PENTIUM WATER

WETLAND ASSESSMENT

Wattle Grove South MRS Amendment 1388/57

Rev 1

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Executive Summary

The Western Australian Planning Commission (WAPC) are proposing to rezone approximately 126 hectares (ha) of 'Rural' zoned land for 'Urban' use residential purposes, under the Metropolitan Region Scheme (MRS) Amendment 1388/57. MRS Amendment 1388/57 is located within Wattle Grove, bound by Welshpool Road East and Crystal Brook Road to the north, and Tonkin Highway to the west. The MRS amendment area is located approximately 30 kilometres (km) east of Perth CBD within the City of Kalamunda.

Figure A illustrates the location and the Wattle Grove MRS amendment area.

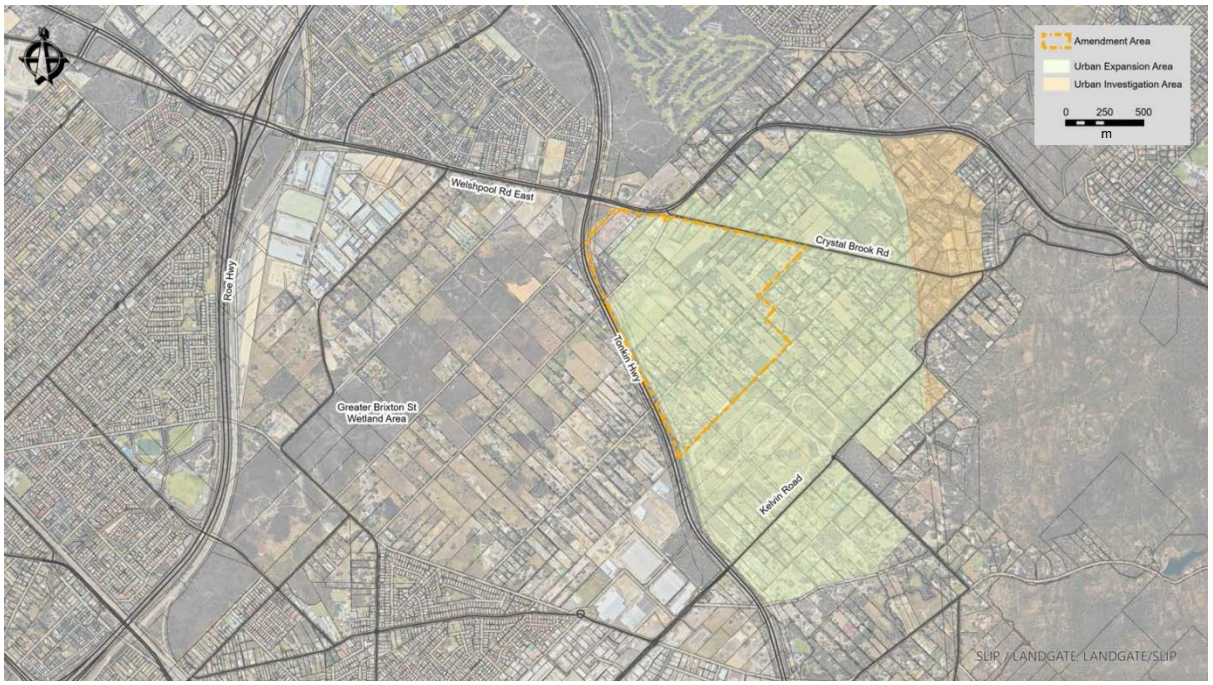

Figure A: Wattle Grove MRS Amendment Area

Wetland Assessment – Scope of Works

The Wattle Grove MRS amendment 1388/57 is subject to a 'formal' assessment by the Environmental Protection Authority (EPA). The EPA's Instruction for Environmental Review No. 2335 for Amendment 1388/57 requires the following scope of works specific to wetlands within and adjacent to the MRS amendment area:

1. Determine the boundaries of wetlands and/or buffer requirements to wetlands within and adjacent to the amendment area proposed to be retained.
2. Boundary and buffer studies should consider the characteristics of hydrology, hydric soils and wetland vegetation, and the water balance of the wetland/wetland dependent vegetation.

Accordingly, the purpose of this wetland report assessment is to address the Environmental Review No. 2335 (Task 11) scope of works.

The wetlands subject to this wetland assessment are shown in Figure B.

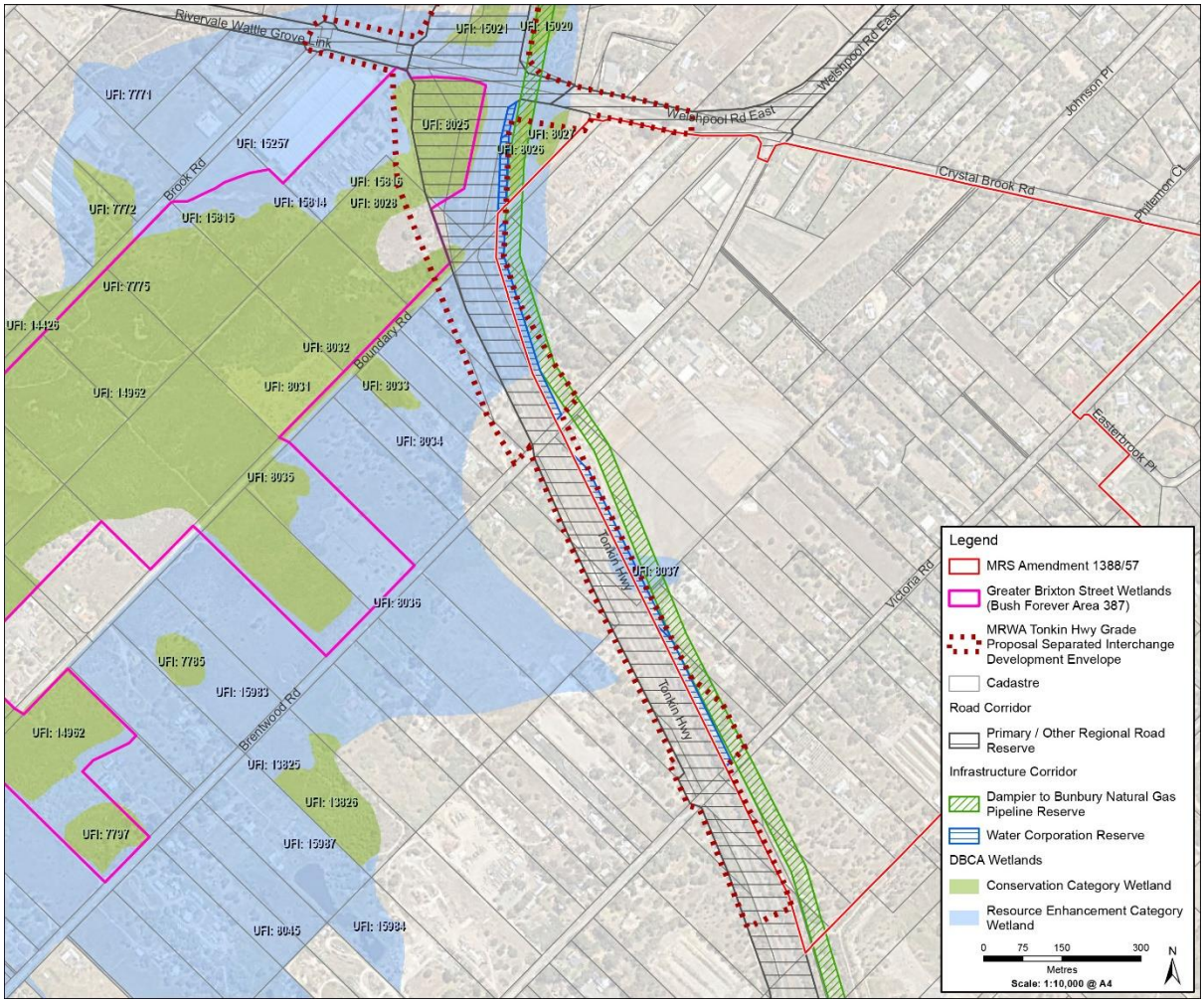

Figure B: Wetlands within the Amendment Area, Lot 501 and the GBSW

The scope of works is specific to the mapped wetlands within the MRS amendment area and the mapped wetlands adjacent to the MRS amendment area The wetlands subject to the scope of works include:

1. Within the MRS amendment area:
    a. Two Resource Enhancement Wetlands (REW) (UFI 8037 & UFI 15257) occurring within the Wattle Grove MRS amendment area within the MRS amendment area.
2. Adjacent to the MRS amendment area. The mapped wetlands adjacent to the MRS amendment area inclusive of:
    a. <u>East of Tonkin Highway</u> - Lot 501:
        i. Two Conservation Category Wetlands (CCW) (UFI 8026 & UFI 8027) and a portion of REW UFI 15257 are mapped within Lot 501. Lot 501 is located adjacent to the MRS amendment northern boundary and the Boundary Road reserve.
    b. <u>West of Tonkin Highway</u> – Greater Brixton Street Wetland (GBSW) & within the eastern portion of Bush Forever Site No. 387:
        i. The GBSW area incorporates numerous Department of Biodiversity, Conservation and Attractions (DBCA) mapped CCW and REW features. The mapped wetlands located in the GBSW within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030.

MRS Amendment Area: REWs (UFI 8037 & UFI 15257) Detailed Wetland Assessment Scope of Work

The scope incorporates undertaking an assessment of the environmental values of the two REW inclusive of:

- The wetland assessment adopted the methodology defined within the 'A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia" (DBCA 2017). This assessment included the following scope:
    - Review of the DBCA GWSCP dataset using available regional scale data.
    - Review current and historical land uses.
    - Determine the boundaries of wetlands and/or buffer requirements to wetlands within and adjacent to the MRS amendment area.

Outside of the MRS Amendment Area: Lot 501 & the GBSW Area - Wetland Buffer Scope of Work

- Assessment of the separation buffers in accordance with 'Guideline for the Determination of Wetland Buffer Requirements' (WAPC 2005) of the following mapped wetlands:
- Within Lot 501: Two Conservation Category Wetlands (CCW) (UFI 8026 and UFI 8027) and portion of REW UFI 15257.
- Within the GBSW area: Numerous mapped wetlands located within 150 m of the MRS amendment area.
- The 'Guideline for the Determination of Wetland Buffer Requirements' (WAPC 2005) requires the completion of the following seven steps to determine the wetland separation:
    - Step 1: Acknowledge existence of wetland.
    - Step 2: Identify wetland attributes, wetland management category and establish management objective.
    - Step 3: Define wetland function area.
    - Step 4: Identify threatening processes.
    - Step 5: Identify role of separation.
    - Step 6: Establish separation requirement.
    - Step 7: Apply separation requirement to proposal and assess its ability to achieve management objective.

Conclusion

MRS Amendment Area: REWs (UFI 8037 & UFI 15257)

Currently within the mapped REWs (UFI 8037 & UFI 15257) are the following land uses:

- Tonkin Highway reserve
- Boundary Road reserve
- Water Corporation pipeline and DBNGP easements
- Semi-rural paddocks
- Commercial landscape supply business
- Commercial turf farm.

The wetland areas have been subject to historical construction works and infilling to support the above land uses. The assessment of the REWs UFI 8037 & UFI 15257 values concluded:

- Historical clearing and infilling activities within the mapped two REW areas associated with the construction of the Tonkin Highway, Water Corporation pipeline and DBNGP which is maintained as a cleared easement.
- The two REW's (UFI 8037 and portion of UFI 15257) within the MRS amendment area are in 'Completely Degraded' condition or in the case of REW UFI 8037 within Tonkin Highway reserve, DBNGP easement and the former turf farm has been completed infilled and cleared of all native vegetation.

- The wetland's ecological values are no longer present. There are no groundwater dependent riparian communities present or habitat (or habitat diversity) for aquatic dependent fauna. The mapped wetland contains a commercial turf area and the cleared Water Corporation and DBNGP easements.

In summary, the detailed wetland assessment recommends the two REWs (UFI 8037 and portion of UFI 15257) within the MRS amendment areas are removed from the GWSCP dataset.

Portions of the former mapped REWs (UFI 8037 and portion of UFI 15257) will be incorporated into POS areas and stormwater bioretention basins adjacent to the Water Corporation pipeline and DBNGP easement. The DWMS (Hyd2O 2024) identifies the future Local Structure Plan and subdivision plans will formally integrate the Water Corporation and DBNGP easement into open space, ensuring the pipeline(s) are protected whilst also providing a valuable community asset that provides local amenity.

DBCA is the custodian of the Geomorphic Wetlands of the Swan Coastal Plain (GWSCP) dataset. An application to DBCA to amend GWSCP dataset for the two REWs (UFI 8037 and portion of UFI 15257) removing these two wetlands from the geomorphic wetland database will occur concurrently with the finalisation of a future Local Structure Plan and LWMS.

DBCA provided advice on the environmental values of the wetlands currently mapped in the GWSCP dataset within the MRS amendment area using available regional scale data. The review concluded that the two REW within the MRS amendment area (portion of UFI 15257 within the amendment area and UFI 8037) have values commensurate with a Multiple Use Wetland (MUW).

Outside of the MRS Amendment Area: Lot 501 & the GBSW Area

The Wattle Grove South MRS amendment 1388/57 does not alter:

- Lot 501 existing 'Parks and Recreation' land use and the existing management of Lot 501.
- The GBSW area 'Parks and Recreation' and Bush Forever Site No 387.
- The proposed 'Urban' land use within the amendment area (and proposed future residential development) does not intrude into the two CCWs (UFI 8026 & UFI 8027) or the GBSW area.

Lot 501 - two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257

The two CCWs are located are within Lot 501. Lot 501 is a 1.6 ha triangular landholding bounded by Tonkin Highway to the west, Welshpool Road to the north and Boundary Road to the south. The landholding also contains a portion of REW UFI 15257. Lot 501 is zoned 'Parks & Recreation' under the MRS and is owned and managed by the WAPC.

Land uses within Lot 501 and 50 m of the two CCWs UFI 8026 & UFI 8027 are the following key land uses:

- Welshpool Road and Tonkin Highway reserves.
- DBNGP and Water Corporation easements.
- Boundary Road reserve.
- Landscape supply commercial business.
- Semi-rural lots.

These land uses have resulted in the historical clearing of significant portion of the two CCWs and native vegetation within Lot 501. The construction of the Welshpool Road, Tonkin Highway, Boundary Road and DBNGP resulted in the clearing of native vegetation and the infilling of the mapped wetland areas. Approximately 80% of Lot 501 has been cleared of native vegetation. Lot 501 currently manages the Tonkin Highway reserve, Welshpool Road reserve and the DBNGP easement as cleared open areas.

The two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501 are in 'Degraded to Completely Degraded' condition as a result of clearing from historical rural land uses and infilling of the wetland areas from the construction of Welshpool Road, Tonkin

Highway and Boundary Road. A commercial landscape supply business and rural landholdings are located immediately south of Boundary Road within the amendment area. In summary, the entire wetland ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 are contained within areas of Lot 501. Specifically, the wetland attributes (i.e., native wetland vegetation or seasonal surface water areas) do not extend outside of Lot 501.

The desktop review site, visit and assessment conclude the existing ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 are aligned with REWs category wetland and/or MUW category wetland.

Boundary Road provides an approximate 20 m permanent infrastructure barrier between the two CCWs within Lot 501 and the commercial landscape supply yard and the semi-rural paddocks within the MRS amendment area.

The wetland assessment concluded the 20 m Boundary Road reserves provides physical separation from the two CCWs (UFI 8026 and UFI 8027) and the portion of REW UFI 15257. The road reserve is managed by the City of Kalamunda and will be maintained in the future.

The conclusion drawn on the status of and the road separation distance is supported by:

- The assessment of the two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 demonstrate ecological values more aligned with REW category and/or MUW category wetlands. This conclusion was underpinned by the following assessment:
    - Approximately 80% of Lot 501 has been historically cleared of native vegetation and subject to infilling.
    - The historical and current land uses resulting in the establishment of open cleared areas within the mapped wetland areas include:
        - Welshpool Road and Tonkin Highway reserves.
        - DBNGP and Water Corporation easements.
        - Boundary Road reserve.
    - Lot 501 is owned and managed by the WAPC and regularly maintained via slashing and mowing of the open grass and weed areas to uphold the road reserves, Water Corporation and DBNGP easements as cleared open areas.
    - The understorey of the two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 within Lot 501 is significantly dominated by weed species including *Avena barbata* (wild oats), *Eragrostis curvula* (African lovegrass), *Ehrharta calycina* (perennial veldtgrass) and *Watsonia meriana*.
    - The Boundary Road reserve adjacent to Lot 501 is a fixed City of Kalamunda road asset.
    - The MRS amendment does not alter:
        - The location or the road reserve land use.
        - The Lot 501 “Parks and Recreation” land use.
    - Immediately east of Boundary Road (i.e., approximately 20 m from the mapped wetlands) are private landholdings including a commercial landscape supply yard and cleared semi-rural property and the DBNGP easement. Portions of these landholdings have been extensively filled and cleared of native vegetation. These land uses (i.e., the privately owned commercial and rural land uses) and the DBNGP easement have been in place for over 20 years.

<u>GBSW area</u>

The GBSW is located approximately 75 m amendment area boundary from the mapped eastern boundary (at the closest point) separated by the four lane Tonkin Highway. The separation distance is further extended by approximately 25 m due to the Water Corporation and DBNGP easements located along the length of the amendment area’s western boundary.

At Brentwood Road there is an at level pedestrian crossing of the four lane Tonkin Highway. The distance to the mapped GBSW boundary from the amendment area along Brentwood Road is approximately 700 m. This pedestrian access would be formally closed either as part of MRWA's proposed Tonkin Highway Grade Separated Interchange (which extends the highway from four to six lanes) or through a future subdivision approval.

The separation distance review of the GBSW and the amendment area identified:

- The existing transport infrastructure (Tonkin Highway) and Water Corporation and DBNGP easements which provides a physical separation boundary to the amendment area.
- The Tonkin Highway Grade Separated Interchange Proposal, specifically, if the upgrade of Tonkin Highway is approved (i.e., increased to six lanes) the minimum separation distance to the amendment area would be extended by an additional 30 m.
- The amendment area and any proposed future development works do not intrude into the GBSW area and remain on the eastern side of Tonkin Highway.

The proposed wetland buffer distance to the GBSW area is:

- A minimum 100 m buffer from the GBSW (at the closest point) will be maintained. The Tonkin Highway reserve in combination with the Water Corporation pipeline and DBNGP easements has already established a minimum 100 m physical boundary between the GBSW wetlands and the amendment area at the closest point. If the MRWA Tonkin Highway Grade Separated Interchange Proposal is approved and constructed (creating a six lane highway) the minimum buffer would extend to approximately 130 m.
- Importantly, the vast majority of the proposed future 'Urban' land uses will be located significantly further (i.e., 500 m plus) from the GBSW area.

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Acronym Table

Acronym	Definition
AH Act	*Aboriginal Heritage Act 1972*
ASS	Acid Sulfate Soils
bgl	Below Ground Level
BC Act	*Biodiversity Conservation Act 2016*
CBD	Central Business District
CCW	Conservation Category Wetland
DBCA	Department of Biodiversity, Conservation and Attractions
DBNGP	Dampier to Bunbury Natural Gas Pipeline
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FCT	Floristic Community Type
GBSW	Greater Brixton Street Wetlands
GWSCP	Geomorphic Wetlands of the Swan Coastal Plain
ha	Hectare
km	Kilometres
kL	Kilolitres
LSP	Local Structure Plan
LWMS	Local Water Management Strategy
m	Metres
m AHD	metres Australian Height Datum
MGL	Maximum groundwater level
MKSEA	Maddington Kenwick Strategic Employment Area
MNES	Matters of National Significance
MRS	Metropolitan Region Scheme
MUW	Multiple Use Wetland
POS	Public Open Space
REW	Resource Enhancement Wetland
SCP	Swan Coastal Plain
TEC	Threatened Ecological Community
UFI	Unique Feature Identifier
UWMP	Urban Water Management Plan
WAPC	Western Australian Planning Commission

1. Summary

1.1. Project background

The Wattle Grove South Metropolitan Region Scheme (MRS) amendment 1388/57 proposes to re-zone an area of approximately 126 hectares (ha) of the Wattle Grove landholdings from 'Rural' to 'Urban'. The landholdings subject to the MRS amendment area is bound by Tonkin Highway (west), Welshpool Road East (north), Crystal Brook Road (north), Victoria Road and Easterbrook Road (east) and the rear boundaries of lots fronting Victoria Road (south).

Regionally, Watle Grove is located within the City of Kalamunda approximately 15 kilometre (km) east of Perth Central Business District (CBD).

The location of the Wattle Grove South MRS amendment area is shown in Figure A.

1.2. Purpose

MRS amendment 1388/57 is subject to a 'formal' assessment by the Environmental Protection Authority (EPA). Table 1 defines the EPA's Instruction for Environmental Review No. 2335 for Amendment 1388/57 specific scopes of works for the assessment of wetlands.

Table 1: Environmental Review No. 2335 Inland Waters – wetland specific scoping requirements

Task	Required Work
11.	• Determine the boundaries of wetlands and/or buffer requirements to wetlands within and adjacent to the amendment area proposed to be retained. • Boundary and buffer studies should consider the characteristics of hydrology, hydric soils and wetland vegetation, and the water balance of the wetland/wetland dependent vegetation.

Accordingly, the purpose of this wetland report assessment is to address the Environmental Review No. 2335 (Task 11) scope of works.

1.3. Wetlands subject to the wetland assessment report

Wetlands within the Swan Coastal Plain (SCP) are protected and managed by the management category assigned by the Department of Biodiversity, Conservation and Attractions (DBCA).

The DBCA management categories and their objectives are outlined in Table 2.

