



STEP Inc

Community-based Environmental Conservation since 1978

9 November 2023

General Manager
Hornsby Shire Council
PO Box 37 Hornsby
NSW 1630

devmail@hornsby.nsw.gov.au

Dear Mayor, Councillors and General Manager

APPLICATION NO: DA/975/2023

Westleigh Park Development Application

Notice of Designated Development and Integrated Development Proposal

STEP Inc is a local community-based environmental group, with a membership of over 550 in the Hornsby/Ku-ring-gai area. Our main objective is to preserve natural bushland in northern Sydney from alienation or degradation and ensure proper management of this bushland including ensuring its role as habitat for animal species. Our group has considerable experience and expertise in environmental issues and regenerating and preserving natural bushland and native vegetation.

Summary

STEP is not satisfied that DA/975/2023 is complete and ready for assessment by the planning panel.

STEP considers that the DA must not be approved with:

- Significant and Irreversible Impacts
- synthetic turf included in the plans
- the mountain bike trails (MTB) trails included in the plans.

STEP also recommends that the DA be refused until:

- an independent assessment of ecological process in the potential Duffys Forest Endangered Ecological Community is completed and exhibited with a view to determining whether the site contains Duffys Forest Endangered Ecological Community.
- an assessment of edge effects, including recreational use, with recommendations for mitigation of impacts, has been completed and exhibited for comment.

- the impact on ecological connections is properly examined and recommendations for the mitigation of impacts, has been completed and exhibited for comment.
- the Vegetation Management Plan is up to industry standards and exhibited for comment.
- a report on the effect of operational anthropogenic noise on wildlife and recommendations for mitigation is completed and exhibited for comment.
- a Fauna Assessment Report and Fauna Management Plan is exhibited for comment.
- A report on the impact of development and landscaping on the urban bird assemblage (Noisy Miners, Rainbow Lorikeets etc) and mechanisms to mitigate their impact on surrounding bushland, particularly the critically endangered STIF, is completed and exhibited for comment.
- a professional ornithologist (preferably associated with the Powerful Owl Project) assesses and publicly reports on the land and the DA to ensure that all the requirements of Powerful Owls are maintained on the subject land.

1. Significant and Irreversible Impacts (SAII)

STEP strongly opposes aspects of the DA that will cause SAII along the shared pathway on Quarter Sessions Road, the Sefton Road extension and along MTB trails.

We are appalled by the SAII proposed by the construction of a shared footpath along Quarter Sessions Road. This path would require the removal of twenty-seven (27) trees, being one (1) tree of long S.U.L.E (Safe Useful Life Expectancy), twenty-one (21) trees of medium S.U.L.E, four (4) trees of short S.U.L.E and one (1) tree of very short S.U.L.E (remove). Removal of trees in this area will simply cause the effects of edge disturbance (wind, humidity and temperature alteration and changes to biodiversity, intrusion of weeds, noise, litter, rubbish from people) to move further into this tiny remnant and cause further degradation of the critically endangered Sydney Turpentine Ironbark Forest (STIF). The fact that the STIF along the edge of quarter Sessions Road is currently rated as disturbed or weedy in no way justifies further impacts. It was initial clearing of the bushland and the subsequent creation of an edge that has degraded the current edge. STEP therefore opposes the shared pathway on the eastern side of Quarter Sessions Road. An alternative must be found.

We are also very concerned about the SAII for the development of the new road from Sefton Road and considers that the proposed road needs to be rerouted.

All SAII in other areas must also be eliminated.

STEP recommends the refusal of this DA until the potential SAII is eliminated.

2. Synthetic turf

STEP remains opposed to synthetic turf due to the high surface temperature in summer, the potential to produce toxic fumes in a bushfire, the impenetrable surface and habitat loss. The release of plastics and fill into the surrounds and water ways cannot be fully captured by the drainage system as the particles are fine enough to be blown by the wind. This impact worsens as the field ages. The stability of cork infill has not been proven in heavy rain events.

Analysis is not provided of the full life cycle cost of installation and maintenance of synthetic turf in comparison with natural grass. There is no functioning system for recycling the synthetic turf in Australia so the cost is not known. The SportEng Synthetic Turf advice claims that Council can send the synthetic grass to Australia's first synthetic recycling plant

(re4ormrecycling) in Mildura at its end of life. This proposed plant is actually in Barnawartha, close to Albury, and is not operating yet and will take some time to develop any economies of scale.

The ESD report (pp10-11) recommends that water is sprayed on the synthetic turf field to mitigate the heat on hot days. There is no analysis of how much water would be required, how much run-off would occur, how it would be collected and the impact of a wet field on player safety. Water spraying is used on hockey fields but they have shorter grass blades that do not require infill.

The Chief Scientist's *Synthetic Turf Study in Public Open Spaces* made many recommendations of further research that is needed to properly understand the impacts and risks of using synthetic turf. In particular, the report states that the research available to date indicates that risk assessments should be undertaken in areas of high environmental risk including bushfire prone areas.

Many community groups, including the Total Environment Centre and Natural Turf Alliance, are calling for a moratorium on approval of synthetic turf installations until Guidelines are released by the Department of Planning.

The DA must not be approved with synthetic turf included in the plans.

3. Ecologically Sustainable Development

The EIS (p358) states that:

The application of the precautionary principle requires an assessment of whether a development will have a threat of serious and irreversible damage and if such a threat exists, scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation.

The precautionary principle must be applied. The proposals to use synthetic turf and developments that are expected to cause SAI discussed earlier must not be approved.

4. Mountain Bike Trails

STEP continues to oppose the development of the mountain bike trail network as:

- Bushland should not be considered as an adventure park
- The trails will cause environmental damage (Appendix 1)
- Switch back design maximises the edge zone, making habitat between the **zigzags** unusable by many organisms, **such as birds and reptiles**, and prevents small organisms crossing
- The trail network gives almost exclusive access to the bushland for a small group of people and denies access to the majority of recreational users, walkers.

The 'Trail plan overview map' on exhibition does not include the linkage to Hornsby but these proposed linkages are shown in Figure 17: 'Indirect impact zones across the development footprint' as 'operational indirect impacts' in the BDAR. Which is true? Are the design and impact of these linkages included in the DA?

Insufficient detail has been provided on surface materials on specific trails.

We are very concerned about the statement “no established trees with a trunk diameter of **200mm** or greater to be cleared without prior consent from Council” p8. This is contrary to the Council's Trees on Private Property policy:

“You can remove a tree that is less than three (3) metres in height;

- If it does not have the potential to achieve a height greater than three (3) metres at maturity
- It is not located within native bushland
- It is less than 150mm in diameter when measured at the base”

<https://www.hornsby.nsw.gov.au/environment/flora-and-fauna/trees/trees-on-my-property>

STEP therefore recommends that the DA is not approved with the inclusion of the MTB trails.

5. Duffys Forest Endangered Ecological Community

STEP has serious concerns about the statement on p27 of the BDAR:

“The patches of PCT 1845 in the subject land did not meet the definition of Duffys Forest TEC due to anomalies in the geographic distribution and lack of diagnostic floristic species throughout the patch.”

STEP does not consider that the extension of geographic distribution should be a factor in the decision. Discoveries of range extensions occur in ecology all the time.

