

# **Preliminary Ecological Assessment of the Floodplain at 609-621 Burwood Highway, Knoxfield**

A report to Knox City Council  
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## **Contents**

Executive Summary .....	1
1. Introduction .....	3
2. Site Inspections.....	4
3. Plant Species.....	4
4. Vegetation Cover.....	6
4.1. The Waterbody.....	6
4.2. Vegetation Fringing the Dam.....	7
4.3. Trees with No Indigenous Understorey .....	8
4.4. The Inlet Drain to the Dam .....	8
5. Fauna .....	8
6. Potential Development Impacts and Options .....	9
7. Planning Matters.....	12
7.1. Victoria Planning Provisions .....	12
7.2. Local Planning Policy Framework.....	13
7.3. Overlays .....	13
8. Recommendations .....	14
Appendix 1 – Plant Species List .....	16
Appendix 2 – Fauna Species List.....	19

## Executive Summary

The former horticultural research station in Knoxfield is under consideration for residential development. This report identifies the ecological issues concerning the site's floodplain and dam ('Lake Knox') that need to be taken into account in the early stages of considering the site's future. An annotated aerial photograph of the floodplain appears in Figure 1 on p. 3.

From my observations, the ecological significance of the site relates largely to the presence of rare wetland plants and habitat for the endangered Blue-billed Duck. All 1.6 hectares of the dam is covered with native submerged plants, including rare species. Those plants underpin the aquatic ecosystem by forming the base of the food chain for the rest of the wetland organisms, from microorganisms to frogs, fish and waterbirds such as the Blue-billed Duck.

In addition, the treed vegetation on the dam's northern bank is quite significant, ecologically and for landscape amenity. Several of the plant species growing there are rare – one of them rare throughout Victoria and others, within Knox.

Even before some of the site's ecologically significant features were identified, the dam and the vegetation to its north were given the planning protection of Schedule 2 of the Environmental Significance Overlay (ESO2) in the Knox Planning Scheme. Because of that overlay and the broader Victoria Planning Provisions, any proposals for rezoning, development, works or vegetation removal on the site must be assessed for their impacts on ecological values.

Any residential development of the former horticultural research station will require a wetland system on the floodplain to manage stormwater. The existing dam could contribute to stormwater management but it would need modification. Modification would also be required to improve the public safety of the currently tall, steep banks on the south, west and east. Shores with more gradual slopes would also be ecologically beneficial.

The theoretical option of filling in the dam and constructing a new wetland system elsewhere would kill much of the vegetation on the northern bank. That is because the root systems of the eucalypts and some other species (including the locally rare Hairy Knotweed) are reliant on the presence of the water in the abutting dam. It would take decades to replace the existing habitat value. Such an outcome would conflict strongly with the objectives of ESO2.

Filling in any part of the dam will also cause the loss of the dense cover of significant submerged native vegetation, although it may be possible to transplant some of it to a new wetland. Losing the dam and its vegetation also means losing the habitat for all the dependent fauna, such as Blue-billed Ducks. It would take some years for a new waterbody to provide similar habitat value.

My detailed consideration of all the matters just discussed has led me to the following recommendations, whose rationale is provided in Section 8:

1. As little as possible of the dam should be removed even though it must be recognised that the banks (other than the northern bank) need to be given much more gradual gradients.
2. The vegetated part of the dam's northern shore should be left unmodified. Even if some of the dam is filled in, that should not extend to the northern shore.
3. Even if it is ultimately decided that the ecological concerns considered here should be overridden by other considerations, there would remain a strong legal reason to restrict the

removal of native vegetation over the whole site to less than one hectare. That is approximately one-third of the total area of native vegetation on the site.

4. If a southern or western part of the dam is to be filled in or re-graded, the loss of significant habitat and rare plants should be compensated by extension of the waterbody into a new wetland area, generally to the northeast of the dam. Figure 5 on p. 11 provides just one example of the sort of concept that could be considered. Aquatic plants that are removed should be transplanted into the new wetland area. The provision of new wetland habitat should be augmented with revegetation and habitat management of dry-land vegetation around the wetland, e.g. on the promontory in the lake depicted in Figure 5. Part of the objective would be to provide an area of seclusion for birds to roost and breed in trees away from humans and dogs.
5. In accordance with ESO2, design work must have regard to Tree Protection Zones for all retained eucalypts. The most important tree to protect is the large, ancient Swamp Gum just north of the inlet channel to the dam (Section 4.3).
6. The design of the proposed development needs to be informed by ecological advice from a consultancy with expertise in waterbird ecology, wetland ecosystems and Water Sensitive Urban Design. Most ecological consultants do not have the required expertise. The brief assessment in this report is only adequate to guide initial consideration of the site's ecological constraints and opportunities.

## 1. Introduction

Residential development proposals are being formulated for land at 609-621 Burwood Hwy, Knoxfield, which was once part of a Victorian Government horticultural research facility. The site includes a shallow, 1.6-hectare farm dam on the floodplain of Blind Creek. An annotated aerial photograph appears in Figure 1.



Figure 1. Annotated aerial photograph of the subject land, with colour tinting to indicate the zones mentioned in the text.

