

ATTACHMENT 1

LOCATION MAP

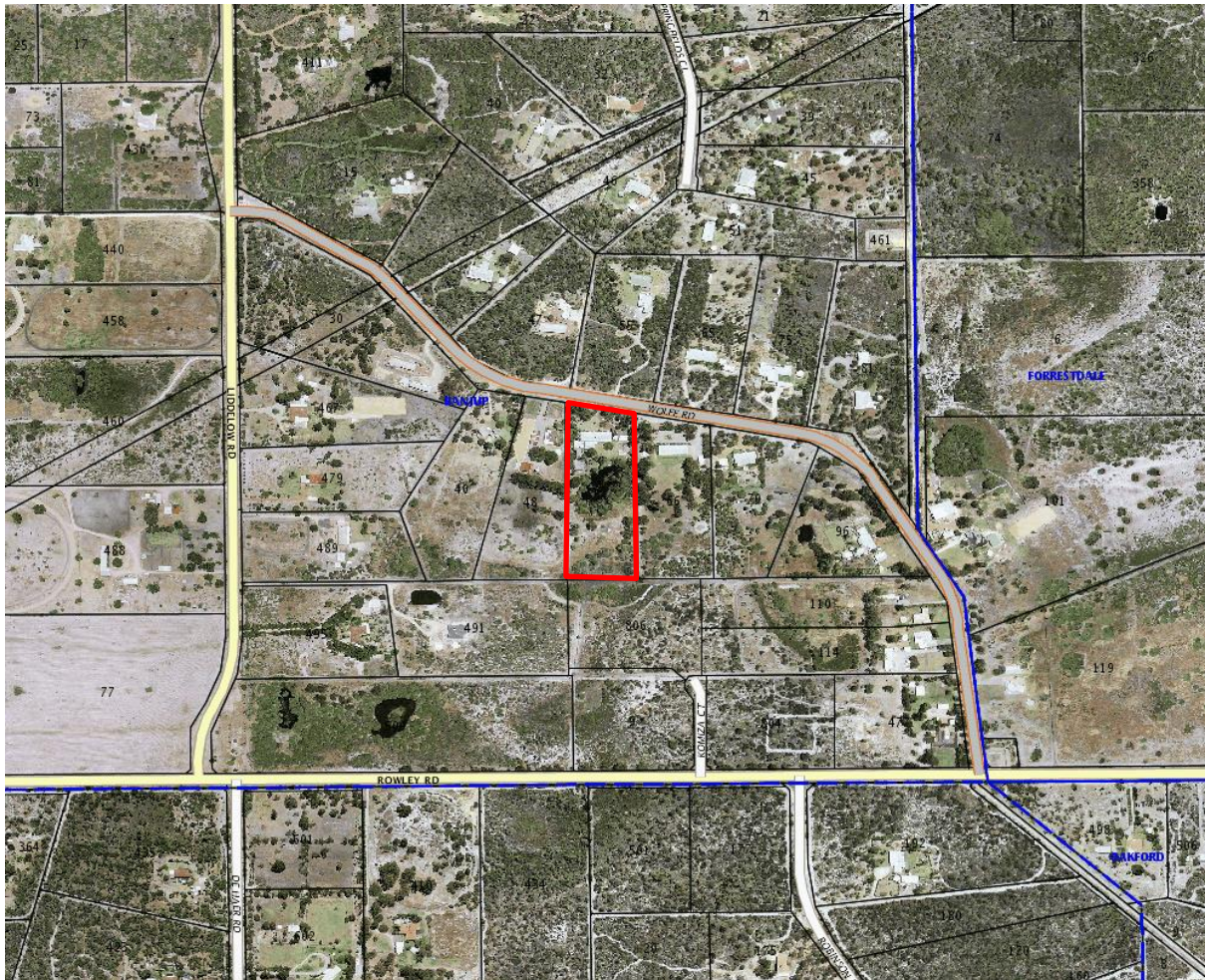


FIGURE 1: LOCATION PLAN LOT 54 WOLFE ROAD, BANJUP

ATTACHMENT 2A

**Copy of Land Assessment March 26 Report
to Peter Webb & Associates**

Mr Peter Webb
Director and Principal Planner
Peter D Webb & Associates
2/19 York Street,
Subiaco WA 6008

Dear Peter

RE: LOT 54 WOLFE ROAD, BANJUP

In response to your request of March 6 to investigate wetland conditions and values affecting Lot 54 Wolfe Road Banjup (Figure 1) in the context of matters before the State Administrative Tribunal relating to actions undertaken by the landowner (A & M Sader) to modify the wetland, I have reviewed relevant data sources and aerial photographs to report as follows;

1.0 COASTAL PLAIN WETLANDS – ORIGINAL MAPPING & CLASSIFICATION

Wetlands of the Swan Coastal Plain were mapped and classified according to their geomorphic type and management category in the mid 1980’s by the V & C Semeniuk Research Group with the results published by the then Water Authority (Hill et al 1996).

Wetlands include not only lakes with permanent open water, but also areas of seasonally, intermittently or permanently waterlogged soil. The geomorphic classification system developed for the Swan Coastal Plain wetlands is based on landform and water permanence as outlined below in Table 1.

Table 1: Geomorphic Wetland Types

Wetland Type	General description
Basin Wetlands	Lake = permanently inundated basin Sumpland = seasonally inundated basin Dampland = seasonally waterlogged basin
Flat wetlands	Floodplain = seasonally inundated flat Palusplain= seasonally waterlogged flat

To assist the protection and management of wetlands on the Swan Coastal Plain, Hill et al (1996) assigned a management category to each of the mapped wetlands according to Table 2.

Table 2: Wetland Management Categories

Management category	General description	Management Objectives
C - Conservation	Wetlands support a high level of ecological attributes and functions	Highest priority wetlands. Objective is preservation of wetland attributes and functions through various mechanisms including; <ul style="list-style-type: none"> • Reservation in parks, reserves and State owned land • Protection under Environmental Protection Policies (EPPs) • Wetland covenanting by landowners
R – Resource enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions.	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value.
M- Multiple use	Wetlands with few important ecological attributes and functions remaining.	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

1.1 The Wetland Affecting Lot 54

Figure 2 shows the relevant portion of the original mapping. Lot 54 occurs within map sheet 2033 -1 SE and is shown as containing part of a ‘**Sumpland**’ wetland with a ‘**Multiple Use**’ management category. The wetland is identified within Figure 2 as **32 Sm**.

1.1.1 The Wetland’s Geomorphic Type

As described in Table 1, wetland **32 Sm** was (in 1996) a seasonally inundated basin. Inundation refers to the situation where soils are covered with free-standing water. By contrast, wetland areas classified as a ‘Dampland’ are seasonally waterlogged. Waterlogging refers to the situation where soils are saturated with water, but where the water does not inundate the soil surface.

1.1.2 The Wetland’s Management Category

The management category of wetlands that are only seasonally inundated or seasonally waterlogged is primarily determined by the nature and condition of its associated vegetation. In such areas vegetation comprising species dependent on wetter soil conditions and being in generally very good or better condition, it is expected to result in a ‘conservation’ management category being assigned. At the other end of the spectrum, if the vegetation is in

a significantly degraded condition it is expected to result in a 'multiple use' management category.

The sumpland wetland type within Lot 54 was assigned a 'Multiple Use' management category in the original (1996) mapping. This category describes wetlands at the most degraded end of the spectrum, with the least potential for meaningful restoration, and hence the least value for conservation purposes. As described in Table 2, wetland **32 Sm** was (in 1996) *a wetland with few important ecological attributes and functions remaining*.

2.0 DEC SWAN COASTAL PLAIN GEOMORPHIC WETLANDS DATASET

The original wetland mapping contained in Hill et al (1996) has subsequently been digitised to form the base layer of the Department of Environment and Conservation's Swan Coastal Plain Geomorphic Wetlands dataset.

This dataset is not a static source of information. In recognition of the changing state of wetlands resulting from land use impacts and also possible errors associated with the broad scale of the original mapping, the DEC have established a Protocol (DEC 2007) whereby modifications to the database can be considered following the provision of site-specific supporting information.

2.1 The Wetland Affecting Lot 54

DEC's SCP geomorphic wetland database was accessed via Landgate's online Map Viewer program on March 12 of this year. The resulting mapping is shown in Figure 3 and depicts the wetland within Lot 54 (ID No 15514) as a Sumpland with a 'Resource Enhancement' management category. This 'new' management category differs from the 'Multiple Use' originally assigned and reported by Hill et al (1996) in that it represents an upgrading of its value for preservation.

It is speculated that the change in management category occurred as a result of work leading to the *Revised Draft Environmental Protection (Swan Coastal Plains Wetlands) Policy* in 2004. This draft policy set out to maintain the protection of the earlier wetlands identified under the 1992 Environmental Protection (Lakes) Policy and also add additional wetlands deemed to be of high conservation value that were not similarly protected at that time.

Figure 4 shows the relevant portion of the wetland mapping that was proposed to accompany the *Revised Environmental Protection (Swan Coastal Plains Wetlands) Policy* in 2004. It shows the extent of the original wetland 32 Sm (refer Figure 1) reduced to only a small remnant, being the clearly inundated portion within Lot 54. This draft 2004 mapping also proposed to assign a significantly higher 'conservation' management category to that remnant.

Ultimately however, in 2005, the then Minister for the Environment decided not to proceed with the *Revised Environmental Protection (Swan Coastal Plain Wetlands) Policy*. As a result, the delineation and geomorphic classification of the wetland remain unchanged (i.e. the wetland boundary and its designation as a 'sumpland' as shown in Figures 2 and 3 remain unaltered but the management category has been upgraded to Resource Enhancement).