We are also very concerned about its reclassification due to the small number of diagnostic species (6) recorded. This simplistic conclusion, even though the soils and topographic location are correct, ignores the effect of fragmentation, fire regime and soil seed storage on floristic composition. STEP has raised the issue of local extinctions in a previous submission due to fragmentation (Appendix 1). The importance of the soil seed bank has been long been established in scientific research and ecological restoration, for example Auld, 1996, Auld, et al. 2000, Thomas 2003, and Standards Reference Group SERA, 2021. The ability to store seed in the soil, while not being present in the above ground flora, means that quadrat and transect sampling only assesses part of the in-situ flora.

STEP considers that the dynamic processes intrinsic in the PCT have been ignored as well as the effects of fragmentation. An assessment a few years ago or post fire may have given a different result. Assessment at a single moment in time is not sufficient in a community like this. Narrow reliance on the rigid science of lists rather than processes will lead to more and more threatened communities being downgraded or delisted.

STEP recommends that the DA be rejected until an independent assessment that considers ecological process in the potential Duffys Forest Endangered Ecological Community is completed and therefore an assessment of whether the site contains Duffys Forest Endangered Ecological Community.

6. Edge effects

The BDAR structure allows some of the main ecological effects of ecosystem disturbance and edge effects to be ignored. STEP has previously raised these issues in a submission (Appendix 1) but they have not been considered in any report for this development.

The authors of the BDAR are seemingly comfortable with new disturbances to vegetation in poor condition on edges but fail to understand that new disturbances and new edges, such as that proposed along Quarter Sessions Road, will in turn create new edge effects and exacerbate degradation **into** existing healthy ecosystems along the new edge.

The microclimate, for example increased wind speed, air and soil temperature, decreased humidity, drier soils, higher abundance of pathogenic microbes and lower abundance of symbiotic fungi occur along any new edge, sometimes as far as 100 m from the edge, and this has a cascading effect on vegetation and hence fauna diversity. (Appendix 1). The overall functioning of the ecosystem is damaged with potentially serious affects, especially to Critically Endangered Ecological Communities such as the Sydney Turpentine Ironbark Forest.

Additional references to those in Appendix 1 are provided at the end of this submission.

STEP is not satisfied that the impact of recreational use, from the circling shared paths and from the pedestrian and MTB trails has been adequately dealt with. Recreational impacts include direct habitat degradation, changes in fauna composition, behaviour and physiology. Road, path, and mountain bike edges will be deleteriously affected by edge effects. These proposed new edges must be prevented or at the very least reduced by landscape and ecological restoration techniques that will reduce this degradation.

STEP recommends that the DA be rejected until an assessment of edge effects of recreational use with recommendations for mitigation of impacts, has been completed.

7. Damage to ecological connections

Interruptions to pollination systems, damage to mycorrhiza symbiosis and other ecological connections is highly probably with new edges and new mountain bike trails. This issue was raised by STEP in a previous submission (Appendix 1) but these serious impacts have not been dealt with in the BDAR or any other report.

STEP seriously questions the statement in the BDAR:

“This [The proposed removal of 0.80 ha of PCT 1281 within the development footprint would not result in further fragmentation of vegetation, as a majority of the impacts are located on the edge of cleared land, or along existing mountain bike trails] would not impact the ability of any fauna currently dispersing seed to continue to disperse seed across the subject land.” P155

There is no evidence that the impact along mountain biking trails has not and will not affect the dispersal of seed across the land, particularly with the prominence of myrmecochory in Australia, for example Lengyel et al (2010).

This unsubstantiated statement has been carried through to the EIS, p210-211.

STEP recommends the deletion of this unsubstantiated statement in both reports.

STEP recommends the refusal of this DA until the impact on ecological connections is properly examined and recommendations made to mitigate the effects.

8. Vegetation Management Plan (VMP)

STEP was shocked by the poor standard of this very generalised report. It must be comprehensively revised before it is a useful document. Examples of below industry standard work include the following.

Poorly researched

There is no evidence that either the ‘National Standards for the Practice of Ecological Restoration in Australia Edition 2.2’. (Standards Reference Group SERA, 2021) or the ‘Best practice guidelines Sydney Turpentine–Ironbark Forest’ (Department of Environment and Climate Change NSW, 2008) has been consulted.

Missing elements

Crucial elements appear to be missing. Any VMP must address the unique requirements:

- of the critically endangered Sydney Turpentine Ironbark Forest
- of the proposed wetlands and their interface with the critically endangered Sydney Turpentine Ironbark Forest
- methodology to restore the decommissioned MTB trails.
- Prioritisation of management zones based on biodiversity values and condition and consider vegetation communities, fauna and flora presence, proposed impacts and mitigation measures (Operation Plan p19).

Cut and paste

Many sections appear to have been derived from previous reports, for example:

“Revegetation has the dual aim of both re-establishing the original native vegetation community at the subject site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due the increased run-off from the hard surfaces created by the associated residential development.” P51

There is no riparian zone or residential development in the DA.

Out of date

The work is not up to date and includes references such as Brodie 1999 but fails to include the National Standards for the Practice of Ecological Restoration in Australia, Edition 2.2 (Standards Reference Group SERA 2021). This has resulted in both terminology and techniques being out of date. For example, ‘assisted regeneration’ (now facilitated regeneration) mentioned on p16 does not align with the industry meaning of the term.

Generalised and lacking depth of knowledge and understanding of ecological restoration

The content is generalised, for example:

“Where required, mulch can be be (sic) laid to a depth up to 100mm. If appropriate, mulching may be considered throughout revegetation areas to aid in the suppression of exotic species germination and increase soil organic matter content to achieve better results”.p18

This does not consider the difference between the range of ecological restoration approaches, e.g. spontaneous regeneration, facilitated regeneration, combined regeneration/reintroduction and reconstruction. Mulching can be very damaging to vegetation management adjoining natural areas as it suppresses natural regeneration and adds an inappropriate amount of organic matter to the soil profile on breakdown, and consequently aids weed growth. If the

recommendation of this report is carried out it will simply result in landscaped areas adjoining bushland with no possibility of integration in the future.

The approaches listed on p1 are confusing and obscure, For example:

“Revegetate the subject site with native terrestrial and species using appropriate species” and

“Increase native vegetation cover through revegetation”.

Does this latter mean increase the area of cover of native species or the increase the density?

Why is only revegetation included but not facilitated natural regeneration or spontaneous regeneration?

Inappropriate planting list

The planting list (Appendix A of the VMP) is derived from the species list of the PCT and therefore contains inappropriate species, for example, *Allocasuarina diminuta* and *Petrophile sessilis* that do not occur in the area.

Inaccurate and inadequate referencing

Buchanan R.A. 2009 is the book titled ‘*Restoring Natural Areas in Australia*’ NOT ‘*Bush Regeneration, Recovering Australian Landscapes*’ (1989).

Rural Fire Service NSW. 2019. Planning for Bush Fire Protection is listed in references under Mortlock.

Harrison et al. is cited on p18 but is not listed in the references.

Photo monitoring

STEP failed to understand the description of the photo monitoring procedure.

Plant numbers and costings

We question both the number of plants required and the costing of the project until an industry standard VMP is produced.

Conclusion

It is STEP’s opinion that the DA cannot be considered for approval until a VMP up to industry standard is exhibited for comment.

9. Anthropogenic Noise

The impact of operational anthropogenic noise on wildlife have been ignored even though STEP has raised it in previous submissions (Appendix 1). Public Address systems, hooters, vehicle movement and other sources of anthropogenic noise must be assessed and recommendations to mitigate their impact on fauna made.

The DA must not be approved without an assessment of operational anthropogenic noise on wildlife and recommendations to reduce the impact.