The dam provides habitat for native waterbirds, pond life and aquatic vegetation. The vegetation around the dam includes substantial numbers of wild, indigenous plants that provide habitat for wildlife. These features and the waterbody itself provide amenity for users of the adjacent Blind Creek trail.

For these reasons, the dam and adjacent native vegetation are covered by Schedule 2 of the Environmental Significance Overlay in the Knox Planning Scheme, based on my 2010 report, 'Sites of Biological Significance in Knox'.

I have been asked to assess the ecological outcomes of possible redevelopment options for the site, including the dam and the surrounding floodplain. I have also been asked to consider these possibilities in the context of the planning controls that apply to the site.

## 2. Site Inspections

I have inspected the site from the adjacent public land as part of the following past projects:

- I and co-workers assessed the site for the 1997 report to Knox City Council titled '*Vegetation Survey of Linear Reserves – A Management Strategy for Riparian and Flood Plain Vegetation*' (see the description of Section B7 in that report);
- I reassessed the ecological attributes of the area as part of my 2009 report to Knox City Council titled '*Blind Creek and Lewis Parklands Ecological Assessment*'. I observed the endangered Blue-billed Duck on the dam and some uncommon plant species around the dam;
- I further assessed the area for my 2010 report, '*Sites of Biological Significance in Knox*', as mentioned above;
- I occasionally walk along the Blind Creek Trail (e.g. for Council's Environmental Weed Plan in 2016), making incidental observations of waterbirds on the dam and plants along the creek.

For the present report, I walked around the dam and its surroundings for three hours on 19th January 2017. I recorded the presence and abundance of all native and introduced species of vertebrate and butterfly in the area. I recorded the presence and abundance of all native and introduced species of plant that I observed within each of three zones: a) in the water of the dam; b) fringing the dam and c) along the inlet drain to the dam. The colour tinting on Figure 1 indicates these zones as well as some trees with no native understorey beneath them. I did not list the plant species elsewhere in the site, where I saw no indigenous plants. I inspected the larger trees for hollows that could be used by wildlife for nesting or roosting. I used satellite positioning to map the locations of rare plants and habitat trees.

## 3. Plant Species

During my inspection on 19th January 2017, I detected 38 wild indigenous plant species, three planted 'Australian natives' and 36 introduced plant species in or around the dam. These are listed in Appendix 1 along with the abundance of each species within each of the zones on Figure 1.

One species – the Floodplain Groundsel (*Senecio campylocarpus*) – is listed by the Department of Environment, Land, Water and Planning as 'rare' throughout Victoria. The species was first recognised as distinct from the very similar Cotton Fireweed *Senecio quadridentatus* in 2004 and it took some years for botanists to determine how common it is. In the past decade, it has been found to be abundant in some areas, including Knox, but the 'rare' listing remains.

No other plant species that I observed on 19th January 2017 is listed as rare or threatened in the whole of Victoria, but six fall in the highest two categories of risk of becoming extinct within Knox, i.e. the categories 'endangered' and 'critically endangered' in Knox.

One of these species, the Small Mud-mat (*Glossostigma elatinoides*), could only be identified with some uncertainty because there was no flowering material to confidently distinguish it from the rarer species, *Glossostigma cleistanthum*. If it is the former, less rare species (as I expect), it is the first record of the species in Knox. The only other records of *Glossostigma elatinoides* I can find within 35 km are from Warrandyte, Wonga Park, Lillydale Lake and near Beaconsfield. If the species turns out to be *Glossostigma cleistanthum*, it is listed as rare throughout Victoria and the only other record from the Melbourne region is from nearby Lakewood Nature Reserve. In either case, the species is quite significant.

Both *Glossostigma* species grow mostly in mud on the bottom of waterbodies. Diving waterbirds often feed off the plants and break off fragments that can be washed ashore, sometimes taking root there. I detected the species from small fragments washed up on the shore of the dam, indicating that it grows beneath the water even though I could not see it – a common occurrence for *Glossostigma* species. A confident identification may become possible when larger fragments wash ashore, particularly if they include flowers or fruit. It may be possible to propagate fragments to flowering stage, or a plant might spontaneously establish on the shore and produce flowers that can be easily accessed.

Because of the difficulty of detection, I am quite uncertain about the abundance of the *Glossostigma* on the floor of the dam.



Figure 2. Leaves and spiral stalks of female flowers of Eel Grass. Inset: close-up of a female flower, showing the curvature of the water surface created by the flower.

Another locally rare species, Eel Grass (*Vallisneria australis*), is abundant in the dam. Again, diving waterbirds feed on the plant and the organisms that live on the leaves, such as water

snails. The plant has a fascinating strategy to protect its flower buds and seeds from being eaten. The minute male flower buds are embedded among the leaf bases until the buds are ready to open, when they detach from the plant and float up to spread their pollen on the water surface. The small, pale pink female flowers remain attached to the parent plant by stalks as they rise to the water surface – see Figure 2. The female flowers open on the surface and modify the surface tension of the water to attract male flowers and pollen grains. Once fertilised, the flower stalk coils tightly to withdraw the flower back to the base of the plant, reducing the exposure to waterbirds while the seeds ripen.

Eel Grass is rare in the Melbourne region. Within 20 km of the dam, the known locations are at Heany Park, Lysterfield Lake, Warrandyte and Wonga Park. At the latter two locations, the Eel Grass grows with the aforementioned Small Mud-mat (*Glossostigma elatinoides*).

