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Via email

Anketell Road Upgrade, Technical Memo: Communities of Tumulus Springs (Organic Mound Springs, SCP) TEC

Main Roads WA (Main Roads) commissioned Biota Environmental Sciences (Biota) to provide information further to the Anketell Road Upgrade Consolidated Biological Report (Biota 2024) regarding the State-listed Critically Endangered 'Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)' Threatened Ecological Community (TEC), which is synonymous with the EPBC Endangered 'Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain' TEC, and the likelihood that a specific occurrence ('WANDI01') could be affected by the Anketell Road Upgrade project.

Further information requests from the Department of Climate Change, Energy, the Environment and Water (DCCEEW) regarding groundwater aspects that are relevant to the projects potential impact upon the TEC occurrence WANDI01, are:

- "Information regarding where the project is predicted to interact with groundwater. If this information is available, information on if and how much dewatering will occur."
- "Information on where the project is predicted to modify surface water, and any impacts to the Peel Main Drain"
- "Information on any potential for contamination of groundwater and surface waters with Acid Sulfate Soils or contaminants"
- "Information on likely hydrological interactions between the proposed action and the Spectacles Wetlands"

1. Available Data

The initial data requests made to the DBCA's TEC, PEC and ESAs database, and the EPBC Act Protected Matters database (7 August 2020; Biota 2022) did not return the specific occurrence in question (WANDI01) as it had not yet been formally accepted into the DBCA database following its survey in 2019 (DBCA 2019).

Following questions from DCCEEW regarding the presence of the TEC in close proximity to the project, Main Roads WA requested searches of both databases in July of 2024 which subsequently returned an occurrence of the TEC 600m northeast of the intersection of Anketell Road and Kwinana Freeway.

2. Information on the Community

The community is characterised by mounds of organic material which have accumulated around springs fed by the groundwater of aquifers. Jasinska and Knott (1994) showed that these springs form a distinct, and scientifically interesting, ecological community believed to be regionally restricted and uncommon (Pinder and Penniford 2002, Pinder et al. 2006). The morphological and hydrological features of tumulus springs – spongy, peaty mounds up to two metres high that continuously seep water from their whole surface or sometimes from a discrete central point. Temporary pools, supporting a different seasonal fauna, may also form in depressions between the mounds.

The Interim Recovery Plan (Department of Conservation and Land Management 2006) broadly describes the community as:

"The community occurs in tumulus springs (organic mound springs) on the Swan Coastal Plain. The habitat of the mound springs is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats, with a high level of heterogeneity of invertebrate fauna assemblages between sites. Groups commonly represented include Ostracoda, Nematoda, Cladocera, Copepoda, Oligochaeta, Tardigrada, Turbellaria and Insecta. Typical and common native vascular plant species associated with the tumulus springs are the trees Banksia littoralis (swamp banksia), Melaleuca preissiana (moonah) and Eucalyptus rudis (flooded gum), and the shrubs Taxandria linearifolia (swamp peppermint), Pteridium esculentum (bracken fern), Astartea scoparia (common astartea) and Cyclosorus interruptus (swamp shield-fern)."

The tumulus mound springs community is naturally fragmented as springs occur in very specific habitats of continuous groundwater discharge. Many springs have been cleared, or packed with limestone (Jasinska and Knott 1994) and the community is currently known from only 27ha. The community is considered to occur at three threat-defined locations, based on the identification of northern, central and southern clusters of occurrences of the community that are likely to be subject to similar threats (including hydrological change associated with particular aquifers that support the community).

3. 'WANDI01' Occurrence

The occurrence (WANDI01) is 2.6 ha in size and situated approximately 375 m east of the closest point of the project boundary within the project's contextual area, with the 500 m buffer surrounding the occurrence intersecting the survey area. Currently situated on crown reserve managed by the Department of Planning, Lands, and Heritage (DPLH), the land use surrounding the WANDI01 occurrence consists of housing developments and bitumen roads.

4. Habitat Critical to the Survival of the Ecological Community

Because of the very restricted distribution of the ecological community, the habitat or areas most critical to the survival of the ecological community comprise:

- the area of occupancy of known occurrences;
- areas of similar habitat within 200 m of known occurrences;
- remnant vegetation that surrounds or links occurrences; and
- the local catchment for the surface and groundwater that maintain occurrences of the ecological community.