The relevance of the changes proposed in 2004 as part of the ultimately aborted *Revised Environmental Protection (Swan Coastal Plain Wetlands) Policy* is that it shows recognition that the key environmental values associated with wetland (ID No 15514) relate to the remnant within Lot 54 which retains surface water, and its associated fringing vegetation.

3.0 CHANGES OVER TIME TO THE WETLAND AFFECTING LOT 54

Attachment A contains aerial photo images dating from 1953 to 2012 showing wetland 15514 has changed over time in relation to the extent of both surface water and the adjacent fringing vegetation. During that period the photos show it has always contained a distinct depression within the portion of Lot 54 where the subject disturbance of wetland conditions has occurred.

3.1 Changes in the Extent of Surface Water

As shown in Attachment A, the depression within Lot 54 is inundated (under water) within aerial images extending for just over fifty years from 1953 (photo 1) up until December 2004 (photo 10).

For the next six years, from December 2005 (photo 11) up until March 2011 (photo 17) the depression appears to be dry, including even during the winter / wet period of July 2008 (photo 13).

From August 2011 (photo 18) up until the most recent image of November 2012 (photo 19), the depression is again inundated (under water) including during the summer / dry period.

3.2 Changes in the Extent of Associated (Wetland) Vegetation

As shown by photos in Attachment A, for over 50 years from 1953 (photo 1) to December 2004 (photo 10) the vegetation associated with this wetland depression has primarily been its marginal or fringing vegetation (in various states of extent).

For a relatively short six year 'dry period', from December 2005 (photo 11) up until March 2011 (photo 17), the associated vegetation included species across the floor of the depression while waterlogged, rather than inundated, conditions prevailed.

In 1953 (photo 1) the inundated depression appears to support an extensive fringe of hydrophytic "water loving" vegetation. By 1965 however (photo 2) the fringing vegetation had been largely depleted, but began to show signs of some regeneration by 1995 (photo 6), and by 2000 (photo 7) was substantially re-established.

The aerial image of August 2011 (photo 18) shows depletion of the fringing vegetation, presumably the result of excavation activity designed to restore surface water.

The most recent image of November 2012 shows no significant change in the fringing vegetation since August 2011.

4.0 CONCLUSIONS

The aerial image of August 2011 (photo 18) suggests the return of inundation was the result of some excavation which either increased the exposure to the underlying shallow watertable, or enabled installation of liner to contain water being supplied from an external source. The latter has subsequently been established to have occurred.

The aerial image of November 2012 (photo 19) shows no significant change in the extent of fringing vegetation after just over a year since disturbance in August 2011 (photo 18). This, in combination with photos from 1981(photo 5) through to 2000 (photo 7) suggest that re-establishment of fringing vegetation will be slow to occur without replanting.

Wetlands support a number of ecosystem values associated with both the presence of water and the nature and extent of their associated vegetation.

The disturbance to wetland (at some time between March 2011 and August 2011), although unauthorised, has resulted in three effects as follows;

- A return of the depression to the status of being to an inundated wetland or waterbody
- A depletion of the depression's long term fringing vegetation, and
- A loss of the depression's short-term 'basin floor vegetation'.

In relation to the first effect of the disturbance, the excavation and associated lining of the waterbody, this could be viewed as beneficial as it returns the presence of surface water which has been a feature of this portion of the wetland for over 50 years since at least 1953.

In relation to the second effect of the disturbance, the partial clearing of fringing vegetation, although this is clearly detrimental it is not necessarily permanent, and was necessary to enable the return of surface water.

In relation to the third effect of the disturbance, the loss of the 'basin floor vegetation', this is not considered to be of significance because;

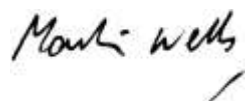
- its occurrence was of only a short term nature (during the six years from around December 2005 to around March 2001) and
- it was associated with waterlogged rather than inundated conditions and hence can be expected to occur extensively within the remaining area of wetland No 15514 (see Figure 3) occurring outside of Lot 54, and
- the portion of wetland No 15514 identified in 2004 as worthy of protection under the then proposed revision to the Swan Coastal Plain Wetlands EPP was limited to the then inundated depression within Lot 54, and included no 'basin floor vegetation'.

The net environmental impact of the unauthorised disturbance therefore comes down to consideration of whether the returned presence of surface water provides a greater ecosystem / wetland benefit compared to the detriment associated with the vegetation that has been depleted to achieve that outcome.

The (temporary) designation to this portion of wetland No 15514 in 2004 as being of conservation value suggests its primary ecosystem value is associated with the presence of surface water.

In relation to the fringing vegetation the historical (aerial photo) evidence shows that it can be expected to regenerate particularly if aided by replanting and with a renewal of the adjacent waterbody.

Yours faithfully



MARTIN WELLS
Principal Consultant
26 March 2013

Figure 1: Location Plan -Lot 54 Wolfe Road, Banjup

Figure 2: Original Wetland Mapping (Hill et al 1996)

Figure 3: DEC Wetland Database Extract

Figure 4: Wetlands forming part of Revised Draft Environmental Protection
(Swan Coastal Plain Wetlands) Policy 2004.

Attachment A: Aerial Photographs over Lot 54 (1953 – 2012)

References

Hill, A., Semeniuk, C., Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain - Volume 2A: Wetland Mapping, Classification and Evaluation, Main Report.* and *Volume 2B. Wetland Mapping, Classification and Evaluation, Wetland Atlas.* Water and Rivers Commission and the Department of Environmental Protection, Perth.

EPA (2004) *Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004.* Environmental Protection Authority, Perth. November 2004 (and associated on-line Map Sheet 2033).

Department of Environment and Conservation (2007) *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset.* Department of Environment and Conservation, Perth. (accessible via the web on www.dec.wa.gov.au/wetlands/wetlandsdata)

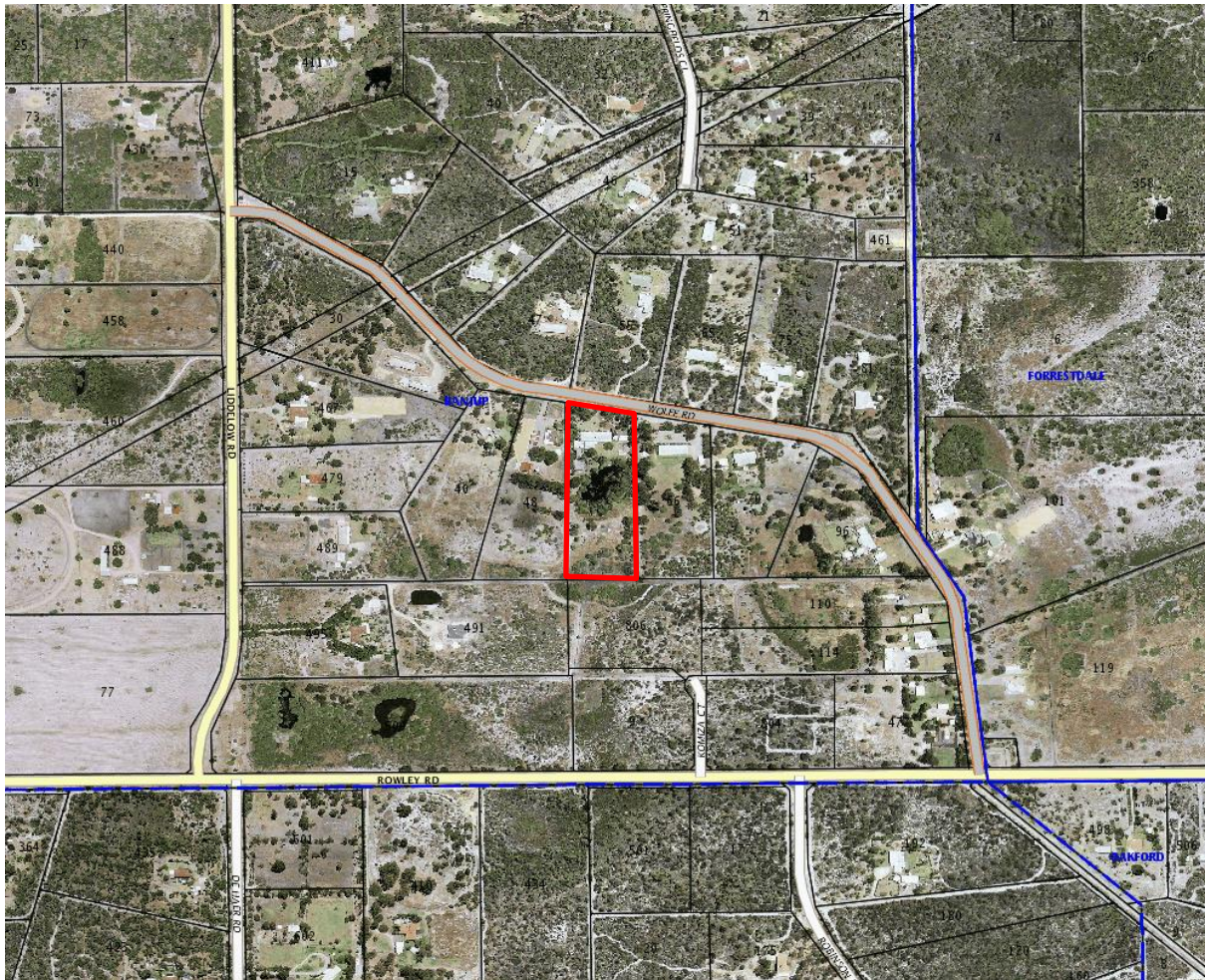


FIGURE 1: LOCATION PLAN LOT 54 WOLFE ROAD, BANJUP

WETLANDS OF MAP SHEET 2033 I SE (Fremantle SE)