10. Fauna Assessment Report and Management Plan

The targeted surveys for threatened species in the BDAR do not give a comprehensive assessment of fauna on site. A detailed fauna assessment of the current and potential fauna from all groups must be made, not just threatened species, so that baseline data of species, abundance, and distribution is established. This must be sufficiently detailed to enable accurate monitoring to take place.

In addition, a Fauna Management Plan is required to minimise impacts on fauna during the and bushland rehabilitation and prolonged construction process. Issues such as fencing that will not trap reptiles and limiting disturbance during the breeding season must be addressed. Second-generation pesticides must not be used due to deleterious impacts on native predators.

STEP supports the stipulation in the Operational Plan of Management that the walking and bike trails are open between sunrise and sunset.

STEP recommends that the DA be rejected until a Fauna Assessment Report and management Plan are exhibited for comment.

11. Artificial Light at Night (ALAN),

Obtrusive light, Light Spill

Light is a major edge effect with local lighting adding to night glow. The depth of scientific concern is demonstrated by a recent issue of Philosophical Transactions of the Royal Society B: Biological Sciences, 2023, devoted to the ecological impacts of ALAN.

Our main concern is the sporting field luminaires and their effect on all wildlife, including insects.

The use of adaptive control and motion sensing lights may be expensive, but they are essential for good management of the site.

The inclusion of a statement that encourages adaptive management to ensure continual improvement with the advent of new technology, research into impacts of light on wildlife in general, and research into local wildlife and ecosystems must be inserted.

12. Directives in recommendations

STEP is concerned that many of the recommendations in environmental reports use the directive ‘should’ instead of ‘must’. ‘Should’ must be replaced by ‘must’, for example.

“The VMP area ~~should~~ [must] be fenced or similarly protected, consistent with the Remedial Action Plan following the completion of construction. VMP p13

“Wildlife friendly lighting (i.e. filtered yellow-green and amber LEDs wavelength of 590nm with light shield protection controlling light spill) ~~should~~ [must] be ~~considered~~ [installed] adjacent to retained bushland areas.” EIS p213

13. Landscape Plans

STEP would like to see the inclusion of more trees with greater canopy spread so there is more connectivity for shade and arboreal fauna. This is a simple strategy for reducing Powerful Owl ~~car~~ strikes by keeping possums and hence owls off the ground.

A separate report is needed to assess the impact of landscaping on the aggressive urban bird assemblage (Noisy Miners, Rainbow Lorikeets etc) and mechanisms to mitigate their impact on surrounding bushland, particularly the critically endangered STIF

STEP is concerned about the mulch depth, see our comments re the VMP. A depth of 75-100mm is acceptable in truly landscaped areas but 100mm depth in less accessible areas

probably includes some areas close to bushland, a depth that may exacerbate weed problems rather than reduce them in the long term.

14. Powerful Owls

STEP is concerned about the absence of legal requirement to allocate species credits to the threatened Powerful Owl as no suitable breeding trees were recorded within the development footprint or within 200 m of the development footprint even though Powerful Owls were recorded on the subject land and are known to breed along the Dog Pound Creek area. It is as if fauna only needs a breeding site but no access to food, shelter and roosting sites to breed and continue their existence.

15. Water Management

STEP could not find any reference to vegetation management of the proposed wetlands in either the VMP or the Water Management Report even though the landscape plans (part 1) state “wetlands and associated lines refer to VMP”. The DA must not be approved without appropriate detail, especially where the proposed wetlands abut the critically endangered STIF.

16. Impacts requiring credits

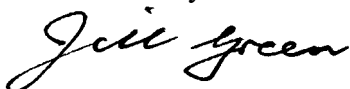
STEP opposes developments that require offsets. The native vegetation and threatened species of Hornsby Shire are too valuable to destroy. STEP strongly prefers that any credits are used on site or the very least in Hornsby Shire.

17. Reports still needed from ecologists and ornithologists

If this development is to cause minimal damage to existing ecosystems, then studies and recommendations must be commissioned and ecologically sound recommendations carried out. Specialised consultants that can assess beyond the BDAR requirements are needed.

- A Fauna Assessment Report
- Literature review of impacts of noise and vibration on fauna and recommendations to mitigate impacts from sporting fields and MTB trails
- An assessment of edge effect/zones and on all edges, paths and trails, particularly affecting the STIF and recommendations to mitigate impacts
- Assessment of MTB trails, especially the switch backs for the impact of all edge effects, including noise and disturbance and recommendations to mitigate impacts
- Assess the impact of development and landscaping on the urban bird assemblage (Noisy Miners, Rainbow Lorikeets etc) and mechanisms to mitigate their impact on surrounding bushland, particularly the critically endangered STIF
- A professional ornithologist (preferably associated with the Powerful Owl Project) to assess the land and the Development to ensure that all the requirements of Powerful Owls are maintained on the subject land.

Yours sincerely



Jill Green
President

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Appendix 1



STEP Inc

Community-based Environmental Conservation since 1978

11 April 2023

Hornsby Shire Council
PO Box 37 Hornsby
NSW 1630

Dear Mayor and Councillors

Westleigh Park – Revised Draft Master Plan

STEP Inc is a local community-based environmental group, with a membership of over 550 in the Hornsby/Ku-ring-gai area. Our main objective is to preserve natural bushland in northern Sydney from alienation or degradation and ensure proper management of this bushland including ensuring its role as habitat for animal species. Our group has considerable experience and expertise in environmental issues and regenerating and preserving natural bushland and native vegetation.

Westleigh Park is a unique area with three threatened ecological communities surrounding the proposed sports fields, Blue Gum Diatreme Forest, Duffys Forest and Sydney Turpentine-Ironbark Forest (STIF), as well as numerous endangered species. The bushland, in addition to the threatened ecological communities, is a tremendous asset for the community. Unfortunately, it has been allowed to become degraded. STEP considers that every effort should be made by Hornsby Council in this Master Plan to prevent further damaging impacts on the bushland as well as rehabilitating past damage.

Summary

The major points of our submission are listed below together with references to sections in the attached document where more details are provided, and questions asked (boxed sections):

1. STEP opposes the continuation of mountain bike trails and construction of new trails within the endangered ecological communities (EECs). This opposition is supported by numerous ecological studies that are described in **Section 1**.
2. Council's attitude towards the existing unsanctioned trails is weak. This following statement made on page 17 provides no justification for the continuing existence of these trails in the face of the threat to the continuing existence of the EECs (**Section 1**):

Council has expressed a desire to provide for a wide range of recreational opportunities at Westleigh Park and recognises, while currently unsanctioned at this site, mountain biking remains popular within the community.

Mountain biking is popular but the damage it does to EECs cannot be justified.

3. The continuation of existing trails and the addition of new ones does not conform with the 'avoid, minimise and mitigate, then offset hierarchy' of the Biodiversity Conservation

Act 2016. Under the draft Master Plan the majority of the EECs would come under the offset category. Satisfactory offsets are not available.

4. The Master Plan provides no information about how Council will institute the process of rehabilitating the weed infested and damaged bushland. Council must close off access to the damaged bushland sections now before any more damage is done.
5. We note that land that was previously classified as STIF in the information provided with the 2021 draft Master Plan is now categorised as 'exotic'. Every effort should be made to restore this land to its original condition in the immediate future. The basic tree structure is still present; the understorey just needs to be restored.
6. The draft Master Plan intends to give the bushland over to a specialised sporting group and cut off opportunities for the majority of the community to appreciate and enjoy it.
7. The link track is unacceptable due to the risks it will generate for the Blue Gum Diatreme Forest (**Section 2**)

Further miscellaneous points are made in **Section 3**.|

Conclusion

STEPs major concern is the threat to the EECs at Westleigh Park. To ignore the complexity of ecological linkages and processes for a development of this type in a large, robust ecological community rated as of 'least concern' may be acceptable but not for an EEC and certainly not for a Critically Endangered EEC, by definition, at risk of collapse.