Although less rare than either of the abovementioned species, the Hairy Knotweed (*Persicaria subsessilis*) is still in the highest ‘critically endangered’ category for its risk of extinction in Knox. Three patches of this sprawling, tangled species grow on the dam’s northern bank. The largest patch measures approximately 4 m × 0.8m and may contain several plants, as may the second-largest patch, which is 1 m in diameter. The last patch is smaller and probably contains a single plant. Another Hairy Knotweed plant was seen on the bank of Blind Creek 130 m north-northeast of the dam in 1997 and 2009 but has not been checked since. There are only eight other known locations in Knox where the species has been recorded, and few others within 20 km.

In the next level of risk of local extinction – ‘endangered’ – are four more species around the dam. The Hop Wattle (*Acacia stricta*) is represented by approximately eight plants on the northeastern shore. The Tree Everlasting (*Ozothamnus ferrugineus*) is represented by a single plant on the northern shore. The Tasmanian Wallaby-grass (*Rytidosperma semiannulare*) is represented by at least five individuals near the southwestern corner but others may well have escaped detection due to the time of year. Finally, the cumbungi, *Typha domingensis*, can only be identified with about 75% confidence due to the lack of flowering material and difficulty penetrating blackberries to reach the solitary plant. The plant is small for a cumbungi and it grows in the water near the southwestern corner of the dam.

Larger amounts of cumbungi were noted around the dam in the 1997 report cited in the Introduction, suggesting that the dam’s vegetation has changed substantially since then.

## 4. Vegetation Cover

### 4.1. The Waterbody

The dam is densely covered with submerged indigenous plants, including the rare mud-mat and an abundance of the rare Eel Grass. A representative view of a shallower section of the dam appears in Figure 3, in which most of the foliage belongs to *Potamogeton crispus* and *Potamogeton ochreatus*. I did not venture into the deepest parts of the dam, which are still not very deep.

I detected no introduced plants in the dam. The dam therefore represents 1.6 hectares of purely native vegetation.



Figure 3. Representative view of a shallow part of the dam..

The dense cover of submerged plants is a critical aspect of the dam's ecological significance because those plants form the base of the food chain for aquatic life and waterbirds, and because they help purify and oxygenate the water.

#### 4.2. Vegetation Fringing the Dam

There is a band of amphibious plants (particularly rushes) within about 1 m of the water around almost the whole dam. These form a stable mixture of indigenous and introduced plants. Among the indigenous species are patches of the locally critically endangered Hairy Knotweed noted above.

Abutting that band on the northern shore of the dam is a strip of predominantly native vegetation up to approximately 12 m wide dominated by Swamp Gums (*Eucalyptus ovata*) and wattle trees – particularly Black Wattle and Blackwood. This strip is depicted in Figure 4. It appears to have grown up on slightly raised ground formed from earth excavated from the dam during its construction, perhaps as many as sixty years ago. It includes the plants of the locally endangered Hop Wattle (*Acacia stricta*) and Tree Everlasting (*Ozothamnus ferrugineus*).



Figure 4. A view westward from near the dam's northeastern corner. The understorey between the dam and the red curve is predominantly indigenous. All the trees are indigenous.

#### 4.3. Trees with No Indigenous Understorey

The oldest tree by far on the site is a Swamp Gum (*Eucalyptus ovata*) with a trunk diameter of roughly 1 m, located 50 m southeast of the dam. It appears as a large tree on an aerial photograph dated 1946, making it probably over a century old. It contains hollows suitable for occupation by certain species of birds, bats and invertebrates.

Preservation of such a tree is important for habitat as well as for natural heritage and history.

Figure 1 on p. 3 maps several other indigenous trees with no native understorey beneath them, along the northern and eastern perimeters. They have all arisen since the land was cleared for agriculture. Three of them, just north of the dam, have small hollows, one of which is occupied by honey bees.

#### 4.4. The Inlet Drain to the Dam

The inlet drain to the dam's southeastern corner supports a patchy mix of introduced and indigenous plants. In places, the canopy of Black Wattle and (mostly) introduced deciduous trees is so dense that there are few plants beneath them. However, toward the dam, there are reasonable numbers of indigenous rushes in the drain. On the nearly-flat ground adjacent to the drain, the understorey comprises dense introduced grasses, dead blackberries and no indigenous plants.

## 5. Fauna

The indigenous fauna I observed on 19th January 2017 included eight waterbird species, seven other bird species, the Spotted Marsh-frog and two butterfly species. The introduced fauna comprised a Mallard, three bird species other than waterbirds, a Redfin (or similar fish) and some Cabbage White butterflies.

Because a three-hour visit cannot be expected to detect much of a site's entire fauna, I draw also on a list I compiled on 1st November 2008 along the Blind Creek Trail between Scoresby Rd and the footbridge immediately northeast of the dam.

The composite list from both these dates appears in Appendix 2. It is likely to be considerably incomplete due to the brevity of the observing period.