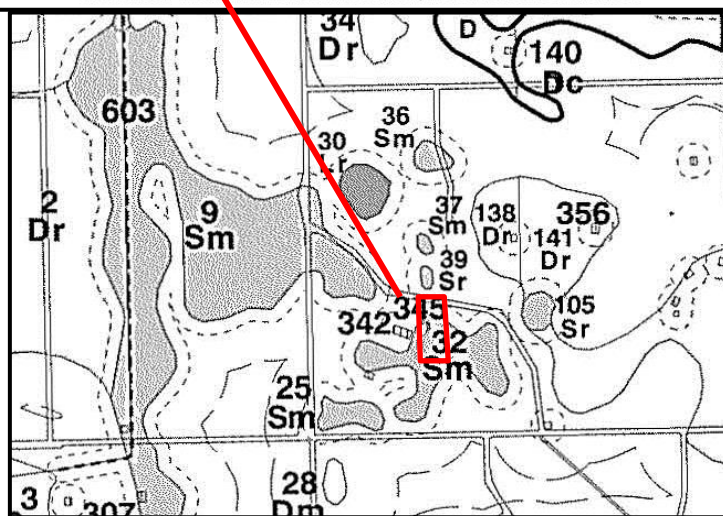
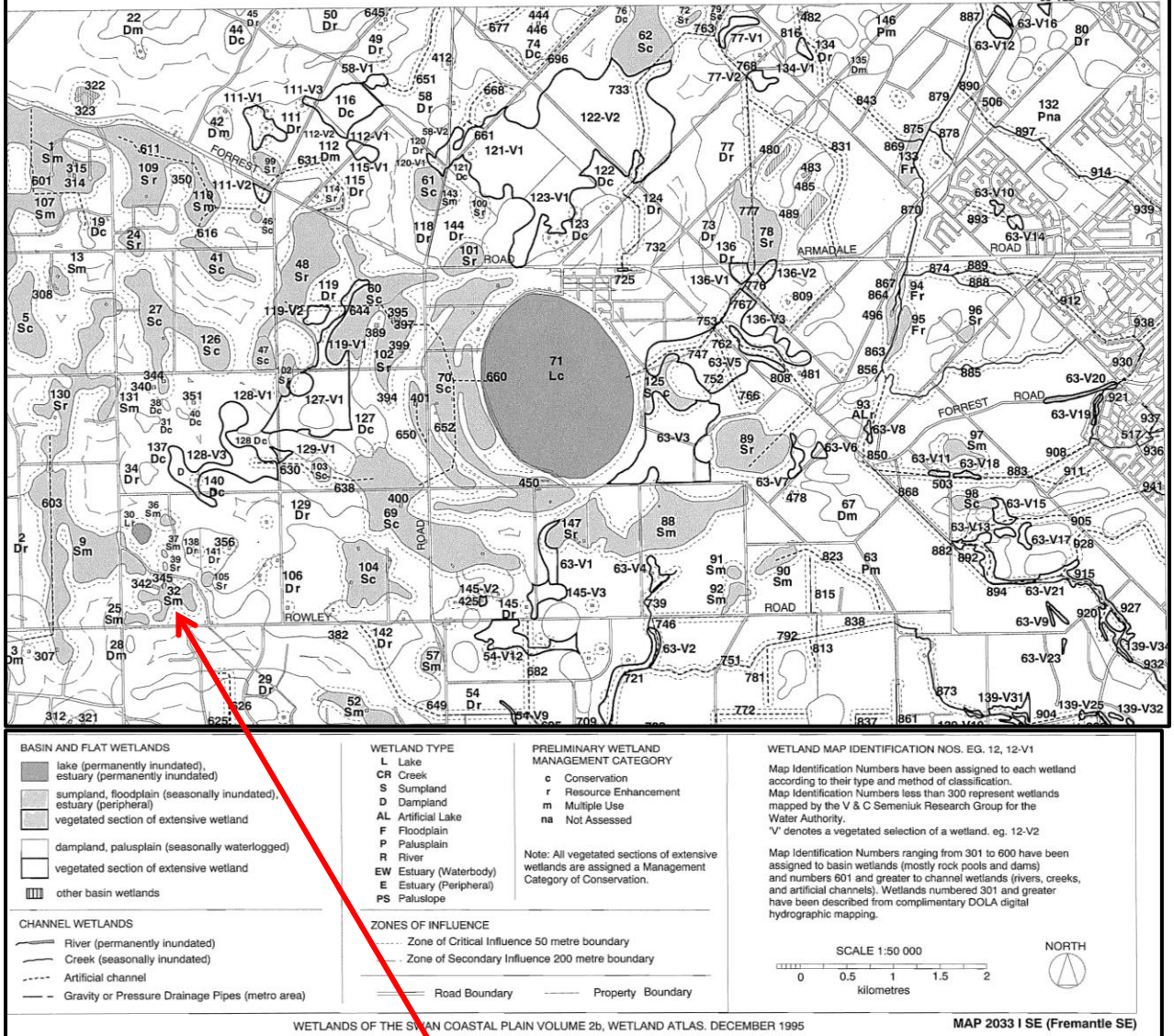


FIGURE 2: ORIGINAL WETLAND MAPPING (HILL ET AL 1996)

(Lot 54 is part of Wetland 32 Sm –a ‘Multiple Use ‘ category Sumpland)

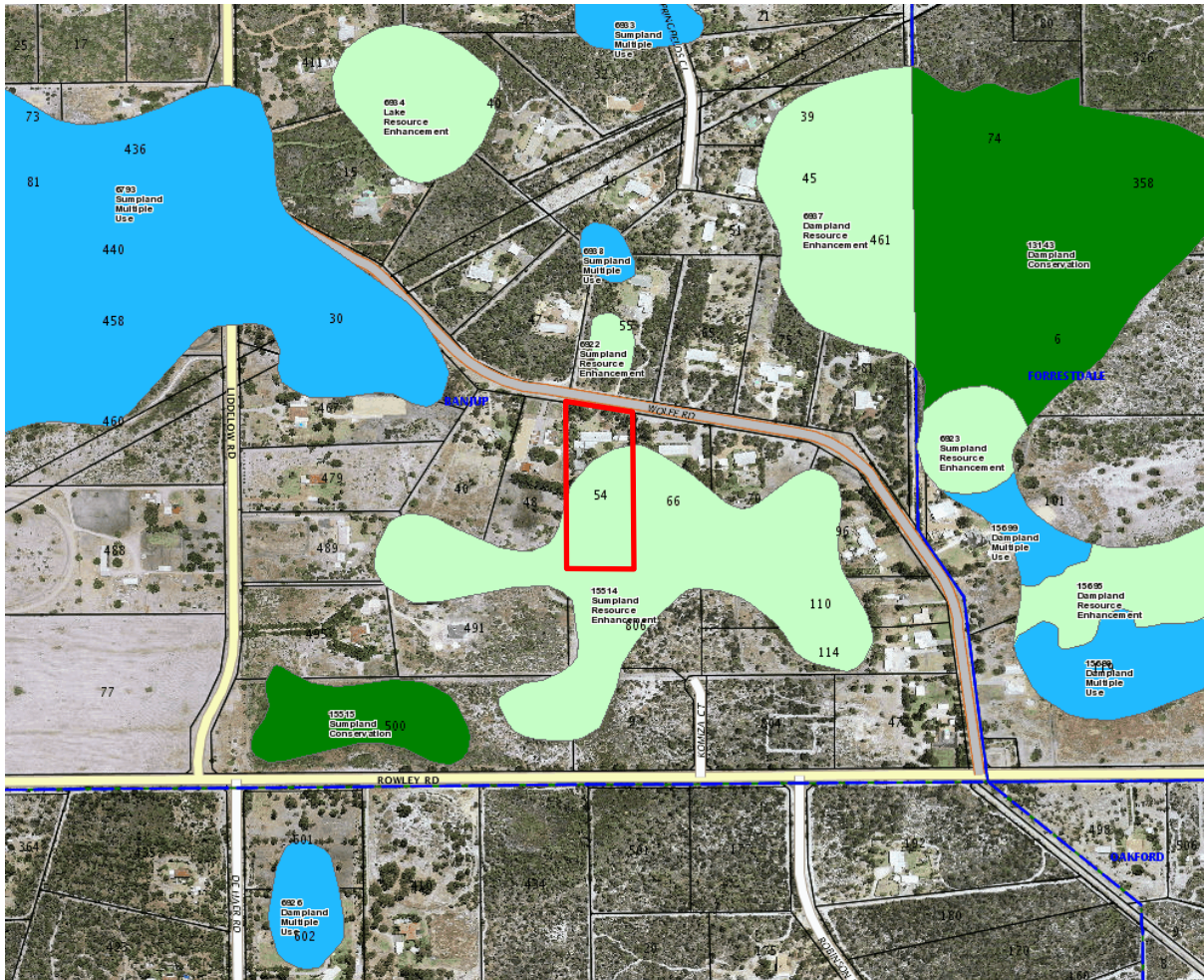


FIGURE 3: DEC WETLAND DATABASE EXTRACT (March 12 2013)

(Lot 54 is part of Wetland ID 15514 –a ‘Resource Enhancement’ category Sumpland)