Table 2: Wetland management categories and management objectives

Category	Objective
Conservation Category Wetlands (CCW)	To preserve wetland (natural) attributes and functions.
Resource Enhancement Wetlands (REW)	To restore wetlands through maintenance and enhancement of wetland functions and attributes.
Multiple Use Wetlands (MUW)	To use, develop and manage wetlands in the context of water, town, and environmental planning.

Table 3 summaries the wetlands subject to this wetland assessment report inclusive of the numerous mapped wetlands within the GBSW area.

Table 3: DBCA mapped geomorphic wetlands present within and adjacent to the MRS Amendment area.

Unique Feature Identifier (UFI)	Geomorphic classification	Management category	Land tenure details	Total area (ha)
Within the MRS amendment area				
UFI 8037	REW	Sumpland	• Lot 301 – zoned Primary Regional Road. • Lot 302 – zoned 'Rural' (Water Corporation easement).	0.86

Unique Feature Identifier (UFI)	Geomorphic classification	Management category	Land tenure details	Total area (ha)
			• Lot 303 - zoned 'Rural' (turf farm). • Dampier to Bunbury Natural Gas Pipeline (DBNGP) easement (D207286). • Lot 107 – zone 'rural' predominantly cleared small rural landholding. • Lot 106 – zone 'rural' predominantly cleared small rural landholding.	
UFI 15257	REW	Palusplain	• Lots 146, 12 & - zoned 'Rural' predominantly cleared small rural landholdings. • Lot 302 – zoned 'Rural' (Water Corporation easement). • DBNGP easement.	30.33 (2.06 is within the amendment area)
North of the MRS amendment area (within 32 m of the MRS amendment area)				
UFI 8026	CCW	Palusplain	• Lot 501 - zoned 'Parks and Recreation'. • Lot 500 – zoned 'Parks and Recreation' & Water Corporation easement. • DBNGP easement.	0.38
UFI 8027	CCW	Palusplain		0.32
UFI 15257	REW	Palusplain		30.33 (0.52 ha is within Lot 501).
GBSW area (within 150 m of the MRS amendment area)				
8025	CCW	Palusplain	Lot 51 Zoned 'Parks and Recreation' & Bush Forever Site No 387	2.78
8028	CCW	Sumpland	Lot 340 Zoned 'Parks and Recreation' & Bush Forever Site No 387	1.48
8030	Multiple Use	Palusplain	Lot 342 Zoned 'Parks and Recreation' & Bush Forever Site No 387	1.29
14962	CCW	Palusplain	Lot 342 Zoned 'Parks and Recreation' & Bush Forever Site No 387	62.68
15257	REW	Palusplain	Lot 51 Zoned 'Parks and Recreation' & Bush Forever Site No 387	30.33

1.3.1. Relevant Policy and Guidance

The relevant government policy and guidance for inland waters and to specifically address EPA's Instruction for Environmental Review No. 2335 (Task 11) requirements are summarised in Table 4.

Table 4: Policy and guidance relevant to this wetland assessment

Policy and Guidance	Key Aspects

Environmental Factor Guideline: Inland Waters (EPA, 2018).	• Inland Waters identified as a key environmental factor.
	• The MRS amendment for the inland waters assessment considers:
	  ○ The potential environmental impacts, the mitigation hierarchy (direct and indirect impacts).
	  ○ Implications of cumulative impacts.
	  ○ Predicted residual impacts and management approaches.

Policy and Guidance	Key Aspects
A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia (DBCA 2017).	• Assessment of the environmental values of the two REW (UFI 8037 & UFI 15257) which intersect the western boundary of the amendment area.

Guidance Statement 33: Environmental Guidance for Planning and Development	• The guidelines provide an option for a site-specific wetland buffer assessment.
	• A wetland buffer distance was determined for:
	  ○ CCWs (UFI 8026 & 8027) within Lot 501 adjacent to the MRS amendment area.
	  ○ Wetlands within the GBSW area.
	• This assessment considered:
	  ○ The physical characteristics relevant to the wetland, including wetland values and attributes.
	  ○ Surrounding land use(s).
	  ○ The feature being mitigated for or against (threatening process).

Draft - Guideline for Determining of Wetland Buffer Requirements (WAPC 2005).	• Separation buffers is recognised as essential for the achievement and maintenance of the wetland's management objective.
	• The Draft Guideline for Determining of Wetland Buffer Requirements were considered in the buffer assessment for:
	  ○ CCWs (UFI 8026 & 8027) within Lot 501 adjacent to the MRS amendment area.
	  ○ Numerous wetlands within the GBSW area.

Better Urban Water Management (WAPC 2008).	• The Wattle Grove South DWMS (Hyd2O 2024) has been prepared to specifically satisfy the following requirements:
	• Better Urban Water Management (WAPC, 2008).
	  ○ Inland Waters technical investigations defined in the instructions for Environmental Review No. 2335 (EPA 2022).
	  ○ The drainage strategy integrates Water Sensitive Urban Design principles to minimise impact to sensitive water resources and wetlands.

Environmental values and pressures for the Greater Brixton Street Wetlands on the Swan Coastal Plain - Section 16(j) of the *Environmental Protection Act 1986* (EPA 2022).	• The Wattle Grove South Wetland Assessment Report incorporates a wetland buffer assessment to the GBSW. • The EPA's s.16(j) GBSW advice has been incorporated into the assessment of the Inland Waters environmental factor and the ERD.

2. Methodology

2.1. Evaluation of the two REWs (UFI 8037 & UFI 15257) within the amendment area

The scope incorporates undertaking an assessment of the environmental values of the two REW inclusive of:

- The wetland assessment adopted the methodology defined within the 'A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia" (DBCA 2017). This assessment included the following scope:
    - Review of the DBCA GWSCP dataset using available regional scale data.
    - Review current and historical land uses.
    - Determine the boundaries of wetlands and/or buffer requirements to wetlands within and adjacent to the MRS amendment area.

The two REWs (UFI 8037 & UFI 15257) within the amendment area subject to the reclassification assessment are shown in Figure 2.

2.2. Buffer assessment of the wetlands located within Lot 501 adjacent to the amendment area & the GBSW area.

Wetlands, located within 150 m of the amendment area, subject to the buffer assessment include:

1. East of Tonkin Highway - Lot 501:
    a. Two Conservation Category Wetlands (CCW) (UFI 8026 & UFI 8027) and a portion of REW UFI 15257 are mapped within Lot 501. Lot 501 is located adjacent to the MRS amendment northern boundary and the Boundary Road reserve.
2. West of Tonkin Highway – Greater Brixton Street Wetland (GBSW) & within the eastern portion of Bush Forever Site 387:
    a. The GBSW area incorporates numerous Department of Biodiversity, Conservation and Attractions (DBCA) mapped CCW and REW features. The mapped wetlands located in the GBSW within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030.

The Wattle Grove South MRS amendment 1388/57 does not alter:

- Lot 501 existing 'Parks and Recreation' land use.
- The GBSW area 'Parks and Recreation' and Bush Forever Site No 387.
- The proposed 'Urban' land use within the amendment area (and proposed future residential development) does not intrude into the two CCWs (UFI 8026 & UFI 8027) or the GBSW area.

In addition, the two CCWs (UFI 8026 & UFI 8027) and the numerous wetlands with the GBSW area are physically separated from the amendment area by key regional infrastructure corridors including:

- Boundary Road reserve.
- Tonkin Highway reserve and Welshpool Road reserve.
- Water Corporation water pipeline easement.
- DBNGP pipeline corridor.

In this context, the purpose of this evaluation is focused on assessing the separation buffers to the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501 and the numerous mapped wetlands within the GBSW area located inside 150 m of the amendment area in accordance with Guideline for the Determination of Wetland Buffer Requirements

(WAPC 2005). The guideline requires the completion of the following seven steps to determine the wetland separation:

- Step 1: Acknowledge existence of wetland.
- Step 2: Identify wetland attributes, wetland management category and establish management objective.
- Step 3: Define wetland function area.
- Step 4: Identify threatening processes.
- Step 5: Identify role of separation.
- Step 6: Establish separation requirement.
- Step 7: Apply separation requirement to proposal and assess its ability to achieve management objective.

Figure 2 illustrates the infrastructure corridors located between the amendment area and the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501 and the mapped wetlands within the GBSW area.

3. Environmental Context

3.1. Desktop assessment

This Wetland Assessment Report references information from various technical assessments and surveys completed across the amendment areas and within the MRWA Tonkin Highway reserve. The key documents of relevance include:

- Wattle Grove South Ecological Surveys. Unpublished report, prepared for the City of Kalamunda (AECOM 2020).
- Environmental Assessment Report: Various Lots, Wattle Grove. Unpublished report prepared for Burgess Design Group (360 Environmental 2018).
- Tonkin Highway Welshpool Road to Hale Road Vegetation condition assessment (Strategen Environmental 2019).
- Tonkin Highway Grade Separated Interchanges, Hale Road, and Welshpool Road EPBC 2019/8529 Preliminary Documentation (GHD 2021).
- Tonkin Grade Separated Interchanges Biological Survey and Targeted Black Cockatoo Habitat Assessment (Woodman Environmental 2021).
- Report on Preliminary Geotechnical Investigation Proposed Wattle Grove Development Victoria Road, Wattle Grove (Douglas Partners 2022).
- Report on Preliminary Geotechnical Investigation Proposed Wattle Grove Development Precinct 1, Victoria Road, Wattle Grove (Douglas Partners 2020).
- Geophysical Subsurface Investigation at Proposed Land Development Site Wattle Grove (GBG Group 2023).
- District Water Management Strategy (Hyd2O 2024).
- Water Balance Assessment (Emerge Associates 2023).

3.2. Wetland assessment areas

This assessment separates the wetlands spatially into the following areas (Figure B):

1. Wetlands east of Tonkin Highway within Lot 501 which includes:
    a. The amendment area (two REWs UFI 8037 & UFI 15257).
    b. Outside of the amendment area in Lot 501 (two CCWs UFI 8026 & UFI 8027 and a portion of REW UFI 15257).
2. The numerous mapped wetlands located west of Tonkin Highway located in the GBSW within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030.

3.3. Ecological wetland values within the amendment area & Lot 501

3.3.1. Historical land use context

A review of historical aerial photography shows the wetland areas within the MRS amendment area, the two CCWs (UFI 8026 & UFI 8027) and numerous wetland areas within the GBSW area have been subject to land clearing to establish semi-rural landholdings.

The earliest available aerial imagery of the Wattle Grove and the GBSW area is from 1953 (Figure C). This aerial illustrates a significant portion of the amendment area was subdivided and cleared for primarily rural land uses including grazing pasture, horse training and market gardens/orchards.

The former Crystal Brook tributary which flowed into the GBSW area via the two CCWs (UFI 8026 & UFI 8027) is visible, traversing the north west portion of the amendment area, linking the two CCWs (UFI 8026 & UFI 8027) before re-joining Yule Brook about 2.2 km within the GBSW area at the location of the Alison Baird Reserve. During this period, deep unlined

open drains were constructed along road reserves and the eastern portion of Boundary Road was constructed clearing a portion of the Crystal Brook tributary.

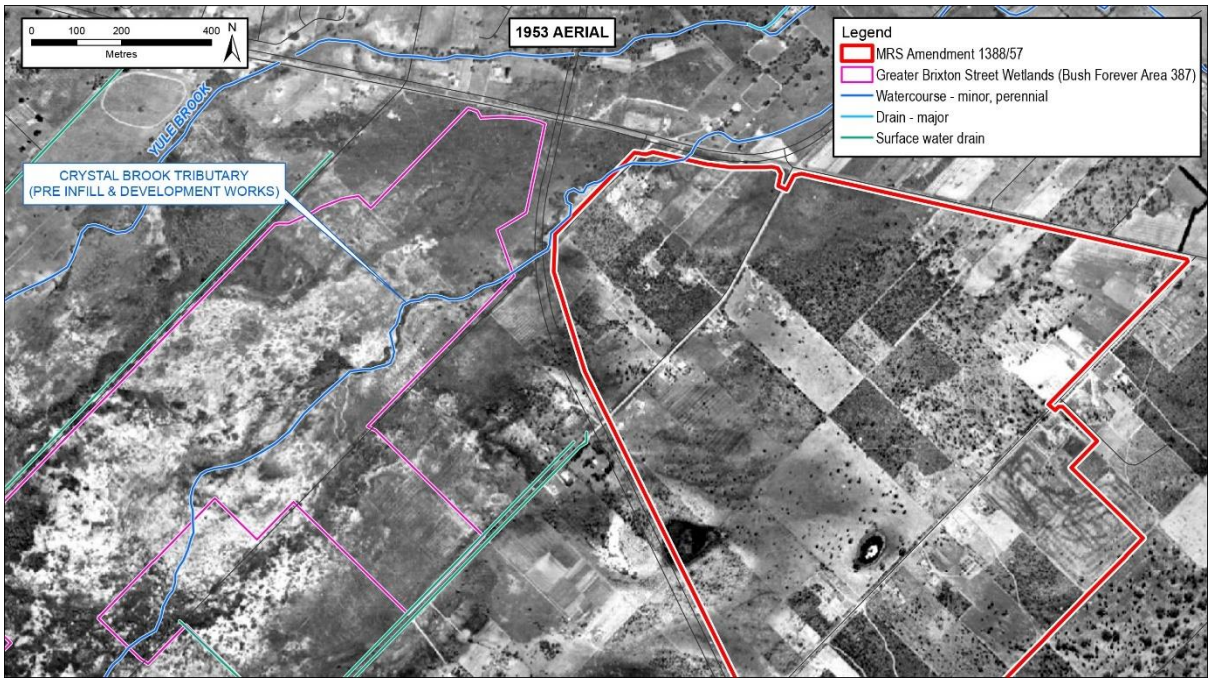


Figure C: Wattle Grove amendment area and the GBSW area (1953 aerial photograph).

The following key development undertaken between 1953 and 1985 amended the regional and local hydrological conditions:

1. Construction of Tonkin Highway, the Boundary Road reserve which bisects:
    a. Crystal Brook
    b. The GBSW area and the amendment area
2. Operational Hartfield Golf Course located in the north-east of Welshpool Road (and approximately 500 m from amendment area) constructed immediately adjacent to Yule Brook.
3. Clearing of vegetation adjacent to Yule Brook and excavation of the brook in areas to function as a drain.
4. Construction unlined open drains both within Brook, Boundary, Brentwood, and Victoria road reserves.
5. Water Corporation pipeline corridor which cleared portions of the two CCWs (UFI 8026 & UFI 8027) and REW (UFI 15257) across Lots 501, 146, 12 and 7.
6. REW (UFI 15257) remnant vegetation within Lots 501, 146, 12 and 7 was cleared to establish commercial land uses (along Boundary Road) and small-scale livestock properties.
7. During the construction of Tonkin Highway REW (UFI 8037) was partially infilled and the landowner of Lot 303 expanded the turf farm across the remaining REW area.
8. Expansion of rural and orchards land uses within the amendment area.
9. Clearing to establish rural lots and commercial business (i.e., poultry farm and laydown areas) within and adjacent to the GBSW area.

3.3.2. Current land use

3.3.2.1. MRS amendment area & adjacent Lot 501

The amendment area and immediately adjacent landholdings comprises numerous land uses including:

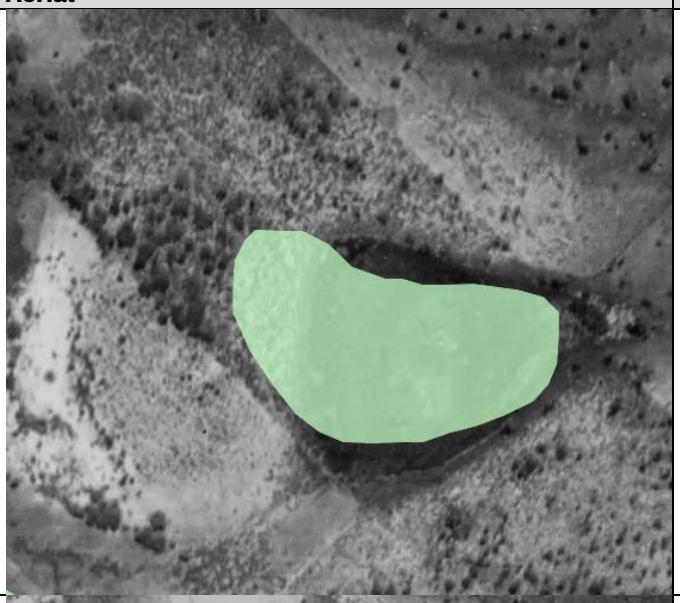
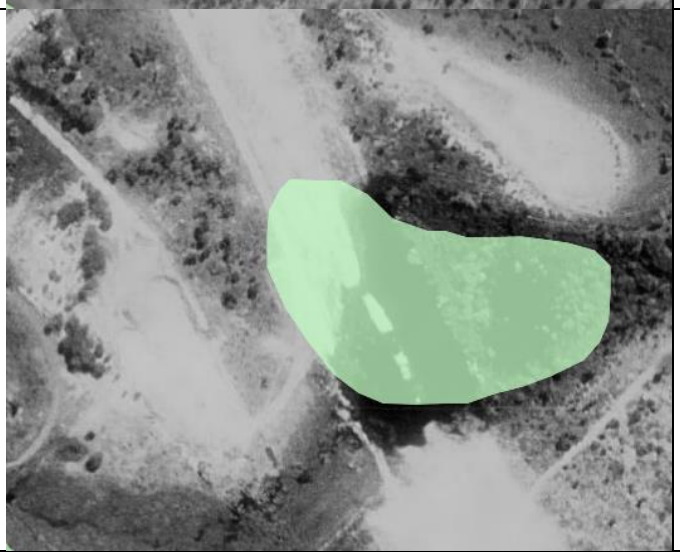
- Commercial landscape supply along Welshpool Road and Boundary Road adjacent to two CCWs (UFI 8026 & UFI 8027) and REW (UFI 15257).
- Residential and semi-rural lots.
- A turf farm within Lots 213, 214, 53 and 303 Brentwood Road the west of the amendment area.

- A former poultry farm within Lot 251 Victoria Road in the south-east portion of the amendment area, which ceased operations approximately ten years ago.
- Water Corporation and DBNGP cleared pipeline easements, which runs parallel to the Tonkin Highway along the amendment area's western boundary.
- Welshpool Road and Tonkin Highway road reserves.

3.3.3. Historical wetland review – within the amendment area

Table 5 outlines the historical aerial assessment of REW UFI 8037 within the amendment area.

Table 5: Historical aerial assessment of REW UFI 8037

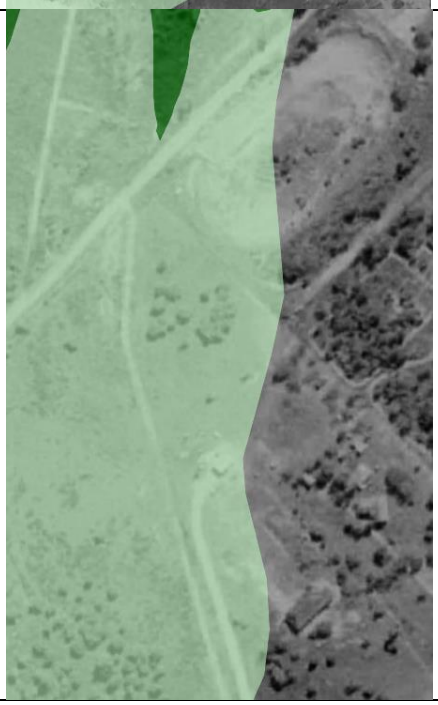
Year	Aerial	Comment
1953		• The earliest aerial of REW UFI 8037. • Intact wetland waterbody. • Clearing and infilling of the REW from landholdings west of the REW.
1974		• Infilling and clearing of the wetland from preloading/ earthworks undertaken for the construction of the Tonkin Highway. • Infilling and clearing of REW UFI 8037 in private landholding. This land clearing was to support rural land use adjacent to the REW.

1981		• Ongoing infilling and works within REW UFI 8037 from the construction Tonkin Highway. • Clearing and infilling from the installation of the Water Corporation's water & the DBNGP pipelines. • Extensive clearing of the REW UFI 8037 area and surrounding landholdings.
2000		• The native vegetation within REW UFI 8037 completely cleared. • Excavation of the wetland to create a water source. • Turf farm is the dominant land use.
2003 to 2023		• Waterbody has been filled with sand to expand the turf farm. • The construction of the turf farm, the Tonkin Highway (via pre-loading) and excavation of the Water Corporation and DBNGP pipeline corridors (~ 15 m in width) involved the removal of clayey/hydric soils. • REW 8037 has been subject to historical impacts including clearing of vegetation and filling works to facilitate the construction of Tonkin Highway, the Water Corporation & DBNGP pipelines, and an operational turf farm. • The wetland's ecological values are no longer present. There are no groundwater dependent riparian communities present or habitat (or habitat diversity) for aquatic dependent fauna.

		• The mapped wetland contains a commercial turf area and the cleared Water Corporation and DBNGP easements.

Table 6 outlines the historical aerial assessment of REW UFI 15257 within the amendment area.

Table 6: Historical aerial assessment of REW UFI 15257

Year	Aerial	Comment
1953		• Extensive land clearing within REW UFI 15257 and adjacent rural landholdings. Significant reduction in riparian vegetation. • Boundary Road reserve which bisects REW UFI 15257 was constructed prior to 1953. • Houses constructed within immediately adjacent to REW UFI 15257.
1979		• Over 90% of the native vegetation within the mapped REW UFI 15257 area has been cleared. • Additional houses (and rural infrastructure) constructed (and infilling) within and immediately adjacent to REW UFI 15257.

1981		• Clearing and infilling within the mapped REW UFI 15257 to support:
		  ○ The construction of Tonkin Highway and excavation of the Water Corporation and DBNGP pipeline corridors (~ 15 m in width).
		  ○ Expansion of the rural lifestyle properties.
		  ○ Clearing and infilling of Lots south of Boundary Road.