The most significant fauna species I observed was the Blue-billed Duck diving in the dam. That species is listed as 'endangered' in Victoria. I have observed small numbers (usually two or four) regularly at nearby Lakewood Nature Reserve and periodically at Waterford Valley Golf Course and the Reservoir Crescent dam in Rowville. Blue-billed Ducks are also recorded in recent years at Caribbean Lake and the lake at Heany Park. I have a strong impression of a small local population that flies daily between local waterbodies. In fulfilling their habitat needs, I expect Blue-billed Ducks make regular use of the dam of interest in this report. They are diving ducks and need to feed in open water with plenty of submerged vegetation, such as that seen in Figure 3. The dam in question does not have enough dense, tall, fringing vegetation to provide breeding habitat for Blue-billed Ducks or many other waterbirds. Blue-billed Ducks are rather shy and in Knox, I have always observed them to retreat when humans approach any closer than several tens of metres.

None of the other fauna species that I observed are rare or threatened but one possible visitor deserves attention. Hardhead (or White-eyed Duck) is listed as vulnerable in Victoria (one level less threatened than endangered). I have observed it at most of the same open waterbodies as the Blue-Billed Duck but more often and in greater numbers (typically four to six individuals), and sometimes at shallower lakes. Hardhead appear to move between waterbodies less frequently than the Blue-billed Duck but it is still likely that they periodically visit the dam of interest here. The most recent record from the dam is from 1992 but this may be simply due to lack of observational data.

## 6. Potential Development Impacts and Options

Any new development of the former horticultural research station will need to have a wetland system to purify and retard the flow of stormwater before it reaches Blind Creek. The existing dam cannot meet the requirements and it does not meet safety requirements for a publicly accessible waterbody. From an engineering perspective, the only options for the required wetland system that can overcome these problems involve:

- Extensive modification of the existing dam; or
- The construction of a whole new system to the northeast of the dam; or
- A combination of the two.

As discussed in my 2009 report to Knox City Council titled '*Blind Creek and Lewis Parklands Ecological Assessment*', these options provide opportunities to improve the environmental values of the existing dam and its surroundings.

The most important opportunity relates to the provision of gently sloping edges to the new or modified wetland(s), which improves safety, provides habitat for far more fringing plants and hence may provide the cover and plant material that many waterbirds need for nesting.

The most important environmental threats associated with a new or modified wetland system are:

- The potential frightening and permanent displacement of Blue-billed Ducks by increased proximity to humans and dogs once the land becomes publicly accessible; and
- Loss of the significant vegetation in the dam and between the dam and the Blind Creek Trail.

I believe that careful design can minimise these threats if the following matters are dealt with:

1. The treed vegetation between the existing dam and the Blind Creek Trail should be retained, with water still lapping on what is currently the dam's northern shore. The vegetation is partly dependent on the adjacent water, so it could be killed if the dam is drained or filled. The construction of a retarding basin levee over the trees' root systems could also kill them, including trees just north of the property boundary;
2. The design should include an open waterbody that is similar to the existing dam in its depth and submerged vegetation but with gradually sloping edges;
3. To allow the less common waterbirds to breed and provide them with enough separation from humans and dogs, the waterbody should extend well away from the publicly accessible part of its shore. Some parts of the shore should be inaccessible to humans and dogs, as at nearby Lakewood Nature Reserve. To provide separation between waterbirds and humans, the area of the wetland system should be at least comparable to the existing dam.

Item 1 above strongly favours the option of retaining the dam's existing north shore as part of the new or modified open waterbody. The other shores are much less important to retain, except perhaps the 40-metre strip extending south-southwest from the dam's northwestern corner to a pair of Swamp Gums with native understorey.

I anticipate that negotiations about the extent of residential development will consider the possibility of filling part of the dam to yield more housing and/or reduce the slope from the natural ground level to a new southern shore. I am not able to assess the need for such an option but I can provide ecological information that may help in its consideration.

If part of the dam were to be filled in along the southern edge, the remainder of the dam could be extended as illustrated conceptually in Figure 5. This would retain the current north shore and part of the dam. The arc formed by the new waterbody, in combination with screening vegetation on the southern side of the Blind Creek Trail, could be used to restrict public access to the north shore and provide security for waterbirds. Part of the new northern lobe of the waterbody could be shallow and provide water purification by denitrification and processes related to macrophyte vegetation. A sedimentation basin would have to be provided on the inlet side. The alignment of a retarding basin levee needs to be carefully chosen with regard to 'tree protection zones' for the remnant eucalypts, which should not be too difficult if the levee is low.



*Figure 5. A concept plan for a new open waterbody (in semi-transparent blue) that retains the dam's existing north shore and would leave the vegetation on that shore out of bounds to the public.*

The concept of Figure 5 involves the loss of a substantial fraction of the habitat relied upon by waterbirds, including Blue-billed Ducks. That loss would be compensated by the creation of a new area of wetland and the much shallower gradient of the new shores, which would provide habitat for numerous additional water plants and probably waterbird nesting sites that are notably lacking in the existing dam. It would be relatively easy to successfully transplant plants from the floor of the existing dam into the new wetland area. The current presence of those plants in the dam is testament to the ability of those species to colonise artificial waterbodies, even without any human assistance. Just as waterbirds and wind have transported wetland plants and pondlife to the dam previously, they will aid colonisation of the new waterbody and its shores.

