWA*	*A 36550*	*North Sister NR*
29	South Coast	18	Albany	18	Yellilup	Private	-	-
30	South Coast	19	Esperance	1	**Coomalbidgup**	LGA	24633	-
31	*South Coast*	*20*	*Esperance*	*2*	*Dundas 33113*	*CCWA*	*A 33113*	-
32	South Coast	21	Esperance	3	Esperance 26410	CCWA	26410	-
33	*South Coast*	*22*	*Esperance*	*4*	*Esperance 27768*	*CCWA*	*27768*	-
34	*South Coast*	*23*	*Esperance*	*5*	*Esperance 27985*	*CCWA*	*27985*	-
35	*South Coast*	*24*	*Esperance*	*6*	*Esperance 32128*	*CCWA*	*A 32128*	-
36	*South Coast*	*25*	*Esperance*	*7*	*Esperance 32776*	*CCWA*	*A 32776*	-
37	South Coast	26	Esperance	8	Gore	CCWA	A 32419	Lake Gore NR
38	South Coast	27	Esperance	9	Mortijinup	CCWA	A 35557	Lake Mortijinup NR
39	South Coast	28	Esperance	10	Mount Le Grand	CCWA	A 22795	Cape Le Grand NP
40	South Coast	29	Esperance	11	North Parriup	CCWA	A 32339	Lake Shaster NR
41	South Coast	30	Esperance	12	Shark	CCWA	A 31197	Shark Lake NR
42	*South Coast*	*31*	*Esperance*	*13*	*Shaster*	*CCWA*	*A 32339*	*Lake Shaster NR*
43	South Coast	32	Esperance	14	Station	CCWA	A 23825	Mullet Lake NR
44	South Coast	33	Esperance	15	Warden	CCWA	A 32257	Lake Warden NR
45	South Coast	34	Esperance	16	**Wheatfield**	CCWA	A 15231	Woody Lake NR
46	South West	1	Blackwood	1	**Boyup Brook 18239**[6]	CCWA	18239	Kulicup NR
47	South West	2	Blackwood	2	Broadwater	CCWA	27080	
48	South West	3	Blackwood	3	Davies	CCWA	30826	Leeuwin-Naturaliste NP
49	South West	4	Wellington	1	Egret	CCWA	38393	Morangel NR
50	South West	5	Wellington	2	Harvey 12632	CCWA	12632	Riverdale NR
51	South West	6	Wellington	3	**Towerrinning**	CCWA	A 24917	Towerrinning NR
52	*South West*	*7*	*Wellington*	*4*	*Wild Horse*	*CCWA*	*A 1740*	*Wild Horse Swamp NR*
53	Swan	1	Perth Hills	1	Chandala	CCWA	A 37060	Chandala NR
54	*Swan*	*2*	*Perth Hills*	*2*	*Chittering*	*CCWA*	*A 29538*	*Chittering Lakes NR*
55	Swan	3	Perth Hills	3	Dobaderry	CCWA	A 43281	Wandoo Cons. Park

Table 2 continued.

No.	DEC Region	No.	DEC District	No.	Wetland	Tenure	Reserve No.	Reserve Name
56	Swan	4	Perth Hills	4	Goonaping	CCWA	A 43281	Wandoo Cons. Park
57	Swan	5	Swan Coastal	1	Bambun	CCWA	A 26756	Bambanup NR
58	Swan	6	Swan Coastal	2	Clifton	CCWA		Yalgorup NP
59	*Swan*	*7*	*Swan Coastal*	*3*	*Ellen Brook*	*CCWA*	*A 27620*	*Ellen Brook NR*
60	Swan	8	Swan Coastal	4	Forrestdale	CCWA	A 24781	Forrestdale Lake NR
61	Swan	9	Swan Coastal	5	Gibbs	CCWA	48797	
62	*Swan*	*10*	*Swan Coastal*	*6*	*Gingin 31241*	*CCWA*	*31241*	
63	Swan	11	Swan Coastal	7	Jandabup	CCWA	7349	Jandabup NR
64	Swan	12	Swan Coastal	8	Joondalup	CCWA	A 31048	Lake Joondalup NR
65	*Swan*	*13*	*Swan Coastal*	*9*	*Karakin*	*WRC*	*7504*	-
66	Swan	14	Swan Coastal	10	McLarty	CCWA	A 39404	Lake McLarty NR
67	*Swan*	*15*	*Swan Coastal*	*11*	*Mungala*	*CCWA*	A 26756	Bambanup NR
68	*Swan*	*16*	*Swan Coastal*	*12*	*Murray 24739*	*CCWA*	*A 24739*	
69	*Swan*	*17*	*Swan Coastal*	*13*	*Nambung*	*CCWA*	A 26756	Bambanup NR
70	Swan	18	Swan Coastal	14	Nine Mile	CCWA	A 16907	Nine Mile Lake NR
71	Swan	19	Swan Coastal	15	Thomsons	CCWA	A 15556	Thomsons Lake NR
72	*Swan*	*20*	*Swan Coastal*	*16*	*Twin Swamps N-W*	*CCWA*	*A 27621*	*Twin Swamps NR*
73	*Swan*	*21*	*Swan Coastal*	*17*	*Wallering*	*CCWA*	A 26756	Bambanup NR
74	Swan	22	Swan Coastal	18	Wannamal	CCWA	A 9838	Lake Wannamal NR
75	Swan	23	Swan Coastal	19	Yurine	CCWA	A 9676	Yurine Swamp NR
76	Warren	1	Donnelly	1	Byenup	CCWA	A 31880	Lake Muir NR
77	Warren	2	Donnelly	2	Jasper	CCWA	36996	D'Entrecasteaux NP
78	Warren	3	Donnelly	3	Maringup	CCWA	36996	D'Entrecasteaux NP
79	Warren	4	Donnelly	4	Muir	CCWA	A 31880	Lake Muir NR
80	Warren	5	Donnelly	5	**Noobijup**	CCWA	A 26680	Noobijup NR
81	Warren	6	Donnelly	6	Poorginup	CCWA	A 31880	Lake Muir NR
82	*Warren*	*7*	*Donnelly*	*7*	*Red (Manjimup)*	*UCL*		
83	Warren	8	Donnelly	8	Tordit-Gurrup	CCWA	A 31880	Lake Muir NR
84	Warren	9	Donnelly	9	Unicup	CCWA	A 25798	Unicup NR
85	Warren	10	Donnelly	10	Wilson	CCWA	A 36996	D'Entrecasteaux NP
86	Warren	11	Donnelly	11	Yarnup	CCWA	29601	Yarnup NR
87	Warren	12	Donnelly	12	Yeagarup	CCWA	A 47878	Greater Hawke NP
88	Warren	13	Donnelly	13	Yeagarup South	CCWA	A 36996	D'Entrecasteaux NP
89	Warren	14	Frankland	1	Boat Harbour 1	CCWA	A 41010	Owingup NR
90	Warren	15	Frankland	2	Kwornicup	CCWA	32284	Kwornicup NR
91	Warren	16	Frankland	3	Owingup	CCWA	A 41010	Owingup NR
92	Wheatbelt	1	Central	1	**Ardath**	CCWA	A 25062	Seagroatt NR
93	Wheatbelt	2	Central	2	Beverley[6]	CCWA / LGA	31837	Yenyenning Lakes NR
94	*Wheatbelt*	*3*	*Central*	*3*	*Bruce Rock 30969*	*CCWA*	*A 30969*	*Kwolyin NR*
95	Wheatbelt	4	Central	4	**Campion**	CCWA	24789	Lake Campion NR
96	*Wheatbelt*	*5*	*Central*	*5*	*Cronin*	*CCWA*	*A 36526*	*Lake Cronin NR*
97	*Wheatbelt*	*6*	*Central*	*6*	*Dowerin*	*LGA*	*4244*	
98	*Wheatbelt*	*7*	*Central*	*7*	***Frasers***[6]	*Private*	-	-
99	*Wheatbelt*	*8*	*Central*	*8*	*Goorly*	*UCL*	-	-
100	Wheatbelt	9	Central	9	Hinds	CCWA	A 16305	Lake Hinds NR
101	*Wheatbelt*	*10*	*Central*	*10*	*Mollerin*	*CCWA*	*A 14429*	*Mollerin NR*
102	*Wheatbelt*	*11*	*Central*	*11*	*Mt Marshall 26687*[6]	*CCWA*	*A 26687*	*North Wallambin NR*
103	Wheatbelt	12	Central	12	Ninan	CCWA	A 27026	Lake Ninan NR
104	Wheatbelt	13	Central	13	Noonying	CCWA	A 10313	Noonying NR
105	Wheatbelt	14	Central	14	Red (Bruce Rock)	CCWA	A 16493	Red Lake NR
106	Wheatbelt	15	Central	15	**Walyormouring**	CCWA	A 17186	Walyormouring NR
107	*Wheatbelt*	*16*	*Great Southern*	*1*	*Ace*	*CCWA*	*A 34522*	*Lake Ace NR*
108	Wheatbelt	17	Great Southern	2	**Altham**	CCWA	A 28395	Chinocup NR
109	Wheatbelt	18	Great Southern	3	Anderson	CCWA	A 25914	Anderson Lake NR
110	Wheatbelt	19	Great Southern	4	Atkins Yate	Private	-	-
111	Wheatbelt	20	Great Southern	5	**Bennetts**	CCWA	36445	Dunn Rock NR
112	*Wheatbelt*	*21*	*Great Southern*	*6*	*Biddy*	*CCWA*	*17617*	*Lake Biddy NR*

Table 2 continued.

No.	DEC Region	No.	DEC District	No.	Wetland	Tenure	Reserve No.	Reserve Name
113	*Wheatbelt*	*22*	*Great Southern*	*7*	*Bokan*	*CCWA*	*9628*	*Bokan NR*
114	Wheatbelt	23	Great Southern	8	Brown	CCWA	A 24428	Nonalling NR
115	Wheatbelt	24	Great Southern	9	**Bryde**	MWR	28667	
116	*Wheatbelt*	*25*	*Great Southern*	*10*	*Cairlocup*	*CCWA*	*28324*	*Cairlocup NR*
117	Wheatbelt	26	Great Southern	11	Casuarina	CCWA	A 25136	Coblinine NR
118	*Wheatbelt*	*27*	*Great Southern*	*12*	*Coblinine*	*CCWA*	*A 25133*	*Coblinine NR*
119	Wheatbelt	28	Great Southern	13	**Coomelberrup**	CCWA	A 10472	Coomelberrup NR
120	Wheatbelt	29	Great Southern	14	**Corrigin 12900**[6]	CCWA	12900	Paperbark NR
121	Wheatbelt	30	Great Southern	15	**Coyrecup**	CCWA	A 28552	Coyrecup NR
122	Wheatbelt	31	Great Southern	16	Dulbinning	CCWA	A 9617	
123	Wheatbelt	32	Great Southern	17	**Dumbleyung**	CCWA / LGA	26664	Dumbleyung Lake NR
124	Wheatbelt	33	Great Southern	18	Flagstaff	CCWA	A 27609	Flagstaff Lake NR
125	*Wheatbelt*	*34*	*Great Southern*	*19*	*Gnowangerup 26569*	*CCWA*	*A 26569*	
126	*Wheatbelt*	*35*	*Great Southern*	*20*	*Gounter*	*CCWA*	*A 21253*	*Lake Gounter NR*
127	*Wheatbelt*	*36*	*Great Southern*	*21*	*Gundaring*	*CCWA*	*A 24373*	*Gundaring Lake NR*
128	Wheatbelt	37	Great Southern	22	Kent 29020[6]	CCWA	A 29020	Lake Bryde NR
129	*Wheatbelt*	*38*	*Great Southern*	*23*	*Kondinin*	*CCWA*	*A 22519*	*Kondinin Lake NR*
130	*Wheatbelt*	*39*	*Great Southern*	*24*	*Kwobrup*	*Private*	-	-
131	Wheatbelt	40	Great Southern	25	Little White	CCWA	A 26786	Carmody NR
132	Wheatbelt	41	Great Southern	26	Martinup	CCWA	A 17055	Martinup NR
133	Wheatbelt	42	Great Southern	27	Mears	CCWA	A 12398	Lake Mears NR
134	*Wheatbelt*	*43*	*Great Southern*	*28*	*Miripin*	*CCWA*	*A 24912*	*Miripin NR*
135	*Wheatbelt*	*44*	*Great Southern*	*29*	*Murapin*	*CCWA*	*A 17257*	*Murapin NR*
136	Wheatbelt	45	Great Southern	30	Ngopitchup	WRC	2184	
137	*Wheatbelt*	*46*	*Great Southern*	*31*	*Nonalling*	*CCWA*	*A 24428*	*Nonalling NR*
138	*Wheatbelt*	*47*	*Great Southern*	*32*	*Pallarup*	*CCWA*	*A 29860*	*Pallarup NR*
139	Wheatbelt	48	Great Southern	33	**Parkeyerring**	CCWA	A 10733	Parkeyerring NR
140	*Wheatbelt*	*49*	*Great Southern*	*34*	*Queerearrup*	*LGA*	*17255*	
141	Wheatbelt	50	Great Southern	35	Range Road Yate	MWR	29124	
142	Wheatbelt	51	Great Southern	36	**Ronnerup**	CCWA	A 39422	Lake King NR
143a	Wheatbelt	52a	Great Southern	37a	Taarblin North	CCWA	A 9550	Taarblin Lake NR
143b	Wheatbelt	52b	Great Southern	38b	Taarblin South	CCWA	A 9550	Taarblin Lake NR
144	Wheatbelt	53	Great Southern	38	**Toolibin**	CCWA	A 24556	Toolibin NR
145	Wheatbelt	54	Great Southern	39	Varley	CCWA	A 27928	Lake Varley NR
146	*Wheatbelt*	*55*	*Great Southern*	*40*	*Wagin 2088*	*CCWA*	*A 2088*	*Casuarina NR*
147	Wheatbelt	56	Great Southern	41	Walbyring	CCWA	A 14398	Walbyring NR
148	*Wheatbelt*	*57*	*Great Southern*	*42*	*Wardering*	*CCWA*	*A 17258*	*Wardering Lake NR*
149	Wheatbelt	58	Great Southern	43	Warrinup	CCWA	A 1931	Warrenup NR
150	Wheatbelt	59	Great Southern	44	West Arthur 5456	CCWA	A 5456	Dead Mans Swamp NR
151	Wheatbelt	60	Great Southern	45	White (Narrogin)	CCWA	A 21284	Quongunnerunding NR
152	Wheatbelt	61	Great Southern	46	White Water	CCWA	A 24428	Nonalling NR
153	Wheatbelt	62	Great Southern	47	**Yaalup**	CCWA	A 36967	
154	Wheatbelt	63	Great Southern	48	Yealering	LGA	9610	

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number, e.g. Albany 26385.
2. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land); WRC (Water & Rivers Commission). DEC has management responsibility for wetlands vested in CCWA.
3. Entries in the 'Reserve No.' and 'Reserve Name' columns are incomplete and unchecked.
4. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).
5. In addition to the 101 SWWMP wetlands currently being monitored under the State Salinity Strategy there are 53 SWWMP wetlands that have been monitored at some time in the past, but are not currently being monitored under SWWMP. These 53 are shown above in *italics.*

Table 2 Notes continued.

6. Beverley Lakes is also known as Yenyenning Lakes, Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp, Frasers Lake as Maisey's 1 or Maisey's A; Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.
7. Reserves in some instances do not include all of the relevant SWWMP wetland.

Table 3. Number of current and historically-monitored wetlands in each DEC Region and District.

DEC Region (Current, historical)	DEC District	Current	Historical
Midwest (6, 5)	Geraldton	0	1
	Moora	6	4
South Coast (21, 13)	Albany	11	7
	Esperance	10	6
South West (6, 1)	Blackwood	3	0
	Wellington	3	1
Swan (14, 9)	Perth Hills	3	1
	Swan Coastal	11	8
Warren (15, 1)	Donnelly	12	1
	Frankland	3	0
Wheatbelt (39, 24)	Central	8	7
	Great Southern	31	17
Totals (101, 53)		**101**	**53**

The locations of DEC Regional and District Headquarters are, in most instances, not obvious from Region or District names and are therefore listed below, for the convenience of readers.

DEC Region / District	HQ Location
Midwest /	Geraldton
Geraldton	Geraldton
Moora	Jurien Bay
South Coast /	Albany
Albany	Albany
Esperance	Esperance
South West /	Bunbury
Blackwood	Busselton
Wellington	Collie
Swan /	Bentley
Perth Hills	Mundaring
Swan Coastal	Wanneroo
Warren /	Manjimup
Donnelly	Pemberton
Frankland	Walpole
Wheatbelt /	Narrogin
Central	Merredin
Great Southern	Narrogin

Table 4. Ramsar and Directory Sites of south-western Australia, and their SWWMP wetlands.

A. Ramsar Sites (each contains one or more Directory Site).

Ramsar Site	Directory Site	SWWMP wetland
Becher Point Wetlands	Becher Point Wetlands	-
Forrestdale & Thomsons Lakes	Forrestdale Lake	Forrestdale
	Thomsons Lake	Thomsons
Lake Gore	Lake Gore System	Gore
Muir-Byenup System	(southern part of) Byenup Lagoon System	Byenup, Poorginup, Tordit-Gurrup
	Lake Muir	Muir
Peel-Yalgorup System	Yalgorup Lakes System	Clifton
	Lake McLarty System	McLarty, *Murray 24739*
Toolibin Lake	Toolibin Lake	**Toolibin**
Vasse-Wonnerup System	Vasse-Wonnerup Wetland System	-
Lake Warden System	Lake Warden System	Station, Warden, **Wheatfield**
		13 Current *1 Historical*

B. Other Directory Sites (not within Ramsar Sites).

Directory Site	SWWMP wetland
Balicup Lake System	*Camel*
Barraghup Swamp	-
Benger Swamp	-
Bennetts Lake	**Bennetts**
Booragoon Lake	-
Brixton Street Swamps	-
Lake Bryde – East Lake Bryde	**Bryde**, Kent 29020
(northern part of) Byenup Lagoon System	**Noobijup**, Unicup, Yarnup
Cape Leeuwin System	-
Chandala Swamp	Chandala
Chittering-Needonga Lakes	*Chittering*
Coyrecup Lake	**Coyrecup**
Lake Cronin	*Cronin*
Doggerup Creek System	-
Dumbleyung Lake	**Dumbleyung**
Dunn Rock Gnamma Holes	-
Ellen Brook Swamps System	*Ellen Brook, Twin Swamps NW*
Gibbs Road Swamp System	Gibbs
Gingilup-Jasper Wetland System	Jasper, Wilson
Lake Grace System	**Altham**
Guraga Lake	Guraga
Herdsman Lake	-
Hutt Lagoon System	-
Joondalup Lake	Joondalup
Karakin Lakes	*Karakin*
Kondinin Samphire Marsh	-
Lancelin Defence Training Area (Cwlth)	-
Lake Logue-Indoon System	**Logue**
Maringup Lake	Maringup

Directory Site	SWWMP wetland
McCarley's Swamp (Ludlow Swamp)	-
Loch McNess System	-
Moates Lake System	Moates, *Angove*, *Gardner*
Mortijinup Lake System	Mortijinup
Mount Soho Swamps	-
Owingup Swamp System	Boat Harbour 1, Owingup
Palmer Barracks, Guildford (Cwlth)	-
Paperbark Swamp	**Corrigin 12900**
Perth Airport Woodland Swamps (Cwlth)	-
Pink Lake	-
Lake Pleasant View System	Albany 26385, **Pleasant View**
RAAF Caversham (Cwlth)	-
Rottnest Island Lakes	-
Spectacles Swamp	-
Lake Thetis	-
Wannamal Lakes System	Wannamal
Yealering Lakes System	Brown, White Water, Yealering, *Nonalling*
Yellilup Yate Swamp System	Yellilup
Yorkrakine Rock Pools	-
	29 Current *9 Historical*

The 'Directory' is 'A Directory of Important Wetlands in Australia', a cooperative project of the State, Territory and Commonwealth Governments. Three editions have been published, in 1993, 1996 and 2001. The Directory continues to be added to and updated from time to time (e.g. by Elscot *et al.* 2009). It is accessible online at http://www.environment.gov.au.

Nine south-west Western Australian Directory Sites are not listed in Tables 4A or 4B, because they are essentially riverine or estuarine and do not contain SWWMP-monitored wetlands. They are Peel-Harvey Estuary (part of Peel-Yalgorup Ramsar Site), Avon River Valley, Blackwood River (Lower Reaches) and Tributaries, Broke Inlet System, Culham Lake System, Fitzgerald Inlet System, Murchison River (Lower Reaches), Oyster Harbour and Swan-Canning Estuary.

Wetlands shown in *italics* have been monitored in the past under SWWMP, but not currently.

Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).

Table 5. Natural Diversity Recovery Catchments and their SWWMP wetlands.

Natural Diversity Recovery Catchment	DEC Region	DEC District	SWWMP-monitored wetlands
Lake Bryde	Wheatbelt	Great Southern	**Bryde**, Kent 29020
Buntine-Marchagee	Wheatbelt	Central	-
Drummond	Swan	Perth Hills	-
Esperance Lakes	South Coast	Esperance	Shark, Station, Warden, **Wheatfield**
Muir-Unicup	Warren	Donnelly	Byenup, Muir, **Noobijup**, Poorginup, Tordit-Gurrup, Unicup, Yarnup, *Red (Manjimup)*
Toolibin Lake	Wheatbelt	Great Southern	Dulbinning, Taarblin, **Toolibin**, Walbyring
			17 Current *1 Historical*

Notes:

1. Kent 29020 is also known as East Lake Bryde
2. Taarblin has two basins, north and south. Both are monitored.
3. *Red (Manjimup)* has been monitored in the past under SWWMP, but is not currently.
4. Most of the wetlands listed above, and some others (non-SWWMP wetlands) not listed, are also monitored under Recovery Catchment programs. Nonetheless it is considered important to continue the twice-yearly routine monitoring under SWWMP, which in all cases pre-dates the establishment of the Natural Diversity Recovery Catchments and their programs.
5. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).

Table 6. Bathymetrically-mapped SWWMP wetlands.

All SWWMP wetlands known by the authors to have been bathymetrically-mapped are listed in the Table below, together with the years of mapping, methods employed, products and custodians / sources.

No.	Wetland	Custodian / Source	Year of Mapping	Products	Methods / Comment
1	**Ardath** [1]	DEC	2004	Paper map. Digital data. D-V calc. [4]	RTK [5]
2	Beverley [2]	DEC	2002/3	Paper map. Digital data. D-V calc.	RTK
3	**Bryde**	DEC	2002	Paper map. Digital data. D-V calc.	RTK
4	Byenup	DEC	2009	Digital data. Maps in preparation.	RTK
5	Clifton	DoW		Not seen.	Mapping referred to by Knott *et al*. (2003).
6	**Campion**	DEC	2004/6/7	Paper map. Digital data. D-V calc.	RTK
7	**Coyrecup**	DEC	2001	Paper map. Digital data. D-V calc. D-SA calc.[4]	RTK at 100m intervals on 9 E-W transects 300m apart.
	Dulbinning	-	-	-	See Water Authority file 00617SW for inflow & outflow channel and some lakebed elevns.
8	**Dumbleyung**	DEC	1998/01	Paper map. Digital data. D-V calc. D-SA calc.	RTK of bed at 100m intervals on 8 E-W transects 1km apart; Photogrammetry of shore. Correction of outflow elevation in 2002.
9	Forrestdale	DoW		Paper map.	Metropolitan Water Board Special Plan 81C, FB 11318, Stadia Book 11319. Arnold (1990d) pp 356, 357, 359, 360.
10	Gore	DEC	2003	Paper map. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
11	Hinds	DEC	2000/1	Paper & PDF maps. Digital data. D-V calc.	
12	Jandabup	DoW		Paper map. 1:5,000.	MWB Special Plan 115, File 763107/74, Stadia L.B. 11650. Arnold (1990a) pp 60, 61, 66.
13	Jasper				Depth transects are shown in Dortch (1996).
14	Joondalup	DoW		Paper map. 1:5,000.	MWB Special Plan 117B, File 763107/74, Stadia L.B. 11651. Arnold (1990b) pp 104, 110-112.
15	Kent 29020 [2]	DEC	2002	Paper map. Digital data. D-V calc.	RTK
16	Mears	DEC	2003	Paper map. Digital data. D-V calc.	RTK
17	*Mollerin* [3]	*DEC*	*2004*	*Paper map. Digital data*	*Photogrammetry and RTK ground truthing.*
18	*Mt Marshall 26687* [2]	*DEC*	*2004*	*Paper map. Digital data. D-V calc.*	*RTK*
19	Ninan	DEC	2000	Paper & PDF maps. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
20	Powell	DoW	2003?		
21	Shark	DEC	2003	Paper map. Digital data. D-V calc.	Boat-based RTK.
22	Station	DEC	2002	Paper map. Digital data. D-V calc.	RTK
23a	Taarblin North	DEC	2004	Paper & PDF maps. Digital data. D-V calc.	RTK
24	Thomsons			Paper maps.	See Arnold (1990c) pp 266, 267, 269, 270. Davis *et al.* (2001).
25	**Toolibin**	DoW		Scanned copy of paper map, '609 009 PWD WA 54732', with spot heights and 0.5mAHD contours	Also see Water Authority file 00617SW for inflow & outflow channel and W bank elevns.
26	**Towerrinning**	Froend & McComb (1991)	1986	≈1:25,000 paper map (<A4); 0.5m contours to –2.5m, shoreline = 0.0m	Weighted graduated rope; ≈50m intervals on 7 transects (4 E-W, 3 N-S) ≈500m apart.
	Walbyring	-	-	-	See DoW (Water Authority) file 00617SW for inflow channel elevations.
27	Warden	DEC	2002	Paper map. Digital data. D-V calc.	Boat-based RTK and echo-sounding.
28	**Wheatfield**	DEC	2002	Paper map. Digital data. D-V calc.	Boat-based RTK.

Notes:

1. Wetlands shown in **bold** are in the group of 25 Intensively Monitored wetlands (see Note 9 of Table 1).
2. Beverley Lakes is also known as Yenyenning Lakes, Kent 29020 as East Lake Bryde and Mt Marshall 26687 as Wallambin North.
3. Wetlands shown in *italics* have been monitored in the past under SWWMP, but not currently.
4. 'D-V calc.' and 'D-SA calc.' are Depth to Volume and Depth to Surface Area calculators, derived from the bathymetry.
5. 'RTK' refers to collecting 3-dimensional position (point) data using the Real-Time Kinematic Differential Global Positioning System (RTK DGPS).
6. SWWMP personnel have participated in mapping several non-SWWMP wetlands, these being Bokarup, Brown (connected to Campion), Cowcowing, Quallilup, and other wetlands (in addition to Station, Warden and Wheatfield) in the Lake Warden System, namely Ewans, Mullet, Windabout and Woody.

Table 7. SWWMP wetlands for which aerial oblique photography is available. High-resolution, low altitude, aerial oblique photographs of the following SWWMP wetlands were captured by DEC during 2008-2011. Requests for these photographs should be directed to jim.lane@dec.wa.gov.au. A small charge for supply may be required.

No.	Wetland Name[1]	Code	Tenure[2]	Local Government Authority	Date of Photography
1	*Ace*[3]	*ACE*	*CCWA*	*Lake Grace*	*17 May 2009*
2	Albany 26385[4]	ALB1	CCWA	Albany	21 May 2008
3	Albany 27157	ALB2	CCWA	Albany	21 May 2008, 28 May 2011
4	**Altham**[5]	ALTH	CCWA	Kent	17 May 2009
5	Anderson	ANDE	CCWA	Tambellup	21 May 2008
6	*Angove*	*ANGO*	*CCWA*	*Albany*	*21 May 2008*
7	**Ardath**	ARDA	CCWA	Bruce Rock	07 June 2010
8	Atkins Yate	ATKI	Private	Lake Grace	17 May 2009
9	Bambun	BAMB	CCWA	Gingin	06 June 2010
10	**Bennetts**	BENN	CCWA	Lake Grace	17 May 2009
11	Beverley[6]	BEVE	CCWA / LGA	Beverley / Brookton / Quairading	07 June 2010
12	*Biddy*	*BIDD*	*CCWA*	*Lake Grace*	*26 May 2010*
13	**Blue Gum**	BLUE	Private	Moora	07 June 2010
14	Boat Harbour 1	BOA1	CCWA	Denmark	26 May 2008, 27 May 2011
15	*Bokan*	*BOKA*	*CCWA*	*Narrogin*	*26 May 2010*
16	**Boyup Brook 18239**[6]	BOYU	CCWA	Boyup Brook	19 May 2008
17	Broadwater	BROA	CCWA	Busselton	6, 11 & 12 May 2011
18	Brown	BROW	CCWA	Corrigin	07 June 2010
19	**Bryde**	BRYD	CCWA	Kent	17 May 2009
20	Byenup	BYEN	CCWA	Manjimup	24 May 2008, 11 May 2011
21	*Cairlocup*	*CAIR*	*CCWA*	*Kent*	*17 May 2009*
22	*Camel*	*CAME*	*CCWA*	*Cranbrook*	*21 May 2008*
23	*Capamaura*	*CAPA*	*CCWA*	*Carnamah*	*07 June 2010*
24	Casuarina	CASU	CCWA	Katanning	17 May 2009
25	Chandala	CHAN	CCWA	Chittering	06 June 2010
26	*Chittering*	*CHIT*	*CCWA*	*Chittering*	*06 June 2010*
27	Clifton	CLIF	CCWA	Mandurah / Waroona	29 May 2011
28	*Coblinine*	*COBL*	*CCWA*	*Dumbleyung*	*17 May 2009*
29	Collets Road	COLL	CCWA	Jerramungup	16 May 2009
30	**Coomalbidgup**	CMBG	LGA	Esperance	16 May 2009
31	**Coomelberrup**	COOM	CCWA	Dumbleyung	17 May 2009
32	**Corrigin 12900**[6]	CORR	CCWA	Corrigin	07 June 2010
33	**Coyrecup**	COYR	CCWA	Katanning	17 May 2009
34	Crackers	CRAC	CCWA	Dandaragan	07 June 2010
35	*Cranbrook 25812*	*CRAN*	*CCWA*	*Cranbrook*	*21 May 2008*
36	*Cronin*	*CRON*	*CCWA*	*Kondinin*	*26 May 2010*
37	Davies	DAVI	CCWA	Augusta-Margaret River	19 May 2008, 11 May 2011
38	Dobaderry	DOBA	CCWA	Beverley	07 June 2010
39	Dulbinning	DULB	CCWA	Wickepin	26 May 2010
40	**Dumbleyung**	DUMB	CCWA / LGA	Dumbleyung / Wagin	17May2009, 26May2010
41	*Dundas 33113*	*DUND*	*CCWA*	*Dundas*	*16 May 2009*
42	**Eganu**	EGAN	CCWA	Coorow	07 June 2010
43	Egret	EGRE	CCWA	Harvey	19 May 2008
44	*Ellen Brook*	*ELLE*	*CCWA*	*Swan*	*06 June 2010*
45	*Eneminga*	*ENEM*	*CCWA*	*Dandaragan*	*07 June 2010*

Table 7 continued.

No.	Wetland Name[1]	Code	Tenure[2]	Local Government Authority	Date of Photography
46	Esperance 26410	ESP1	CCWA	Esperance	16 May 2009
47	*Esperance 27768*	*ESP2*	*CCWA*	*Esperance*	*16 May 2009*
48	Esperance 27985	ESP3	CCWA	Esperance	16 May 2009
49	*Esperance 32128*	*ESP4*	*CCWA*	*Esperance*	*16 May 2009*
50	*Esperance 32776*	*ESP5*	*CCWA*	*Esperance*	*16 May 2009*
51	Flagstaff	FLAG	CCWA	Woodanilling	17 May 2009
52	Forrestdale	FORR	CCWA	Armadale	06 June 2010
53	*Gardner*	*GARD*	*CCWA*	*Albany*	*21 May 2008*
54	Gibbs	GIBB	CCWA	Armadale	06 June 2010
55	*Gingin 31241*	*GING*	*CCWA*	*Gingin*	*06 June 2010*
56	*Gnowangerup 26264*	*GNO1*	*CCWA*	*Gnowangerup*	*21 May 2008*
57	*Gnowangerup 26569*	*GNO2*	*CCWA*	*Gnowangerup*	*17 May 2009*
58	**Goonaping**	GOON	CCWA	Beverley	07 June 2010
59	Gore	GORE	CCWA	Esperance	16 May 2009
60	*Gounter*	*GOUN*	*CCWA*	*Kondinin*	*26 May 2010*
61	*Gundaring*	*GUND*	*CCWA*	*Wagin*	*17 May 2009*
62	Guraga	GURA	LGA	Dandaragan	07 June 2010
63	Harvey 12632	HARV	CCWA	Harvey	19 May 2008
64	Jandabup	JAND	CCWA	Wanneroo	06 June 2010
65	Jasper	JASP	CCWA	Nannup	20 May 2008
66	Jerdacuttup	JERD	CCWA	Ravensthorpe	16 May 2009
67	Joondalup	JOON	CCWA	Joondalup	06 June 2010
68	*Karakin*	*KARA*	*WRC*	*Gingin*	*06 June 2010*
69	Kent 29020[6]	KENT	CCWA	Kent	17 May 2009
70	*Kondinin*	*KOND*	*CCWA*	*Kondinin*	*07 June 2010*
71	*Kwobrup*	*KWOB*	*Private*	*Kent*	*17 May 2009*
72	Kwornicup	KWOR	CCWA	Plantagenet	21 May 2008
73	Little White	LITT	CCWA	Narrogin	26 May 2010
74	Maringup	MARI	CCWA	Manjimup	20 May 2008, 11 & 28 May 2011
75	Martinup	MART	CCWA		11 May 2011
76	McLarty	MCLA	CCWA	Murray	21 May 2008
77	Mears	MEAR	CCWA	Brookton	07 June 2010
78	Mettler	METT	CCWA	Albany	21 May 2008
79	*Miripin*	*MIRI*	*CCWA*	*Woodanilling*	*17 May 2009*
80	Moates	MOAT	CCWA	Albany	21 May 2008
81	Mortijinup	MORT	CCWA	Esperance	16 May 2009
82	Mount Le Grand	MLGR	CCWA	Esperance	16 May 2009
83	Muir	MUIR	CCWA	Manjimup	20 & 24 May 2008
84	*Mungala*	*MUNG*	*CCWA*	*Gingin*	*06 June 2010*
85	*Murapin*	*MURA*	*CCWA*	*Woodanilling*	*17 May 2009*
86	*Murray 24739*	*MURR*	*CCWA*	*Murray*	*21 May 2008*
87	*Nambung*	*NAMB*	*CCWA*	*Gingin*	*06 June 2010*
88	Ngopitchup	NGOP	WRC	Broomehill	24 May 2008
89	Nine Mile	NINE	CCWA	Murray	19 May 2008
90	*Nonalling*	*NONA*	*CCWA*	*Corrigin*	*07 June 2010*
91	**Noobijup**	NOOB	CCWA	Cranbrook	24 May 2008
92	North Parriup	NPAR	CCWA	Ravensthorpe	16 May 2009

Table 7 continued.

No.	Wetland Name[1]	Code	Tenure[2]	Local Government Authority	Date of Photography
93	Owingup	OWIN	CCWA	Denmark	20 May 2008
94	Pabelup South	PABE	CCWA	Jerramungup	16 May 2009
95	*Pallarup*	*PALL*	*CCWA*	*Lake Grace*	*17 May 2009*
96	Parkeyerring	PARK	CCWA		11 May 2011
97	Pillenorup	PILL	CCWA	Plantagenet	21 May 2008, 28 May 2011
98	*Pinjarrega*	*PINJ*	*CCWA*	*Coorow*	*07 June 2010*
99	*Plantagenet 25386*	*PLAN*	*CCWA*	*Plantagenet*	*21 May 2008*
100	**Pleasant View**	PLEA	CCWA	Albany	21 May 2008, 28 May 2011
101	Poorginup	POOR	CCWA	Manjimup	20 May 2008
102	Powell	POWE	CCWA	Albany	21 May 2008, 28 May 2011
103	*Queerearrup*	*QUEE*	*LGA*	*Woodanilling*	*17 May 2009*
104	Range Road Yate	RANG	MWR	Kent	17 May 2009
105	Red (Bruce Rock)	REDB	CCWA	Bruce Rock	07 June 2010
106	*Red (Manjimup)*	*REDM*	*UCL*	*Manjimup*	*24 May 2008*
107	**Ronnerup**	RONN	CCWA	Lake Grace	17 May 2009
108	Shark	SHAR	CCWA	Esperance	16 May 2009
109	*Shaster*	*SHAS*	*CCWA*	*Ravensthorpe*	*16 May 2009*
110	Station	STAT	CCWA	Esperance	16 May 2009
111	*Streets*	*STRE*	*Private*	*Moora*	*07 June 2010*
112a	Taarblin North[7]	TAAN	CCWA	Narrogin	26 May 2010
112b	Taarblin South[7]	TAAR	CCWA	Narrogin	26 May 2010
113	Thomsons	THOM	CCWA	Cockburn	06 June 2010
114	**Toolibin**	TOOL	CCWA	Wickepin	26May2010, 07Jun2010
115	Tordit-Gurrup	TORD	CCWA	Manjimup	20 May 2008 (limited), 11 (E) & 28 (W) May 2011
116	**Towerrinning**	TOWE	CCWA	West Arthur	24 May 2008
117	*Twin Swamps N-W*	*TWIN*	*CCWA*	*Swan*	*06 June 2010*
118	Unicup	UNIC	CCWA		11, 27 & 28 May 2011
119	Varley	VARL	CCWA	Kulin	26 May 2010
120	*Wagin 2088*	*WAGI*	*CCWA*	*Wagin*	*17 May 2009*
121	Walbyring	WALB	CCWA	Wickepin	26May2010, 07Jun2010
122	*Wallering*	*WALL*	*CCWA*	*Gingin*	*06 June 2010*
123	Wannamal	WANN	CCWA	Gingin	06 June 2010
124	Warden	WARD	CCWA	Esperance	16 May 2009
125	Warrinup	WARR	CCWA	Cranbrook	24 May 2008
126	*Wardering*	*WARD*	*CCWA*		*11 May 2011*
127	West Arthur	WEST	CCWA		11 & 27 May 2011
128	**Wheatfield**	WHEA	CCWA	Esperance	16 May 2009
129	*White (Albany)*	*WHIA*	*CCWA*	*Albany*	*21 May 2008*
130	White (Narrogin)	WHIN	CCWA	Narrogin	26May2010, 07Jun2010
131	White Water	WHIW	CCWA	Corrigin	07 June 2010
132	*Wild Horse*	*WILD*	*CCWA*	*West Arthur*	*19 May 2008*
133	Wilson	WILS	CCWA	Manjimup	20 May 2008
134	**Yaalup**	YAAL	CCWA	Kent	17 May 2009
135	Yarnup	YARN	CCWA	Cranbrook	24 May 2008, 27 May 2011
136	Yealering	YEAL	LGA	Wickepin	07 June 2010
137	Yellilup	YELL	Private	Jerramungup	21 May 2008, 28 May 2011
138	Yurine	YURI	CCWA	Gingin	06 June 2010

Table 7 continued.

Notes:

1. Wetlands without official names at the commencement of monitoring are identified by Local Government Authority and Reserve Number (e.g. Albany 26385).
2. CCWA (Conservation Commission of Western Australia); LGA (Local Government Authority); MWR (Minister for Water Resources); UCL (Unallocated Crown Land), WRC (Water & Rivers Commission). DEC has management responsibility for wetlands vested in CCWA.
3. The SWWMP wetlands shown in *italics* have been monitored under SWWMP at various times in the past, but are not currently monitored, not at least under SWWMP.
4. Wetlands not shown in italics are 'current' SWWMP wetlands being routinely monitored by the authors for surface water depth, salinity, pH and (until 2007) nutrients, under the State Salinity Strategy. These include the Intensively Monitored wetlands shown in bold.
5. Wetlands shown in **bold** are SWWMP wetlands being Intensively Monitored by other DEC scientific staff for potential changes in plant and animal communities, shallow groundwater levels and detailed water chemistry under the State Salinity Strategy. They are a subset of the 'current' wetlands.
6. Beverley Lakes is also known as Yenyenning Lakes; Boyup Brook 18239 as Kulicup Swamp; Corrigin 12900 as Paperbark Swamp and Kent 29020 as East Lake Bryde.
7. Taarblin North and Taarblin South refer to the northern and southern basins respectively of one wetland (Taarblin).

Table 8. Number of SWWMP wetlands with 1, 2, 3, etc. years of September and/or[1] November depth, pH and salinity data as at November 2011.

	No. of currently monitored wetlands			No. of historically monitored wetlands		
Number of years of Sep and/or[1] Nov data at Nov 2011	**With Depth data**	**With pH data**	**With Salinity data**	**With Depth data**	**With pH data**	**With Salinity data**
0	2				2	2
1		3	2		4	2
2			1	1	4	3
3				5	10	7
4				4	12	5
5				9	4	9
6		2	2	10		5
7		1		4	2	3
8		2	2		3	1
9	2	2	1		5	4
10		3	2	2	4	
11	4	2	2	4	2	6
12	7	7	6	2		1
13	4	3	3	11		3
14			2			
15		1	1			
16	3					
17	1	2	2			
18	2	7	3			
19	4	3	4			
20	4	5	4		1	
21	1	5	3			1
22		4	3	1		
23	2	3	6			
24	1	2	3			
25	1	3	3			
26	3	5	3			
27	5	5	3			
28	9	7	6			
29		10	1			
30	5	11	1			
31	4	3	10			1
32	13		10			
33	23		10			
34	1		2			
Total Wetlands	101	101	101	53	53	53

SUMMARY

	No. of currently monitored wetlands			No. of historically monitored wetlands		
Number of years of Sep and/or[1] Nov data at Nov 2011	**With Depth data**	**With pH data**	**With Salinity data**	**With Depth data**	**With pH data**	**With Salinity data**
≥ 10	97	91	93	20	7	12
≥ 20	72	63	68	1	1	2
≥ 30	46	14	33	0	0	1

Notes:

1. The objective is to monitor all SWWMP wetlands in both September *and* November each year. However, on occasions, circumstances may prevent data collection at one or a few wetlands in either Sep or Nov (rarely at same wetland in both months) of a particular year.
2. More wetlands have 10+, 20+, 30+ years of depth data than salinity (or pH) data because in most years some wetlands are dry in September and/or November.
3. Fewer wetlands have 10+, 20+, 30+ years of pH data than salinity data because routine pH monitoring began several years after depth and salinity monitoring.
4. Taarblin North is not included in this Table. It has been monitored for a shorter period than Taarblin South, which is included. They are two connected basins of the same wetland (Lake Taarblin).

APPENDIX 1. Reports, publications and databases in which use is made of SWWMP data.

Adeney, J.A. (2001). *Cyanobacterial issues in the Lake Powell / Torbay Inlet drainage system.* CSIRO Land and Water, Perth, Technical Report 44/01.

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GRAPHS

The following graphs of wetland water depth, pH and salinity are arranged in the same order (alphabetical by wetland name) as in Table 1 where coordinates, tenure and location (by Local Government Authority) are provided.

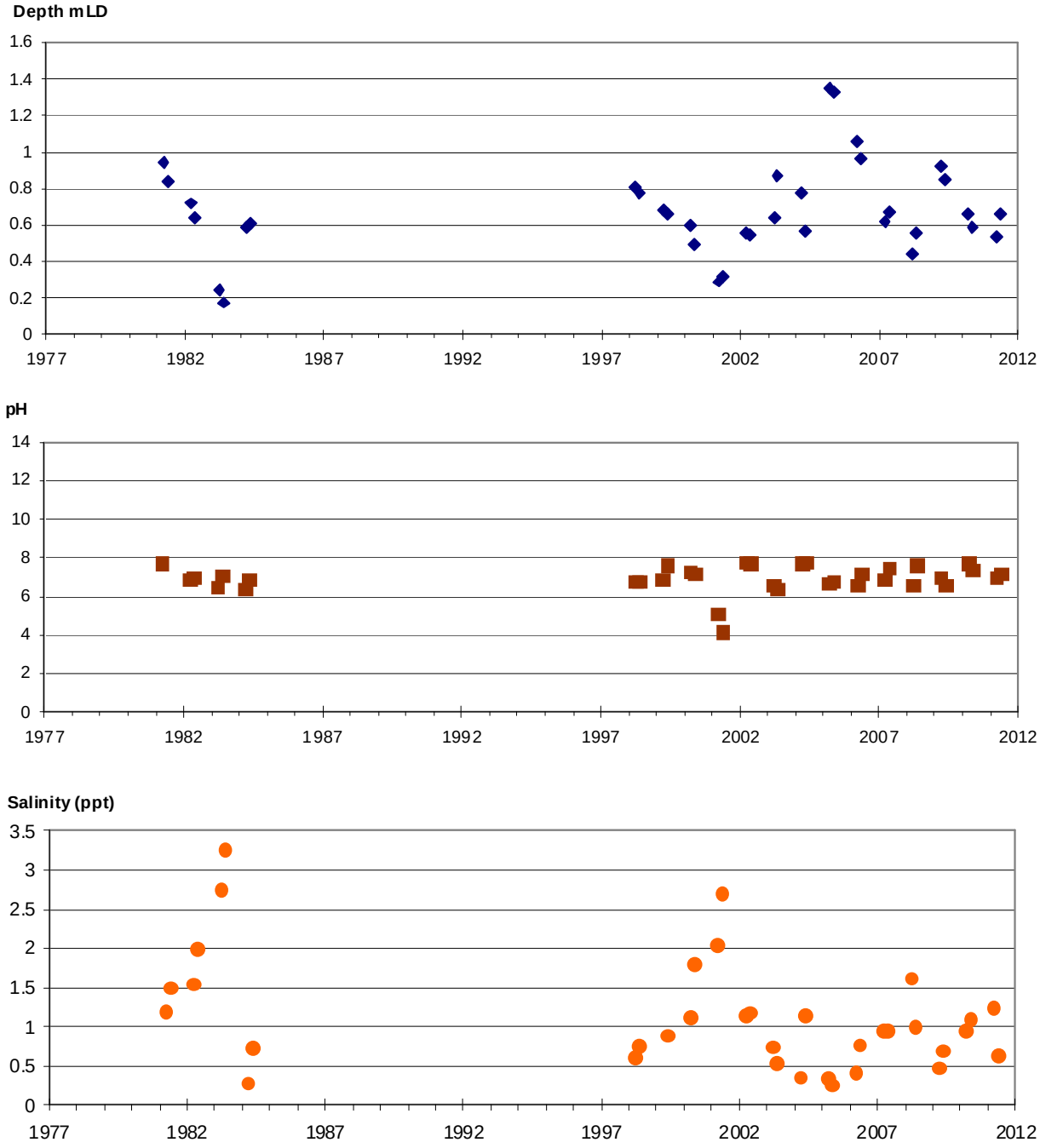
Only routinely-collected September and November data from the 101 SWWMP wetlands currently monitored under the State Salinity Strategy are displayed.

The 25 wetlands Intensively Monitored by DEC scientific staff for additional biological and physico-chemical attributes (see last paragraph of Section 3 and Note 9 of Table 1) are indicated.

Listing as a Wetland of International Importance under the 'Ramsar' *Convention on Wetlands* (Government of Western Australia 1990, 2000; Wetlands International 2002) and listing in 'A Directory of Important Wetlands in Australia' (Environment Australia 2001) is indicated where this is the case.

Inclusion in a Natural Diversity Recovery Catchment (Government of Western Australia 1996a; Wallace & Lloyd 2008) is also indicated where applicable.

ALBANY 26385

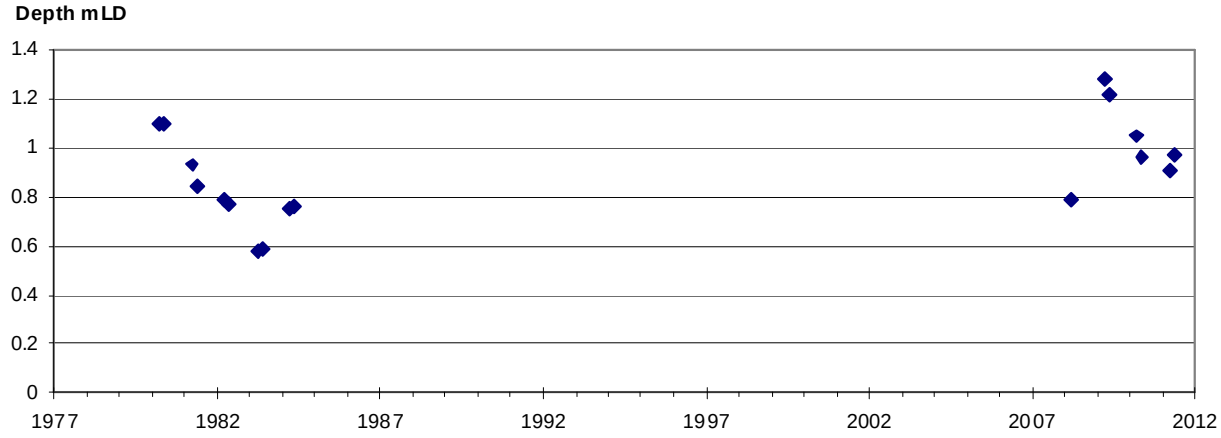


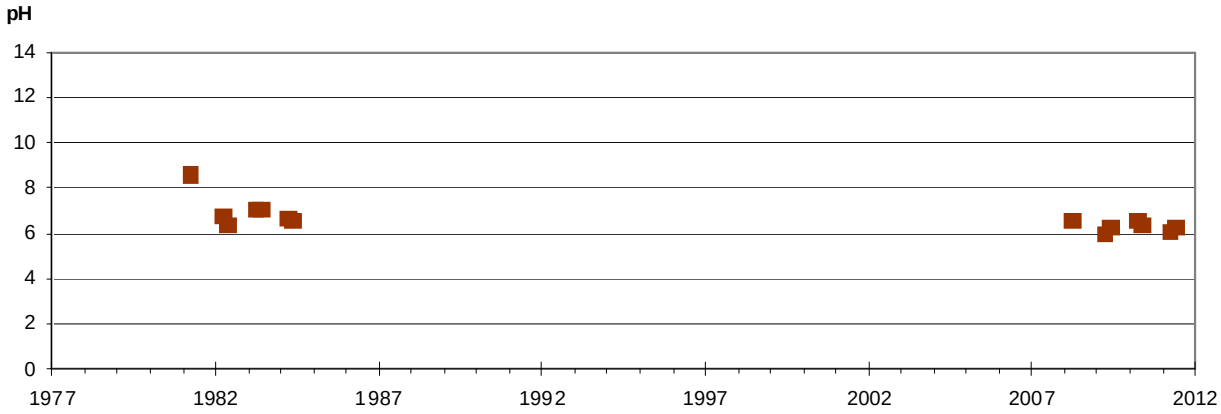
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

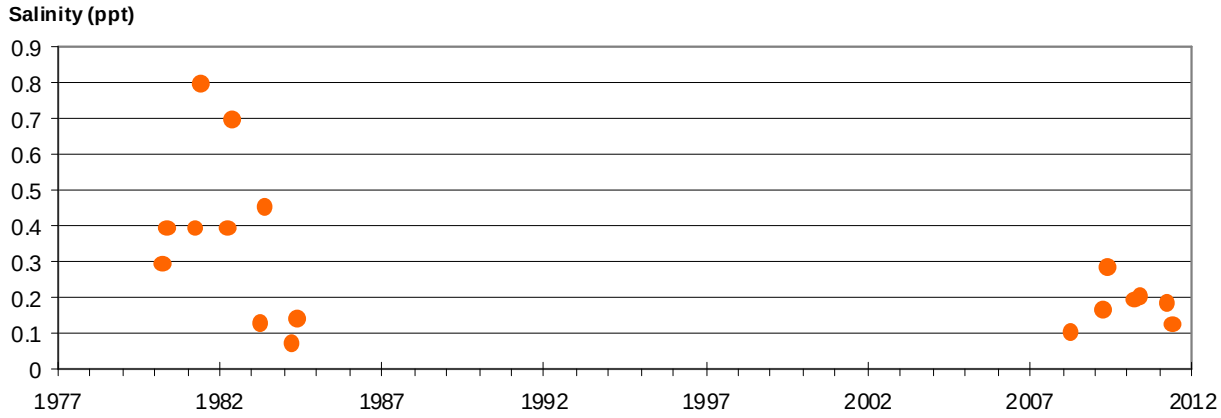
Albany 26385 is a component of the 'Lake Pleasant View System', which is listed in the 'Directory of Important Wetlands in Australia'.

Albany 26385 is in the Albany District of the South Coast DEC Region.

ALBANY 27157



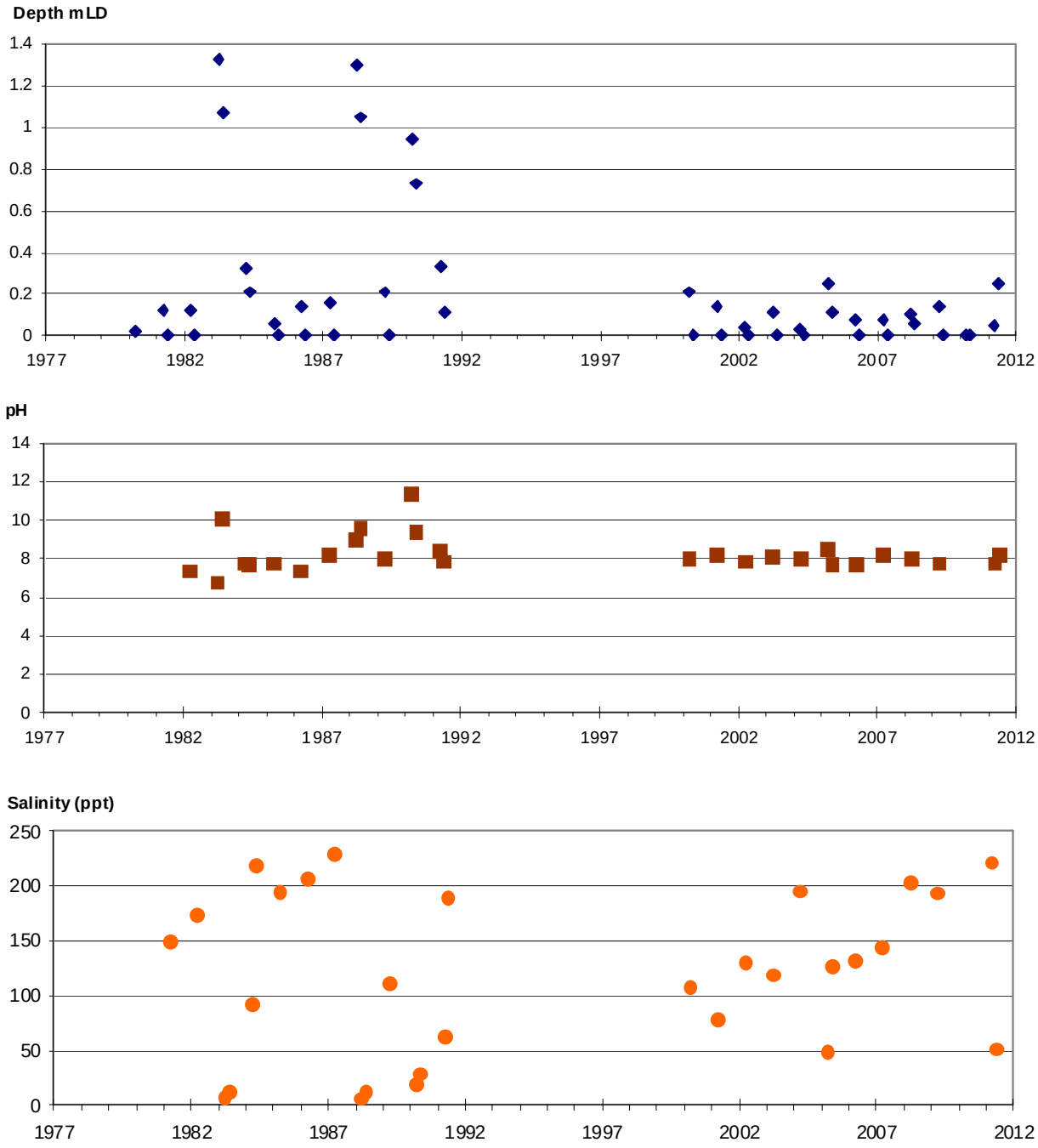




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Albany 27157 is in the Albany District of the South Coast DEC Region.

ALTHAM [IM]

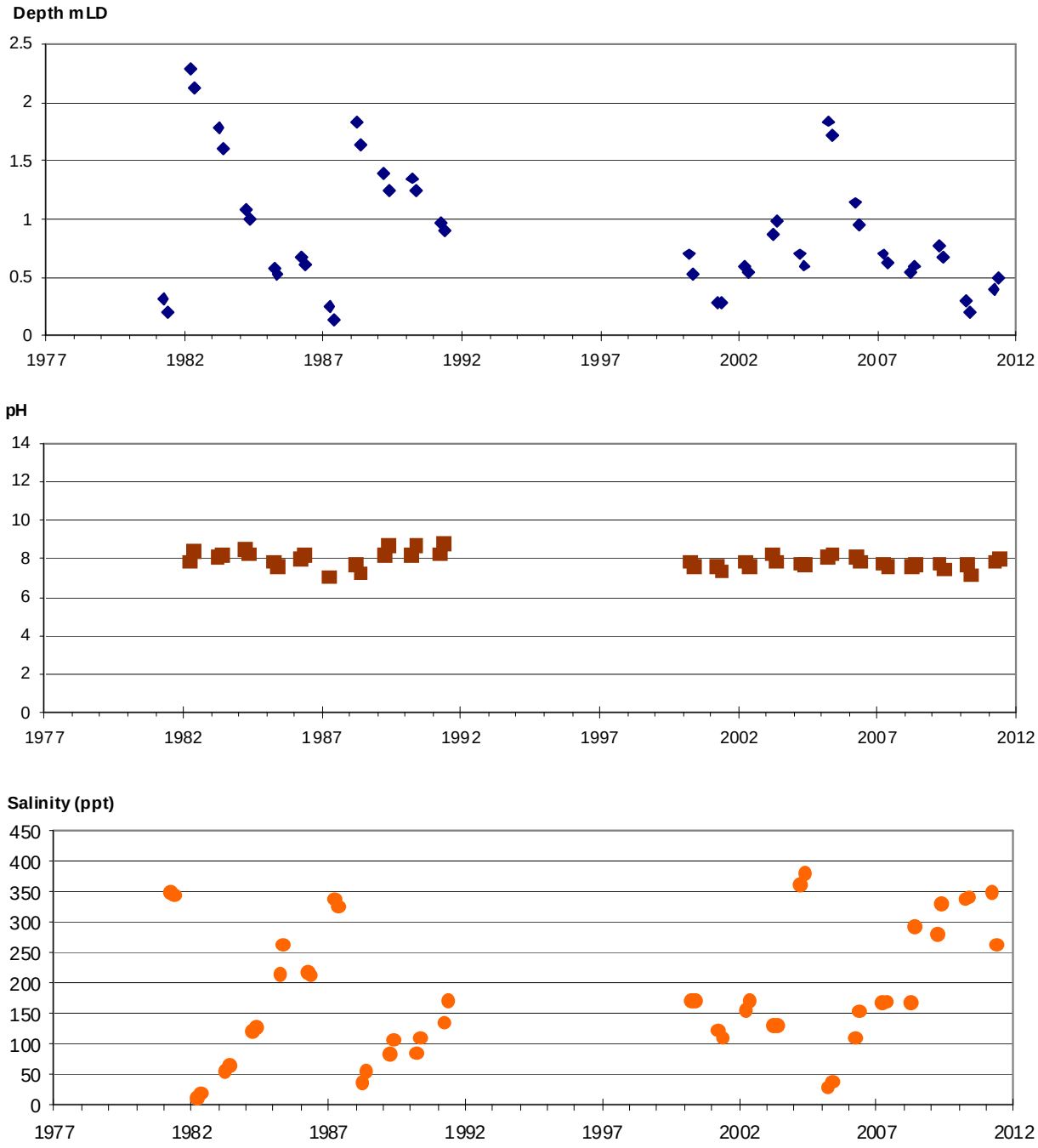


Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Altham is a component of the 'Lake Grace System', which is listed in the 'Directory of Important Wetlands in Australia'.