The precautionary principle, 'lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment, where there are threats of serious or irreversible environmental damage' (Department of Agriculture, Water and the Environment, 2019) should have been applied when the site was purchased and the mountain bike tracks through STIF and Duffys Forest closed. They should certainly be closed now. Mitigation is not sufficient, avoidance by closing the tracks is needed.

Council must plan for decades and centuries to come to prevent ecosystem collapse, not just for the perceived immediate needs of the community.

It may be possible to renegotiate funding for mountain bike tracks in another location, but it is not possible to renegotiate the collapse of ecosystems.

Yours sincerely



Jill Green

President

Research which Underpins our Comments

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STEP opposes the presence of mountain bike tracks in the Sydney Turpentine-Ironbark Forest (STIF) and Duffys Forest. We believe that Council has neither applied the precautionary principle (Department of Agriculture, Water and the Environment, 2019) nor applied the Offsets Mitigation Hierarchy (Department of Climate Change, Energy, the Environment and Water. 2023) to firstly avoid damage to the Duffys Forest and STIF, but rather has moved straight to ‘mitigate’ (partially) and ‘offset’ (mostly).

No one in the STEP committee is an accredited assessor under 6.10 of the BC Act (Department of Planning, Industry and Environment, 2019) but we are seriously concerned about the possibility of a serious and irreversible impact on the Duffys Forest Endangered Ecological Community and the Sydney Turpentine-Ironbark Forest Critically Endangered Ecological Community.

Definition of threatened ecological communities and species

The definition of a Threatened Ecological Community according to the Department of Climate Change, Energy, the Environment and Water (threatened ecological communities) is:

An ecological community is a naturally occurring group of native plants, animals and other organisms that are **interacting** in a unique habitat. Its structure, composition and distribution are determined by environmental factors such as soil type, position in the landscape, altitude, climate and water availability.

The native plants and animals within an ecological community have **different roles and relationships that, together, contribute to the healthy functioning of the environment**. [Our emphasis]

The definition of biodiversity is also essential to any discussion on threatened ecological communities:

Biodiversity is the variety of all life forms on earth - the different plants, animals and micro-organisms and the **ecosystems of which they are a part**. [Our emphasis]
(Department of Climate Change, Energy, the Environment and Water, 2023)

STEP considers that the description of threatened communities in NSW has been downgraded from the requirements of the International Union for the Conservation of Nature (IUCN) to include 'salient processes and interactions' (Rodríguez et al, 2015). Final determinations by the NSW Threatened Species Scientific Committee (e.g. that for STIF) and assessments of biodiversity generally include only lists of flora and fauna, without the different roles and relationships that contribute to the healthy functioning of the environment (Department of Climate Change, Energy, the Environment and Water, threatened ecological communities) being considered.

As this is the case, STEP does not believe that an assessment of the impact of the current and proposed mountain bike tracks can be made on the Critically Endangered STIF and the Endangered Duffys Forest Ecological Community.

STEP would like to remind Hornsby's planners that a critically endangered ecosystem is one step from collapse. In **Appendix 1** there is more detail on the implications of ecosystem collapse.

STEP is not contemplating the collapse of all STIF or Duffys Forest in NSW, but we do consider that collapse is possible on the Westleigh site due to the lack of analysis of basic processes. We have no doubt that Council can maintain forested ecosystems, but we are less sure that they will have the characteristics of STIF or Duffys Forest in the years to come. Council must plan for decades and centuries to come to prevent ecosystem collapse.

Keith et al (2013) identifies four distributional and functional symptoms of ecosystem collapse of which risk (C) rates of environmental (abiotic) degradation; and (D) rates of disruption to biotic processes are the most applicable to Westleigh Park.

We would like to highlight, with examples, some of the complex interactions that Council and consultants should have considered. Unfortunately, we have had to work with the original flora report (Natural Resources, 2016) as none other was available to us. These are:

- A. ecological connections
- B. edge effects and fragmentation
- C. impact of bikes versus walkers
- D. artificial light
- E. anthropogenic noise

A. Ecological connections

Example 1 Orchid pollination

We have assumed that all the recorded orchids could be in STIF or Duffys Forest as many were not allocated a community in the report, and many have been recorded at different sites in STIF, e.g. Sydney Olympic Park, 2021. Sadly, in 2023 no definite pollinator was known for *Lyperanthus*.

To conserve the assemblage of 12 orchid species on site (**Appendix 2**) a large array of insect pollinators is needed: flies (e.g. fungus gnats), native bees (e.g. *Lasioglossum*, *Exoneura*, *Tetragonula* and *Trichocolletes*), wasps (e.g. *Thynnine* spp, Orchid Dupe Wasp) and ants (e.g. *Iridomyrmex*). Favourable environmental conditions are needed throughout the life cycle of these insects. For example, soils with appropriate texture, structure, depth, organic matter and leaf litter must be present not just for the orchid but for nests and food items for *Thynnine* wasps, *Iridomyrmex* ants, fungus gnats, *Lasioglossum* bees and *Trichocolletes* bees. Pithy stems need to be present for the *Exoneura* bee and hollow trunks for the *Tetragonula* bee. Flowering plants of the Fabaceae must be present to sustain *Trichocolletes venustus*, the pollinator of *Diuris* spp (see **Appendix 2**).

Are the Orchidaceae currently setting seed? Have any of these linkages been examined when designing the new mountain bike trails? Do the new trails damage soils essential for these orchids and their pollinators?

Example 2 Pollination of other plants

The positive diagnostic species for STIF (NSW Catchment Management Authority, 2013) have a range of pollination mechanisms. The grasses are wind pollinated but most of the diagnostic species have a complex of pollination mechanism.

The Eucalypts (including *Syncarpia* and *Angophora*) are visited by a wide suite of pollinators but flying-foxes are particularly important pollinators as they can transport pollen large distances and increase out-crossing (Sydney Bats, 2011). The most common flying fox, the Grey-headed Flying-fox, is now listed as Vulnerable and this ecosystem service may be threatened (NSW Office of Environment and Heritage, 2020).

Two small shrubs in STIF and Duffys Forest pollinated by birds and mammals are *Banksia spinulosa* and *Lambertia formosa*. *L. formosa* is reported as being pollinated by birds (Australian Botanic Gardens) but one study of *B. spinulosa* breeding found that sugar gliders, brown antechinus, eastern pygmy possum and the eastern spinebill were principal pollinators (Carthey, 1991). Even though only one of these pollinators is diurnal and hence active while the mountain bikers are active, they will all have their habitat (e.g. dense shrubs, nest building material, quiet) disturbed/reduced by bikers, particularly where tracks are dense and popular. Pollination may well be reduced due to habitat reduction by disturbance.

Many of the understory shrubs are insect pollinated and full consideration of the insect's habitat requirements needs to be undertaken to ensure that viable populations of insects are maintained. One of the positive diagnostic species, *Leucopogon juniperinus*, appears to self-pollinate frequently before the flower opens (Smith-White, 1955) and little consideration needs to be given to pollinators.

After studying plant-pollinator networks in Australian urban bushland remnants and residential areas Prendergast and Ollerton (2021) stated that:

The potential to disrupt the interactions between pollinators such as bees and the flowering plants that they visit. ... may cause cascading local extinctions and have consequences for pollination services.