1985		• The Water Corporation and the DBNGP pipeline easement adjacent to the Tonkin Highway remain cleared of remnant vegetation. • Over 95% of the mapped REW UFI 15257 within the amendment area has been cleared. • Clearing and earth working the Lots south of Boundary Road for commercial land use. • Planting of non-native trees within the rural paddocks along the Water Corporation and DBNGP easement. • Expansion of rural properties within and adjacent to REW UFI 15257.

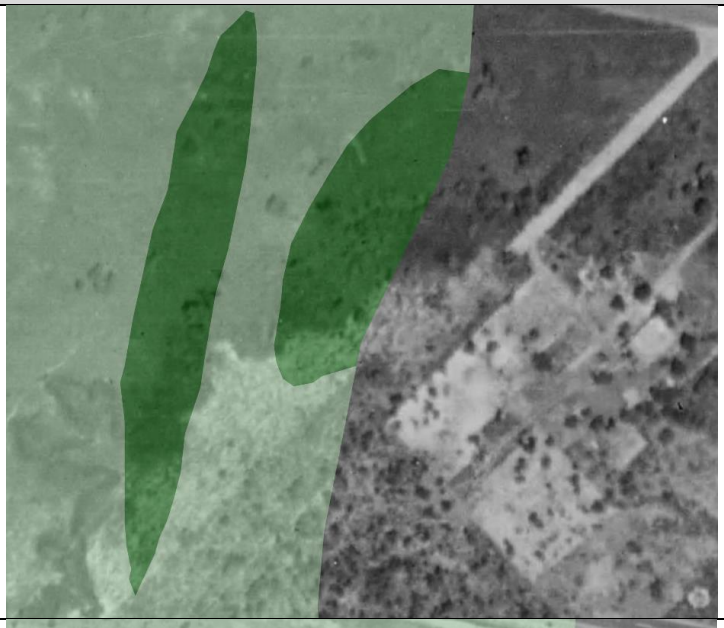
2000		• Commercial landscape/garden supply stockyard established adjacent to the Boundary Road within the mapped wetland boundary. • Additional houses constructed immediately adjacent to REW UFI 15257. • The Water Corporation and DBNGP easement remain cleared of vegetation.

2003 to 2020		• Additional clearing of native vegetation and infilling of the wetland for the following purpose:
		  ○ Expansion of the commercial landscape/garden supply stockyard.
		  ○ Expansion of land uses within the rural properties to include landscaped gardens, swimming pools & tennis court.
		• Maturing of the non-native trees planted in the early 1990s along fence lines.
		• Within and adjacent to the Tonkin Highway reserve, the following vegetation was surveyed and mapped:
		  ○ Planted stands of *Corymbia calophylla* (Marri) and non-native eucalypt Eucalyptus camaldulensis (Red River Gum) over non-native eucalypt *Casuarina cunninghamiana subsp. cunninghamiana*, *Melaleuca preissiana*, *Jacksonia sternbergiana* and *Schinus terebinthifolia over introduced species on various soils and topographical positions (Woodman Environmental 2021).
		• Within the DBNGP easement (open paddock area):
		  ○ Cleared paddocks with *Eucalyptus camaldulensis* (Red River Gum).
		• The vegetation was surveyed as in 'Completed Degraded' condition.

3.3.4. Historical wetland review – adjacent to the amendment area

Table 7 outlines the historical aerial assessment of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 within Lot 501, located north-west of the amendment area adjacent to Tonkin Highway and Welshpool Road.

Table 7: Historical aerial assessment of two CCWs (UFI 8026 UFI 8027) and portion of REW UFI 15257 within Lot 501

Year	Aerial	Comment
1953		• Wetlands connected to Crystal Brook. • Boundary Road partially constructed and bisects Crystal Brook. • Clearing of native vegetation within the two CCWs (UFI 8026 UFI 8027), REW UFI 15257 within Lot 501 and immediate surroundings. • Portions of the landholdings adjacent south of Boundary Road were cleared.
1965		• Over 80% of the native vegetation within the two CCWs (UFI 8026 UFI 8027) and the portion of the REW UFI 15257, Crystal Brook tributary and immediate surroundings within Lot 501 was cleared. • Boundary Road constructed further westward with formalisation of the Crystal Brook tributary into an open road side drain. • The mapped CCWs are located immediately adjacent to the constructed Boundary Road. • Rural landholdings south of Boundary Road have been cleared of native vegetation.

1985		• Widening of Welshpool Road into Lot 501. • The DBNGP easement is located wholly across CCW UFI 8026. • The construction of the Tonkin Highway and the installation of the water and DBNGP pipeline which involved the removal of clayey/hydric soils. • The two CCW (UFI 8026 UFI 8027) and REW UFI 15257 within Lot 501 demonstrate limited native vegetation re-growth i.e., regular maintenance of the cleared areas. • Landholdings south of Boundary Road were cleared and earth worked and infilled. • Boundary Road terminated at Tonkin Highway.
2000		• Lot 501 is estimated to be 80% cleared of native vegetation. • Lot 501 is subject to regular vegetation maintenance program with a focus on clearing the wetland understorey and the Water Corporation and DBNGP pipeline easement. • Landholdings south of Boundary Road used as commercial landscape/garden supply business.

2003 to 2020		• No significant change to the status of the two CCWs (UFI 8026 UFI 8027) and REW UFI 15257 within Lot 501 not significantly changed. The wetlands areas remain subject to regular maintenance (i.e., mowing of grass/understorey). • Expansion of the commercial landscape supply business south of Boundary Road.

3.3.5. Geology

3.3.5.1. Regional Geology

Regional topographic contour mapping (DPIRD 2019) indicates that the Amendment Area is relatively flat to undulating, with elevation ranging from 21 m Australian Height Datum (AHD) in the west of the amendment area to 35 m AHD in the east. The amendment area is located between Yule Brook Main Drain (approximately 200 m to the north and north-west) and Bickley Brook Main Drain (approximately 1.8 km to the south).

A summary of the regional geological succession is provided in Table 8.

Table 8: Regional geological succession within the amendment area and Lot 501

Stratigraphy	Lithology
Amendment Area (and UI and UE areas)	
Superficial Formations	
Bassendean Sand	Sand, minor silt and clay.
Guildford Formation	Alluvial sand and clay with shallow-marine and estuarine lenses.
Yoganup Formation	Sand with minor clay.
Osborne Formation: • Kardinya Shale Member. • Henley Sandstone Member.	Siltstone and shale, minor sandstone / claystone.

The superficial formations underlying the amendment area comprise of the Yoganup Formation with areas of overlying Bassendean Sand (to the east, central and southern areas), and the Guildford Formation (west and north-west). The non-continuous Guildford Formation interfingers with the Bassendean Sand and is close to the surface in areas along the north western and western boundary within the amendment area. The Leederville Formation intersect the superficial formations approximately 30 m below ground level (bgl).

Table 9 provides a summary of the geological map units within the amendment area and immediate surrounds including Lot 501.

Table 9: Summary of the geological map units within the amendment area and Lot 501

Map Unit	Description	Equivalent Unit on Geological Maps
S_8	• Sand – white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin.	Bassendean Sand (Qpb).
S_{10}	• Sand – S8 (sand) over sandy clay to clayey sandy of the Guildford Formation, of eolian origin.	Thin Bassendean Sand over Guildford Formation (Qpb/Qpa).
S_{12}	• Sand – structureless, yellow, fine-grained, subangular, and medium to coarse grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay, of colluvial origin.	Yoganup Formation (Qpr).
Mgs_2	• Gravelly silt – strong brown, tough, common pebbles of fine to coarse-grained, sub-rounded granite, some dolerite and rare sandstone (SS), variable sand content.	Colluvium (Qc).
Ms_4	• Sandy silt – cream to pale brown, angular to rounded sand, low cohesion, of alluvial origin.	Alluvium (Qha).
Cs	• Sandy clay – white/grey to brown, fine to coarse-grained, subangular to rounded sand, clay of moderate plasticity gravel and silt layers near scarp.	Guildford Clay (Qpa).

3.3.5.2. Geotechnical Assessment

Two geotechnical investigations in October 2020 and November 2022 were undertaken within the amendment area. The geotechnical investigations included (Douglas Partners 2020 & 2022):

- Excavation of 27 test pits.
- Perth sand penetrometer (PSP) testing adjacent to each test pit location.
- Installation of 2 groundwater monitoring bores.
- Infiltration testing at seven locations.

Table 10 summarises the geotechnical assessment (Douglas Partners 2020 & 2022) and the alignment with the regional geological units and aquifer.

Table 10: Superficial Formation Geological Condition (Douglas Partners 2020 & 2022)

Formation	Stratigraphy	Thickness	Lithology	Aquifer
Superficial	Topsoil / Bassendean Sand	0.1 m to 0.15 m.	Dark grey-brown and grey-brown, sandy topsoil with silt and roots.	Superficial aquifer
	Bassendean Sand	0.5 m and test pit termination depths of 2.5 m.	**SAND SP:** loose to dense, fine to medium grained, light grey and light yellow brown.	
	Yoganup Formation	Below Bassendean Sand and from 0.8 m depth.	**SAND SP-SM:** medium dense to dense, light brown and yellow-brown sand, with low plasticity to non-plastic fines content of between approximately 5% to 12%, underlying topsoil or surficial fill at some test locations. Fines content typically increases with depth.	
		Between 0.1 m and 1.6 m extending to depths of between 0.6 m and termination depths of up to 2.5 m in some locations.	**SAND/Clayey SAND SP-SC/SC:** yellow-brown sand with clay/clayey sand (approximately 12% and greater content of low plasticity fines).	

		Between 0.6 m and 1.5 m extending to termination depths of up to 2.5 m in some locations.	**Clayey SAND SC:** yellow-brown low plasticity clayey sand was encountered.	

Figure D illustrates the regional geology and geological investigations within the amendment area and the GBSW area.

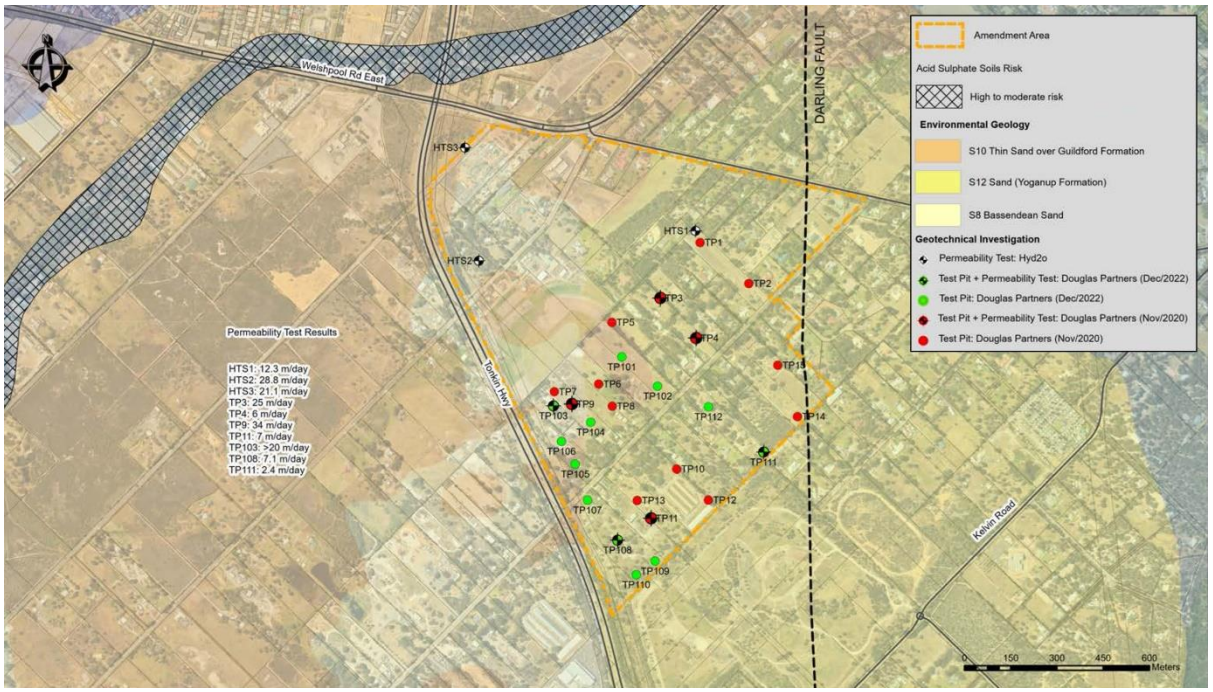


Figure D: Regional Geological Mapping

3.3.6. Hydrology

3.3.6.1. Surface Water

The amendment area is situated within the Yule Brook sub-catchment (Figure E) which forms the northern most section of the larger Swan Avon Canning River Catchment. The Yule Brook (and its major tributaries, Woodlupine Brook and Crystal Brook) has a total catchment area of 56 km^2, most of which is highly modified and includes urban uses such as light to medium industry and high-density residential developments, as well as agricultural uses such as horticulture and poultry farming (Hyd2o 2023).

The amendment area represents approximately 2% of the total Yule Brook catchment area and 15% of the GBSW area sub-catchment. However, the surface water contribution towards the GBSW amendment area is estimated to be 7.8% (much less than 15%) due to its sandy soils (enables infiltration of surface water) and deep groundwater table (Hyd2o 2023).

Crystal Brook once traversed through the amendment area into the GBSW area. However, in the early 1950's, the brook was diverted (via an excavated drain) north of the amendment area into the Yule Brook. The Crystal Brook tributary within the north western portion of the amendment area was historically cleared and filled to support the following developments:

- Rural and commercial land uses.
- Construction of Welshpool Road.
- Construction of Tonkin Highway.
- Construction of Boundary Road and associated open road side drains.

Remnants of the Crystal Brook creek line within the north-eastern portion of the GBSW area, adjacent to Tonkin Highway remains intact. Surface water from the north-western portion of the amendment area conveyed via the Boundary Road culvert, beneath the Tonkin Highway, follows for the first approximately 500 m the Crystal Brook tributary alignment.

The Crystal Brook tributary within the GBSW area is not contiguous and has been subject to land clearing and rural land uses.

In larger stormwater events, surface water is intercepted by the open road side drain adjacent to Boundary Road.

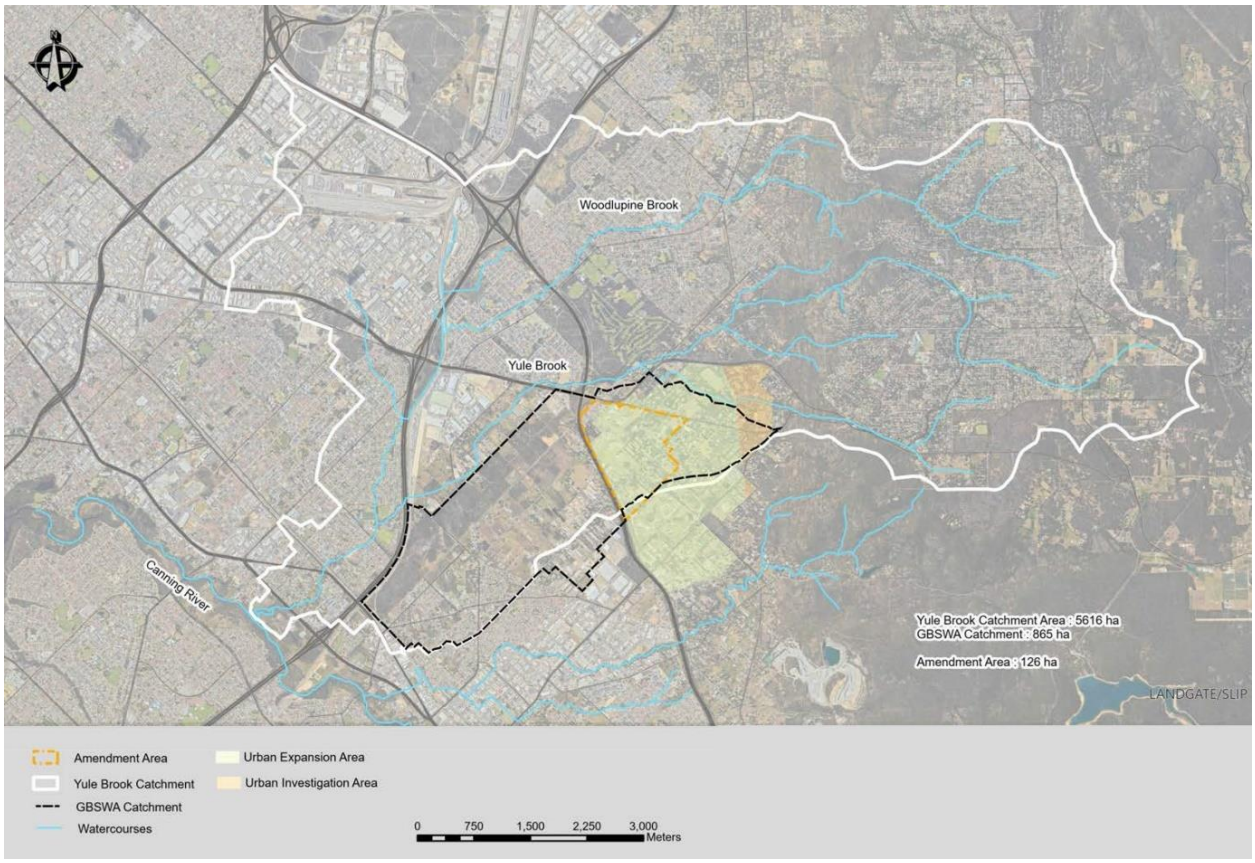


Figure E: Yule Brook Sub-Catchment (Hyd2o, 2024a)

3.3.6.2. Groundwater

The DWER regional mapping in the area extends over the amendment area is but is limited is local accuracy by the distance of the closest DWER bores to the site, which is over 5 km to the west, with no bores to the north, east and south. More detailed site-specific investigations were therefore undertaken to provide local mapping of groundwater levels and flow directions.

The detailed site specific investigations across the amendment area, and within the GBSW area, encompasses 23 bores and a further three regional DWER bores. The groundwater data determined the contours ranged from approximately 16 m AHD in the north eastern to approximately 19 mAHD on the western boundary at the amendment area.

Groundwater flow generally ranges from north west to south east across the amendment area (Hyd2o 2023). The regional groundwater depth was found to range from 5 m to 20 m below the natural ground surface (Hyd2o 2023).

3.3.7. Regional vegetation context

Heddle *et al.* (1980) regional vegetation complex mapping, used to assess pre-European vegetation, identified the amendment area and Lot 501 as straddling three vegetation complexes, specifically, the Forrestfield, Southern River, and Guildford Complex.

These complexes align with three major landforms, Foothills (Ridge Hill Shelf) in the east of the survey area, the Pinjarra Plain, and a combination of Bassendean Dunes and Pinjarra Plain. The three vegetation complexes are described in Table 11.

Table 11: Vegetation complexes of the survey area and percent remaining in the Perth-Peel region (Heddle et al. 1980)

Complex	Description	% Remaining
Forrestfield Complex	Vegetation ranges from open forest of *Corymbia calophylla – Eucalyptus wandoo* – E. *marginata* to open forest of *E. marginata – C. calophylla – A. fraseriana – Banksia* spp. With fringing woodland of *E. rudis* in the gullies that dissect this landform.	10.3%
Southern River	Open woodland of Marri-Jarrah-banksia on the elevated areas and a fringing woodland of *Eucalyptus rudis -Melaleuca rhaphiophylla* along the streams.	16.8%
Guildford Complex	A mixture of open forest to tall open forest of *C. calophylla – E. wandoo – E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis – M. rhaphiophylla*.	5.87%

3.3.8. Vegetation units

The wetland vegetation assessment(s) is underpinned by:

1. Wattle Grove South Ecological Surveys. Detailed vegetation and flora surveys were completed in October 2019 (AECOM 2020).
2. Biological Survey and Targeted Black Cockatoo Habitat Assessment for the Tonkin Grade Separated Interchanges. Flora and vegetation field survey completed between August to December 2019 and March 2020 (Woodman Environmental 2021).

3.3.8.1. REW - UFI 8037

The wetland vegetation within REW UFI 8037 was historically cleared in the early 1980's to accommodate the construction of the Tonkin Highway, the Water Corporation water pipeline and the DBNGP. In the early 2000's the landowner extended the turf farm across the mapped REW area.

There is no native vegetation within the turf farm (Lot 303), the Water Corporation water pipeline and DBNGP easements (Lot 302) and the Tonkin Highway road reserve (Lot 301). The remnant vegetation is 0.08 ha area within Lots 107 and Lot 106. This remnant vegetation consists of scattered trees (primarily Red River Gums) in a cleared rural paddock.

The 2023 aerial photograph, shown in Figure F, illustrates the status of REW 8037 within the turf farm and the Tonkin Highway reserve.