Altham is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

ANDERSON

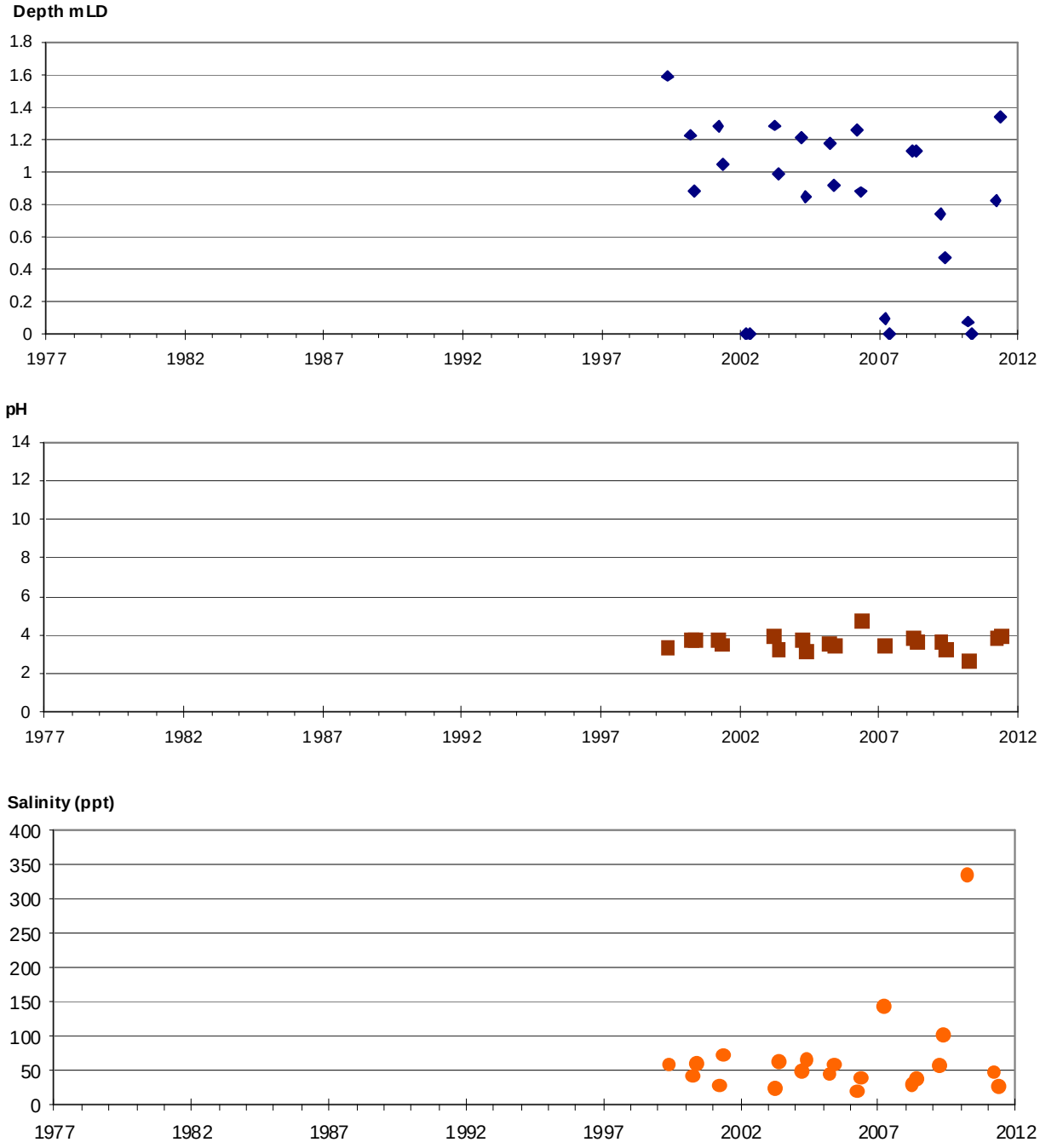


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Anderson is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

ARDATH [IM]

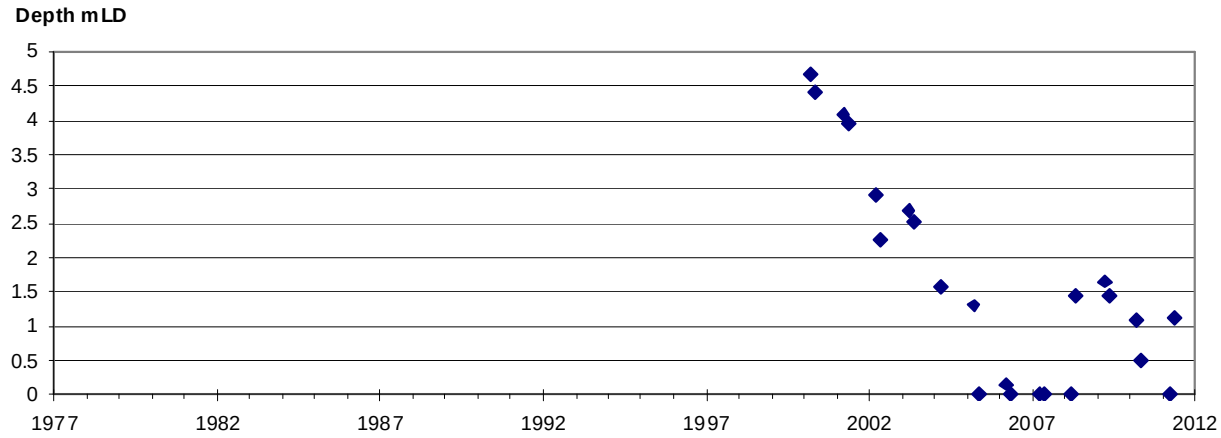


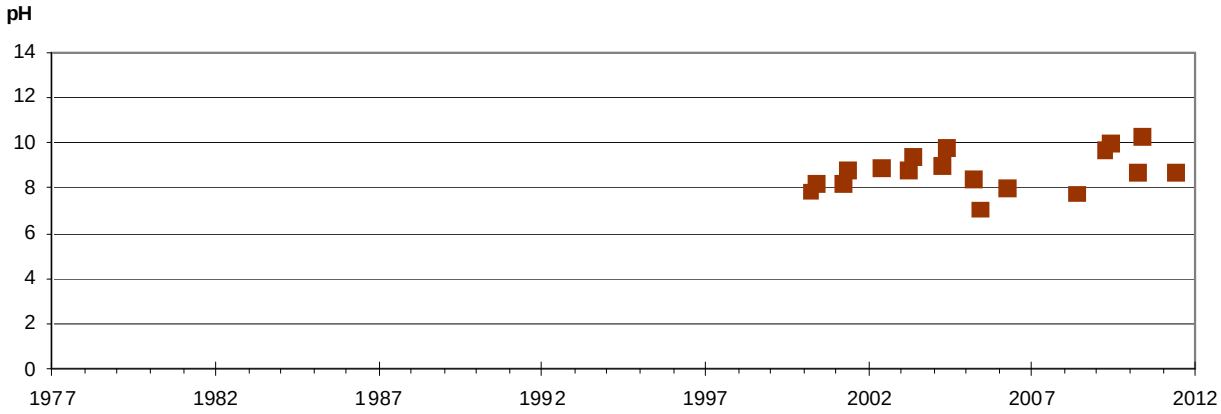
Notes:

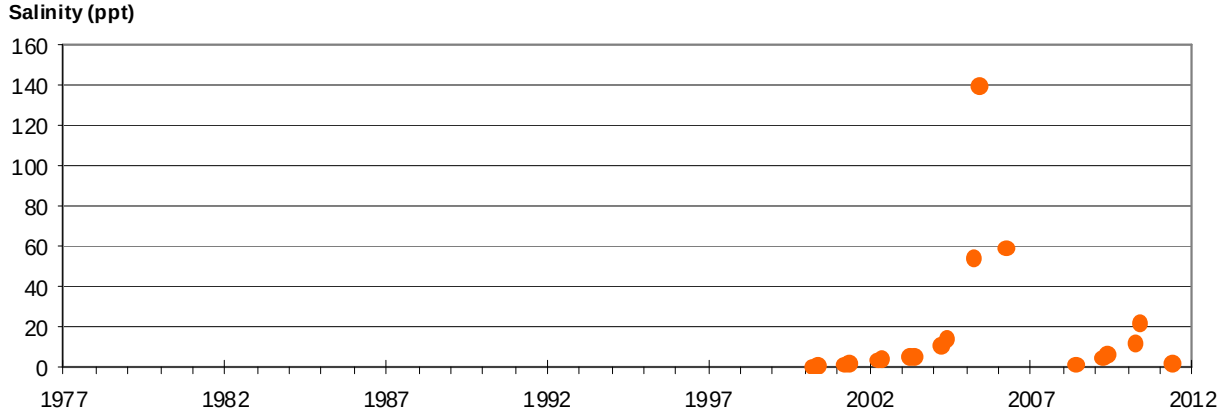
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Ardath is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

ATKINS YATE



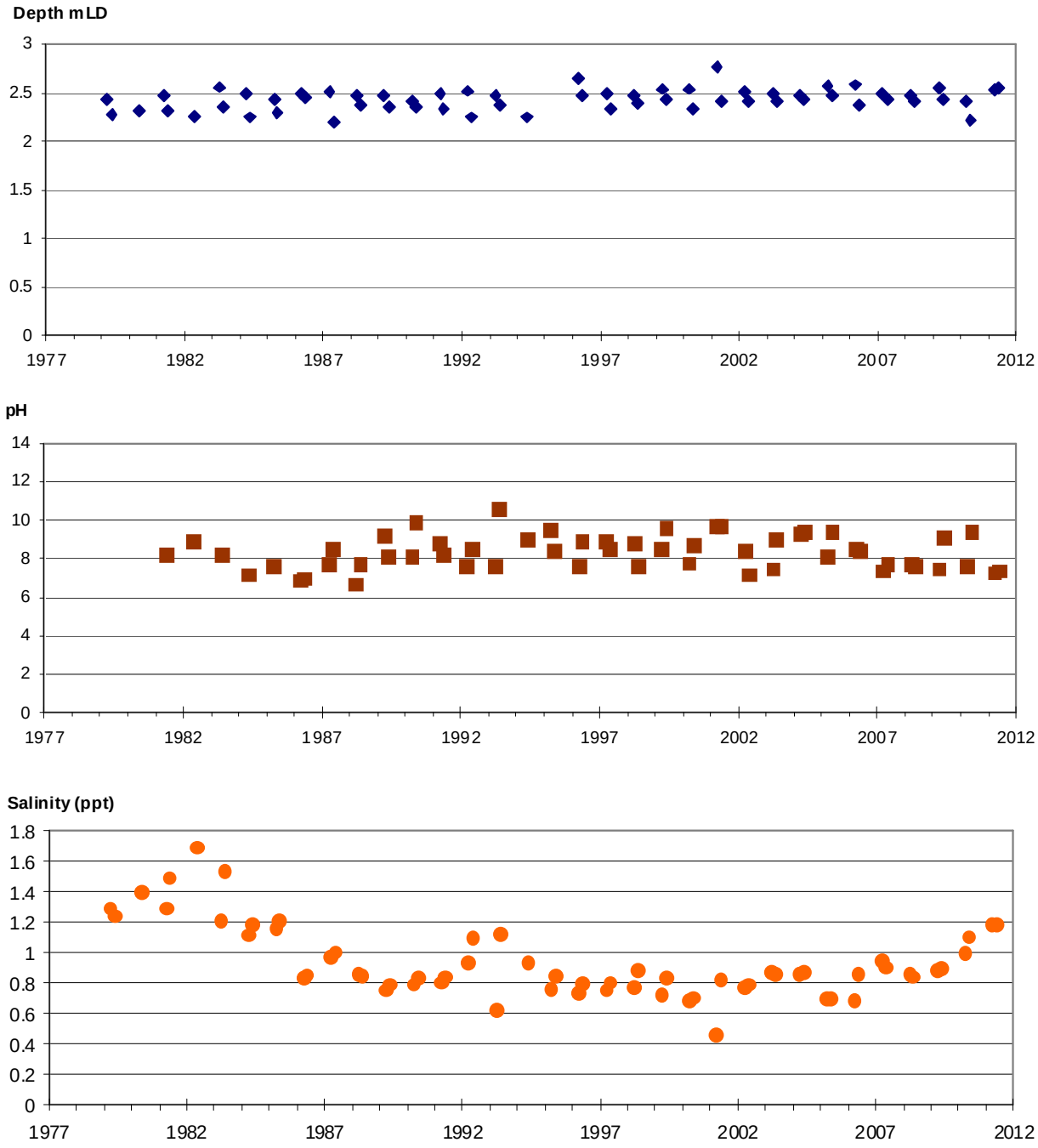




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Atkins Yate is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

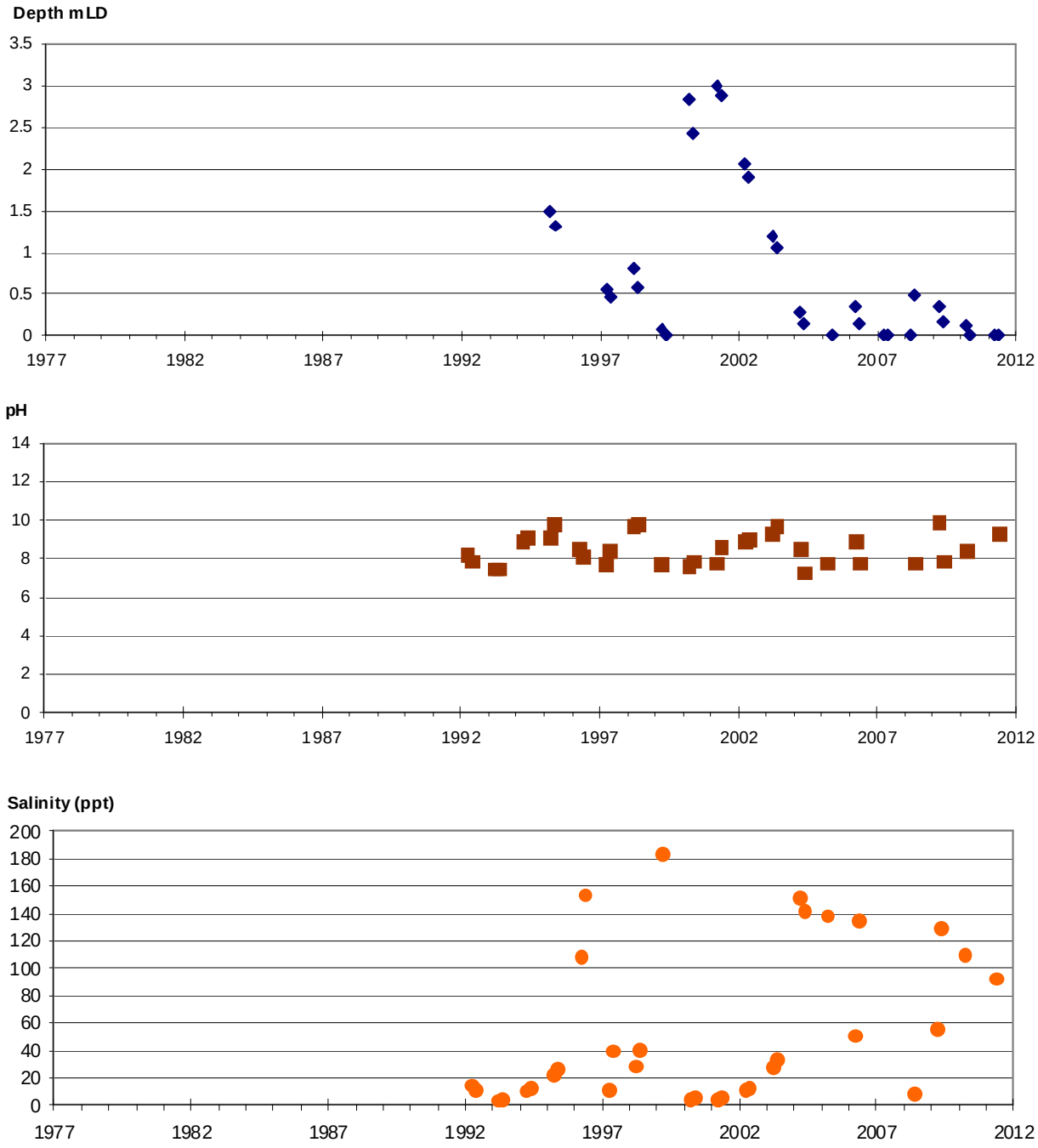
BAMBUN



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Bambun is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

BENNETTS [IM]



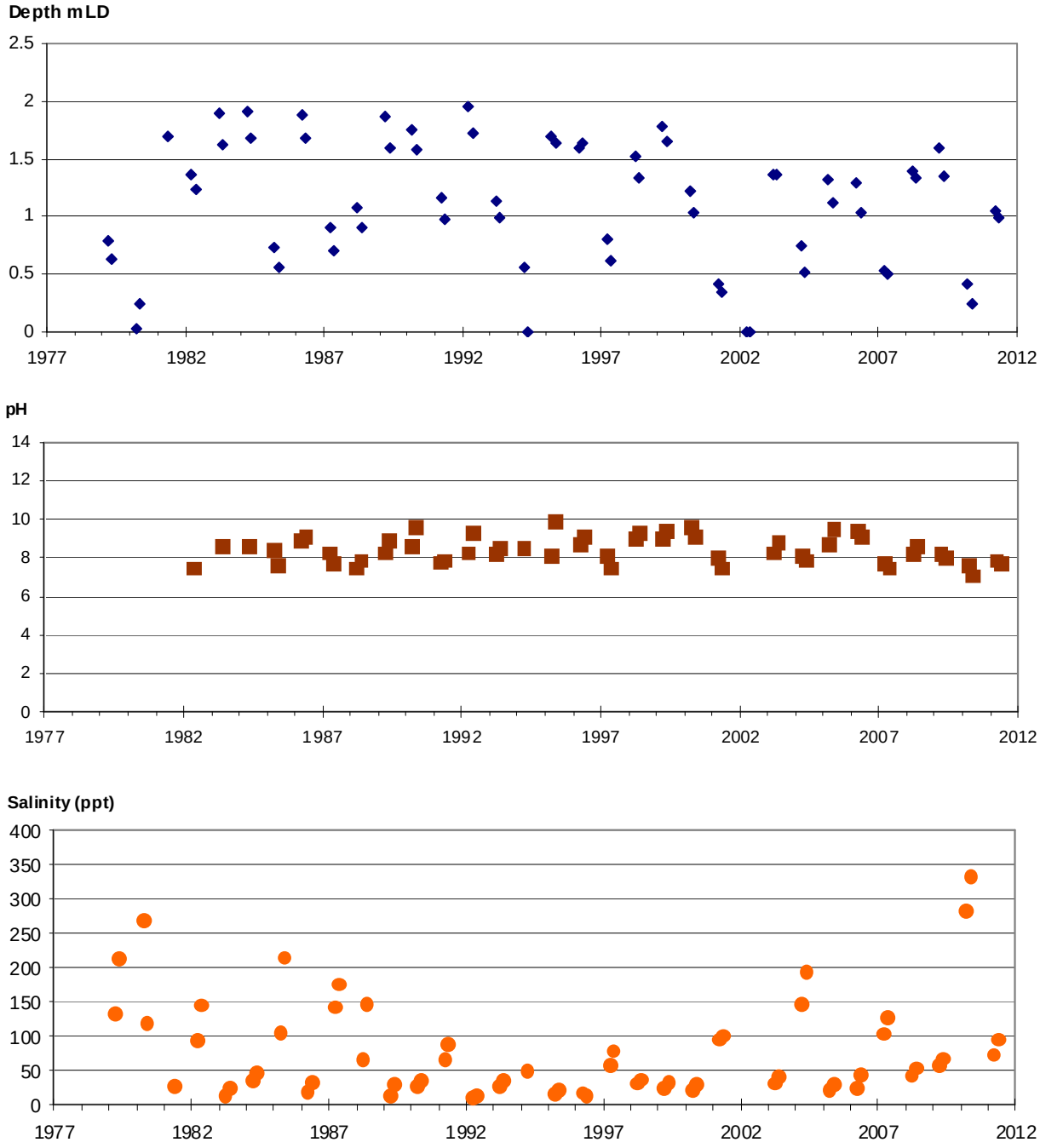
Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Bennetts Lake has been nominated for listing in the 'Directory of Important Wetlands in Australia' (Elscot *et al.* 2009).

Bennetts is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

BEVERLEY

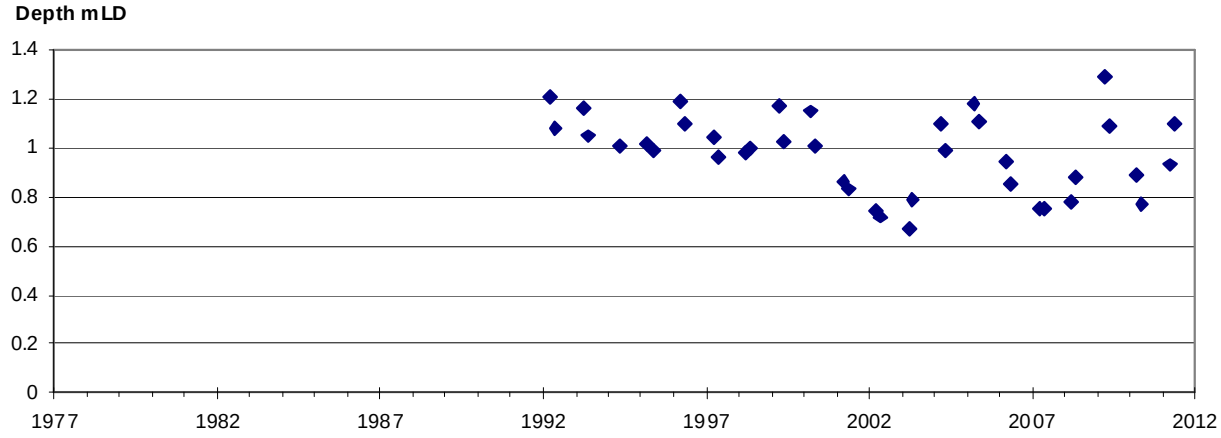


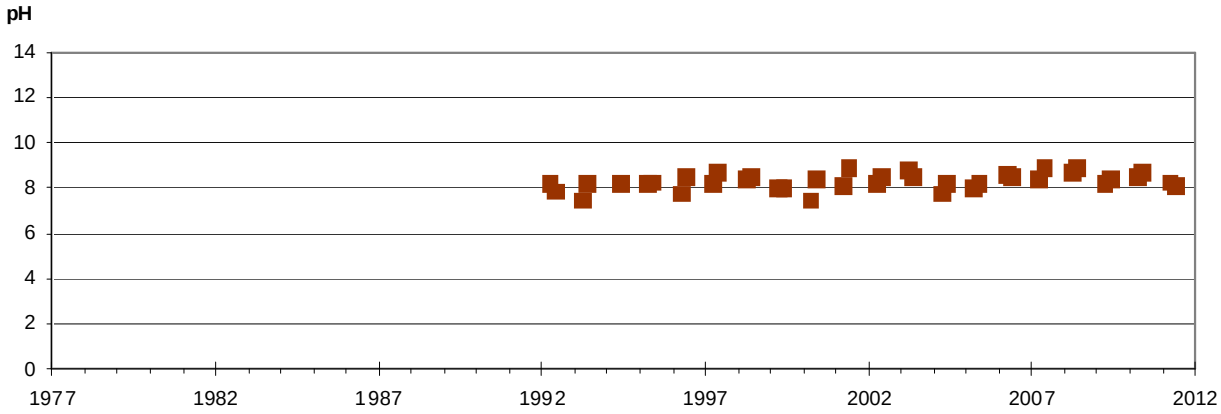
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

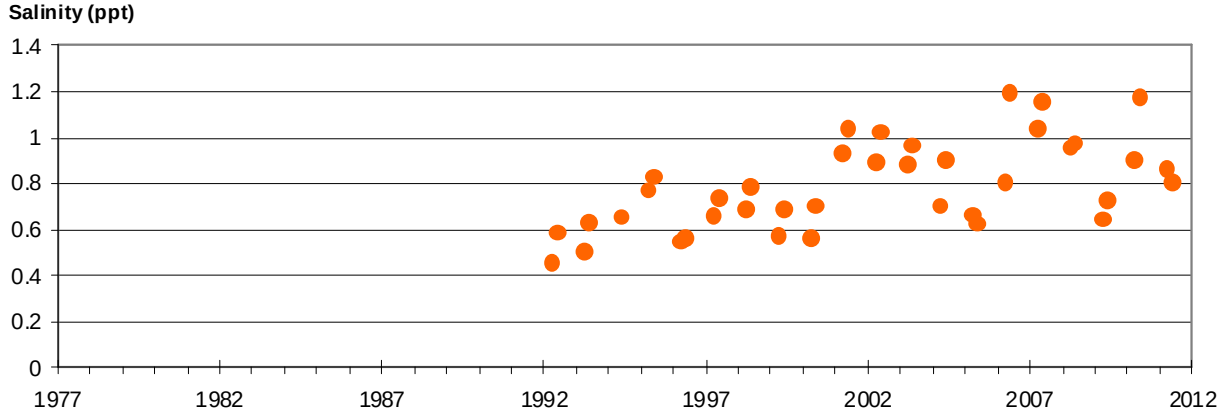
Beverley Lakes is also known as Yenyenning Lakes.

Beverley is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

BOAT HARBOUR 1





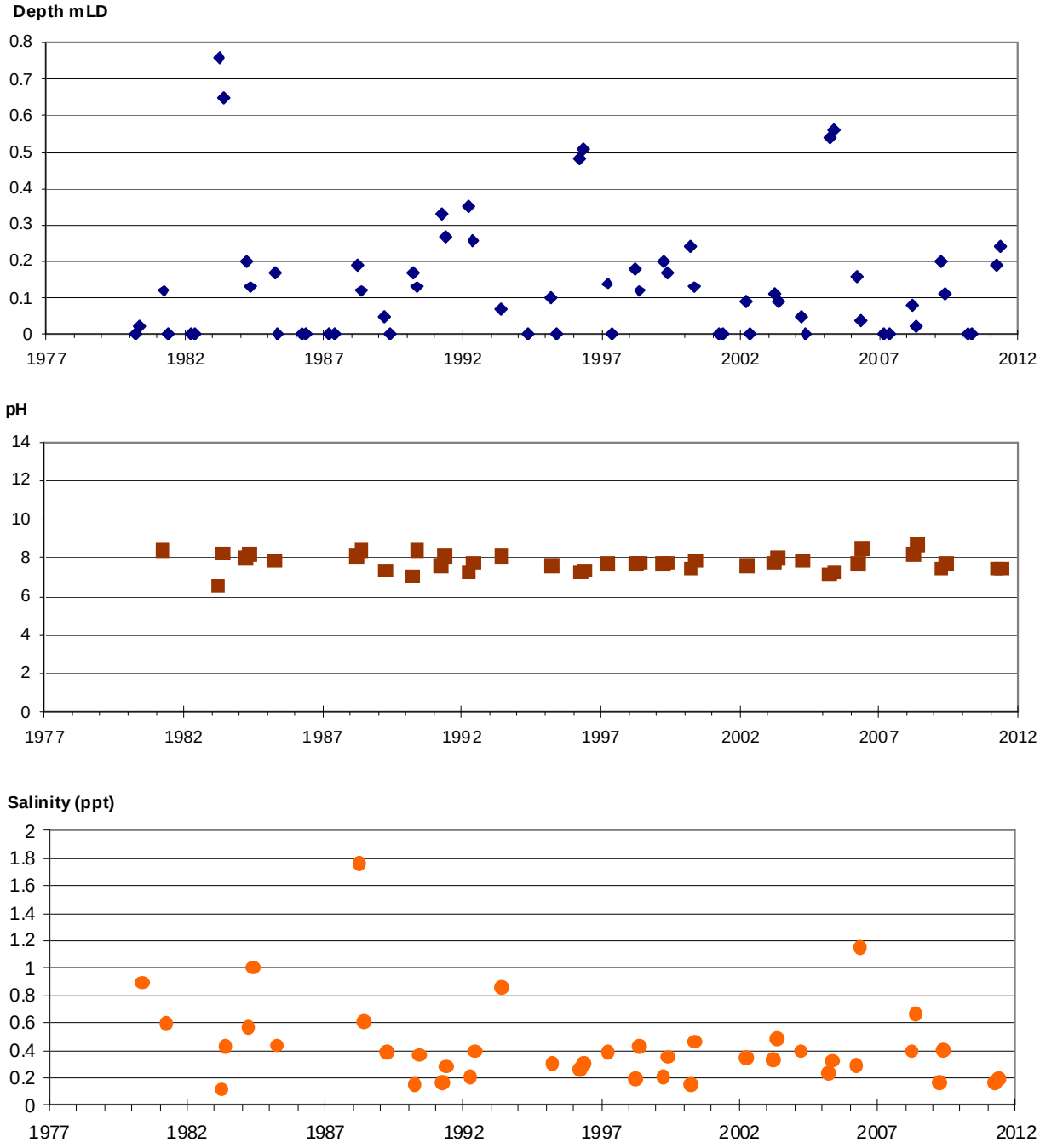


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Boat Harbour 1 is a component of the 'Owingup Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

Boat Harbour 1 is in the Frankland District (headquartered in Walpole) of the Warren DEC Region.

BOYUP BROOK 18239 [IM]

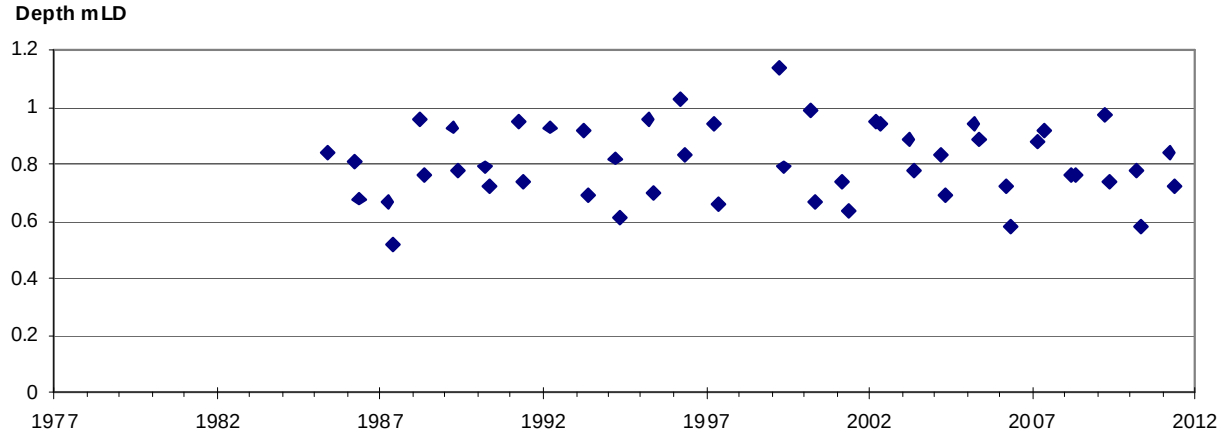


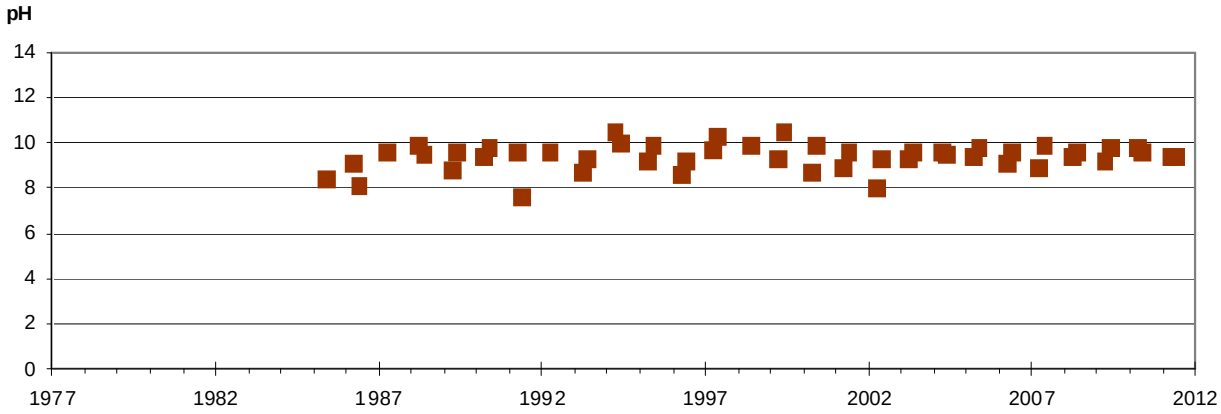
Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

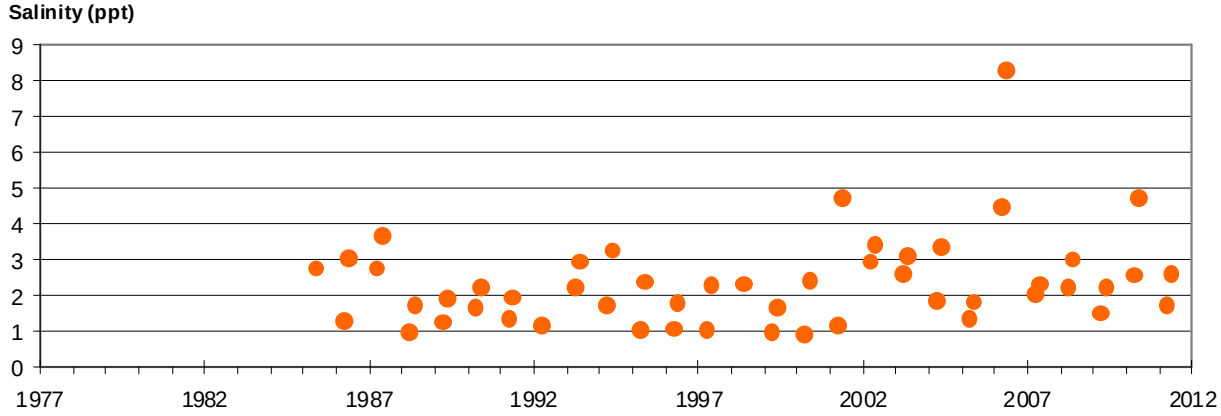
Boyup Brook 18239 is also known as Kulicup Swamp.

Boyup Brook 18239 is in the Blackwood District (headquartered in Busselton) of the South West DEC Region.

BROADWATER



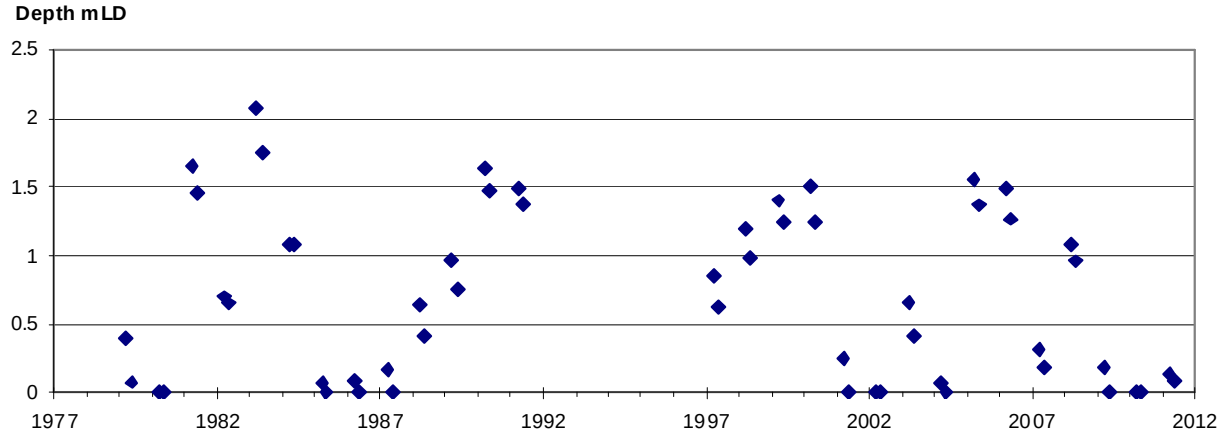


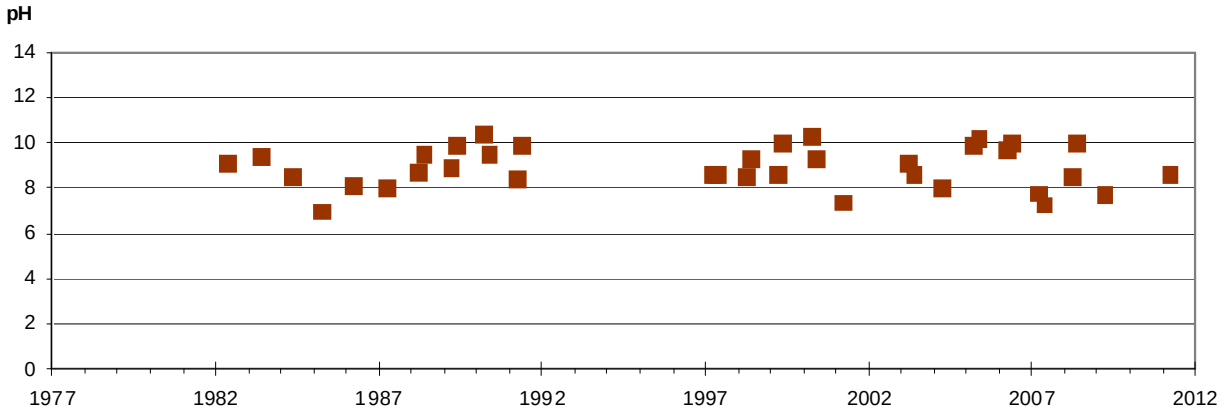


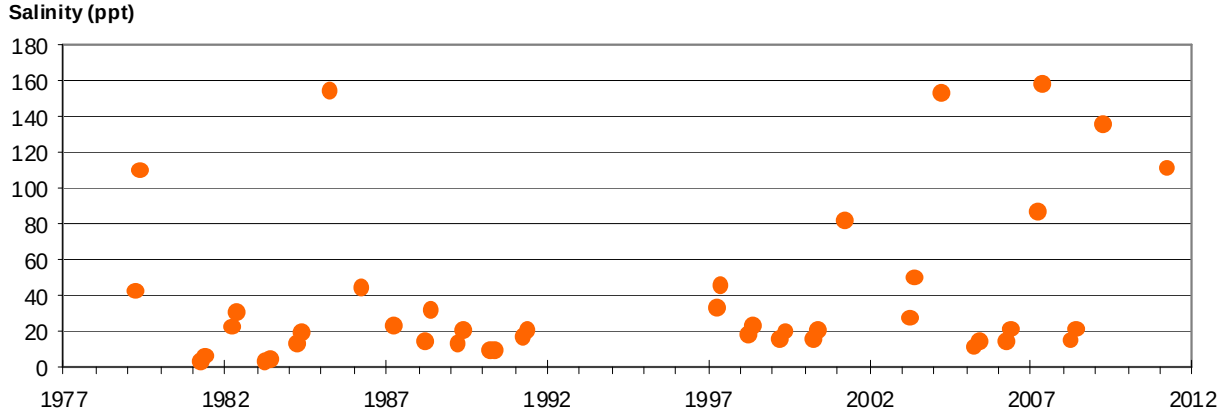
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Broadwater is in the Blackwood District (headquartered in Busselton) of the South West DEC Region.

BROWN





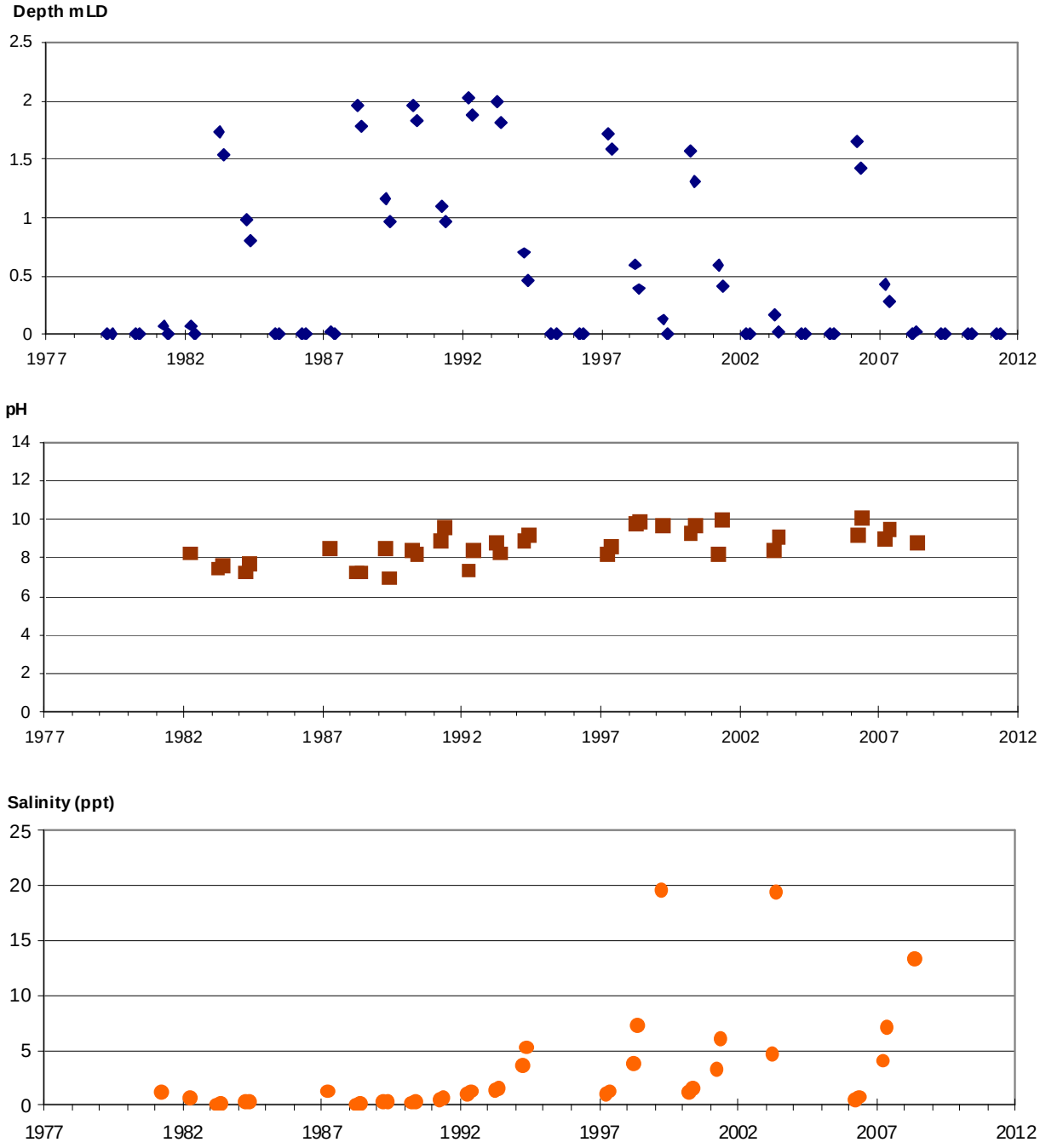


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Brown is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

Brown is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

BRYDE [IM]

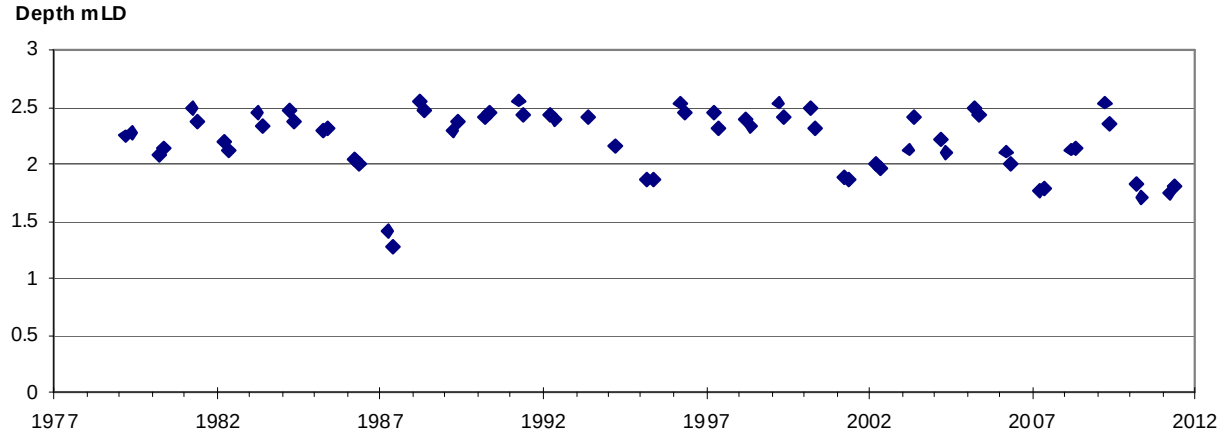


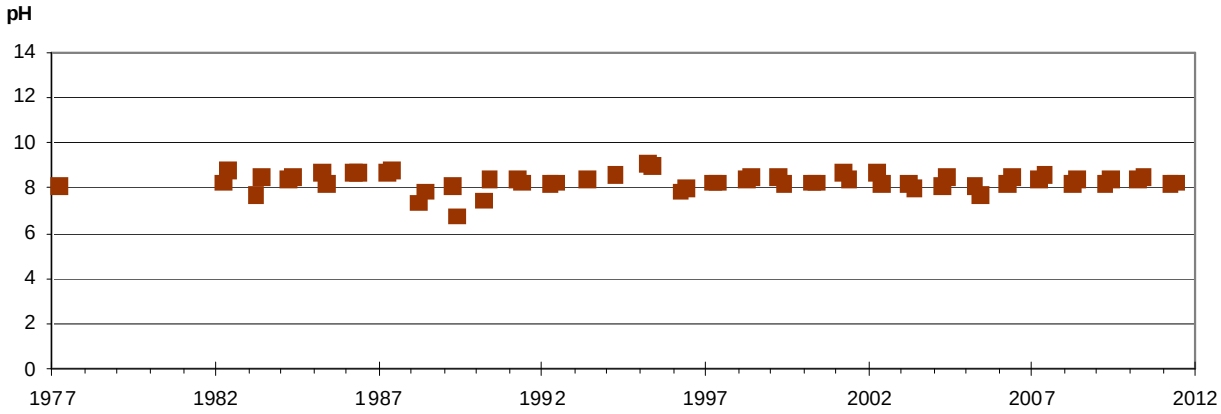
Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

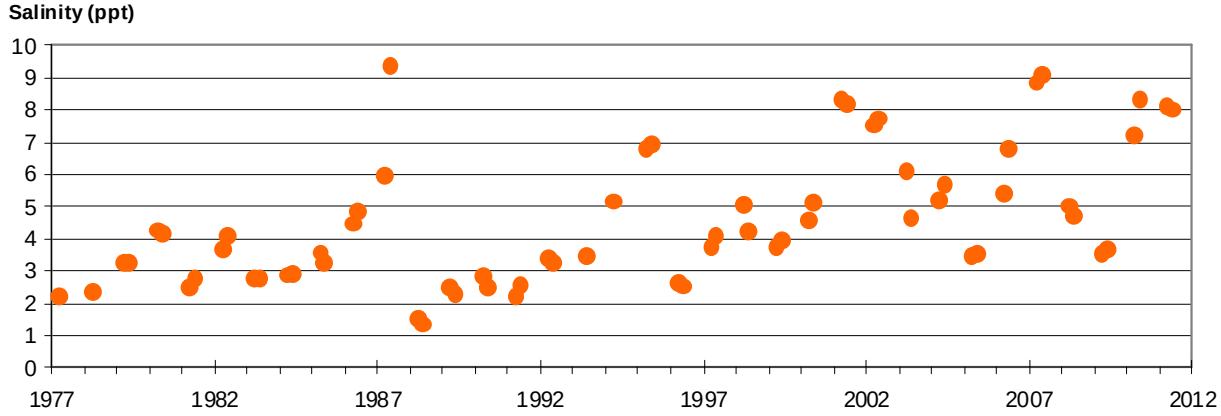
Bryde is part of the 'Lake Bryde – East Lake Bryde System' listed in the 'Directory of Important Wetlands in Australia'.

Bryde is within the Lake Bryde Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

BYENUP





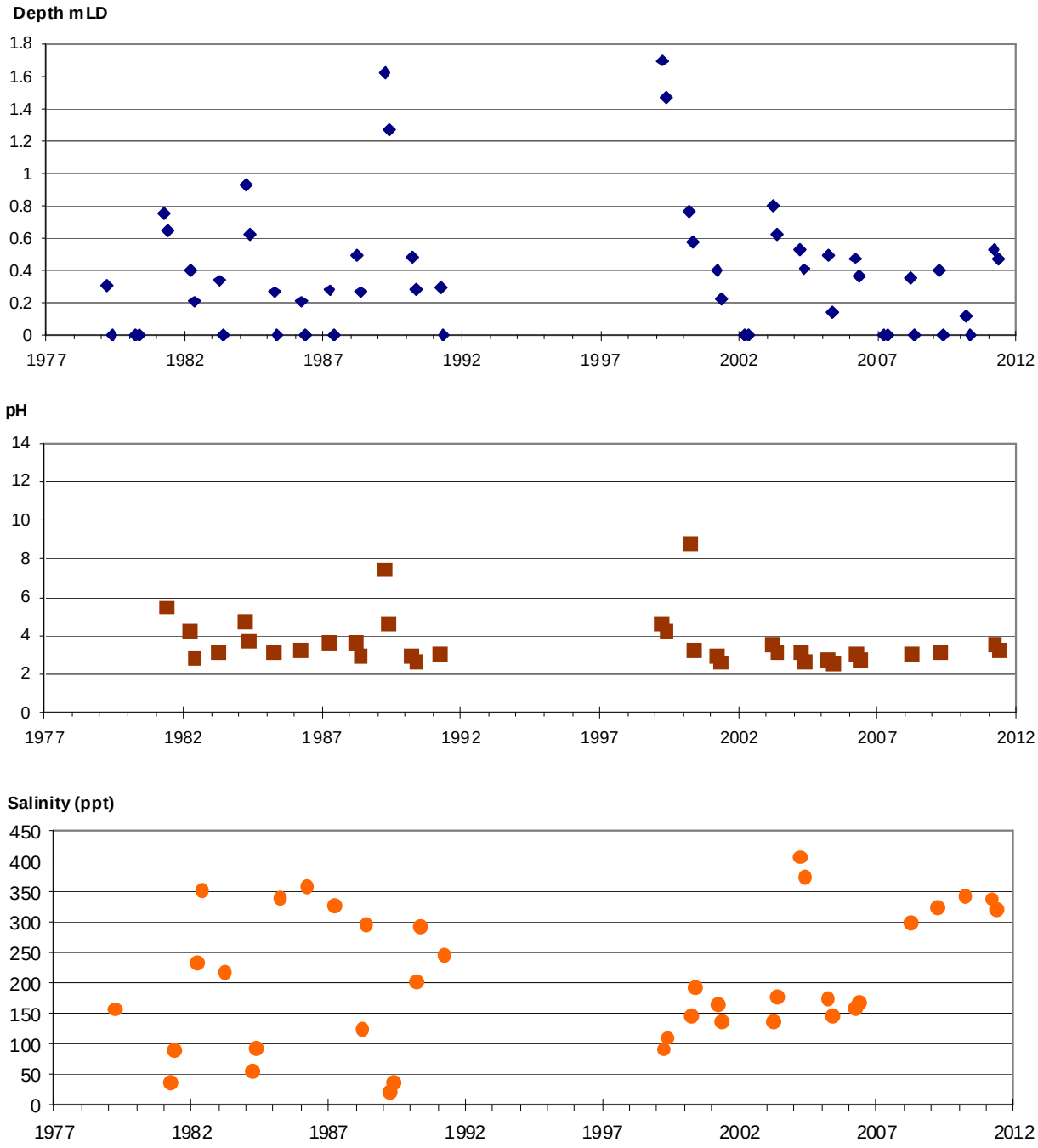


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Byenup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also part of the 'Byenup Lagoon System' listed in the 'Directory of Important Wetlands in Australia'.

Byenup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

CAMPION [IM]

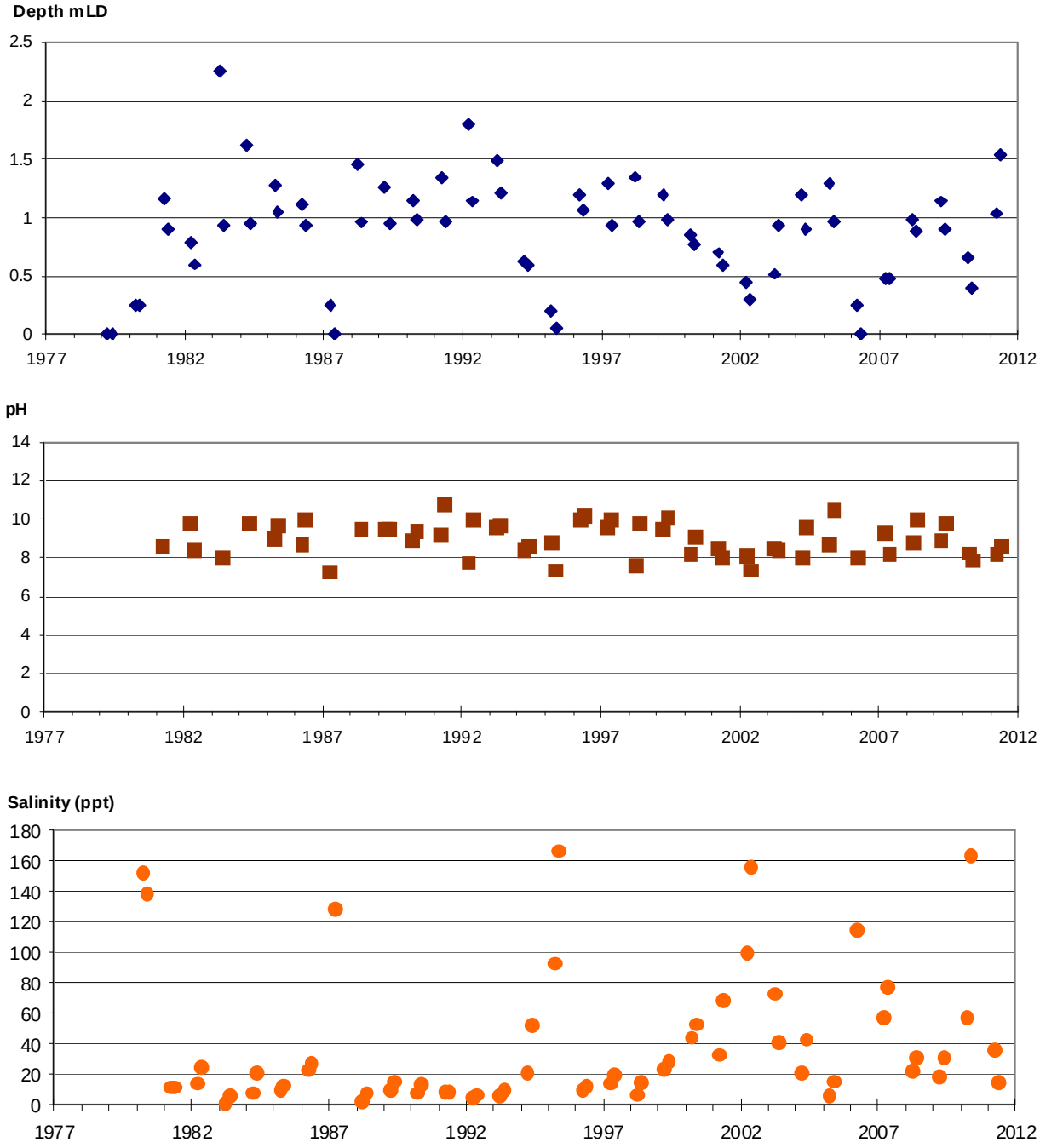


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Campion is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

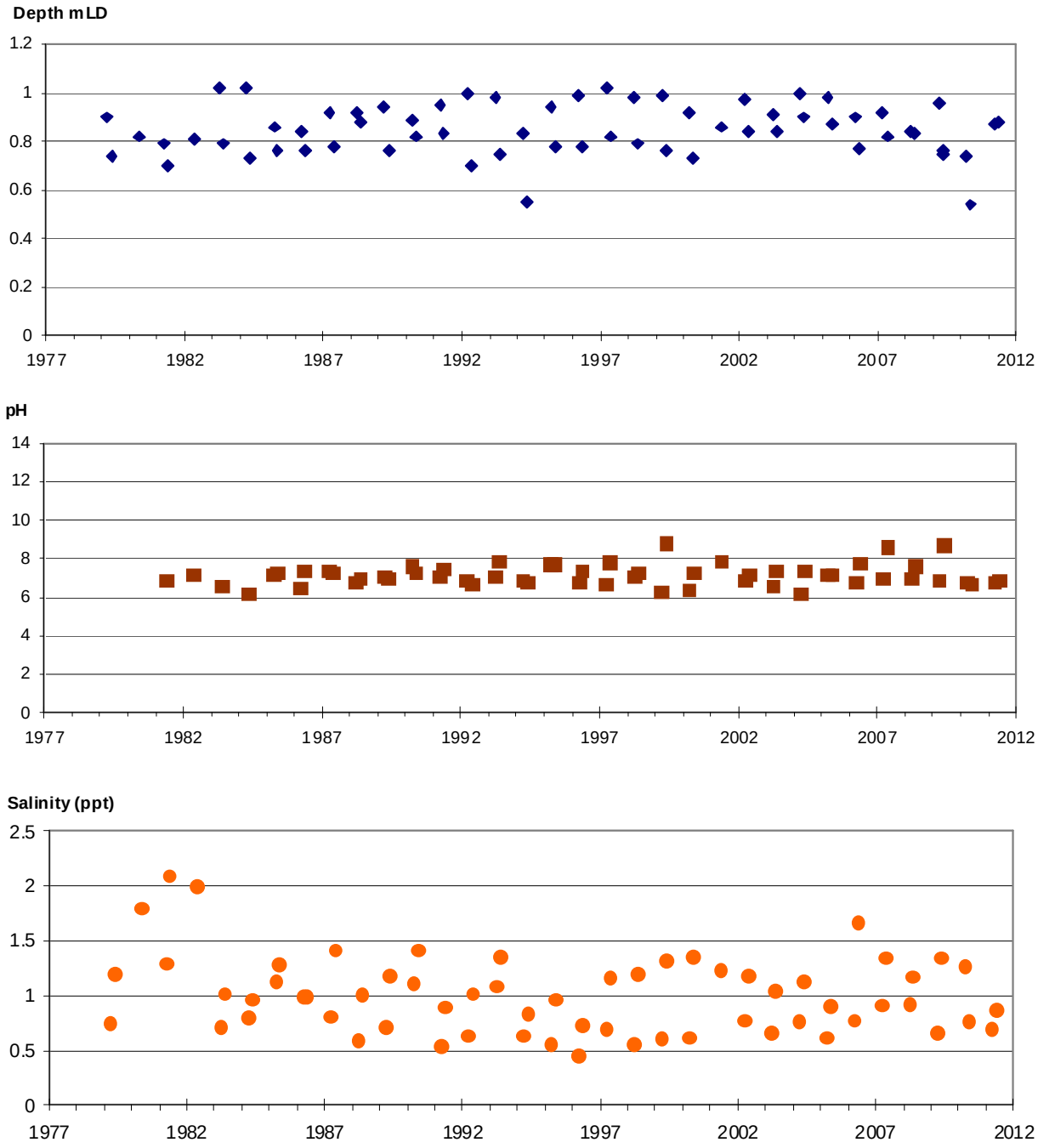
CASUARINA



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Casuarina is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

CHANDALA

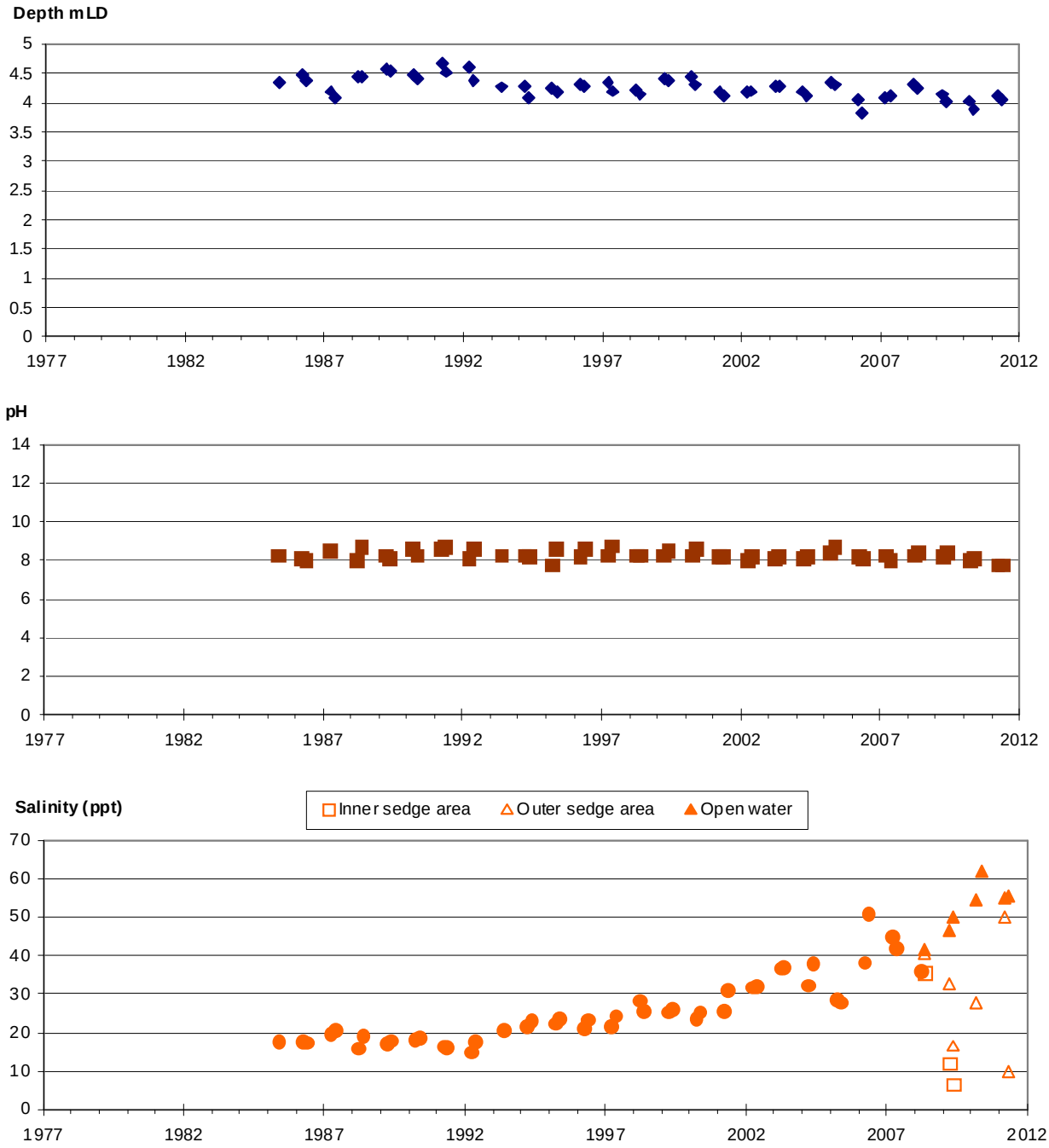


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Chandala Swamp is listed in the 'Directory of Important Wetlands in Australia'.

Chandala is in the Perth Hills District (headquartered in Mundaring) of the Swan DEC Region.