Are local extinctions happening at Westleigh Park due to poor pollination? Are shrubs setting seeds now? Were the pollinators and the life cycle requirements of the pollinators considered when designing the mountain bike tracks?

Example 3 Mycorrhizas

According to the Australian National Herbarium (2013) between 80 and 90% of plants form mycorrhizas. These associations are vital for plant health.

Research on mycorrhizas has been undertaken for decades but research in this complex area is continuing. For example, Orchids such as *Dipodium* are directly parasitic on the associated fungi as they lack chlorophyll. Boddington et al (2016) found that the roots of two species of *Dipodium* are largely colonised by members of the ectomycorrhizal basidiomycete family, the Russulaceae. They state that the fact that these plants consistently grew close to the base of Eucalyptus and Callitris trees suggested that the orchids acquire carbon and minerals from the tree host via an ectomycorrhizal connection.

Research in 2022 into five Australian *Cryptostylis* species demonstrated that Tulasnellaceae formed the main fungal associations of the *Cryptostylis* species with each species of Australian *Cryptostylis* associated with three to seven Tulasnella Operational Taxonomic Units except for *C. hunteriana*. Some ectomycorrhizal, ericoid and saprotrophic fungi were detected infrequently (Arifin et al, 2022).

Soil compaction can damage and kill mycorrhizas (Wisconsin Pollinators) as can very high temperatures.

Was the importance and complexities of fungal diversity and spore dispersal considered before track design?

B. Edge effects and fragmentation

STEP could find no evidence that Council has considered the effect fragmentation will have on the long-term survival of the STIF or Duffys Forest at Westleigh Park; fragmentation from other forest ecosystems (isolation), reduction in the area of the community (habitat loss) and internal fragmentation.

When a forest is fragmented, microclimatic conditions change at the edge zone, e.g. reduction in humidity, greater temperature variability, increased light penetration and wind disturbance (Guimarães et al, 2014), increased noise, pollution, human recreation and roadkill (Aspelin, 2018). Even edges of roads and trails can result in microclimatic changes that affect the types of vegetation that can grow there, changes in suitability for species, and the intrusion of edge-tolerant species that are often generalist predators and exotic species that outcompete native species and habitat specialists (Aspelin, 2018). Results of studies from a variety of locations and ecosystem types show that edge-effect interactions can have significant consequences for ecosystems and conservation, including higher tree mortality rates, reduced bird densities in, and bush encroachment and reduced wildlife densities (Porensky and Young, 2013). Edge effects can be measured so far into forests, for example a difference of 0.3°C 100 m from the edge (Hofmeister et al, 2019), that these edges should be considered altered zones.

A meta-analysis of the effects of fragmentation on herbivorous insects (Guimarães et al, 2014) clearly showed that edges exhibited strong effects on plant herbivory rates, as edge plants exhibited 70% more damage than interior plants. Edges also increased herbivore abundance by 14% and herbivore richness by almost 65%. Effects of edge formation were particularly obvious for Lepidoptera (mainly caterpillars) and Orthoptera. They considered that higher herbivory rates on edge habitats have the potential to alter community composition and should be studied in detail to unravel their effects on ecosystem functioning.

Guimarães et al (2014) also quote research that, in general, shows that leaves in high light environments tend to be tougher, smaller, and have higher concentrations of phenols compared with shaded leaves. These factors may all directly impact herbivore feeding as increased consumption rates in plants of low nutritional quality are explained by herbivores tending to compensate for low food quality by increasing food consumption.

The edge zone of the STIF bordering the paths and roads of the sporting area appears to be the most vulnerable edge. It is currently partly protected by weeds and 'grassland' but the proposed design shows the STIF abutting a 2.5 m wide shared path (presumably glary, HOT concrete) with adjacent car parks and pedestrian paths. As this is a western facing contact, heat, wind, light (both natural and artificial), reduced humidity and noise will penetrate deep into the STIF if not right across it as it is only approximately 100 m wide.



Has Hornsby Council considered the edge zone of the STIF bordering the paths and roads of the sporting area and provided a sufficient buffer zone to prevent ecological damage?

In a global review of habitat fragmentation Aguilar et al (2019) found that fragmentation, separately from edge effects, reduces plant progeny quality. They found that progeny from fragmented habitats showed overall genetic erosion in contrast with progeny in continuous habitats, with the exception of plants pollinated by vertebrates. They found that plant progeny in fragmented habitats showed reduced germination, survival and growth. Habitat fragmentation had stronger negative effects on the progeny vigour of outcrossing- than mixed-mating plant species, except for vertebrate-pollinated species. They observed increased inbreeding coefficients due to fragmentation correlated negatively with progeny vigour. They concluded that:

Our findings reveal a gloomy future for angiosperms remaining in fragmented habitats as fewer sired progeny of lower quality may decrease recruitment of plant populations, thereby increasing their probability of extinction.

Has Council considered the possible effect of inbreeding on these Threatened Ecological Communities?
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Internal fragmentation is currently a problem in Westleigh Park and will continue to be so with design of the new bike track network. Internal fragmentation carries with it all the problems of microclimate alterations and biological alterations that fragmentation does but perhaps to a lesser degree. Other factors may be increased, such as scaring the wildlife and endangering fauna's essential functions in the ecosystem. STEP has summarised the effect of internal fragmentation on fauna in a previous submission (March 2022) from information in California Fish and Wildlife Journal, 2020:

- direct habitat degradation
- detrimental changes in behaviour, reproduction, growth, immune system function, levels of stress hormones and finally the survival of the individual animals, populations and fauna communities
- the increased time and energy spent by wildlife on flight, flushing and vigilance to the detriment of other beneficial behaviours
- changes to wildlife composition and species richness with recreational impacts
- harassment by recreational users
- the alteration of diel (24 hour) behaviour to avoid recreationists
- carrying capacity for different fauna groups (e.g. insects, amphibians, reptiles, birds, mammals) when recreation impacts on their habitat
- edge effects along trails, zones that can stretch up to 100 m from trails and make these edges unsuitable for some birds and butterflies
- the effect of night riding on fauna
- the difference in fauna responses to bikes compared to walkers (e.g. flushing for greater distances)

One could argue forever about whether mountain bikers or walkers have a greater impact on fauna. Walkers have a long impact due their slow speed but mountain bikers startle fauna more easily. It is difficult to reach a more specific generalisation on which activity has the most severe effect as studies are on different ecosystems, on different species, different seasons of the year and with different research methodologies (Grapentin et al, 2018). What is clear from studies is that recreation causes disturbance to wildlife. In an endangered community and a critically endangered community this disturbance must be minimised, or ecosystem process will be disrupted, and ecosystem collapse may ensure.



Has Hornsby Council considered the effect of the two hubs on internal fragmentation in STIF and Duffys Forest on the future of the forest?

Switch back design maximises the edge zone, making habitat between them unusable by many organisms and prevent small organisms crossing.



Has Hornsby Council considered the density of tracks at the switchbacks on fragmentation?

The long-term effect of separation from other forest ecosystems, habitat loss and internal fragmentation is hard to ascertain but concepts such as time delayed extinction and extinction debt are particularly worrying when considering these two ecosystems.

Krauss et al (2010) review a wide range of research and consider that extinction processes often occur with a time delay and populations living close to their extinction threshold might survive for long time periods before they go extinct, the 'extinction debt'. They conclude that in present-day fragmented and perturbed landscapes, populations of many species might be on a path to extinction even without any further habitat loss occurring. Semper-Pascual et al (2021) consider that this time delay potentially provides a window of opportunity for conservation to avert extinctions, as species may persist in fragmented landscapes for years.