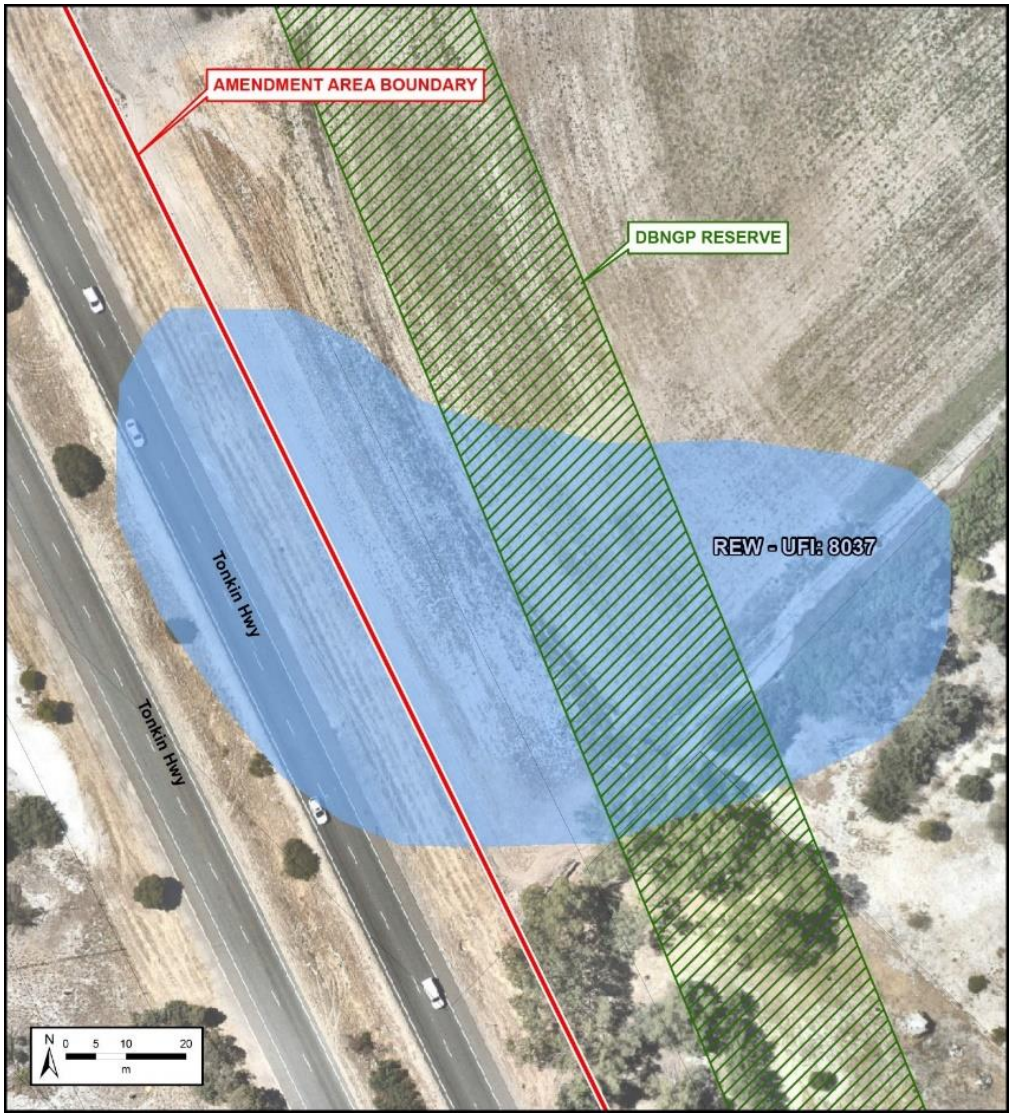


Figure F: REW 8037 and the DBNGP easement.

3.3.8.2. REW UFI 15257

In 1985 over 90% of the remnant native vegetation within REW UFI 15257 has been historically cleared. The historical clearing of the vegetation within REW UFI 15257 was a direct result of establishing rural livestock paddocks and dwellings, construction of Tonkin Highway and the Water Corporation pipeline and the DBNGP.

Currently within the mapped REW (UFI 15257) are the following land uses:

- Tonkin Highway reserve
- Boundary Road reserve
- Water Corporation and DBNGP pipeline easements
- Semi-rural paddocks
- Commercial landscape supply business

REW UFI 15257 with the existing land uses is shown in Figure G.

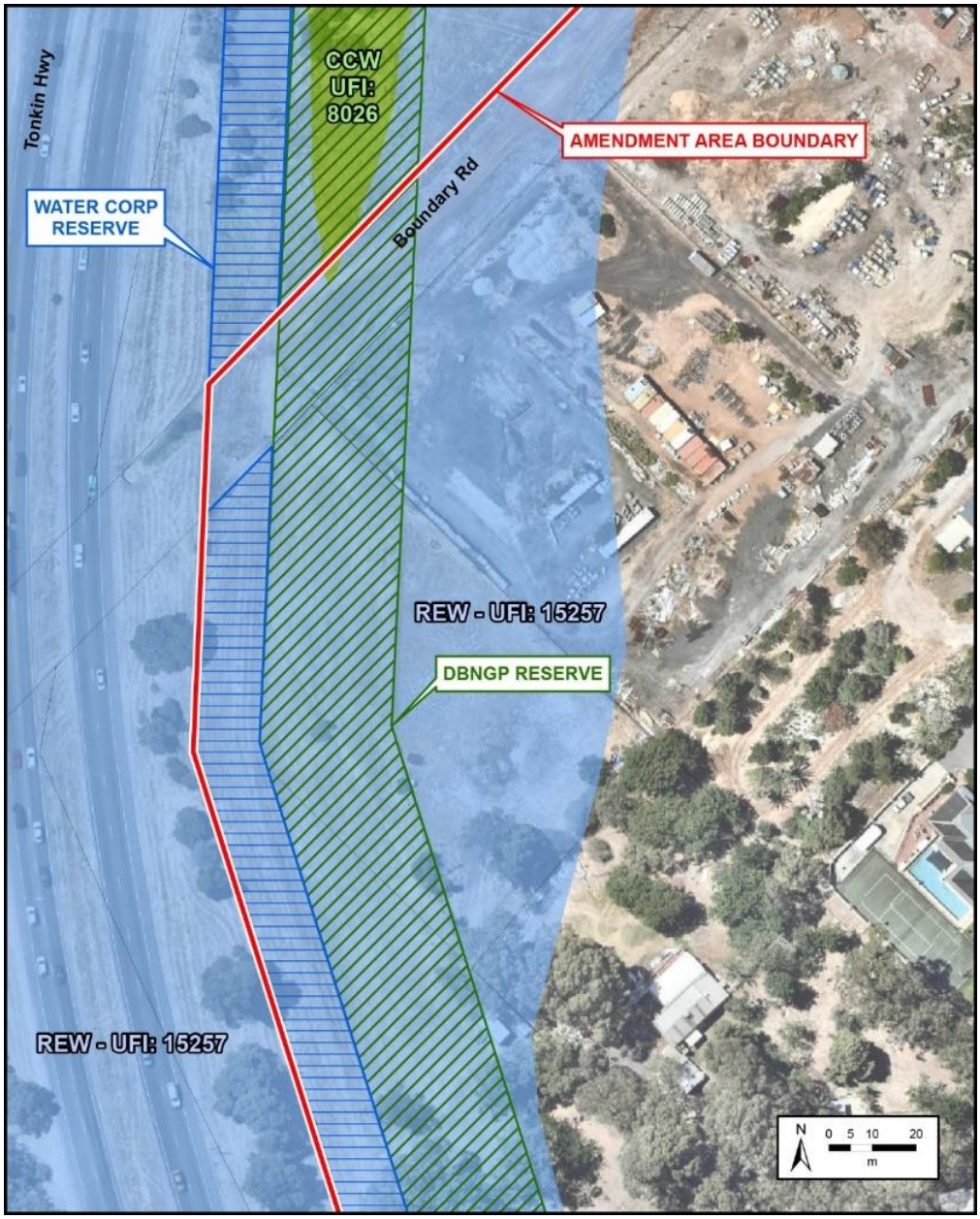


Figure G: REW 15257 and the DBNGP and Water Corporation easement

Between 1985 and 1995 the landowner(s) planted eucalyptus trees along fence lines adjacent to the cleared Water Corporation and the DBNGP pipeline easements. Additionally, MRWA planted trees within the Tonkin Highway road reserve.

The ecological/botanical surveys undertaken by AECOM and Woodman Environmental between 2019 to 2020 identified for the portion of REW UFI 15257 that is within the amendment area as:

- Within and adjacent to the Tonkin Highway reserve:
    - Planted stands of *Corymbia calophylla* (Marri) and non-native eucalypt *Eucalyptus camaldulensis* (Red River Gum) over non-native eucalypt *Casuarina cunninghamiana* subsp. *cunninghamiana*, *Melaleuca preissiana*, *Jacksonia sternbergiana* and **Schinus terebinthifolia* over introduced species on various soils and topographical positions (Woodman Environmental 2021).
- Within the DBNGP easement:
    - Cleared paddocks with *Eucalyptus camaldulensis* (Red River Gum).
    - 'Scattered trees' and open paddock areas with no native understorey (AECOM 2020).

Figure H outlines the vegetation unit mapping (Woodman Environmental 2021).

Figure H: Vegetation Types (Woodman Environmental 2021).

The site visit identified the planted Red River Gums as the dominant tree species along the DBNGP easement boundary (Plate 1).

Plate 1: Planted *Eucalyptus camaldulensis* (Red River Gum) trees within REW 15257

Plate 2 shows the open paddock and Water Corporation and DBNGP easements are.

Plate 2: REW 15257 within the amendment area and the cleared Water Corporation and DBNGP easements and the Tonkin Highway road reserve.

3.3.8.3. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

The two CCWs are located are within Lot 501. Lot 501 is a 1.6 ha triangular landholding bounded by Tonkin Highway to the west, Welshpool Road to the north and Boundary Road to the south. The landholding also contains a portion of REW UFI 15257.

The two CCWs and the portion of REW UFI 15257 within Lot 501 have been historically disturbed from the construction of the adjacent roads and the installation of the Water Corporation pipeline and the DBNGP.

Within 50 m of the two CCWs UFI 8026 & UFI 8027 are the following key land uses:

1. Welshpool Road and Tonkin Highway.
2. Boundary Road
3. Landscape supply commercial business.
4. Rural lots.

The land uses within Lot 501 (inclusive of the two CCWs and the portion of REW UFI 15257) including the Tonkin Highway, Welshpool Road and Boundary Road reserves, Water Corporation pipeline/DBNGP easements has resulted in the historical clearing of significant portion of the native vegetation within Lot 501.

Immediately adjacent to the adjacent to Lot 501 (including the two CCWs and the portion of REW UFI 15257) within the amendment area are the following land uses, Boundary Road reserve, commercial landscaping business and cleared rural lots. There is no remnant native vegetation within 70 m of the two CCWs.

Figure I illustrated the existing the status of the two CCWs within Lot 501 and the adjacent Tonkin Highway (west), Welshpool Road (north), Boundary Road (south) and the commercial landscape business (south).

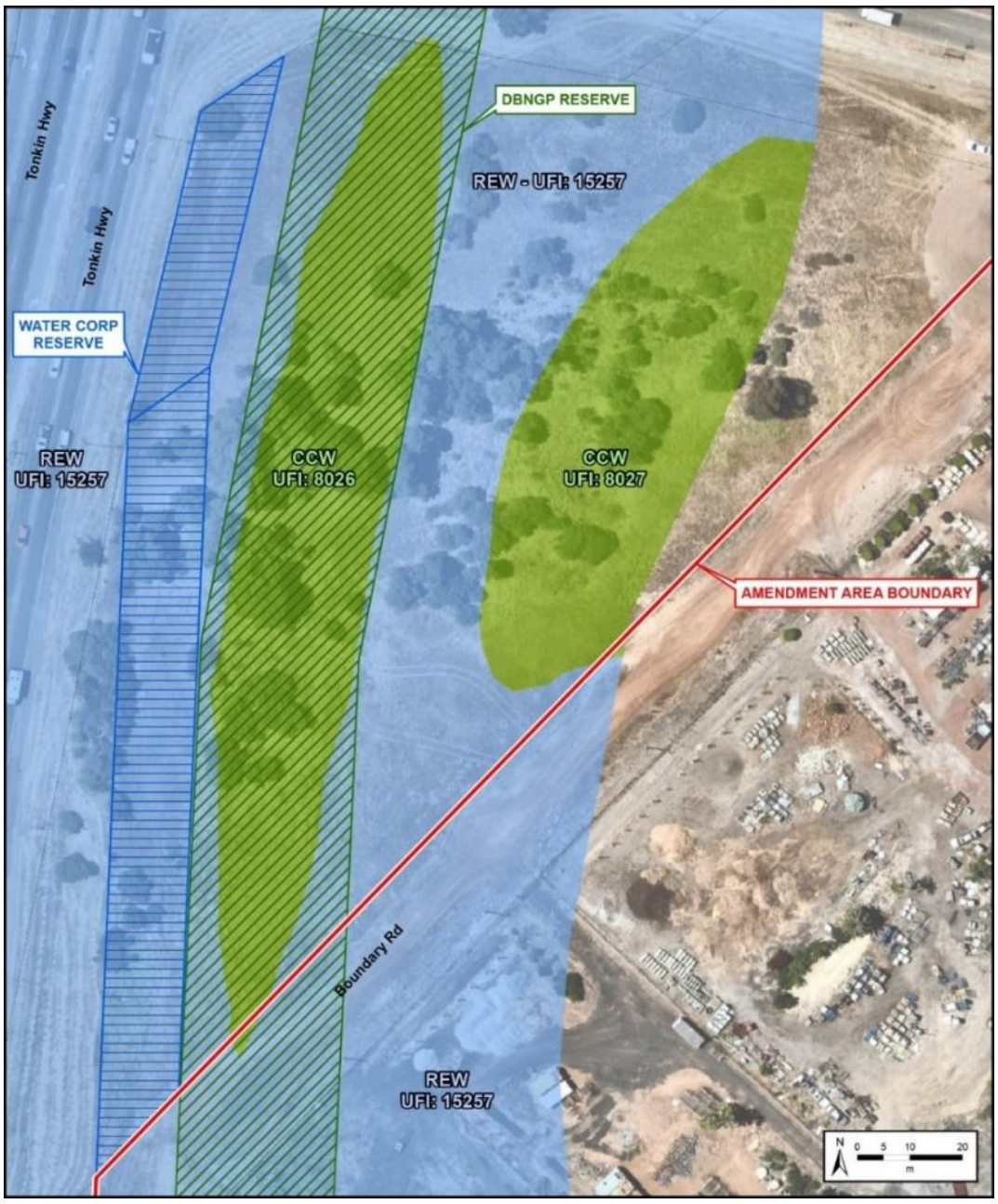


Figure I: CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501.

Boundary Road is a City of Kalamunda local road asset. The MRS amendment does not alter the Boundary Road reservation and/or its current location or the City's management of the road reservation.

The Water Corporation and DBNGP easements and the two CCWs (UFI 8026 & UFI 8027) and portion of REW 15257 within Lot 501 are illustrated in Plate 3.

Plate 3: The cleared DBNGP easement bisects CCWs UFI 8026 & UFI 8027

Woodman Environmental (2021) vegetation survey identified the following vegetation units within primarily the mapped CCWs areas within Lot 501:

- Mid open woodland of *Corymbia calophylla* over low woodland of mixed species dominated by *Eucalyptus rudis*, *Melaleuca rhaphiophylla* and *Melaleuca preissiana* over tall sparse shrubland of mixed species dominated by *Acacia saligna* over mid sparse shrubland of *Acacia pulchella* over mid tussock grassland of mixed species dominated by **Avena barbata*, * *Eragrostis curvula* and **Ehrharta calycina* over **Watsonia meriana* on grey and brown sandy loam and clay loam on plains, flats, and drainage lines.
- Individual or stands of *Corymbia calophylla* over introduced species including **Avena barbata*, **Bromus diandrus* and **Ehrharta calycina* on various soils and topographical positions.

The mapped vegetation units within Lot 501 are illustrated in Figure 4.

Boundary Road reserve and the adjacent landscape supply business and the two CCWs within Lot 501 is shown in Plate 4.

Plate 4: Boundary Road reserve and the adjacent landscape supply business

3.3.9. Vegetation condition

3.3.9.1. REW UFI 8037 & UFI 15257

The AECOM survey of portions two REWs (UFI 8037 & UFI 15257) and the two CCWs (UFI 8026 & UFI 8027) identified as being significantly altered areas because of historical clearing and construction of key infrastructure corridors (Tonkin Highway reserve, Water Corporation pipeline and the DBNGP easement). Consequently, the vegetation condition was rated as 'Completely Degraded'.

Weeds are prevalent throughout the wetlands, due to the high level of historical land clearing and disturbance associated with historical and existing land uses.

3.3.9.2. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

Woodman Environmental survey of Lot 501 inclusive of the two CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 rated the vegetation as being in a 'Degraded' Condition with the REW UFI 15257 rated in 'Completely Degraded' condition.

3.3.10. Flora

Database research identified the potential for *Banksia mimica* (T) to be within 500 m of two REWs (UFI 8037 UFI and 15257) with a known population 3 recorded in 2000 on properties south east of Crystal Brook Road and Brentwood Road. All properties in this vicinity have been cleared and no native vegetation remains (AECOM 2020). B. mimica was not recorded during the AECOM (2020) and Woodman Environmental (2021) surveys field survey.

The AECOM (2020) and Woodman Environmental (2021) surveys assessed portions of the amendment area (including portions of REWs (UFI 8037 UFI and 15257) and CCWs (UFI 8026 & UFI 8027)) and the Tonkin Highway road reserve for the flora species including:

- Flora identified as a Threatened (T) or Priority (P) species (formally listed significant taxa – includes taxa listed under both State and Commonwealth legislation and classified as Priority by DBCA).
- Locally endemic or associated with a restricted habitat type (e.g., surface water or GDEs).
- New species or species with anomalous features that indicate a potential new species.
- Representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range).
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids.
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

The AECOM (2020) and Woodman Environmental (2021) surveys did not identify any conservation significant flora was recorded within or adjacent to:

- The portions of UFI 8037 and UFI 15257 that intersect the amendment area.
- Lot 501 inclusive of the two CCWs (UFI 8026 & UFI 8027) and REW UFI 15257.

The closest significant flora recorded was approximately 1 km south and south-west of REW UFI 8037. The significant flora species include (Woodman Environmental 2021):

1. *Conospermum undulatum* (T)
2. *Johnsonia pubescens* subsp. *cygnorum* (P2)
3. *Verticordia lindleyi* subsp. *lindleyi* (P4)

3.3.11. Threatened and Priority Ecological Communities

Database searches undertaken by AECOM (2020) and Woodman Environmental (2021) identified 14 conservation significant ecological communities that occurred in proximity of the amendment area. The AECOM (2020) and Woodman Environmental (2021) confirmed no Threatened Ecological Communities (TEC), listed under the *Biodiversity Conservation Act 2016* (BC Act) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) occur within the REW areas (UFI 8037 and UFI 15257) and Lot 501 inclusive of the two CCWs (UFI 8026 & UFI 8027).

The wetland areas (REWs (UFI 8037 and UFI 15257) and the two CCWs (UFI 8026 & UFI 8027)) been subject to historical clearing and rural land uses, and therefore do not contain Threatened or Priority Ecological Communities.

The closest TECs located within the GBSW area (100 m to 1 km to the west) include:

- SCP3a - *Corymbia calophylla -Kingia australis* woodlands on heavy soils, Swan Coastal Plain (WA); *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan Coastal Plain (Commonwealth.
- SCP3b - *Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain
- SCP10a - Shrublands on dry clay flats (WA); Clay Pans of the Swan Coastal Plain (Commonwealth).

Within the amendment area the following TEC has been recorded approximately 500 m – 1 km east of REWs (UFI 8037 and UFI 15257):

- SCP20a - *Banksia attenuata* woodlands over species rich dense shrublands (WA); Banksia Woodlands of the Swan Coastal Plain (Commonwealth).

3.3.12. Fauna

Conservation significant fauna searches were conducted using a 10 km buffer in NatureMap and the EPBC Protected Matters Search Tool (PMST) to identify fauna species potentially occurring in the amendment area.

The database search indicated 38 fauna taxa of conservation significance have the potential to occur within the amendment area. A total of 14 species are listed as Threatened under both the BC Act and EPBC Act. However, the two REWs (UFI 8037 UFI & 15257) which intersect the amendment area are predominantly or entirely cleared of native vegetation for the following land uses, Tonkin Highway, rural livestock paddocks, commercial landscaping supply business, and a turf farm, and therefore there is no intact wetland habitat areas.

An assessment of the likelihood for each species to occur was undertaken, based on the habitat types with the amendment area using desktop information (i.e., Naturemap) and AECOM (2020) and Woodman Environmental (2021) detailed vegetation and flora surveys.

The results of the assessment determined the following conservation significant fauna species may potentially use the planted vegetation/remnant vegetation within REWs (UFI 8037 & UFI 15257) and the two CCWs (UFI 8026 & UFI 8027):

- *Calyptorhynchus banksii naso* (Forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

- *Zanda latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda baudinii* (Baudin's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Isoodon obesulus fusciventer* (Quenda) – Priority 4 (BC Act).

3.3.12.1. REW UFI 8037 & UFI 15257

The REWs (UFI 8037 & UFI 15257) comprise planted mature trees, predominantly *Eucalyptus camaldulensis* (Red River Gum), cleared livestock pastures or turf farm therefore providing limited fauna habitat. Sightings of Quenda were recorded in several lots across the amendment area, however due to the lack of any understorey/riparian vegetation, it is unlikely the infilled REWs areas (UFI 8037 and UFI 15257) provide suitable habitat for ground dwelling fauna, such as Quenda.

The mature stands of *Eucalyptus camaldulensis* (Red River Gum) have the potential to provide secondary low value foraging and roosting habitat for the threatened Forest red-tailed black cockatoo species.

3.3.12.2. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

The Water Corporation pipeline and DBNGP corridors which dissect the two CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 are maintained as cleared easements. The existing weeds and grass understorey is regularly slashed which limits any native vegetation re-growth.

The *Corymbia calophylla* trees within the two CCWs (UFI 8026 & UFI 8027) and the portion of REW (UFI 15257) within Lot 501 has the potential to provide foraging and roosting habitat to Carnaby's cockatoo and Forest red-tailed black cockatoos. The limited native vegetation areas within small wetland areas (bisected by infrastructure corridors) could provide habitat areas for frogs and reptiles.

3.3.13. Social

3.3.13.1. REW UFI 8037 & UFI 15257

The REWs UFI 8037 and UFI 15257 have been subject to significant alteration due to historical clearing to facilitate livestock paddocks, rural residential and turf farm purposes, and the construction of infrastructure, including Tonkin Highway reserve, Water Corporation pipeline and the DBNGP easements. The Water Corporation and DBNGP easements are maintained as cleared grassed areas which is regularly slashed.