CLIFTON (with Depth axis 0-5m)



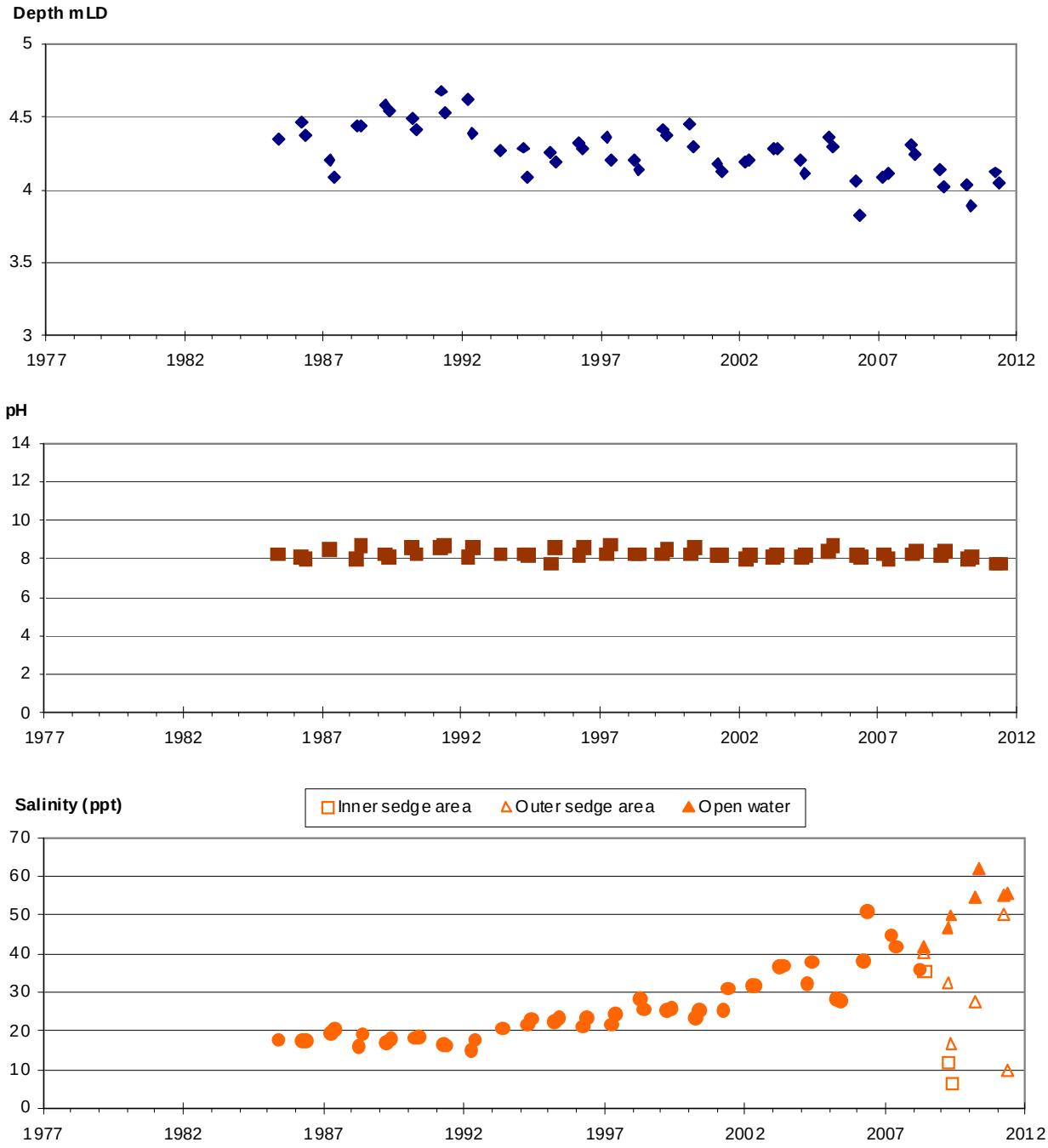
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Clifton is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Clifton is also a component of the 'Yalgorup Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

Clifton is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

CLIFTON (with Depth axis 3-5m)



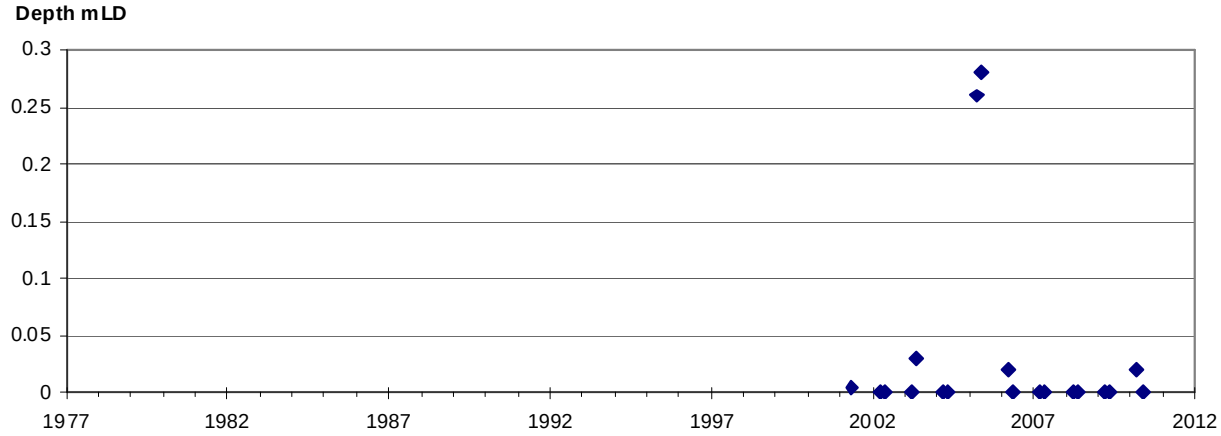
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

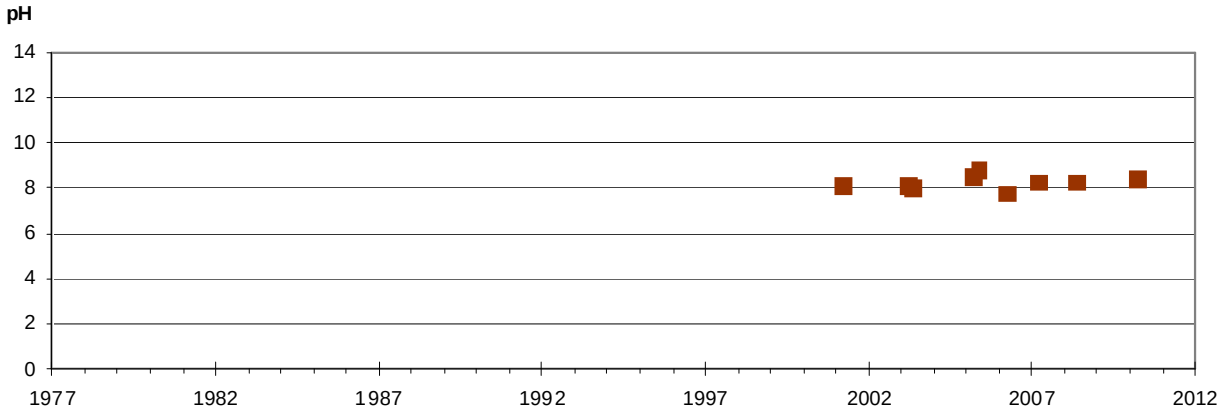
Clifton is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

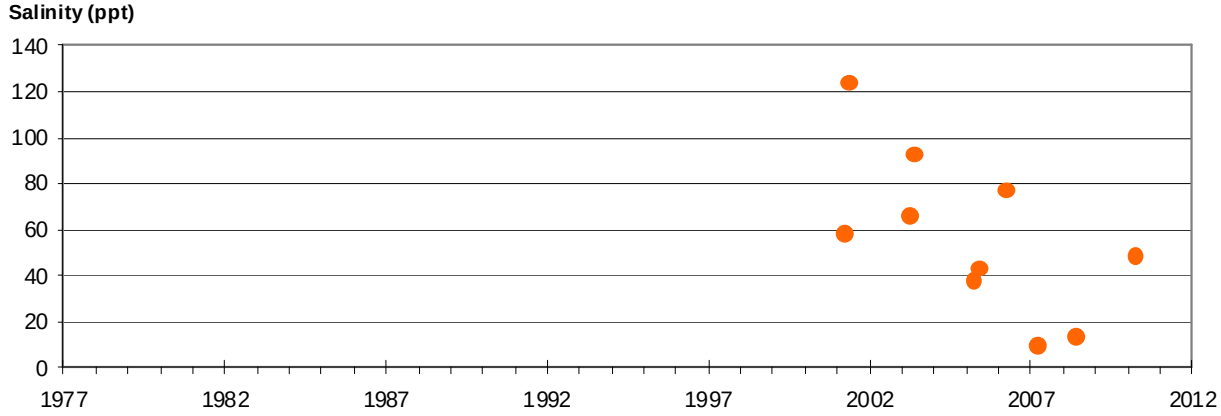
Clifton is also a component of the 'Yalgorup Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

Clifton is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

COLLETS ROAD



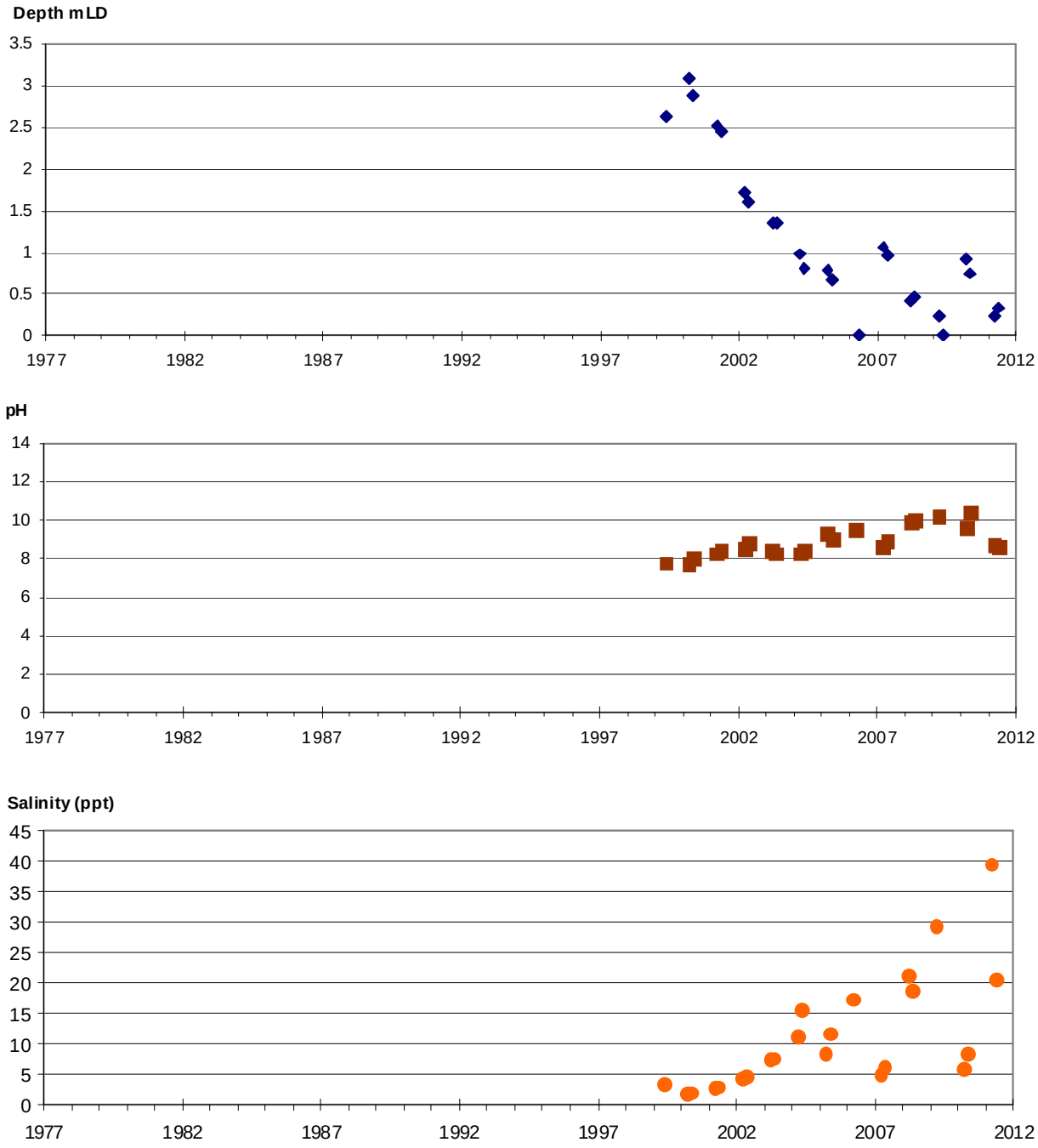




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Colletts Road Swamp is in the Albany District of the South Coast DEC Region

COOMALBIDGUP [IM]

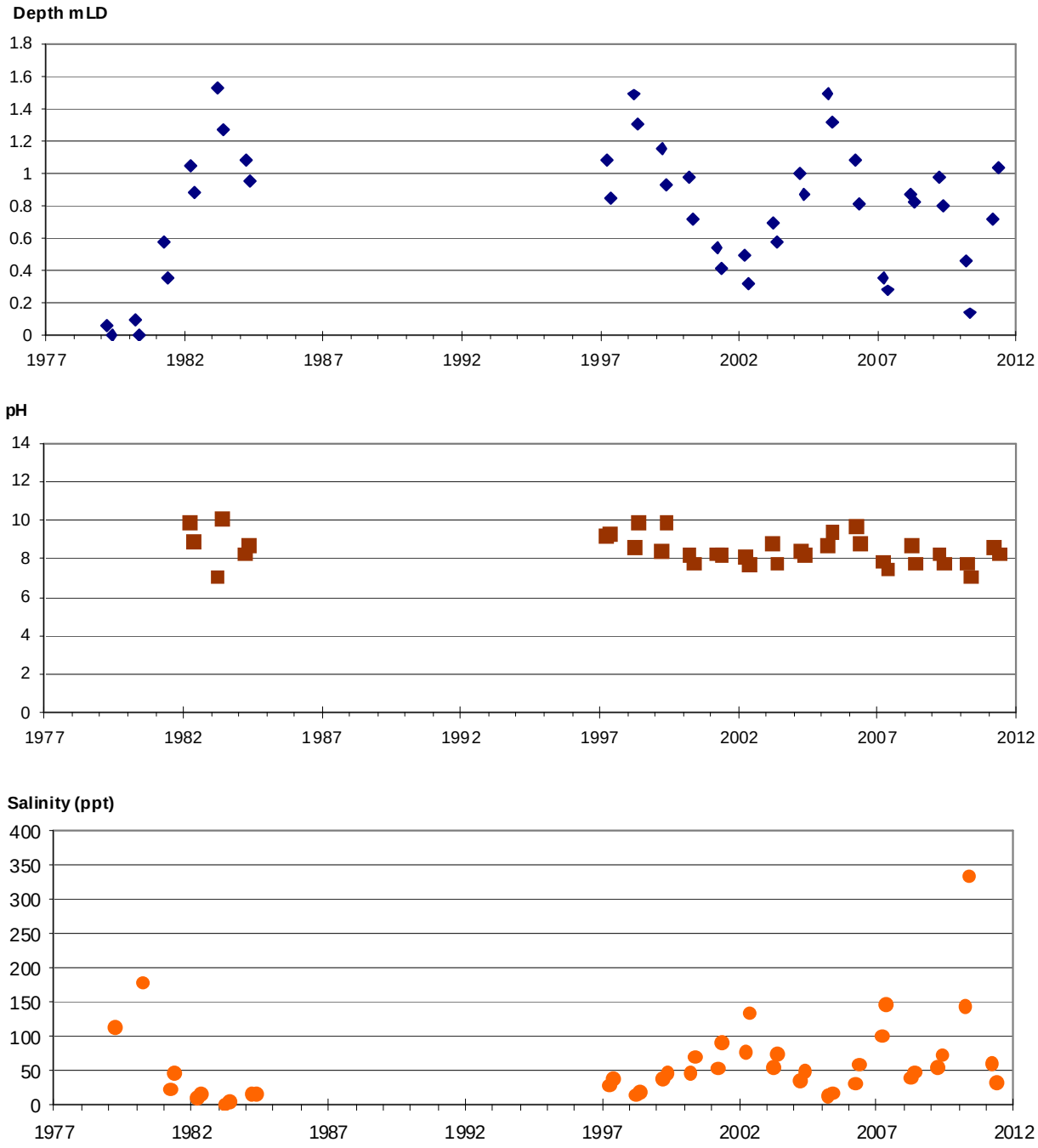


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Coomalbidgup is in the Esperance District of the South Coast DEC Region.

COOMELBERRUP [IM]

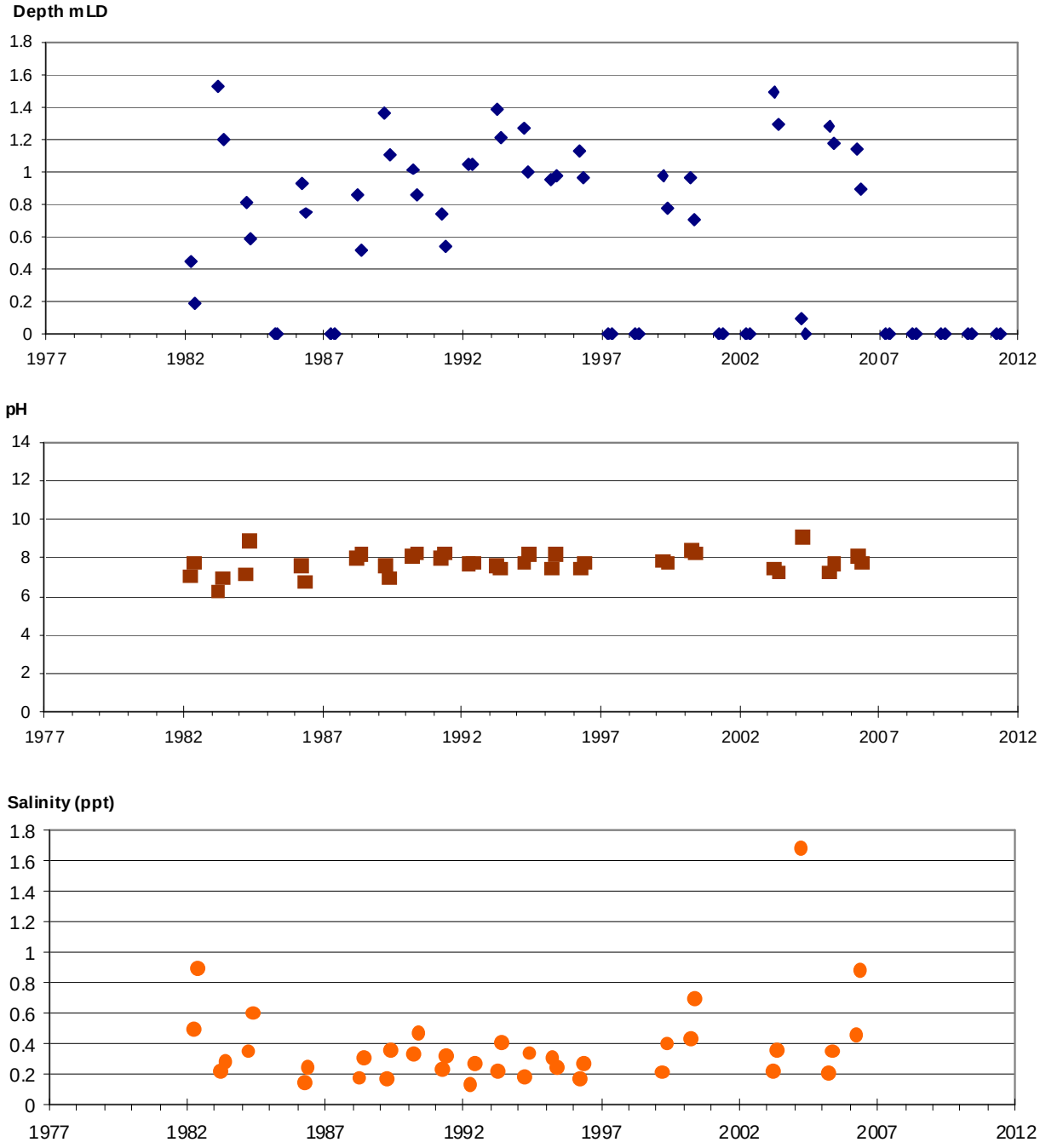


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Coomelberrup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

CORRIGIN 12900 [IM]



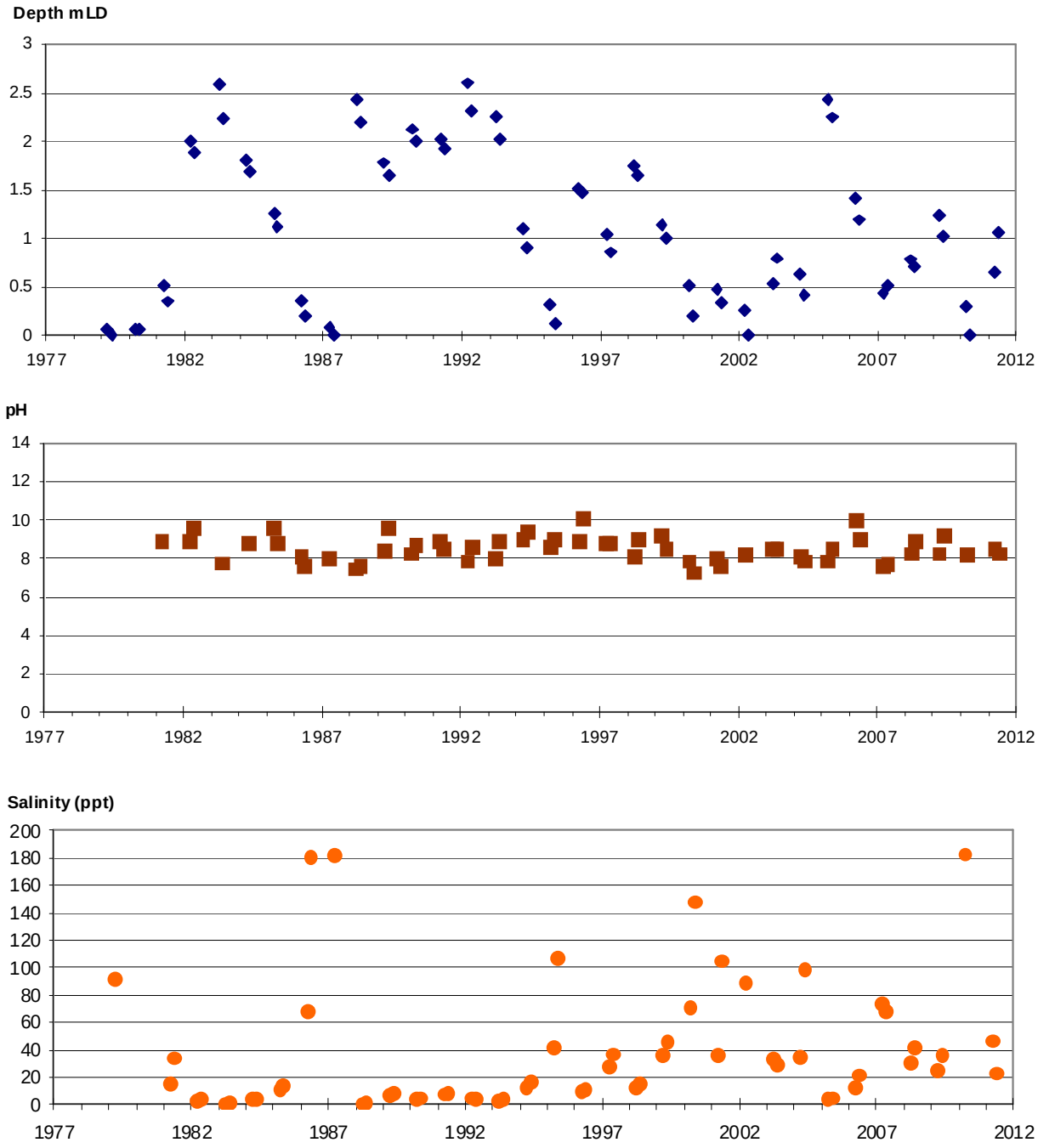
Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Corrigin 12900 (also known as Paperbark Swamp) has been nominated for listing in the 'Directory of Important Wetlands in Australia' (Elscot et al. 2009).

Corrigin 12900 is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

COYRECUP [IM]



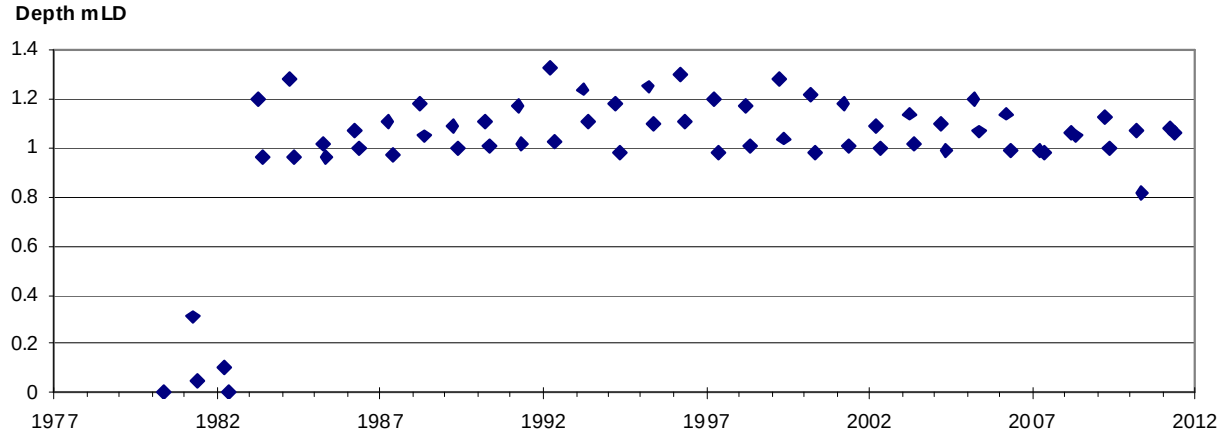
Notes:

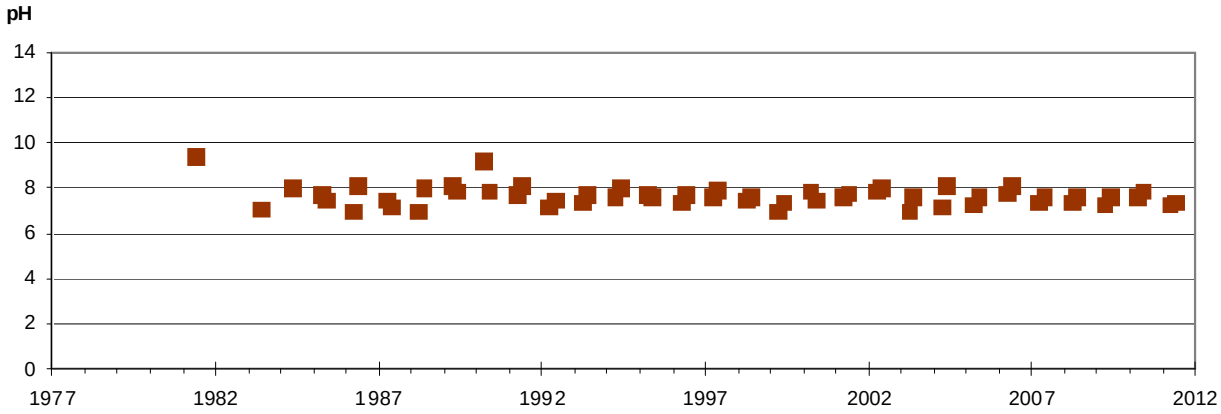
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

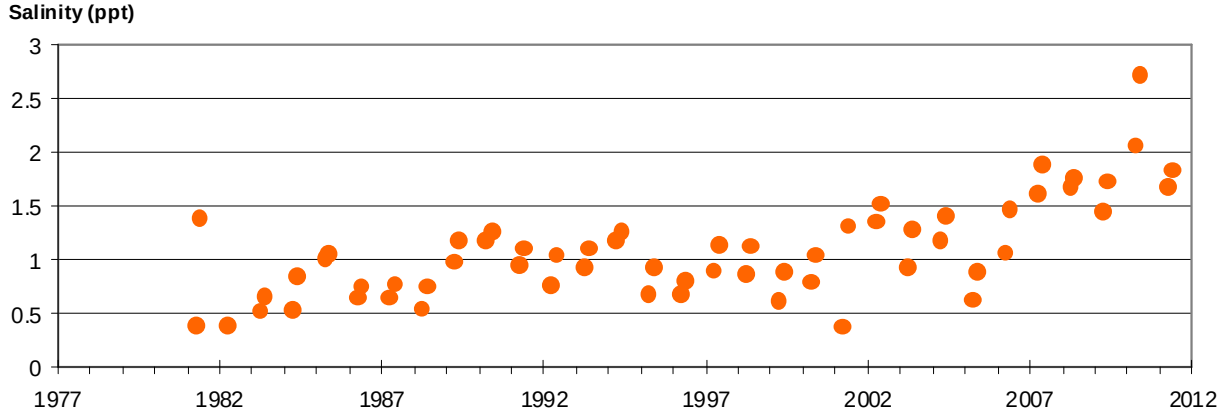
Coyrecup Lake is listed in the 'Directory of Important Wetlands in Australia'.

Coyrecup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

CRACKERS



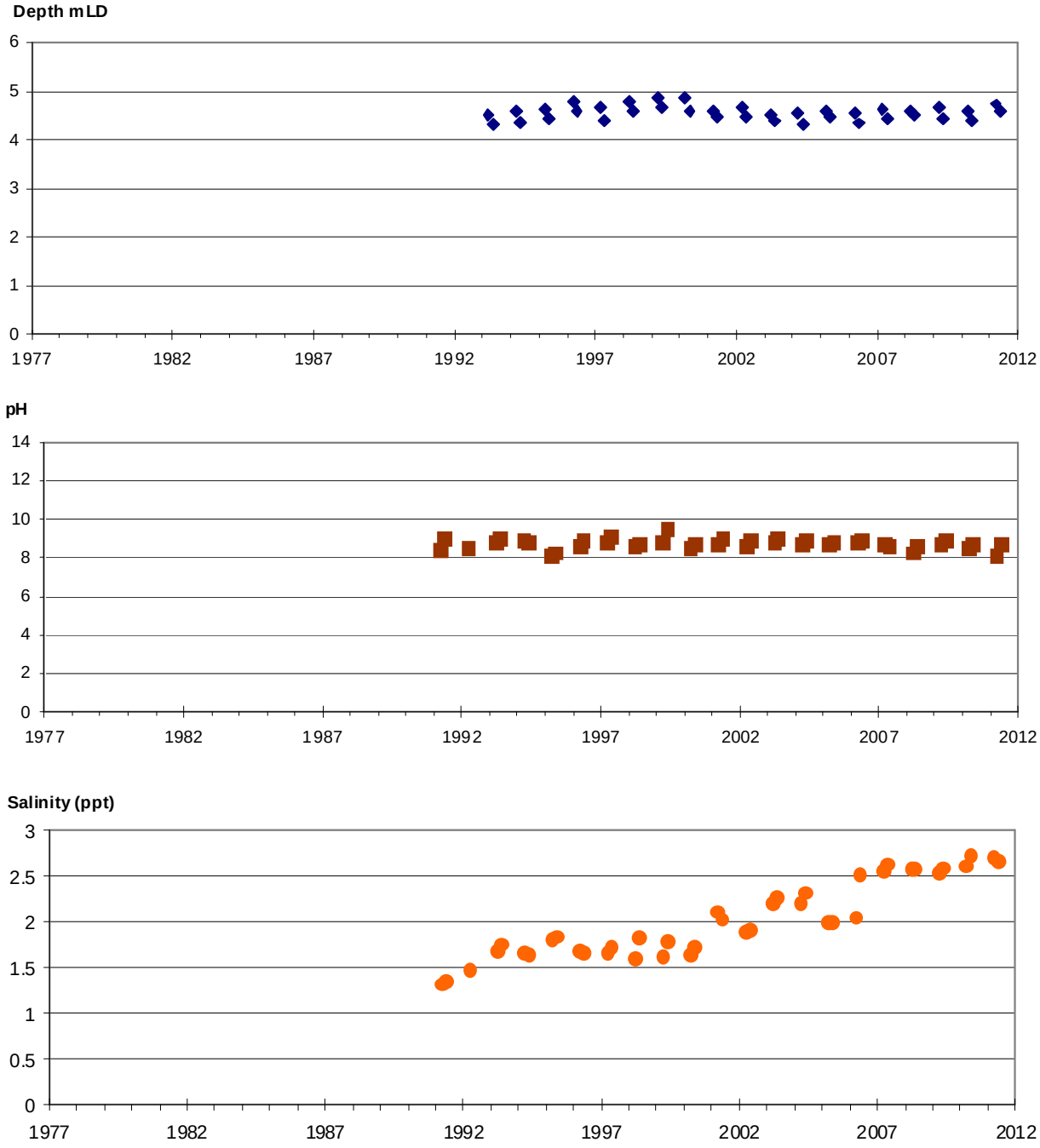




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Crackers is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

DAVIES (with Depth axis 0-6m)

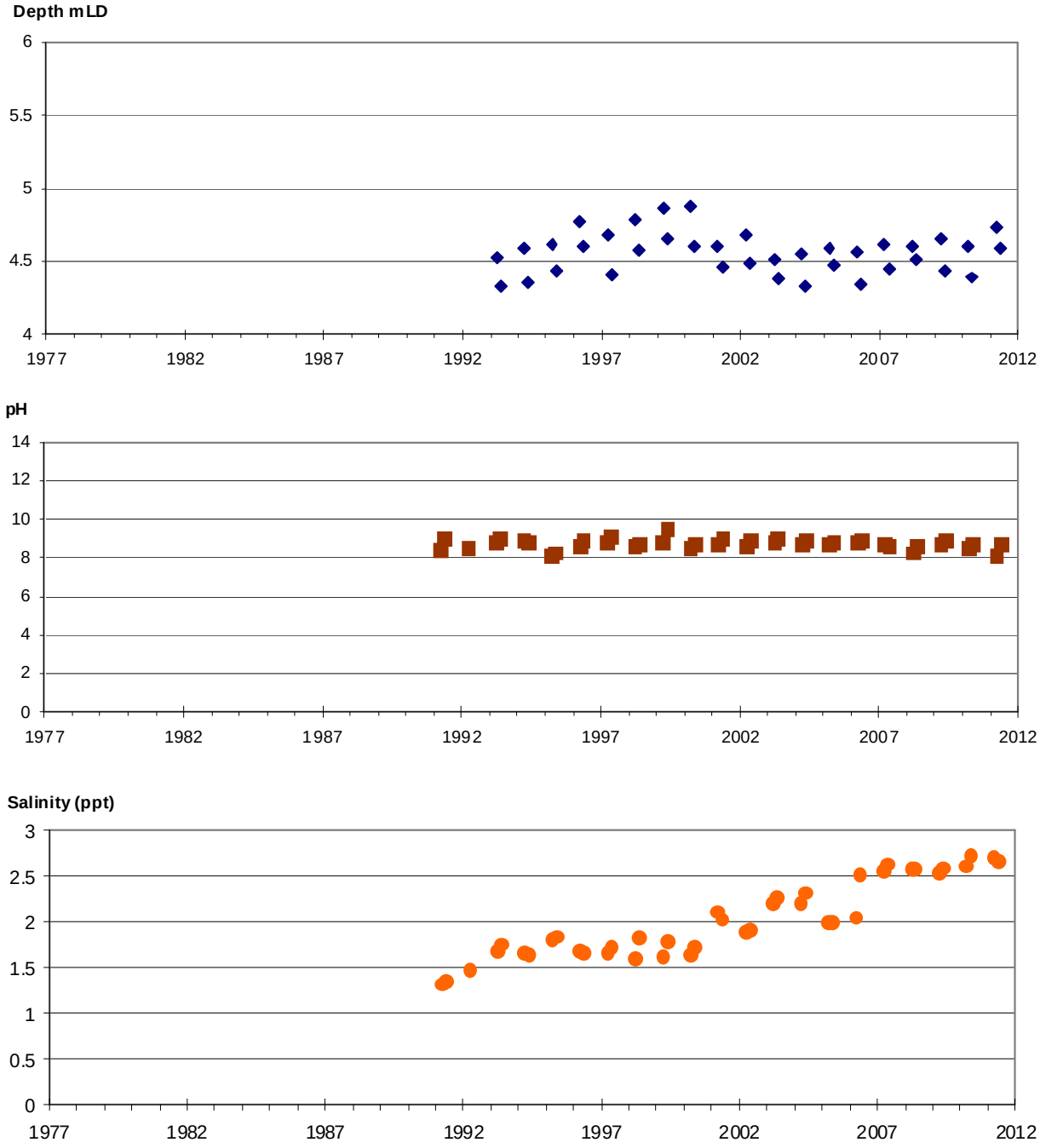


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Davies is in the Blackwood District (headquartered in Busselton) of the South West DEC Region.

DAVIES (with Depth axis 4-6m)

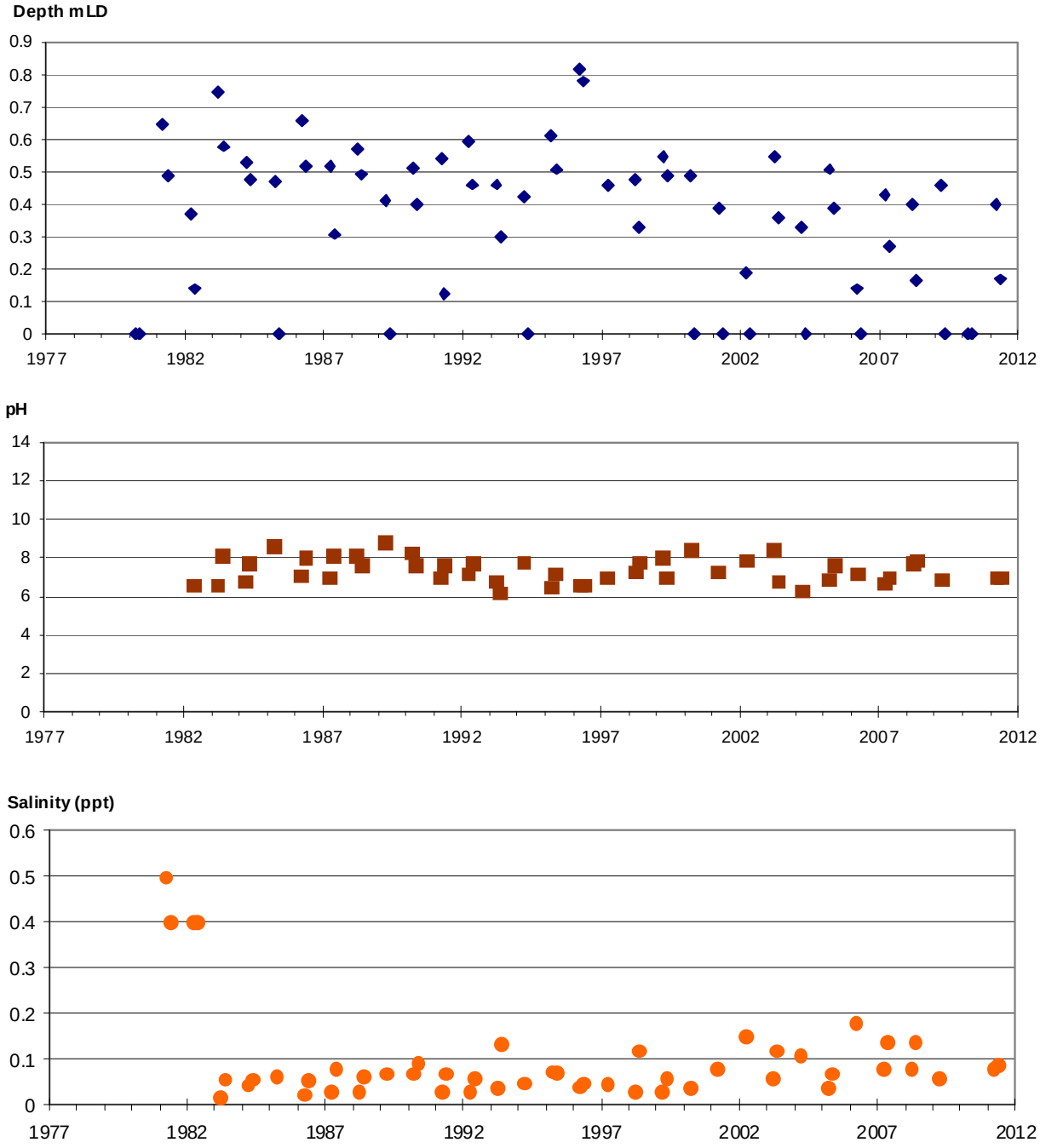


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Davies is in the Blackwood District (headquartered in Busselton) of the South West DEC Region.

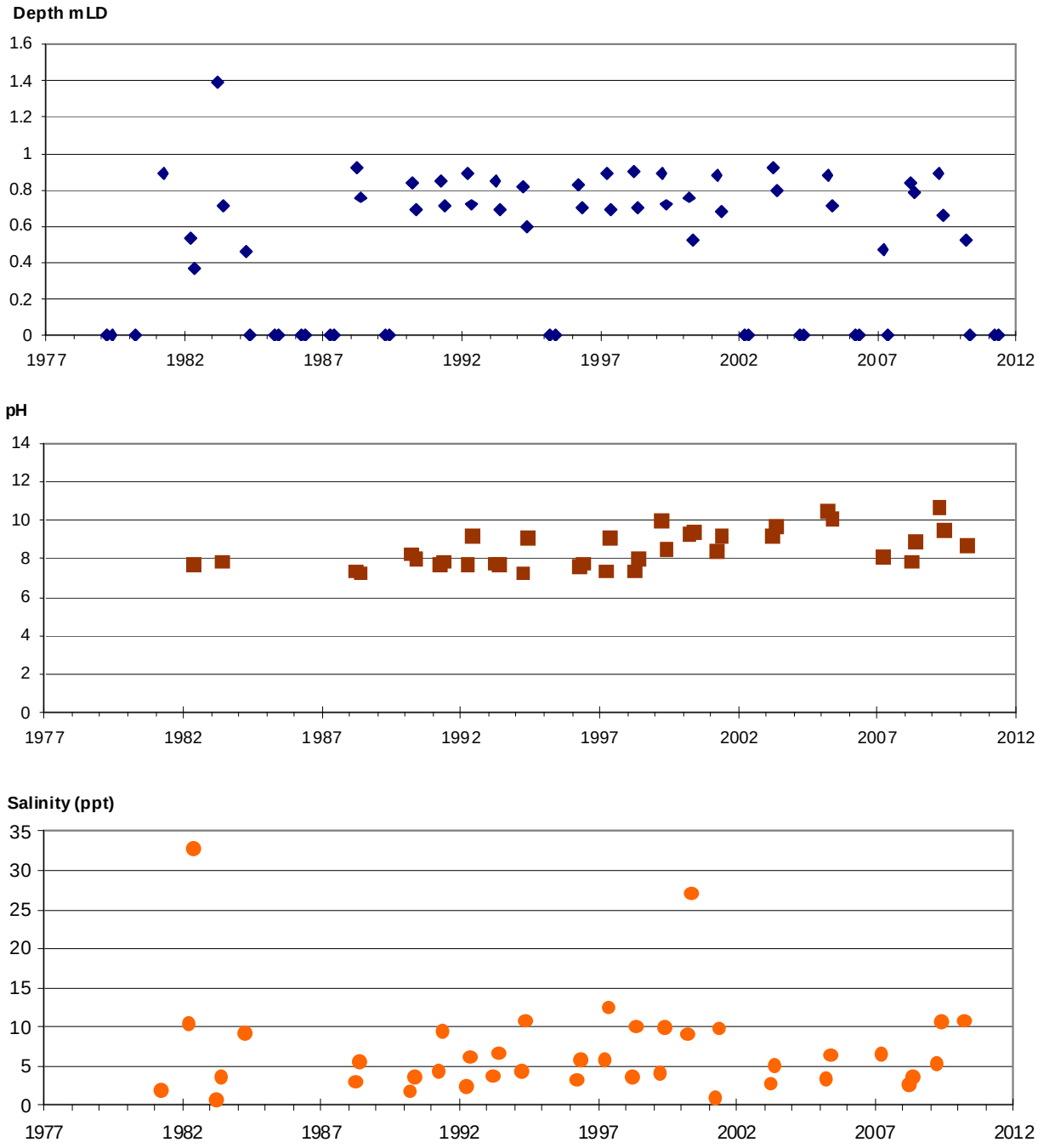
DOBADERRY



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Dobaderry is in the Perth Hills District (headquartered in Mundaring) of the Swan DEC Region.

DULBINNING

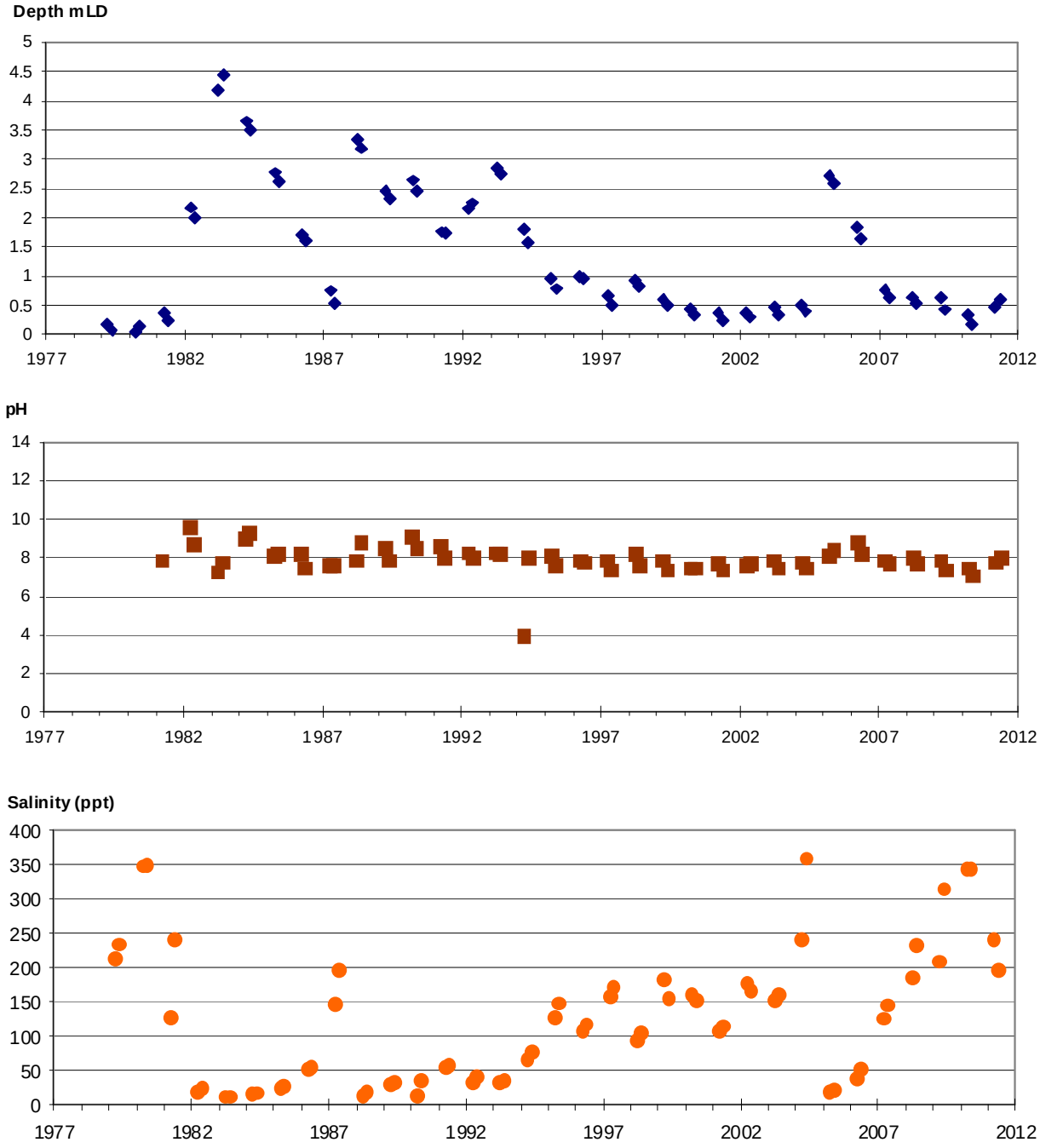


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Dulbinning is within the Toolibin Lake Natural Diversity Recovery Catchment.

Dulbinning is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

DUMBLEYUNG [IM]

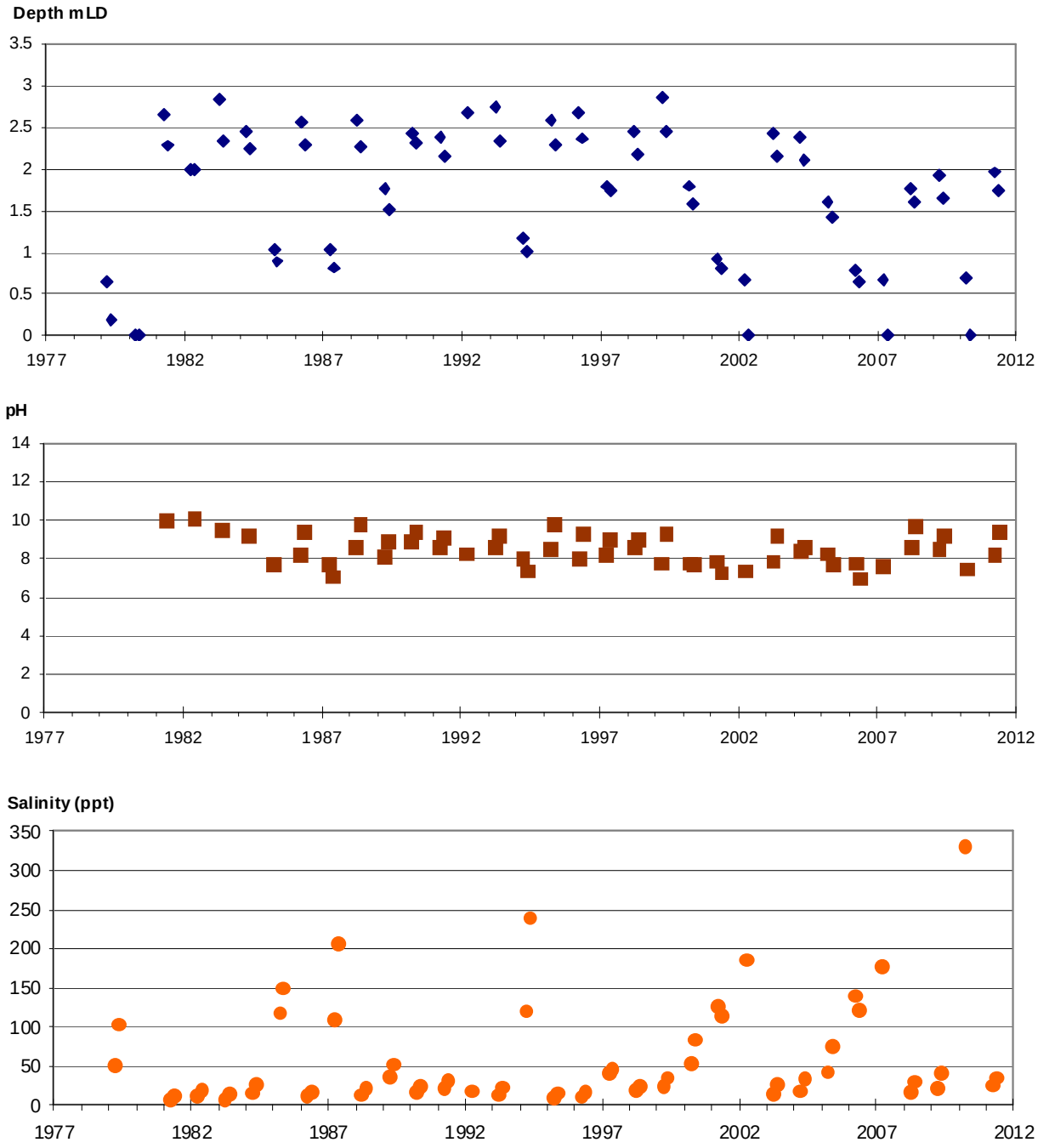


Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Dumbleyung Lake is listed in the 'Directory of Important Wetlands in Australia'.

Dumbleyung is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

EGANU [IM]

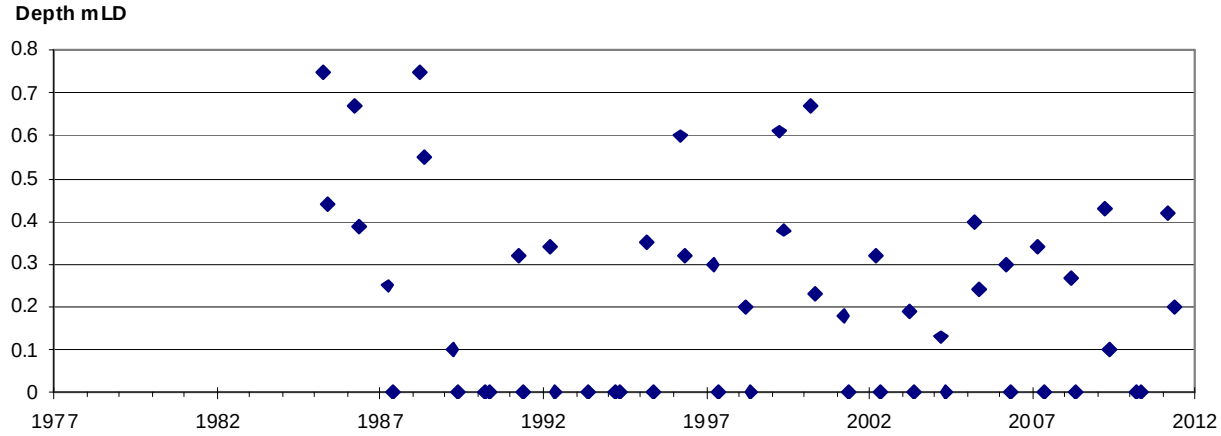


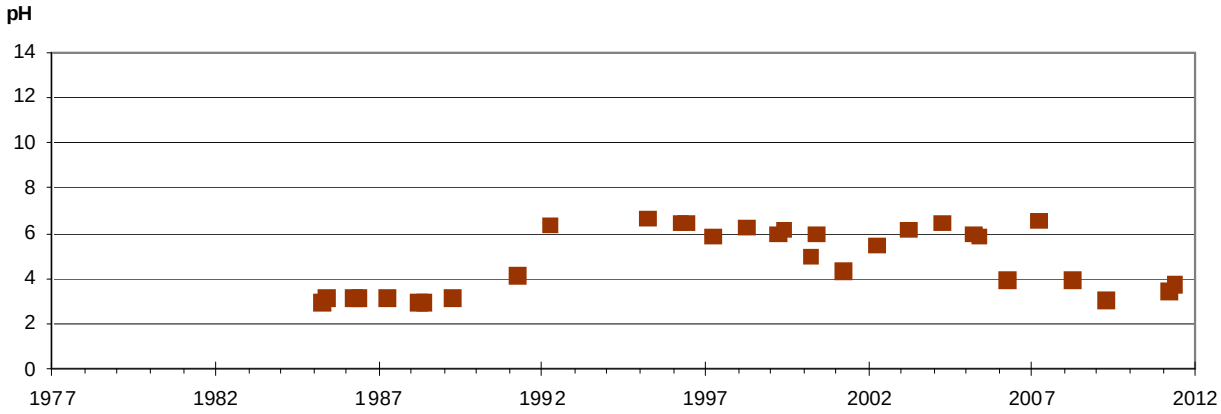
Notes:

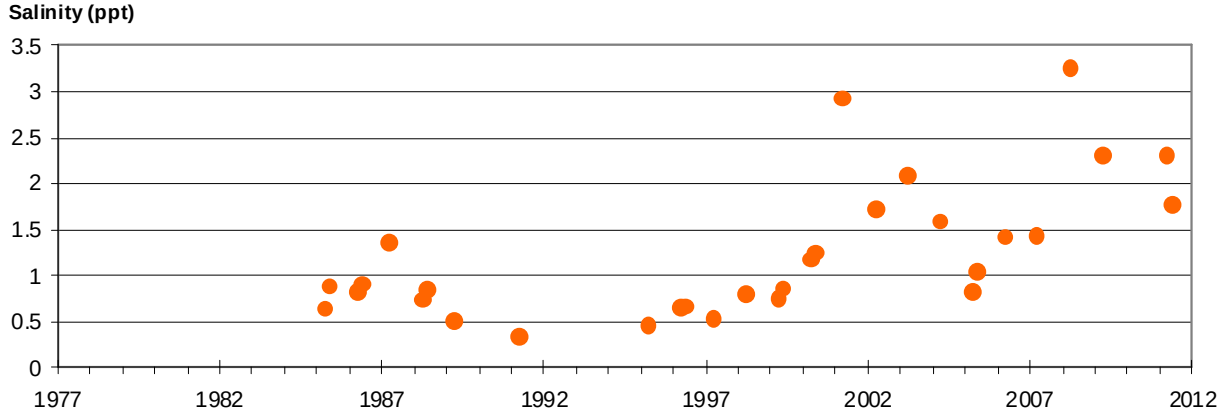
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Eganu is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

EGRET





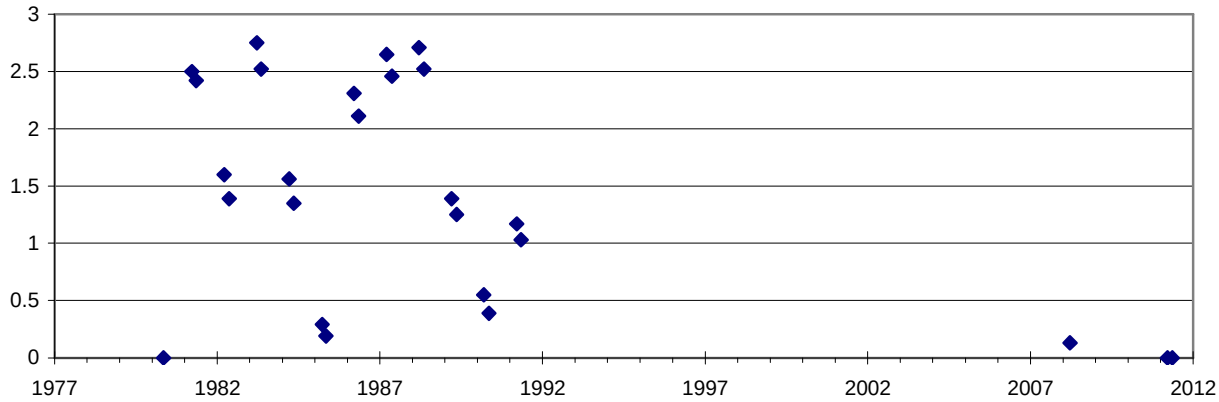


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

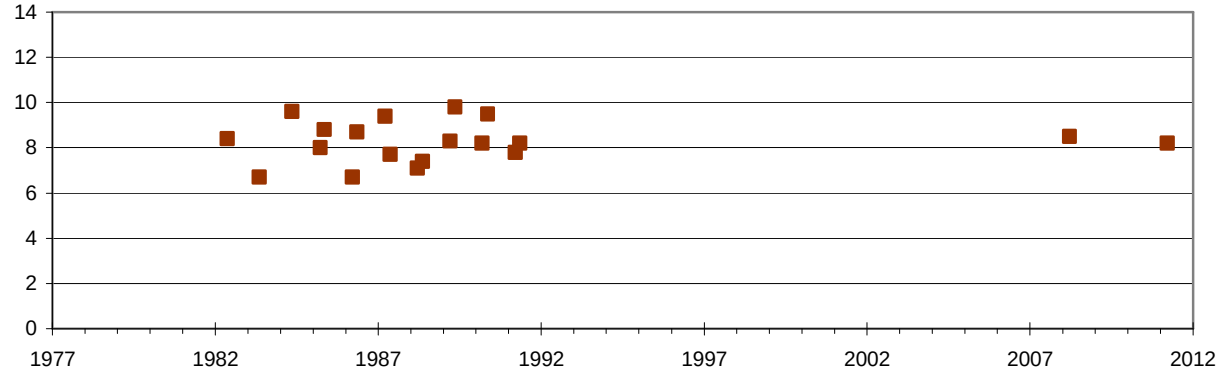
Egret is in the Wellington District (headquartered in Collie) of the South West DEC Region.