Put simply, long-lived species (both flora and fauna) may be recorded as present for years but fail to reproduce and hence go extinct. This could apply to large species that provide the structure of the forest or down to the smallest orchid. If the pollinator or germination requirements are missing, or predation is excessive, local extinction is assured. If insects and other fauna continue to suffer detrimental changes in behaviour, reproduction, growth, immune system function, levels of stress hormones due to recreational activity their local extinction is certain, and consequently their ecosystem roles go missing.

If proper ecosystem analyses are done, this gives time to overcome extinction issues but if only lists are compiled, then crucial missing environmental factors linkages and interactions may be overlooked.

Has Hornsby Council considered that these patches of STIF and Duffys may already be suffering from delayed extinction?

STEP was not able to consider the impact of track construction as no specifications were given.

How wide are the tracks? Are they raised or at ground level? Armoured or FRP, other materials? What bike speed is envisaged and hence what will be the impact on wildlife? Will drainage be disrupted? Will dispersal of small organisms such small lizards be disrupted?

Threatened species have received scant attention in the document. Threatened plants are too often treated as stationary objects.

Is there room for threatened plants to disperse by seed or vegetative mechanisms or are they cut-off by tracks?

C. Artificial light

By law, the declaration of a threatened ecological community uses a very bottom-up model of ecosystem control as it requires the description of geology, soils, position etc. Equally important is the top-down view of ecosystems where predation mainly controls the community organisation because predators limit herbivores, herbivores limit plants and plants limit nutrient levels through nutrient uptake (Reece et al, 2012).

Bottom-up model control

Nutrient → Plants → Herbivore → Predator

Top-down control

Predator → Herbivore → Plant → Nutrient

At Westleigh Park some of the top predators are diurnal, for example Kookaburra, Pacific Baza and the Vulnerable Square-tailed Kite but the apex predators are the nocturnal Powerful Owl and Barking Owl. Therefore, apart from being listed as vulnerable and looking cute, Powerful Owls and Barking Owls are essential ecosystem controls, and their presence helps ensure healthy ecosystems.

STEP therefore strongly opposes night riding and supports the strict implementation of standard that reduce the impacts of lighting on plants, wildlife and ecosystems by applying strict standards.

Sadly, native marsupial predators are probably long gone, and we presume that the Spotted-tail Quoll is no longer present in the area. Unfortunately, we did not have access to the new fauna studies.

Has Council considered the effect of artificial light on pathways, roads, sporting fields and other facilities on ecosystem functions and fauna?

D. Anthropogenic noise pollution

To quote from the Powerful Owl Coalition submission in 2021 concerning Westleigh Park:

As long ago as 2010 (Blickley and Patricelli, 2010) it was recognised that noise can impact wildlife species at the individual and population level. Effects include damage to hearing, the masking of sounds important for survival and reproduction, chronic stress, startling, interference with mating and hence population declines. Shannon (2015) discussed the decline in bird diversity and abundance in noisy environments, as well as alteration in the timing and the pitch of calls. Parris and McCauley (2016) state that animals are altering their natural behaviours or relocating to avoid noisy areas and changes in animal behaviour can have a flow on effects for whole ecosystems.

Sports fields are a well know source of noise pollution (Schaudinischky and Schwartz, 1972). The noise produced is complex with noise from players, spectators, whistles, and announcements (White Noise Acoustics, 2020) as well as cars.

Many of the local nocturnal fauna become active at dusk and early dark, the exact time of evening sport activities. The adjacent Dog Pound/Larool Creek Powerful Owl pair become active at this time. During winter when it is dark from approximately 6pm to 6am, the first 4 hours of hunting will be affected by noise from the sporting fields (assuming lights out at 10 pm), 33% of their foraging time.

Noise mitigation protocols (White Noise Acoustics, 2020) will need to be in place, not just for the human neighbours but also for the Powerful Owls as listening for prey is a major hunting strategy (Mo et al, 2016). In an overseas study, for each dB increase in noise, the odds of an owl successfully capturing prey declined by 8% (Mason et al, 2016).

According to local Powerful Owl citizen scientists, mating calls are also prominent in the evening and difficulty locating each other may be a problem.

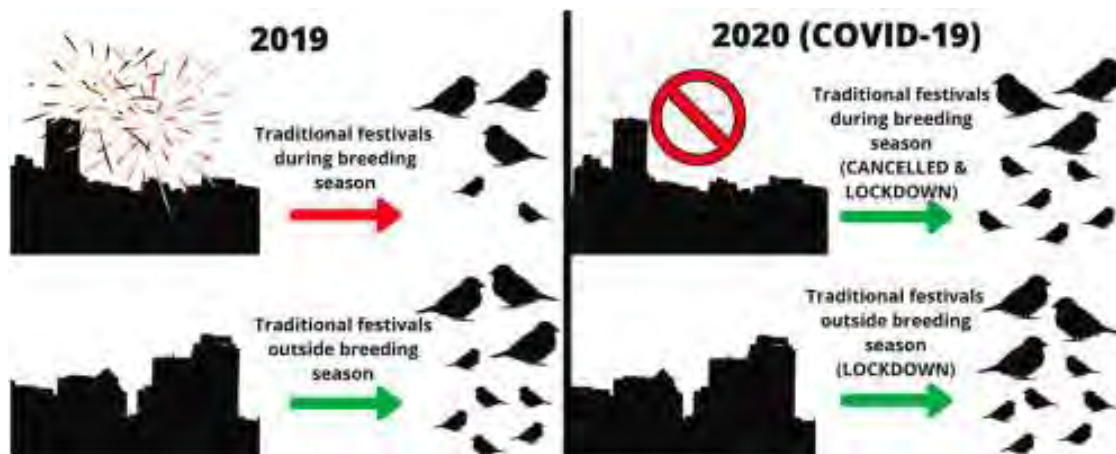
Recommendation – noise protocols, with a particular focus on the needs of Powerful Owls, must be developed and implemented.

We can now include the requirements of Barking Owls as well.

Continuing research, e.g. Klingbeil et al (2020) has shown that anthropogenic noise pollution is an important factor associated with breeding distributions of bird species in North America. Senzaki et al (2020) demonstrated that acoustically oriented birds have reduced species richness and abundance and different community compositions in experimentally noise-exposed areas relative to comparable quiet locations. They suggested that noise pollution not only affects

acoustically oriented animals, but that the effect of noise may continue through biological communities through indirect effects. Heggie-Gracie et al (2020) also found that increased native bird richness and abundance within fragments were primarily associated with less noise and lower neighbouring human density.

Bernat-Ponce et al (2021) provided a simple abstract of breeding success with and without the noise of human festivals on house sparrows. Festivals proved to have a deleterious impact on breeding success.



Has Hornsby Council considered the effect of anthropogenic noise from traffic, crowds, loudspeakers, whistles etc on the three threatened ecological communities, and on Powerful Owls? Have protocols been developed?

Section 2. BioBanking Site Containing Blue Gum Diatreme Forest

The Draft Master Plan states that the BioBanking site cannot be impacted by the proposals and other uses (page 9).

Has Hornsby Council considered the effect of noise and artificial light on the prime predators, particularly the Powerful Owls known to inhabit the BioBanking site?
Has Hornsby Council considered the effect of noise and artificial light on ecosystem functioning in the Blue Gum Diatreme Forest in BioBanking site?