The portion of REWs UFI 8037 and UFI 15257 within the amendment area are located within private landholdings, infrastructure easement and therefore are not available to the public for recreational purposes and provides no public visual amenity.

The portion of the REWs UFI 8037 and UFI 15257 (inclusive of the planted mature trees (predominantly *Eucalyptus camaldulensis*) will be incorporated into POS areas and stormwater bioretention basins adjacent to the Water Corporation and DBNGP pipeline easement. The DWMS (Hyd2O 2024) identifies the future Local Structure Plan and subdivision plans will formally integrate the Water Corporation and DBNGP easement into open space, ensuring the pipeline is protected whilst also providing a valuable community asset that provides local amenity.

3.3.13.2. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

The two CCWs (UFI 8026 & UFI 8027) like the REWs (UFI 8037 & UFI 15257), have been subject to historical anthropogenic impacts including the construction of Tonkin Highway, Welshpool Road, and Boundary Road. The wetlands were further disturbed from the installation of the Water Corporation pipeline and the DBNGP. The Water Corporation and the DBNGP easements are maintained as cleared grassed areas which is regularly slashed.

Lot 501 inclusive of the wetland areas are subject to regular maintenance (slashing).

Boundary Road provides an approximate 20 m permanent infrastructure barrier between the two CCWs within Lot 501 and the commercial landscape supply yard and the semi-rural paddocks within the MRS amendment area.

The two CCWs (UFI 8026 & UFI 8027) are outside of the amendment area located adjacent to the approximate 20 m Boundary Road reserve and is therefore not subject to any land use change.

3.3.14. Cultural

A search of the Department of Planning, Lands and Heritage (DPLH) – Aboriginal Heritage Places mapping tool (DPLH 2024) concluded that the amendment area intersects one registered heritage site: Brentwood Road Swamp (Site ID 4343). Wetland UFI 8037 also intersects this heritage site.

Figure J illustrates the location of the Brentwood Road Swamp (Site ID 4343).

The Brentwood Road Swamp was recorded in 1973 and is listed on the Register of Aboriginal Sites as an artefact scatter with an unreliable location. However, this mapped registered site (and its immediate surroundings) have been subject to historical disturbance including the construction of Tonkin Highway, Water Corporation water pipeline, the DBNGP and a commercial turf farm.

The Brentwood Road Swamp (Site ID 4343) is a heavily disturbed and altered environment. A cultural heritage survey completed with the Traditional Owner elders in 2021 identified no cultural material within the amendment area (Horizon Heritage 2021).

A search of the State Heritage Office InHerit search tool did not identify any European cultural heritage places within or adjacent to the Amendment Area (SHO 2021).

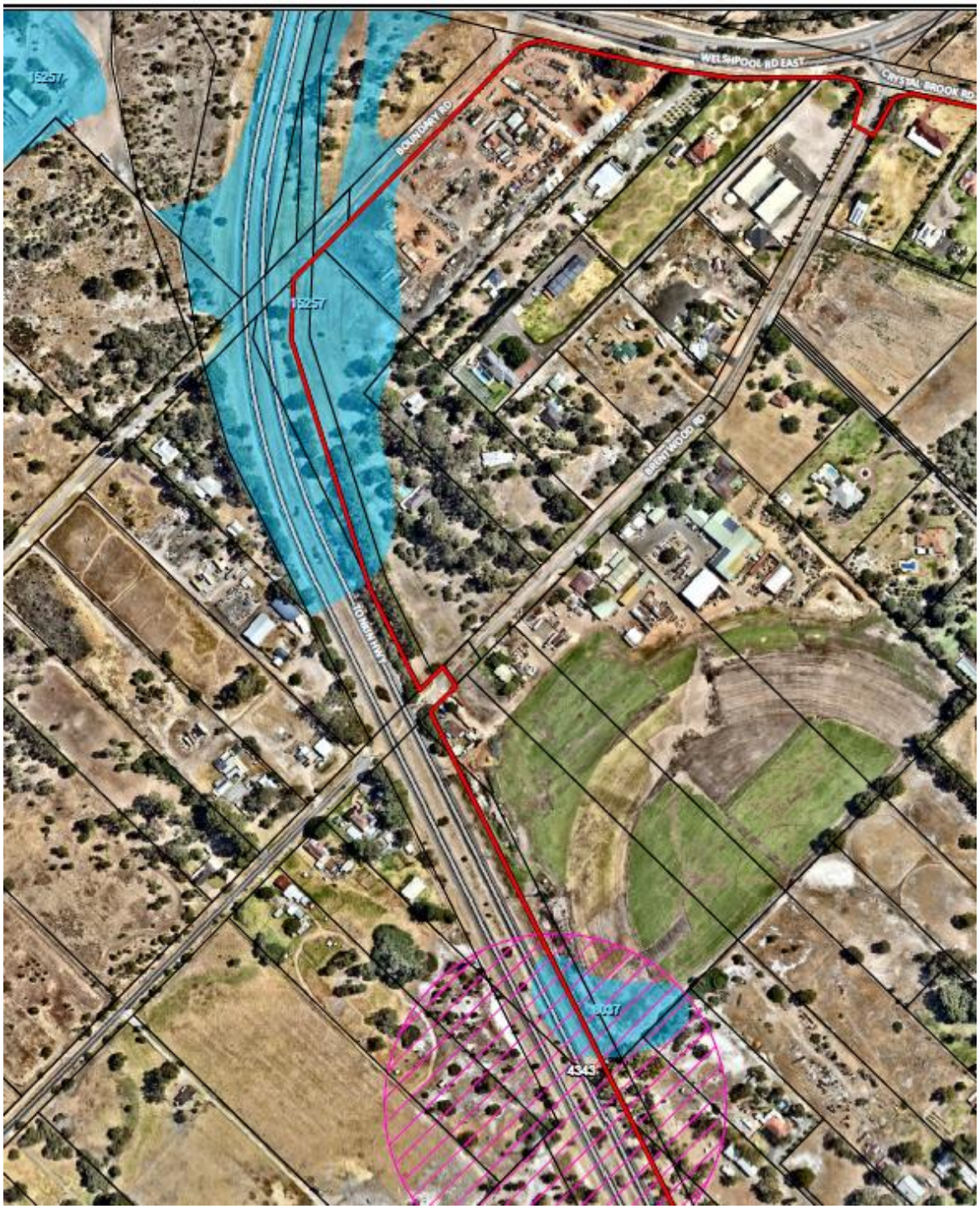


Figure J: Aboriginal Heritage Sites and Wetlands within the Amendment Area

3.4. Summary

Significant wetlands within and adjacent to the amendment area are defined as follows:

- The REWs within the amendment area (UFI 8037 & UFI 15257)
- The two CCWs (UFI 8026 & UFI 8027) and portion of REW (UFI 15257) within Lot 501.

The location and extent of the mapped wetlands within and adjacent to the MRS amendment area is shown in Figure B.

The values of each wetland feature documented as part of the wetland assessment are summarised in Table 12.

Table 12: Summary of significant wetland features and their attributes

Wetland Attribute	Wetlands within the amendment area		Wetlands within Lot 501		
Wetland	**REW UFI 8037**	**REW UFI 15257**	**CCW UFI 8026**	**CCW UFI 8027**	**REW UFI 15257**
Area	0.86 ha.	30.33 ha (approximately 2.06 ha is within the amendment area).	0.38 ha.	0.32 ha.	30.33 (0.52 ha is within Lot 501).
Geomorphology	Bassendean Sand over sandy clay to clayey sand of the Guildford Formation.		Bassendean Sand over sandy clay to clayey sand of the Guildford Formation.		
Hydrology	Sumpland	Palusplain	Palusplain	Palusplain	Palusplain
Vegetation unit	• Over 90% of the mapped REW has no native vegetation. Native vegetation was historically cleared, and the wetland infilled to establish the rural land uses and then subsequently, for the establishment of a turf farm, construction of Tonkin Highway and Water Corporation and DBNGP easements. • The vegetation present is scattered trees approximately 0.08 ha at the periphery of the REW in Lots 106 and 107.	• Within the Tonkin Highway reserve and Water Corporation easement: ○ Stands of *Corymbia calophylla* (Marri) and non-native eucalypt *Eucalyptus camaldulensis* (Red River Gum) over non-native eucalypt *Casuarina cunninghamiana* subsp. *cunninghamiana, Melaleuca preissiana, Jacksonia sternbergiana* and **Schinus terebinthifolia* over introduced species. • Within the DBNGP easement: ○ Cleared paddocks with *Eucalyptus camaldulensis* (Red River Gum).	• 80% of Lot 501 has been historically cleared of native vegetation. The remnant vegetation community consists of non-continuous patches of: ○ Mid open woodland of *Corymbia calophylla* over low woodland of mixed species dominated by *Eucalyptus rudis, Melaleuca rhaphiophylla* and *Melaleuca preissiana* over tall sparse shrubland of mixed species dominated by *Acacia saligna* over mid sparse shrubland of *Acacia pulchella* over mid tussock grassland of mixed species dominated by **Avena barbata*, * *Eragrostis curvula* and **Ehrharta calycina* over **Watsonia meriana* on grey and brown sandy loam and clay loam on plains, flats, and drainage lines. ○ Individual or stands of *Corymbia calophylla* over introduced species including **Avena barbata*, **Bromus diandrus* and **Ehrharta calycina* on various soils and topographical positions (mostly with REW UFI 15257).		

Vegetation condition	Vegetation is predominately cleared and is surveyed in a 'Completely Degraded' condition.	Vegetation is predominately cleared and is surveyed in a 'Completely Degraded' condition.	Vegetation is surveyed in a 'Degraded to Completely Degraded' condition.
TEC	No State & Commonwealth listed TECs were surveyed / observed.	No State & Commonwealth listed TECs were surveyed / observed.	No State & Commonwealth listed TECs were surveyed / observed.
Conservation Significant flora	No conservation significant flora present.		No conservation significant flora present.
Conservation Significant fauna	• Lack of dense understorey for Quenda. • Limited foraging/roosting/breeding trees for the threatened black cockatoo species within the planted stands of *Eucalyptus camaldulensis* (Red River Gum).		• The limited native vegetation, in particular the *Corymbia calophylla* (Mari) trees within the two CCWs (UFI 8026 and UFI 8027) has the potential to provide foraging and roosting habitat to the threatened Carnaby's cockatoo and Forest red-tailed black cockatoo species. • Former Crystal Brook tributary and two CCW wetland areas provides habitat for frogs and reptiles.
Heritage sites	The wetland is located within one heritage site: Brentwood Road Swamp (Site ID 4343). This heritage site has historically been high disturbed from the construction of Tonkin Highway, Water Corporation and DBNGP pipelines and the turf farm.	The wetland is not within an identified as an Aboriginal Heritage Place.	The CCWs and portion of REW UFI are not within an identified as an Aboriginal Heritage Place.

3.5. Ecological Wetland Values – GBSW Area

The GBSW comprises a complex of significant wetlands, including areas of seasonally waterlogged flats (palusplain) and seasonally inundated basins (sumplands). Table 13 outlines the DBCA mapped geomorphic wetland features within the GBSW area.

Table 13: Summary of significant wetland features and their attributes

Wetland category	UFI No.	Total Area
CCW	7637, 7646, 7653, 7747, 7748, 7775, 7797, 8025, 8028, 8031, 8032, 8035, 13129, 13131, 13365, 14962, 15255, 15815, 15816.	Approximately 150.1 ha
REW	8036, 15257, 15814, 15983	Approximately 10 ha
MUW	7740, 7744, 7746, 8030, 14964, 15254, 15724	Approximately 6.5 ha

The nearest DBCA mapped geomorphic wetland features within the GBSW area to the amendment area outlined in Table 14.

Table 14: Summary of the DBCA mapped wetland features within 75 m to 150 m of the amendment area.

UFI No.	Geomorphic classification	Management category	Land tenure details	Total area (ha)
GBSW area (within 75 m to 150 m of the MRS amendment area)				
8025	CCW	Palusplain	Lot 51 Zoned 'Parks and Recreation'	2.78
8028	CCW	Sumpland	Lot 340 Zoned 'Parks and Recreation'	1.48
8030	Multiple Use	Palusplain	Lot 342 Zoned 'Parks and Recreation'	1.29
14962	CCW	Palusplain	Lot 342 Zoned 'Parks and Recreation'	62.68
15257	REW	Palusplain	Lot 51 Zoned 'Parks and Recreation'	30.33

3.5.1. Land use context

The GBSW area and associated buffer supports a variety of existing conservation, rural, drainage and road corridor land uses, including:

- Bush Forever Ste 387.
- Rural-residential lots and dwellings.
- Equine and small-scale livestock properties.
- Light commercial and machinery lay down areas.
- Waste and recycled material storage and stockpiling.
- The construction of road side drainage swales along Brook Road, Boundary Road, and Brentwood Road.

Under the MRS, the GBSW (inclusive of the DBCA mapped wetlands) are reserved for 'Parks and Recreation' or 'Public Purposes'. Designated Bush Forever Site 387 covers an area of 176 ha across the GBSW area. Brook Road and Boundary Road frame, to the north and south, the majority of the GBSW area.

Figure 1 illustrates the GBSW area and Bush Forever Site 387 boundary.

Historical development of the surrounding landholdings to the GBSW resulted in the construction of open road side drainage lines, which still exist. Both Brook Road and Boundary Road contain constructed roadside swales, which capture and direct surface water runoff as well as intersected groundwater flows.

Table 15 outlines the historical aerial assessment of the numerous wetlands within the GBSW area.

Table 15: Historical aerial assessment of the GBSW area

Year	Aerial	Comment
1953		• Localised pre-earthworks/infilling associated with the construction of rural land uses. • Crystal Brook linked the two CCWs (UFI 8026 UFI 8027) remains partially intact within the eastern wetlands in the GBSW area. • The Crystal Brook tributary was a key conveyance pathway for seasonal surface water flows.
1974		• The Crystal Brook tributary was disrupted by the construction of Boundary Road and the excavation of open road side drains.

1981		• The construction of Tonkin Highway and the formalisation of open drains and culverts adjacent to the highway. • Commercial and rural lifestyle development within and adjacent to the GBSW area. • Clearing of vegetation south of Boundary Road and along Brook Road.
1995		• Consolidation of commercial land uses along Brook Road north of the GBSW area. This has resulted in localised infilling and clearing of wetland vegetation. • Expansion of rural land uses along Boundary Road and the north-west portion of Brook Road resulting in significant clearing of native vegetation within the eastern portion of the GBSW area. • Upgrade of Brook Road and Boundary Road.

2020		• Surface water flows is primarily via the open drains along Boundary Road and Brook Road. • A portion of the surface water flow conveyed via the Boundary Road culvert, follows the original Crystal Brook tributary alignment for the first approximately 500 m. • The Crystal Brook tributary with the GBSW area is no longer contiguous and has been subject to historical land clearing. • Evidence of re-growth of native vegetation within the GBSW post-acquisition and inclusion of the landholdings into Bush Forever Site 387.

3.5.2. Tenure and land management

The management of the GBSW area is not uniform. It incorporates a non-continuous A-Class Reserve area, Bush Forever Sites No. 387 and No. 422, State Government agencies (i.e., DBCA and the Western Australian Planning Commission (WAPC)), University of Western Australia (UWA) and private landholdings.

A summary of the GBSW management areas, summary of the environmental land assets and the land manager are outlined in Table 16.

Table 16: GBSW management reserves & tenure

Reserve / Management Areas	Summary of environmental values	Land Manager	Distance to Amendment Area
Within Bush Forever Site No. 387			

A Class Reserve / GBSW	• Non-contiguous reserve consisting of Brixton Block, Wanaping Block and separate landholdings, Alison Baird Reserve, private and government owned landholdings.
	• TECs identified include:
	  ○ FCT 3a - Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain.
	  ○ FCT 7, FCT 8, FCT 9, FCT 10a - Clay pans of the Swan Coastal Plain.
	  ○ FCT 21c - Low lying Banksia attenuata woodlands or shrublands.
	  ○ FCT 23a - Banksia Woodlands of the Swan Coastal Plain IBRA Region.
	• Guildford Vegetation Complex is the dominant vegetation complex (Heddle et al. 1990). Only 5.1% of Guildford complex remains on the Swan Coastal Plain.
		DBCA	100 m – 200 m

	• DBCA's Threatened and Priority Fauna and Atlas of Living Australia databases identified 319 vertebrate species have the potential to occur in the GBSW area (EPA 2022).		
State Government owned	• Multiple mapped CCWs & REWs. • Historical clearing & intact vegetation areas.	WAPC	400 m – 1,000 m
Private landholdings	• Private landholdings (not including UWA landholding). • Industrial land use & rural lifestyle.	Various private landowners	200 m

Alison Baird Reserve - 35 ha area.	• CCW areas – including clay pans which are listed as Wetlands of National Significance.
	• Over 650 native taxa from 80 families and characterised 13 vegetation communities (Tauss et al. 2019).
	• Alison Baird Reserve is recognised as the most floristically biodiverse area with an extensive number of endemic species including Spider net grevillea, Swamp starflower and the *Pyramid mulla mulla* (Tauss et al. 2019; Tauss and Weston 2010).
	• EPBC Act listed:
	  ○ FCT 3a - Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain.
	  ○ FCT 7, FCT 8, FCT 9, FCT 10a - Clay pans of the Swan Coastal Plain.
	  ○ FCT 21c - Low lying Banksia attenuata woodlands or shrublands.
	  ○ FCT 23a - Banksia Woodlands of the Swan Coastal Plain IBRA Region.
	• Sumpland CCW areas with areas of Melaleuca woodlands over shrubland heath.
	• Endangered Ecological Community *Corymbia calophylla — Kingia australis* woodlands on heavy soils of the Swan Coastal Plain).
	• Threatened or priority fauna habitat including:
	  ○ Carnaby's black cockatoo
	  ○ Forest red-tailed black cockatoo
	  ○ Chuditch
	  ○ Southern brown bandicoot
		UWA	1,500 m

Wanaping Block - 38 ha area.		DBCA	2,200 m
Brixton Block - 21 ha area.		DBCA / Friends of Brixton Street Wetland	2,900 m
GBSW Areas outside of Bush Forever Site No. 387			
Private landholdings / High School	• Mix of wetland types (CCWs, REWs, MUW) and areas with intact native vegetation and cleared areas. • Semi-rural properties within the western portion of the GBSW area. • Industrial development within the western portion of the GBSW area adjacent to Roe Highway. • High school area	• Rehoboth Christian College • Various private landowners	600 m - 2,900 m

3.5.3. Regional Geology

The unique wetlands and associated ecology of the GBSW area are underpinned by a distinct hydrogeology (alluvial Pinjarra Plain characterised by soils of the Guildford Formation) which established a relatively flat landscape, which supports surface water flows and channels that can lead to waterlogging and the formation of seasonal wetlands.

Table 17 outlines the regional geology within the GBSW area.

Table 17: Regional geological succession within the GBSW Area

Stratigraphy	Lithology
GBSW area	
Superficial Formations	
Bassendean Sand	Sand, minor silt and clay.
Guildford Formation	Alluvial sand and clay with shallow-marine and estuarine lenses.
Osborne Formation: • Kardinya Shale Member • Henley Sandstone Member	Siltstone and shale, minor sandstone / claystone.

The Guildford Formation clay layers form a complex sequence of clay lenses that is laterally and vertically varied. The clay layers demonstrate high resistivity which restrict the flow of water.

The regional geological map units within the GBSW area are Guildford Formation with Bassendean Dunes and Bassendean. Dunes/Pinjarra Plain (Churchward and McArthur 1980).

The Geological Survey of Western Australia, (Environmental Geology Series Armadale Part Sheets 2033 I & 2133 IV (Jordan 1986)), indicates the GBSW area is underlain by white clay of the Guildford Formation and is comprises:

- **Sand (S8):** white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals, of eolian origin.
- **Clayey sand (SC):** silty in part, pale grey-brown, medium to coarse, poorly sorted, sub-angular to rounded, frequent heavy minerals, rare feldspar, of alluvial origin.
- **Sand (S10):** white to pale grey at surface, yellow at depth, fine to medium-grained, moderately well sorted, subangular to subrounded quartz, of eolian origin, over other units.
- **Sand (S12):** structureless, yellow, fine-grained, subangular, and medium to coarse-grained subrounded to rounded quartz, feldspar and heavy minerals common, minor silt and clay, of colluvial origin.
- **Sandy silt (Ms4):** cream to pale brown alluvium, clayey in part, fine to medium-grained sand, of alluvial origin.
- **Sandy clay (Cs):** white, grey to brown, fine to coarse-grained, subangular to rounded sand, clay of moderate plasticity gravel and silt layers near scarp.

Geotechnical investigations undertaken for the Maddington Kenwick Strategic Employment Area (MKSEA) Precincts 2 and 3B indicate soil characteristics generally comprised of topsoil or fill to depths ranging from 0.1 m to 1.2 m, overlying sand, clayey, silty, or gravelly materials. The clayey and sandy materials encountered include stiff to hard clay or clayey sand/sandy clay (Emerge 2023b).

3.5.4. Surface Water

The GBSW area located within the western portion of the Yule Brook catchment (Figure E). Two main surface watercourses dissect the catchment Woodlupine Brook and Yule Brook. The Yule Brook catchment has been highly altered by a range of urban uses such as light to medium industry, residential developments, and agricultural production (DWER 2019). Both the Woodlupine Brook and Yule Brook watercourses ultimately and discharge to the Canning River south-west of the GBSW area.