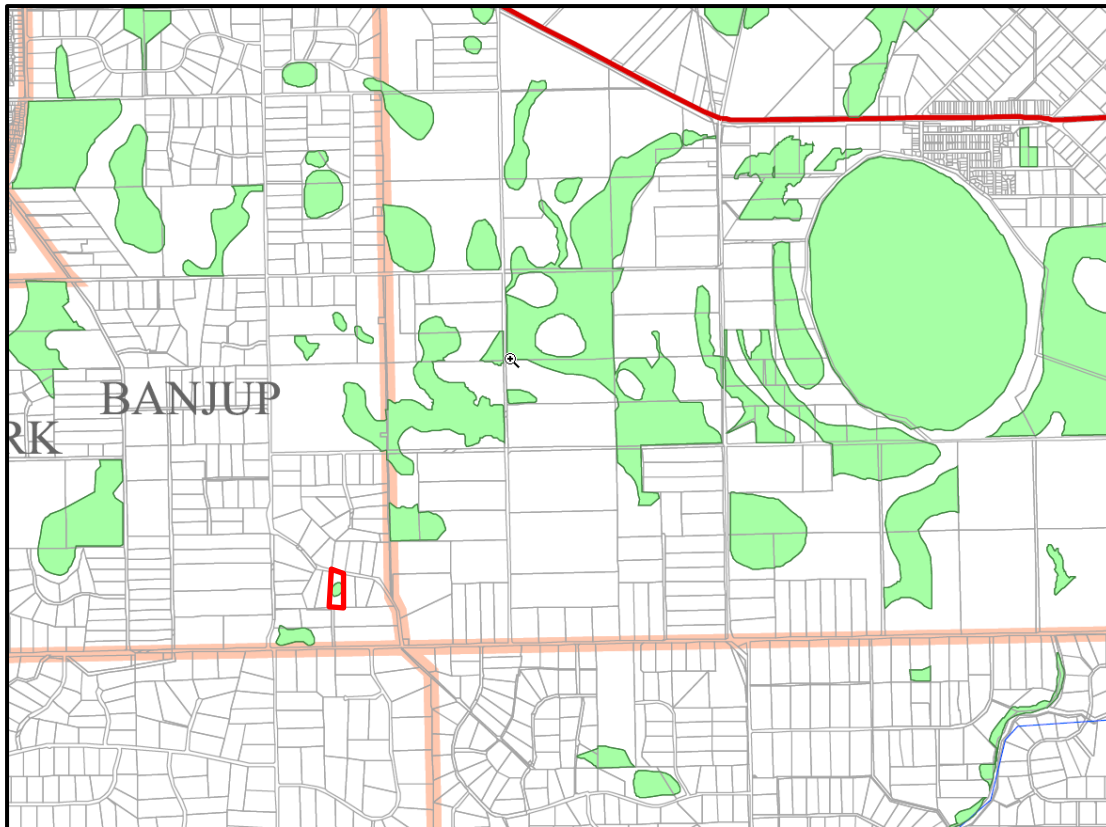


FIGURE 4: WETLANDS FORMING PART OF REVISED DRAFT ENVIRONMENTAL PROTECTION (SWAN COASTAL PLAIN WETLANDS) POLICY 2004.

(Portion of Map Sheet 2033 showing remnant portion of Wetland ID 15514 within Lot 54 as a proposed 'Conservation' category wetland).

ATTACHMENT A

Aerial Photographs over Lot 54 (1953 – 2012)



Photo 1: 1953 (INUNDATED – Extensive Fringing Vegetation)



Photo 2: 1965 (INUNDATED – Depleted Fringing Vegetation)



Photo 3: 1974



Photo 4: 1977



Photo 5: 1981



Photo 6: 1995 (INUNDATED – Recovering Fringing Vegetation)



Photo 7: 2000 (INUNDATED – Re-established Fringing Veg)



Photo 8: April 2002



Photo 9: December 2003



Photo 10: December 2004 (Inundated, and good fringing vegetation)



Photo 11: December 2005 (START LOSS OF INUNDATED WATERBODY)



Photo 12: December 2006



Photo 13: July 2008

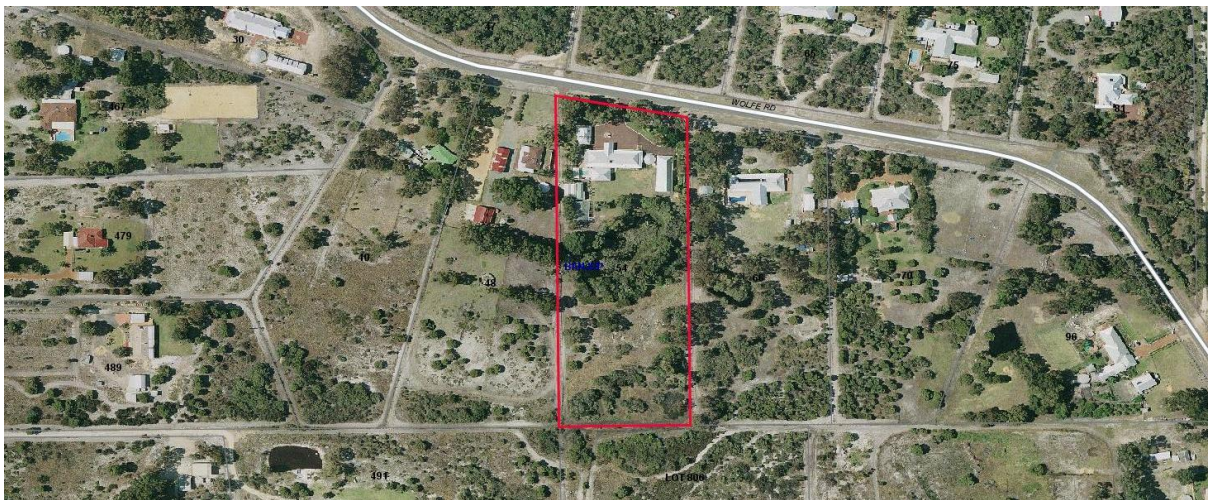


Photo 14: December 2008

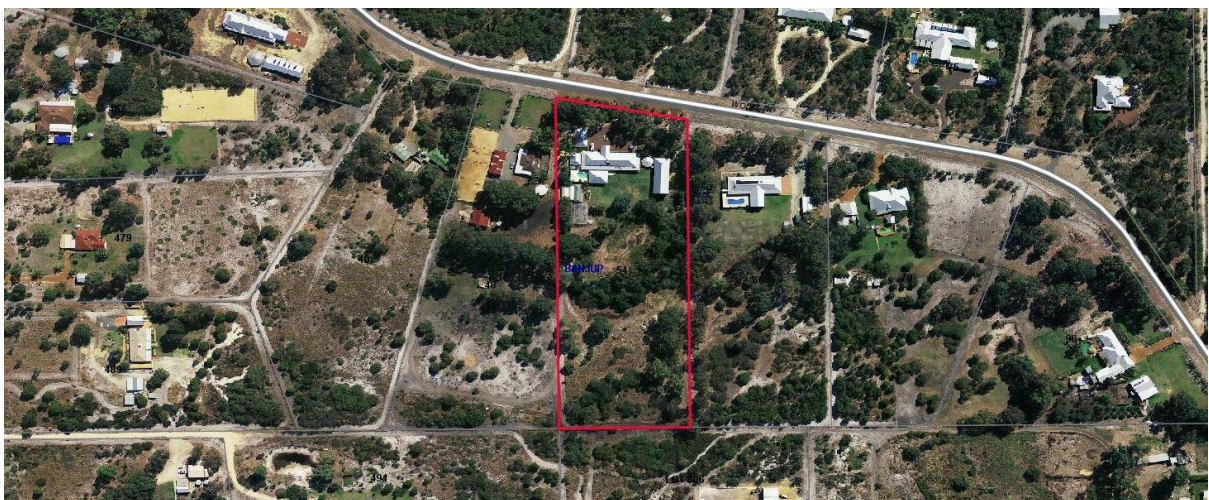


Photo 15: May 2010



Photo 16: November 2010

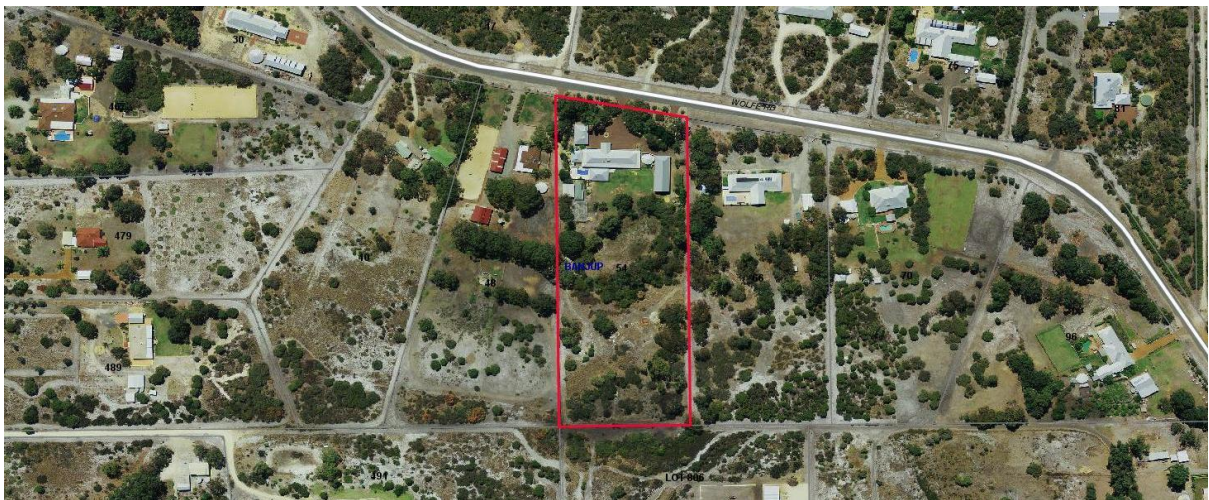


Photo 17: March 2011



Photo 18: August 2011 (RETURN TO INUNDATION but depleted Fringing Vegetation)



Photo 19: November 2012 (CURRENT CONDITION)

ATTACHMENT 2B

Copy of Land Assessment May 2013

Supplementary Report

**SUPPLEMENTARY REPORT ADDRESSING
LOT 54 WOLFE ROAD, BANJUP**

in relation to matters before the State Administrative Tribunal
(SAT DR 12 and 69 of 2013, Sader and City of Cockburn)

prepared for

Peter Webb and Associates

on behalf of

Antoine and Malaky Sader

by



LAND ASSESSMENT PTY LTD
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Tel: (08) 9388 2427
Company Report No. 1304/2

May 2013

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- B. Soil and Water Analysis Results
- C. Hydrograph Data From Nearby Department of Water Bore
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- F. Suggested 'Dampland' Revegetation Area
- G. Appropriate Plants for Revegetation

PREFACE

This report relates to matters before the State Administrative Tribunal arising from disturbance created to a wetland area as a result of the formation of a constructed lake within Lot 54 Wolfe Road, Banjup within the City of Cockburn.