I would expect a wetland of the kind suggested in Figure 5 to surpass the habitat value of the existing dam within three or four years from construction, as long as access by humans and dogs is adequately managed.

The concept in Figure 5 is only put forward here as one example of a possible way to seize the site's environmental opportunities and avoid the environmental threats. I can imagine alternatives that could be considered, including filling less (or none) of the existing dam and instead grading the edges more gradually (except the northern shore).

## 7. Planning Matters

I have been asked to consider existing environmental planning controls and policy. I do so from my perspective as an ecologist with experience in planning provisions related to the environment. I make no pretence of being legally qualified.

The redevelopment of the subject land involves both strategic and statutory planning. In my experience, it is important in developments like this to avoid focusing on narrow statutory planning matters (e.g. the ‘biodiversity assessment guidelines’ for permit applicants) at the expense of the broader environmental issues raised by rezoning and radical changes in permitted land uses.

### 7.1. Victoria Planning Provisions

Chapter 12 of the Victoria Planning Provisions (VPPs) begins by saying that ‘Planning should help to protect the health of ecological systems and the biodiversity they support (including ecosystems, habitats, species and genetic diversity) and conserve areas with identified environmental and landscape values’. This is relevant to the land of interest here, in view of the rare species and the identified values for biodiversity. Clause 12.01 requires Council to ensure that strategic planning (e.g. rezoning for the redevelopment under consideration here):

- ‘Avoids and minimises significant impacts, including cumulative impacts, of land use and development on Victoria’s biodiversity...’; and
- ‘Assists in the protection and management of sites containing high value biodiversity’.

Since Amendment VC101 in 2015, the prevailing interpretation of ‘Victoria’s biodiversity’ and ‘high value biodiversity’ has focused on species listed as rare or threatened throughout Victoria. In the present case, that relates directly to the Blue-billed Ducks observed on the dam, the Floodplain Groundsel growing on the banks and potentially the Mud-mat if it proves to be the statewide-rare *Glossostigma cleistanthum*. In order to protect those species, their habitat needs to be protected. The essential habitat feature for the ducks and the mud-mat is the dense vegetation growing on the floor of the dam. It can be conserved by retaining the dam (or part thereof) and/or creating a new wetland of similar depth. The Floodplain Groundsel volunteers itself readily around local wetlands and is unlikely to be significantly affected by any development options that may be considered.

Clause 12.01-1 of the VPPs provides the instruction that planning should consider, ‘as relevant’, the ‘Biodiversity Assessment Guidelines’ and the ‘Native Vegetation Information Management System’ (NVIM). Unfortunately, as is common in Knox, the information provided by the NVIM for the dam and its surroundings is clearly erroneous in regard to the extent and condition of the native vegetation, and is therefore not very relevant. The flaws arise because the information is based on computer predictions rather than direct observations. No account is taken of considerations such as the north-south movement of Blue-billed Ducks between the dam and Lakewood Nature Reserve or the absence of breeding habitat for that species at the dam. The Biodiversity Assessment Guidelines rely on the same information that comes out of the NVIM and therefore is similarly flawed.

Clause 12.01-2 only applies to planning permits for the removal of native vegetation. Such a permit can only be issued in the present case once the strategic planning matters are resolved and amendments are approved for rezoning and possibly changes to overlays such as the Environmental Significance Overlay. Nevertheless, it is important to anticipate now what

permit conditions would eventually apply in relation to each of the development concepts under consideration. If more than one hectare of native vegetation is to be removed (i.e. approximately one-third of the total across the proposed development site), the Biodiversity Assessment Guidelines require that a permit application must demonstrate that measures have been taken to minimise the adverse environmental impacts, which may well be impossible. This should be taken into account at the strategic planning stage; e.g. rezoning and any accompanying amendments to policies or overlays should not reduce the capacity for vegetation removal to be minimised and it should not be simply presumed that a permit could be issued to remove more than one hectare of vegetation (which includes the 1.6 ha of submerged vegetation in the dam).

### *7.2. Local Planning Policy Framework*

A draft 'Knox Central Structure Plan' and associated Amendment C149 were exhibited in November 2016. The amendment proposes to amend the Municipal Strategic Statement and replace Clause 22.04 (Knox Central Principal Activity Centre Local Policy) with a new Clause 22.15 (Knox Central Activity Centre Local Policy).

At pages 42-44, the draft 'Knox Central Structure Plan' includes a master plan for the development site of which the dam and its surroundings are part. Of particular relevance, it includes the following principles:

- 'Development of the site protects and enhances any remnant vegetation, particularly in the fringe areas of the existing water body'. This would support the principles and guidance I have given above. It would be inconsistent with filling the dam in;
- 'The development should retain and enhance the water body on site in order to facilitate integrated water management and to provide a high level of neighbourhood amenity'. This would mean modifying the existing dam (e.g. making it safe for public access and incorporating WSUD principles) and would not be consistent with filling it all in.

However, the Knox Central Structure Plan is only a draft for public consultation.

If Amendment C149 proceeds to adoption, the most relevant provision from an ecological perspective is in the table on p. 3 of Clause 22.15, where it states that 'New public open space on the site [in question] will integrate with the Blind Creek corridor and contribute to the environmental, recreational and access functions of the Corridor'. I have taken this into account in my considerations above. Any significant reduction in the site's wetland area, or any failure to address the environmental threats identified earlier, would conflict with the goal of contributing to the environmental functions of the Blind Creek corridor.