GBSW area is situated on the Pinjarra Plain landform, which is characterised by impermeable soil layers often resulting in expressions of perched groundwater. This landform significantly affects the flow of water, specifically (Emerge Associates 2023b):

- The majority of surface water runoff flows into surface water channels, including natural waterways (i.e., Yule Brook) and extensive network of constructed, open, and unlined drains, occurring along roads.
- Surface water is maintained as perched groundwater due to the impermeable clay layers rather than infiltrating downwards into underlying regional aquifers. The perched groundwater can move laterally through the catchment, until it intersects a drain or more permeable soil layers enabling deeper groundwater recharge.
- The primary water outputs would comprise evapotranspiration and surface water export via Yule Brook, into the Canning River.

The construction of roads, open road side drains and stormwater pipes within the GBSW area resulted in an efficient conveyance of stormwater towards the Yule Brook and the Canning River. This outcome changed the historical hydrological flows patterns within areas of the GBSW with less surface water available to traverse the wetland (and associated flora and water dependent vegetation communities) areas (Tauss et al. 2019).

3.5.5. Groundwater

The GBSW area comprise a complex series of regionally and nationally significant wetlands, including areas of seasonally waterlogged flats (palusplain) and seasonally inundated basins (sumplands). The GBSW comprises native vegetation, which is highly biodiverse, supporting at least 611 native plant taxa, threatened and priority flora, threatened ecological communities, and habitat for threatened and priority fauna.

Consequently, vegetation within these wetlands is expected to be sustained by direct rainfall and localised perched groundwater, and not from incoming surface water flows or a deeper permanent aquifer. A shallow perched aquifer occurs between the Guildford Formation and the overlying sand and sandy clay associated with the Bassendean Sand unit (Bourke 2017). Wetlands within the GBSW rely almost solely on rainfall to fill due to the underlying clay-dominated soils of the Guildford formation, which are waterlogged through winter and form deep pools in clay depressions (DBCA 2018).

In the context of this assessment, wetland value is considered to include the potential for the wetland to support any of the following attributes:

- Flora or fauna species listed as threatened under the EPBC Act or BC Act.
- Species listed by DBCA as Priority 1, 2, 3, or 4.
- TECs or Priority Ecological Communities (PECs) as listed under the EPBC Act.
- GDEs.

3.5.6. Regional Vegetation

The regional vegetation complex mapping (Heddle et al. 1980) illustrates the GBSW area occurs within the Guildford complex. This vegetation complex has been subject to significant historical land clearing since European settlement, resulting in approximately 5.1% of its original extent currently remaining.

3.5.6.1. Key studies and investigations

A range of parties have undertaken vegetation and flora surveys and reporting across the GBSW area. The key studies which underpin the assessment of the GBSW flora and vegetation include:

- Vegetation, Flora, and Conservation Values of Lot 106 Wanaping Road, Kenwick in the Greater Brixton St Wetlands (Keighery and Tauss 2008).
- Flora, Vegetation and Wetlands of MKSEA (Tauss and Weston 2010).
- Environmental Review City of Gosnells Town Planning Scheme No. 6 Amendments 166 and 169 (Emerge Associates, 2023c).
- The Greater Brixton Street Wetlands Management Guidelines, Natural History and Research (Marshall, 2000).

The Floristic Community Types (FCTs) and associated threatened and priority ecological communities which occur within the GBSW area and are considered groundwater dependent are defined in Table 18 (Emerge Associates 2023c).

Table 18: Threatened and Priority FCTs recorded within GBSW (Emerge Associates 2023c)

FCT	Dominant water balance process	Ecological water requirements
FCT 3a - *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan Coastal Plain.	• The community requires a relatively shallow (approximately 0.5 to 3 m) depth to groundwater, and occurrences can become inundated in the wetter months due to rainfall and surface flows (DoEE 2017).	• The *Corymbia calophylla – Kingia australis* woodlands on heavy soils of the Swan Coastal Plain TEC occurs on flat landforms which are saturated due to an underlying impervious soil layer (such as a claypan or hardpan) which acts as a barrier to drainage of water through the soil, causing waterlogging.
FCT 7, FCT 8, FCT 9, FCT 10a - Clay pans of the Swan Coastal Plain.	• The TEC is reliant on the local catchment sustaining poorly drained flats, i.e., fresh surface water pooling over a confining layer (Emerge Associates 2023c).	• The Clay pans of the Swan Coastal Plain TEC occurs when a clay substrate forms an impermeable layer close to the surface and impedes water movement vertically enabling water to collect on the surface. The TEC relies on rainfall and/or local surface flow to fill the clay pan landform and are less likely to be influenced by groundwater (DSEWPaC 2012).
FCT 21c - Low lying *Banksia attenuata* woodlands or shrublands. FCT 21c. FCT 23a - Banksia Woodlands of the Swan Coastal Plain IBRA Region.	• This community is largely restricted to the uplands on the Bassendean system, consisting of low dunes and interwoven wetlands. • Muchea limestone and other palusplain vegetation types that access water at depth, albeit potential shallow depth) (Emerge Associates 2023c).	• The community occurs within wetland and/or heavy soils associated with the eastern side of the Swan Coastal Plain (DoEE 2017). • The Shrublands and woodlands on Muchea limestone TEC occurs on palusplain soils locally mapped as Muchea Limestone comprising limestone, clay, and sand. The community can occur as a wetland or terrestrial environment that accesses groundwater at depth with sustained saturation which allows plants to access stored water. • These vegetation units are reliant on water predominantly from the rainfall and surface water flows which saturates the perched aquifer.

3.5.6.2. Groundwater Dependent Ecosystems

The GBSW area is located within the Mungala consanguineous wetland suite as identified by Hill et al. (1996). The Mungala consanguineous suite is characterised by its location in the transition between Bassendean Dunes and Pinjarra Plain and contains approximately 25,979 ha of wetlands, of which approximately 12.6% comprises CCWs (Emerge Associates 2023c).

All the vegetation units / ecosystems across the GBSW area (including upland Banksia and *Corymbia* (marri) woodlands) are considered groundwater-dependent by Tauss et al. (2019).

The GBSW vegetation and flora communities depend significantly on the seasonal rainfall and associated surface water flows which seasonally fills and waterlogs the impermeable clay layers forming a perched groundwater layer.

3.5.6.3. Flora within the GBSW

Flora and vegetation studies of the GBSW area have recorded 611 native plant taxa. The conservation significant flora species recorded by Tauss et al. (2019) within the GBSW area are outlined in Table 19.

Table 19: Conservation significant flora species within GBSW (Tauss et al. 2019)

Species	Level of Significance	
	State	Commonwealth EPBC Act
Grevillea thelemanniana	Threatened	Critically Endangered
Ptilotus pyramidatus	Threatened	Critically Endangered
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	Threatened	Critically Endangered
Andersonia gracilis	Threatened	Endangered
Austrostipa bronwenae	Threatened	Endangered
Calytrix breviseta subsp. Breviseta	Threatened	Endangered
Diuris purdiei	Threatened	Endangered
Eremophila glabra subsp. Chlorella	Threatened	Endangered
Lepidosperma rostratum	Threatened	Endangered
Conospermum undulatum	Threatened	Endangered
Eleocharis keigheryi	Threatened	Endangered
Calandrinia sp. Piawaning (A.C. Beauglehole 12257)	Priority 1	
Schoenus sp. Beaufort (G.J. Keighery 6291)	Priority 1	
Comesperma griffinii	Priority 2	
Comesperma rhadinocarpum	Priority 2	
Diuris brevis	Priority 2	
Isotropis cuneifolia subsp. glabra	Priority 2	
Lepyrodia curvescens	Priority 2	
Schoenus loliaceus	Priority 2	
Byblis gigantea	Priority 3	
Chamaescilla gibsonii	Priority 3	
Cyathochaeta teretifolia	Priority 3	
Eryngium pinnatifidum subsp. palustre (G.J. Keighery 13459)	Priority 3	
Eryngium subdecumbens (G.J. Keighery 5390)	Priority 3	
Isopogon drummondii	Priority 3	
Myriophyllum echinatum	Priority 3	
Schoenus benthamii	Priority 3	
Schoenus capillifolius	Priority 3	
Schoenus pennisetis	Priority 3	
Schoenus sp. Waroona (G.J. Keighery 12235)	Priority 3	
Stylidium aceratum	Priority 3	
Stylidium longitubum	Priority 3	
Aponogeton hexatepalus	Priority 4	
Drosera occidentalis	Priority 4	
Hydrocotyle lemnoides	Priority 4	
Ornduffia submersa	Priority 4	
Schoenus natans	Priority 4	
Verticordia lindleyi subsp. lindleyi	Priority 4	

4. Detailed wetland assessment

4.1. Preliminary evaluation of REW UFI 8037 and REW UFI 15257 (within the MRS Amendment area)

The results of the desktop and field assessments as outlined in Section 3 were used to complete the preliminary and secondary evaluations as appropriate, in accordance with the "A methodology for the evaluation of wetlands on the SCP, Western Australia" (DBCA 2017).

The preliminary evaluation identifies whether the wetland(s) or wetland portion is of high conservation value i.e. is listed under international or national lists or registers as significant (e.g. Ramsar listed), or the wetland is spatially dominated by vegetation in good or better condition and supports additional high conservation values such as threatened species or communities (DBCA 2017).

Table 20 presents a summary of the desktop review for the two REWs (UFI 8037 & UFI 15257) within the amendment area.

Table 20: Preliminary evaluation of REW UFI 8037 and REW UFI 15257

No.	Criteria	REW UFI 8037	REW UFI 15257
		Y/N	Y/N
1.	The wetland is currently recognised as internationally or nationally significant for its natural values. Lists/registers include: • The Ramsar Convention on Wetlands. • State Government endorsed candidate sites for the Ramsar. • Convention on Wetlands. • Directory of Important Wetlands in Australia National Heritage List or equivalent.	N	N
2.	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and is identified as significant for its natural values under one or more of the following: • Conservation Reserves for Western Australia Systems 1, 2, 3, 5. • Conservation Reserves for Western Australia, The Darling System – System 6. • A Systematic Overview of Environmental Values of the Wetlands, Rivers, and Estuaries of the Busselton – Walpole Region. • The Environmental Significance of Wetlands in the Perth to Bunbury Region Bush Forever, Swan Bioplan (including Peel Regionally Significant Natural Areas) or equivalent.	N	N
3.	The wetland supports a breeding, roosting, or refuge site or a critical feeding site for populations of fauna listed by the Australian Government (for example, EPBC Act, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, threatened and specially protected fauna listed under the BC Act).	N	N
4.	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and supports one or more of the following: • An occurrence of a TEC. • A confirmed occurrence of a priority 1 or priority 2 ecological community. • A confirmed occurrence of a declared rare (threatened) flora species.	N	N
5.	Equal to or greater than 90% of the wetland supports vegetation in a 'good or better' condition using the vegetation condition scale outlined in Appendix B of DBCA guidelines (2017a).	N	N
6.	The wetland is spatially dominated by vegetation in a 'good or better' condition using the vegetation condition scale outlined in Appendix B and is known to support internationally, nationally, or state-wide scientific values including geo-heritage and geo-conservation.	N	N

7.	The wetland is spatially dominated by vegetation in a good or better condition using the vegetation condition scale outlined in Appendix B and meets one of the following: • ≤ 10% of wetlands of the same type are assigned Conservation management category within the Swan Coastal Plain (by area).	N	N
Confirmed Conservation Category Wetland?		N	N
Secondary Evaluation required?		Y	Y

Following the evaluation process, if the wetland(s) is assigned to the "Conservation Management Category" through the preliminary evaluation, no further evaluation is required. If the wetland does not meet any of the preliminary evaluation criteria a secondary evaluation is triggered.

The desktop review and preliminary evaluation of the two REWs (UFI 8037 & UFI 15257) against the wetland specific criteria concluded these two wetlands are not consistent with "Conservation Management Category" criteria. In accordance with DBCA's evaluation methodology a secondary assessment was required.

4.2. Secondary evaluation

The secondary evaluation using the results of the detailed investigations assesses the wetland(s) against a series of criteria related to wetland geomorphology, wetland processes, linkages, habitats, flora, fauna, cultural, scientific, and educational values. The outcomes are tallied with cumulative scores for high (H), intermediate (I) and low (L) values totalled.

Management categories are assigned based on whether the wetland has predominantly high values (assigned 'conservation'), intermediate values (assigned 'resource enhancement') or low values (assigned 'multiple use').

Table 21 presents the results of the secondary evaluation of REWs UFI 8037 & UFI 15257.

Table 21: Summarised results of the secondary assessment

Attributes / Functions / Values	**Scores**		
	High	**Intermediate**	**Low**
UFI 8037			
Geomorphology	I		I
Wetland processes			II
Linkages			I
Habitats			I
Flora	I		III
Fauna	I		I
Cultural	I	I	
Scientific and educational			
Total score	4	1	9
Defining attributes / functions / values	Geomorphology, flora, fauna and cultural		
Applicable management category	Multiple Use category		
UFI 15257			
Geomorphology	III		I
Wetland processes			II
Linkages		I	
Habitats			I
Flora	I	I	II
Fauna	I		I
Cultural			I
Scientific and educational			
Total score	5	2	8
Defining attributes / functions / values	Geomorphology, flora, and fauna		
Applicable management category	Multiple Use category		

The detailed secondary evaluation criteria recorded for each attribute/function/value for REWs UFI 8037 & UFI 15257 are provided in Appendix A and Appendix B.

Plate 5: Southern portion of REW 15257 within the amendment area

4.3. Alignment with the DBCA preliminary wetland advice

DBCA's 2021 advice specific to the wetlands and the GBSW area within the amendment area outlined within the MRS Amendment Request - Wattle Grove South (WAPC 2021), comprised:

1. The REW (UFI 15257) partially intersects the site, but that this area has been significantly modified during the construction of Tonkin Highway and the DBNGP.
2. REW (UFI 8037) has been cleared and filled and no longer exists.
3. The DBCA and DWER have recently undertaken a review of the environmental values of the wetlands currently mapped in the GWSCP dataset using available regional scale data. While this dataset is unpublished, the result of the mapping indicates that the two REW within the amendment area (UFI 15257 & UFI 8037) have values commensurate with a MUW.
4. The proposed development will reduce impacts on the wetlands within the GBSW (located to the west Tonkin Highway) by improving water quality and reducing the nutrient levels exported from the amendment area.

The conclusions from the detailed assessment of the REWs (UFI 8037 & UFI 15257) environmental values and the requirements for retention were consistent with DBCA's review that "REWs UFI 15257 & UFI 8037 have values commensurate with a MUW".

4.4. REWs (UFI 8037 & UFI 15257) review

The MRS Amendment Request - Wattle Grove South (WAPC, 2021) incorporates the following DBCA's advice specific to the wetlands within the amendment area:

- The REW (UFI 15257) partially intersects the site, but that this area has been significantly modified during the construction of Tonkin Highway and the DBNGP. The original wetland area was historically cleared pre-1950 (initially establish rural landholdings) and contains no surface water body and no fauna habitat for aquatic dependent fauna species.
- REW (UFI 8037) has been cleared and filled and no longer exists. The wetland has been historically infilled and contains no surface water body and no fauna habitat for aquatic dependent fauna species.

- The DBCA and DWER have recently undertaken a review of the environmental values of the wetlands currently mapped in the GWSCP dataset using available regional scale data. While this dataset is unpublished, the result of the mapping indicates the two REW within the amendment area (UFI 15257 & UFI 8037) have values commensurate with a MUW.

The assessment of the REWs UFI 8037 and portion of UFI 15257 values concluded:

- The wetland values are representative of MUW category wetland, in alignment with the wetland advice provided by DBCA i.e., the wetlands are in 'Completely Degraded' condition or have been completely infilled.
- REW 8037 has been subject to historical impacts including clearing of native vegetation and infilling works to facilitate the construction of Tonkin Highway, the Water Corporation pipeline and DBNGP, and a commercial turf farm.
- The wetland's ecological values (or GDEs) are no longer present. There are no groundwater dependent riparian communities present or habitat (or habitat diversity) or aquatic dependent fauna. The mapped wetland contains a commercial turf area and the cleared Water Corporation and DBNGP easements.
- Currently within the mapped portion of REW (UFI 15257) in the MRS amendment area are the following land uses:
    - Tonkin Highway reserve
    - Boundary Road reserve
    - Water Corporation pipeline and DBNGP easements
    - Semi-rural paddocks
    - Commercial landscape supply business
- The REW (UFI 15257) wetland area has been subject to historical infrastructure construction works and infilling to support the above land uses and infrastructure.
- Within and adjacent to the Tonkin Highway reserve, the following vegetation was surveyed and mapped:
    - Planted stands of *Corymbia calophylla* (Marri) and non-native eucalypt *Eucalyptus camaldulensis* (Red River Gum) over non-native eucalypt *Casuarina cunninghamiana* subsp. *cunninghamiana*, *Melaleuca preissiana*, *Jacksonia sternbergiana* and **Schinus terebinthifolia* over introduced species on various soils and topographical positions (Woodman Environmental 2021).
- Along the boundary of the Water Corporation / DBNGP easement (maintained as an open paddock area):
    - Planted *Eucalyptus camaldulensis* (Red River Gum).
- There is no seasonal surface water present within REW UFI 15257 (within the MRS amendment area) or fauna habitat for aquatic dependent fauna species. The vegetation was surveyed as in 'Completed Degraded' condition.

It is recommended for the two REWs (UFI 8037 and portion of UFI 15257) within the MRS amendment areas are removed from the GWSCP dataset. DBCA is the custodian of the GWSCP dataset. An application to DBCA to amend GWSCP dataset for the two REWs (UFI 8037 and portion of UFI 15257) removing these two wetlands from the geomorphic wetland database will occur concurrently with the finalisation of a future Local Structure Plan and LWMS.

4.4.1. Proposed Management

Portions of the former mapped REWs (UFI 8037 and portion of UFI 15257) will be incorporated into POS areas and stormwater bioretention basins adjacent to the Water Corporation pipeline and DBNGP easement. The DWMS (Hyd2O 2024) identifies the future Local Structure Plan and subdivision plans will formally integrate the Water Corporation pipeline and DBNGP easement into open space, ensuring the pipeline(s) are protected whilst also providing a valuable community asset that provides local amenity.

In large storm events (for example a 100 year storm event) stormwater contained in stormwater basins will overtop and infiltrate across POS areas including the Water Corporation/DBNGP easement. This is in alignment with the existing (or pre-development) stormwater flow patterns.

The DPLH Aboriginal Heritage Places mapping tool (DPLH 2024a) identified the MRS amendment area intersects one registered heritage site:

- Brentwood Road Swamp (Site ID 4343). REW (UFI 8037) intersects a portion of this heritage site.

A cultural heritage survey completed with the Traditional Owner elders in 2021 concluded (Horizon Heritage 2021):

- The Brentwood Road Swamp (Site ID 4343) is a heavily disturbed and altered environment.
- No cultural material was observed/recorded within the MRS amendment area.

This section of the MRS amendment area is adjacent or within the Water Corporation/DBNGP easement. Activities within the DBNGP easement is restricted and generally prohibits any construction works. Accordingly, the Water Corporation and DBNGP easement will form POS areas. Stormwater bioretention basin would be located adjacent (but outside of) the POS / easement area. All future works within proximity of Brentwood Road Swamp (Site ID 4343) will be undertaken in consultation with the Traditional Owner group.

The planted mature trees (include Red River Gums and Marri trees) aligning the easement boundaries will be managed within POS area.

5. Wetland Buffer Assessment

The buffer assessment was applied to the mapped wetlands within approximately 150 m of the amendment area. The following wetlands are located within 150 m of the amendment area:

1. Two CCWs (UFI 8026 & UFI 8027) are located are within Lot 501. Lot 501 a 1.6 ha triangular landholding bounded by Tonkin Highway to the west, Welshpool Road to the north and Boundary Road to the south. The landholding also contains a 0.52 ha portion of REW UFI 15257.
2. GBSW area which incorporates numerous DBCA mapped CCW and REW features. The mapped wetlands within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030.

The Wattle Grove South MRS amendment 1388/57 does not alter the existing land uses outside of the amendment area. Specifically, the proposed 'Urban' land use within the amendment area does not intrude into Lot 501 or the GBSW area.

Figure B illustrates the location of the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501 and the numerous mapped wetlands within the GBSW area.

5.1. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

5.1.1. Land use review

The wetland assessment identified there is currently no separation buffer from the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501. The mapped wetland and associated buffer area has been subject to historical anthropogenic impacts, specifically, the existing infrastructure corridors, which both frame and intrude into the mapped wetlands areas and immediate surrounds within Lot 501. Key infrastructure located immediately adjacent to or within the mapped wetland areas within Lot 501 include:

- Boundary Road reserve.
- Tonkin Highway reserve and Welshpool Road reserve.
- Water Corporation water pipeline easement.
- DBNGP easement.

The existing infrastructure corridors are fixed and operational. These structures essentially frame and contain the limited wetland environmental and ecological values to entirely within Lot 501 without the application of any additional buffers to surrounding land uses i.e., landscape supply yard, Welshpool Road and Tonkin Highway. Importantly, the wetland buffer assessment identified:

- The wetland/ecological values associated with the mapped CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 do not extend outside of Lot 501.
- The MRS amendment does not alter the existing WAPC land management practices including regular mowing and slashing of the wetland areas to maintain the road reserves/Water Corporation and DBNGP as cleared areas.

The Boundary Road reserves separate Lot 501 (inclusive of the two CCWs and a portion of REW UFI 15257) from the adjacent commercial (landscape supply business) and rural lots. The mapped CCWs (and portion of REW UFI 15257) are located at the southern border of the Boundary Road reserve. The MRS amendment does not alter the Boundary Road reservation and/or its current location. However, as the majority of Boundary Road is unsealed, the future key infrastructure work adjacent to Lot 501 will be to seal (i.e., asphalt surfacing) Boundary Road and install footpaths within the road reserve.

CCW UFI 8026 is located wholly within the DBNGP easement.

There is no native vegetation in the amendment area within 70 m of the two CCWs (UFI 8026 & UFI 8027) the landholdings Immediately south of Boundary Road has been historically

cleared and is currently used for commercial landscape supply business, rural lots, and the Water Corporation water pipeline and DBNGP easements.