The report provides a supplement to the Land Assessment March 26 letter to Mr Peter Webb, Planning Consultant, and has been requested as a result of the on-site mediation meeting of April 16 with City of Cockburn staff and State Administrative Tribunal Sessional Member Mr Peter Curry.

In between preparation of the March 26 letter and this Supplementary Report, it has been pointed out by the City of Cockburn that the lower-lying portion of Resource Enhancement Wetland 15514 within Lot 54 is identified as a protected wetland under the 1992 Environmental Protection (Swan Coastal Plain Lakes) Policy (refer **Attachment A**).

The purpose of this policy is to protect the environmental values of lakes on the Swan Coastal Plain. The EPP was gazetted in 1992, together with Miscellaneous Plan No. 1815 which depicted lakes protected under the policy. The EPP made the filling, draining, excavating, polluting and clearing of these lakes an offence unless authorised by the EPA. The 'lakes' referred to in this policy are those shown on Department of Land Administration Miscellaneous Plan No. 1815 (available for inspection at EPA head office) that were in most cases selected for inclusion on the basis that they consisted of areas of standing water of 1,000 square metres or more as at 1 December 1991.

Notwithstanding the fact that the landholder's disturbance to the wetland depression within Lot 54 was unauthorised, the aerial photography history included with the March 26 letter shows this area had, at the time of disturbance, been devoid of any standing water for approximately six years and hence no longer held environmental values associated with being a 'lake'.

Furthermore, it is understood that the landholder's actions were made in ignorance of the fact that the lower-lying portion of his property, although not exhibiting any sign of standing water, was shown on Department of Land Administration Miscellaneous Plan No. 1815 as a 'lake' and hence is protected under the 1992 EPP.

1.0 MANAGEMENT OF ENVIRONMENTAL RISKS

A number of environmental risk factors associated with the works were discussed at the on-site mediation meeting (April 16) and management of these is addressed in this section.

The 'works' that have already occurred within the lower-lying portion of Lot 54 include some clearing of vegetation, shallow excavation, installation of a plastic liner, and the filling of the resulting depression with water sourced from a mixture of groundwater (adjacent bore) and roof-top runoff (from a nearby large workshop / shed).

Additional proposed works include revegetation of the lake margins although they are currently in abeyance pending resolution of the matters before the State Administrative Tribunal (SAT).

The landowner's purpose behind these works is to create an aesthetically pleasing landscape feature within this 'rural-living' zoned property. The works have created a 'constructed lake' and this has not been designed as, or intended to be, an 'artificial wetland' to mimic the character of a natural wetland.

Constructed lakes are defined as constructed, permanently inundated basins of open water, formed by simple dam walls or by excavation below ground level (DoW 2007). Artificial wetlands on the other hand, are vegetated detention areas that are either permanent or ephemeral and are specifically designed and built to remove pollutants from drainage runoff, or for their ecological functions (DoW 2007).

Four specific environmental risk factors relating to these works were identified during the mediation meeting. They relate to acid sulfate soils, water quality, water quantity and nuisance insects.

1.1 Potential Disturbance of Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments that are either acidic or have the potential to become acidic when exposed to air. These soils are commonly found in low-lying, water logged environments predominantly in coastal or estuarine areas including groundwater dependent wetlands. In this context, ASS (actual and potential ASS) have the capacity to generate acidity due to the presence of iron sulfides (mainly pyrite) found in permanently waterlogged, frequently anoxic and submerged soil layers (Singh et al 2012).

In an anoxic state, these materials remain benign, and do not pose a significant risk to human health or the environment. However, disturbing ASS, exposing them to

atmospheric oxygen, can cause acidification in wetlands. Land developmental projects involving dewatering, dredging or excavation therefore have the potential to expose ASS to oxidation locally.

ASS risk mapping sourced from Landgate's online 'WA Atlas' shows the subject portion of Lot 54 as being within the category of 'high to moderate risk of ASS occurrence within 3m from the surface elevation'.

Notwithstanding this, the potential for the works to have caused disturbance to any acid sulfate soil material is considered to be very low on the basis of the following;

- Depth of excavation for the constructed lake was less than 0.5 m below the pre-existing land surface (previous basin floor).
- Visual examination of excavated soil material around the edge of the lake on April 16 showed only grey siliceous sand and minor humic pan material which is to be expected within lower-lying portions of the Bassendean soil-landscape system. The weakly coherent humic pan material is not comparable with the black, organic rich ooze known as MBO (monosulfidic black ooze) or other sulfidic material such as jarosite, which are indicative of ASS conditions.
- The excavated soil material now located around the perimeter of the lake was sampled on April 16 and tested for pH and salinity (**Attachment B**). The results show a neutral to only slightly acid pH within a non-saline soil. Had ASS materials been exposed during excavation the excavated soil material would have been expected to be more acidic.
- The lake water is a mix of groundwater (extracted via the nearby bore) and from the roof of the nearby workshop / shed. Analysis of this water (sampled on April 16 with results in **Attachment B**) showed an alkaline pH reading and non-saline water. Had ASS materials been exposed during excavation the water within the lake, being partly sourced from groundwater at this time of year, would have been expected to be more acidic.
- Depth to groundwater on April 16 was 5.95 m below the natural land surface as measured within the bore adjacent to the north eastern end of the constructed lake. Given a likely seasonal fluctuation in the watertable level of around 2m* this suggests the watertable and associated waterlogged, anoxic soil conditions would not have been intercepted.

* Based on interpretation of hydrograph from nearby Department of Water Bore (JE4c – see **Attachment C**).

1.2 Maintaining Water Quality

Within the lake

The risk of eutrophication (nutrient enrichment with associated algal or aquatic weed blooms) is proposed to be managed by the landowner through;

- the on-going use of the following equipment professionally supplied and installed by 'Clearpond' a business that has been in operation since 1992 supplying waterfeatures and addressing lake management needs
 - three continuously operating 90 cm diameter aerators (sub-air system 12000 aeration) each having its own pump;
 - an occasional use waterfall with its own 30,000 L / hr capacity pump;
 - an occasional use fountain (to help circulate and aerate the water) powered by a separate pump with a 194,000 L / hr. capacity; and
 - an Oase Skimmer box for removal of leaves and other pollutants from the lake surface.
- preventing entry of potentially fertiliser enriched runoff from the nearby lawn area (a perimeter bund is suggested);
- no feeding of waterbirds which might otherwise lead to their congregation in large numbers with increased nutrient loading from uneaten food and faeces;
- maximising the use of 'clean' roof runoff as a water source whenever available as an alternative to using groundwater (of currently unknown nutrient status);
- maintenance of relatively cool water temperature with lake depth now at about 1 m as a result of the pre-existing topography and the excavation of about 0.5 m during construction.

Beyond the lake

The lake is currently designed with no formal spillway or other outlet for water. As such it is not directly connected to the remaining 'natural' portion of the wetland (Resource Enhancement Wetland 15514 within DEC database – see Figure 3 attached to the March 26 letter).

The constructed lake has a plastic liner and hence the underlying groundwater will be protected from any adverse changes to lake water quality should they occur.

In an unforeseen significant rainfall event resulting in lake over-flow, site topography dictates that overflow would occur on the southern side and into the adjacent portion of the sumpland (Wetland 15514). As a result of 'within lake' measures outlined above, nutrient levels within any such overflow should be significantly less than if land was utilised for livestock grazing (as occurring elsewhere within the sumpland).

1.3 Maintaining Water Quantity

The constructed lake has not been designed as part of a stormwater management system however it is fed, in part, by runoff from the approximately 216 m² roof of the nearby workshop / shed which would otherwise be directed to a soak-well.

The constructed lake is approximately 1500 m² in area and will be subject to water loss through evaporation. It has a plastic liner preventing water loss through leakage to groundwater and there is no designed spillway or other water outlet from the lake.

Maintaining the quantity of water within the lake will therefore occur through the landowner manually controlling the inflow (pumping) of water from the groundwater bore (see photo in **Attachment D**) and controlling the extent to which it is supplemented with roof runoff.

1.4 Potential for Nuisance Insects

Midges can detract from outdoor activities for residents and neighbours, and nutrient enrichment within the constructed lake could produce a flush of midges responding to any stagnant water and algal growth.

The risk of midge problems is being managed through;

- mechanical aeration of the lined waterbody*
- preventing algal growth associated with nutrients entering the lake (Sect 2.1).

* In a literature review of constructed lakes in the Perth Metropolitan and South West Region, ENV Australia (2008) report that there were fewer mosquito and midge problems in lined water bodies where aeration features are installed.