ENEMINGA

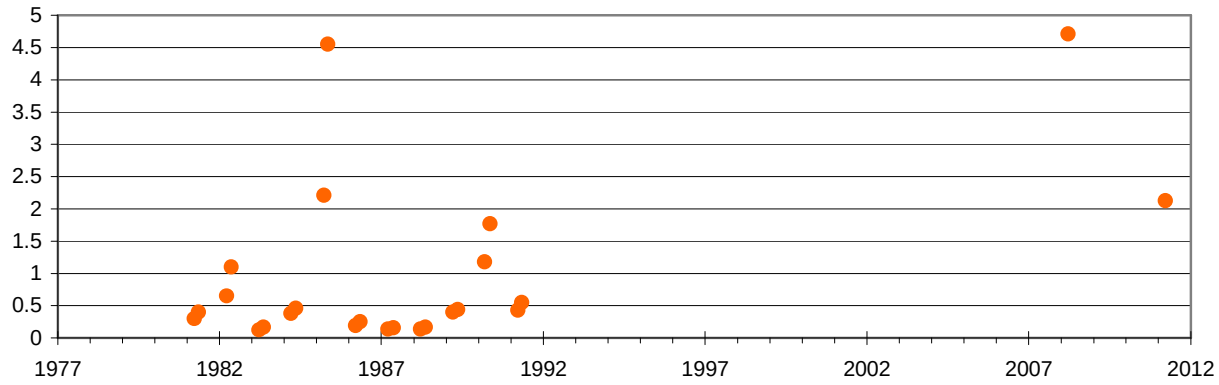
Depth mLD



pH



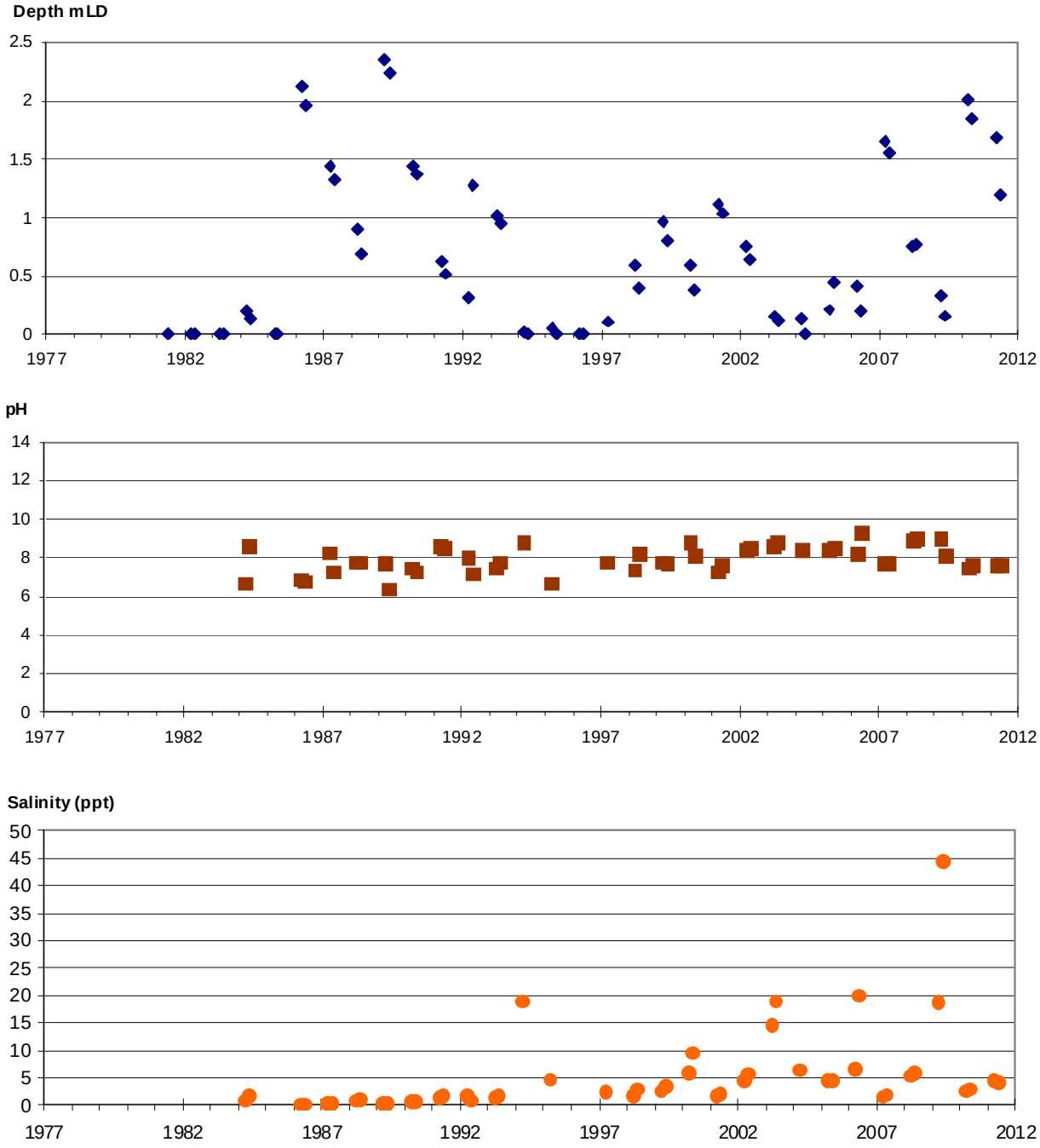
Salinity (ppt)



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Eneminga is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

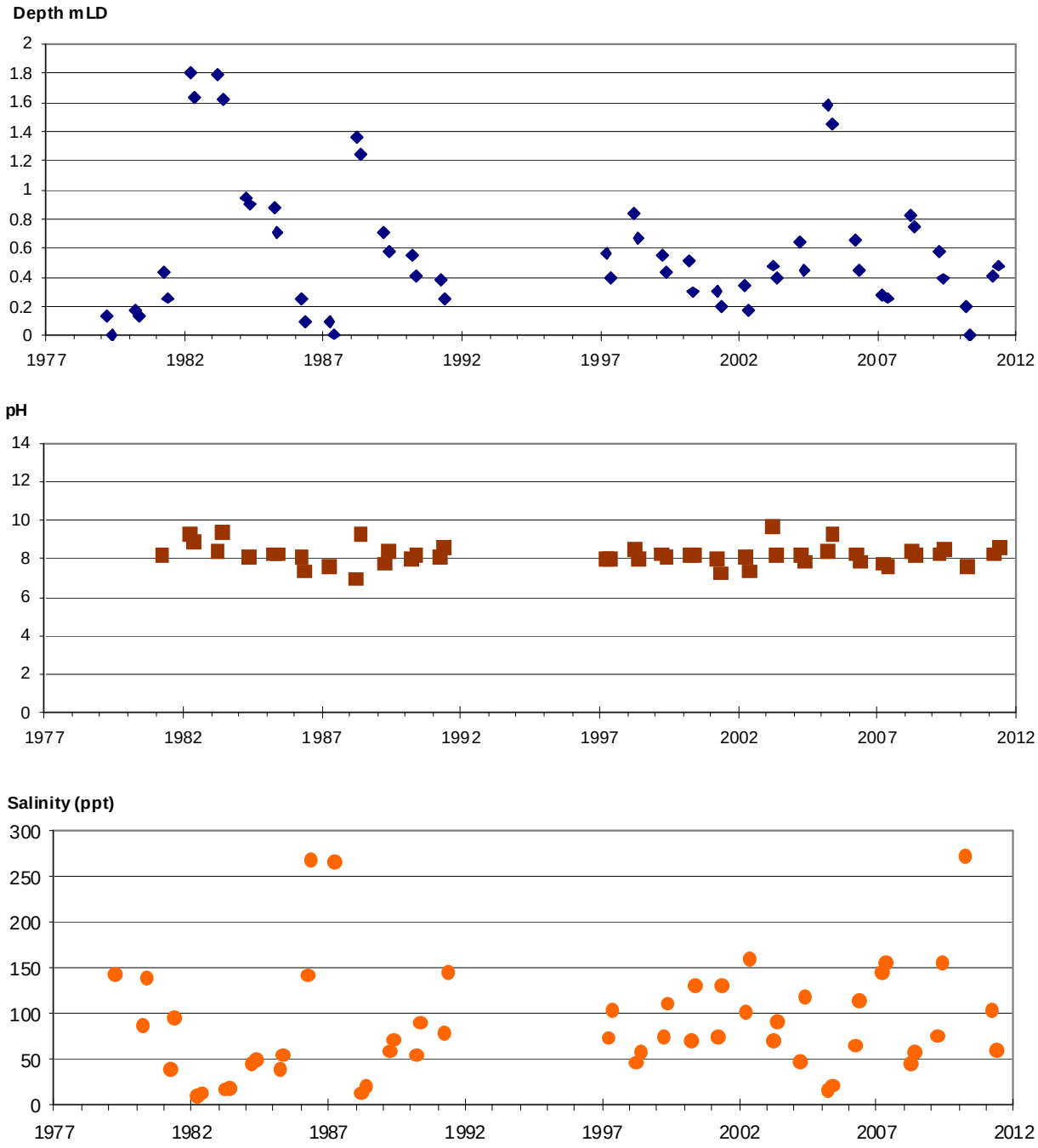
ESPERANCE 26410



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Esperance 26410 is in the Esperance District of the South Coast DEC Region.

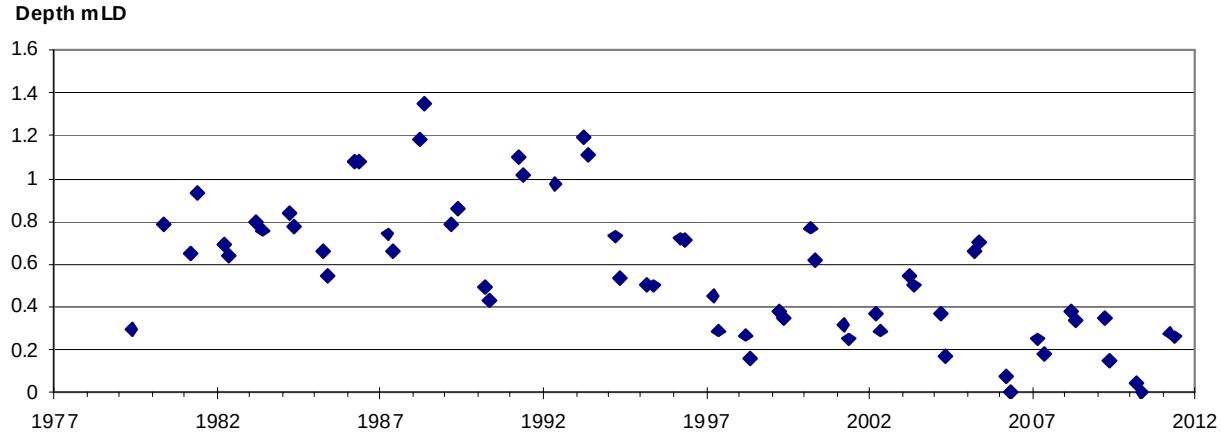
FLAGSTAFF

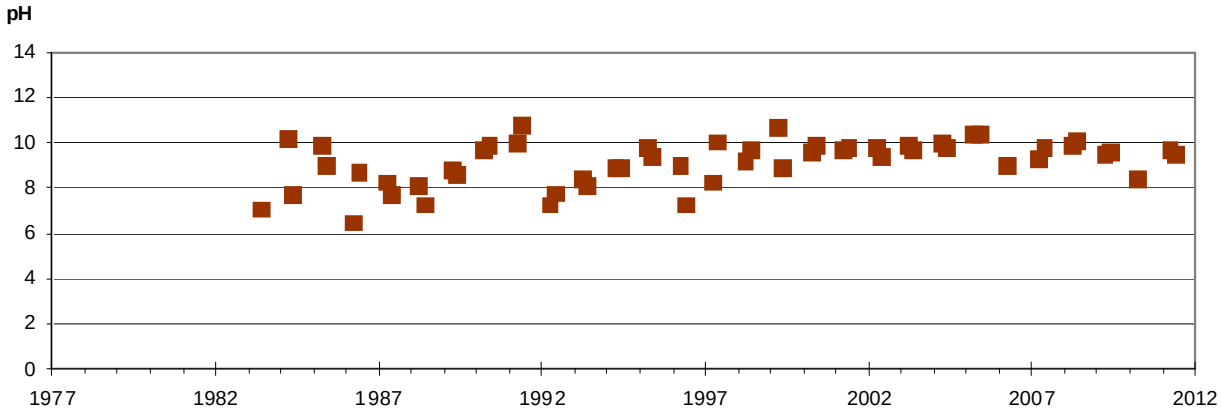


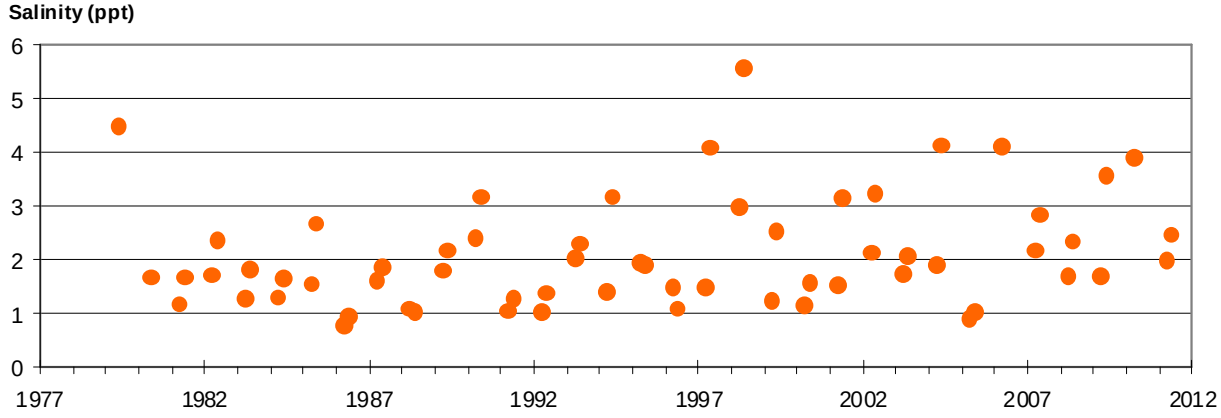
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Flagstaff is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

FORRESTDALE





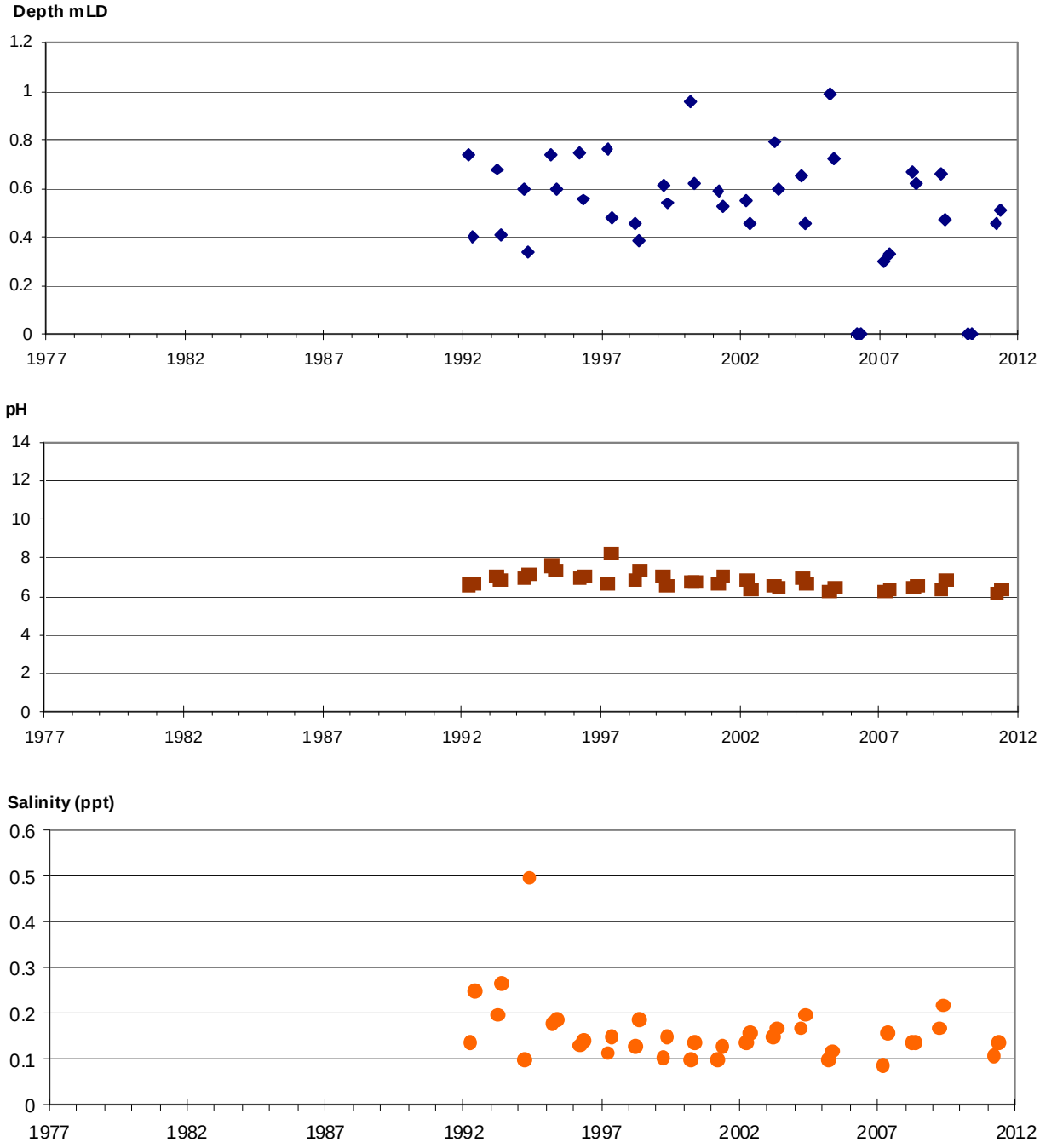


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Forrestdale Lake is a component of the 'Forrestdale and Thomsons Lakes' system, which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also listed in the 'Directory of Important Wetlands in Australia'.

Forrestdale is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

GIBBS

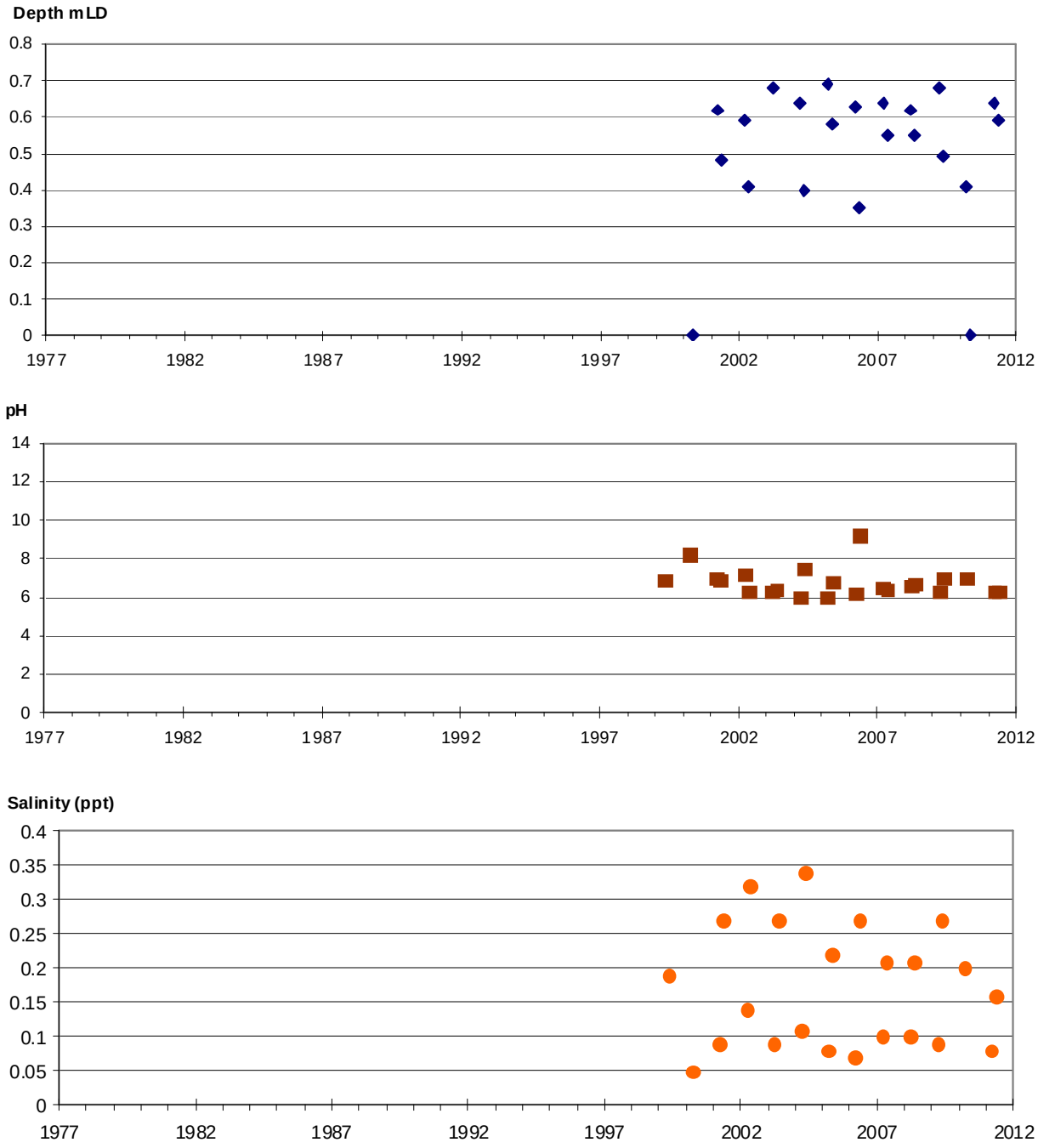


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Gibbs is a component of the 'Gibbs Road Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

Gibbs is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

GOONAPING [IM]

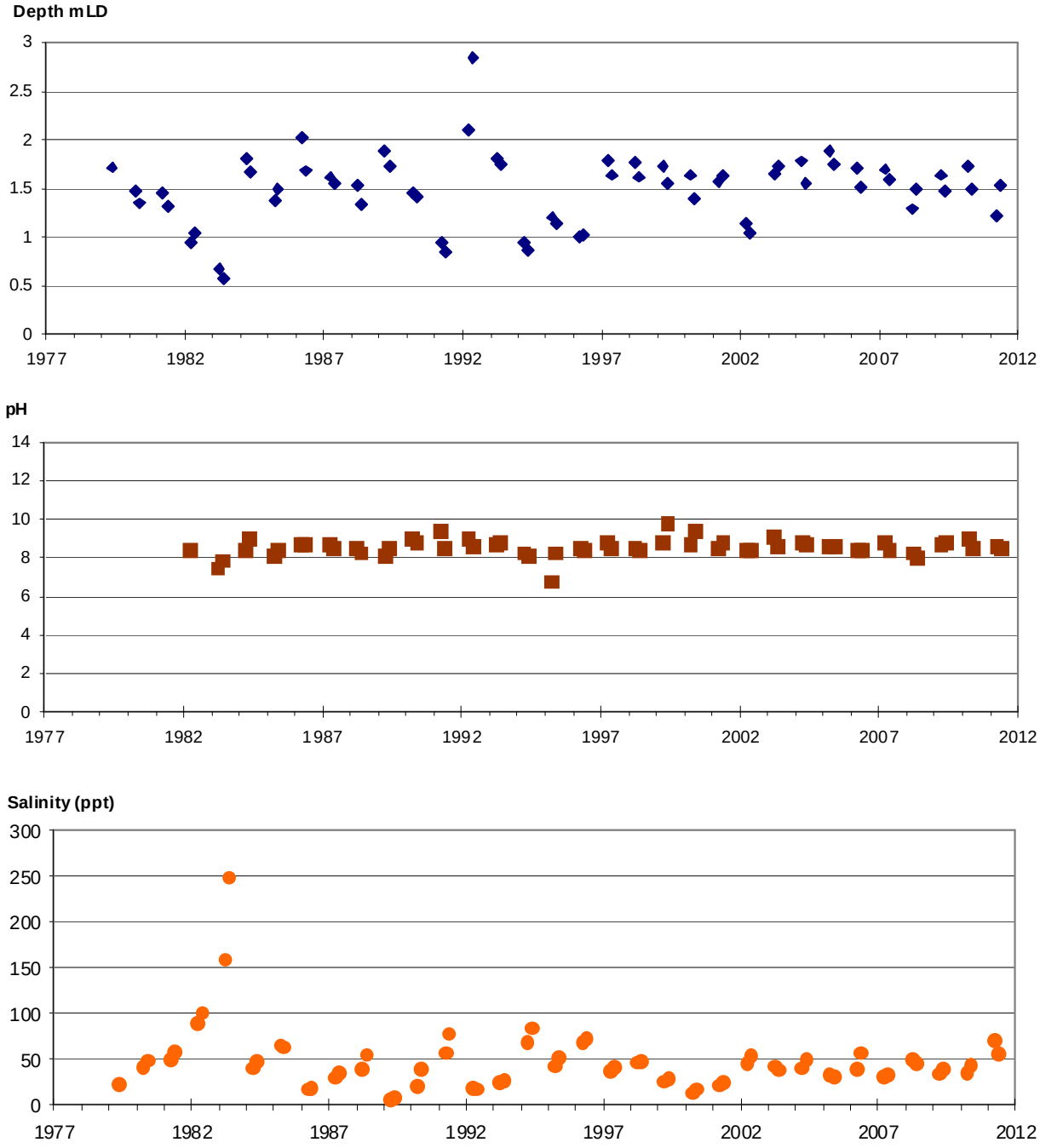


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Goonaping is in the Perth Hills District (headquartered in Mundaring) of the Swan DEC Region.

GORE



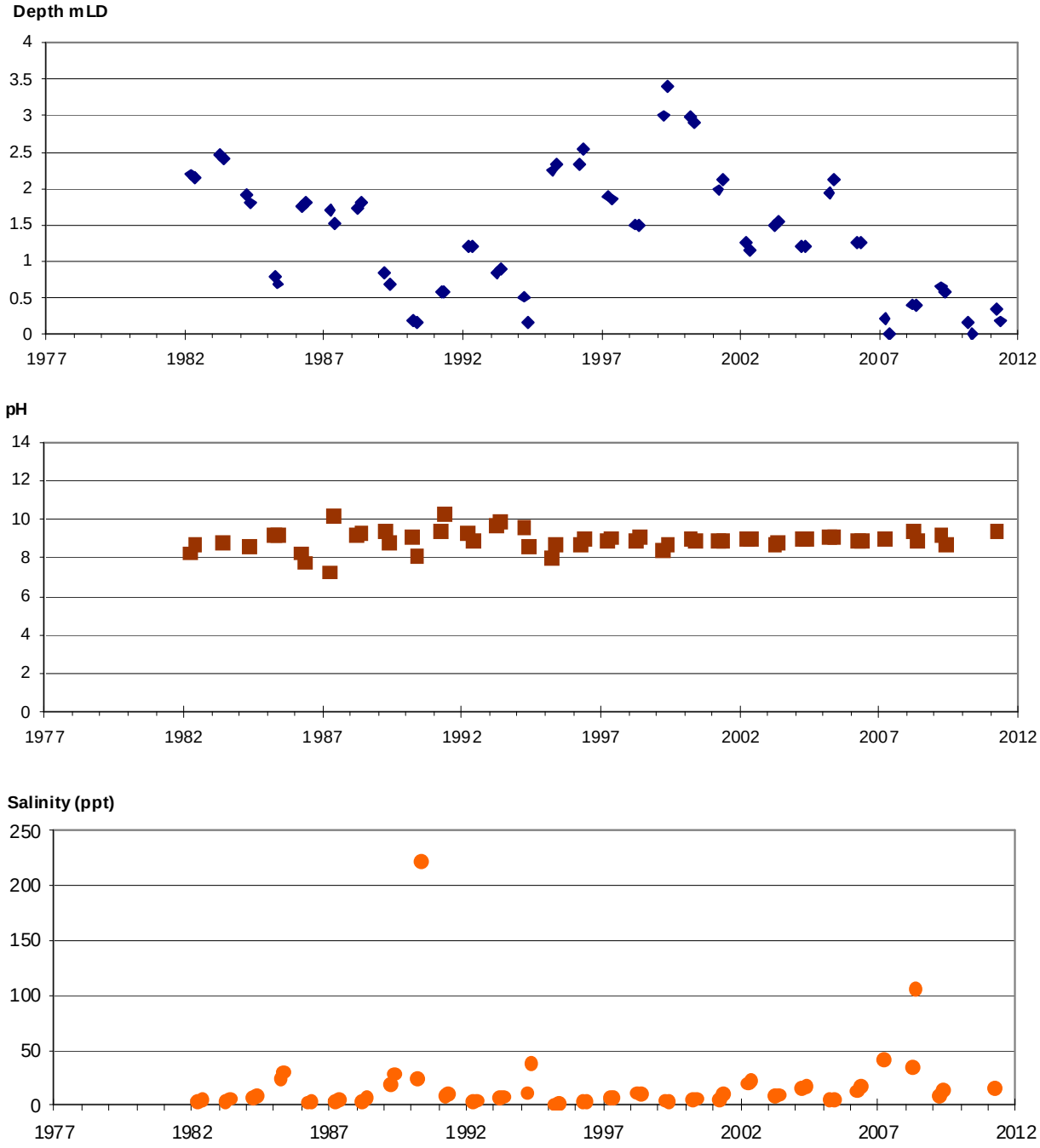
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Lake Gore is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Lake Gore is also a component of the 'Lake Gore System', which is listed in the 'Directory of Important Wetlands in Australia'.

Gore is in the Esperance District of the South Coast DEC Region.

GURAGA (with Salinity axis 0-250ppt)

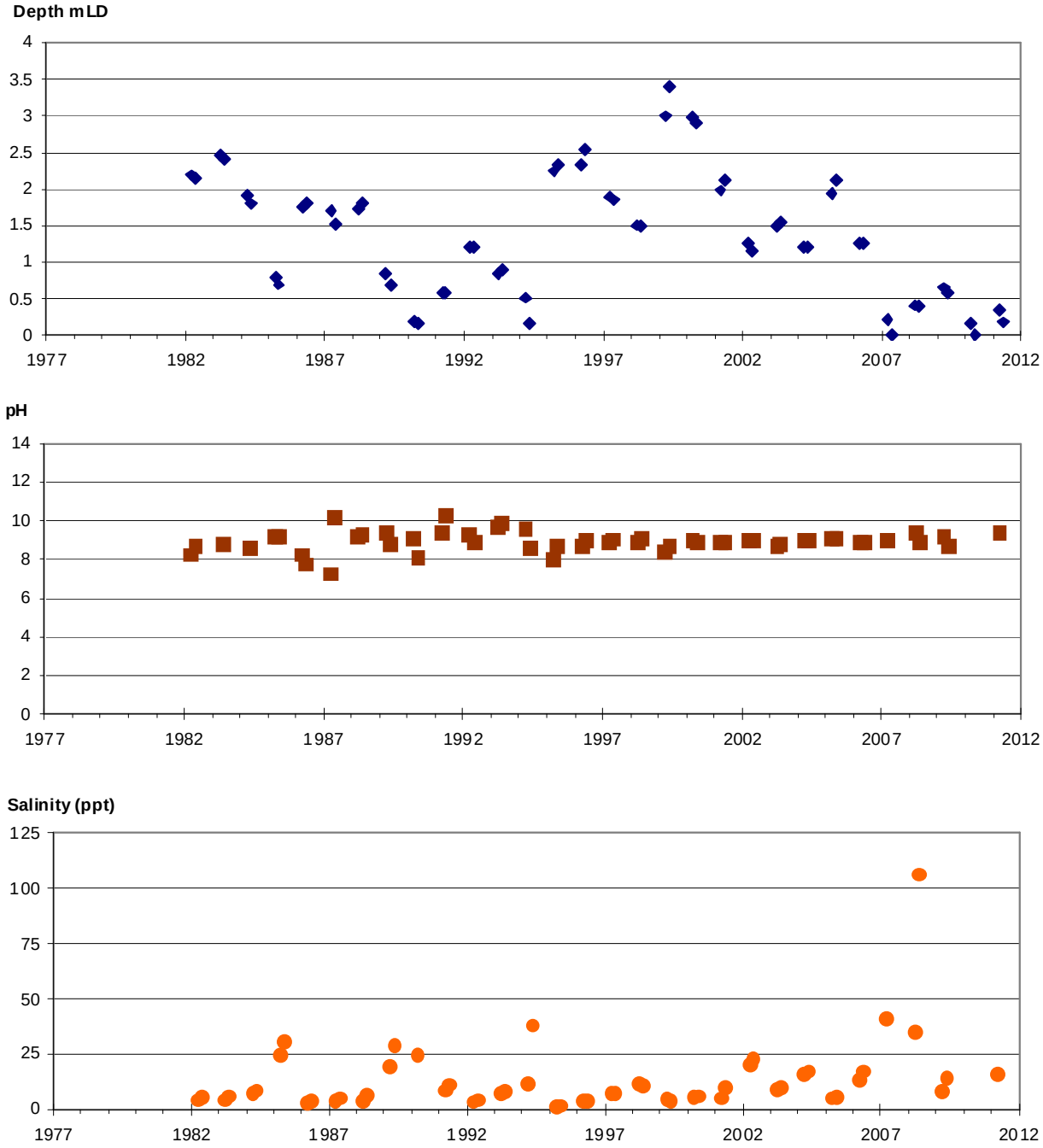


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Guraga Lake is listed in the 'Directory of Important Wetlands in Australia'.

Guraga is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

GURAGA (with Salinity axis 0-125ppt)

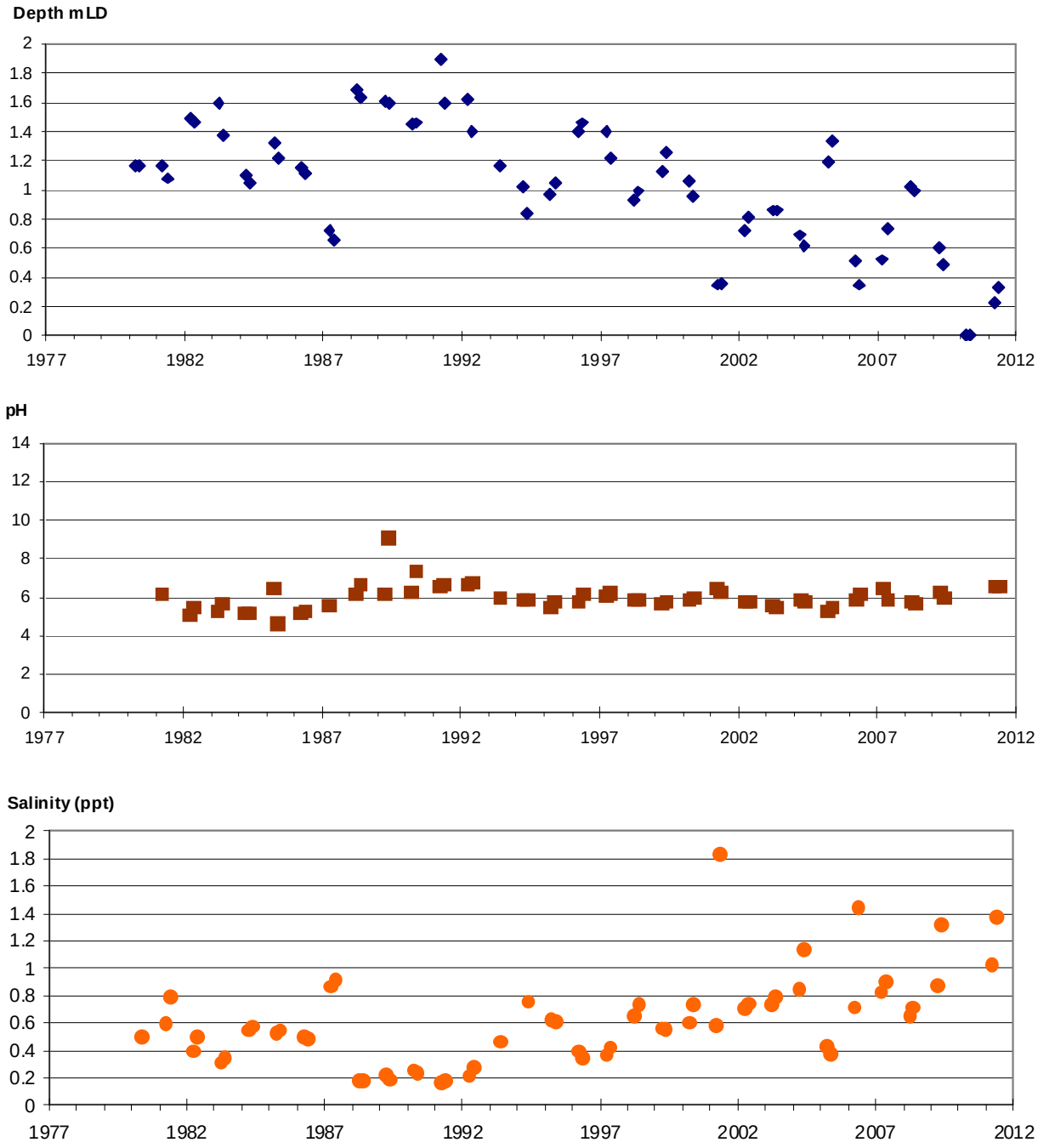


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Guraga Lake is listed in the 'Directory of Important Wetlands in Australia'.

Guraga is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

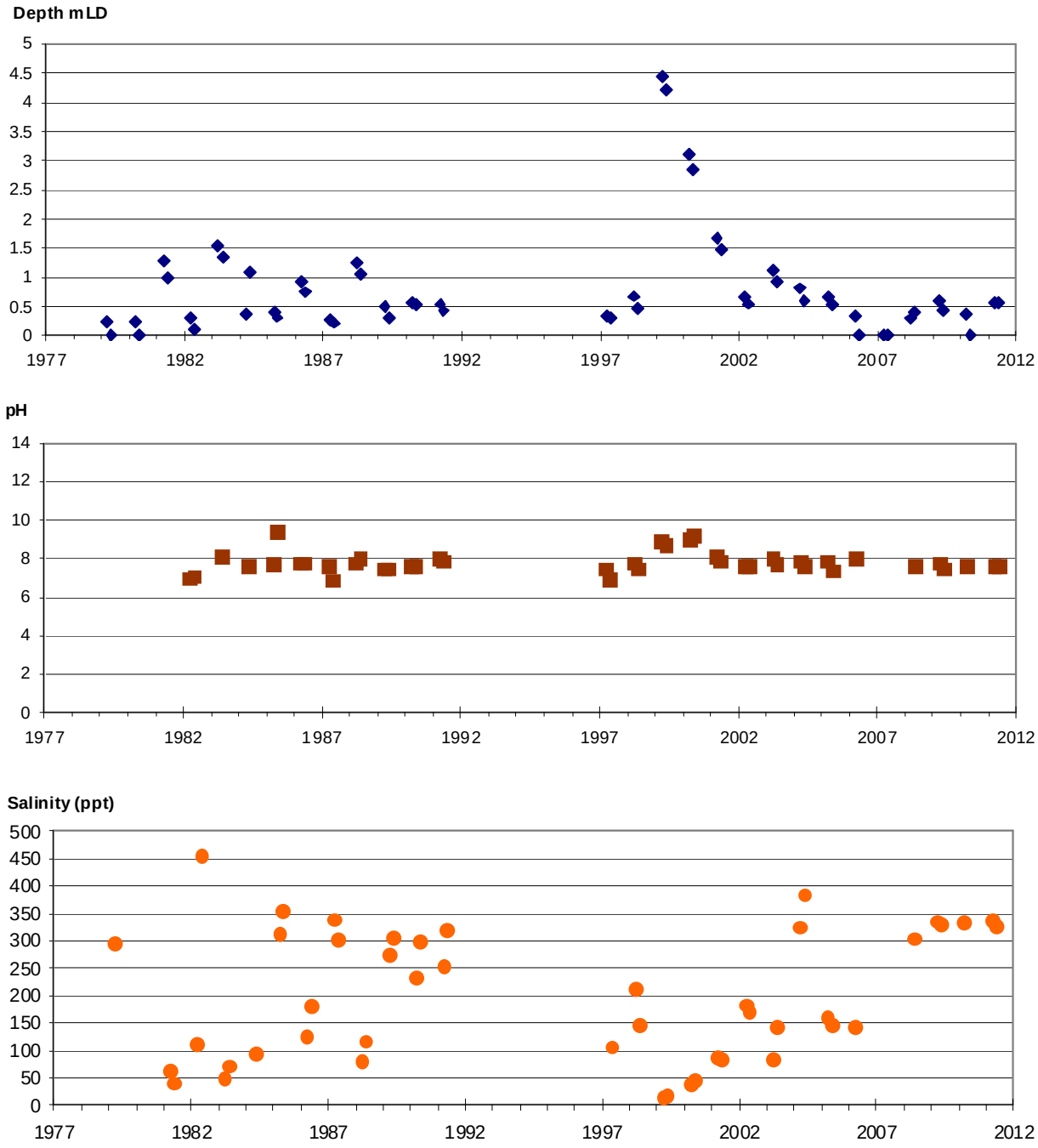
HARVEY 12632



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Harvey 12632 is in the Wellington District (headquartered in Collie) of the South West DEC Region.

HINDS

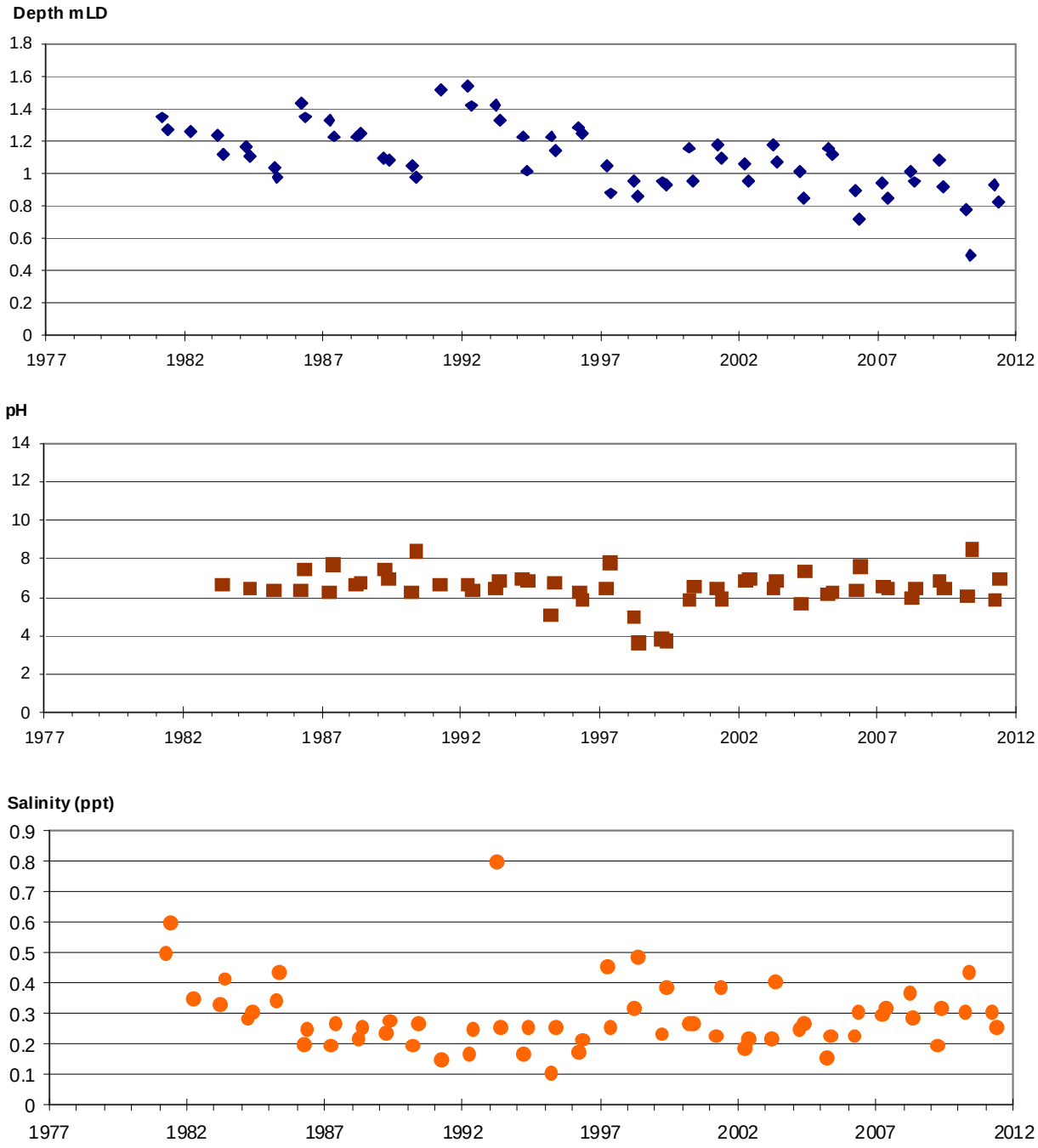


Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Hinds is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

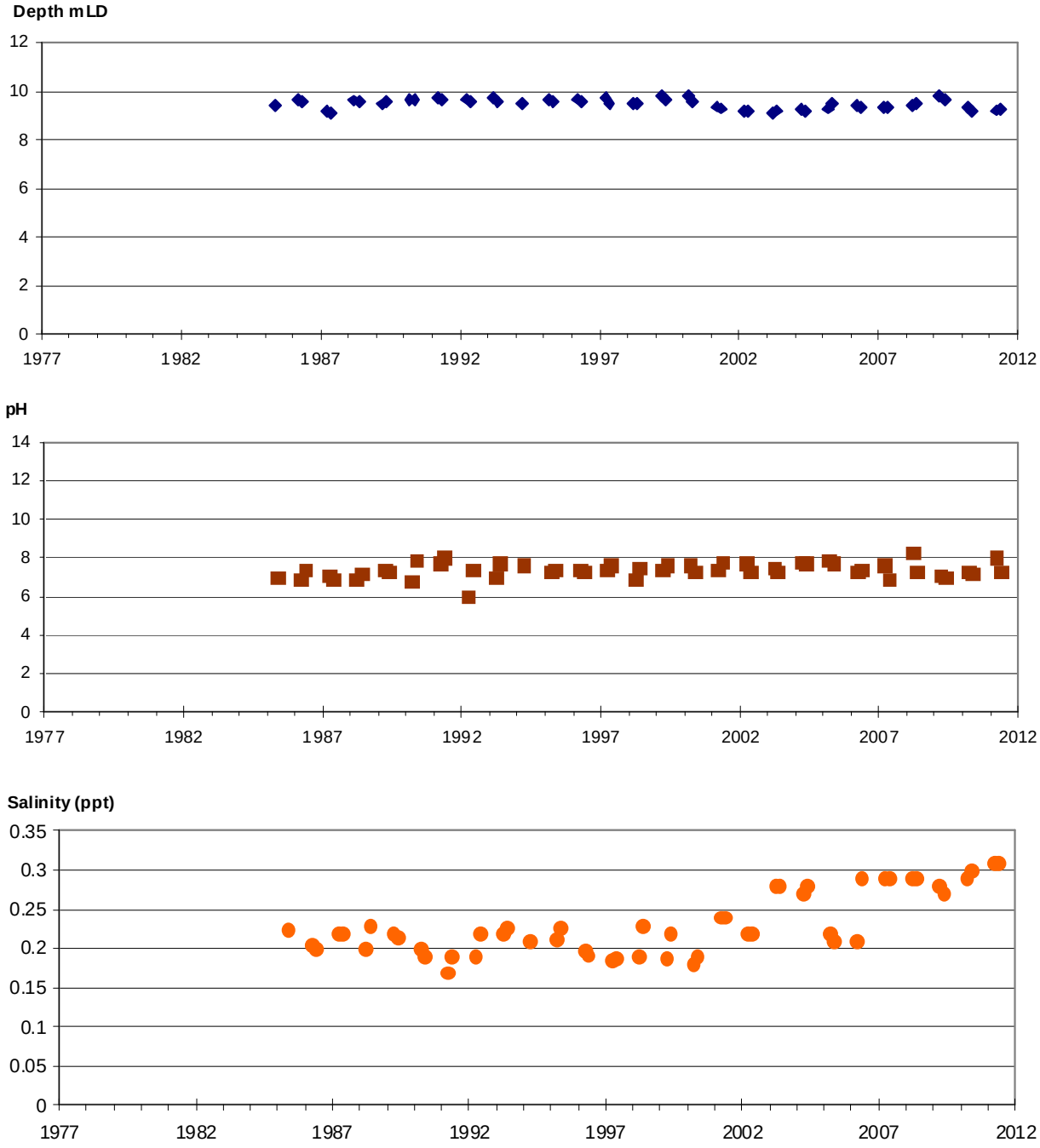
JANDABUP



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jandabup is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

JASPER (with Depth axis 0-12m)

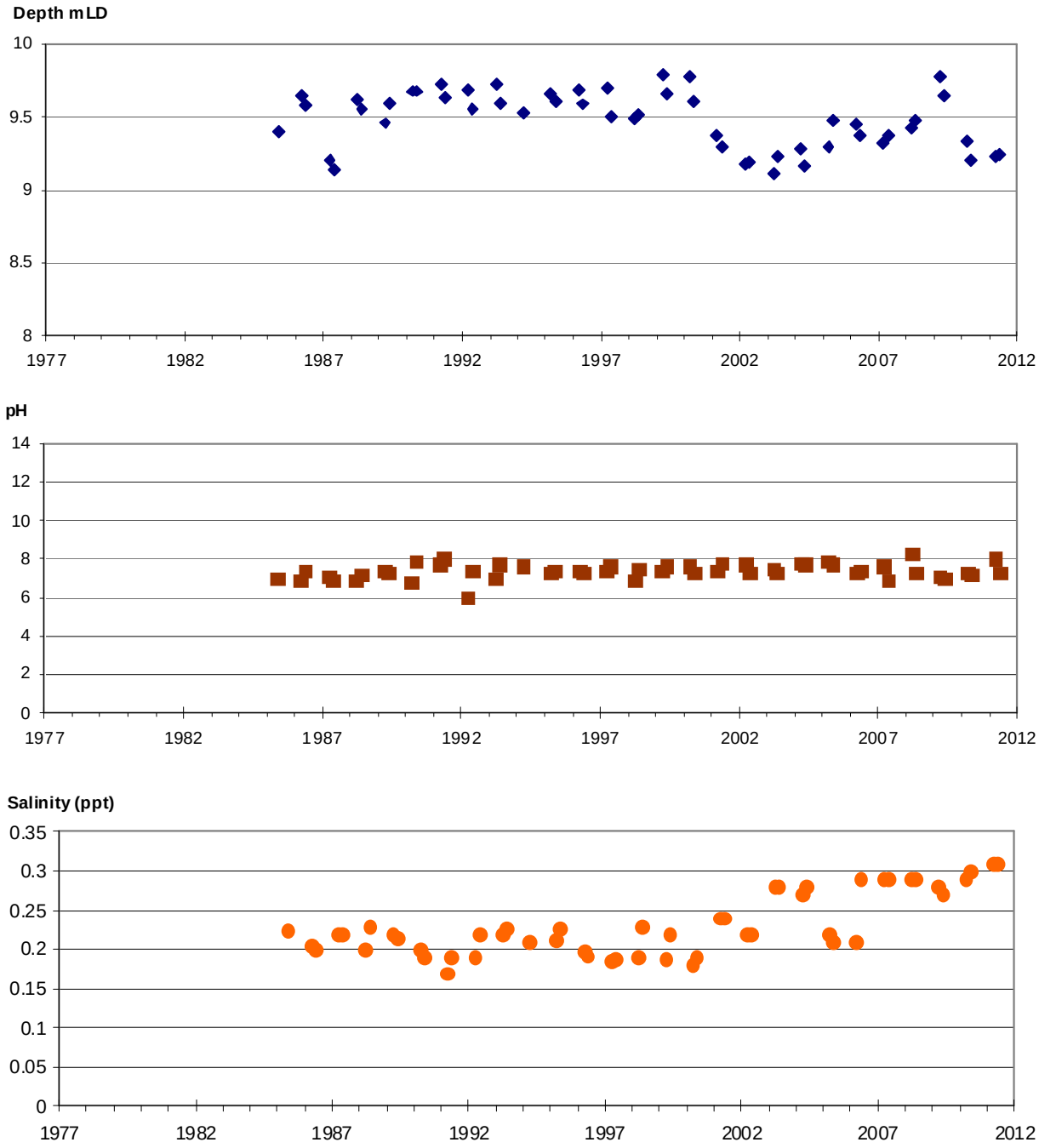


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jasper is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

Jasper is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

JASPER (with Depth axis 8-10m)

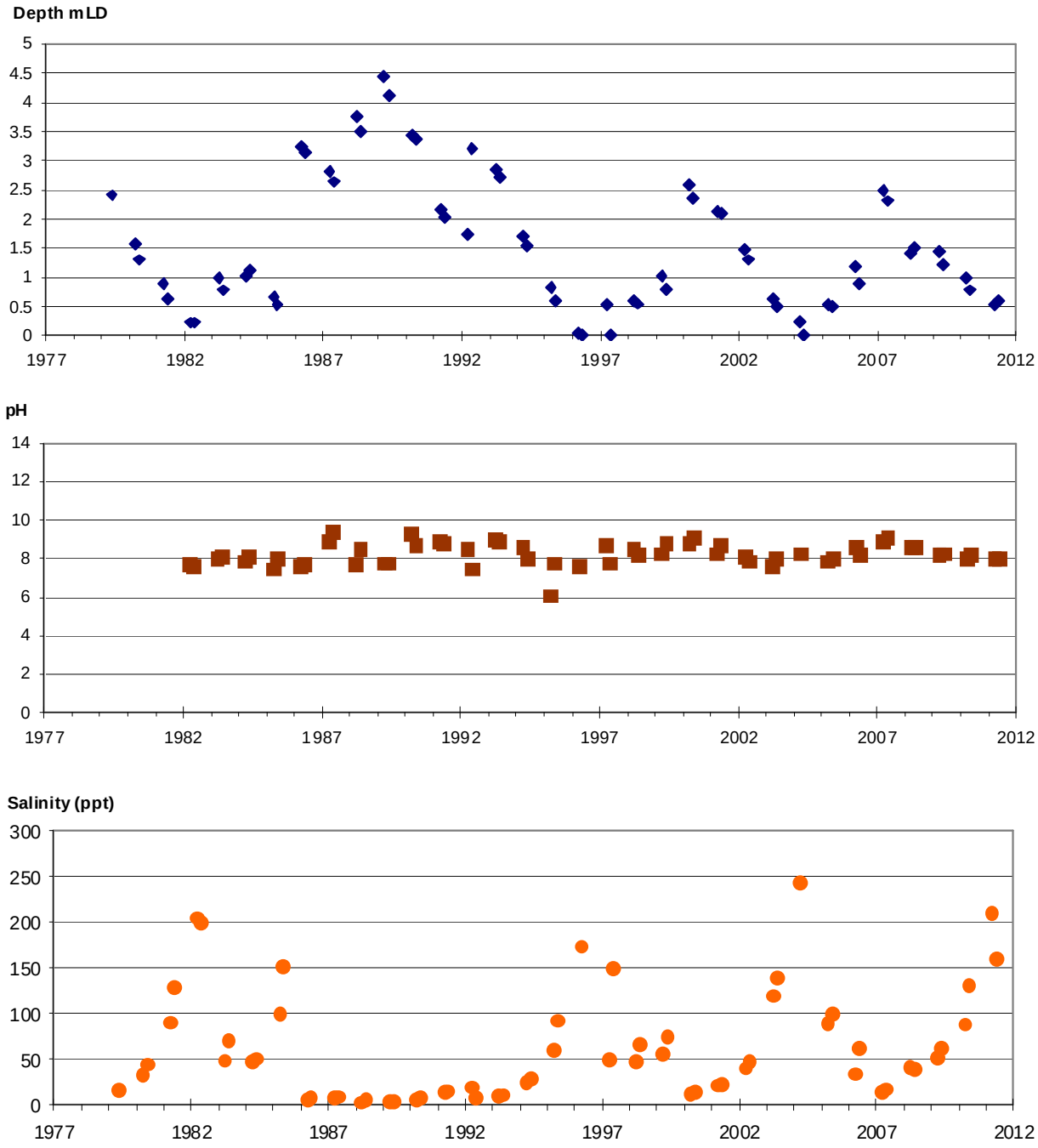


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jasper is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

Jasper is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

JERDACUTTUP

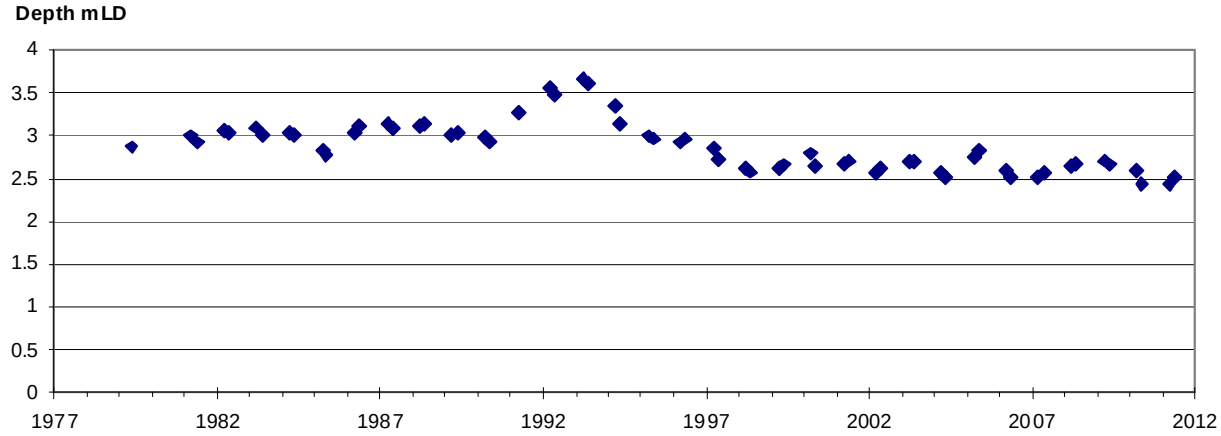


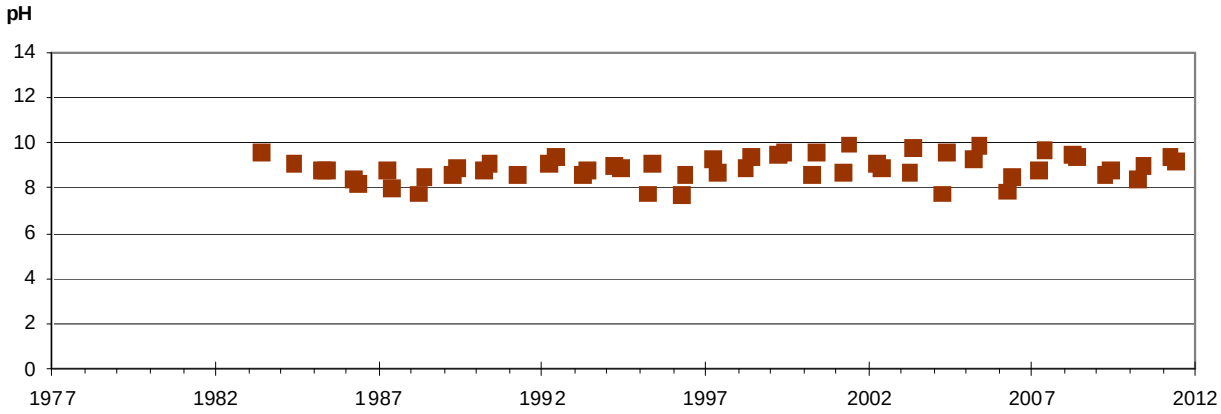
Notes:

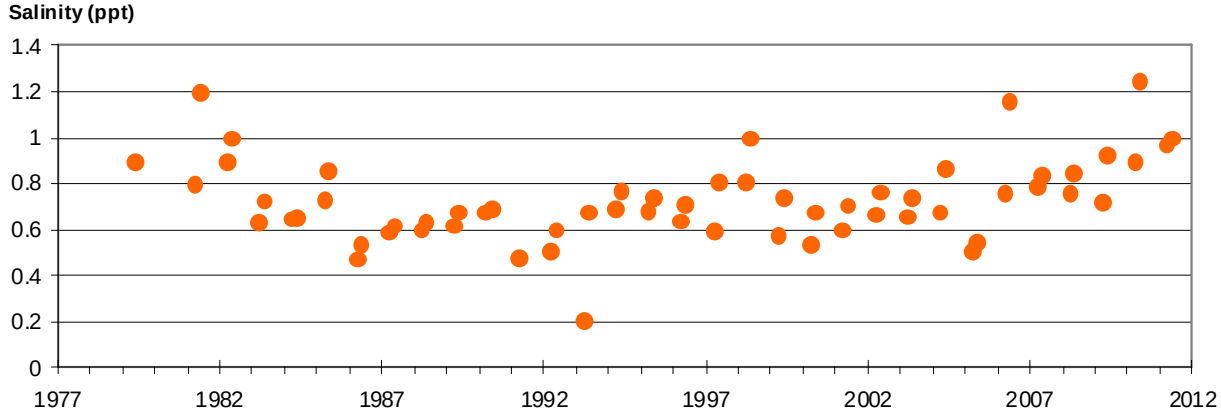
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Jerdacuttup is in the Albany District of the South Coast DEC Region

JOONDALUP





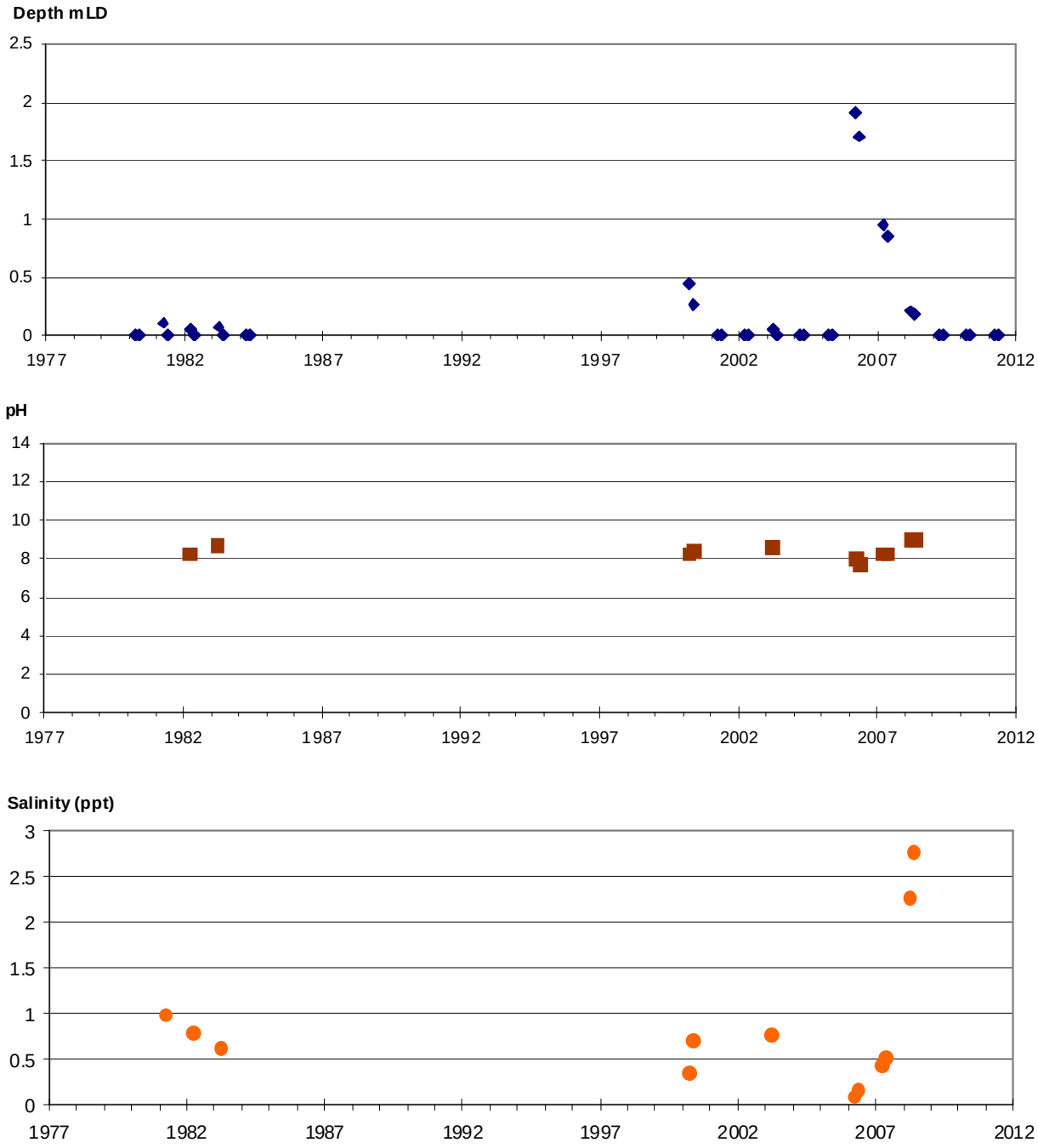


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Joondalup Lake is listed in the 'Directory of Important Wetlands in Australia'.