Lot 501 is owned by the WAPC. The landholding is regularly maintained via slashing and mowing of the open grass and weed areas to uphold the road reserves, Water Corporation and DBNGP easements as cleared open areas.

The desktop review site, visit and assessment conclude the existing ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 are aligned with REWs category wetland and/or MUW category wetland.

Figure K illustrates the status of Lot 501 (which includes the two CCWs and portion of REW UFI 15257), inclusive of the adjacent land uses, the Tonkin Highway, Welshpool Road, the Boundary Road reserve, and the Water Corporation and DBNGP easements.

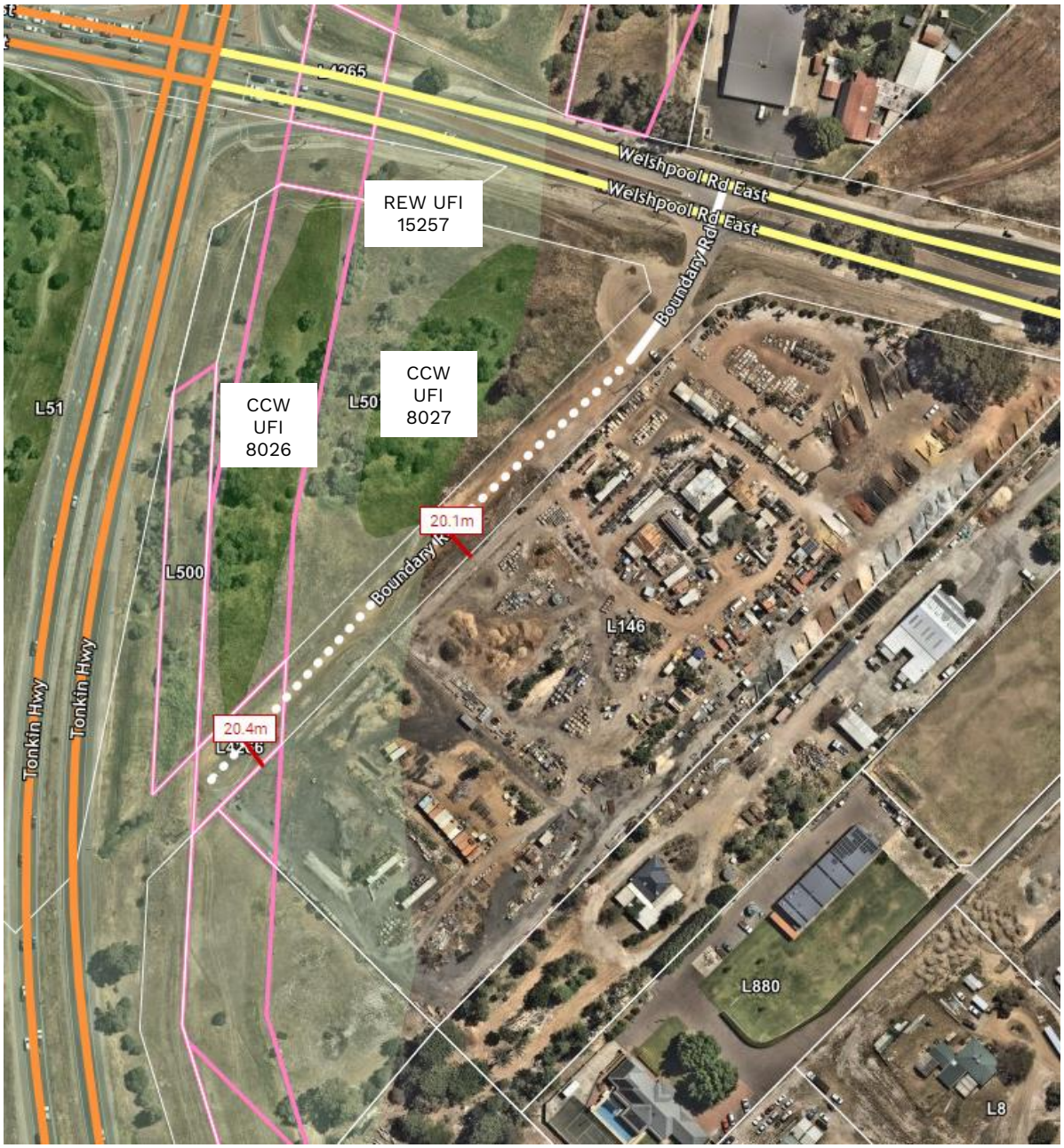


Figure K: CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 within Lot 501.

5.1.2. Wetland buffer assessment

The wetland buffer assessment of the two CCWs (UFI 8026 & UFI 8027) within Lot 501 is summarised in Table 22.

Table 22: CCWs UFI 8026 & UFI 8027 and wetland buffer assessment

Wetland buffer assessment step	Assessment
Step 1 - Wetland existence	• The DBCA wetland mapping identifies the two CCWs (UFI 8026 & UFI 8027) and a portion of REW UFI 15257 within Lot 501 as 'Palusplain'. • Lot 501 is owned and managed by the WAPC and regularly maintained via slashing and mowing of the open grass and weed areas to uphold the road reserves, Water Corporation and DBNGP easements as cleared open areas. • The existence of the two CCWs and one REW is confirmed.

Step 2 – Wetland attributes	• The two CCWs are narrow and small in area (UFI 8026 is 0.38 ha in area & CCW UFI 8027 0.32 ha). The REW UFI 15257 is 0.52 ha in area.
	• The two wetlands (UFI 8026 & UFI 8027) and REW UFI 15257 have been significantly modified because of:
	  ○ Construction of Tonkin Highway Welshpool Road and Boundary Road.
	  ○ The Water Corporation pipeline and the DBNGP easement which are maintained as cleared open areas.
	• Woodman Environmental survey of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 within Lot 501 rated the vegetation as being in a 'Degraded to Completely Degraded' condition.
	• The key environmental attributes for the two wetlands (UFI 8026 & UFI 8027) are:
	  ○ The two CCWs and the REW are located within a portion of the former Crystal Brook tributary.
	  ○ CCW UFI 8026 is 0.38 ha in area. The native vegetation area is approximately 0.28 ha. CCW UFI 8026 is wholly within the DBNGP easement.
	  ○ CCW UFI 8027 is 0.32 ha in area. The native vegetation area is approximately 0.25 ha.
	  ○ No TECs or priority flora are present.
	  ○ The *Corymbia calophylla* trees within the two CCWs has the potential to provide limited foraging and roosting habitat to the threatened Carnaby's cockatoo and Forest red-tailed black cockatoo species.
	  ○ The limited native vegetation areas within the two CCW wetland areas could provide habitat areas for frogs and reptiles.

Step 3 – Wetland function	• **Vegetation**
	  ○ Woodman Environmental (2021) vegetation survey identified the following vegetation units:
	  ▪ Mid open woodland of *Corymbia calophylla* over low woodland of mixed species dominated by *Eucalyptus rudis, Melaleuca rhaphiophylla* and *Melaleuca preissiana* over tall sparse shrubland of mixed species dominated by *Acacia saligna* over mid sparse shrubland of *Acacia pulchella* over mid tussock grassland of mixed species dominated by **Avena barbata*, **Eragrostis curvula* and **Ehrharta calycina* over **Watsonia meriana* on grey and brown sandy loam and clay loam on plains, flats, and drainage lines.
	  ▪ Individual or stands of *Corymbia calophylla* over introduced species including **Avena barbata*, **Bromus diandrus* and **Ehrharta calycina* on various soils and topographical positions (mostly within the REW area).
	  ○ No State & Commonwealth listed TECs were surveyed / observed.
	  ○ No conservation significant flora was surveyed / observed.
	• **Geology/Hydric Soils**
	  ○ Bassendean Sand over sandy clay to clayey sand of the Guildford Formation.

	○ Geotechnical investigations within the vicinity of Lot 501 identified the geology as sandy clay to clayey sandy of the Guildford Formation. • **Hydrology** ○ There are no existing bioretention swales managing / treating surface water from the surrounding catchment entering Lot 501. ○ Remnants of the Crystal Brook creek line within the north-eastern portion of the GBSW area, adjacent to Tonkin Highway remains intact. Surface water from the north-western portion of the amendment area conveyed via the Boundary Road culvert, beneath the Tonkin Highway, follows for the first approximately 500 m the Crystal Brook tributary alignment. ○ The groundwater depth ranges from 4 m to 20 m bgl. Groundwater flow generally ranges from north west to south east across the amendment area (Hyd2o 2023).
Step 4 – Threatening processes	• Threats identified to the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 within Lot 501 from the future 'Urban' land use located south of Boundary Road include: ○ Changes to hydrology - alteration to surface water levels and flows. ○ Changes to hydrology - reduced water quality. ○ Groundwater rise through higher recharge. ○ Managing drainage from the amendment area to the Boundary Road culvert. ○ Unauthorised pedestrian access has the potential to impact significant wetlands, watercourses and vegetation through trampling or taking of vegetation, litter accumulation and disturbance of fauna. ○ Introduction or spread of weeds. ○ Introduction or spread of disease (Phytophthora dieback). ○ Increase of feral animals.
Step 5 – Role of the separation	• The proposed development was determined to have the potential to provide the following threatening processes: ○ Alteration to the existing surface water flow regime. ○ Surface water quality. • The DWMSs propose a range of groundwater and stormwater management strategies that will protect and sustain the existing hydrology of the wetlands, and vegetation, with respect to water quality. The DWMS sets out the following management strategies (Hyd2O 2024): ○ Treating stormwater runoff within the amendment areas prior to entering Lot 501 and the two CCWs. ○ Use of reticulated sewerage systems. ○ Implementation of the DWMS and the proposed groundwater and stormwater management strategies and design requirements will ensure the pre-development hydrology of the two CCWs and vegetation is maintained, such that the potential impacts are unlikely to occur. • Unauthorised public access: ○ Lot 501 is peripheral to the majority of the amendment area. It is located at the north-western boundary of the amendment area, wedged between Welshpool Road, Tonkin Highway and Boundary Road. The existing road infrastructure provide a physical barrier to Lot 501. ○ The amendment area does not propose to install any paths within Lot 501. ○ Public access can be managed through the installation of a footpath along Boundary Road reserve adjacent to Lot 501. • Spread of weeds: ○ Weeds species dominate Lot 501 understorey including *Avena barbata*, *Eragrostis curvula*, *Ehrharta calycina* and *Watsonia meriana*. No works are proposed within Lot 501. The landowner (the WAPC) of Lot 501 currently manages weeds through regular slashing/mowing inclusive of the mapped CCW areas. ○ The weed species are already highly prevalent within the amendment area and Lot 501. Future development activities within

	the amendment area will not result in the intensification of weeds. The implementation of the proposed scheme amendment, through subdivision, development and supporting infrastructure works provides an opportunity to remove the majority of weeds (and associated weed seed bank within the topsoil) through the clearing of weed dominated areas as part of future bulk earthworks. ○ Future environmental retention areas and stormwater drainage swales/basins will be the focus of the weed management measures. ○ The risk of weeds from the amendment area during the construction phase will be addressed in a Construction Environmental Management Plan (CEMP). The CEMP will address: ▪ Hygiene management (weeds and Phytophthora dieback). ▪ Hydrocarbon spill management. ▪ Sediment and erosion control actions. ▪ Dust management. ▪ Monitoring program (parameters to be monitored, methodology and frequency). ▪ Reporting. ▪ Corrective actions. • Introduction or spread of disease (*Phytophthora* dieback): ○ The threat from *Phytophthora* dieback would be addressed through the implementation of hygiene protocols to mitigate the risk of dieback spread, through the implementation of the CEMP during construction. • Feral animals: ○ Currently, there are no active feral animal controls within Lot 501. The key feral animals threat is primarily from cats. Under the City of Kalamunda Keeping and Control of Cat Local Law 2023, cats are prohibited in the City's Parks and Reserves. Lot 501 containing the two CCWs is zoned 'Parks and Recreation' could be added to the City's registered prohibited. Cats observed within Lot 501 can be trapped and removed by the City. ○ All cats over six-months must be microchipped, sterilised, and registered with the City of Kalamunda. Cat registrations must register with the City of Kalamunda.
Buffer	• Summary: ○ The assessment of the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501 concluded the wetlands are highly modified due to: ▪ Historical clearing and construction of infrastructure corridors. ▪ The regular maintenance program to keep the Water Corporation and DBNGP easements and the Tonkin Highway / Welshpool Road reserves cleared. ○ Boundary Road provides a physical barrier to the amendment area and is located immediately adjacent to the two CCWs and the portion of REW UFI 15257 within Lot 501. ○ There is no native vegetation (or wetland environmental values) south of Boundary Road in the amendment area. The landholdings south of the mapped CCWs has been cleared of vegetation and is used as a landscape supply yard. ○ The buffer assessment of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 within Lot 501 considered: ▪ The existing management practices undertaken within Lot 501. ▪ The Boundary Road reserve. ▪ Minimising the threats from the MRS amendment (i.e., future 'Urban' development). ○ The desktop review site, site investigation and assessment conclude the existing ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW UFI 15257 are aligned with REWs category wetland and/or MUW category wetland.

	• **Wetland buffer:** ○ The wetland assessment identified there is currently no separation buffer from the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501. ○ The mapped wetland and associated buffer area has been subject to historical anthropogenic impacts, specifically, the existing infrastructure corridors, which both frame and intrude into the mapped wetlands areas and immediate surrounds within Lot 501. Key infrastructure located immediately adjacent to or within the mapped wetland areas within Lot 501 include: ▪ Boundary Road reserve. ▪ Tonkin Highway reserve and Welshpool Road reserve. ▪ Water Corporation water pipeline easement. ▪ DBNGP easement. ○ The existing infrastructure corridors are fixed and operational. These structures essentially frame and contain the limited wetland environmental and ecological values to entirely within Lot 501 without the application of any additional buffers to surrounding land uses i.e., landscape supply yard, Welshpool Road and Tonkin Highway. Importantly, assessment identified: ▪ The wetland/ecological values associated with the mapped CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 do not extend outside of Lot 501. ○ The wetland assessment concluded the existing 20 m Boundary Road reserves provides an existing physical separation from the two CCWs (UFI 8026 and UFI 8027) and the portion of REW UFI 15257. ○ The road reserve is managed by the City of Kalamunda and will be maintained in the future. ○ The conclusion drawn on the status of and the road separation distance is supported by: ▪ The assessment of the two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 demonstrate ecological values more aligned with REW category and/or MUW category wetlands. ▪ The values of the two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 are contained wholly within Lot 501. ▪ This conclusion was underpinned by the following assessment: • Approximately 80% of Lot 501 has been historically cleared of native vegetation and subject to infilling. • The historical and current land uses resulting in the establishment of open cleared areas within the mapped wetland areas include: ○ Welshpool Road and Tonkin Highway reserves. ○ DBNGP and Water Corporation easements. ○ Boundary Road reserve. • Lot 501 is owned and managed by the WAPC and regularly maintained via slashing and mowing of the open grass and weed areas to uphold the road reserves, Water Corporation and DBNGP easements as cleared open areas. • The understorey of the two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 within Lot 501 is significantly dominated by weed species including *Avena barbata* (wild oats), *Eragrostis curvula* (African lovegrass), *Ehrharta calycina* (perennial veldtgrass) and *Watsonia meriana*. • The two CCWs (UFI 8026 and UFI 8027) and portion of REW UFI 15257 are in a 'Degraded to Completely Degraded' condition. ○ The MRS amendment does not alter:

	▪ The location or the Boundary Road reserve land use. ▪ The Lot 501 "Parks and Recreation" land use. ○ Immediately south of Boundary Road (i.e., approximately 20 m from the mapped wetlands) are private landholdings including a commercial landscape supply yard and cleared semi-rural property and the DBNGP easement. Portions of these landholdings have been extensively filled and cleared of native vegetation. These land uses (i.e., the privately owned commercial and rural land uses) and the DBNGP easement have been in place for over 20 years. ○ The two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 have limited ecological attributes which are entirely contained within Lot 501 and do not extend into the Boundary Road reserve or the MRS amendment.
Step 7 – Wetland management	• The site review and wetland assessment conclude the existing ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW (UFI 15257) within Lot 501 are aligned with REWs category wetland and/or MUW category wetland. • Boundary Road provides an approximate 20 m permanent infrastructure barrier between the two CCWs within Lot 501 and the commercial landscape supply yard and the semi-rural paddocks within the MRS amendment area. • Lot 501 is owned and managed by the WAPC as a 'Parks and Recreation' reserve. Lot 501 is located outside of the MRS amendment area. The Wattle Grove South MRS amendment does not: ○ Alter the existing 'Parks and Recreation' land use zoning within Lot 501. ○ Alter the City of Kalamunda's Boundary Road reserve land use. • Noting Lot 501 is outside of the MRS amendment boundary, the management of the two CCWs (UFI 8026 & UFI 8027 and portion of REW UFI 15257) will incorporate the following: ○ Formal Boundary Road as a hard infrastructure barrier to the wetlands from future 'Urban' land uses. ○ Formalising a footpath on the southern side of Boundary Road (i.e., adjacent to the proposed future 'Urban' land uses area or the current commercial landscaping yard). ○ Install contemporary drainage basins adjacent to Boundary Road (within the amendment area) with the objective of improving surface water quality and maintaining existing flow rates from the amendment area via the Boundary Road culvert. ○ The proposed formalising of Boundary Road, footpath, and drainage basin areas (within the amendment area) will be defined and managed in accordance with the following sequential planning stages: ▪ Wattle Grove South LSP – which incorporates LWMS and landscape masterplan. ▪ Subdivision approval – subdivision condition requirements will require: • UWMP. • Detailed landscape plan which incorporates the drainage basins/swales. • Detailed engineering drainage design. • No impacts or loss of the wetland's foreshore functions, vegetation or other water dependent ecosystems are expected to the wetlands within Lot 501. Lot 501 is not subject to the MRS Amendment 1388/57 and will be managed in accordance with the landowner's (WAPC) existing management practices. • The WAPC as the landowner of Lot 501 (or MRWA as the proponent for the Tonkin Highway Grade Separated Interchanges proposal which intersections a portion of Lot 501) may seek to formally engage with DBCA for the purpose of amending the GWSCP dataset (specifically the category

	status of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW (UFI 15257)) within Lot 501.

Plates 6 and 7 illustrate the existing weeds/grassed area within and surrounding the two CCWs areas and the DBNGP easement.

Plate 6: CCW UFI 8026 and REW UFI 15257 located within the DBNGP easement.

Plate 7: CCW UFI 8027 and REW UFI 15257 adjacent to the DBNGP easement.

5.2. Wetlands within the GBSW area

5.2.1. Land use review

The following existing infrastructure corridors form a physical barrier between the GBSW area (inclusive of the GBSW numerous mapped wetlands) and the amendment area. The infrastructure corridors include:

- Tonkin Highway reserve (which is proposed to increase to six lanes).
- Water Corporation water pipeline easement.
- DBNGP pipeline easement.

The closest wetland (CCW UFI 14962) within the GBSW area (and the Tonkin Highway reserve) is situated approximately 75 m to the west of the amendment area, separated by the four-lane Tonkin Highway. Note the mapped CCW (UFI 14962) extends into the Tonkin Highway reserve. The measurement was taken from the CCW (UFI 14962) from within the highway reserve. If the upgrade of Tonkin Highway is approved (i.e., increased to six lanes) the separation distance to the amendment area would be further extended by an approximate 30 m.

Within the amendment area, immediately adjacent to the Tonkin Highway is the Water Corporation and DBNGP pipeline easements. The *Dampier to Bunbury Pipeline Act 1997* excludes development within the easement. These easements further extend the separation distance from the proposed future residential development, within the amendment area to the closest wetland within the GBSW area to approximately 105 m.

The significant portion of the Wattle Grove amendment area is located significantly further than 100 m south-east of the GBSW area.

Figure L illustrates the locations of the closest mapped wetland to the amendment area and the Water Corporation and DBNGP easements.