The Midge Research Group of Western Australia (2007) advises that midges and mosquitoes are least likely to be a problem in water bodies that have emergent vegetation in small stands parallel to predominant wind direction.

Should the existing measures listed above for the constructed lake prove insufficient, it is suggested that some emergent vegetation be established as outlined by the Midge Research Group. In the worst case scenario of a significant midge problem the landowner has the ability to manipulate water levels so that the water body dries out in summer to reduce the insect productivity of the water body.

2.0 DEFICITS CAUSED TO THE WETLAND ECOSYSTEM

In common with most of the remaining portions of Resource Enhancement Wetland 15514 the aerial history attached to this consultant's March 26 letter shows that between 2005 and 2011 the depression within Lot 54 had reverted to, at best, a seasonally waterlogged 'dampland' rather than being a seasonally inundated 'sumpland'. As a result, and in combination with land use pressures, it can be expected that some degradation to the ecosystem of Wetland 15514 may already have occurred and reduced its habitat value.

Anecdotal evidence from the landowner suggests that just prior to the wetland disturbance associated with construction of the artificial lake, a number of the trees fringing the depression were dying or in poor condition and the floor of the depression contained only scattered low shrubs and weeds. In the absence of site – specific 'on the ground' data on the nature and composition of this vegetation prior to the disturbance it is difficult to quantify the impact to the wetland ecosystem beyond just a measure of the affected area. This is estimated to be approximately 1800 m² consisting of about 1500 m² of waterbody and 300 m² of adjacent terrain.

Based on Department of Agriculture land resource mapping over the Jandakot groundwater scheme area (Wells et al 1986) it is likely that the vegetation at the time of disturbance would have included tree species such as *Melaleuca preissiana*, *Melaleuca raphiophylla*, *Banksia littoralis* and *Eucalyptus rudis* along with various sedgeland, herbland or shrubland species. It is considered unlikely that the vegetation lost from within the approx. 1800 m² portion of the 10.5 ha Resource Enhancement Wetland 15514 was of particular conservation significance and is not adequately represented in less disturbed areas elsewhere on the Swan Coastal Plain.

3.0 BENEFITS OF THE CONSTRUCTED LAKE

Notwithstanding the fact that the landowner's disturbance to the wetland depression within Lot 54 was unauthorised, its designation as an EPP lake underscores the point made in this consultant's March 26 letter that the key environmental values associated with this portion wetland (ID No 15514) related to the presence of surface water, and not just its associated fringing vegetation.

The aerial photo history attached to this consultant's March 26 letter shows seasonal inundation had been a feature of this portion of wetland No 15514 for over 50 years, since at least 1953. The return of the depression to the status of being an open waterbody provides not only aesthetic and passive recreational use value to the landowner, but also environmental benefits such as a drought refuge and possible habitat for wildlife. The mechanical aeration of this constructed lake also provides a possible benefit to that wildlife in terms of improved water quality compared with that in the natural (seasonally inundated) wetland occurring prior to 2005.

Predicted regional implications of climate change include an increase in mean daily temperatures and reduced rainfall (particularly winter rainfall) in southwest Australia over the coming decades (CSIRO 2007). In a study of Bibra Lake, Strategen (2009) reported that an increasingly drier climate has resulted in a progressive decline in groundwater levels over the Jandakot Mound. Ongoing reduction in the water level of that lake threatens its ecological values, including fringing vegetation health and habitat value for water birds. These climatic factors and associated impacts are also relevant to the complete drying out of the wetland area within Lot 54.

The return of an area of surface water, albeit within a constructed lake, should therefore be of environmental benefit to wildlife, particularly birds. It can also be of benefit in providing a source of water to assist revegetation within Lot 54.

4.0 REVEGETATION PLAN

As the landowner is now aware of the wetland status as well as the environmental repercussions of its unauthorised disturbance, there is a willingness to significantly change the intended plan for landscape plantings around the lake and to undertake revegetation as necessary to reinstate or compensate for any deficits caused to the wetland ecosystem.

In its letter of 30 November 2012 to the landowner (**Attachment E**) the City of Cockburn has specified its requirement for a revegetation plan and has listed a number of matters to be considered. These matters relate to plant establishment and maintenance, control of weeds and rabbits, success criteria, and reporting requirements.

This report, in providing a supplement to our March 26 letter, is not intended to satisfy the requirement for a management plan. The preparation and implementation of such a plan should be undertaken by persons suitably qualified in revegetation, however the following comments relating to the scope and location of this work can be provided here;

- Given the 'dampland' status of the affected area at the time of disturbance, and for some six years previously, it would be inappropriate to attempt to re-establish a 'sumpland' (seasonally inundated) wetland environment.
- Given the likelihood of continuing low watertable levels beneath the site, and the 'benefits' of the now constructed lake in terms of aesthetic and environmental values, there would seem to be nothing to be gained by its 'removal' from the site.
- Apart from possibly improving aesthetic values, establishment of vegetation near the edges of the waterbody is likely to be of limited environmental benefit. This is because, unlike the situation where an artificial wetland is being used as part of a treatment train process to improve stormwater quality, the constructed lake within Lot 54 is essentially a closed system, a large pond designed as a landscaping feature. This waterbody is supplied by a mix of groundwater and clean roof runoff, any runoff from the adjacent area of lawn is to be diverted, and there is to be no 'downstream' output or release into natural waterways.
- It would be inappropriate to 'retrofit' the constructed lake in an attempt to mimic the functions of the natural wetland which existed prior to 2005 and its subsequent drying out to form a dampland area.

- In light of the above it is suggested that environmental repair measures would be better directed towards compensatory revegetation within the adjacent rear portion Lot 54 which is also part of Resource Enhancement Wetland 15514 (refer **Attachment F**). In this location a dampland vegetation community could be re-established over an equivalent area to the 1800 m² which has been disturbed.
- **Attachment G** contains a list of appropriate native plants for revegetation as suggested by the City of Cockburn. This is based on a species list for Central Coastal Plain soils contained within its Grow Local Plants brochure which has been provided to the landowner.
- Given the contemporary 'dampland' rather than 'sumpland' environment within Lot 54 it is suggested that a mix of locally available plants suited to damp and drier soil conditions be selected from this list, and that establishment success would be enhanced by reticulation of water sourced from the constructed lake.
- Through discussions with an appropriately qualified revegetation consultant (Mr Andrew Waters of Woodgis, Environmental Assessment and Management) it is understood that for sustainable revegetation irrigation should not be permanently relied upon. After initial plant establishment, the availability of water for irrigation should be considered an insurance against plant loss from extended hot dry periods, with the management plan specifying trigger points at which the landowner should renew irrigation, and for what period.

5.0 CONCLUSION

As input to the mediation process for the matters before the State Administrative Tribunal (SAT DR 12 and 69 of 2013) it is intended that the March 26 letter and this supplementary report assist in achieving an environmentally beneficial outcome in the wake of the unauthorized disturbance to the wetland area within Lot 54.

In essence it is suggested that;

1. The constructed lake is retained in accordance with its intended purpose as an aesthetic landscape feature within a rural residential setting, because even with that objective it provides some environmental value as a drought refuge for birds and as a water source to assist revegetation within Lot 54.
2. In recognition of the changed hydrological and climatic environment, no attempt is made to retrofit this feature in order to mimic the natural 'sumpland' wetland that existed prior to 2005.
3. In recognition of the negative effects to the wetland as it existed at the time of disturbance, an environmental offset be created by re-establishing a dampland vegetation community within a nearby portion of Lot 54 that is part of the same geomorphic wetland and is of equivalent area to that affected by the disturbance.
4. In accordance with the requirements of the City of Cockburn, a plan for the re-establishment and maintenance of that vegetated environmental offset be prepared and implemented at the cost of the landowner, and to Council's satisfaction.

6.0 REFERENCES

CSIRO and Bureau of Meteorology 2007, *Climate Change in Australia* [online]. Technical Report, 140pp. Available at: www.climatechangeinaustralia.gov.au.

Department of Environment and Conservation (DEC) Geomorphic Wetlands Swan Coastal Plain dataset. Accessed online at: <http://www.dec.wa.gov.au/management-and-protection/wetlands/wetlands-mapping/geomorphic-wetlands-swan-coastal-plain-dataset.html>

Department of Water (2007) *Interim Drainage and Water Management Position Statement: Constructed Lakes*.

ENV Australia Pty Ltd (2008) *Constructed Lakes in the Perth Metropolitan Area and South West Region - Literature Review and Interview Project* - Prepared for Department of Water, Western Australian Local Government Association, and the Urban Development Institute of Australia.

Land Assessment Pty Ltd (2013) unpublished letter of March 26 (with attachments) to Mr Peter Webb of Peter Webb and Associates, Town Planning Consultants.