Joondalup is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

KENT 29020

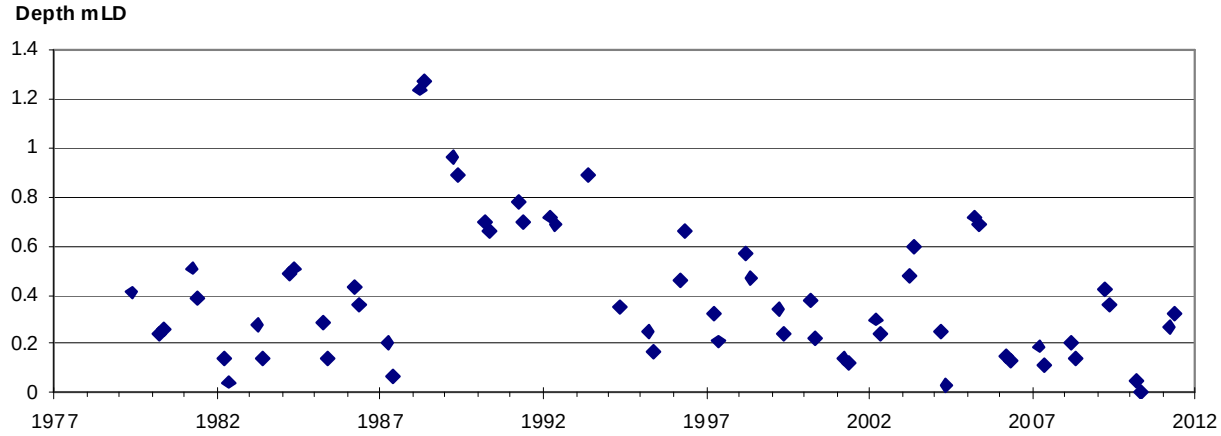


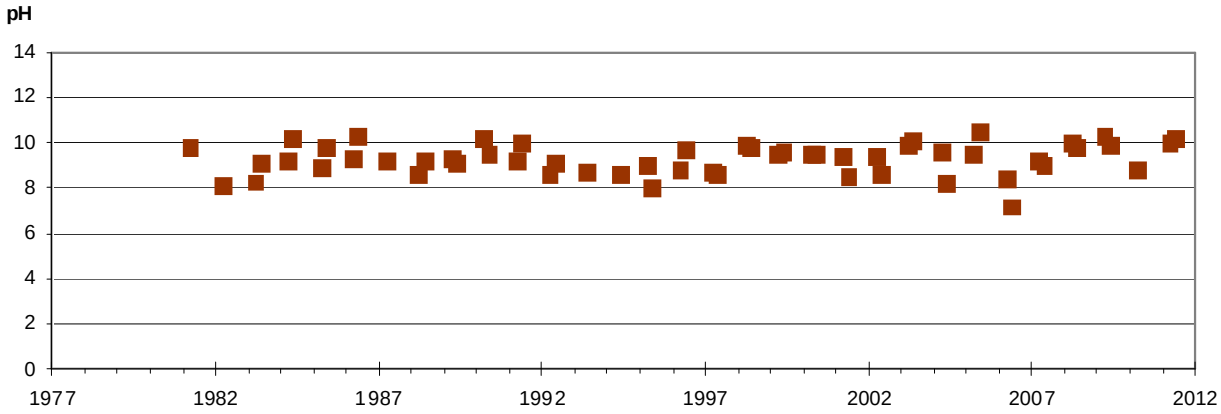
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

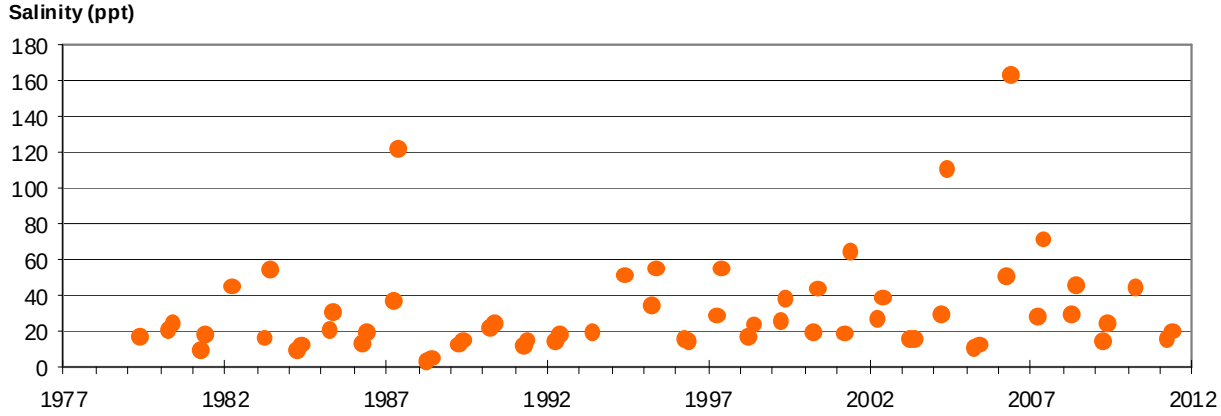
Kent 29020 (also known as East Lake Bryde) is a component of the 'Lake Bryde – East Lake Bryde System', which is listed in the 'Directory of Important Wetlands in Australia'.

Kent 29020 is within the Lake Bryde Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

KWORNICUP



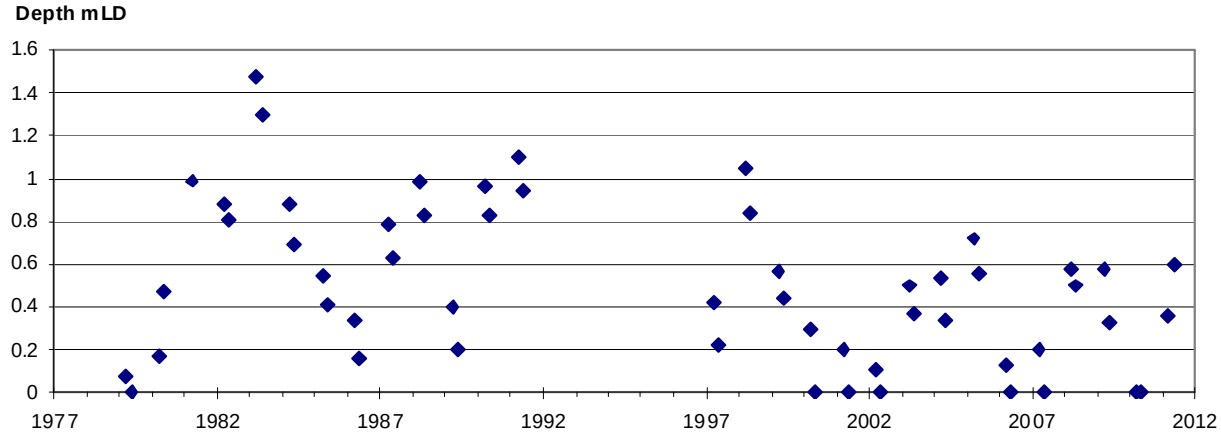


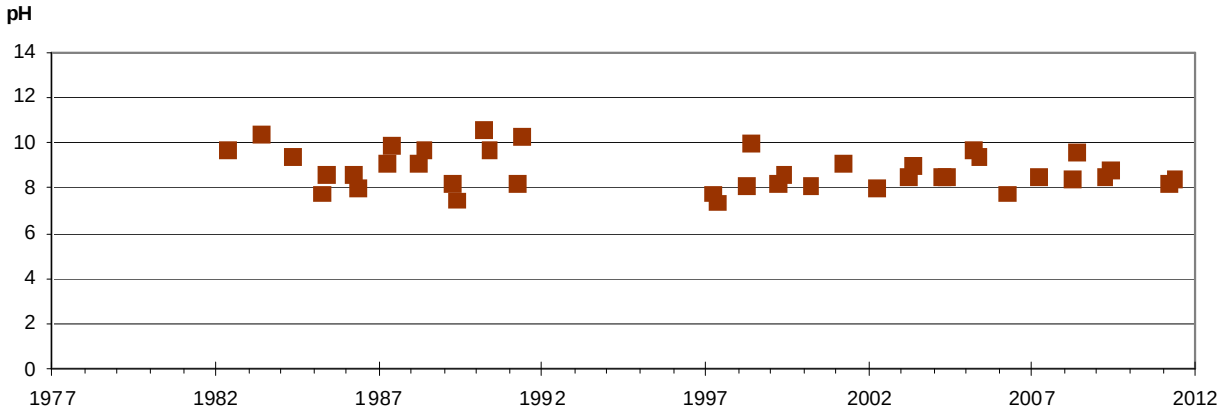


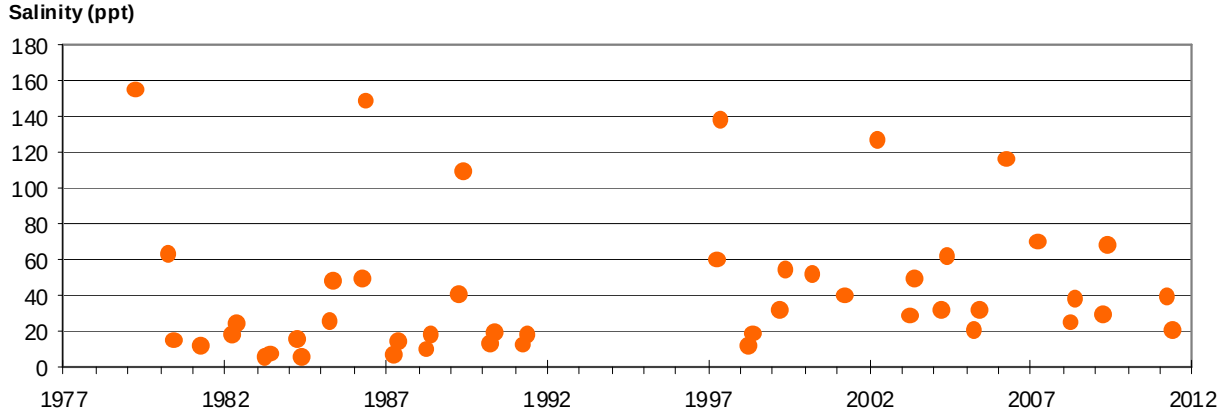
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Kwornicup is in the Frankland District (headquartered in Walpole) of the Warren DEC Region.

LITTLE WHITE



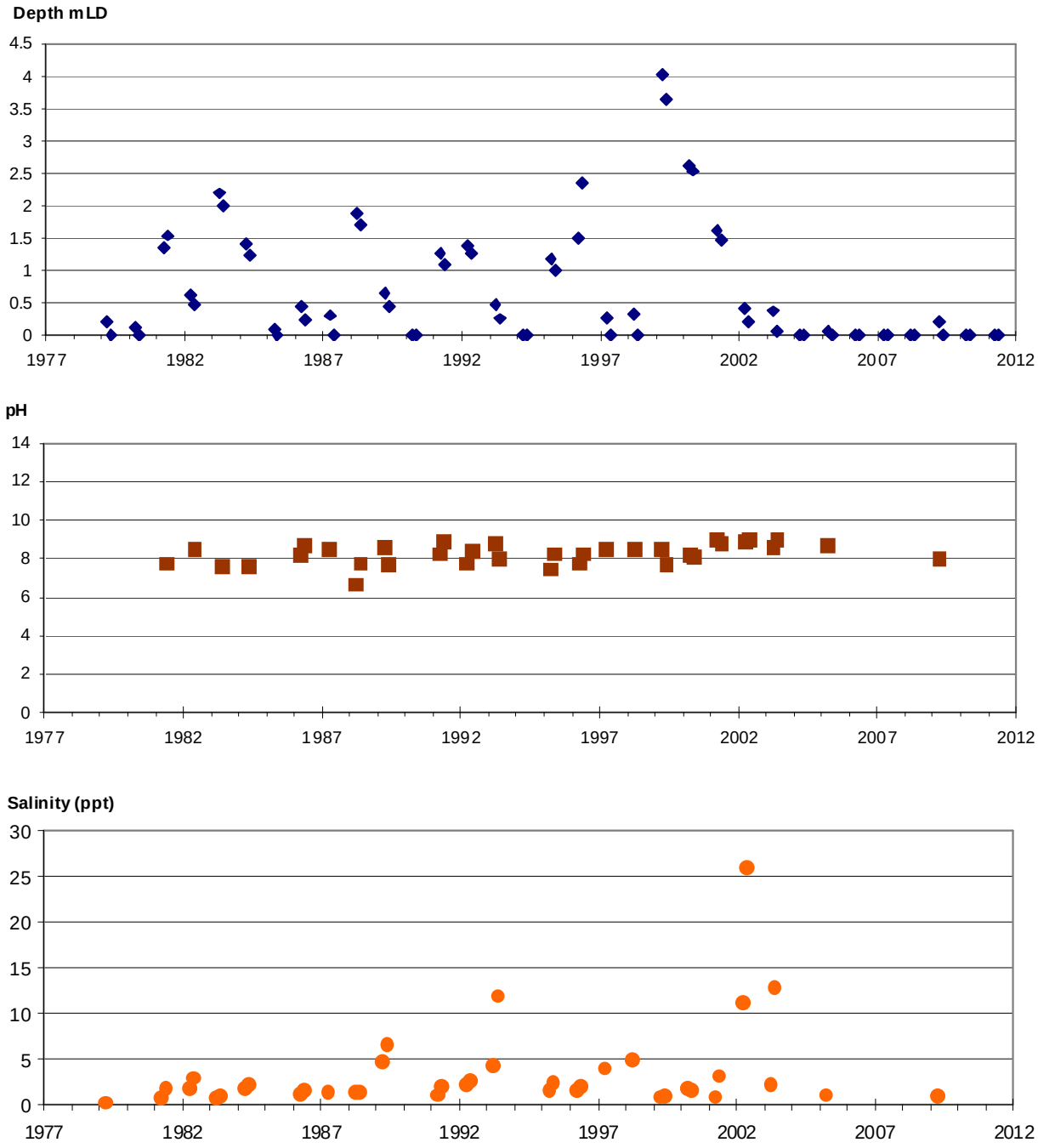




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Little White is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

LOGUE [IM]

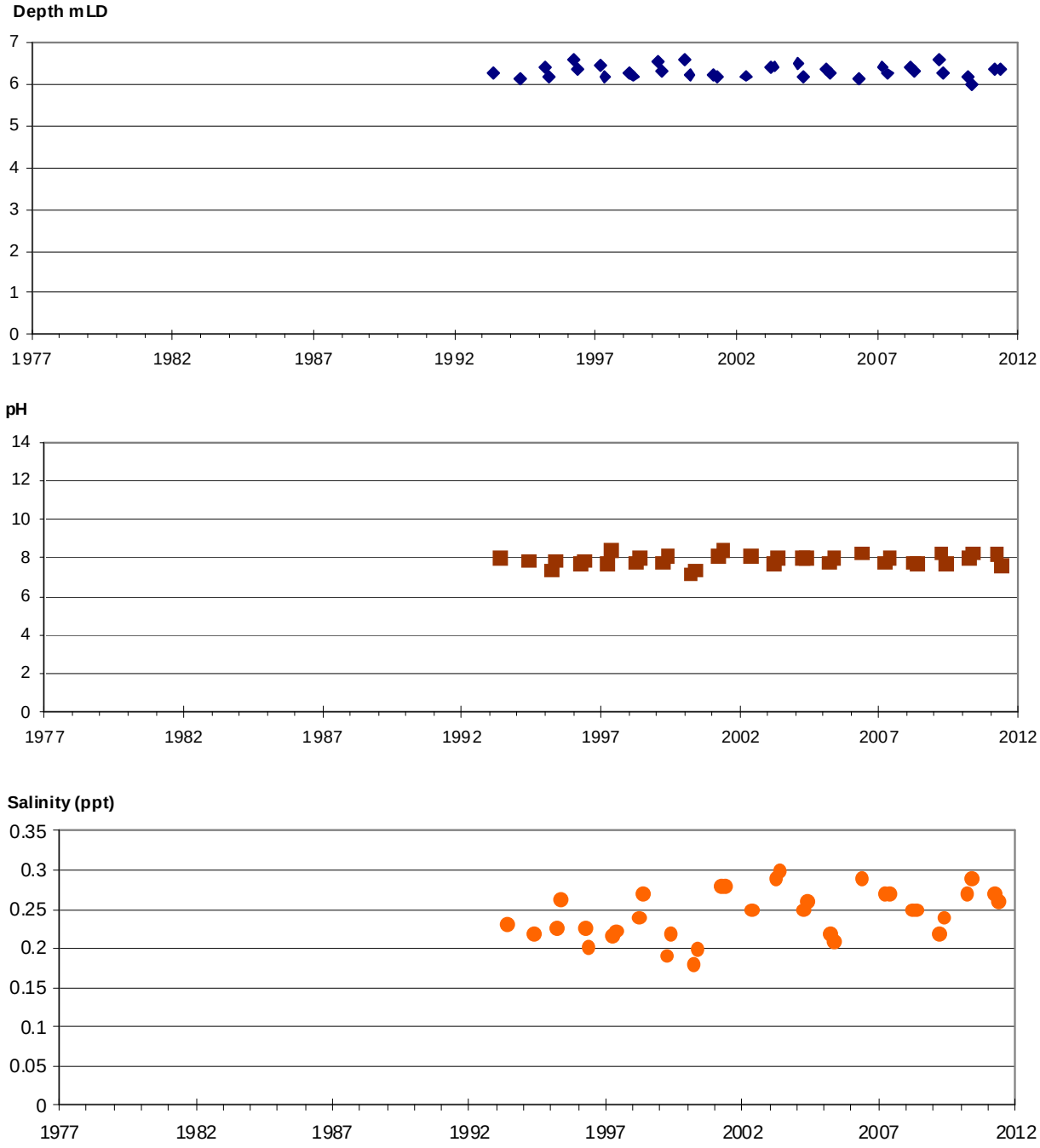


Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Logue is a component of the 'Lake Logue-Indoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

Logue is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

MARINGUP (with Depth axis 0-7m)

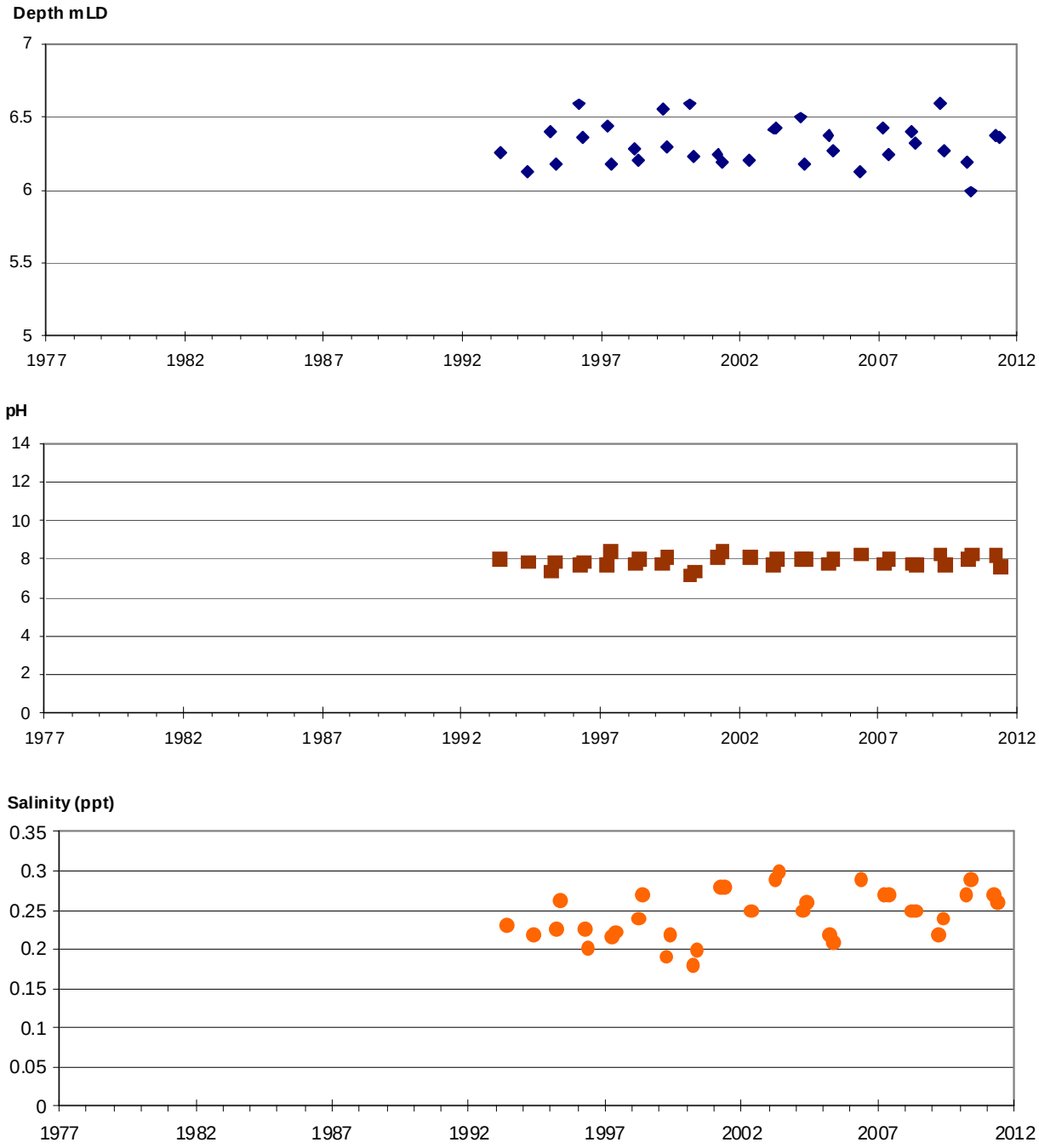


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Maringup Lake is listed in the 'Directory of Important Wetlands in Australia'.

Maringup is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

MARINGUP (with Depth axis 5-7m)

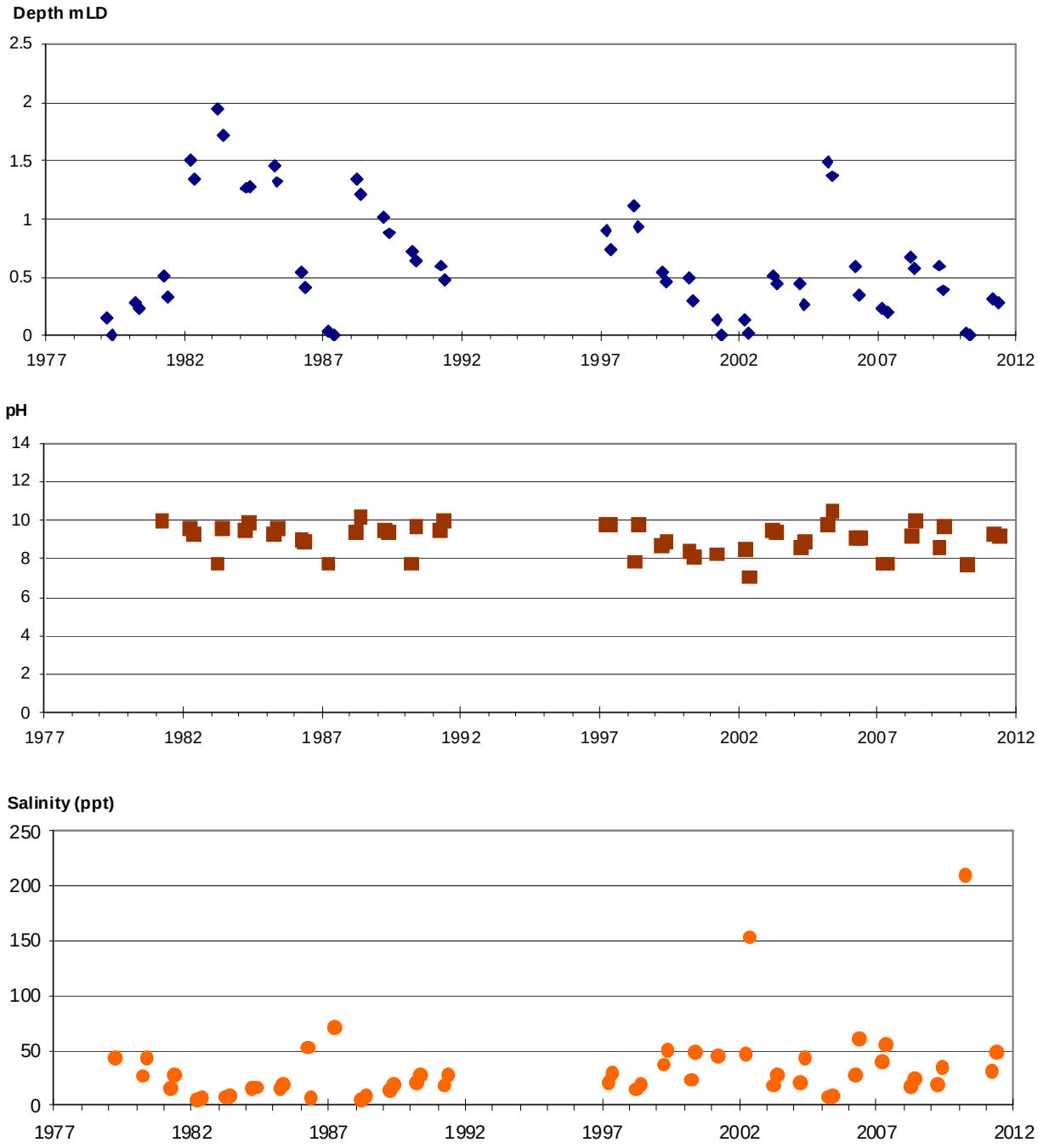


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Maringup Lake is listed in the 'Directory of Important Wetlands in Australia'.

Maringup is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

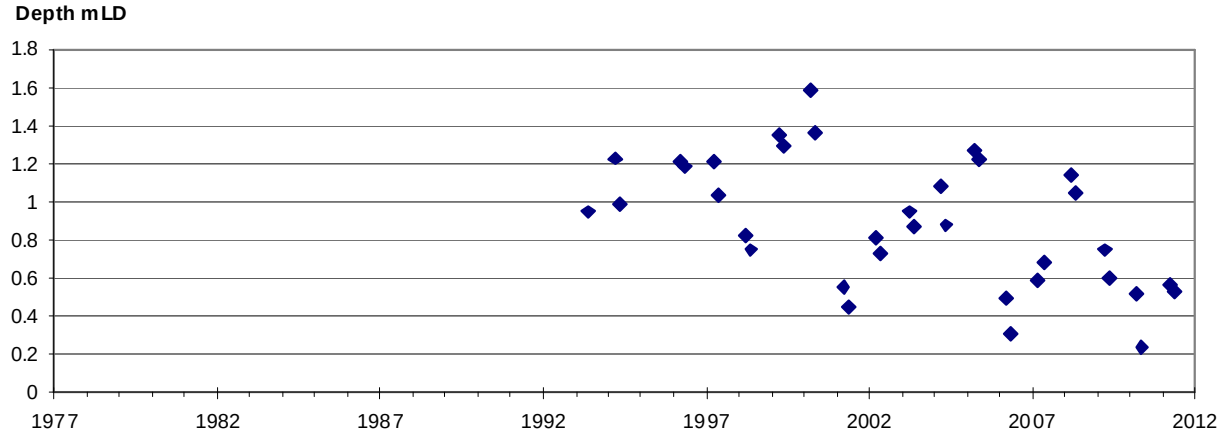
MARTINUP

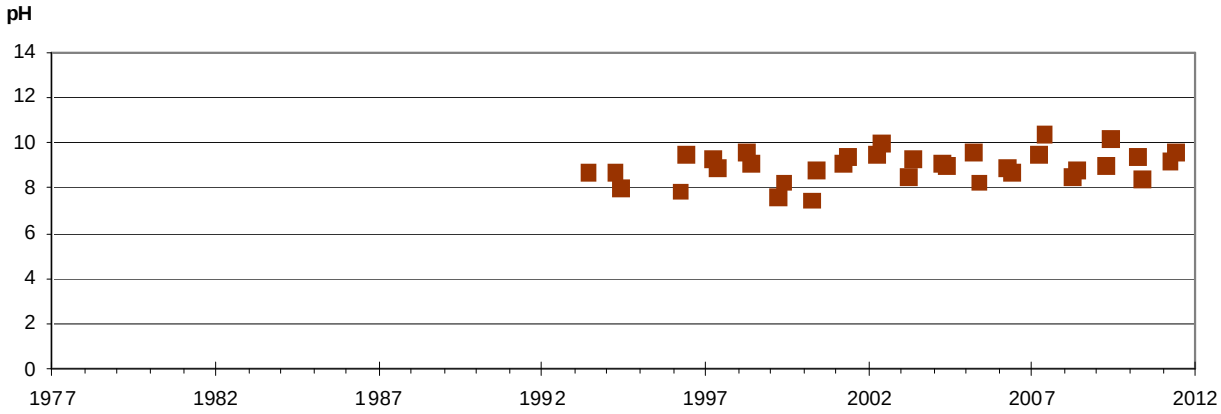


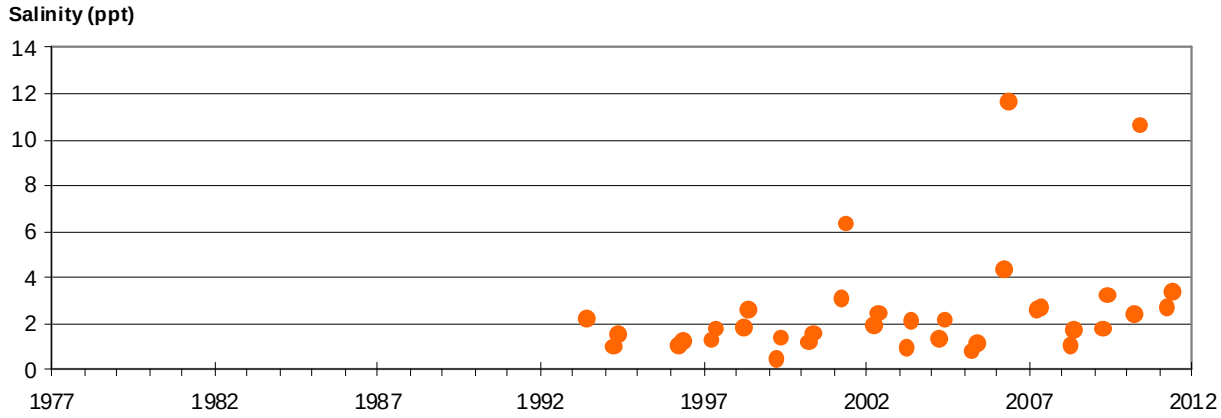
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Martinup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

McLARTY





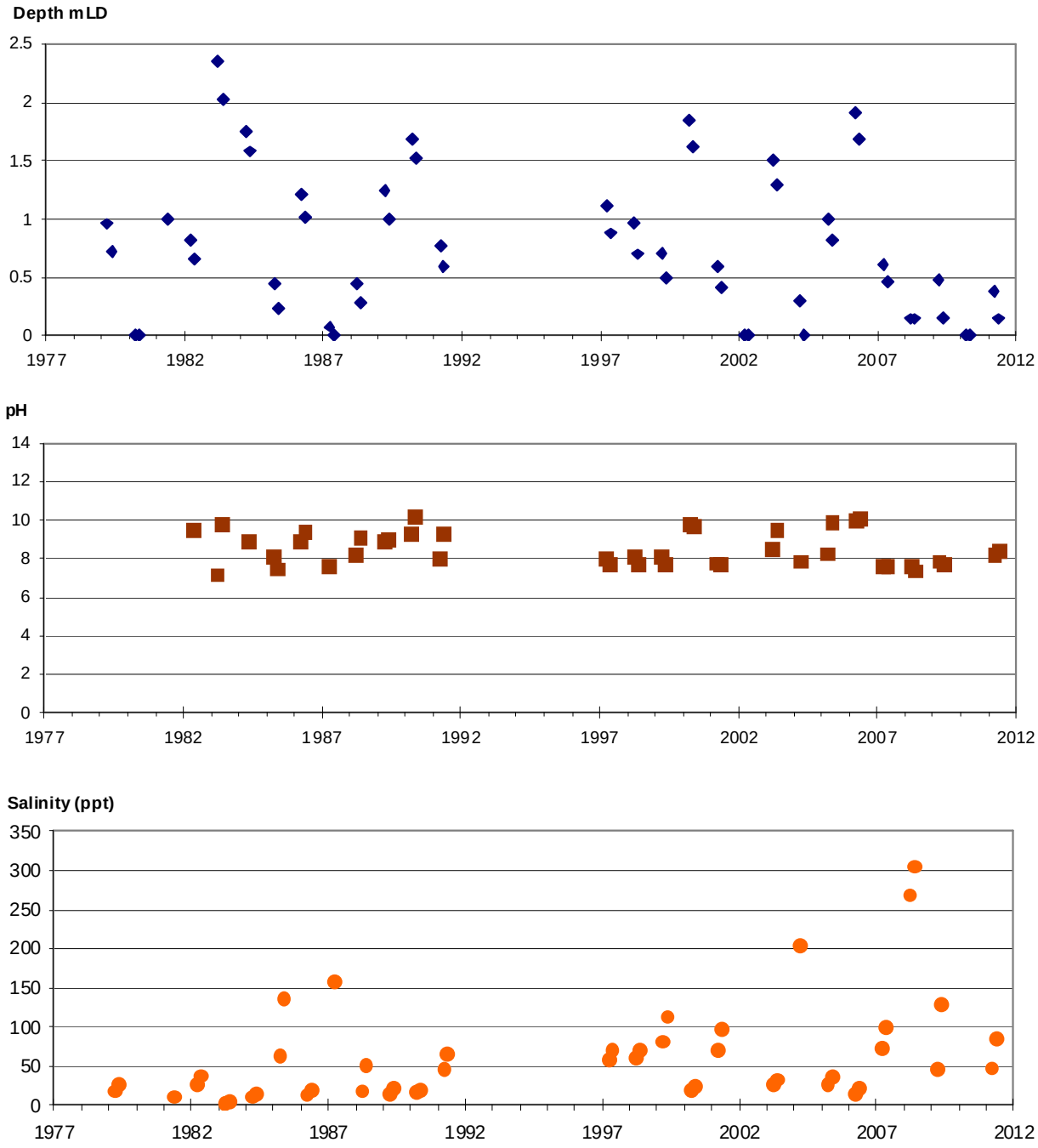


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

McLarty is a component of the 'Peel-Yalgorup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Lake McLarty System' listed in the 'Directory of Important Wetlands in Australia'.

McLarty is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

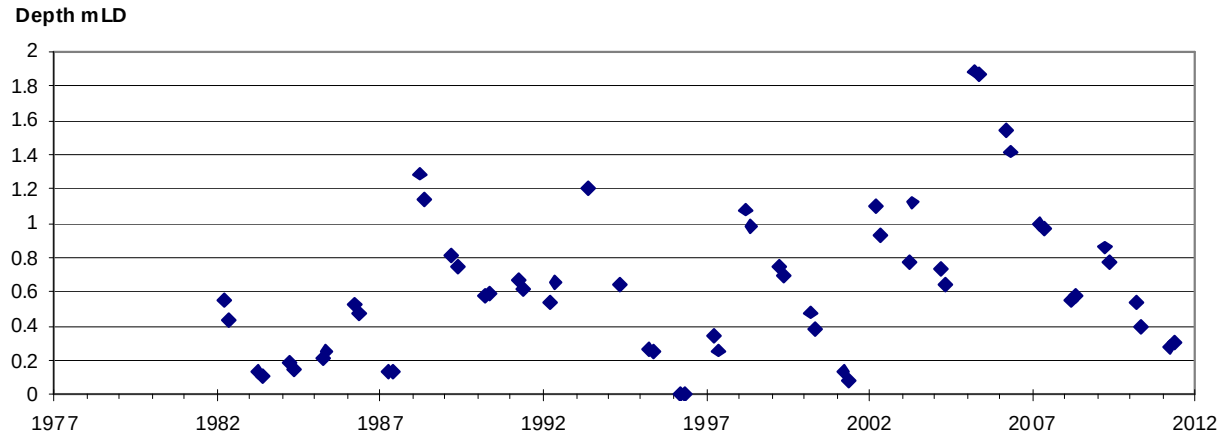
MEARS

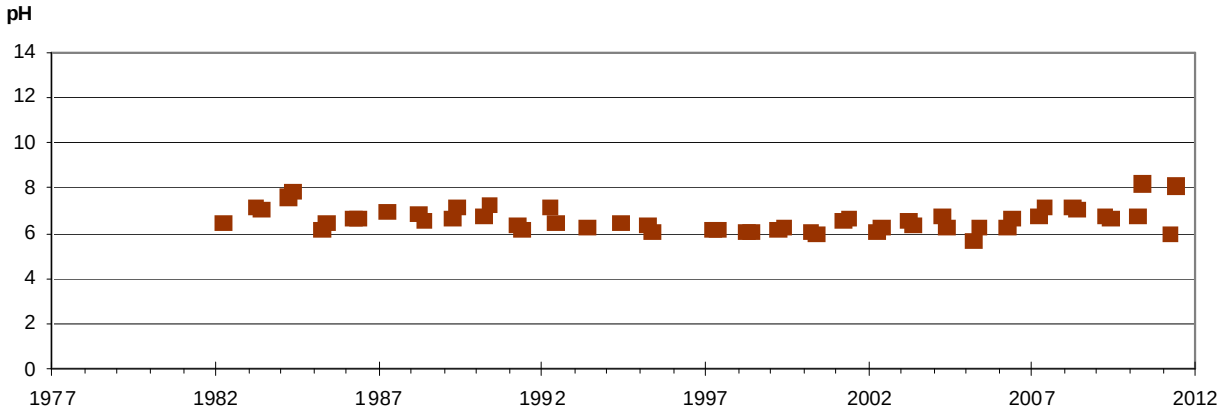


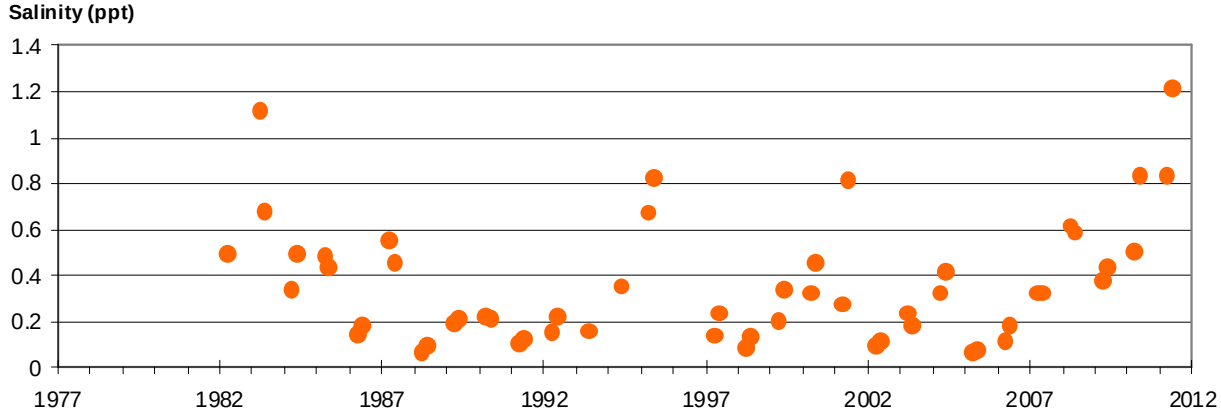
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Mears is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

METTLER



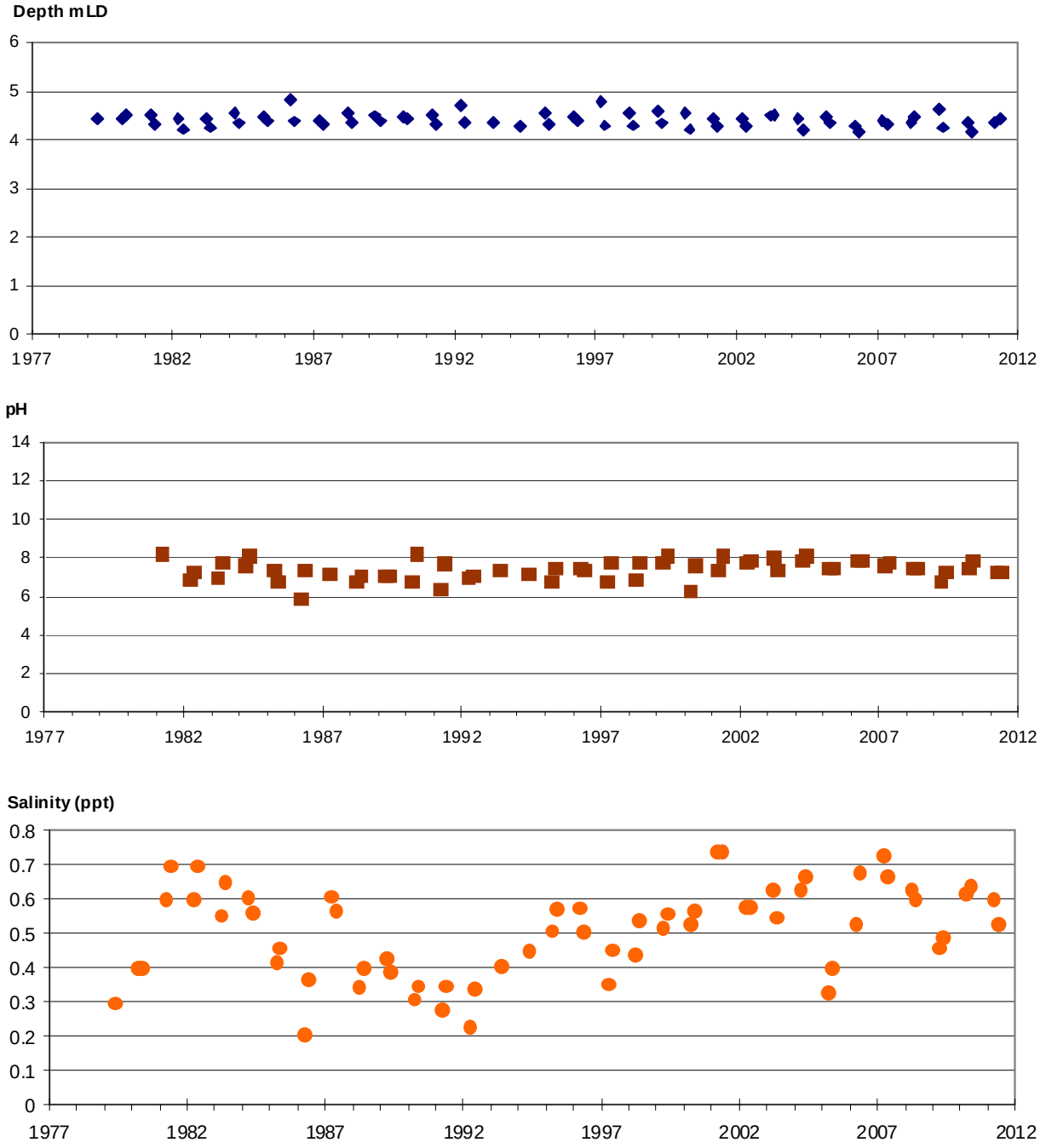




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Mettler is in the Albany District of the South Coast DEC Region

MOATES (with Depth axis 0-6m)

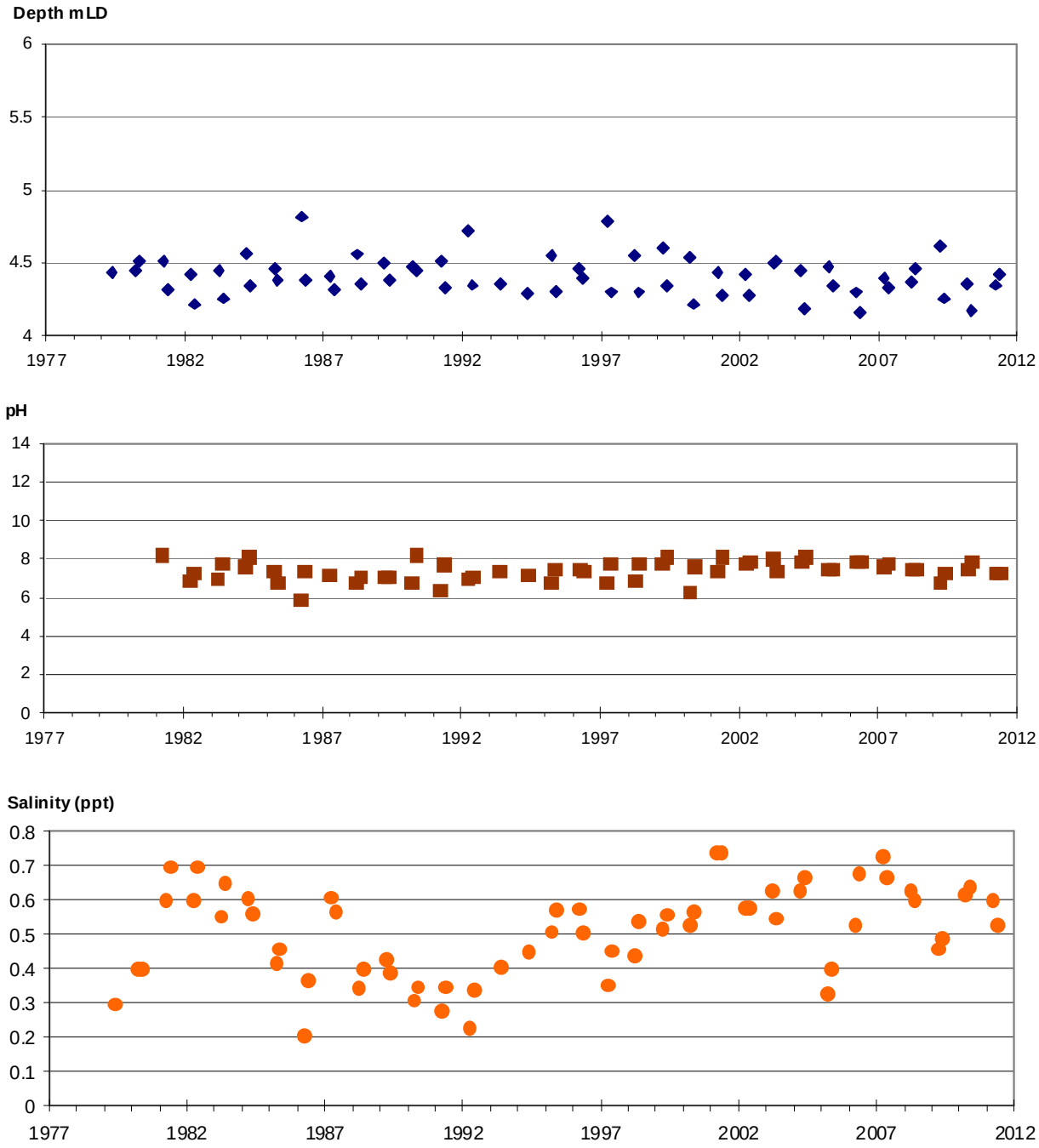


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Moates is a component of the 'Moates Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

Moates is in the Albany District of the South Coast DEC Region

MOATES (with Depth axis 4-6m)

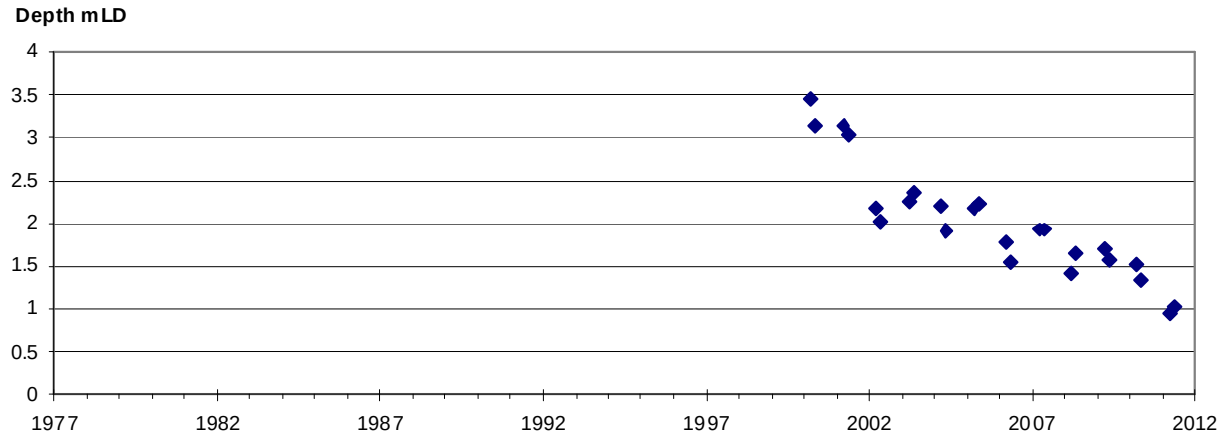


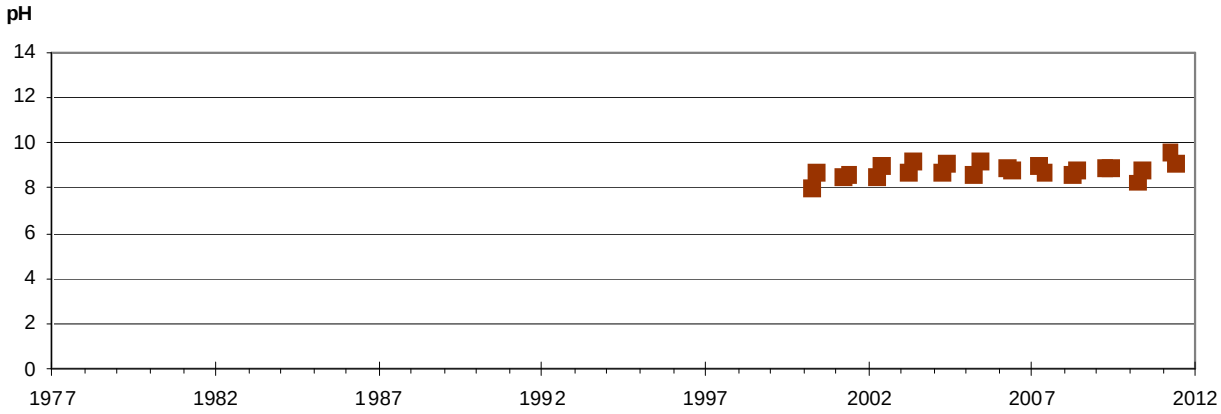
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

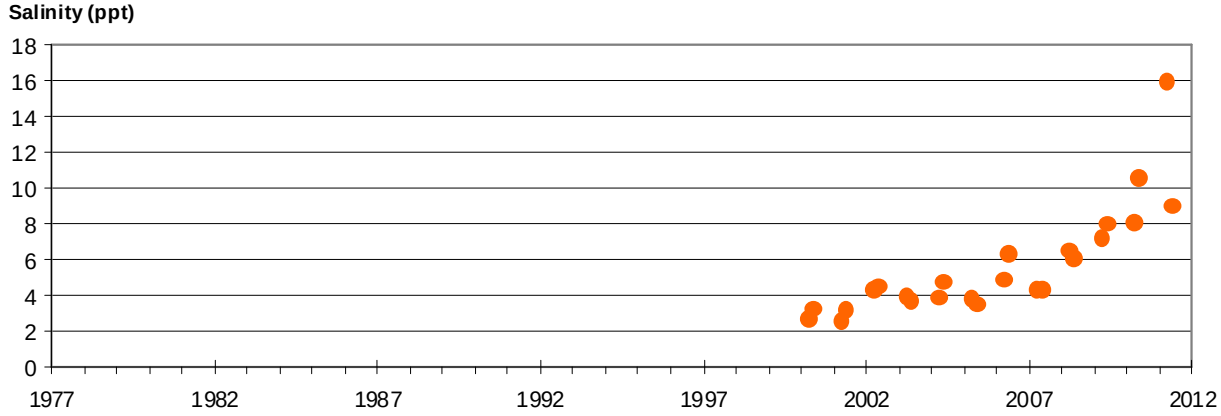
Moates is a component of the 'Moates Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

Moates is in the Albany District of the South Coast DEC Region

MORTIJINUP





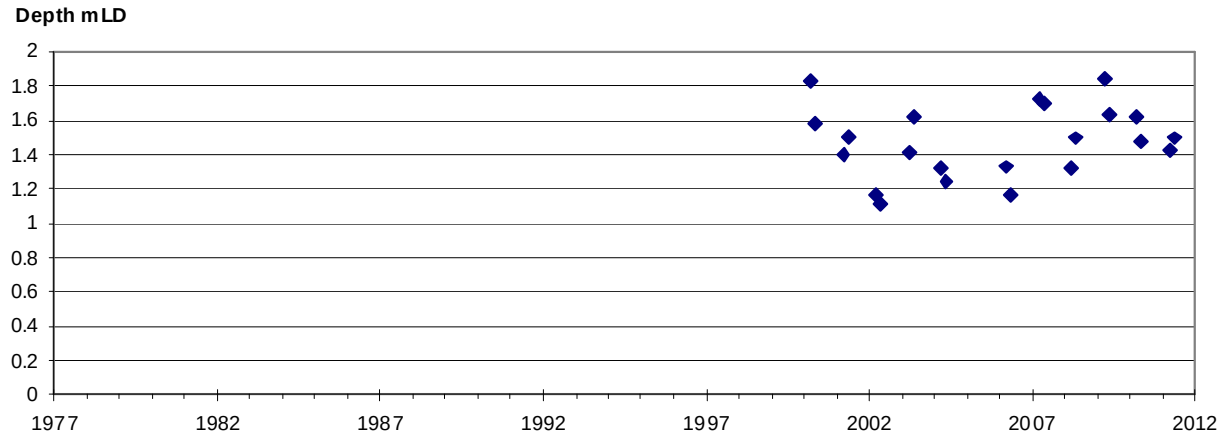


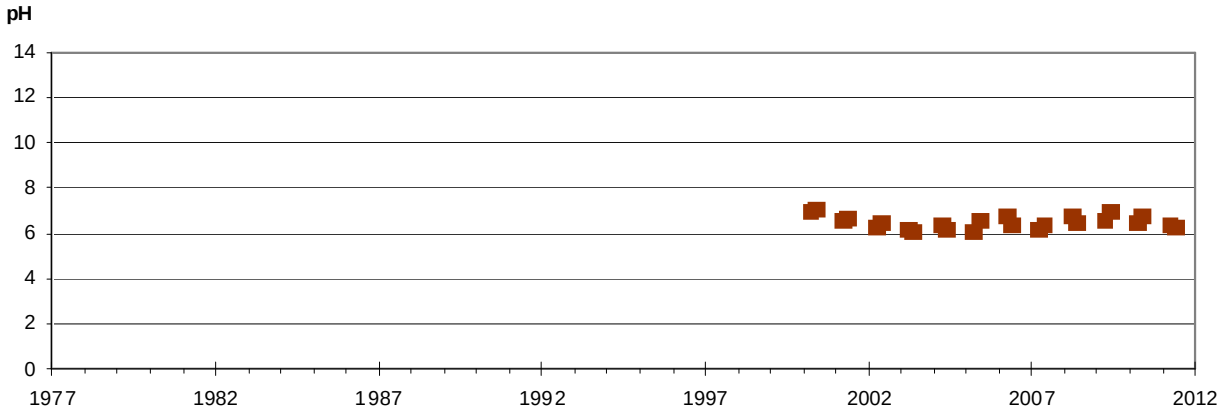
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

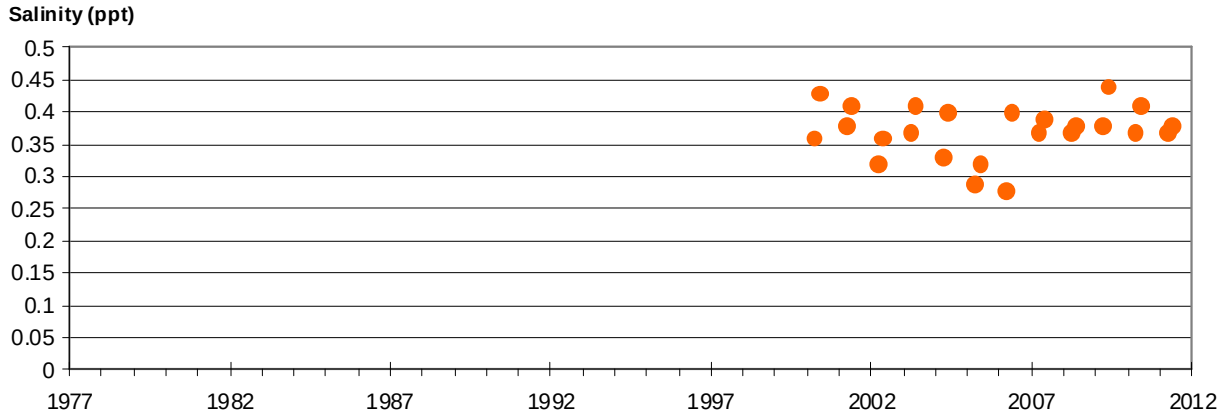
Mortijinup is a component of the 'Mortijinup Lake System', which is listed in the 'Directory of Important Wetlands in Australia'.

Mortijinup is in the Esperance District of the South Coast DEC Region.

MOUNT LE GRAND



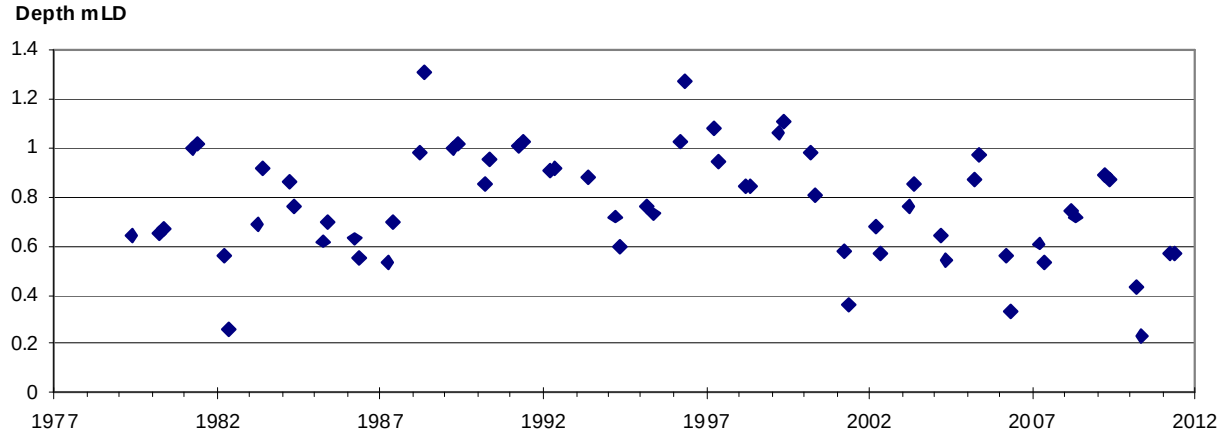


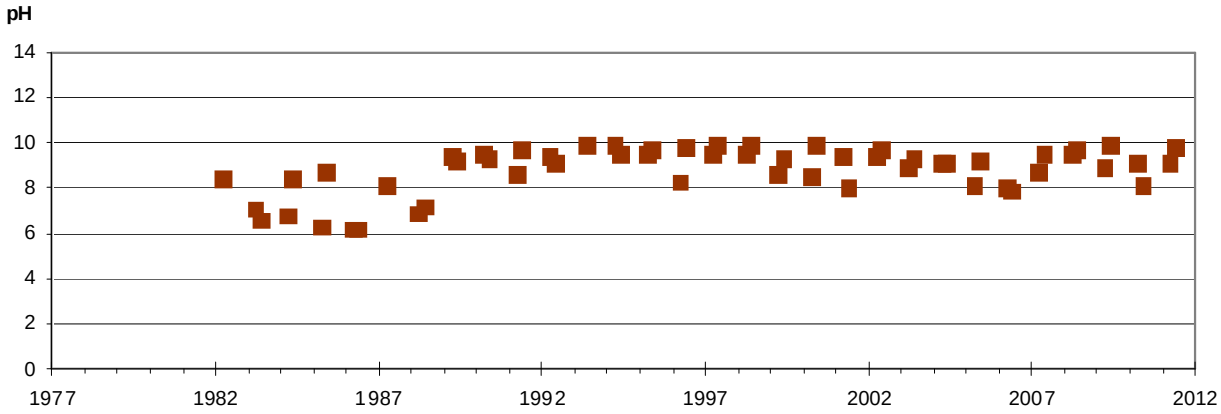


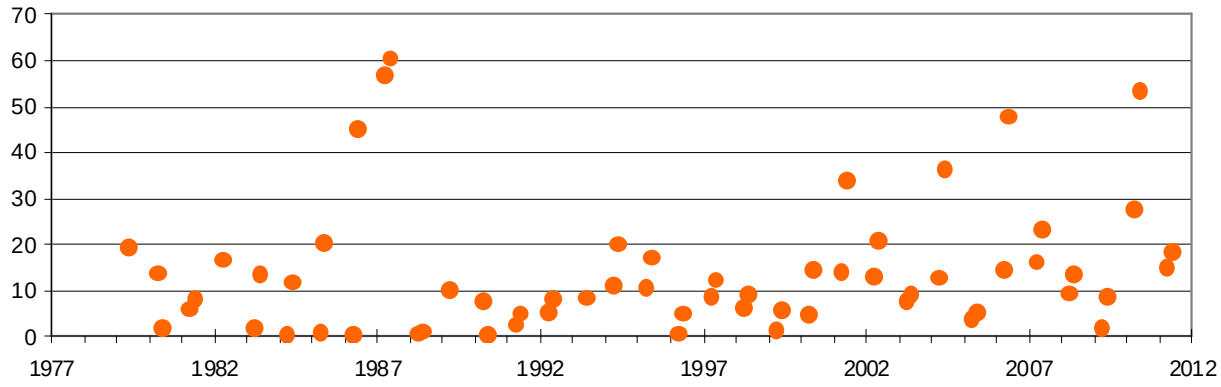
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Mount Le Grand is in the Esperance District of the South Coast DEC Region.