Hornsby-Westleigh-connections



As part of its submission in May 2021 the Powerful Owl Coalition wrote:

POC acknowledges that much of the connection is on roads and currently used fire trails and most of the remainder will be on disused maintenance trails. We also acknowledge that these trails could be reopened, for short times, for maintenance work on the sewer main. We are however concerned about permanently reopening these maintenance trails for constant traffic of mountain bikes and pedestrians. Short term construction work and withdrawal will enable the Powerful Owls to recolonise the trails, but permanent opening and traffic will remove habitat forever, both by vegetation removal and by constant disturbance.

The Powerful Owl Coalition (2018) specifically highlights the importance of riparian areas: ‘maintaining suitable buffers by not designing walking tracks, bike ways and other facilities along riparian habitat and other core habitat areas to avoid noise and disturbance’.

The trail between Ginger Meggs Park and the creek marked ‘bridge across creek required’ is straight through riparian habitat.

Juvenile Powerful Owls and roosting owls have been recorded very close to the connection track.

Recommendation – The Hornsby-Westleigh Connection is not constructed. If the pressure is overwhelming from sporting groups, an alternate route from the end of Valley Road is preferable as it would cause less habitat damage.

In May 2021, STEP’s submission stated that:

In addition to the concerns expressed in the Powerful Owl submission we are concerned about the safety and enjoyment of walkers on the Blue Gum Walk at the Ginger Meggs end. The proposed connection shares several hundred metres with this extremely popular walk. The connection should not be built or rerouted through the end of Valley Road, avoiding conflict.

Along with the Powerful Owl Coalition, we still oppose the construction of the Hornsby-Westleigh Connections for the above reasons. We oppose the northern connection to the Dog Pound Creek fire trail at Westleigh as it is perilously close to the BioBanking site and is very steep. We oppose the southern connection to Wareemba Ave at Westleigh as it is ridiculously steep and would be extremely expensive to construct or very damaging to the ecosystem, or both. As these links are extension of mountain bike tracks, there is no use pretending that they will be usable by pedestrians (page 17), certainly not on weekends.

Section 3. Other Comments

1 Pedestrian and cycle access

In STEP's submission on the Hornsby Park Master Plan in May 2021 we stated that:

Bicycles and walkers do not mix well as bikes travel at many times the speed of walkers. Even on 'shared paths' the experience of our members, who both walk and cycle, shows that pedestrians are severely disadvantaged by cyclist's speed and behaviour. Cyclists often don't bother to warn walkers that they are approaching by voice or bell. Often walkers are engaged in conversation or are using earbuds and don't hear a cyclist.

We feel that Council has the ratio of bike and pedestrian trails incorrect as its own Active Living Strategy of 2015 showed 23% participation in walking as exercise and only 6.5% cycling. A 2021 GHD report commissioned by AusCycling estimates that participation in mountain biking nationally is estimated to be between 73,823 and 837,352, (0.29% and 3.25% of Australia's population respectively).

We are therefore very concerned about the tiny amount of pedestrian only access to the bushland. More people than bikes could enjoy the area even with greatly reduced track length, particularly the elimination of the switchbacks.

2 Sports fields

As a member of the Natural Turf Alliance, STEP opposes the use of a synthetic surface on the central platform. STEP would need to see a well-argued case for its use before we would support its installation.

3 Play space

STEP supports the development of a play space, but it does seem very small to accommodate the siblings of children playing sport. Would it be possible to manoeuvre some more space from the parking area?

4 Landscaping around the sports fields

Landscaping must be designed to buffer the STIF, protect the Powerful Owls from car strike and provide shade wherever suitable.

5 Fencing

Fencing is necessary around sporting fields to prevent balls entering bushland but fencing must be of a standard to prevent wildlife injury, for example trapping Swamp Wallabies and preventing bird collisions (WWF et al, 2008).

6 Environmental sustainability

STEP supports environmental sustainability and water sensitive urban design. We are particularly concerned about water sensitive urban design as the neighbouring creeks are a vital and integral part of ecosystem functioning and habitat preservation, particularly for Powerful Owls and the BioBanking site.

Page 25 of the Master Plan provides a broad-brush approach to sustainability. However, STEP would like to recommend a few additions (marked in bold):

The key sustainable design elements in the proposed development include bicycle racks to encourage active transport, electric vehicle charging, rooftop **and carpark** solar system, solar hot water, LED lighting and motion sensors, minimising light pollution **for fauna and residents**, high water efficiency rating for fixtures, waste management plan, rainwater tanks and passive solar design of the amenities architecture, **noise minimisation protocols for the benefit of fauna and residents**.

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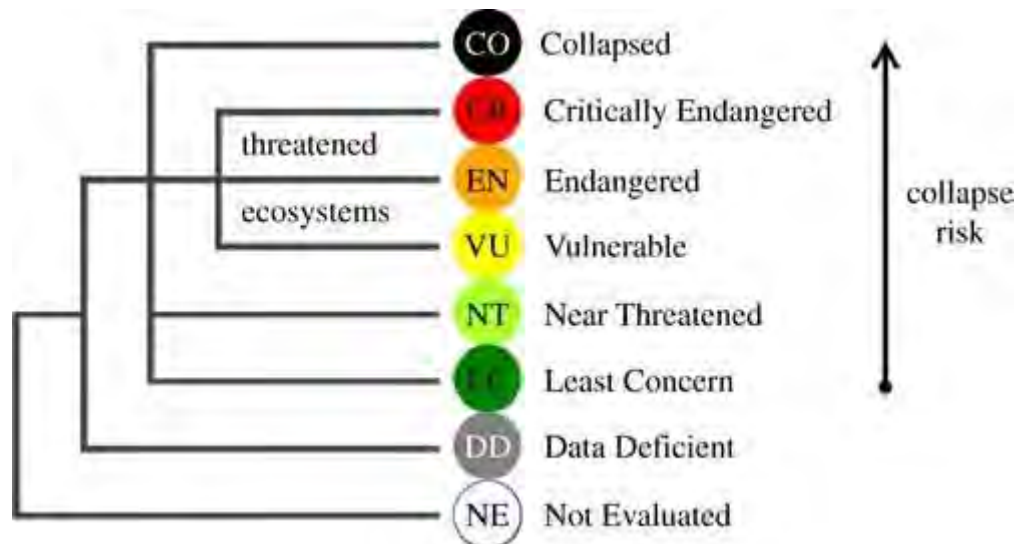
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Appendix 1. Hierarchy of Ecosystem Health

The hierarchy of ecosystem assessment by the IUCN is shown below.



Structure of the IUCN Red List of Ecosystems categories (Rodríguez et al, 2015)

Defining ecosystem collapse is far more difficult than defining extinction. Keith et al (2013) define it as:

Collapse is ... a transformation of identity, loss of defining features, and replacement by a novel ecosystem. It occurs when all occurrences lose defining biotic or abiotic features, and characteristic native biota are no longer sustained. For example, collapse may occur when most of the diagnostic components of the characteristic biota are lost from the system, or when functional components (biota that perform key roles in ecosystem organisation) are greatly reduced in abundance and lose the ability to recruit. Chronic changes in nutrient cycling, disturbance regimes, connectivity or other ecological processes (biotic or abiotic) that sustain the characteristic biota may also signal ecosystem collapse.

Keith et al (2013) state:

Novel ecosystems may retain some or many biotic and abiotic features of the pre-collapse systems from which they were derived, but their relative abundances will differ, they may be organised and interact in different ways and the composition, structure and/or function of the new system has moved outside the natural range of spatial and temporal variability of the old one. A collapsed ecosystem may have the capacity to recover given a long time scale, or with restoration, but in many systems recovery will not be possible.