Landgate WA Atlas - Accessed online at:
<https://www2.landgate.wa.gov.au/bmvf/app/waatlas/>

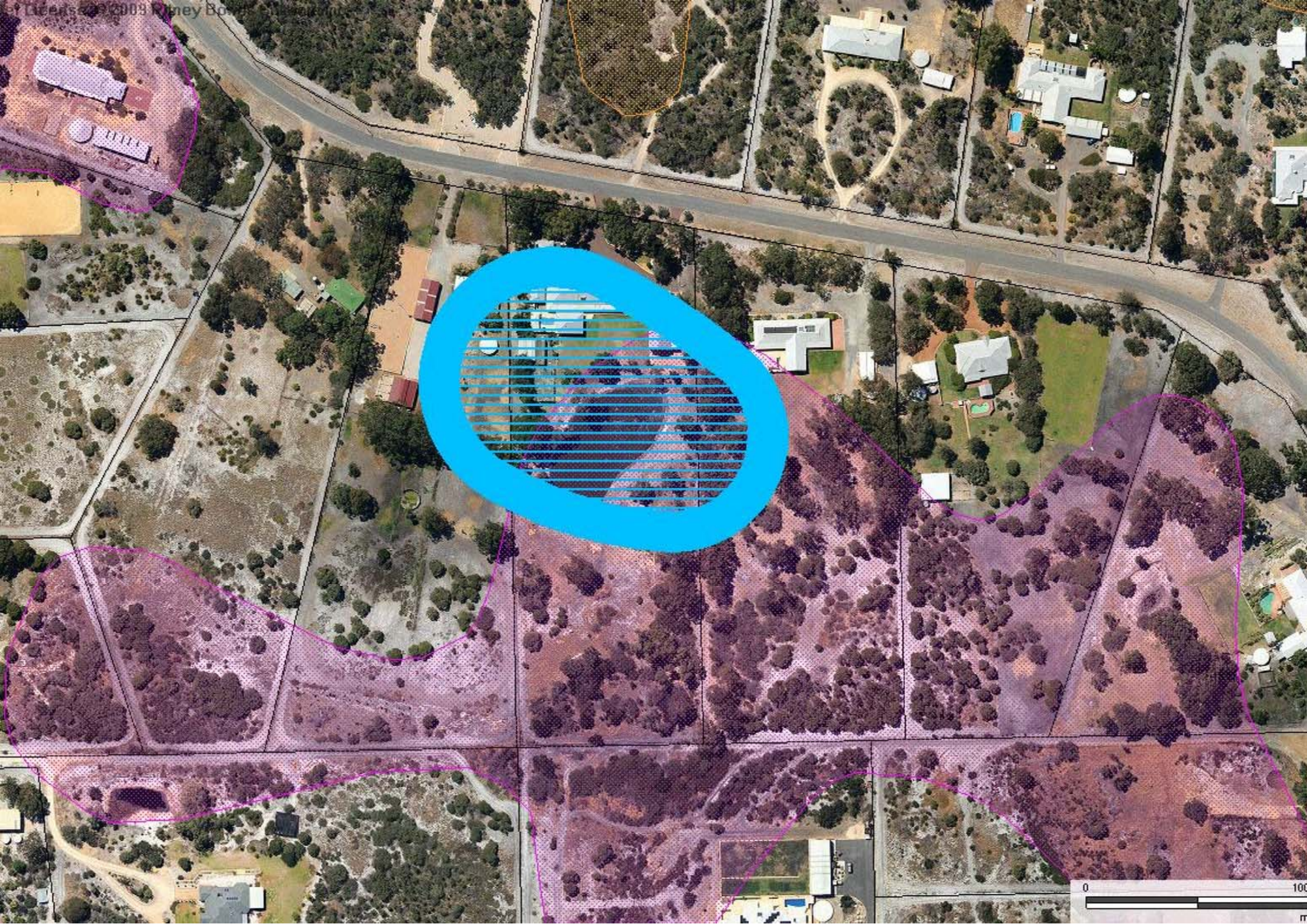
Midge Research Group of Western Australia (2007) *Chironomid Midge and Mosquito Risk Assessment Guide for Constructed Water Bodies*.

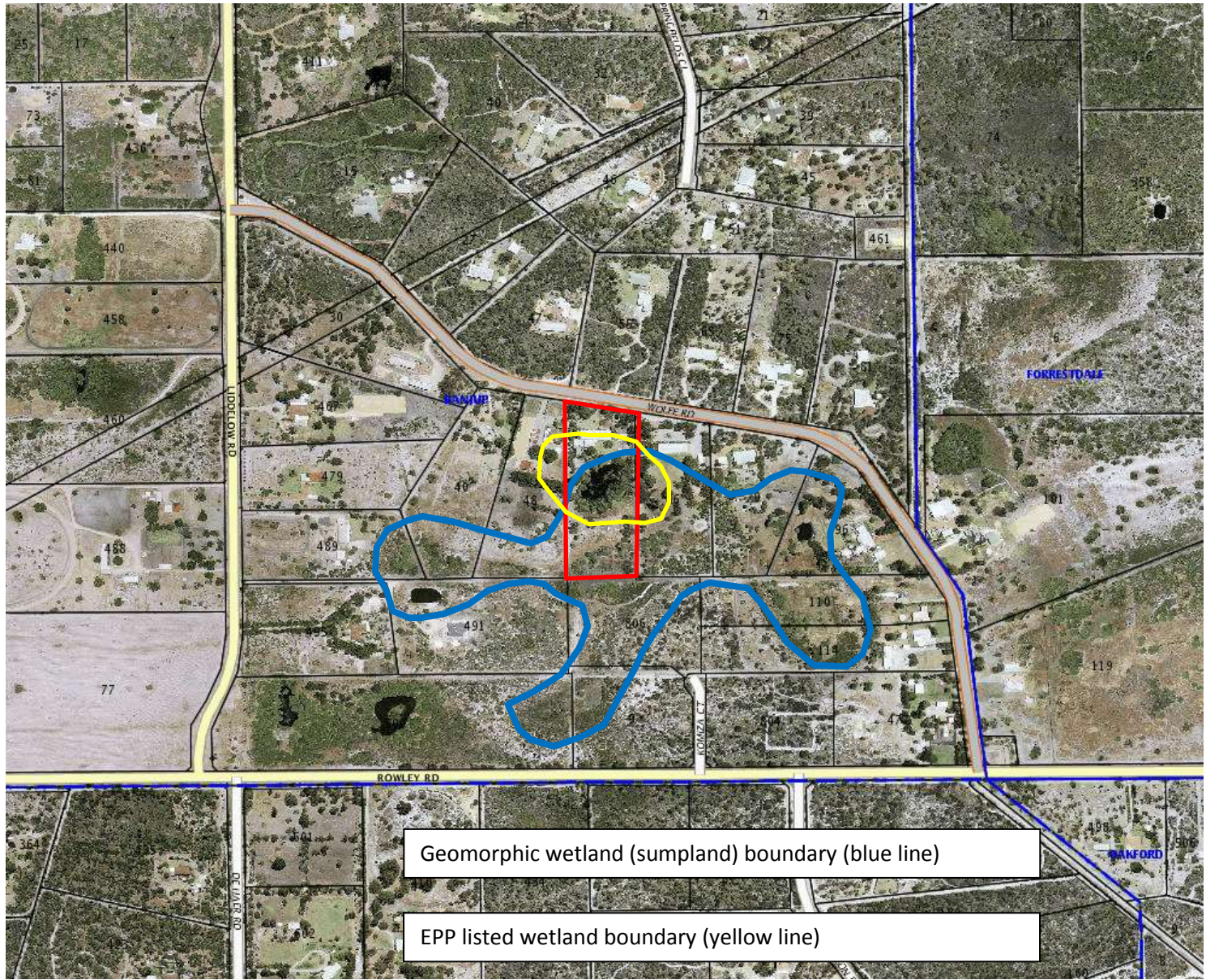
Singh, B. Pal, Y. Clohessy, S. and Wong, S (2012). *Acid Sulfate Soil Survey in Perth Metropolitan Region, Swan Coastal Plain WA* Prepared by Contaminated Sites Branch Environmental Regulation Division Department of Environment and Conservation, Government of Western Australia. March 2012.

Strategen (2009) *Bibra Lake Landscape, Recreational and Environmental Management Plan* Prepared for City of Cockburn by Strategen December 2009.

Wells, M. R. Richards N.L.B. and Clarke A.J. (1986) *Jandakot groundwater scheme area – a study of land resources and planning considerations*. Western Australian Department of Agriculture. Division of Resource Management. Technical Report 48.

ATTACHMENT A
ENVIRONMENTAL PROTECTION (SWAN COASTAL PLAIN LAKES)
POLICY - DESIGNATED AREA





Geomorphic wetland (sumpland) boundary (blue line)

EPP listed wetland boundary (yellow line)

ATTACHMENT B
SOIL AND WATER ANALYSIS RESULTS*

*** From opportunistic sampling on April 16 of excavated soil material currently forming the perimeter of the constructed lake (2 samples labelled B1 and B2, one each from northern and southern sides respectively) as well as a water sample (labelled BW) taken from near the rock feature at south-western end of the lake on the same day.**



		WIS13184	WIS13185
Lab No			
Name		B1	B2
Depth		0-10	0-10
Conductivity	dS/m	0.037	0.021
pH Level (CaCl2)	pH	6.1	5.4
pH Level (H2O)	pH	6.9	6.4