MUIR







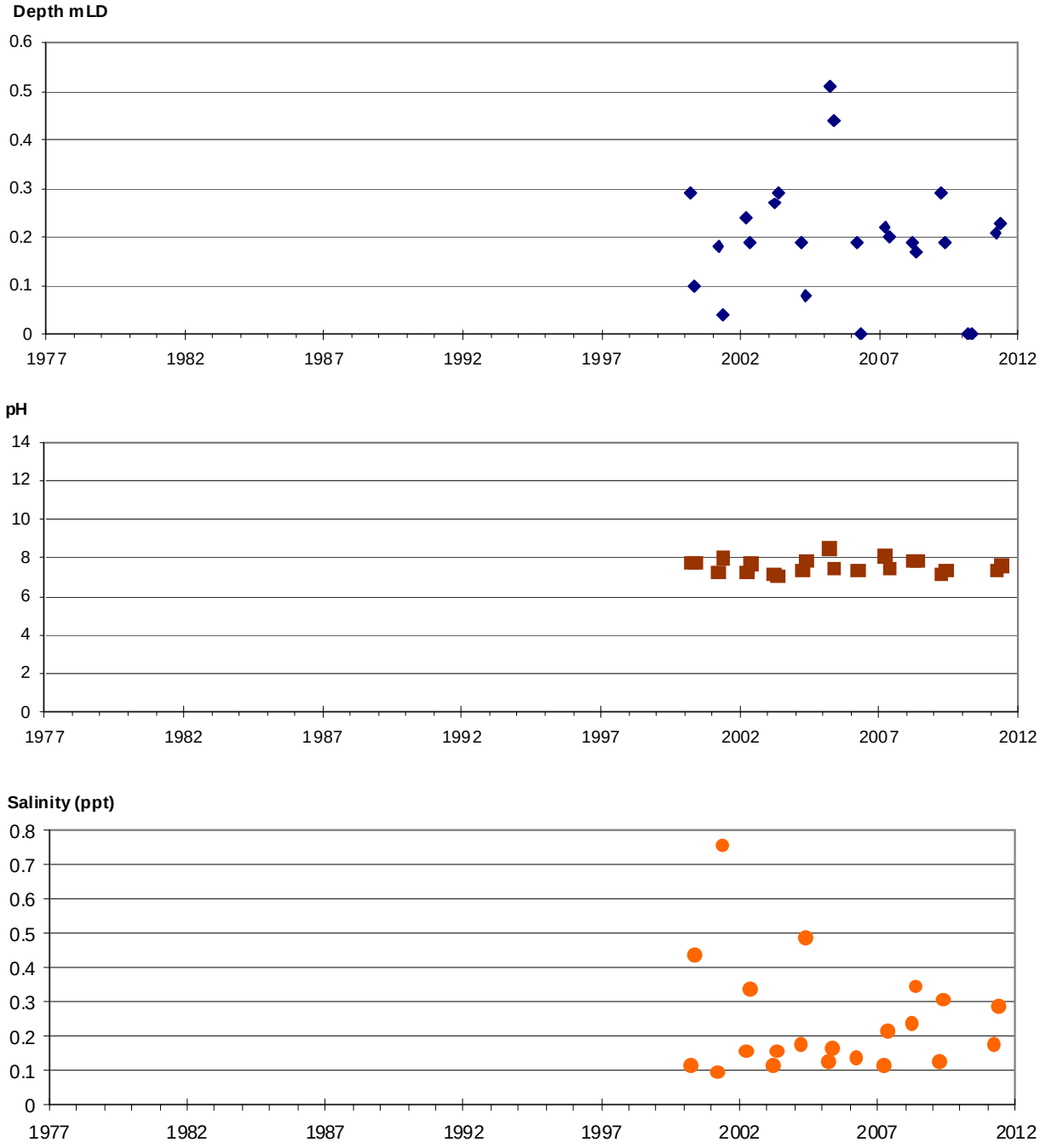
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Lake Muir is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Lake Muir is also listed in the 'Directory of Important Wetlands in Australia'.

Muir is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

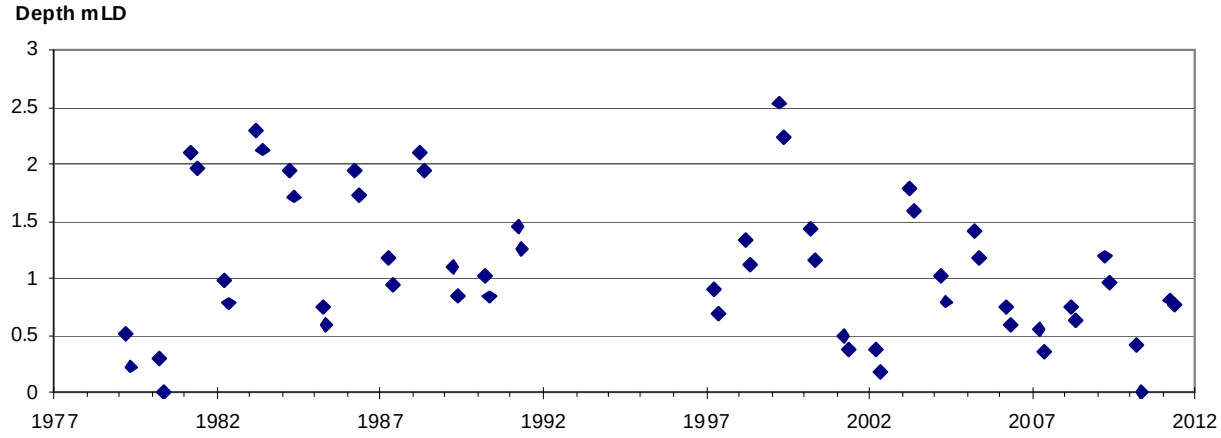
NGOPITCHUP

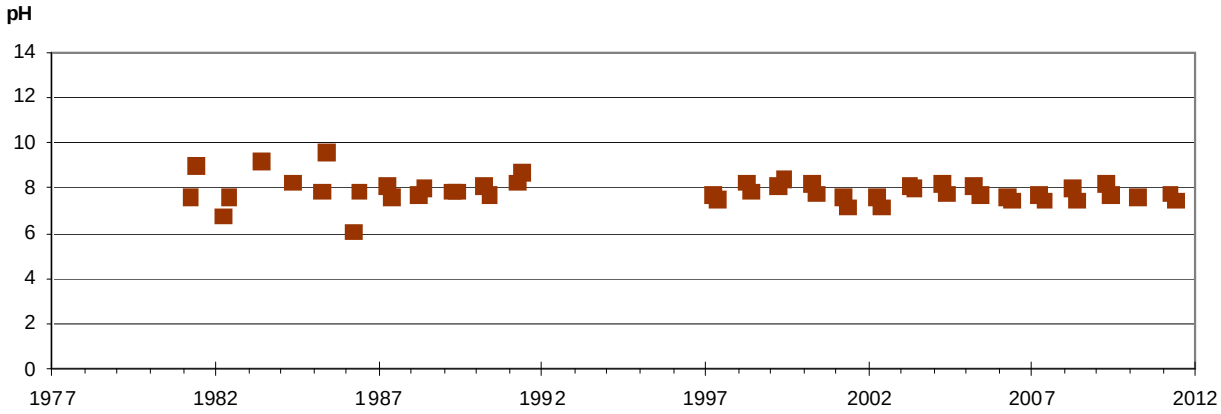


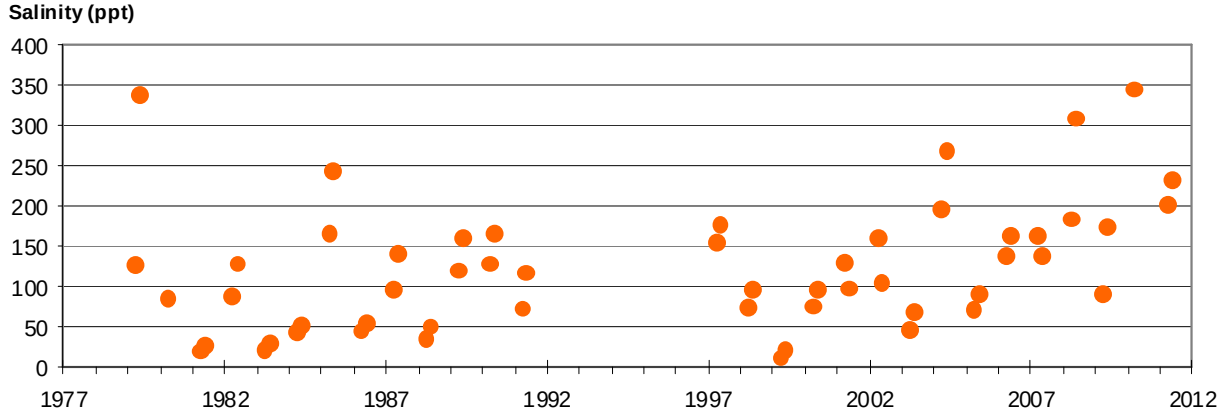
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Ngopitchup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

NINAN



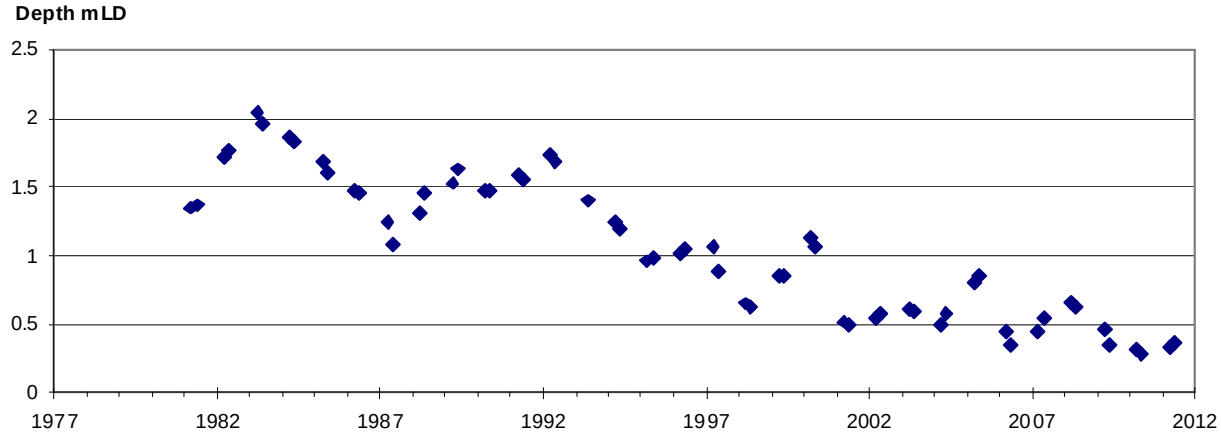


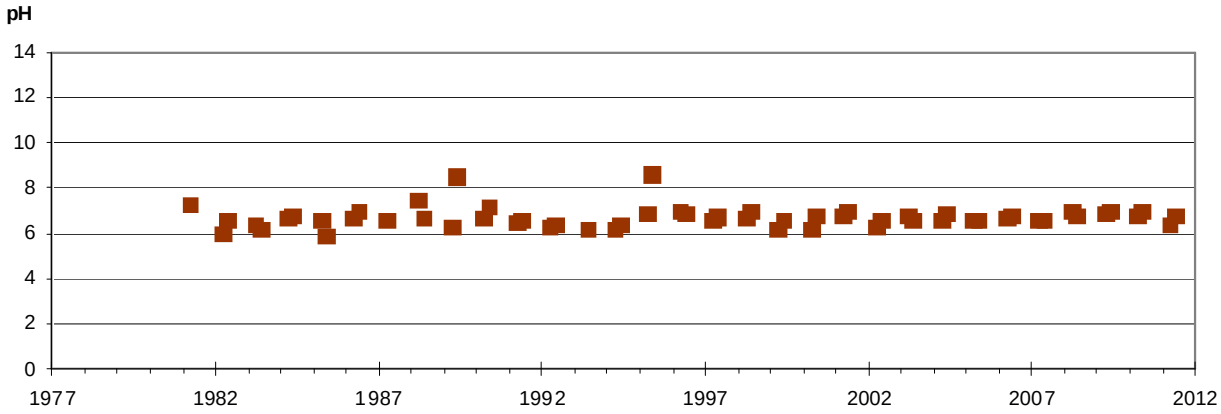


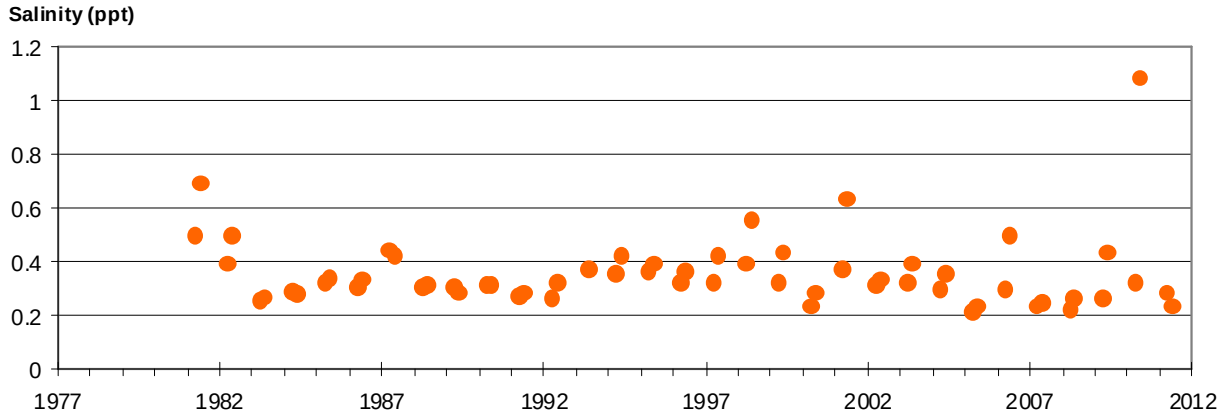
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Ninan is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

NINE MILE



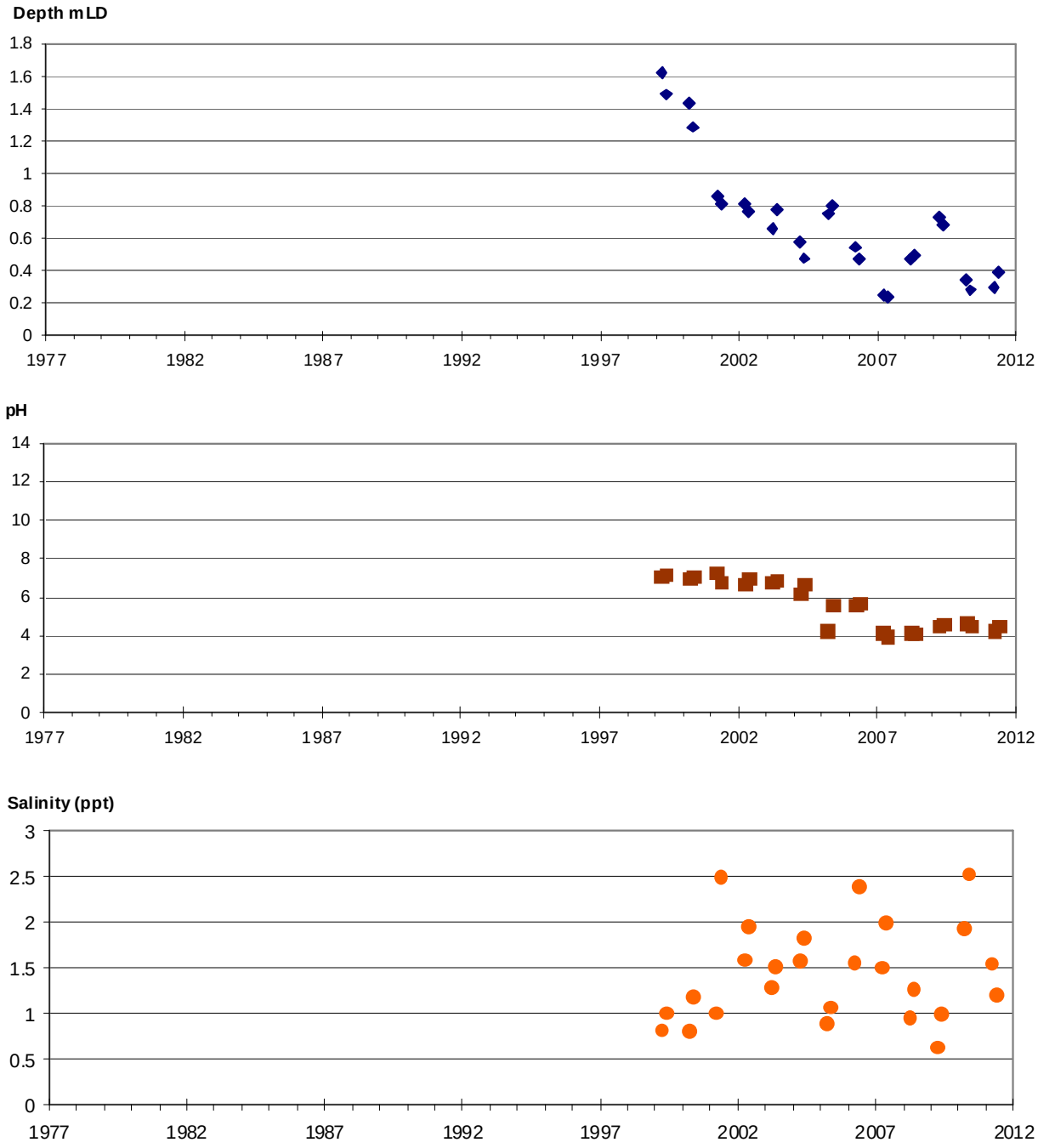




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Nine Mile is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

NOOBIJUP [IM]



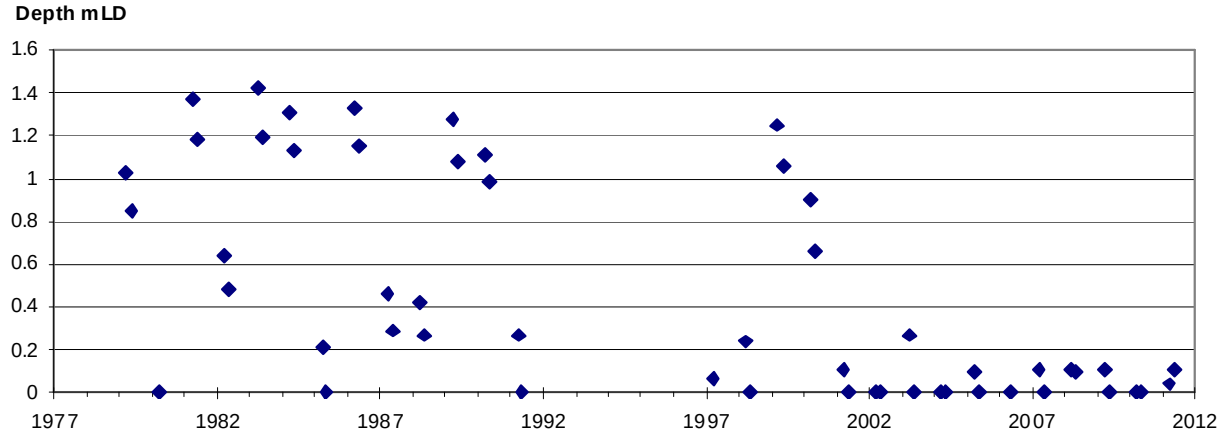
Notes:

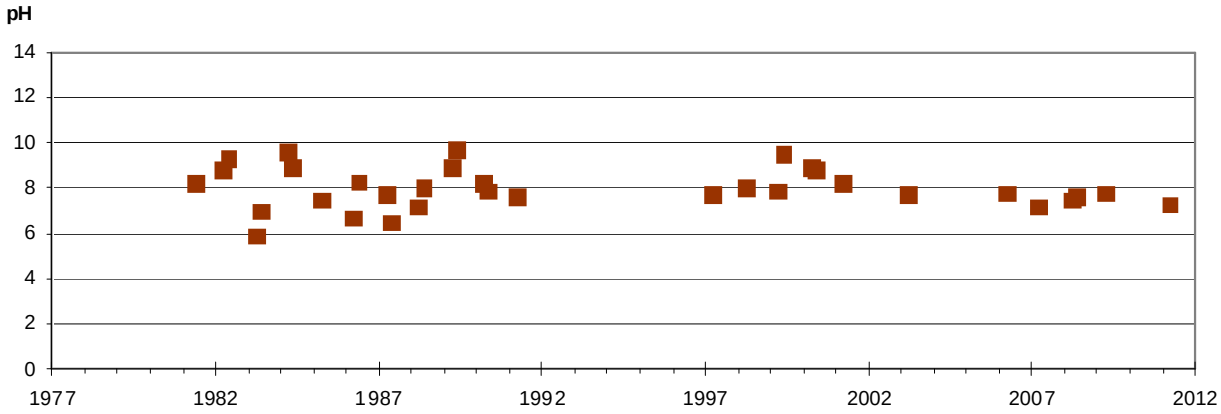
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

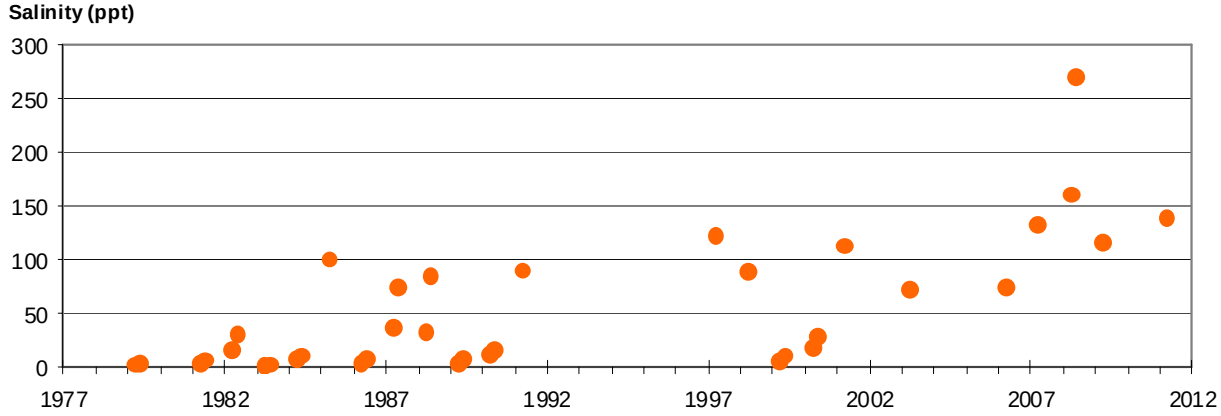
Noobijup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

Noobijup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

NOONYING



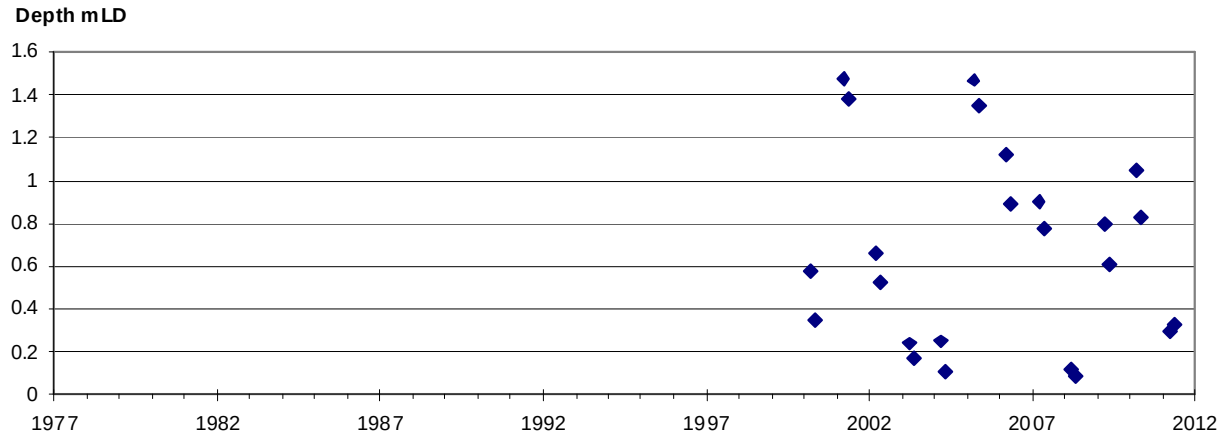


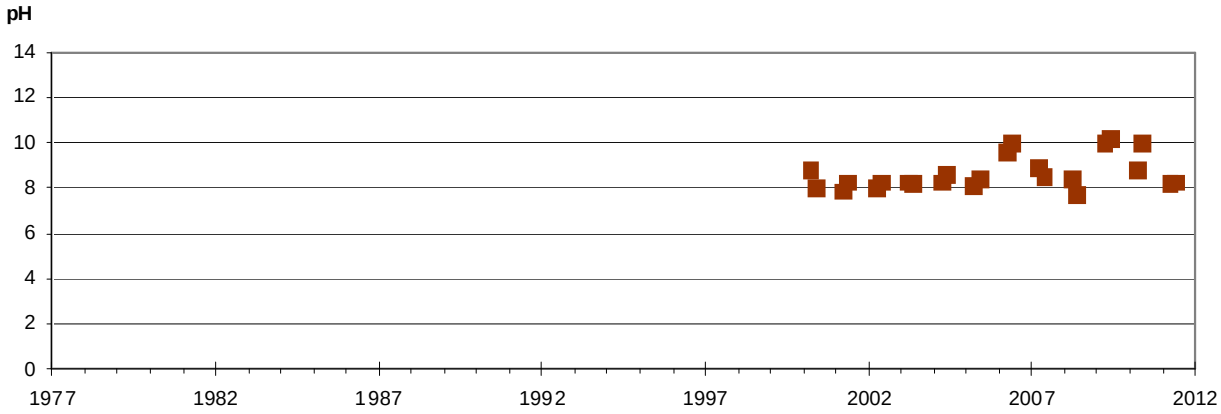


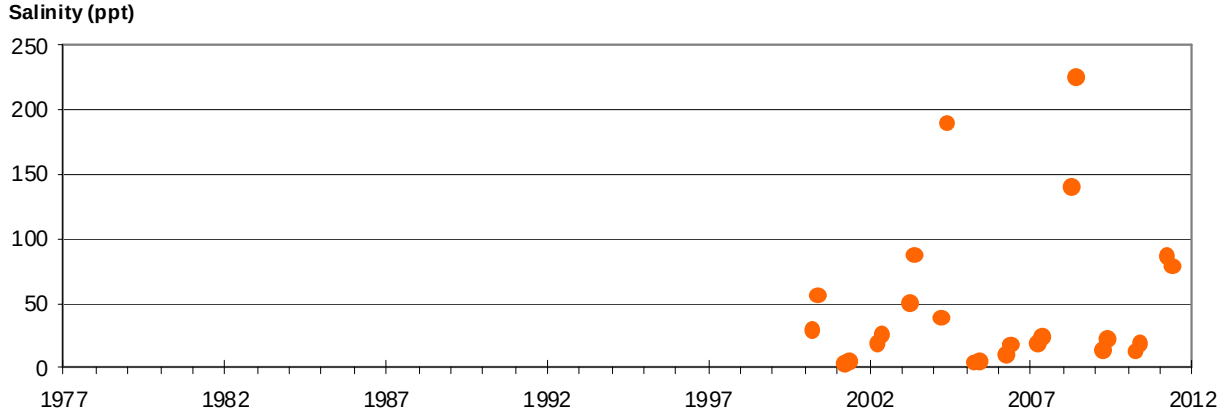
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Noonying is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

NORTH PARRIUP



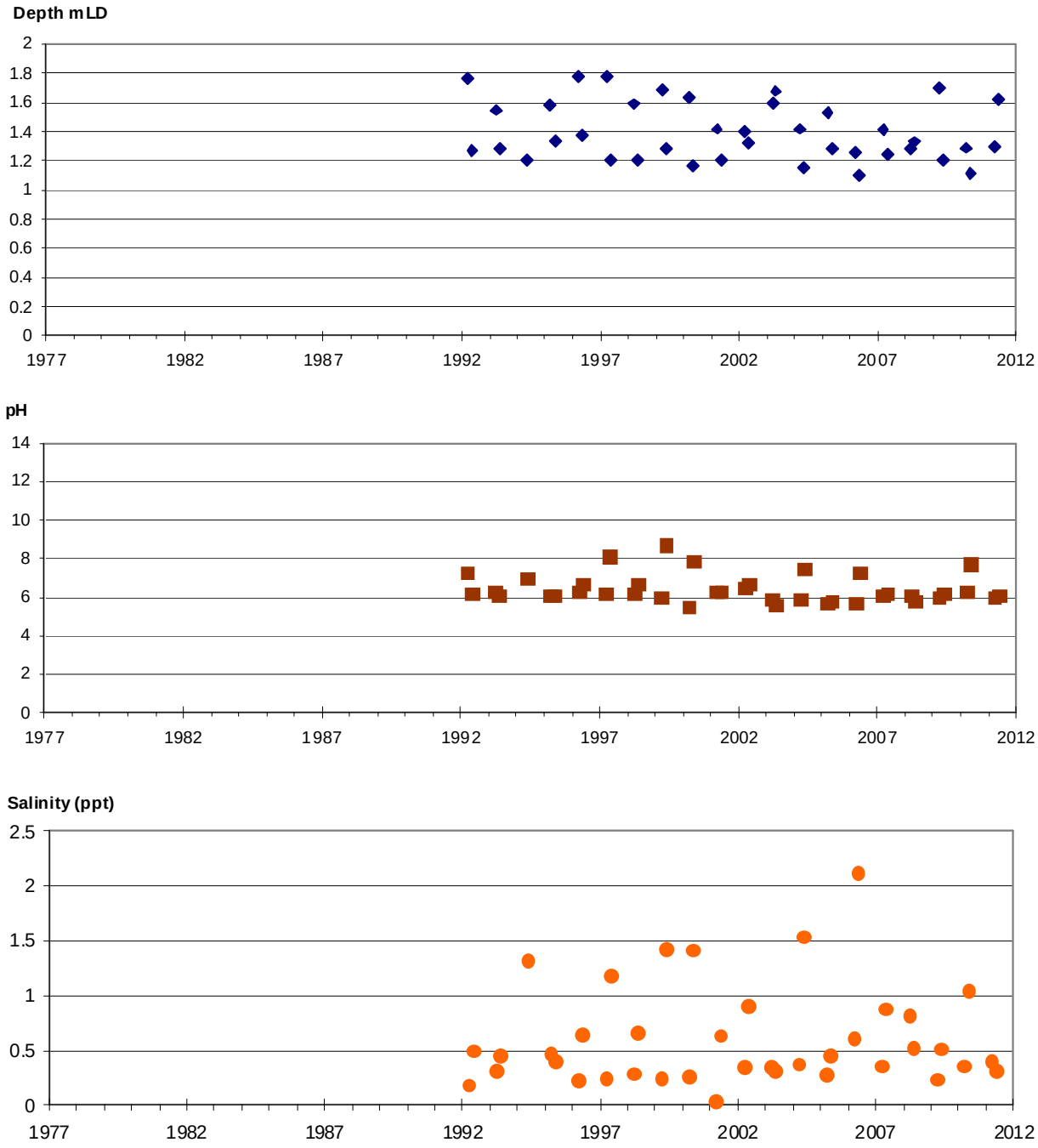




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

North Parriup is in the Esperance District of the South Coast DEC Region.

OWINGUP

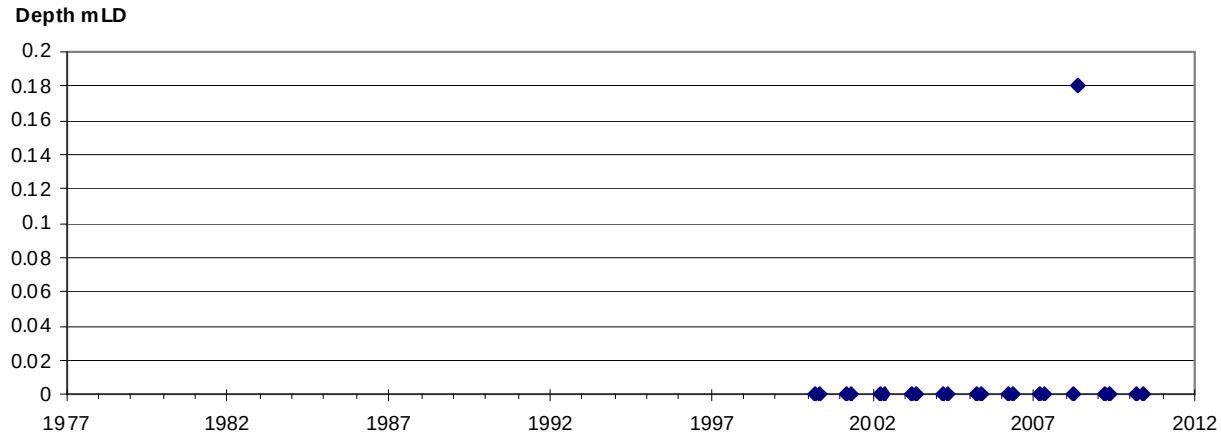


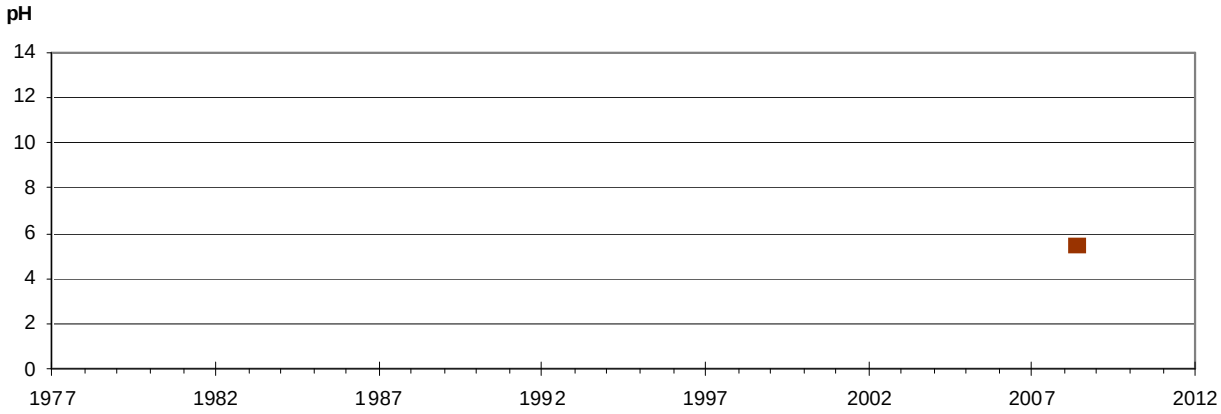
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

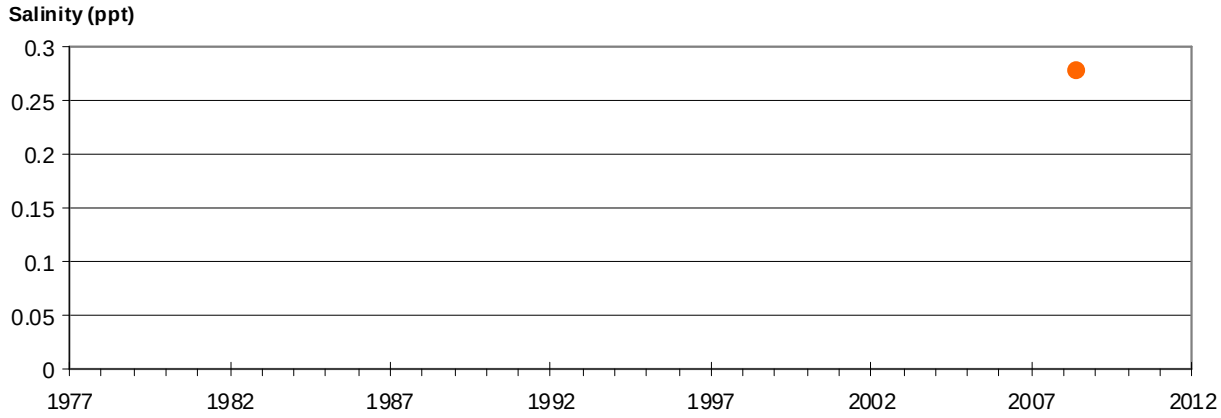
Owingup is a component of the 'Owingup Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

Owingup is in the Frankland District (headquartered in Walpole) of the Warren DEC Region.

PABELUP SOUTH



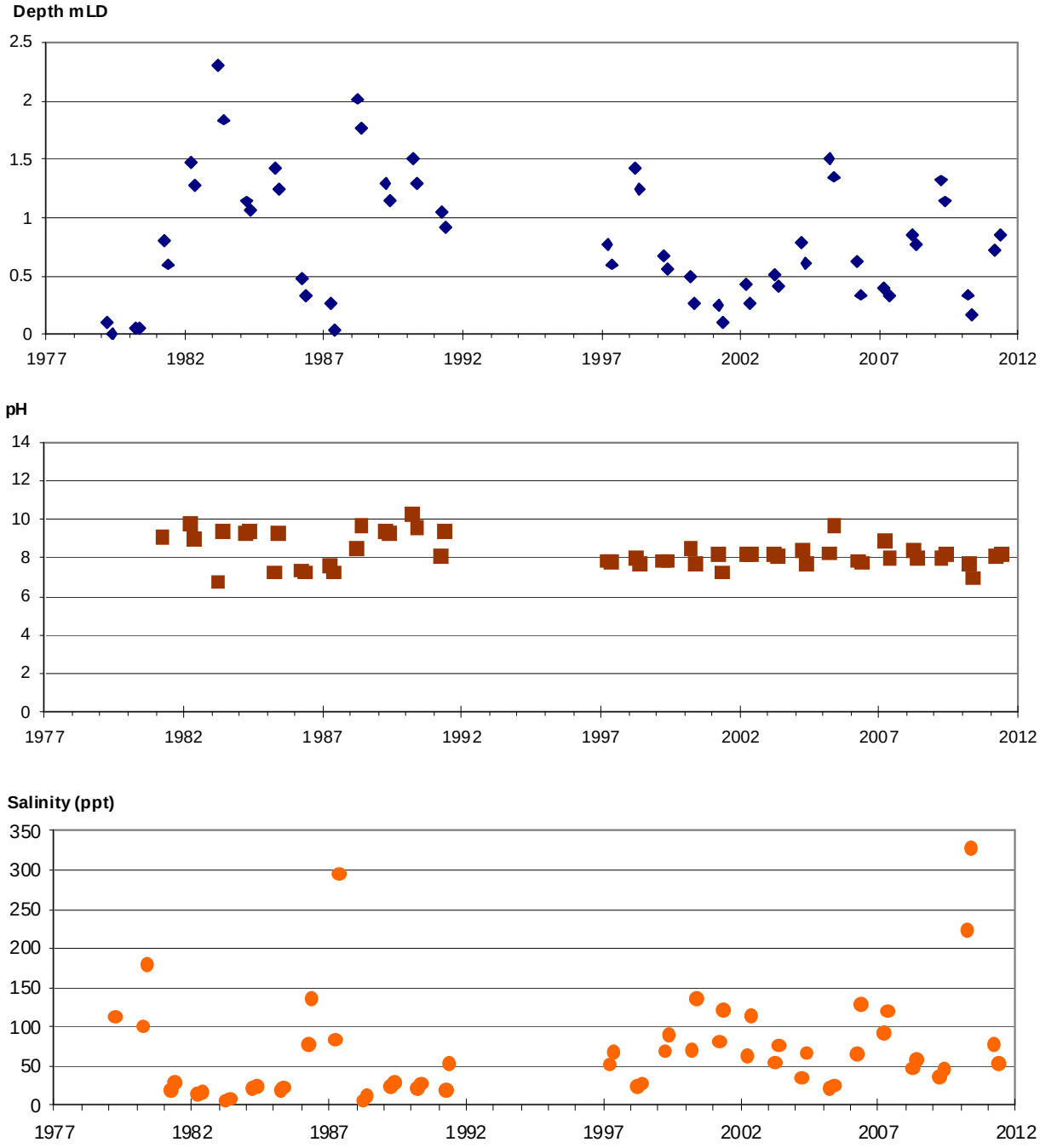




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Pabelup South is in the Albany District of the South Coast DEC Region

PARKEYERRING [IM]

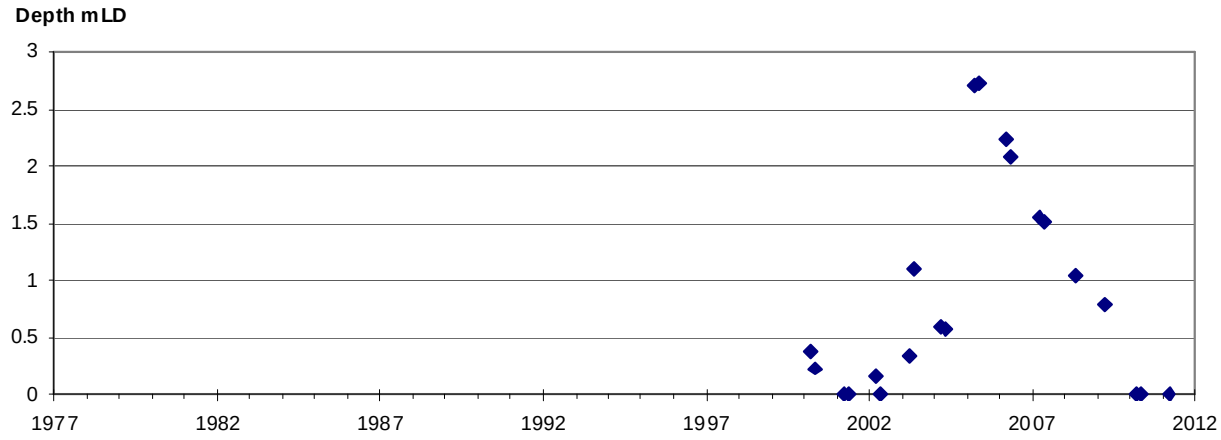


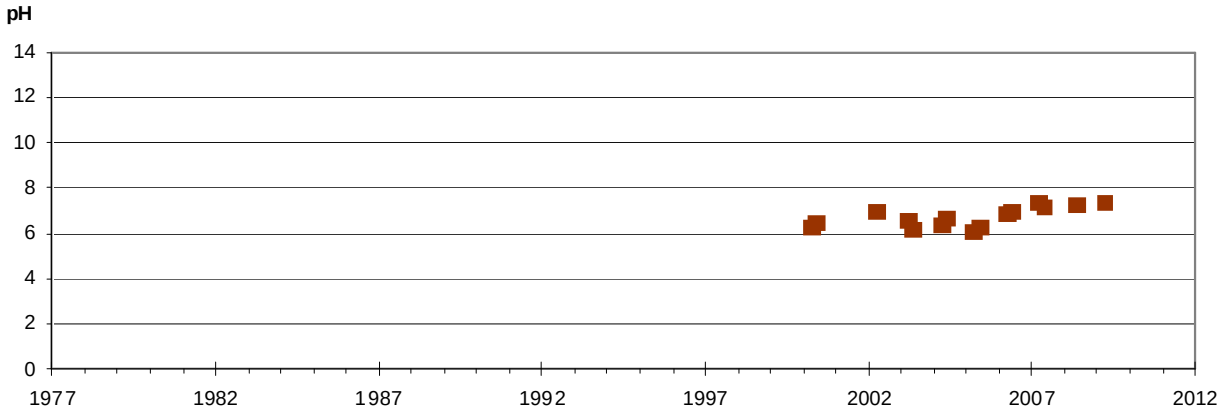
Notes:

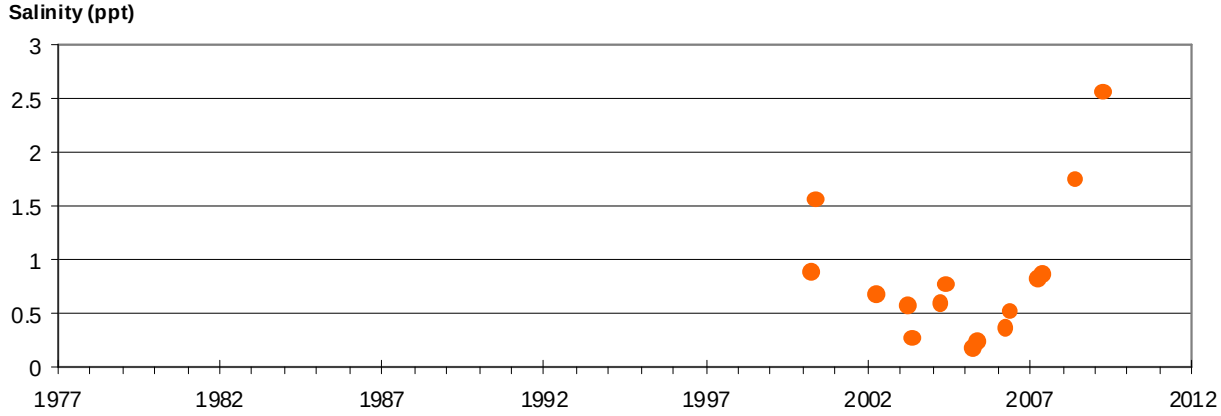
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Parkeyerring is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

PILLENORUP



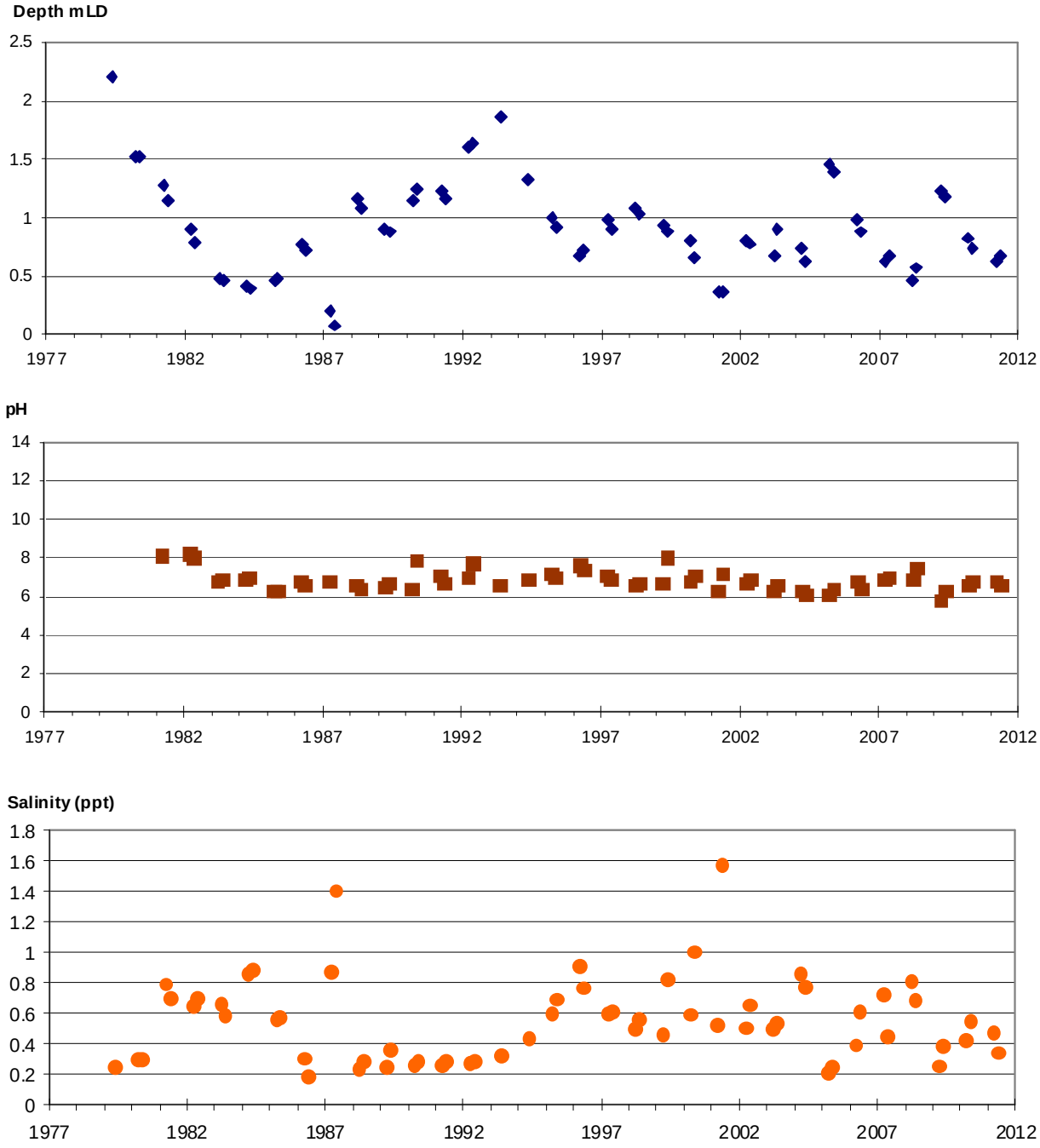




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Pillenorup is in the Albany District of the South Coast DEC Region

PLEASANT VIEW [IM]

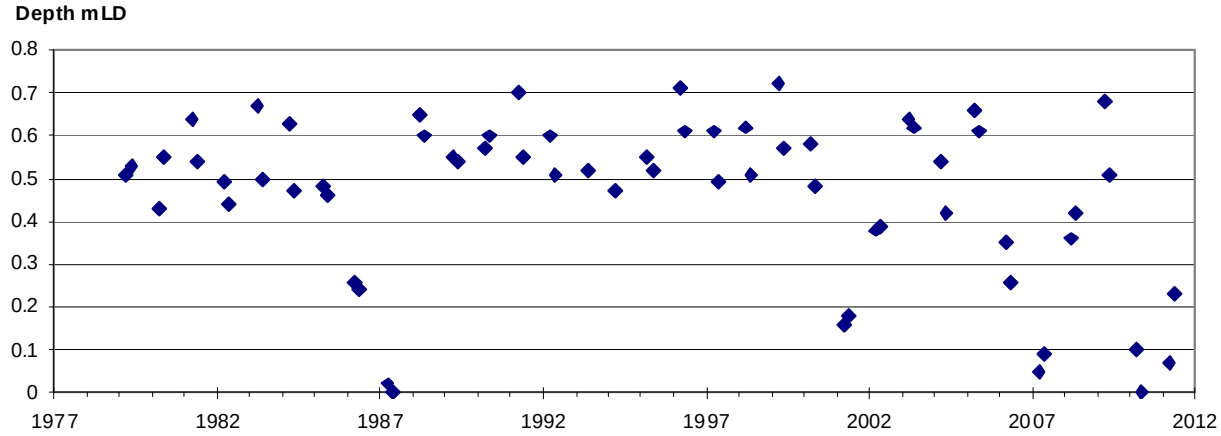


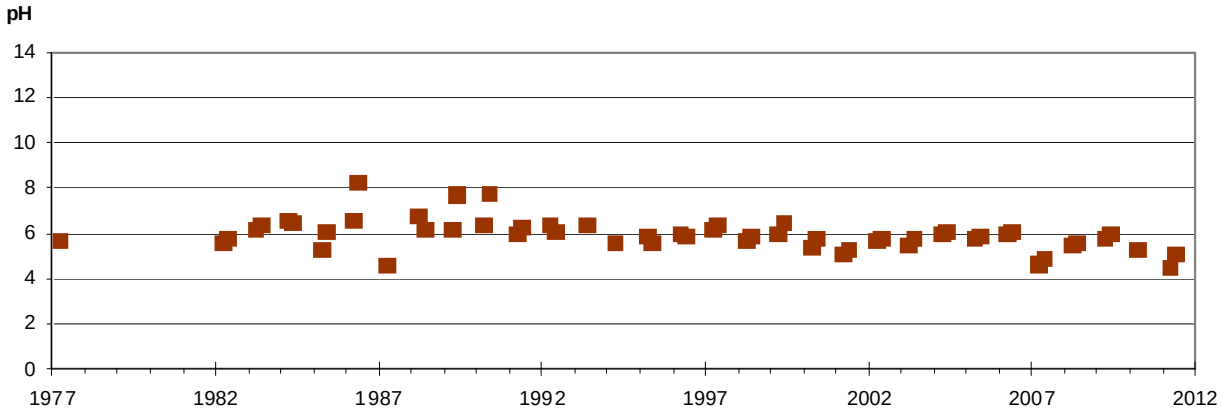
Notes:
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

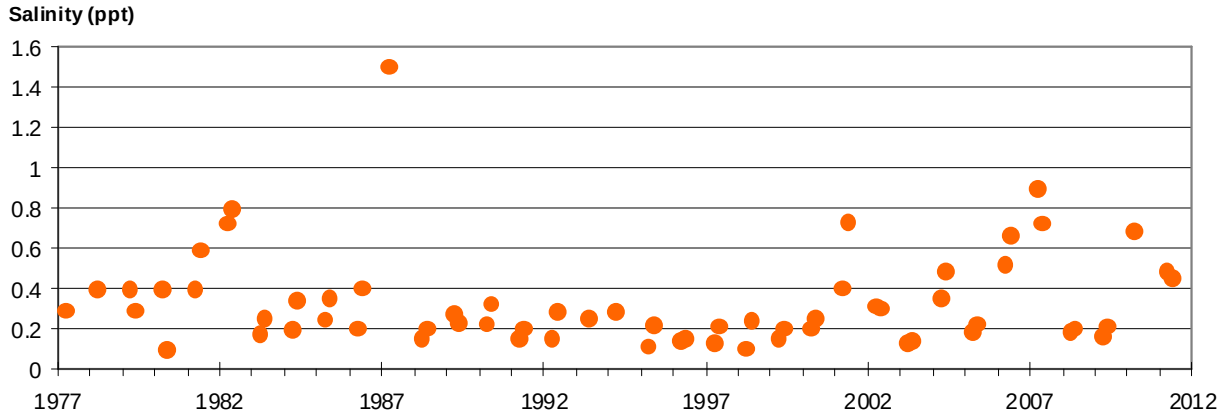
Pleasant View is a component of the 'Lake Pleasant View System', which is listed in the 'Directory of Important Wetlands in Australia'.

Pleasant View is in the Albany District of the South Coast DEC Region

POORGINUP





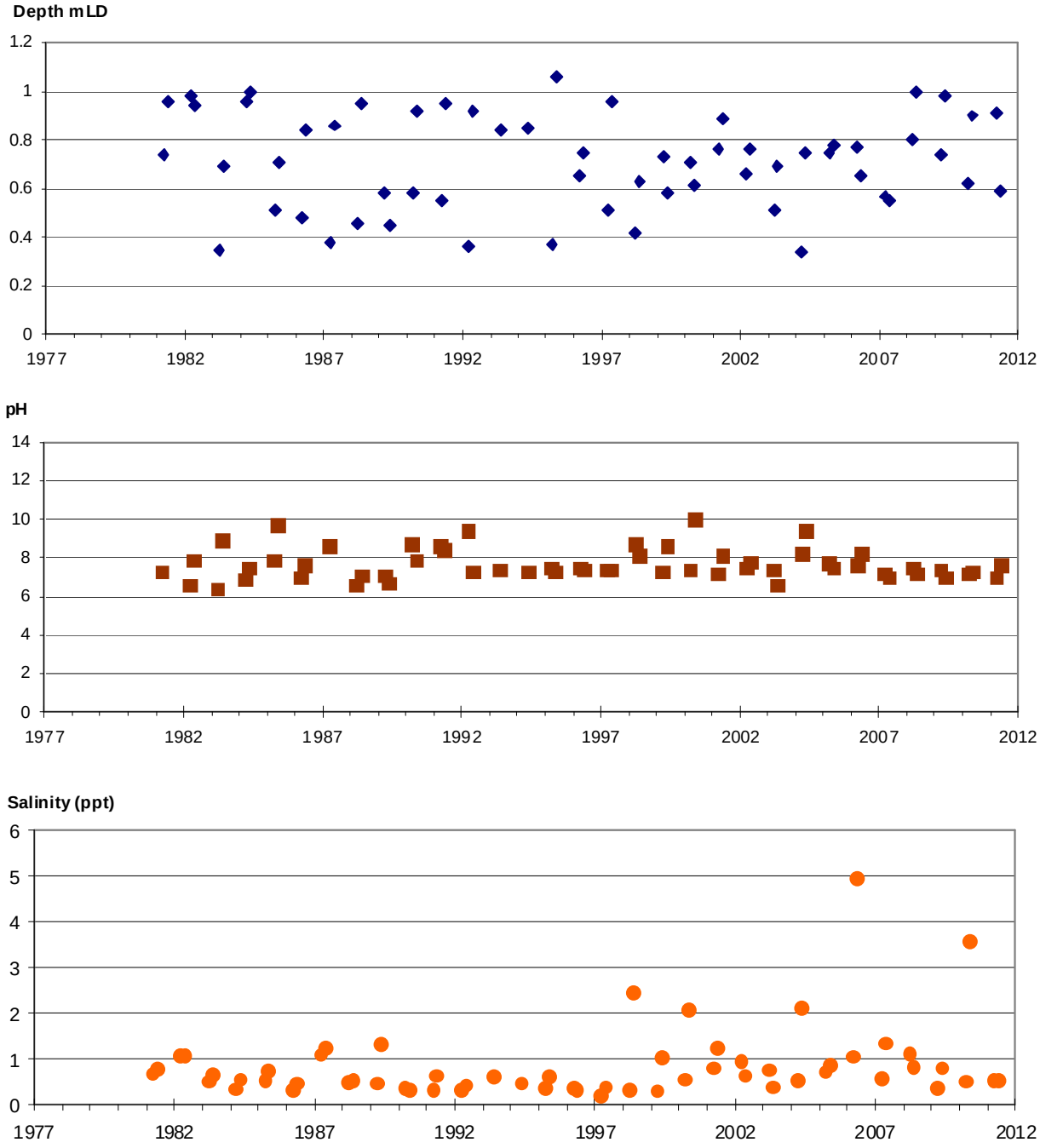


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Poorginup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

Poorginup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

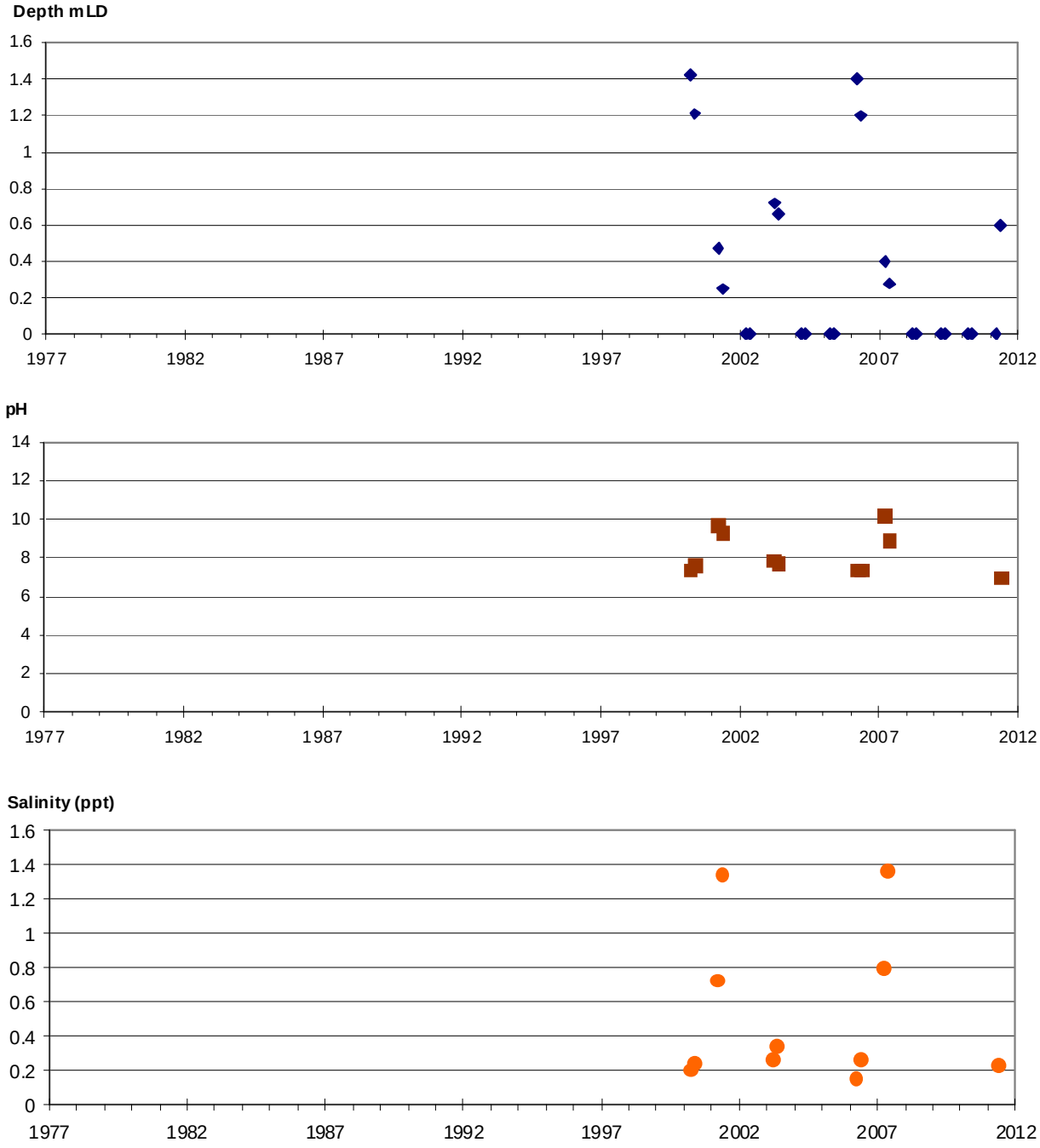
POWELL



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Powell is in the Albany District of the South Coast DEC Region

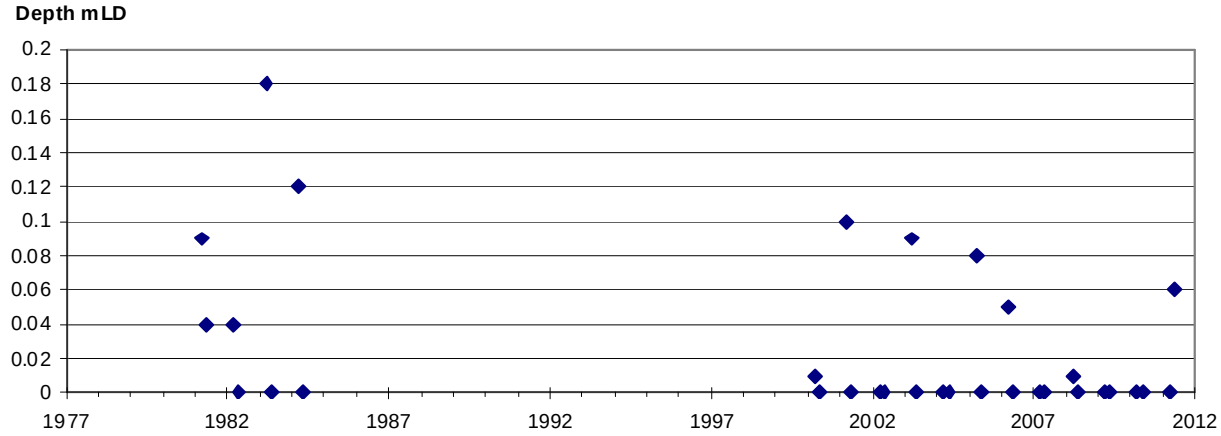
RANGE ROAD YATE

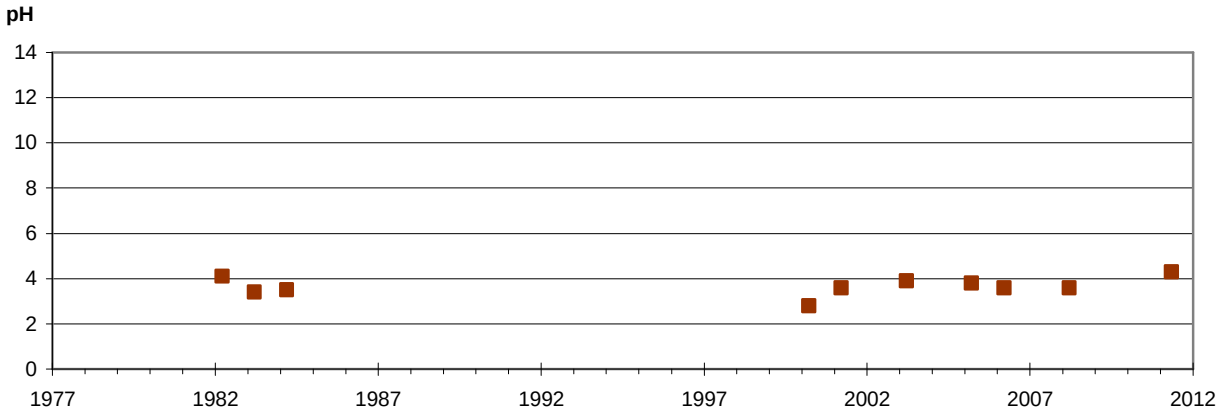


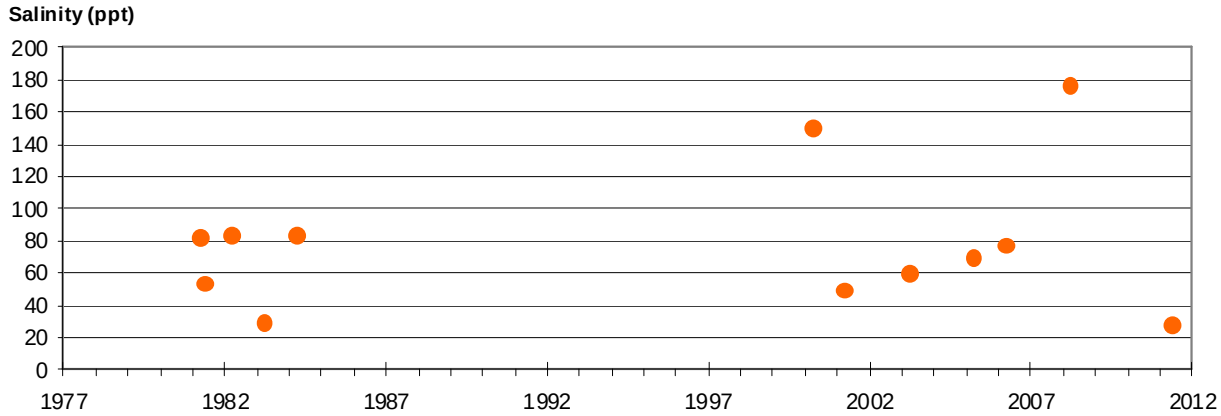
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Range Road Yate is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