If the draft Knox Central Structure Plan and/or Amendment C149 are materially altered or not adopted, different considerations may apply.

### *7.3. Overlays*

Schedule 2 of the Environmental Significance Overlay (ESO2) applies to the dam, its shores and the native vegetation north of the dam. It provides extensive planning protection to the site's indigenous flora and fauna. The most salient of its objectives are:

- Protection of species identified as being threatened with local extinction, such as those discussed in Section 3 above;

- Enhancement of the condition and viability of aquatic ecosystems, which gain scant recognition elsewhere in the planning scheme;
- Avoidance of vegetation removal;
- Avoidance of fragmentation of habitat. This is of particular relevance to Blue-billed Ducks, which already have to fly regularly between local wetlands in order to make up enough habitat for their survival in Knox.

As the primary author of ESO2, I have taken it fully into account in my advice in this report. However, it is common in Victoria for ecological reports in such cases to focus on the state-wide Biodiversity Assessment Guidelines with inadequate regard to the additional requirements imposed by an Environmental Significance Overlay. It will be important in the present case for the proponent's ecological consultants to be made fully aware of all the requirements for assessment, design and offsetting that result from the overlay, beyond those of the Biodiversity Assessment Guidelines.

Overlays other than ESO2 that apply to the land in question do not appear directly important in regard to the site's ecological values and sensitivities. However, the Land Subject to Inundation Overlay provides some additional impetus to use the dam and the rest of the floodplain not for residential development but for public purposes that can tolerate flooding.

## 8. Recommendations

Based on my analysis above, I offer the following recommendations and associated rationale. They need to be considered side by side with non-ecological matters such as financial viability and maximising the efficiency of providing housing for Melbourne's growing population.

1. As little as possible of the dam should be removed even though it must be recognised that the banks (other than the northern bank) need to be given much more gradual gradients. *Rationale:* The 1.6 hectares of purely native vegetation in the dam is highly significant in its own right and it is vital to the aquatic ecosystem (including Blue-billed Ducks) as the base of the food chain. The plants also purify and oxygenate the water. Any reduction in the size of the waterbody will also impair the habitat for shy waterbirds like Blue-billed Ducks that keep their distance from shores with public access.
2. The vegetated part of the dam's northern shore should be left unmodified. Even if some of the dam is filled in, that should not extend to the northern shore. *Rationale:* The dam's north shore and its fringing vegetation are quite significant, ecologically and for landscape amenity. The root systems of the eucalypts, the rare Hairy Knotweed and several other plants are reliant on the presence of the water in the abutting dam. At least some of those plants would die or become unviable if the dam were filled in. It would take decades to replace the existing habitat value. This outcome would conflict strongly with the planning provisions discussed in Section 7 above.
3. Even if it is ultimately decided that the ecological concerns considered here should be overridden by other considerations, there would remain a strong legal reason to restrict the removal of native vegetation over the whole site to less than one hectare. That is approximately one-third of the total area of native vegetation on the site. *Rationale:* The state-wide Biodiversity Assessment Guidelines (BAGs) place more onerous conditions (the 'moderate risk-based pathway') on removal of native vegetation once a threshold of one hectare is reached. One of those conditions is a requirement to demonstrate that vegetation

removal is minimised. I cannot see how this could be demonstrated. The BAGs are quite prescriptive in this regard. In addition, ESO2 has a (more discretionary) decision guideline to consider, as appropriate, '*Whether the proposal adopts appropriate siting, design and management measures to avoid, or at least minimise, any adverse impacts on indigenous vegetation, habitat values, hydrology and land stability*'.

4. If a southern or western part of the dam is to be filled in or re-graded, the loss of significant habitat and rare plants should be compensated by extension of the waterbody into a new wetland area, generally to the northeast of the dam. Figure 5 on p. 11 provides just one example of the sort of concept that could be considered. Aquatic plants that are removed should be transplanted into the new wetland area. The provision of new wetland habitat should be augmented with revegetation and habitat management of dry-land vegetation around the wetland, e.g. on the promontory in the lake depicted in Figure 5. Part of the objective would be to provide an area of seclusion for birds to roost and breed in trees away from humans and dogs. *Rationale:* ESO2 and the BAGs require the loss of native vegetation to be offset to achieve a net gain in habitat (ESO2) or no net loss (BAGs). ESO2 places priority on offsets within Knox, preferably on the same site as the vegetation removal. I believe that the offsetting measures just described would provide genuine habitat compensation as well as providing ancillary benefits for amenity and stormwater management.
5. In accordance with ESO2, design work must have regard to Tree Protection Zones for all retained eucalypts. The most important tree to protect is the large, ancient Swamp Gum just north of the inlet channel to the dam (Section 4.3).
6. The design of the proposed development needs to be informed by ecological advice from a consultancy with expertise in waterbird ecology, wetland ecosystems and Water Sensitive Urban Design. The brief assessment in this report is only adequate to guide initial consideration of the site's ecological constraints and opportunities. *Rationale:* The nature of the site's environmental sensitivities and the appropriate design responses and offsetting lie outside the capacity and experience of most ecological consultants. Expert attention to these matters is required by the site's high ecological values.