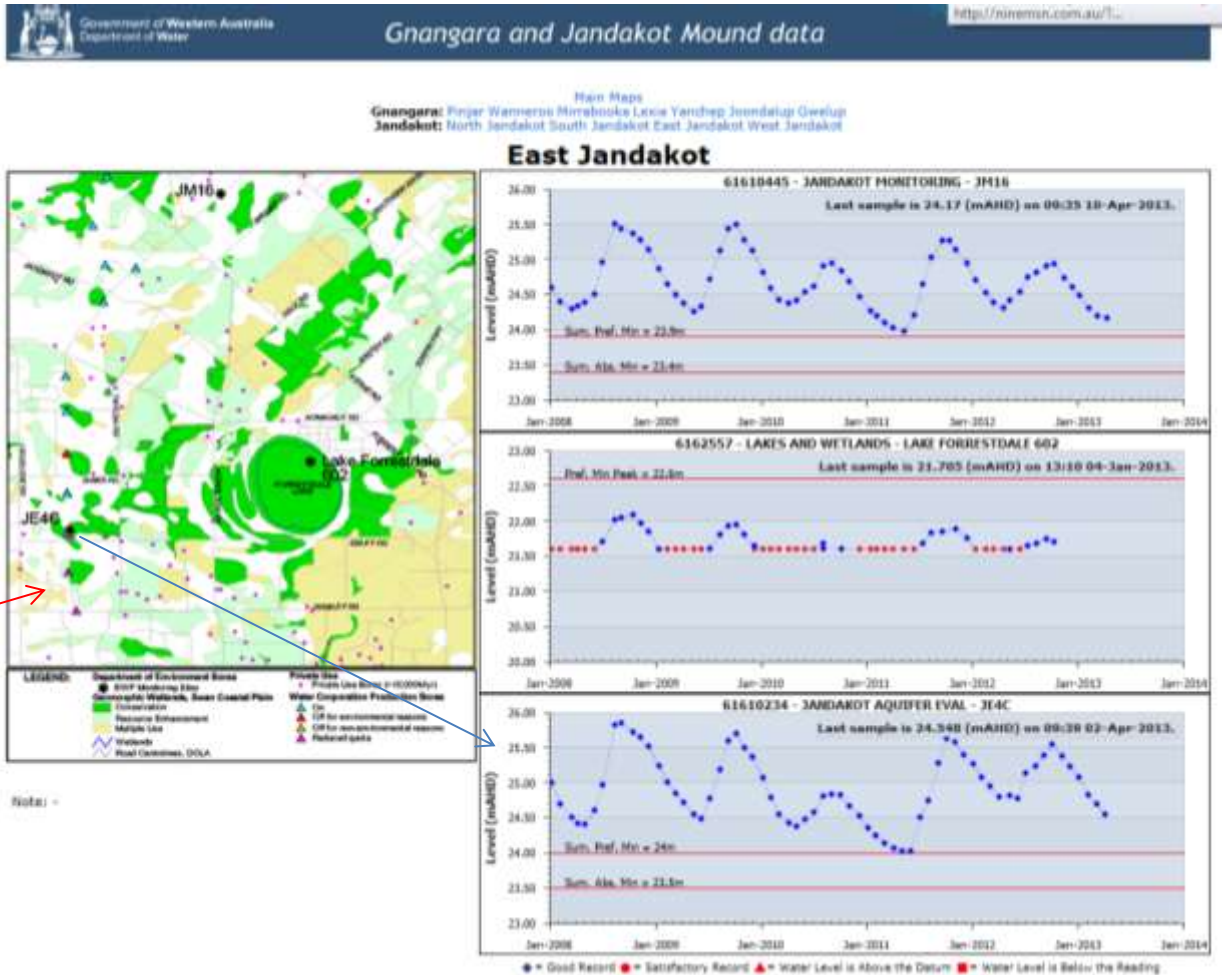


Lab No	130809
Name	BW
Code	06/04/13
Customer	Land Assess

Conductivity	dS/m	1.412
pH		8.7

ATTACHMENT C

HYDROGRAPH DATA FROM NEARBY DEPARTMENT OF WATER BORE



Note: Topographic data contained within Landgate’s on-line WA Atlas and Map Viewer indicate the natural land surface in vicinity of constructed lake is at about 26 m AHD. Depth to groundwater determined on-site (April 16) was 5.95 m below surface (i.e. around 20 m AHD) which is about 4 m lower than the comparable level at DoW bore JE 4C. Even allowing for spatial variation in depth to the superficial aquifer this anomaly suggests that the snap-shot measurement from the on-site bore may not be a true reflection of watertable below the constructed lake, and possibly due to bore casing or local drawdown effects of nearby bores. Notwithstanding this, the fact remains that this portion of the sumpland has remained dry (i.e. above seasonal watertable levels) since 2005.

ATTACHMENT D
SITE PHOTOGRAPHS



1. View southwards from residence across lawn to constructed lake.



3. View to north east across lake with workshop shed which provides roof runoff.



2. View to south west across lake and showing plastic liner.



4. Bore and pump near workshop shed provides groundwater for lake input.

ATTACHMENT E

CITY OF COCKBURN - REVEGETATION PLAN LETTER

Direct Telephone: 94113465
Our ref: 5514819, CTR

Mr & Mrs Sader
54 Wolfe Road
BANJUP WA 6164

Dear Mr & Mrs Sader,

SUBJECT: REVEGETATION PLAN

I understand that you have been requested to remove an artificial lake you have on your property and to re-instate the native vegetation around the wetland. There is also a requirement for you to submit a Revegetation Plan to the City's Environmental Services Section for approval outlining how you intend to undertake the revegetation works.

I have enclosed a plant species list which provides a list of the local endemic species that will be required to be used when undertaking the revegetation. The plants used should only be local native species shown on the list.

Also enclosed is a Grow Local Plants brochure which provides the addresses of some local plant nurseries where you can purchase the plants.

Things to consider when developing your Revegetation Plan include:

- The area will need to be maintained for 2 years to allow plants to establish.
- Planting should be undertaken in winter to ensure plants develop strong roots before summer.
- Plants must be planted to achieve a final planting density of 1.6 plants per square metre. Infill planting may be required achieve this density after two years as some plants may not survive.
- If sedges are to be planted they must be planted to achieve a density of 3 plants per square metres after two years.
- To ensure a high plant survival rate it is recommended that, over the two-year maintenance period, you undertake weed control to help promote plant survival.
- Rabbit control using tree guards is also recommended.
- Two reports annual reports will be required to be submitted to the City detailing the progress of the revegetation. One after 12 months and another after 24 months.

The City will undertake an inspection of the revegetation after two years to ensure it meets the required planting density.

Should you have any further questions in relation to the Revegetation plan please contact the undersigned on 94113465 or Linda Metz on 94113 632.

Yours sincerely,

CHRIS BEATON
ENVIRONMENTAL MANAGER

Date: 30 November 2012

ATTACHMENT F
SUGGESTED 'DAMPLAND' REVEGETATION AREA





Photo 1: Proposed revegetation area



Photo 2: Proposed revegetation area

ATTACHMENT G
APPROPRIATE PLANTS FOR REVEGETATION

Suggested species for revegetation in Banjup areas*				
GENUS	SPECIES	COMMON NAME	damp areas	wet areas
Acacia	huegelii			
Acacia	pulchella var pulchella	Prickly Moses		
Acacia	saligna	Orange scented wattle		
Acacia	stenoptera	Narrow Winged Wattle		
Adenanthos	cygnorum	Woolly Bush		
Adenanthos	obovatus	Basket Flower		
Allocasuarina	fraseriana	Fraser's Sheoak		
Allocasuarina	humilis	Dwarf sheoak		
Anigozanthos	humilis	Cats Paw		
Anigozanthos	manglesii	Kangaroo Paw		
Aotus	cordifolia		✓	✓
Astartea	fascicularis		✓	✓
Banksia	attenuata	Candle Banksia		
Banksia	ilicifolia	Holly Leaved Banksia		
Banksia	littoralis	Swamp Banksia	✓	✓
Banksia	menziesii	Firewood Banksia		
Banksia	dallanneyi	Couch Honeypot		
Baumea	articulata	Jointed Twig Rush		✓
Boronia	capitata	Cluster Boronia		
Bossiaea	eriocarpa	Common Brown Pea		
Burchardia	umbellata	Milk Maid		
Calothamnus	lateralis		✓	✓
Calytrix	angulata	Yellow Starflower		
Centella	cordifolia		✓	✓
Comesperma	virgatum			
Conostylis	aculeata	Cottonhead/Prickly Conostylis		
Conostylis	juncea			
Dampiera	linearis	Common Dampiera		
Dasypogon	bromeliifolius	Pineapple Bush		
Daviesia	triflora			
Eremaea	pauciflora	Orange flowered Eremaea		
Eremaea	asterocarpa			
Eucalyptus	marginata	Jarrah	✓	
Eucalyptus	todtiana	Prickly Bark		
Gompholobium	tomentosum	Hairy Yellow Pea		
Hemiandra	pungens	Snake Bush		
Hibbertia	huegelii			
Hibbertia	racemosa	Stalked Guinea Flower		
Hypocalymma	angustifolium	White Myrtle	✓	✓
Hypocalymma	robustum	Swan River Myrtle		
Jacksonia	furcellata	Grey Stinkwood		

Suggested species for revegetation in Banjup areas*				
GENUS	SPECIES	COMMON NAME	damp areas	wet areas
Jacksonia	sternbergiana	Green Stinkwood		
Juncus	pallidus	Pale Rush	✓	✓
Kunzea	galbrescens (ericifolia)	Spearwood	✓	
Lepidosperma	longitudinale	Pithy Sword Sedge		
Macrozamia	riedlei	Zamia Palm		
Meeboldina	scariosa	Velvet Rush	✓	✓
Melaleuca	lateritia	Robin Redbreast Bush	✓	✓
Melaleuca	preissiana	Stout Paperbark	✓	✓
Melaleuca	rhaphiophylla	Swamp or Freshwater Paperbark	✓	✓
Melaleuca	scabra	Rough Honey Myrtle		
Melaleuca	thymoides			
Melaleuca	teretifolia	Banbar	✓	✓
Mesomelaena	pseudostygia			
Nuytsia	floribunda	W.A Christmas Tree		
Patersonia	occidentalis	Purple Flag		
Pericalymma	ellipticum	Swamp Tea Tree	✓	✓
Petrophile	linearis	Pixie Mops		
Philothea (prev. Eriostemon)	spicata	Pepper and Salt		
Phlebocarya	ciliata			
Stirlingia	latifolia	Blue Boy		
Thysanotus	manglesianus	Fringed Lilly		
Waitzia	citrina			
Xanthorrhoea	preissii	Blackboy/Grasstree		

* Provided by City of Cockburn April 30 2013.