RED (BRUCE ROCK)



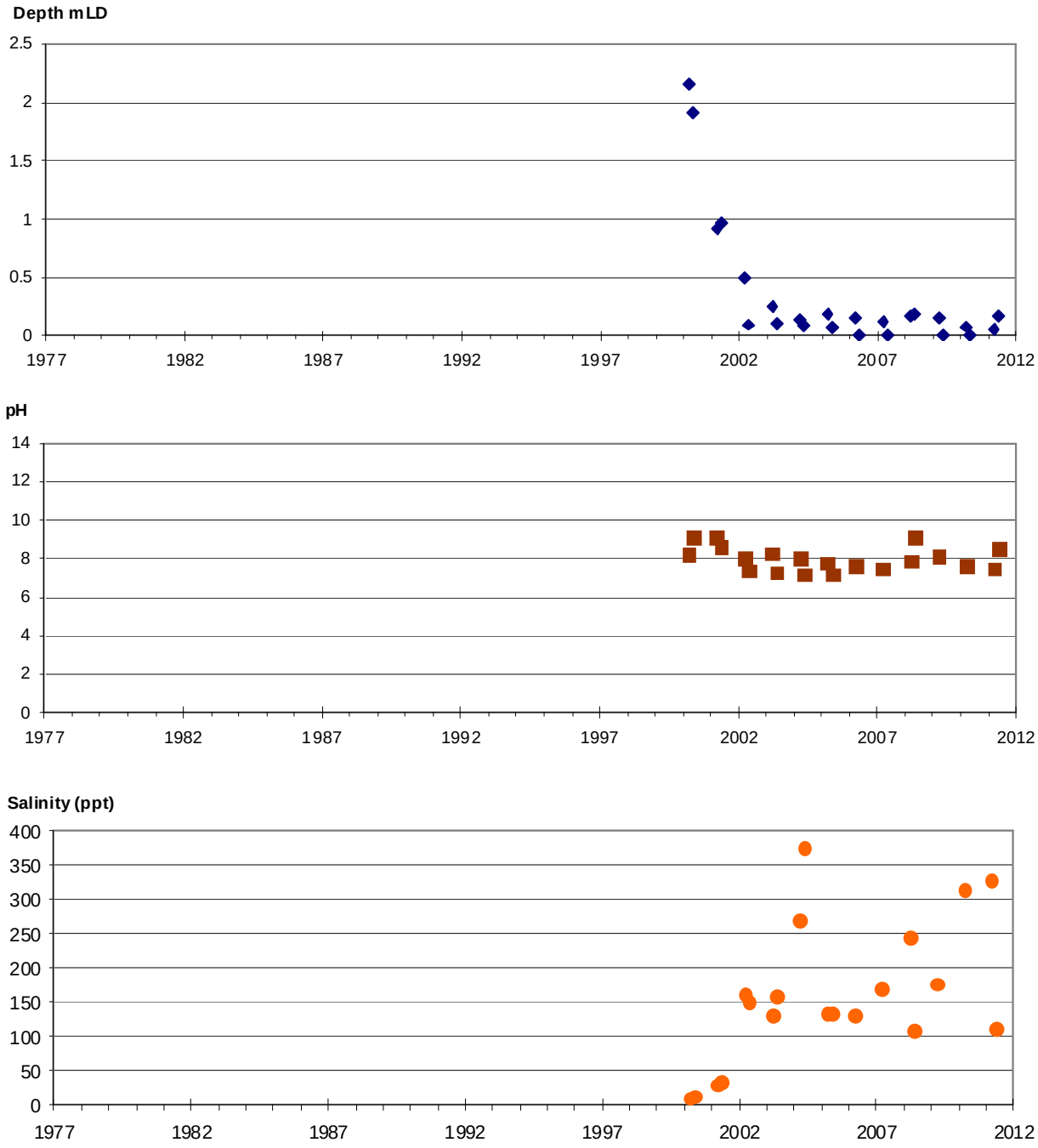




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Red (Bruce Rock) is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

RONNERUP [IM]

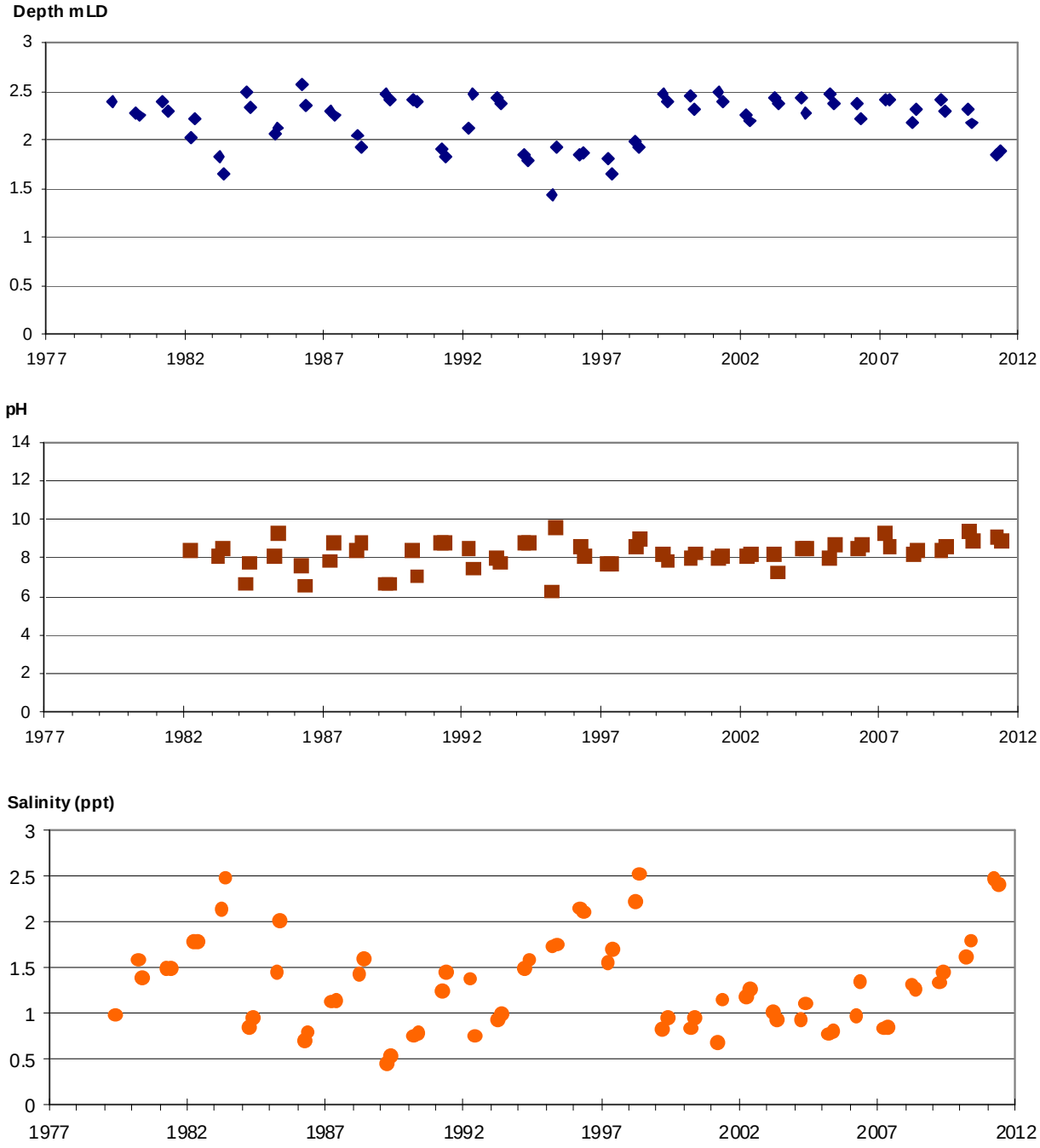


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Ronnerup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

SHARK



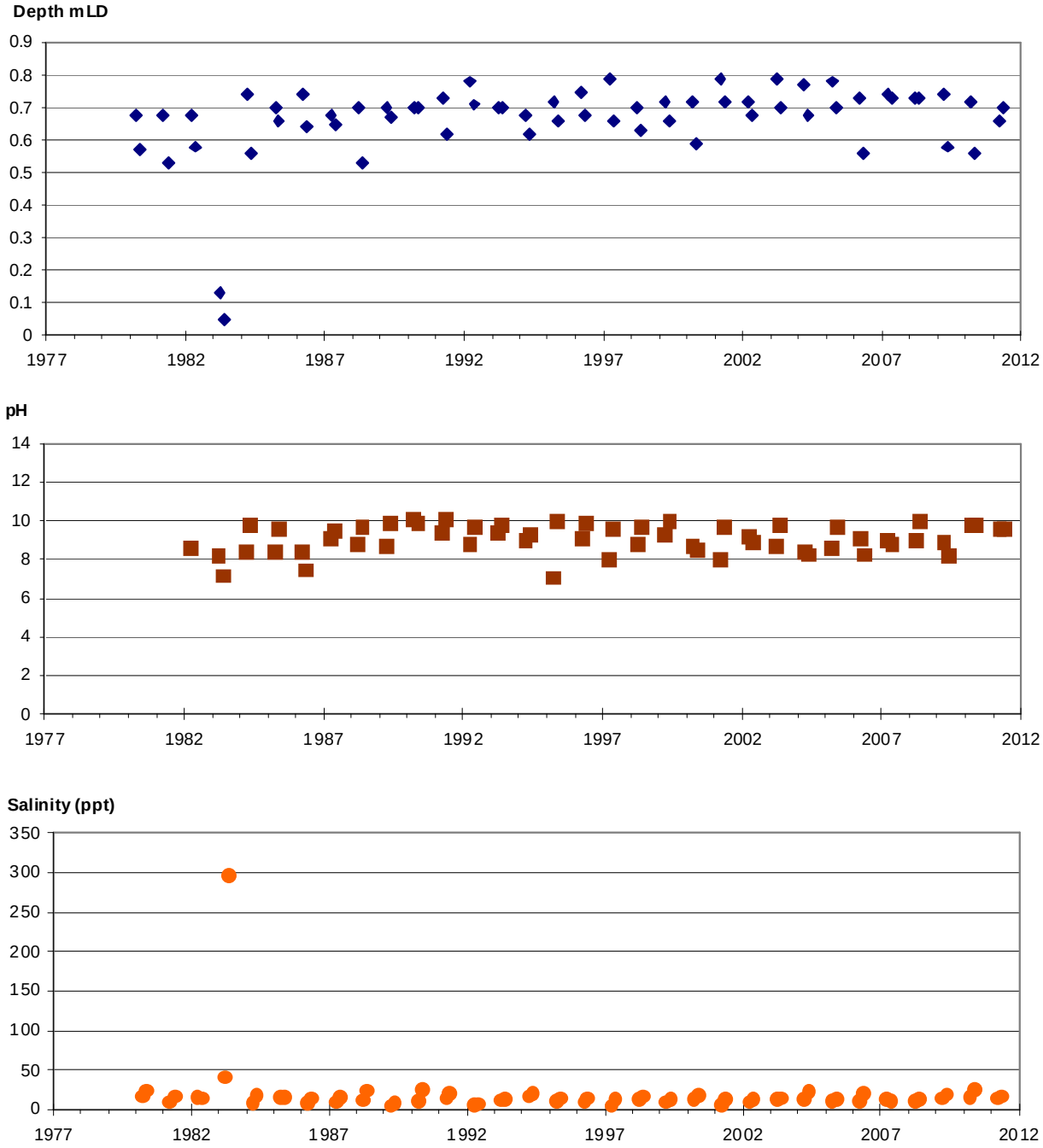
Notes:

1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Shark is within the Esperance Lakes Natural Diversity Recovery Catchment.

Shark is in the Esperance District of the South Coast DEC Region.

STATION (with Salinity axis 0-350ppt)



Notes:

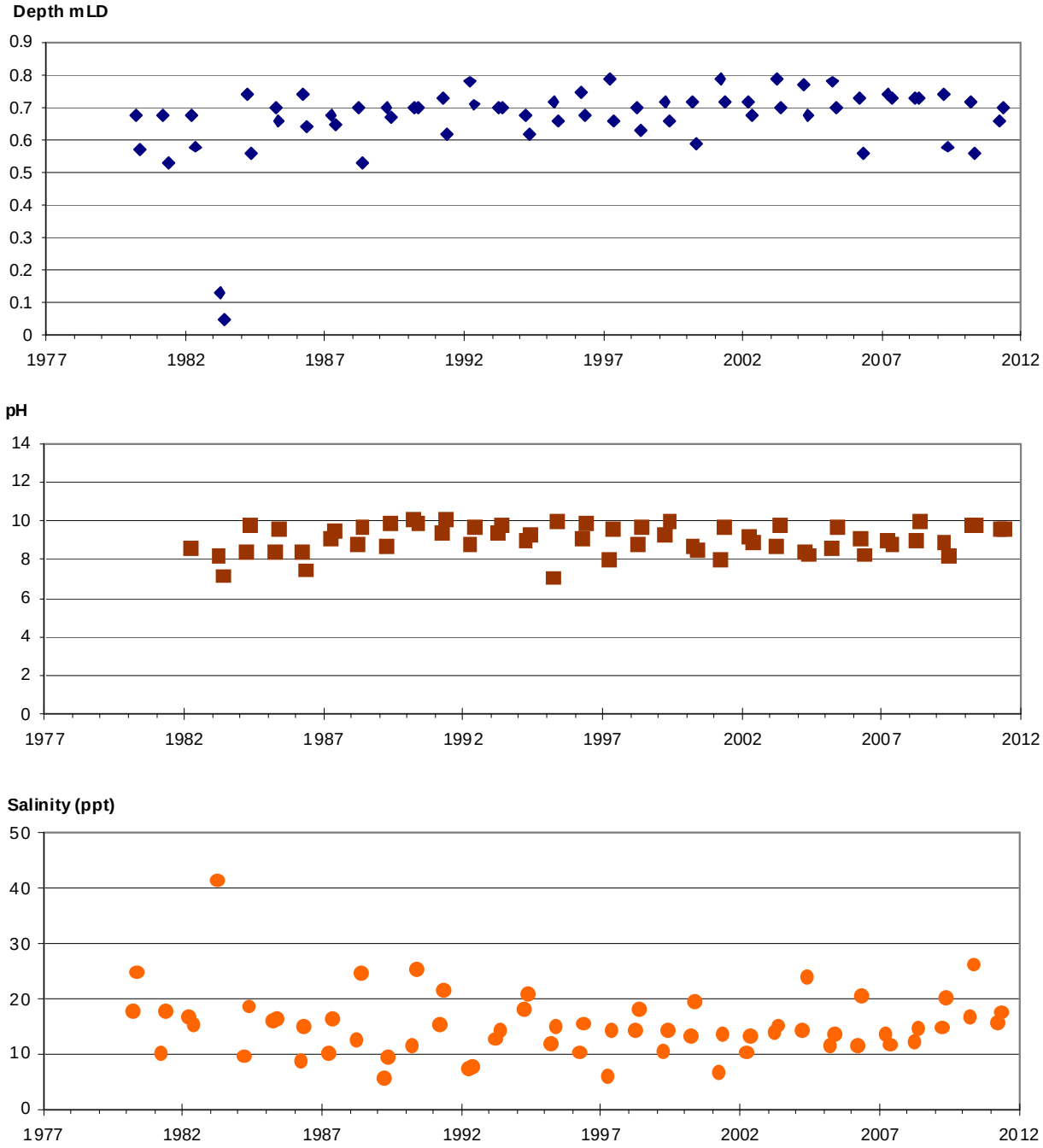
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Station is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Station is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

Station is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DEC Region.

STATION (with Salinity axis 0-50ppt)



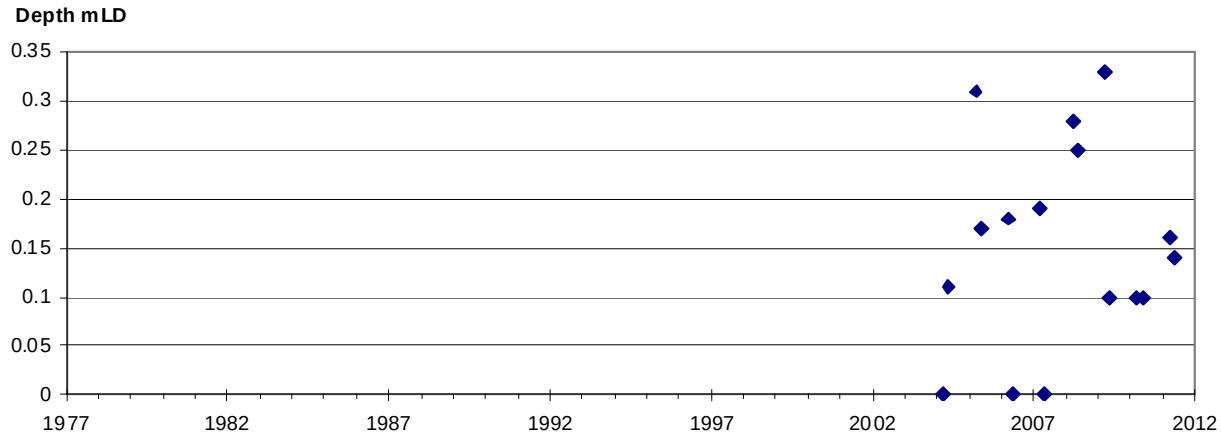
Notes:

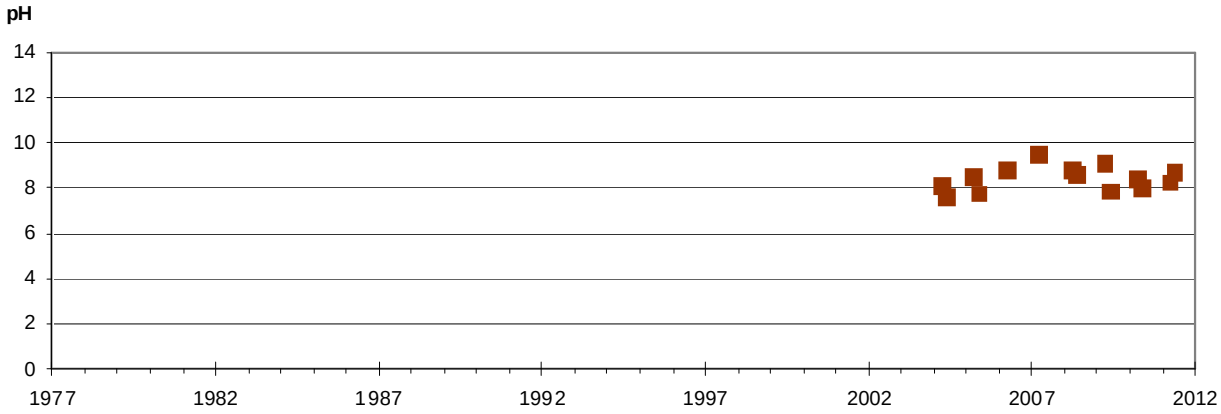
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

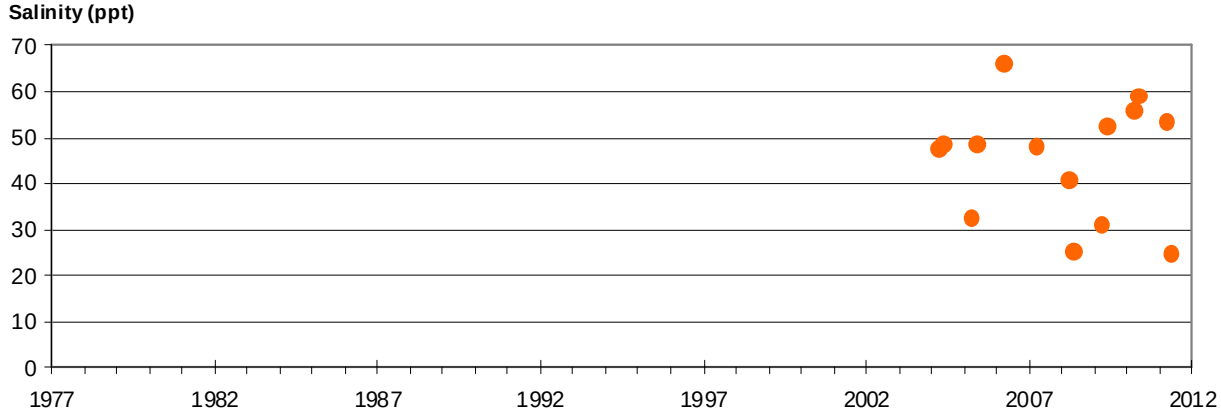
Station is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Station is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'. Station is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DEC Region.

TAARBLIN (NORTH)





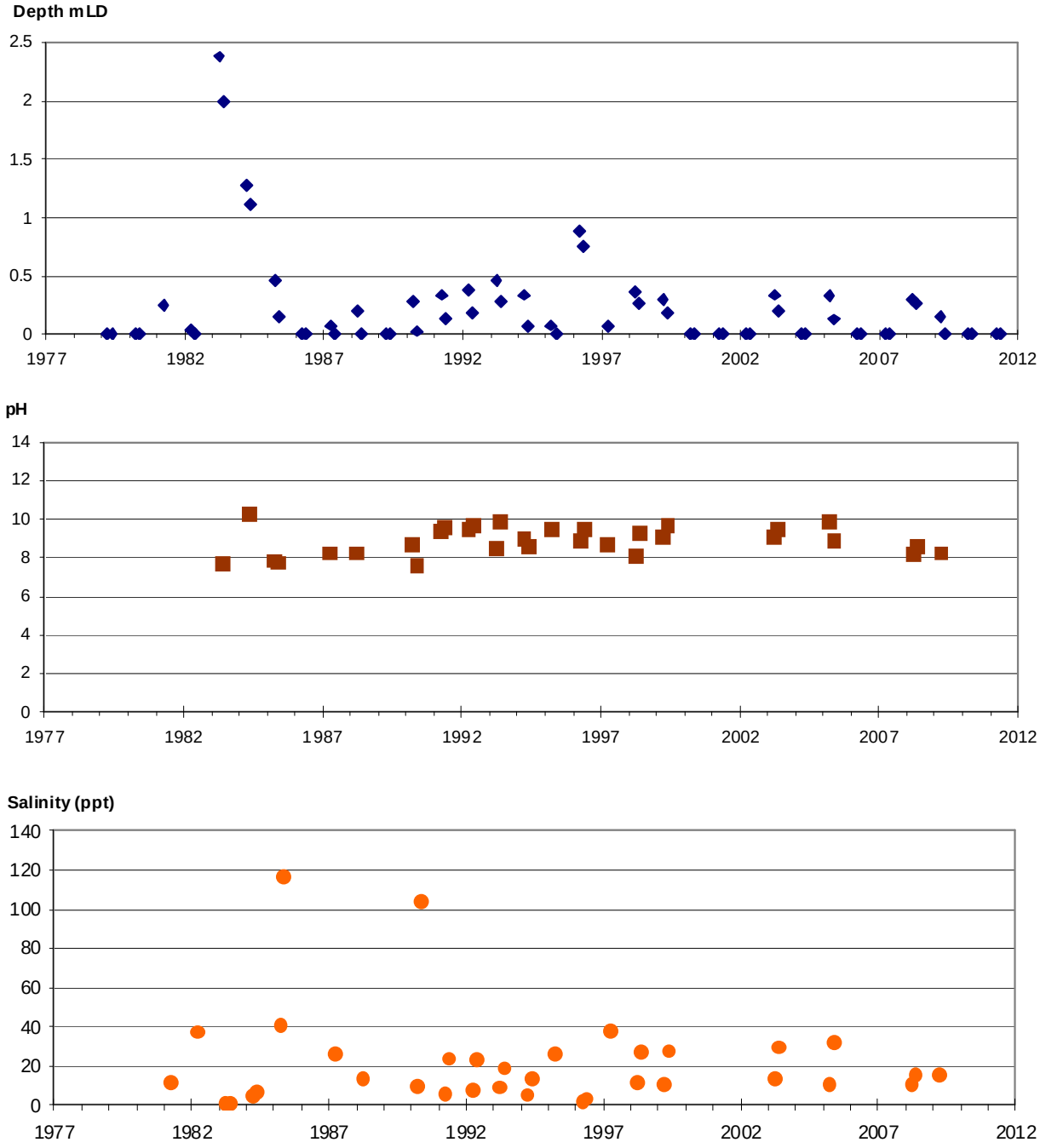


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Taarblin (North) is a short distance downstream from, and receives pumped, bypassed and potentially overflow water from, the Toolibin Lake Natural Diversity Recovery Catchment.

Taarblin (North) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

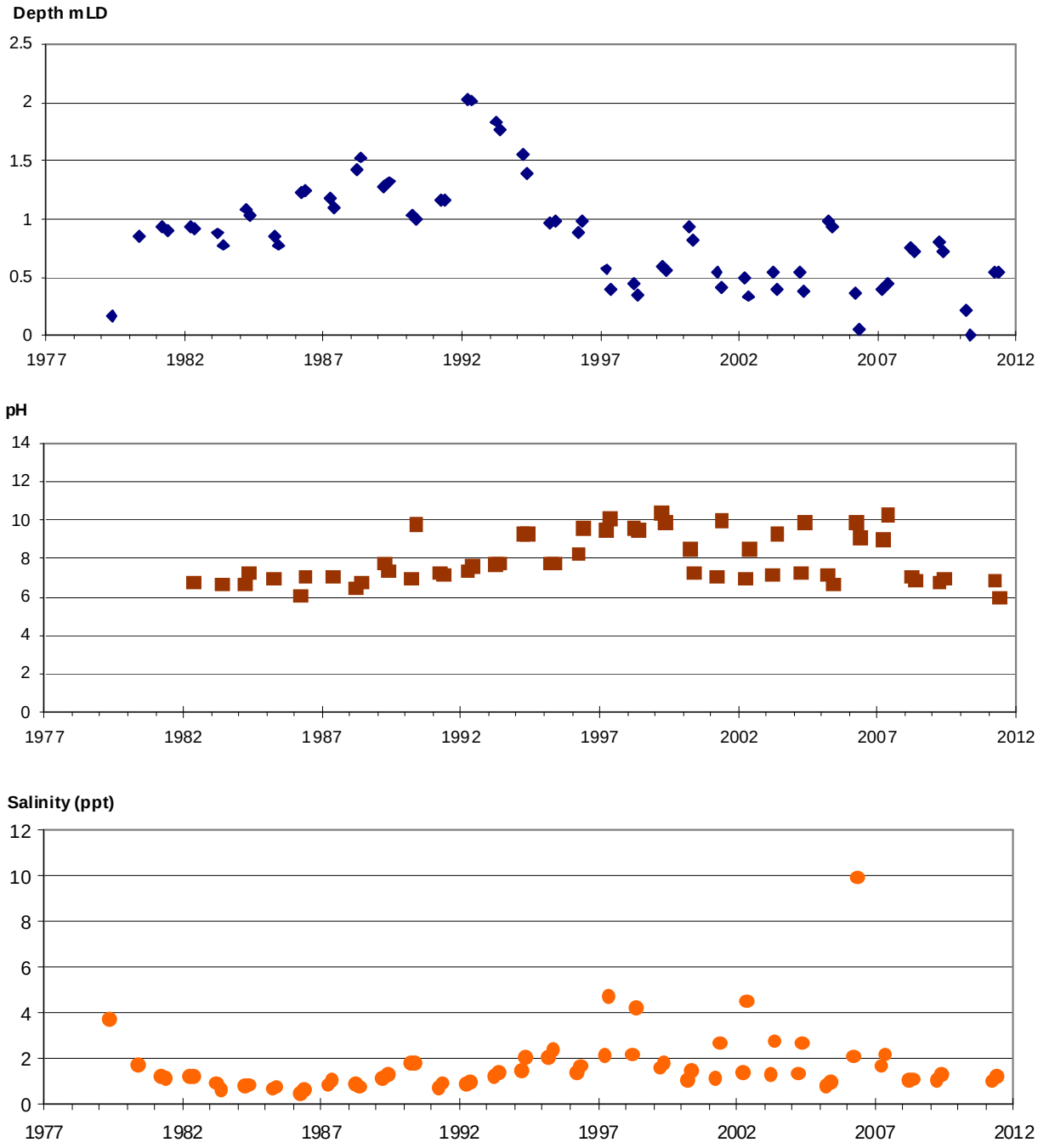
TAARBLIN (SOUTH)



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Taarblin (South) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

THOMSONS

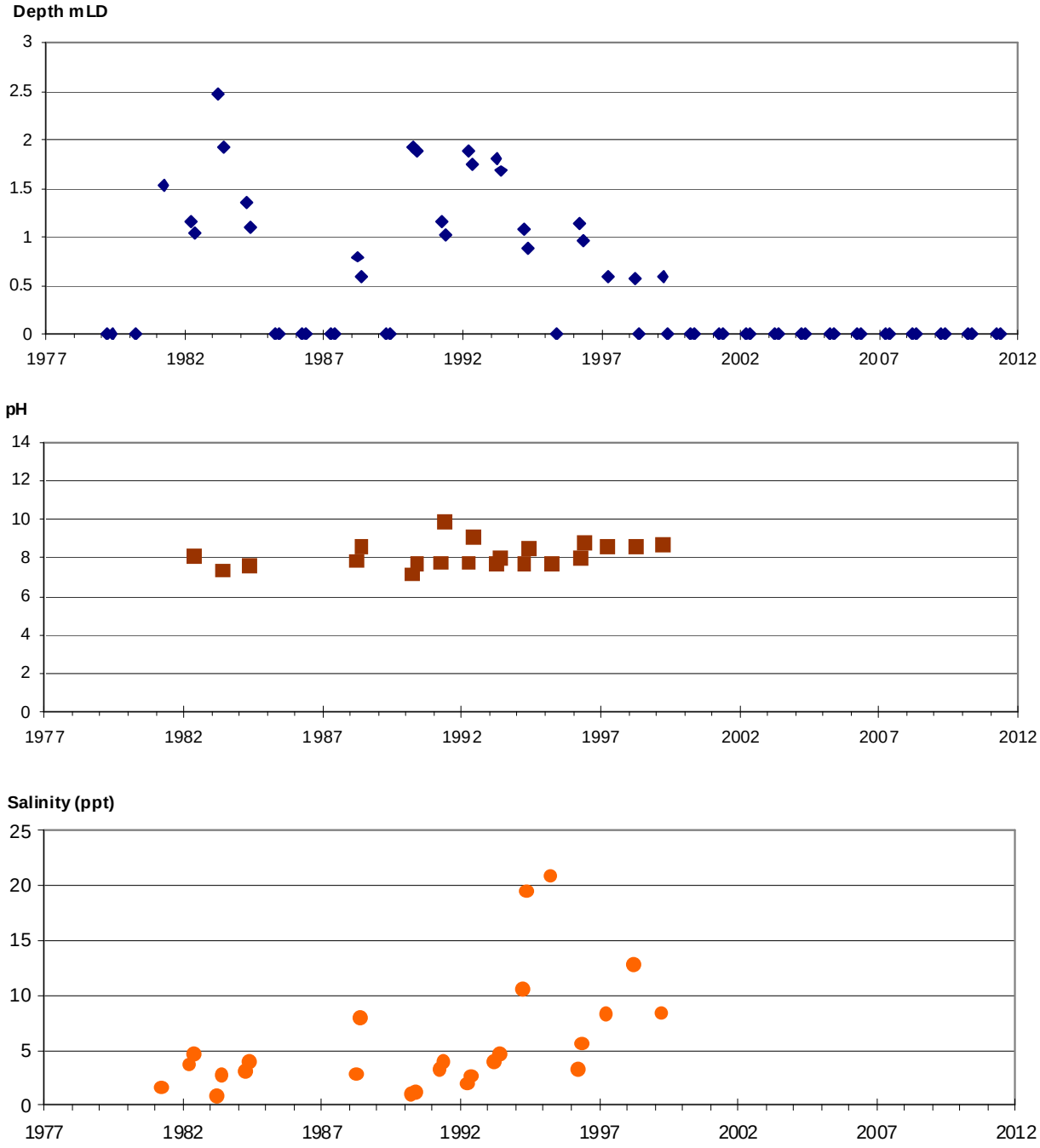


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Thomsons Lake is a component of the 'Forrestdale and Thomsons Lakes' system, which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also listed in the 'Directory of Important Wetlands in Australia'.

Thomsons is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

TOOLIBIN [IM]



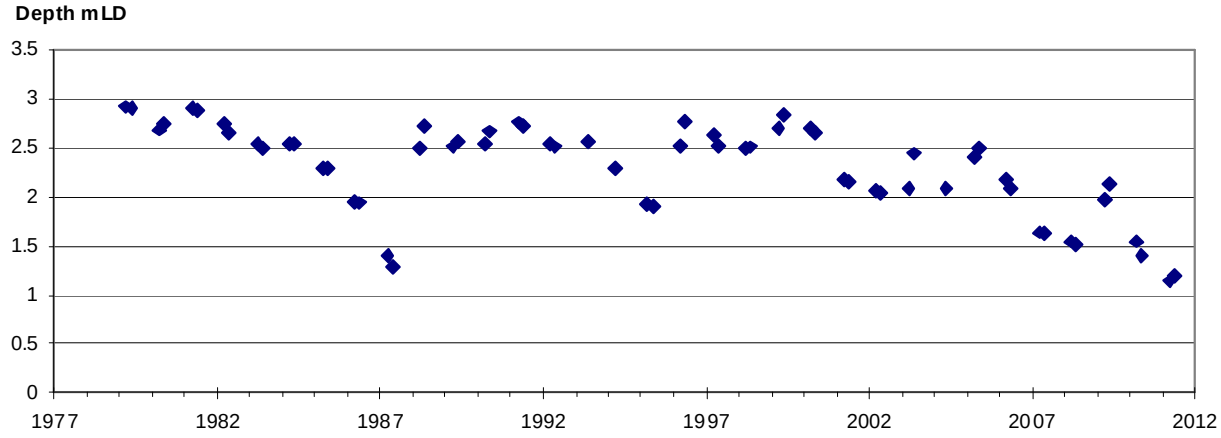
Notes:

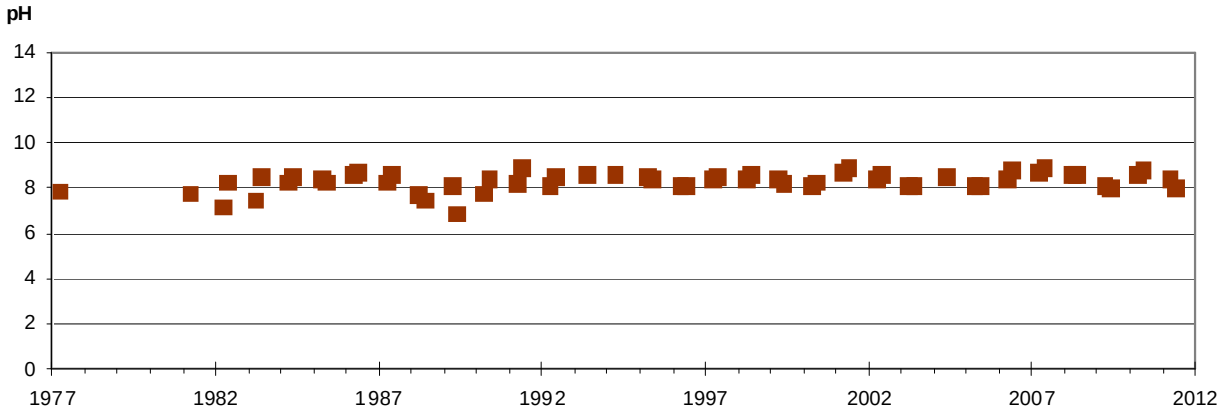
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

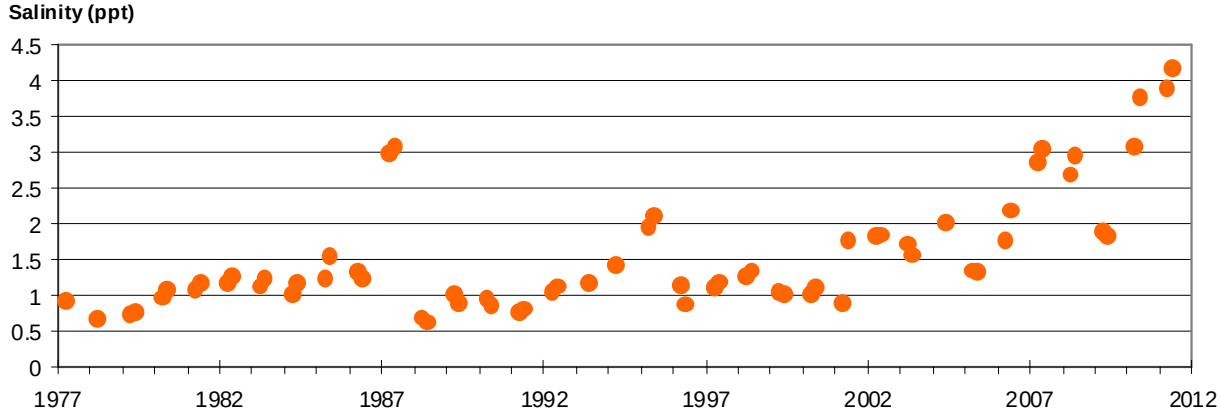
Toolibin Lake is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands and is also listed in the 'Directory of Important Wetlands in Australia'.

Toolibin is in the Toolibin Lake Natural Diversity Recovery Catchment and is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

TORDIT-GURRUP





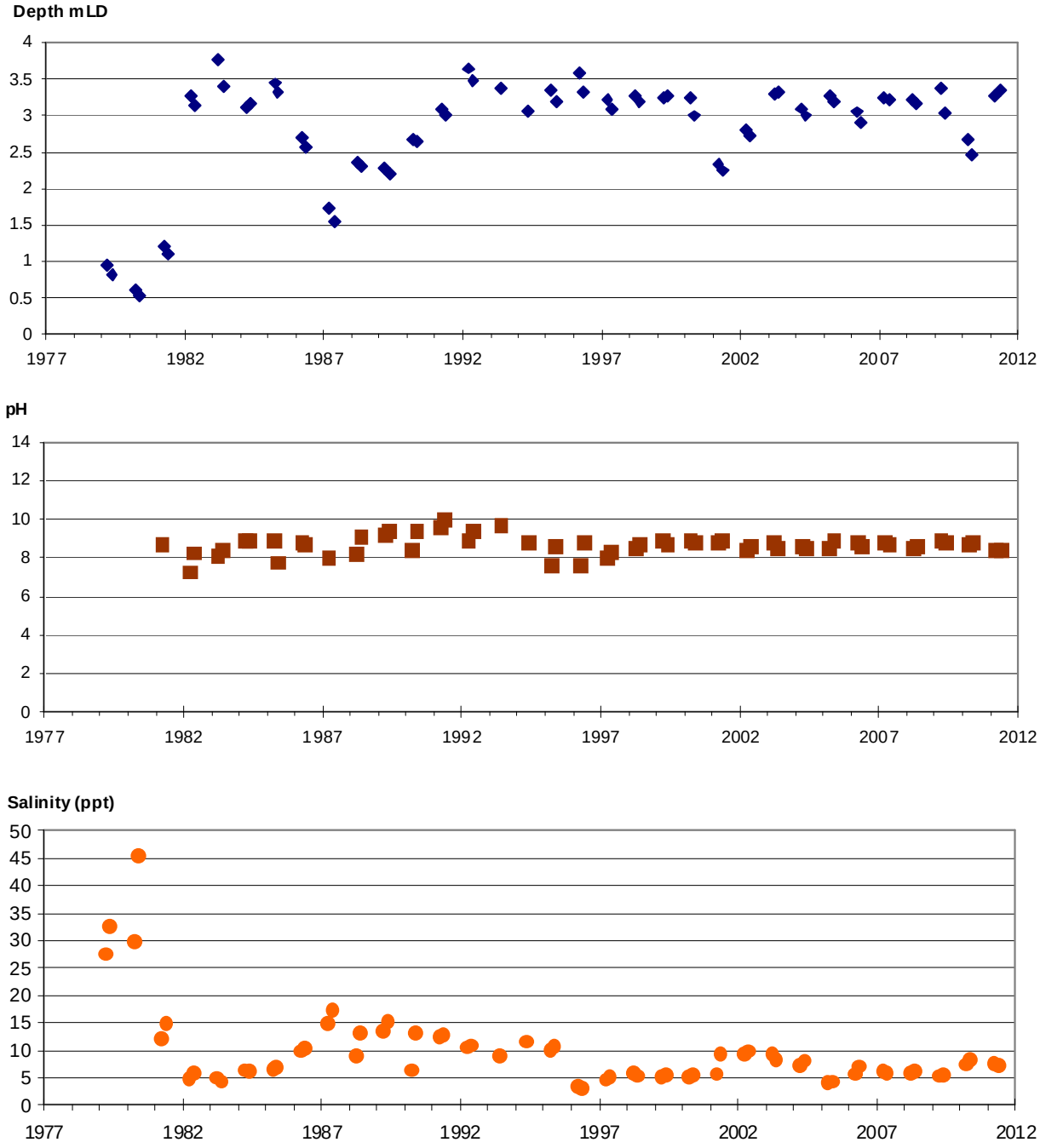


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Tordit-Gurrup is a component of the 'Muir-Byenup System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands, and is also a component of the 'Byenup Lagoon System' listed in the 'Directory of Important Wetlands in Australia'.

Tordit-Gurrup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

TOWERRINNING [IM]

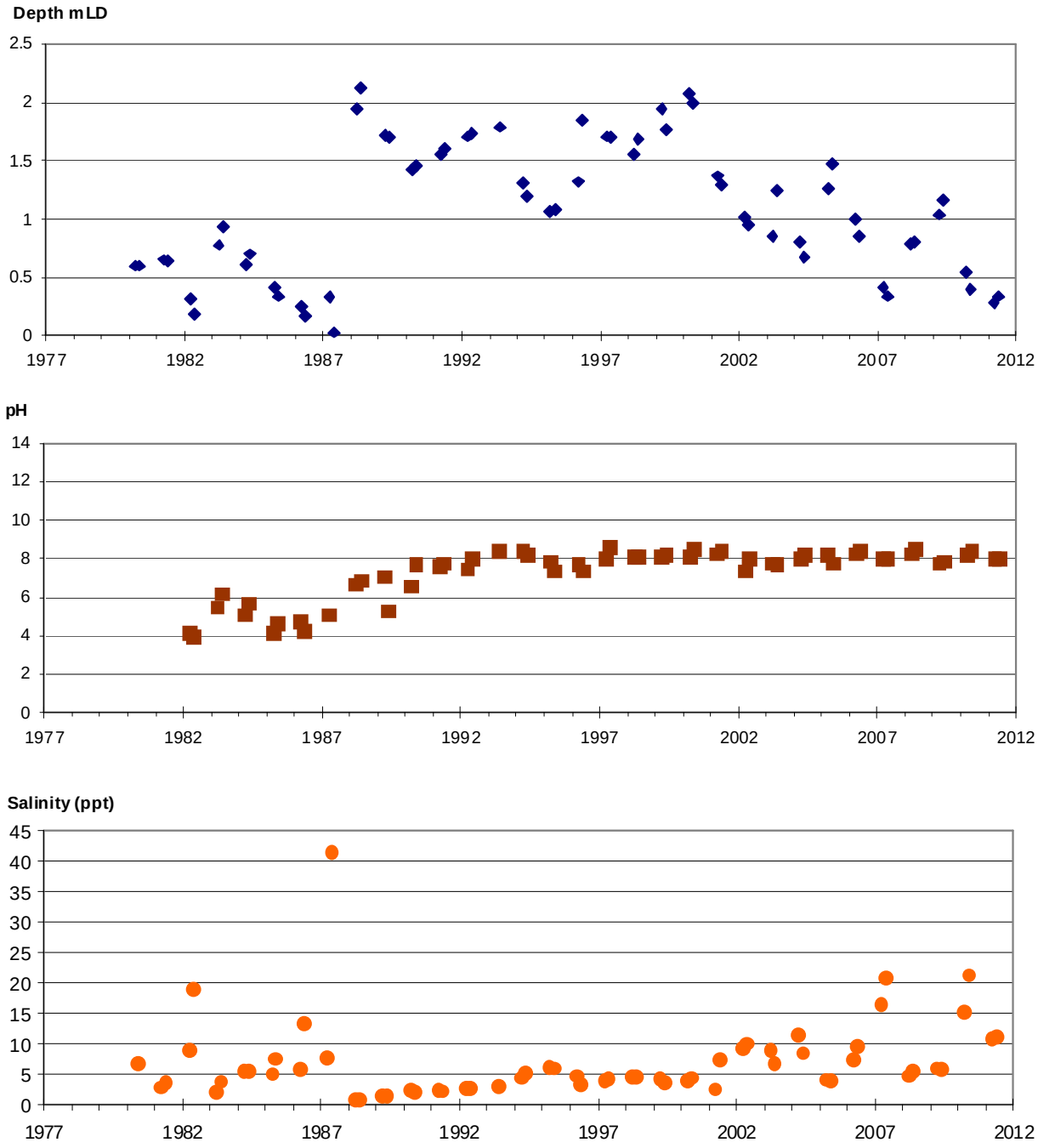


Notes:

1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Towerrinning is in the Wellington District (headquartered in Collie) of the South West DEC Region.

UNICUP

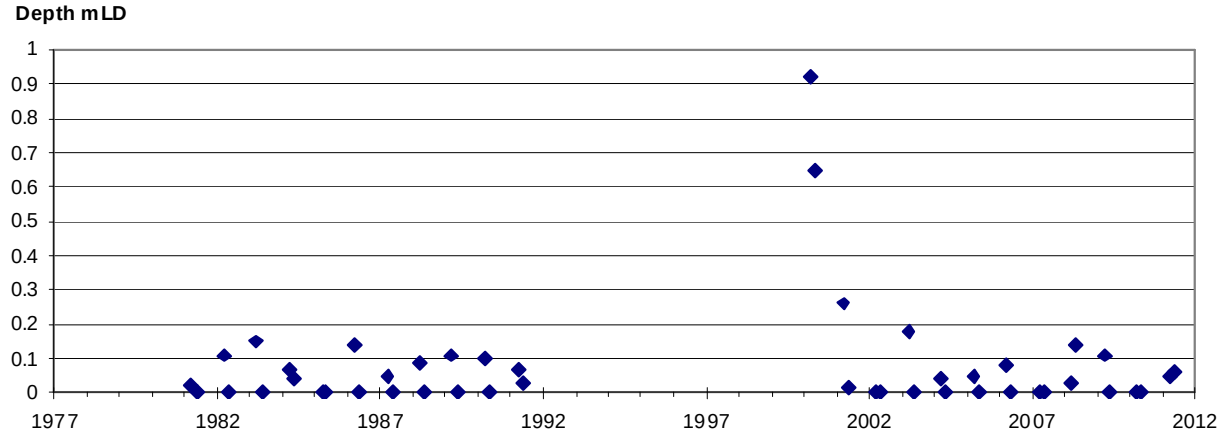


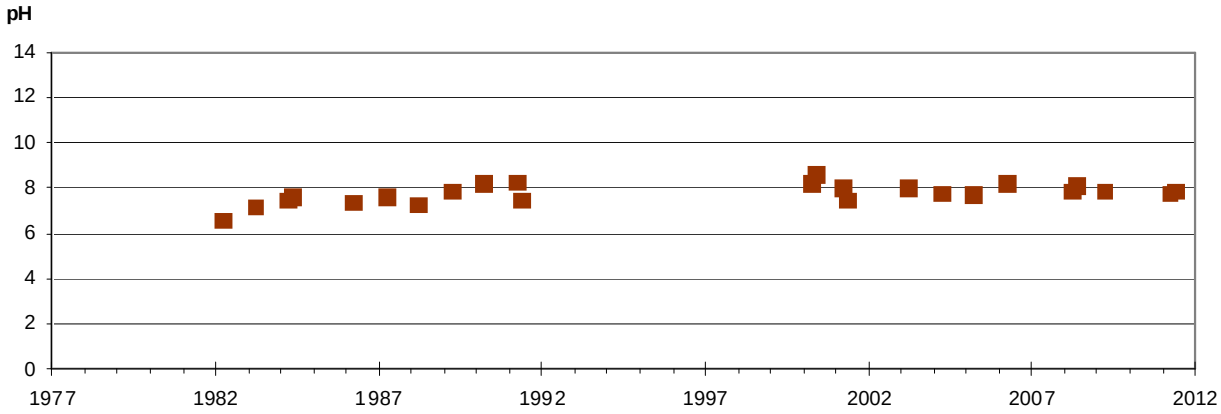
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

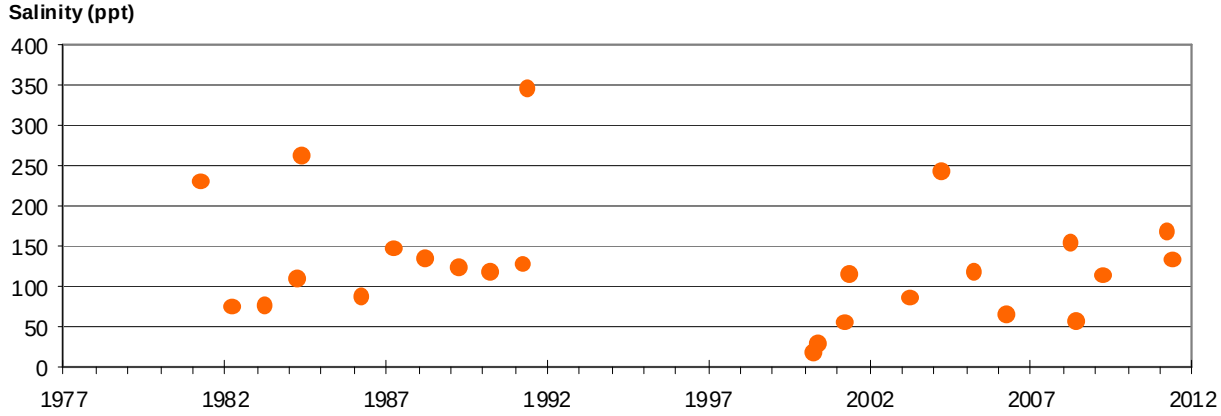
Unicup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

Unicup is within the Muir-Unicup Natural Diversity Recovery Catchment and is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

VARLEY



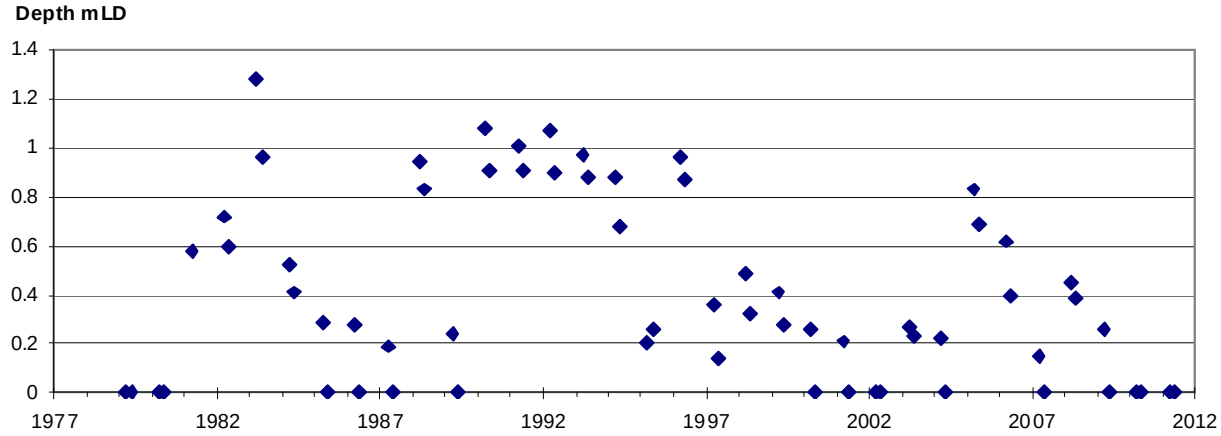


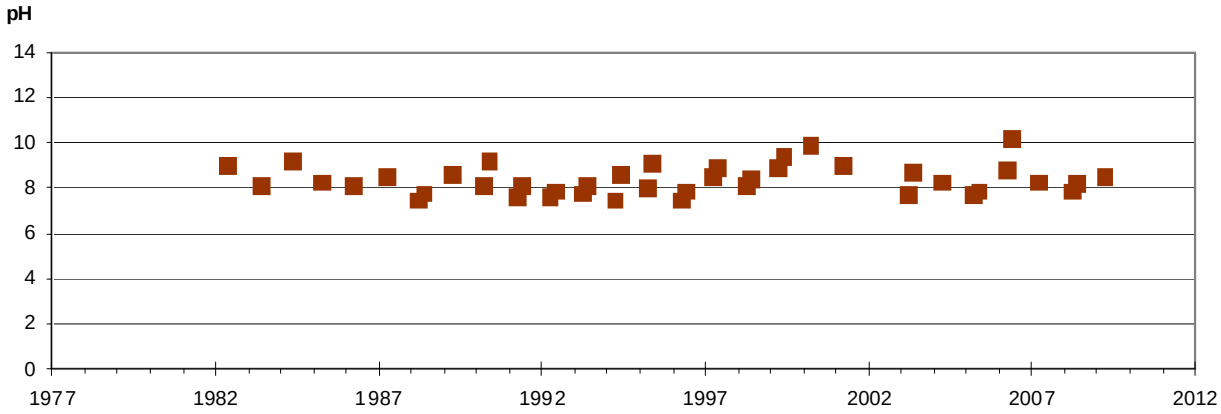


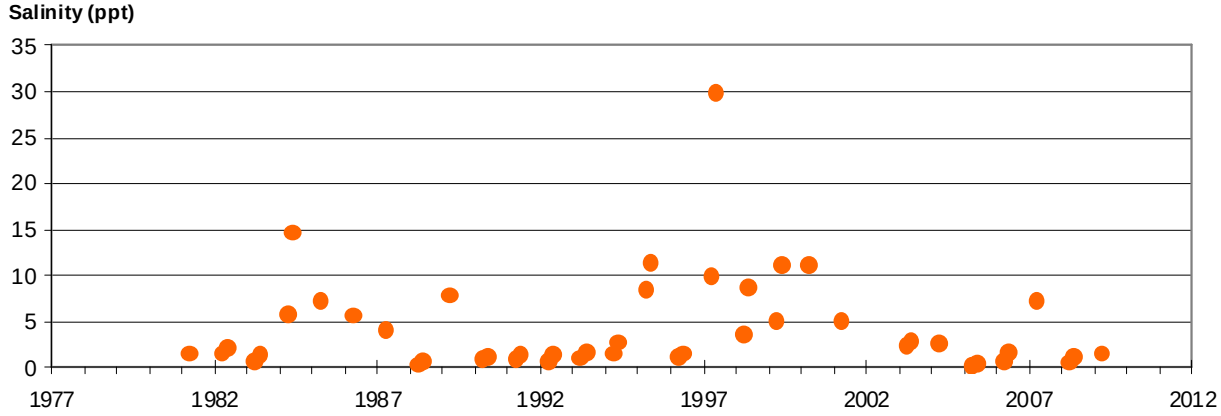
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Varley is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

WALBYRING





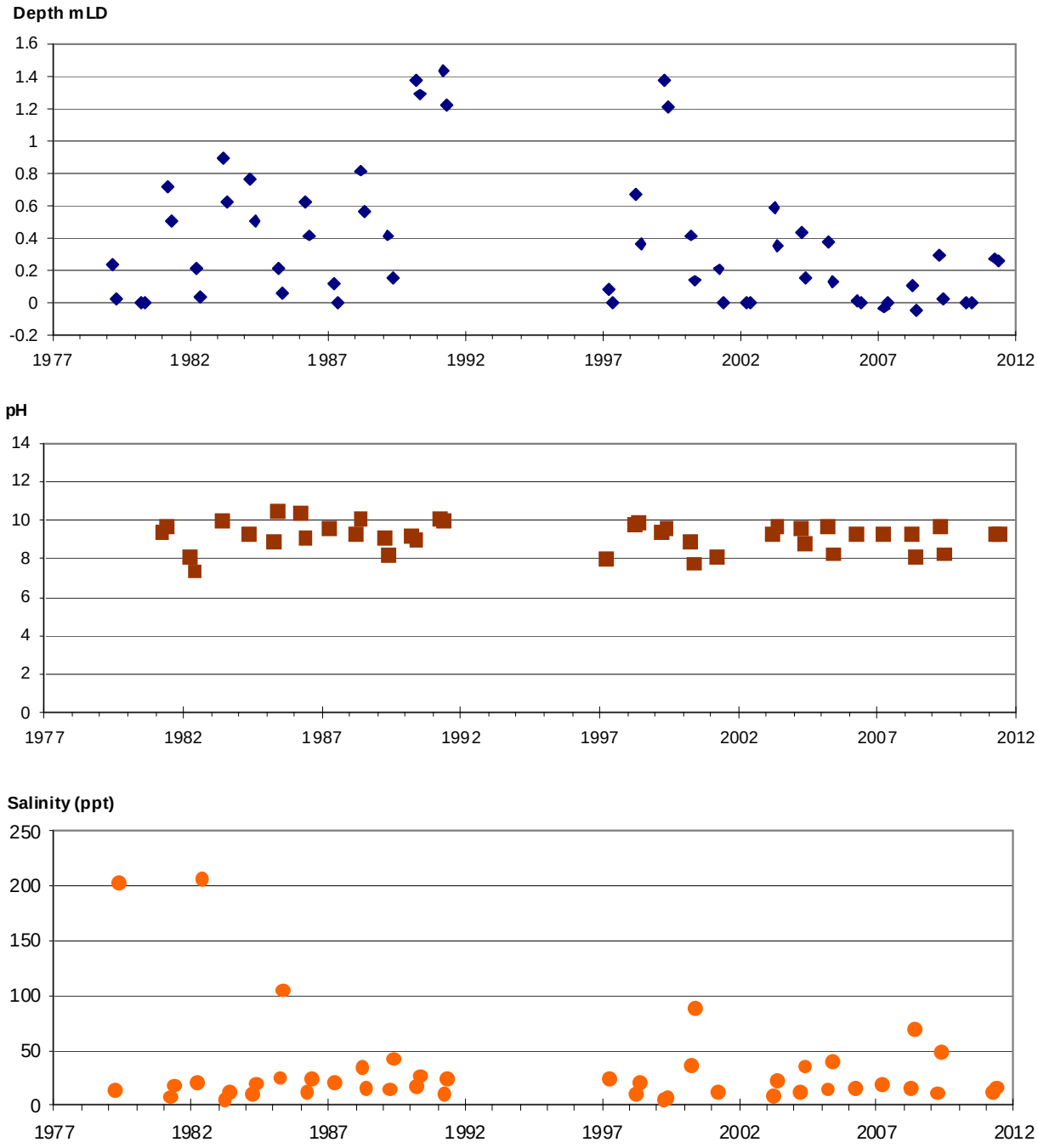


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Walbyring is a short distance downstream from, and potentially receives overflow water from, the Toolibin Lake Natural Diversity Recovery Catchment.