## Appendix 1 – Plant Species List

The table below lists all the plant species found in the colour-coded zones of Figure 1.

Species whose names are in bold type are at substantial risk of becoming extinct in Knox, in the ‘endangered’ or ‘critically endangered’ categories. After each species’ name, the three columns represent the zones and the symbols indicating the species’ abundance as follows:

- Scarce, or so concentrated in one or two locations as to be at risk of being destroyed by chance;
- ✓ Present in moderate numbers, not dominant within a vegetation stratum;
- D Dominant (or sharing dominance) within the relevant vegetation stratum, at least in some areas;
- M Many individuals but with too little cover to be dominant in the relevant vegetation stratum.

### Wild Indigenous Plant Species

Scientific Name	Common Name	Abundance		
		In the dam water	Beside the dam	Along the drain
<u>Mosses and Liverworts</u>				
<i>Campylopus introflexus</i>	Heath Star Moss		✓	
<i>Chiloscyphus semiteres</i>	Green Worms		✓	
<u>Submerged aquatic species</u>				
<b><i>Glossostigma ?elatinoides</i></b>	<b>Small Mud-mat</b>	–		
<i>Potamogeton crispus</i>	Curly Pondweed	M		
<i>Potamogeton ochreateus</i>	Blunt Pondweed	D		
<b><i>Vallisneria australis</i></b>	<b>Eel Grass</b>	D		
<u>Trees</u>				
<i>Acacia dealbata</i>	Silver Wattle	–		–
<i>Acacia mearnsii</i>	Black Wattle	D		D
<i>Acacia melanoxylon</i>	Blackwood	D		
<i>Eucalyptus ovata</i>	Swamp Gum	D		
<u>Shrubs</u>				
<b><i>Acacia stricta</i></b>	<b>Hop Wattle</b>	–		
<i>Cassinia arcuata</i>	Drooping Cassinia	✓		✓
<i>Goodenia ovata</i>	Hop Goodenia	✓		
<b><i>Ozothamnus ferrugineus</i></b>	<b>Tree Everlasting</b>	–		
<i>Solanum ?laciniatum</i>	Large Kangaroo Apple	–		
<u>Grasses and Rushes</u>				
<i>Austrostipa rudis</i> subsp. <i>rudis</i>	Veined Spear-grass		M	
<i>Hemarthria uncinata</i>	Mat Grass		–	
<i>Juncus amabilis</i>	Hollow Rush	–	✓	✓
<i>Juncus gregiflorus</i>	Green Rush		M	✓
<i>Juncus sarophorus</i>	Broom Rush	–	D	✓
<i>Lachnagrostis filiformis</i>	Common Blown Grass		✓	
<i>Lomandra longifolia</i> subsp. <i>longifolia</i>			–	
	Spiny-headed Mat-rush			
<i>Microlaena stipoides</i>	Weeping Grass		✓	
<i>Rytidosperma fulvum</i>	Leafy Wallaby-grass		D	
<i>Rytidosperma laeve</i>	Smooth Wallaby-grass		✓	
<i>Rytidosperma penicillatum</i>	Slender Wallaby-grass		✓	
<b><i>Rytidosperma semiannulare</i></b>			–	
	<b>Tasmanian Wallaby-grass</b>			
<i>Rytidosperma setaceum</i>	Bristly Wallaby-grass		✓	

Scientific Name	Common Name	Abundance		
		In the dam water	Beside the dam	Along the drain
<i>Themeda triandra</i>	Kangaroo Grass		-	
<i>Typha ?domingensis</i>	<b>Cumbungi</b>	-		
<b>Others</b>				
<i>Alternanthera denticulata</i>	Lesser Joyweed		-	
<i>Epilobium hirtigerum</i>	Hairy Willow-herb		✓	
<i>Helichrysum luteoalbum</i>	Jersey cudweed		-	
<i>Lythrum hyssopifolia</i>	Small Loosestrife		✓	
<i>Persicaria decipiens</i>	Slender Knotweed		✓	
<i>Persicaria subsessilis</i>	Hairy Knotweed		✓	
<i>Senecio campylocarpus</i> *	Floodplain Groundsel		-	
<i>Senecio hispidulus</i>	Rough Fireweed		-	
<i>Senecio quadridentatus</i>	Cotton Fireweed		✓	

### Planted Specimen Plants

Scientific Name	Common Name	Abundance	
		Beside the dam	Along the drain
<i>Callistemon citrinus</i>	Crimson Bottlebrush	-	-
<i>Melaleuca styphelioides</i>	Prickly Paperbark		-
<i>Sannantha ?pluriflora</i>	Tall Baeckea	-	