Appendix 2. Orchids Recorded at Westleigh Park (Natural Resources, 2016)

Orchid	Community	Pollinator(s)	Notes	References
<i>Caladenia carnea</i>	Scribbly Recorded in STIF elsewhere (Sydney Olympic Park, 2021)	Flies, bees, and wasps through food deception and by male thynnine wasps through sexual deception	Demonstrated that thynnine males prefer to visit flowers low in habitat (15 cm) rather than higher (55 to 105 cm) in <i>Chiloglottis</i> sp. Males of the thynnine wasp have to be the correct size and behaviour to remove and deposit pollen. Female thynnines spend the majority of their lives underground, where they seek out, paralyse and lay their eggs on scarabaeid beetle larvae. When females emerge from their subterranean homes they 'call' to available males with pheromones. Thynnine wasps are obligate pollinators of over 150 species of sexually-deceptive orchids in Australia.	Reiter et al (2018) Handel and Peakall (1993) Phillips et al (2019) Semple et al (2017) Copeland and Backhouse (2022)
<i>Cryptostylis erecta</i> and <i>C. subulata</i>	STIF and Duffys	Pollinated by males of the Orchid Dupe Wasp, <i>Lissopimpla excelsa</i>	The female wasp inserts her eggs inside caterpillar larva using her ovipositor. The developing wasp feeds inside the caterpillar, i.e. it is parasitic.	Copeland and Backhouse (2022) OzAnimals.com
<i>Microtis</i> spp	Recorded in STIF elsewhere (Sydney Olympic Park, 2021)	Most species produce nectar and attract a wide range of insect pollinators, with several species partially self-pollinating	Flightless worker ants of the species complex <i>Iridomyrmex gracilis</i> (Lowne) are effective pollinators of <i>Microtis parviflora</i> R.Br. This orchid is self-compatible but not autogamous and ant pollination results in very high levels of seed set. Ants forage persistently, visiting individual flowers and inflorescences repeatedly for nectar. 75% of the flowers are pollinated by ants within 3 days of opening. <i>Iridomyrmex</i> is one of the largest and most frequently encountered groups of ants in Australia. They are also one of the most ecologically important groups as they interact strongly with many other invertebrates as well as many plants. Nests are located in soil, with or without covering, and range in size from a few hundred to over 300,000 workers. The above-ground structure of nests varies from large mounds decorated with small	Copeland and Backhouse (2022) Peakall and Beattie (1989) Jones (1975) AntWiki (2022)

Orchid	Community	Pollinator(s)	Notes	References
			<p>pebbles and having many entrances to single, cryptic holes just large enough for individual workers to squeeze through.</p> <p>Most species of <i>Iridomyrmex</i> are general scavengers. They also tend aphids and coccids and will collect nectar when available.</p>	
<i>Pterostylis longifolia</i> and <i>Pterostylis pedunculata</i>	STIF and Duffys	Fungus gnat (<i>Mycomya</i> spp)	<p>Genus of orchids very much relies on the fungus gnat for its survival.</p> <p>The orchid produces chemicals which mimic the sex pheromones that the female insects produce. This lures the male fungus gnat, which will often try to copulate with a flower, thinking it is a female.</p> <p>Fungus gnats thrive in moist conditions, especially where there is an abundance of decaying vegetation and fungi.</p>	<p>Hayashi et al (2021)</p> <p>Congdon (2022)</p> <p>University of California Agriculture and Natural Resources (2019)</p>
<i>Thelymitra ixioides</i>	Scribbly Recorded in STIF elsewhere (Sydney Olympic Park, 2021)	Pollinated by simple food deception and flowers readily attract small native bees. Most species capable of self-pollination.	<p>Spotted Sun Orchids are pollinated by native bees of the genus <i>Lasioglossum</i> and <i>Exoneura</i>.</p> <p><i>Lasioglossum</i> bees usually nest in burrows in the ground. Image shows bare friable soil.</p> <p><i>Lasioglossum</i> are known to visit plants in the families; Asteraceae, Convolvulaceae, Cucurbitaceae, Liliaceae, Malvaceae, Papilionaceae (the pea family) and Rosaceae.</p> <p>Trampling by people and livestock and tilling should be managed to conserve the nesting sites of the soil-nesting species <i>Lasioglossum</i> bees.</p> <p><i>Exoneura</i> (reed bees) excavate tiny nest burrows inside pithy stems of plants such as grass trees or tree ferns. Reed bees also use exotic plants for their nests, in particular canes of Lantana. Two or more adult bees may share a nest and co-operate to share nest duties.</p>	<p>Westmeier (2022)</p> <p>Copeland and Backhouse (2022)</p> <p>Aussie Bee, <i>Lasioglossum</i> bees</p> <p>BioNET-EAFRINET</p> <p>Aussie Bee, Reed bees</p>
<i>Thelymitra</i> spp	Duffys	As above	As above	

Orchid	Community	Pollinator(s)	Notes	References
<i>Cymbidium suave</i>	Not in Natural Resources (2016)	Australian species pollinated by small native bees attracted to flowers by scent and nectar	The flowers of native <i>Cymbidium</i> species are pollinated by bees of the genus <i>Trigona</i> (now <i>Tetragonula</i>). The stingless bee's nest is usually made in the trunks of large trees and can contain several thousand bees.	Copeland and Backhouse (2022) Australian National Botanic Gardens, Cymbidium Australian Museum (2021)
<i>Dipodium</i> spp	Not in Natural Resources (2016) Recorded in STIF elsewhere (Sydney Olympic Park, 2021)	Pollination is by insects through simple food deception	Pollinated by native bees. Entomophilous (small bees and wasps). Pollination mechanism conspicuously specialised.	Copeland and Backhouse (2022) Australian National Botanic Gardens, Dipodium Florabase (2016)
<i>Diuris maculata</i>	Not in Natural Resources (2016) Members have reported it in STIF elsewhere	Pollination is through simple food deception, with yellow-flowered species mimicking bush peas of family Fabaceae	Guild mimicry of a diversity of 'egg and bacon' legumes best explains the pollination of <i>D. maculata</i> rather than precise mimicry of any one pea species. <i>Trichocolletes venustus</i> was the only native bee species found in significant numbers, and the flowers it visited were almost exclusively the legumes <i>Hardenbergia violacea</i> and <i>Daviesia ulicifolia</i> ssp <i>ulicifolia</i> . <i>T. venustus</i> nest gregariously in ground, flower visiting record: <i>Aotus</i> Smith [Fabaceae], <i>Comesperma</i> Labill [Polygalaceae], <i>Daviesia</i> Sm [Fabaceae], <i>Dillwynia</i> Sm [Fabaceae], <i>Hardenbergia</i> Benth [Fabaceae], <i>Hovea</i> R.Br. [Fabaceae], <i>Leptospermum</i> Forster & G.Forster [Myrtaceae], <i>Mirbelia</i> Sm. [Fabaceae], <i>Pultenaea</i> Sm. [Fabaceae].	Copeland and Backhouse (2022) Indsto et al (2006) Department of Climate Change, Energy, the Environment and Water (2012)
<i>Lyperanthus suaveolens</i>	Not in Natural Resources (2016)	Pollination mechanism and vector unknown	The pollination mechanism is not known but <i>L. suaveolens</i> is strongly fragrant in warm weather and has nectar, indicating that it may be pollinated by bees.	Copeland and Backhouse (2022) Wikipedia (2021)