Essential habitat elements include the hydrological regime associated with the:

- mound springs characterised by continuous discharge of groundwater in raised areas of peat;
- recharge areas on the western side of tumulus spring areas that are likely to provide the hydraulic pressure head for the adjacent spring area; and

- groundwater feeding the springs from aquifers and mounds.

5. Key Threatening Processes to the Ecological Community

The EPBC Act provides for the identification and listing of key threatening processes. A process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. The following EPBC-listed key threatening processes, current at the date of writing, may be relevant to the ecological community or specific plants and animals that comprise it:

- Land clearance.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*) (indirectly, through potential impacts on any nearby Banksia woodland likely to be important in maintaining the local hydrology of the springs on which the tumulus springs assemblages depend).
- Fire regimes that cause declines in biodiversity.

In addition to the EPBC-listed key threatening processes, there are a number of other key threats that may also impact upon the TEC occurrence, all of which are briefly described below:

Land Clearing

The tumulus springs on heavy soils were often perceived as a hindrance to farming practices as they were excessively wet and boggy and many were cleared, levelled, packed with limestone and planted with kikuyu grass, excavated and dammed, or the spring brooks dammed (Jasinska and Knott 1994).

Residential or rural development surrounds the majority of the spring areas, including the WANDI01 occurrence, with significant potential to impact on local groundwater flow and quality, in addition to general impacts of rainfall decline and abstraction on the regional flows from the Jandakot Mound.

Dunes of varying sizes occur on the western side of tumulus spring areas and are likely to provide important recharge areas. Several occurrences (Wandi, Egerton, and Duckpond springs; occurrences 10, 1 and 8 respectively) are surrounded by developed areas and their recharge dune has been completely removed or fundamentally altered.

Dieback

It is not known if the community type is susceptible to dieback disease caused by *Phytophthora* species. However, the plants that inhabit the tumulus springs themselves are largely species that are thought not to be sensitive to dieback. In particular, *Melaleuca preissiana* and the sedges that dominate the community are not dieback sensitive.

Altered Fire Regimes

It is also likely that the fire regime around each of the spring areas has been altered since 1750, especially those located in agricultural areas. The wetland vegetation associated with the springs is likely to be less adapted to very hot fires than upland vegetation as the sites are permanently moist and are unlikely to have burnt as readily. In addition, the build-up of peat makes the areas very prone to fires that occur in dry seasons that are capable of destroying the peat mounds themselves. An increase in the frequency of hot fires is likely to pose a significant threat to the wetland-adapted flora and fauna.

Weed Invasion

Weed invasion is a significant biotic threat to the community. Most occurrences of this community are close to weed sources such as urban and rural areas, and high levels of disturbance have led to significant weed invasion in some cases. Weeds suppress early

plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to the easy ignition of high fuel loads.

The severity of weed invasion associated with collapse is uncertain, but it is assumed conservatively that the community reaches a collapsed state when only 10% (plausible range 0–20%) of its plant species are native.

Changes to Hydrology

Hydrological changes (including increased runoff during rain events, changes in depth to groundwater, movement of contaminants within stormwater, and use of phosphorus-based fertilisers) are considered the most significant threat to the tumulus springs ecological community.

Where nutrient sources can contaminate surface or groundwater entering the springs, enhanced nutrient levels are likely to favour weed invasion and possibly alter water quality such that some components of the invertebrate fauna cannot survive. Nutrient input is most likely to be from very localised areas in the case of surface flow into the springs, so land use adjacent to the springs may have a significant affect on the water quality.

The maintenance of the flora and fauna of the tumulus springs community is dependent on a permanent supply of fresh water and in the local water mounds in dunes adjacent to each of the spring areas. It is likely that the pressure from the superficial aquifer drives the springs. The local hydrologic pressure created within the dunes adjacent to each of the spring areas is also likely to be significant in terms of maintaining the spring flow.

The groundwater feeding the springs consists of three main aquifers – the unconfined Superficial aquifer (in the north commonly known as the Gngangara Mound, in the south – the Jandakot Mound), the deep, partly confined Leederville aquifer and the deep, mostly confined Yarragadee aquifer.