### Wild Introduced Species

Scientific Name	Common Name	Abundance	
		Beside the dam	Along the drain
<i>Acacia baileyana</i>	Cootamundra Wattle		-
<i>Agrostis capillaris</i>	Brown-top Bent	M	M
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	✓	
<i>Aster subulatus</i>	Aster-weed	-	
<i>Bromus catharticus</i>	Prairie Grass	✓	✓
<i>Cenchrus clandestinus</i>	Kikuyu	D	D
<i>Centaureum erythraea</i>	Common Centaury	-	
<i>Cirsium vulgare</i>	Spear Thistle	✓	
<i>Crataegus monogyna</i>	Hawthorn	✓	
<i>Cynodon dactylon</i>	Couch	D	
<i>Cyperus eragrostis</i>	Drain Flat-sedge	✓	✓
<i>Dactylis glomerata</i>	Cocksfoot		✓
<i>Ehrharta erecta</i>	Panic Veldt-grass	D	✓
<i>Ehrharta longiflora</i>	Annual Veldt-grass	✓	
<i>Erica lusitanica</i>	Spanish Heath	-	
<i>Erigeron sumatrensis</i>	Fleabane	-	
<i>Fraxinus angustifolia</i>	Desert Ash	✓	✓
<i>Holcus lanatus</i>	Yorkshire Fog	✓	✓
<i>Hypochaeris radicata</i>	Cat's Ear	✓	

\* *Senecio campylocarpus* was first recognised as a distinct species in 2004 and was listed as rare throughout Victoria. Once described, it was found to be moderately common in parts of Victoria but the 'rare' listing remains.

Scientific Name	Common Name	Beside the dam	Along the drain
<i>Lotus subbiflorus</i>	Hairy Bird's-foot Trefoil	M	
<i>Lysimachia arvensis</i>	Pimpernel	✓	
<i>Malus pumila</i>	Domestic Apple	-	
<i>Malva</i> species, unidentified	a mallow	-	
<i>Modiola caroliniana</i>	Carolina Mallow	-	
<i>Paspalum dilatatum</i>	Paspalum	✓	✓
<i>Phalaris aquatica</i>	Toowoomba Canary-grass	✓	
<i>Pittosporum undulatum</i>	Sweet Pittosporum		-
<i>Plantago lanceolata</i>	Ribwort	✓	
<i>Prunella vulgaris</i>	Self-heal	-	
<i>Prunus cerasifera</i>	Cherry-plum	-	
? <i>Raphanus raphanistrum</i>	Wild Radish	✓	
<i>Rubus anglocandicans</i>	Blackberry	M	M
<i>Rumex crispus</i>	Curled Dock	✓	
<i>Salix</i> ?× <i>reichardtii</i>	Pussy Willow	-	
<i>Salix</i> species	a willow		✓
<i>Vulpia bromoides</i>	Squirrel-tail Fescue	✓	

## Appendix 2 – Fauna Species List

I observed the species below on or near the dam, either while walking past on 1/11/2008 or (in the case of those ticked) during three hours on 19/1/17. Such brief periods of observation cannot detect the full range of wildlife present. An asterisk at the start of a species' name indicates that the species is introduced.

<u>Common name</u>	<u>Scientific name</u>	
<b>Waterbirds</b>		
Blue-billed Duck	<i>Oxyura australis</i>	
Australian Wood Duck	<i>Chenonetta jubata</i>	✓
*Mallard	<i>Anas platyrhynchos</i>	✓
Pacific Black Duck	<i>Anas superciliosa</i>	✓
Grey Teal	<i>Anas gracilis</i>	✓
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	✓
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	✓
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	✓
Dusky Moorhen	<i>Gallinula tenebrosa</i>	✓
Eurasian Coot	<i>Fulica atra</i>	✓
<b>Other Birds</b>		
Masked Lapwing	<i>Vanellus miles</i>	
Silver Gull	<i>Larus novaehollandiae</i>	
*Spotted Turtle-Dove	<i>Streptopelia chinensis</i>	✓
Crested Pigeon	<i>Ocyphaps lophotes</i>	
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	✓
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	
Eastern Rosella	<i>Platycercus eximius</i>	
Tawny Frogmouth	<i>Podargus strigoides</i>	
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	
Spotted Pardalote	<i>Pardalotus punctatus</i>	✓
Red Wattlebird	<i>Anthochaera carunculata</i>	
Little Wattlebird	<i>Anthochaera chrysoptera</i>	
Bell Miner	<i>Manorina melanophrys</i>	
Noisy Miner	<i>Manorina melanocephala</i>	✓
Magpie-lark	<i>Grallina cyanoleuca</i>	✓
Willie Wagtail	<i>Rhipidura leucophrys</i>	✓
Australian Magpie	<i>Gymnorhina tibicen</i>	✓
Little Raven	<i>Corvus mellori</i>	
Mistletoebird	<i>Dicaeum hirundinaceum</i>	
Welcome Swallow	<i>Hirundo neoxena</i>	✓
*Common Blackbird	<i>Turdus merula</i>	✓
*Common Starling	<i>Sturnus vulgaris</i>	
*Common Myna	<i>Acridotheres tristis</i>	✓
<b>Other Vertebrates</b>		
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	
Spotted Marsh Frog	<i>Limnodynastes tasmaniensis</i>	✓
*?Redfin	<i>?Perca fluviatilis</i>	✓
<b>Butterflies</b>		
Greenish Grass-dart	<i>Ocybadistes walkeri sothis</i>	
Caper White	<i>Belenois java teutonia</i>	
*Cabbage White	<i>Pieris rapae rapae</i>	✓
Meadow Argus	<i>Junonia villida calybe</i>	✓
Common Grass-blue	<i>Zizina labradus labradus</i>	✓