Walbyring is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

WALYORMOURING [IM]

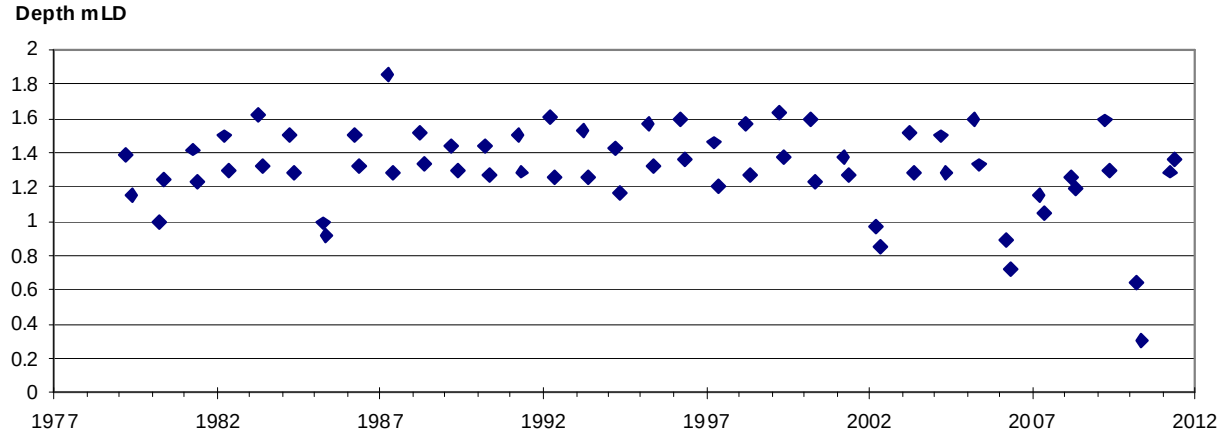


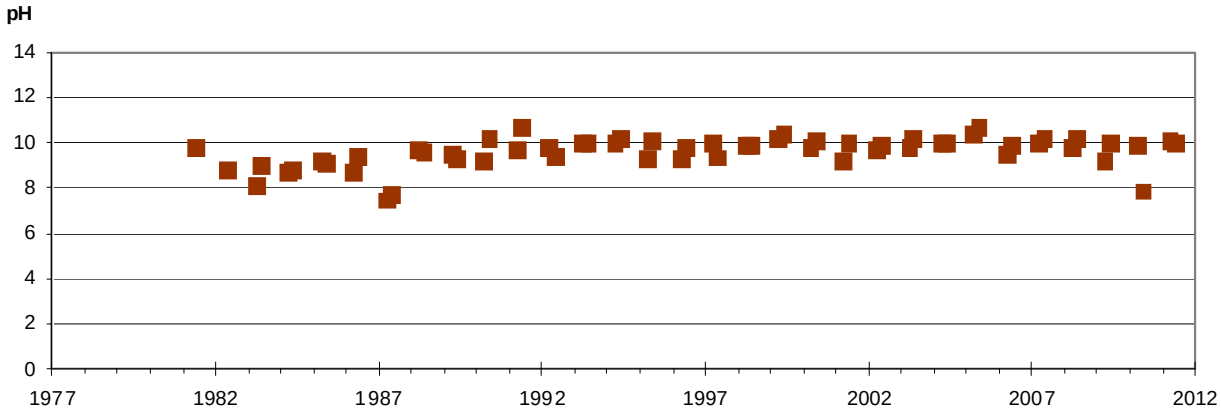
Notes:

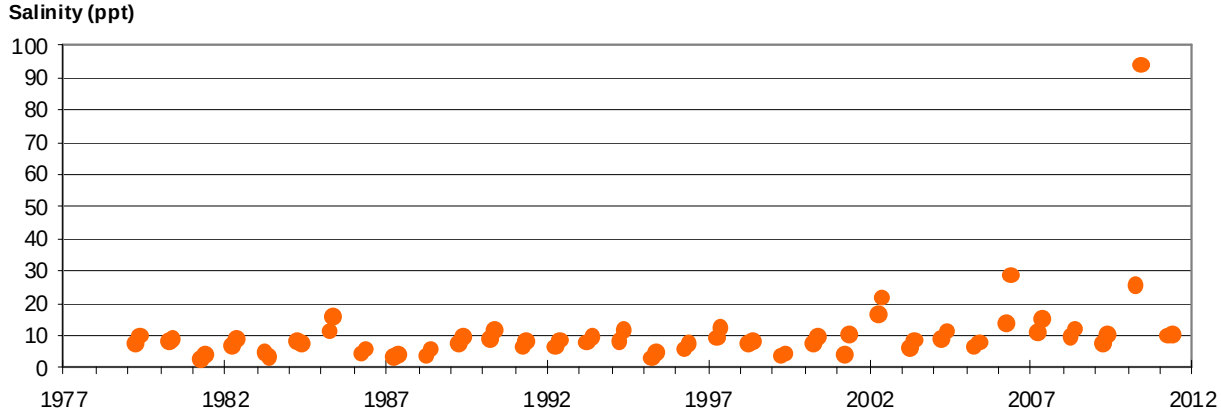
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Walyormouring is in the Central District (headquartered in Merredin) of the Wheatbelt DEC Region.

WANNAMAL





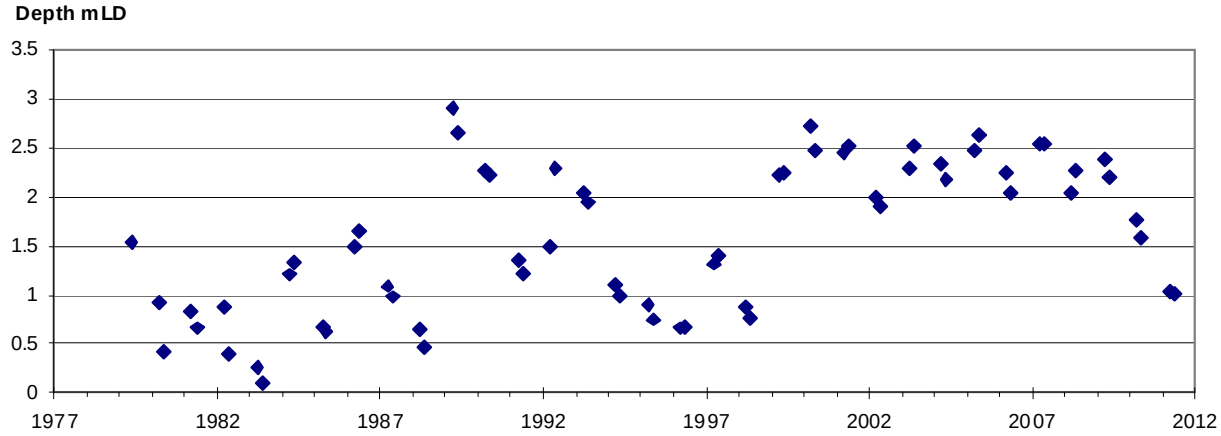


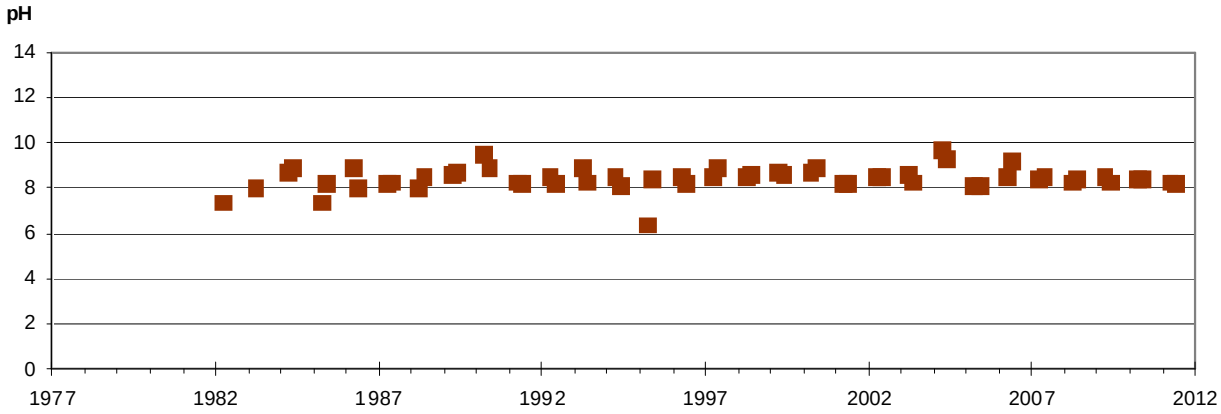
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

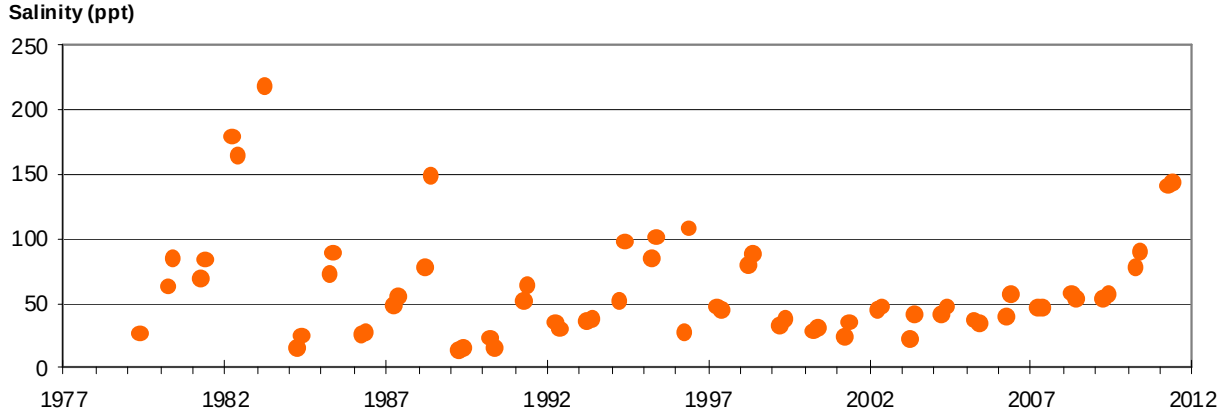
Wannamal is a component of the 'Wannamal Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

Wannamal is in the Swan Coastal District (headquartered in Wanneroo) of the Swan DEC Region.

WARDEN







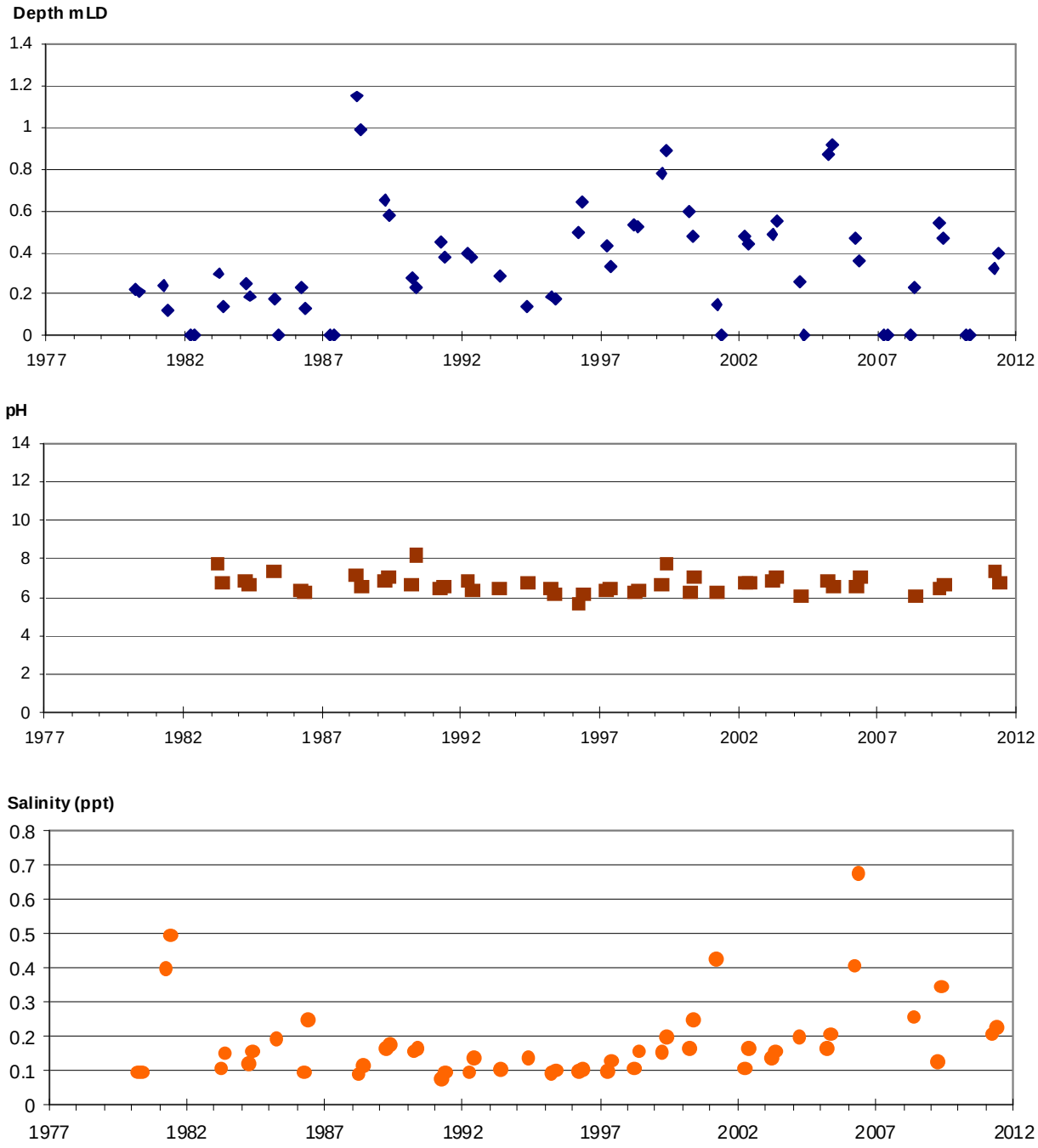
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Warden is a component of the 'Lake Warden System', which is listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands.

Warden is also a component of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

Warden is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DEC Region.

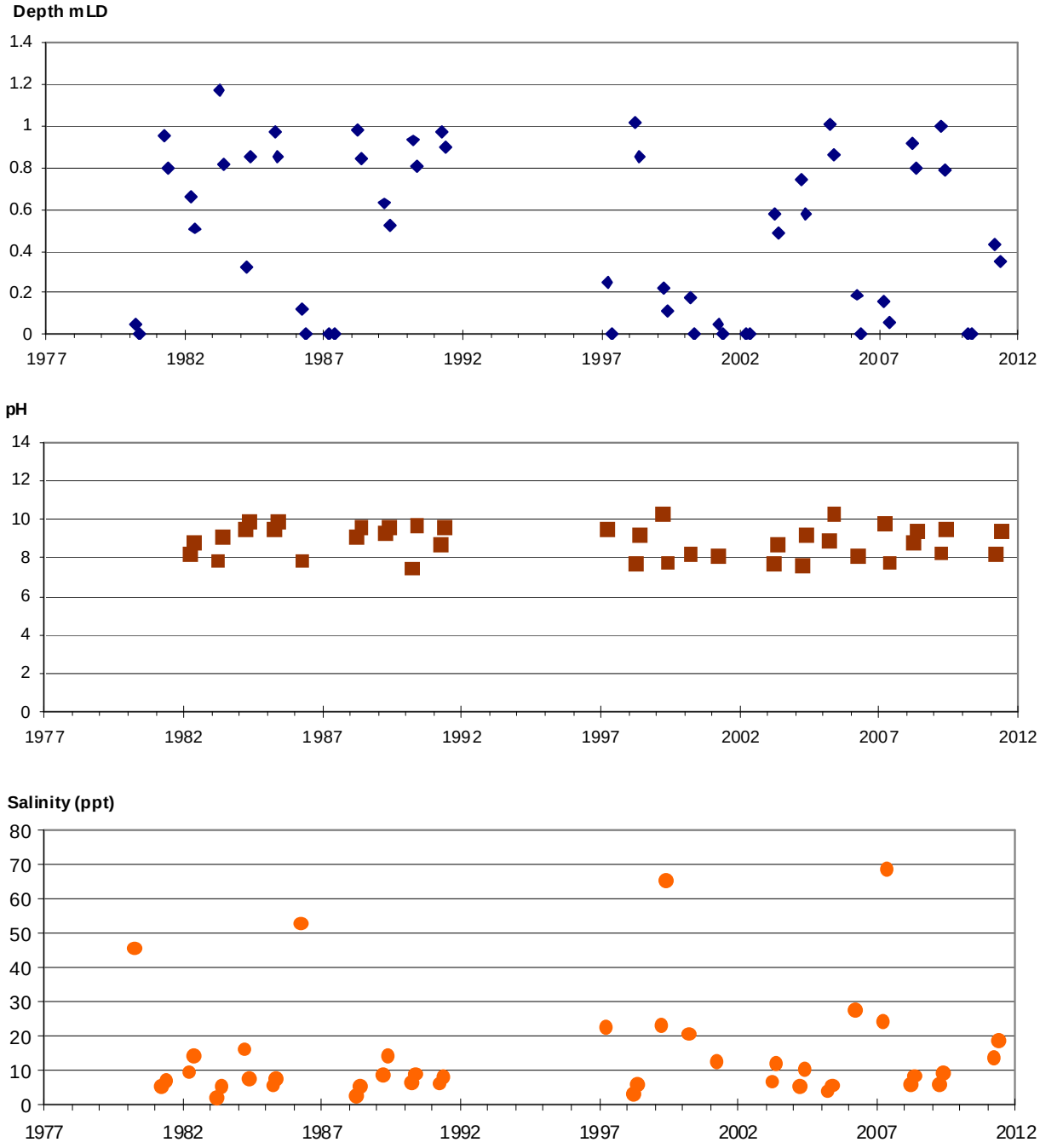
WARRINUP



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Warrinup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

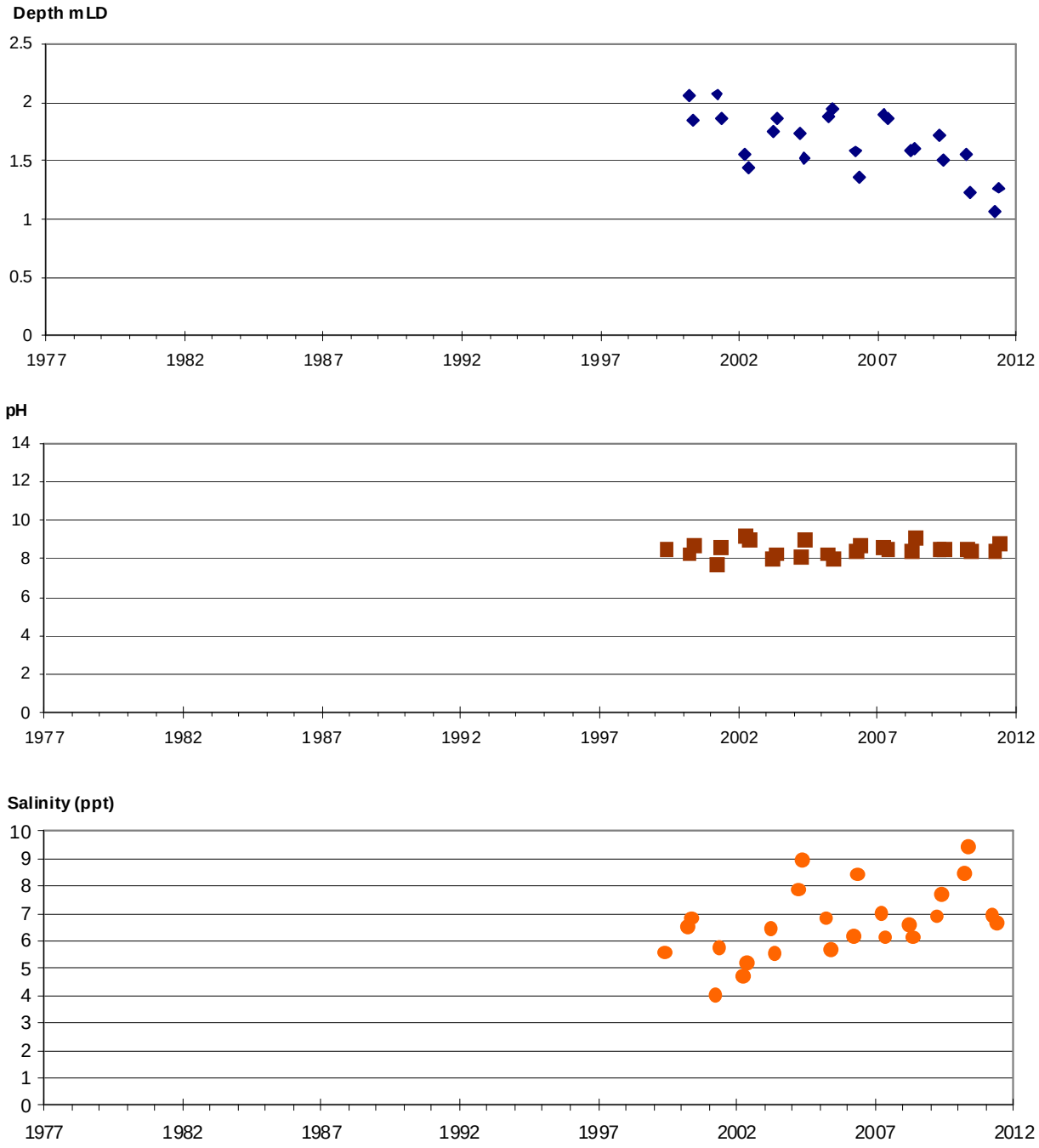
WEST ARTHUR 5456



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

West Arthur 5456 is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

WHEATFIELD [IM]



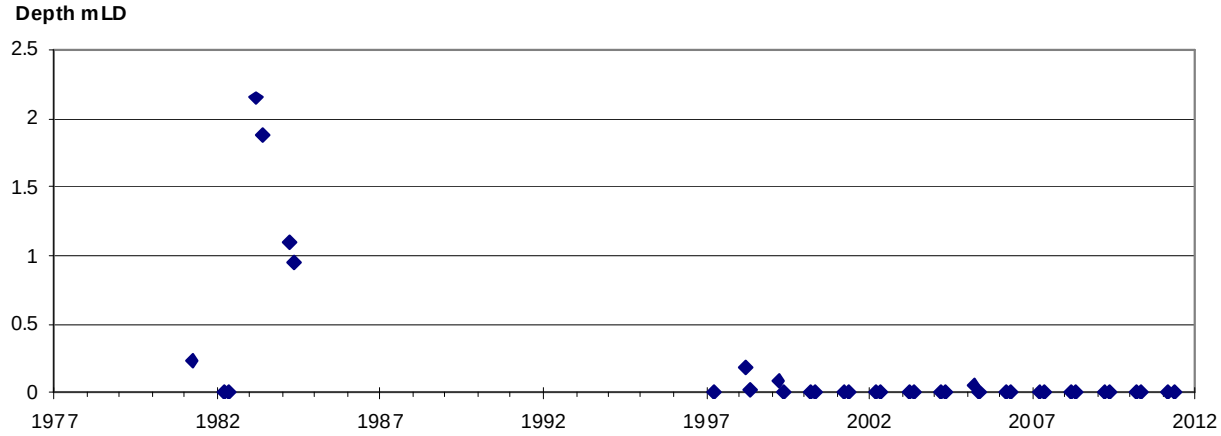
Notes:

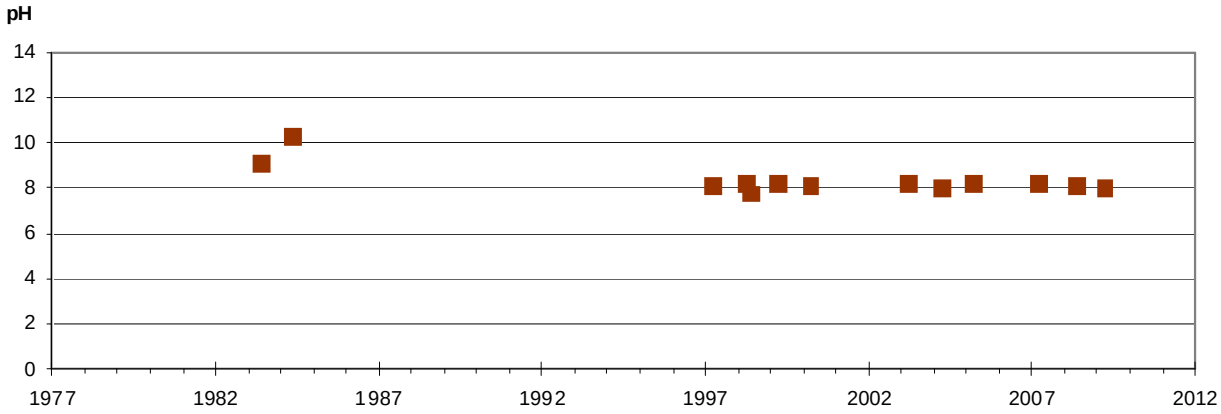
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

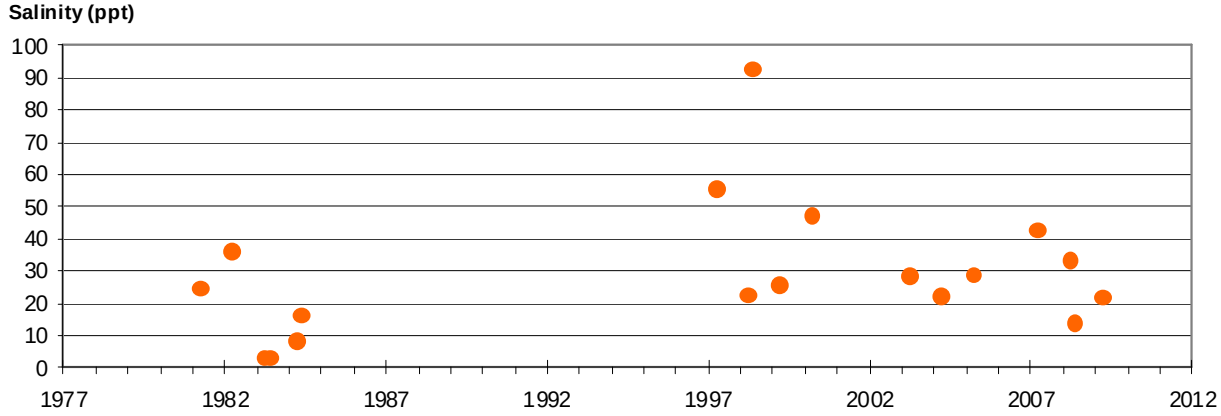
Wheatfield is part of the 'Lake Warden System' listed as a Wetland of International Importance under the 'Ramsar' Convention on Wetlands and is also part of the 'Lake Warden System' listed in the 'Directory of Important Wetlands in Australia'.

Wheatfield is within the Esperance Lakes Natural Diversity Recovery Catchment and is in the Esperance District of the South Coast DEC Region.

WHITE (NARROGIN)



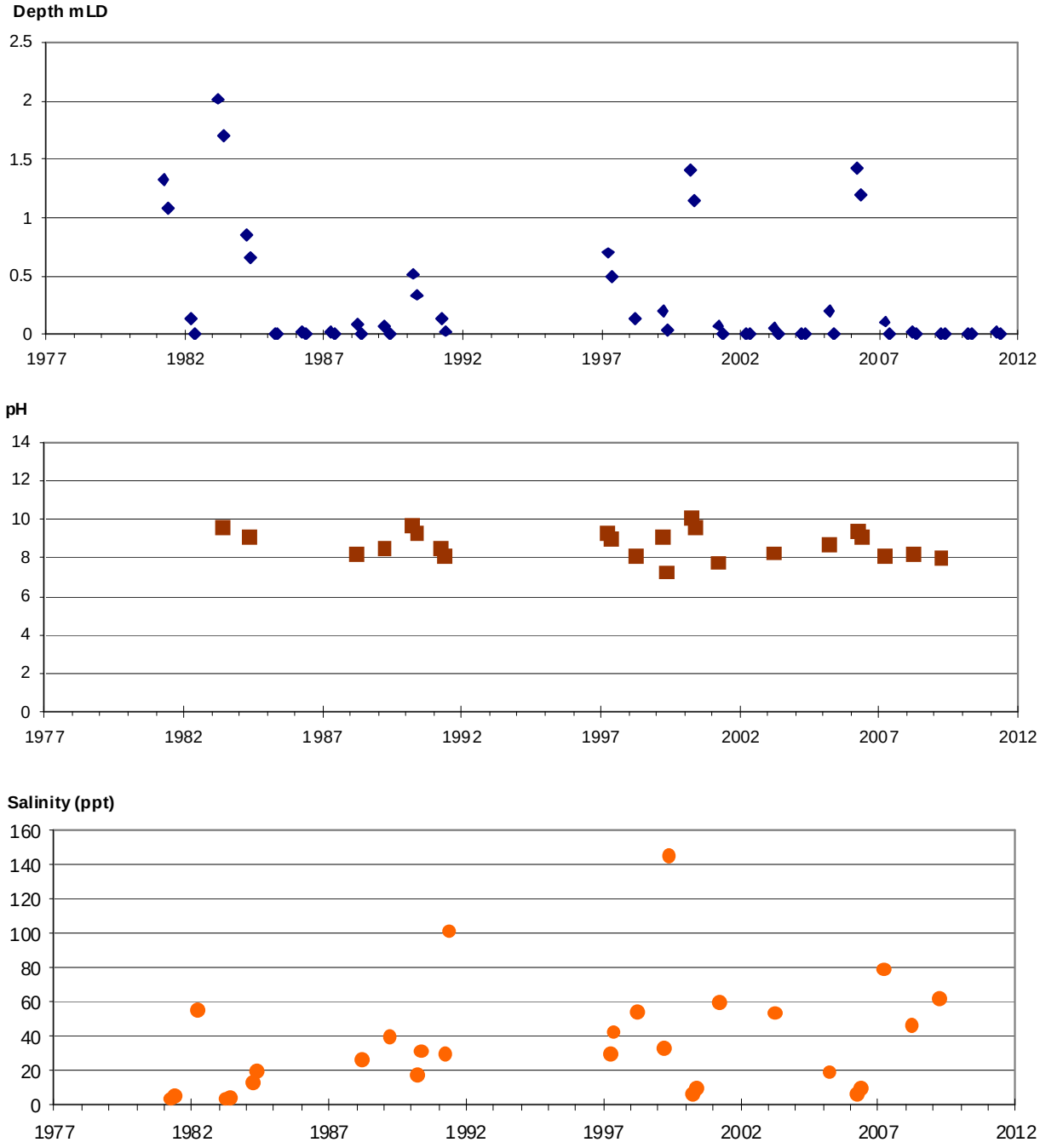




Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

White (Narrogin) is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

WHITE WATER

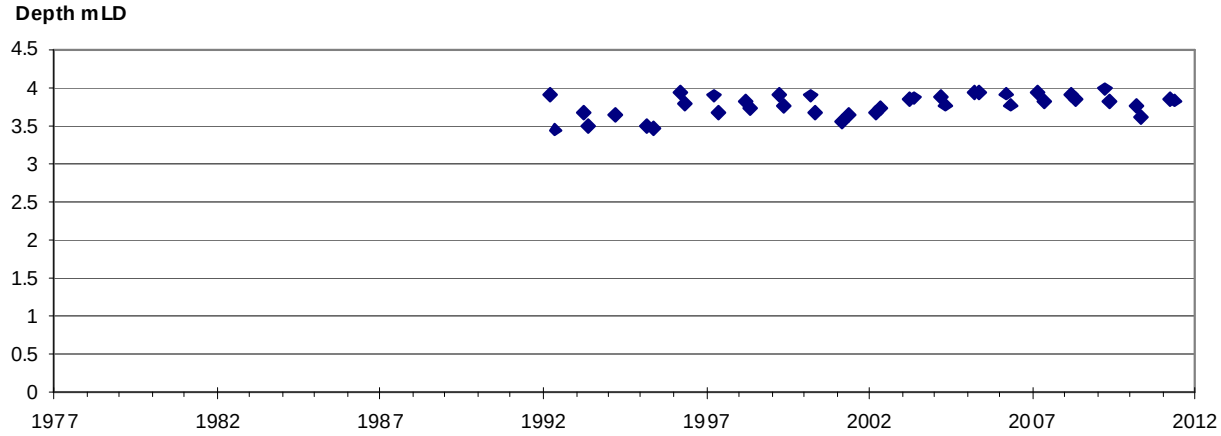


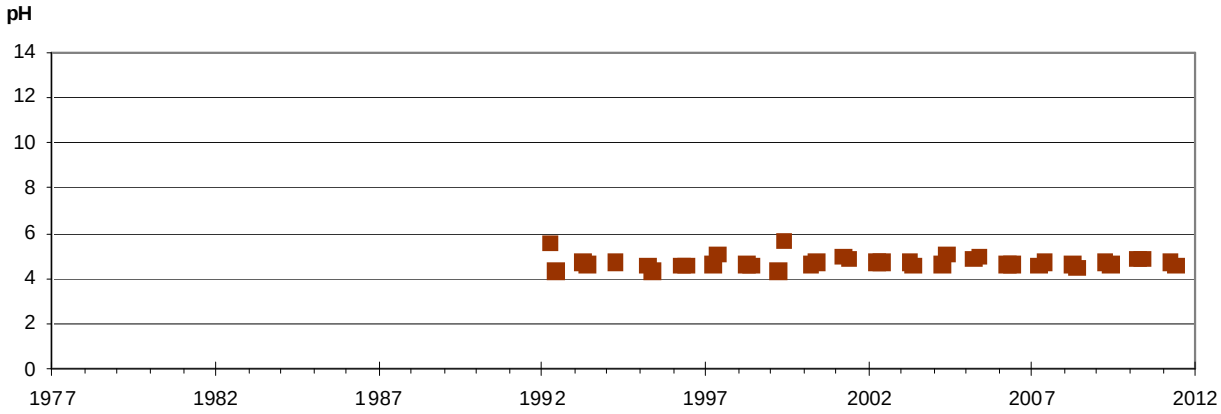
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

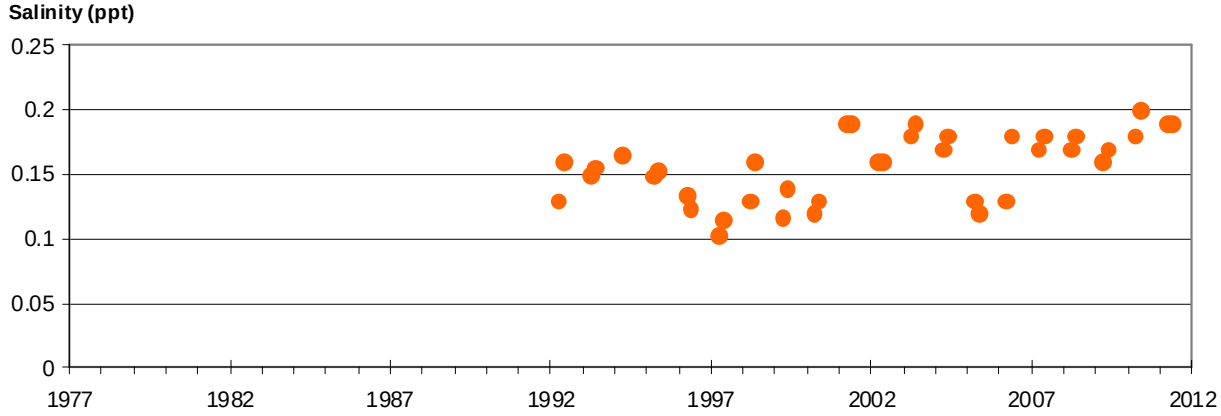
White Water is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

White Water is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

WILSON





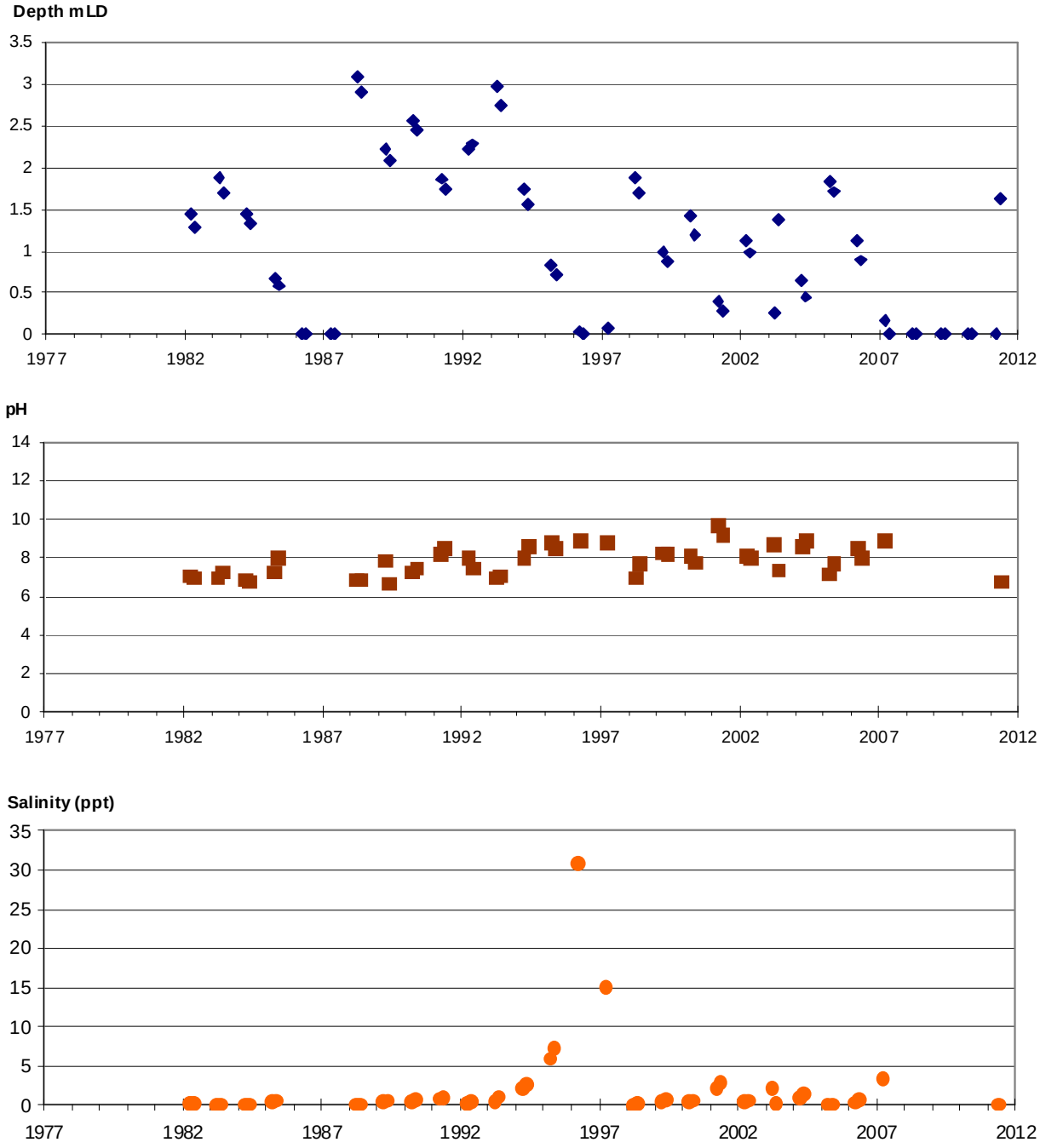


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Wilson is a component of the 'Gingilup-Jasper Wetland System', which is listed in the 'Directory of Important Wetlands in Australia'.

Wilson is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

YAALUP [IM]

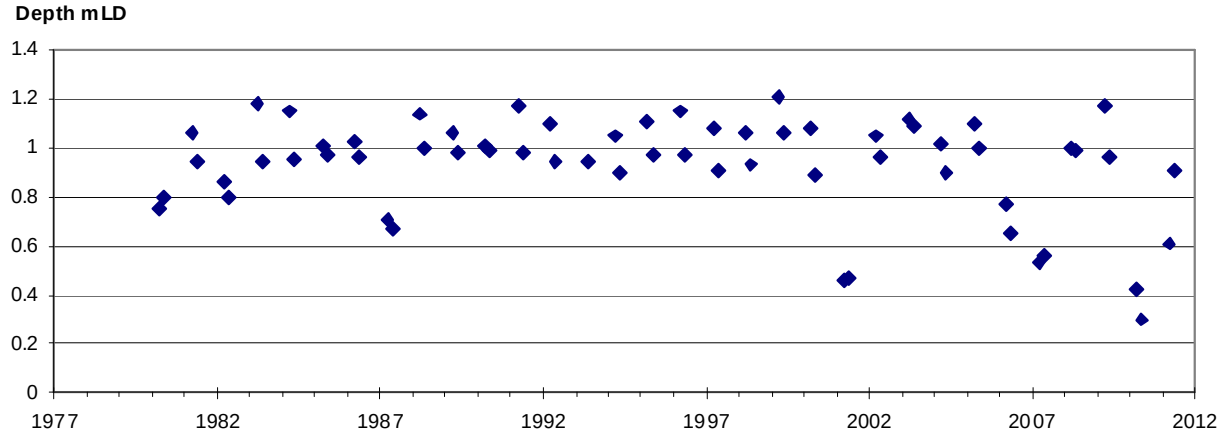


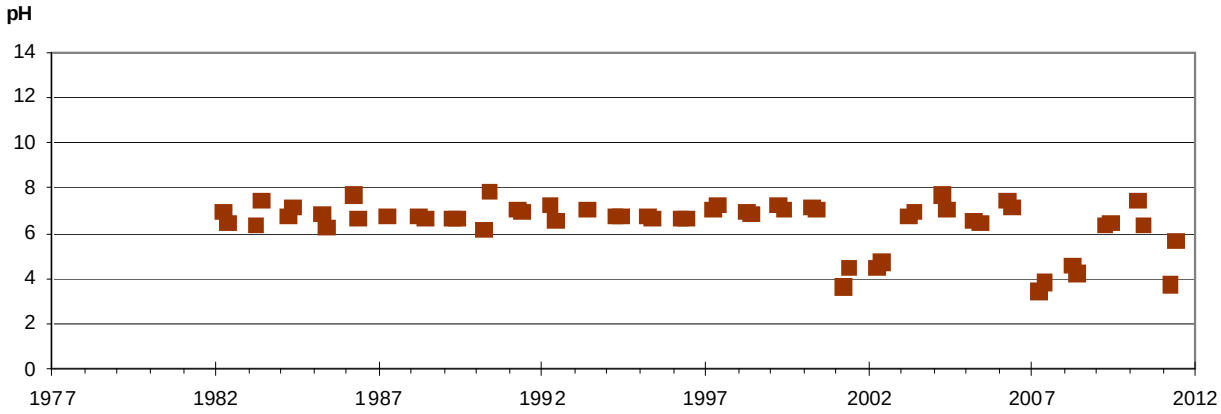
Notes:

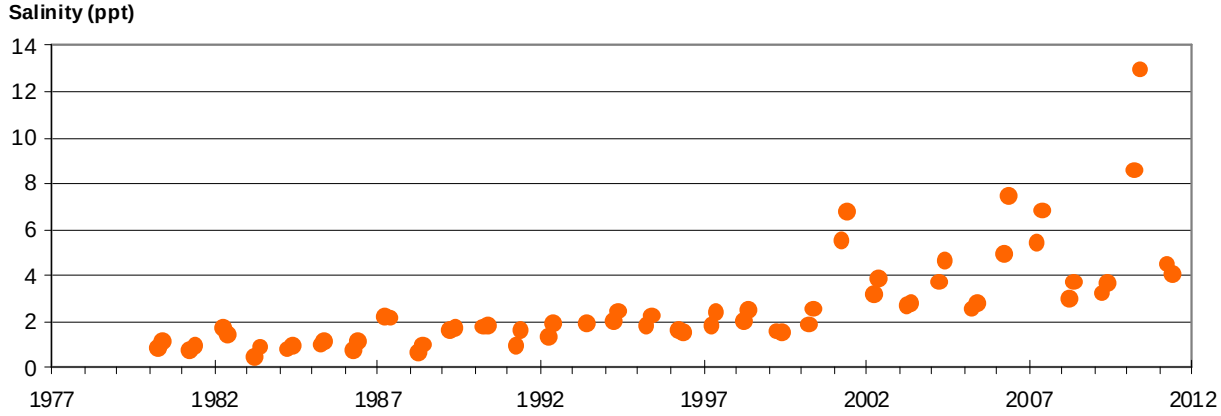
1. [IM] indicates this is one of 25 wetlands Intensively Monitored for additional biological and physico-chemical attributes.
2. Year labels are positioned at 1st July each year.
3. Data are from September and November routine monitoring periods only.

Yaalup is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

YARNUP







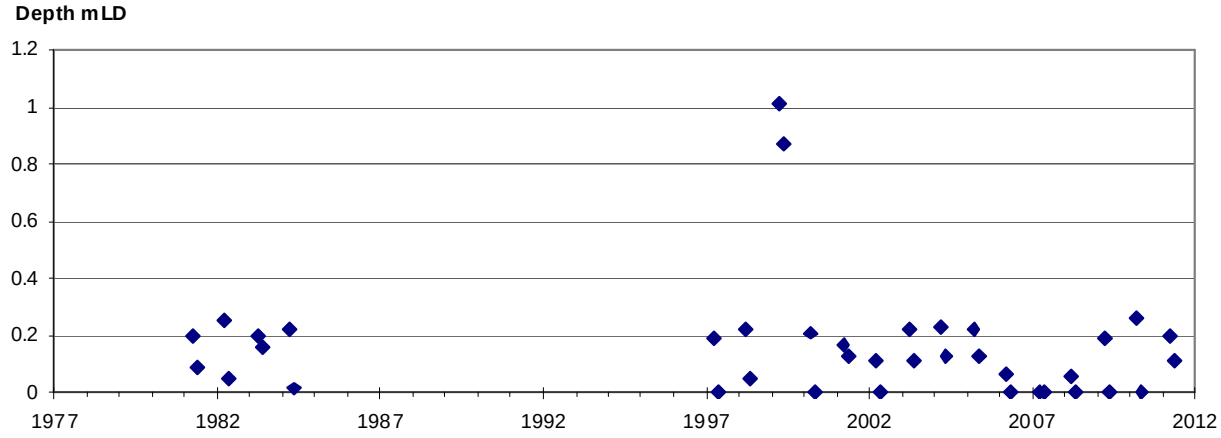
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

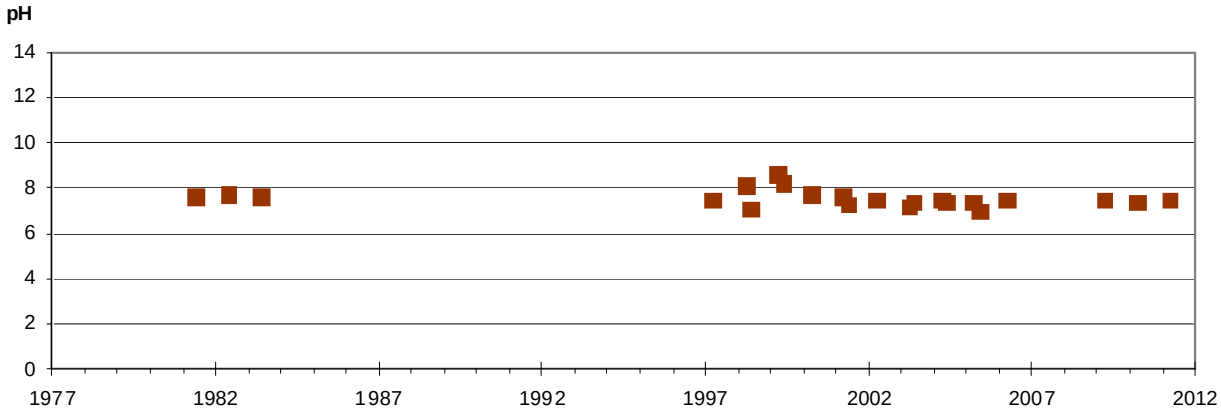
Yarnup is a component of the 'Byenup Lagoon System', which is listed in the 'Directory of Important Wetlands in Australia'.

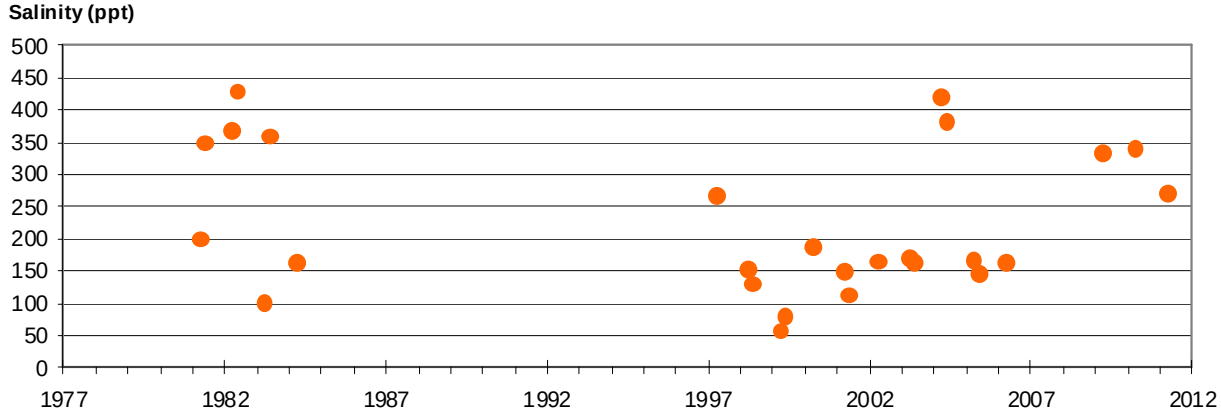
Yarnup is within the Muir-Unicup Natural Diversity Recovery Catchment.

Yarnup is in the Donnelly District (headquartered in Pemberton) of the Warren DEC Region.

YARRA YARRA



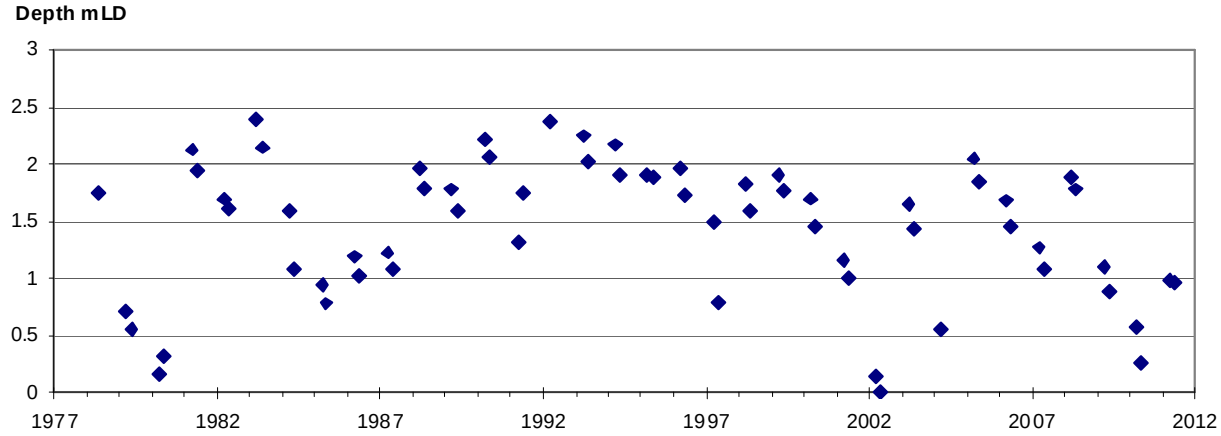


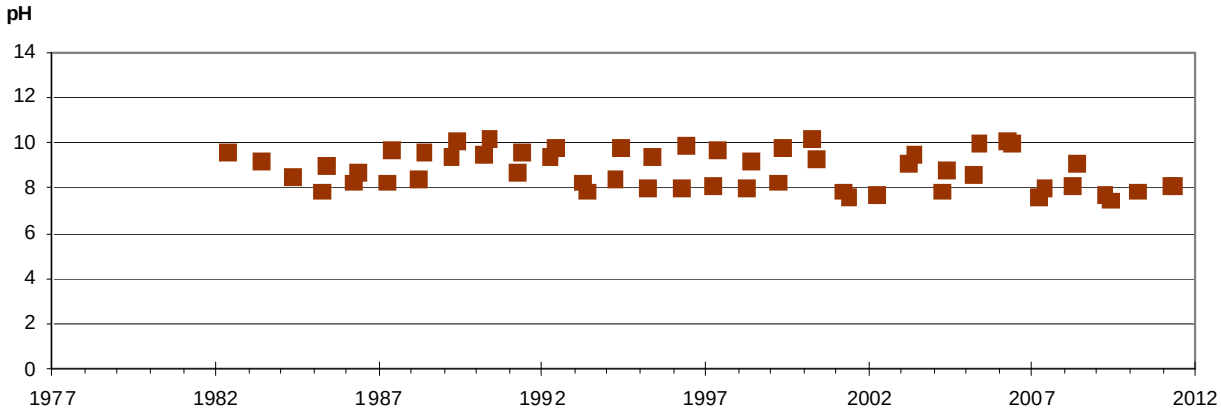


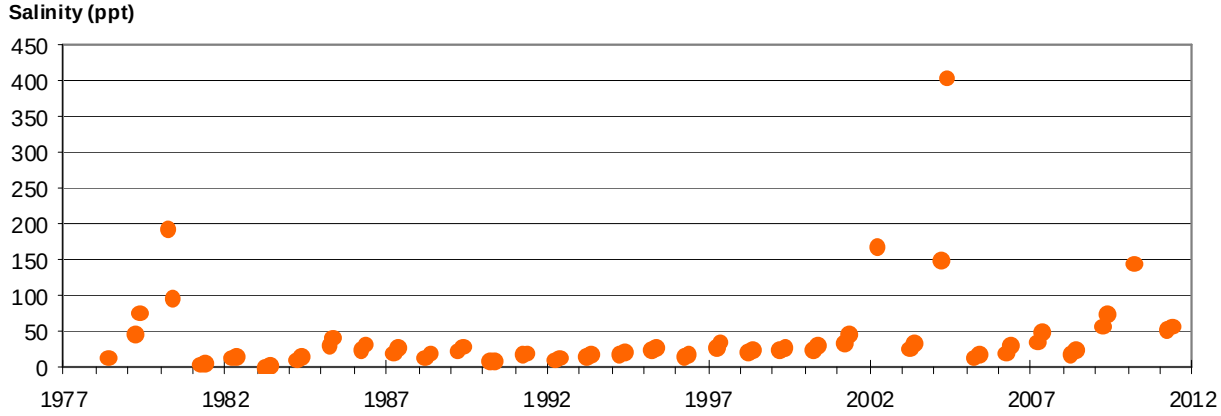
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yarra Yarra is in the Moora District (headquartered in Jurien Bay) of the Midwest DEC Region.

YEALERING





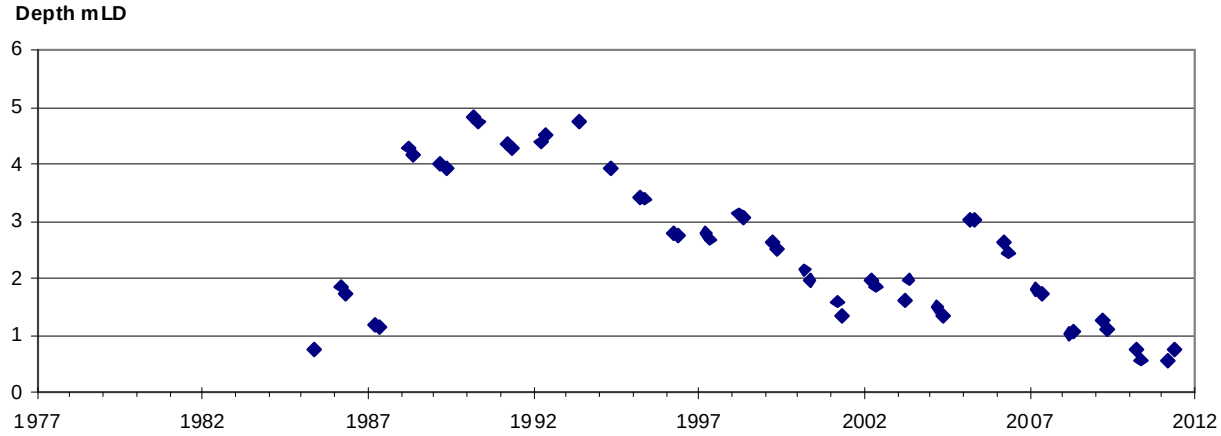


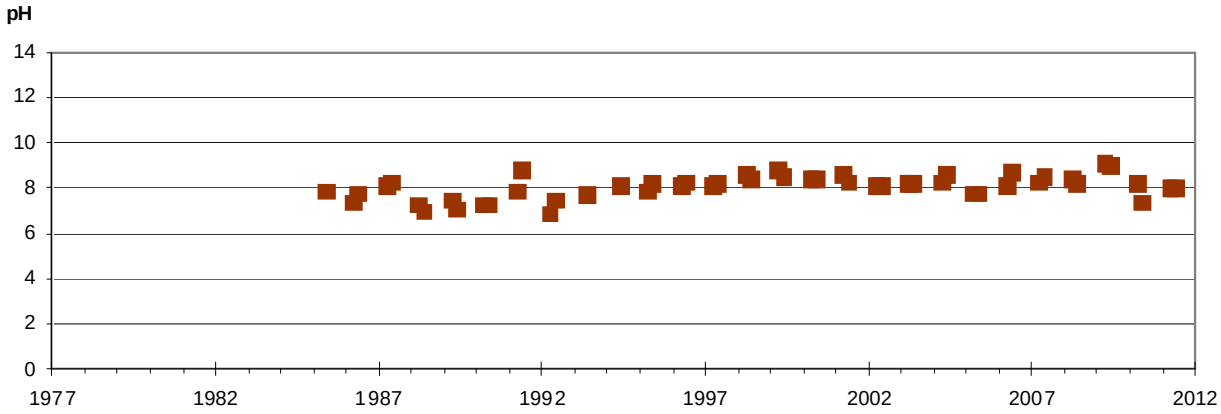
Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

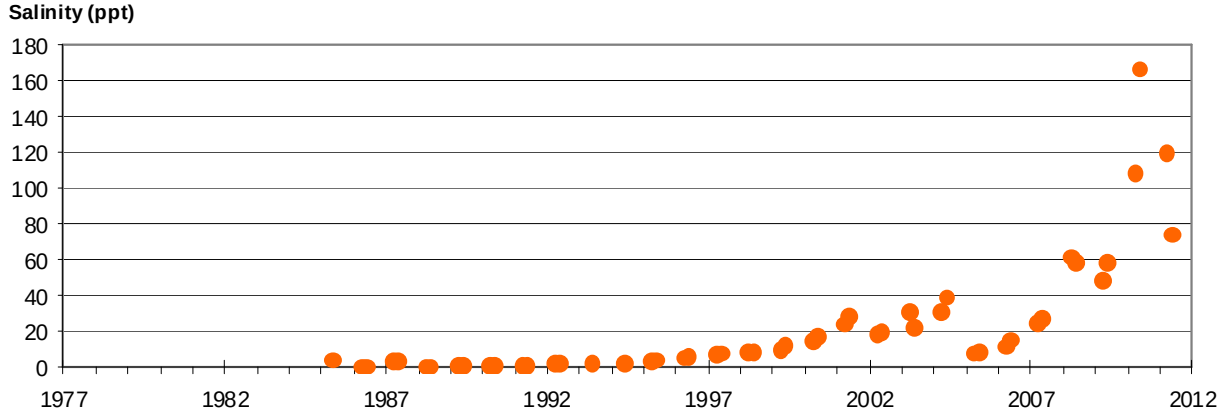
Yealering is a component of the 'Yealering Lakes System', which is listed in the 'Directory of Important Wetlands in Australia'.

Yealering is in the Great Southern District (headquartered in Narrogin) of the Wheatbelt DEC Region.

YELLILUP





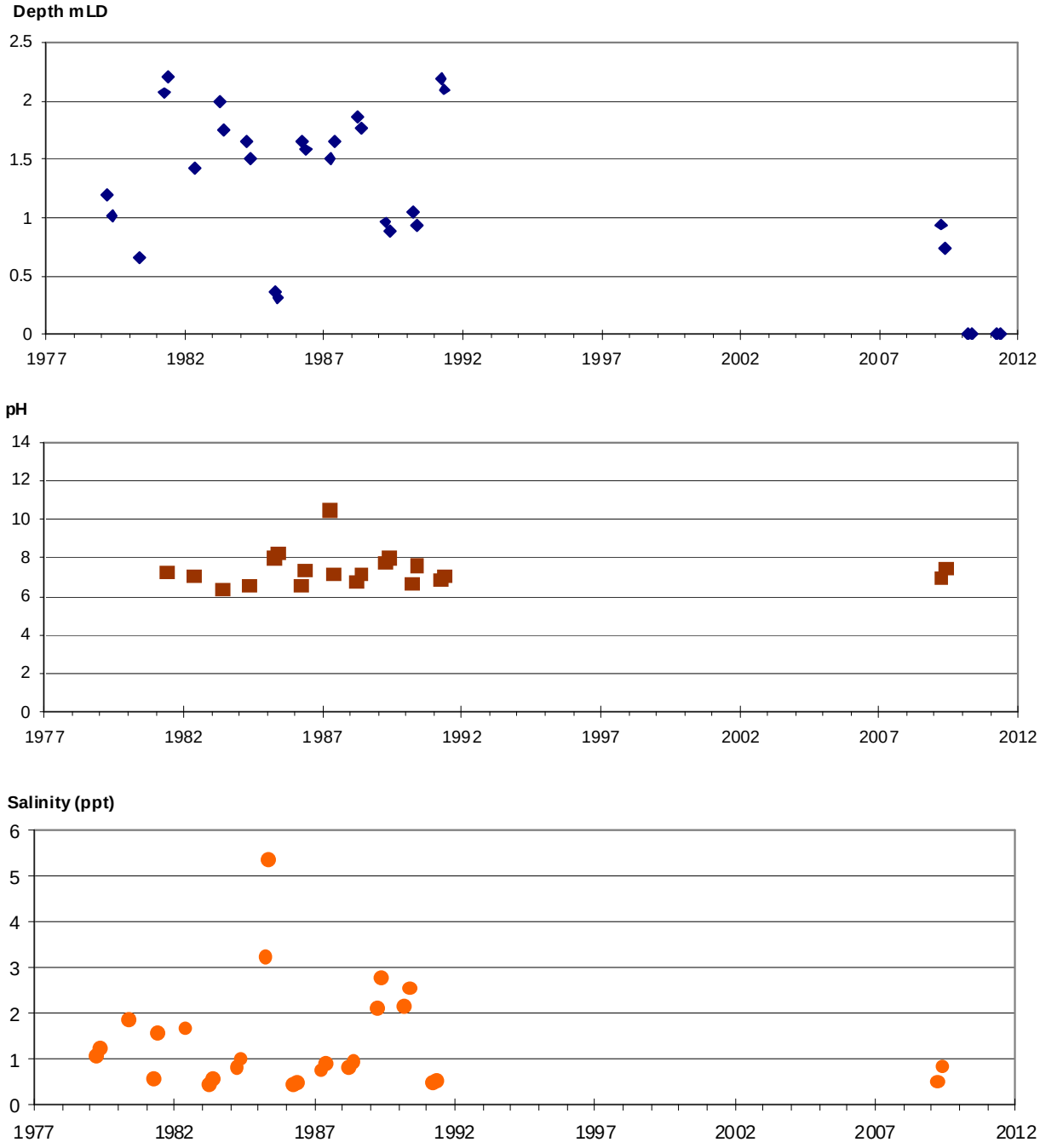


Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yellilup Lake is a component of the 'Yellilup Yate Swamp System', which is listed in the 'Directory of Important Wetlands in Australia'.

Yellilup is in the Albany District of the South Coast DEC Region

YURINE



Notes:
1. Year labels are positioned at 1st July each year.
2. Data are from September and November routine monitoring periods only.

Yurine is in the Swan Coastal District of the Swan DEC Region