Data from bores that occur adjacent to occurrences provide useful information on the trend of groundwater in the area in both the superficial and deep aquifers. They currently show declining trends for groundwater of approximately 0.5 to 2 m in the local Perth Superficial Swan aquifer, the aquifer most likely to influence the community. The largest groundwater decline is evident within the southern-most occurrences (Wandi, Wellard, Duckpond), with a decline of nearly 35 m occurring over 36 years. A 50-year forecast of the projected groundwater level shows a potential continuing decline of up to approximately 50 m.

The severity of impacts of groundwater decline are difficult to predict, as the groundwater flows to mound springs are related to complex geologies.

6. Likelihood of the Project Affecting the TEC

With regards to flora, fauna and ecological aspects of the TEC occurrence, it is highly unlikely that the project will have any **direct** impact upon these values, given the separation from the projects boundary and the lack of remnant native vegetation and connectivity within the area of the project closest to the occurrence.

However, **indirect** impacts to the flora, fauna and ecological aspects of the TEC occurrence may be likely due to potential hydrogeological changes within the designated buffer of the WANDI01 occurrence. These potential hydrogeological impacts will require further work from appropriately experienced consultants.

From a flora, fauna, and ecological community viewpoint, the following statements regarding current and potential impacts to the occurrence are considered relevant:

1. A current DWER administered groundwater extraction license (202605) covers the WANDI01 TEC occurrence entirely with an extraction bore sited within the occurrence extent. The licence was issued to the City of Kwinana in June 2023 (expiring in 2030) and has an allocation of 226,285KL with more allocation available for use.
2. The TEC occurrence occurs on different soil and vegetation type to that of the projects potential footprint.
3. Unlike the other known occurrences, its hydrology is not driven by the Gnangara Mound which is severely declining due to water extraction.
4. The proposed project probably poses less risk to the mound spring than the immediately adjacent land clearing and land use which surrounds the TEC occurrence entirely.
5. The project would not result in the direct loss of any designated wetland associated with the occurrence as the TEC lies outside of the potential development envelope.
6. Decreased depth to groundwater due to removal of native vegetation would not occur as the amount of native vegetation in the survey area in proximity to the TEC is minimal and the majority has already been cleared and developed.
7. It is highly likely that the surrounding urban development already drastically affects the rainwater infiltration through increased impervious areas in the form of roads, along with an increased potential for contamination such as hydrocarbons from vehicles and the use of fertilisers with phosphorus.
8. There is an appropriate environmental buffer providing adequate separation between the project boundary and the sensitive ecological feature being the TEC occurrence

This buffer of native vegetation to the west of the TEC occurrence, will help in minimising any off-site impacts. The buffer zone is mainly a contiguous area adjacent to the ecological community (with the exception of suburban bitumen roads) and is important for protecting the integrity of the ecological community. As the risk of indirect damage to an ecological community is usually greater where actions occur close to an area, the purpose of any buffer zone is to minimise this risk. For instance, the buffer zone will help protect the root zone of edge trees and other components of the ecological community from weed invasion, polluted water runoff and other damage that may be attributed to the project. Fire breaks and other built asset protection zones do not typically provide a suitable buffer and should be additional to a vegetated buffer.

9. The project area is situated outside of numerous recommended separation buffer widths for key threats to inland waters (WAPC 2005):
 - Habitat modification: maintaining ecological processes (50 m)
 - Water quality: reducing nutrient inputs (200 m)
 - Water quality: minimising sedimentation (100 m)
 - Water quality: protection from inputs of heavy metals (200 m)
 - Water quality: protection from rising salinity (250 m)

7. Recommended Further Work

Given comments from DCCEW regarding the potential impact to the TEC from groundwater aspects of the project, it is recommended that advice is sought from a hydrogeological consultant, ultimately leading to a Hydrological Management Plan, including:

- Site specific investigations to determine groundwater systems and the level of dependency the TEC occurrence has on groundwater to confirm the recommended buffer zone distances that would be required.
- Additional hydrological assessments, such as groundwater profile modelling and the identification of local flow system boundaries, in order to estimate any potential impacts of the project on the TEC occurrence.
- A potential ongoing monitoring survey and monitoring plan to determine if there are any changes to the water chemistry and the richness and composition of the invertebrate assemblages of the TEC occurrence during the course of the project.
- Maintenance of the hydrological characteristics of the TEC occurrence, when the project receives approval.

Please contact us should you wish to discuss the above or any further information is required.

Sincerely,

Biota Environmental Sciences Pty Ltd

Scott Werner
Principal Biologist

References

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