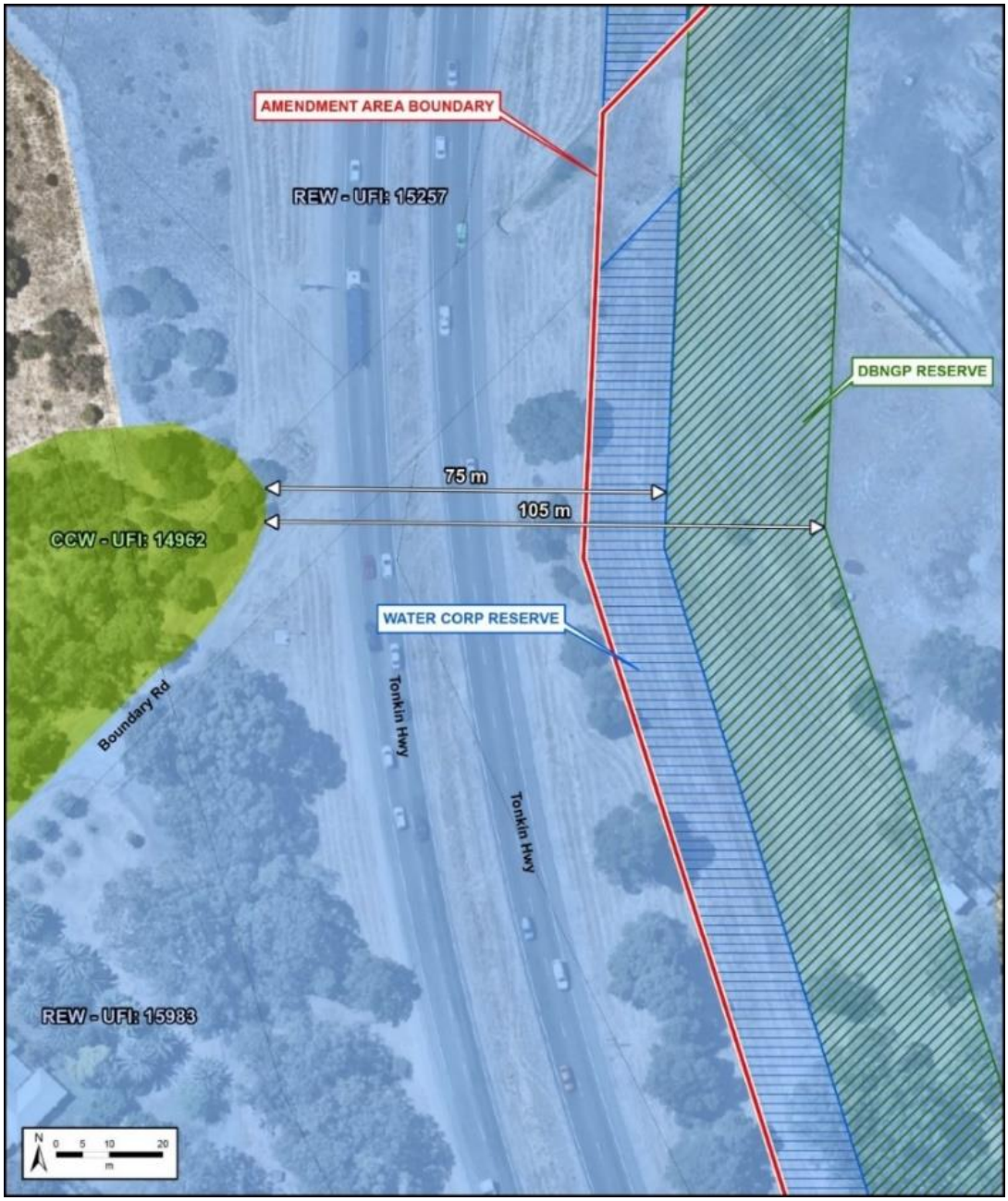


Figure L: Physical infrastructure separating CCW UFI 14962 and the Amendment Area.

5.2.2. Wetland buffer assessment

The wetland buffer assessment of the numerous mapped CCW and REW features within the GBSW (primarily inside 150 m of the amendment area) is summarised in Table 23.

Table 23: GBSW buffer assessment

Wetland buffer assessment step	Assessment
Step 1 - Wetland existence	• The GBSW are a Nationally Important Wetland which comprises a complex of significant wetlands, including areas of seasonally waterlogged flats (palusplain) and seasonally inundated basins (sumplands) and cover 176 ha. • The mapped wetlands within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030.
Step 2 – Wetland attributes	• Overarching GBSW area

	○ Non-contiguous reserve consisting of Brixton Block, Wanping Block and separate landholdings, Alison Baird Reserve, private and government owned landholdings. ○ TECs identified include: ▪ FCT 3a - *Corymbia calophylla - Kingia australis* woodlands on heavy soils of the Swan Coastal Plain. ▪ FCT 7, FCT 8, FCT 9, FCT 10a - Clay pans of the Swan Coastal Plain. ▪ FCT 21c - Low lying *Banksia attenuata* woodlands or shrublands. ▪ FCT 23a - Banksia Woodlands of the Swan Coastal Plain IBRA Region. ▪ Guildford Vegetation Complex is the dominant vegetation complex (Heddle et al. 1990). Only 5.1% of Guildford complex remains on the Swan Coastal Plain. ○ DBCA's Threatened and Priority Fauna and Atlas of Living Australia databases identified 319 vertebrate species have the potential to occur in the GBSW area (EPA 2022). • CCW UFI 8025, UFI 8028, UFI 14962 ○ The GBSW mapped wetlands within 150 m of the amendment area (including CCW UFI 8025, UFI 8028, UFI 14962) are mapped as: ▪ Mixed shrublands on seasonally waterlogged or inundated flats or edges of depressions. ▪ Water filled depressions, may be clay based (claypans) or humus rich or combinations of both. ▪ The vegetation condition ranges from 'Good' to 'Completely Degraded' (Emerge 2023c).
Step 3 – Wetland function	• Vegetation ○ The vast majority of the GBSW comprises native vegetation, which is highly biodiverse, supporting at least 611 native plant taxa, threatened and priority flora, threatened ecological communities, and habitat for threatened and priority fauna. • Geology/Hydric Soils ○ The Guildford Formation clay layers form a complex sequence of clay lenses that is laterally and vertically varied. Cemented clay layers are common within a few metres of the surface of the GBSW area. It is these clay layers that underpin the base of the claypans (Lane and Evans 2019). • Hydrology ○ The primary water input is rainfall; however, some inflows occur from upstream catchments. ○ The GBSW rely primarily on rainfall to fill due to the underlying clay-dominated soils of the Guildford formation, which are waterlogged through winter and form deep pools in clay depressions (DBCA 2018). ○ Perched groundwater moves laterally until it intersects drainage lines or is utilised via evapotranspiration.
Step 4 – Threatening processes	• Threats identified to the GBSW mapped wetlands within 150 m of the amendment from the future 'Urban' land use include: ○ Changes to hydrology - alteration to surface water levels and flows. ○ Changes to hydrology - reduced water quality. ○ Managing drainage from the amendment area to the Boundary Road culvert. ○ Unauthorised pedestrian access has the potential to impact significant wetlands, watercourses and vegetation through trampling or taking of vegetation, bank erosion, litter accumulation and disturbance of fauna. ○ Introduction or spread of weeds. ○ Introduction or spread of disease (*Phytophthora* dieback). ○ Increase of feral animals.
Step 5 – Role of the separation	• The proposed development was determined to have the potential to provide the following threatening processes: ○ Alteration to the existing surface water flow regime. ○ Surface water quality.

	• The DWMS propose a range of groundwater and stormwater management strategies that will protect and sustain the existing hydrology of the wetlands, and vegetation, with respect to water quality. The DWMS sets out the following management strategies (Hyd2O 2024):
	  ○ Treating stormwater runoff within the amendment areas prior to entering Lot 501 which is then directed via the Boundary Road culvert towards the GBSW area.
	  ○ Use of reticulated sewerage systems.
	  ○ Implementation of the DWMS and the proposed groundwater and stormwater management strategies and design requirements will ensure the pre-development hydrological flows towards the GBSW is maintained (Hyd2O 2024).
	• Unauthorised public access:
	  ○ Access to the GBSW is not considered a significant threat for the following reasons:
	  ▪ Tonkin Highway (four lanes) provides a physical barrier to the GBSW area. The highway is proposed to be widened to six lanes, providing additional physical separation distance to the GBSW area.
	  ▪ There is no direct pedestrian access to the GBSW area.
	  ▪ A pedestrian footpath exists across Tonkin Highway at Brentwood Road. The majority of the GBSW area is between Boundary Road and Brook Road which is approximately 700 m to the north. The closest portion of the GBSW area along Brentwood Road is approximately 550 m west of Tonkin Highway. This portion of the GBSW is adjacent to rural lots and dog training/kennels. The Brentwood Road pedestrian crossing is proposed to be closed as part of the MRWA Tonkin Highway upgrade.
	  ▪ The other alternative access routes into the GBSW area are via Welshpool Road and then Brook Road (approximately 1.3 km) or via Crystal Brook Road, Kelvin Road and then Bickley Road (approximately 6.7 km).
	  ▪ Figure M illustrates the existing access pathway/roads towards the GBSW area.
	• Spread of weeds:
	  ○ Weeds species within Lot 501 which is located adjacent to the Boundary Road culvert includes *Avena barbata*, *Eragrostis curvula*, *Ehrharta calycina* and *Watsonia meriana*. The Lot 501 landowner (the WAPC) currently manages weeds through regular slashing/mowing inclusive of the CCW areas.
	  ○ The weed species are already highly prevalent within the amendment area and Lot 501. Future development activities within the amendment area will not result in the intensification of weeds. The implementation of the proposed scheme amendment, through subdivision, development and supporting infrastructure works provides an opportunity to remove the majority of weeds (and associated weed seed bank within the topsoil) through the clearing of weed dominated areas as part of future bulk earthworks.
	  ○ Future environmental retention areas and stormwater drainage swales/basins will be the focus of weed management measures.
	  ○ The risk of weeds from the amendment area during the construction phase will be addressed in a CEMP. The CEMP will address:
	  ▪ Hygiene management (weeds and *Phytophthora* dieback).
	  ▪ Hydrocarbon spill management.
	  ▪ Sediment and erosion control actions.
	  ▪ Dust management.
	  ▪ Monitoring program (parameters to be monitored, methodology and frequency).
	  ▪ Reporting.
	  ▪ Corrective actions.
	• Introduction or spread of disease (*Phytophthora* dieback):
	  ○ The threat from *Phytophthora* dieback would be addressed through the implementation of hygiene protocols to mitigate the risk of

	dieback spread, through the implementation of CEMP during construction.
	• Feral animals:
	  ○ The key feral animals threat is primarily from cats and foxes. Under the City of Kalamunda Keeping and Control of Cat Local Law 2023, cats are prohibited in the City's Parks and Reserves.
	  ○ All cats over six-months must be microchipped, sterilised, and registered with the City of Kalamunda and/or the City of Gosnells.
	  ○ The City of Gosnells also provides cat trapping services and requires all cats to be registered.

Buffer	• Summary:
	  ○ The buffer assessment to the numerous DBCA mapped CCW and REW features within the GBSW and specifically the mapped wetlands within 150 m of the amendment area include, three CCW UFI 8025, UFI 8028, UFI 14962, one REW UFI 5257 and a MUW UFI 8030 considered:
	  ▪ The existing transport infrastructure (Tonkin Highway) and Water Corporation and DBNGP easements which provides a physical separation boundary to the amendment area.
	  ▪ MRWA's proposed upgrade to Tonkin Highway. If the upgrade of Tonkin Highway is approved (i.e., increased to six lanes) the minimum separation distance to the amendment area would be extended by a further 30 m.
	  ▪ The amendment area and any proposed future development works do not intrude into the GBSW area and remain on the eastern side of Tonkin Highway.
	• Wetland buffer:
	  ○ The four lane Tonkin Highway reserve in combination with the Water Corporation and DBNGP pipeline easements establishes a minimum 100 m physical boundary between the GBSW wetlands and the amendment area at the closest point. If the Tonkin Highway upgrade is approved and constructed the minimum buffer would extend to approximately 130 m.
	  ○ In acknowledgement of the Tonkin Highway reserve and the adjacent Water Corporation and DBNGP pipeline easements the proposed buffer distance to the future residential development will remain a minimum 100 m from the GBSW.
	  ○ The threats to the wetlands within the GBSW from future residential development can be managed within this proposed buffer.

Step 7 – Wetland management	• The proposed wetland buffer distance to the GBSW area is: • A minimum 100 m buffer from the GBSW (at the closest point) will be maintained. The Tonkin Highway reserve in combination with the Water Corporation and DBNGP pipeline easements has already established a minimum 100 m physical boundary between the GBSW wetlands and the amendment area at the closest point. • If the MRWA Tonkin Highway Grade Separated Interchange Proposal is approved and constructed (creating a six lane highway) the minimum buffer would extend to approximately 130 m. Noting the vast majority of the proposed future 'Urban' land uses will be located significantly further (i.e., 500 m plus) from the GBSW.

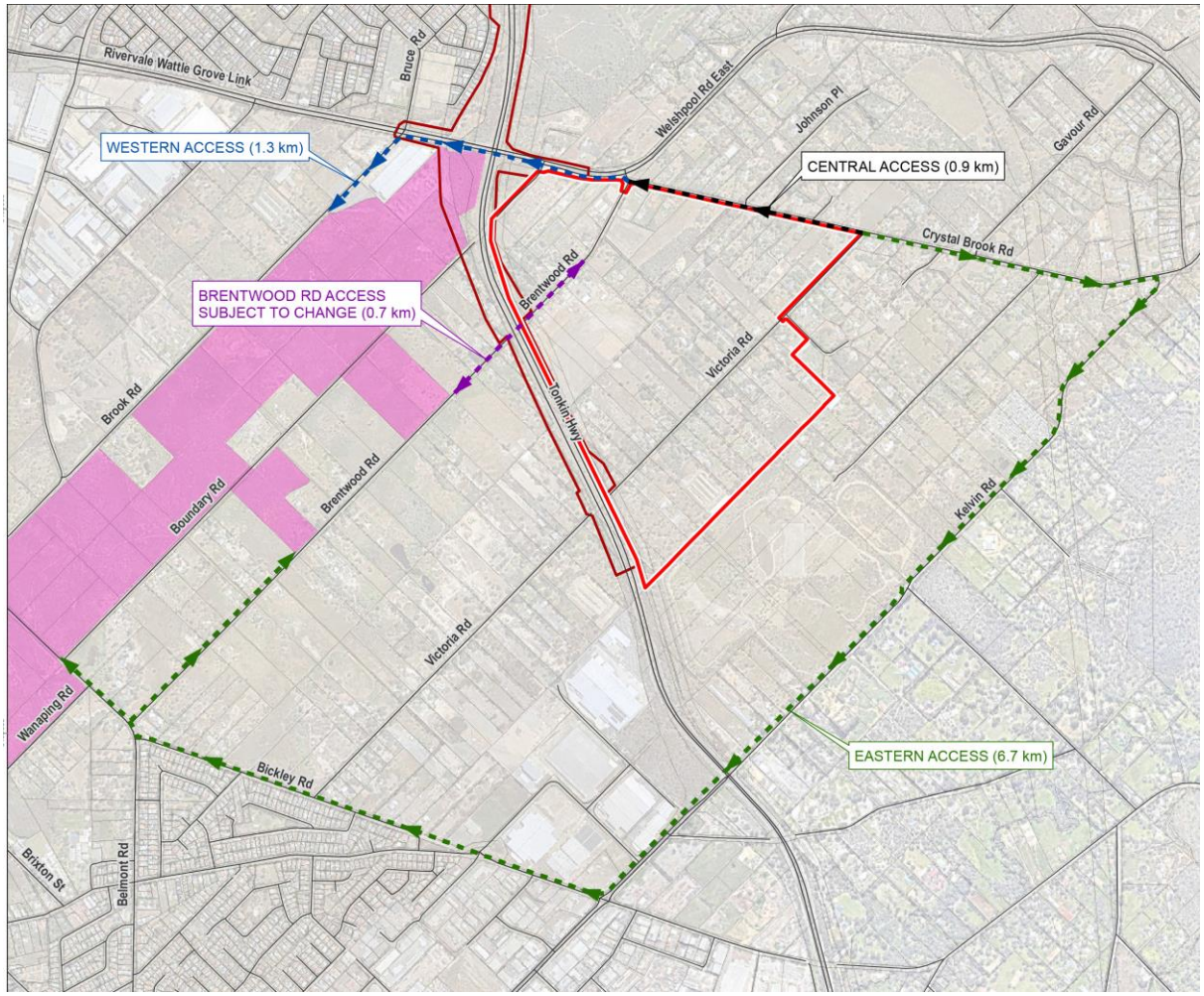


Figure M: Access Pathways towards the GBSW

6. Summary and recommendations

6.1. Summary

Based on the results of the wetland assessment, the following conclusions and recommendations are provided:

1. Overall, since 1953, the wetlands within the amendment area and the adjacent Lot 501 have been subject to significant historical anthropogenic impacts, resulting in the clearing of native vegetation and the infilling of the mapped wetland areas. For example, the historical clearing and infilling of wetland areas to establish rural landholdings and the construction of key infrastructure corridors including:
    a. Welshpool Road, Tonkin Highway and Boundary Road.
    b. Water Corporation and DBNGP pipeline easements
2. The detailed wetland assessment recommends the removal of UFI 8037 and portion of UFI 15257 within the MRS amendment area from the GWSCP dataset. This recommendation is reflective of the historical land uses and the 'Completely Degraded' ecological condition of the two wetlands. Specifically, historical anthropogenic impacts including the construction of the Tonkin Highway, Water Corporation and DBNGP pipelines and adjacent land uses including commercial turf farm and rural lots resulted in the clearing and infilling of the wetlands.
3. The advice received from DBCA acknowledges the two REWs (UFI 8037 & UFI 15257) have values commensurate with a MUW category wetland.
4. The evaluation and assessment of the wetlands in Lot 501 concluded the existing ecological attributes and values of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW (UFI 15257) are aligned with REWs category wetland and/or MUW category wetland.
5. The specific evaluation and assessment of the two CCWs and the portion of REW UFI 15257 within Lot 501 determined the wetlands are in a 'Degraded to Completely Degraded' condition, specifically REW UFI 15257.
6. The wetland assessment identified there is currently no separation buffer from the two CCWs (UFI 8026 & UFI 8027) and portion of REW UFI 15257 within Lot 501. The existing infrastructure corridors (Boundary Road, Tonkin Highway and Welshpool Road) framing Lot 501 are fixed and operational. These structures essentially frame and contain the limited wetland environmental and ecological values to entirely within Lot 501 without the application of any additional buffers to surrounding land uses i.e., landscape supply yard, Welshpool Road and Tonkin Highway. Importantly, assessment identified:
    a. The wetland/ecological values associated with the mapped CCWs (UFI 8026 & UFI 8027) and REW UFI 15257 do not extend outside of Lot 501.
    b. The MRS amendment does not alter the existing WAPC land management practices including regular mowing and slashing of the wetland areas to maintain the road reserves/Water Corporation and DBNGP as cleared areas.
7. The two CCWs (UFI 8026 & UFI 8027) and the numerous wetlands with the GBSW area are physically separated from the amendment area by key regional infrastructure corridors including:
    a. Boundary Road reserve.
    b. Tonkin Highway reserve and Welshpool Road reserve.
    c. Water Corporation water pipeline easement.
    d. DBNGP easement.

6.2. Evaluation of REW UFI 8037 and REW UFI 15257

The DBCA acknowledges that the wetland spatial information provided in their Geomorphic Wetlands of the Swan Coastal Plain dataset is not 100% accurate. A modification to the dataset can be requested if it is considered that the management category or boundary of a wetland is incorrect or has been altered.

The assessment of the REWs UFI 8037 and portion of UFI 15257 values concluded:

- Removal of REW (UFI 8037) which totals 0.86 ha from the DBCA GWSCP dataset.

- Removal of the portion of REW (UFI 15257) which totals approximately 2.06 ha (within the MRS amendment area) from the DBCA GWSCP dataset.
- The removal of UFI 8037 and portion of UFI 15257 within the MRS amendment area from the GWSCP dataset is reflective of the historical land uses and the 'Completely Degraded' ecological condition of the two wetlands. Specifically, historical anthropogenic impacts including the construction of the Tonkin Highway, Water Corporation pipeline and DBNGP and adjacent land uses including commercial turf farm and rural lots resulted in the clearing and infilling of the wetlands.
- An application to DBCA to amend the GWSCP dataset for the two REWs (UFI 8037 and portion of UFI 15257) will be undertaken concurrently with the finalising of the Local Structure Plan and the LWMS.
- Portions of the two former wetland areas will be incorporated into POS areas and stormwater bioretention basins.
- It is not expected there will be any measurable impacts to the 'Completely Degraded' REWs UFI 8037 and portion of UFI 15257 within the MRS amendment area. The existing trees planted within the portion of UFI 15257 within MRS amendment area (mostly located within the Water Corporation / DBBGP easement boundary) will be retained and integrated in POS areas and stormwater bioretention basins.

6.3. Wetland Buffer Assessment

6.3.1. CCWs UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501

The assessment of the CCWs (UFI 8026 & UFI 8027 and portion of REW UFI 15257 within Lot 501) demonstrate ecological values aligned with REW category and/or MUW category wetlands. This assessment considered the Lot 501 wetlands could justify a downgrading of their wetland management categories.

The WAPC as the landowner of Lot 501 (or MRWA as the proponent for the Tonkin Highway Grade Separated Interchanges proposal which intersections a portion of Lot 501) may seek to formally engage with DBCA for the purpose of amending the GWSCP dataset (specifically the category status of the two CCWs (UFI 8026 & UFI 8027) and the portion of REW (UFI 15257)) within Lot 501.

The wetland assessment concluded the existing 20 m Boundary Road reserves provides an existing physical separation from the two CCWs (UFI 8026 and UFI 8027) and the portion of REW UFI 15257.

6.3.2. GBSW area

The buffer assessment acknowledged the existence of the Tonkin Highway reserve, the Water Corporation pipeline and the DBNGP easements. This establishes a physical separation barrier of a minimum 100 m from any proposed future development within the amendment area to the GBSW area.

In consideration of potential threats to the mapped wetlands within the GBSW area, because of the proposed 'Urban' land use change:

1. There will be no change to hydrological regimes that would result in impacts to groundwater dependent vegetation within the GBSW area, specifically, no changes to the existing surface water volumes flowing towards the GBSW area.
2. Treatment of surface water in vegetated drainage swales/basins within the amendment areas prior to discharging into Lot 501 and the Boundary Road culvert.
3. The pre-development surface water flow volumes will be maintained into Lot 501.
4. Controlling public access through the installation of footpaths and closure of the Brentwood Road cross over across Tonkin Highway.

The buffer assessment recommended maintaining the minimum 100 m separation buffer (inclusive of the existing Tonkin Highway reserve and the Water Corporation pipeline and DBNGP easements) will be established to the future 'Urban' development within the amendment area at the closet point. If the Tonkin Highway upgrade is approved and constructed the minimum buffer would extend to approximately 130 m.

7. References

AECOM. 2020. Wattle Grove South Ecological Surveys. Unpublished report, prepared for the City of Kalamunda.

Beard, J., Beeston, G., Harvey, J., Hopkins, A., & Shepherd, D. 2013. The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. Conservation Science Western Australia, 9(1), 1-152.

Churchward, H. M., & McArthur, W. M. 1980. 'Landforms and Soils of the Darling System' in Atlas of Natural Resources, Darling System, Western Australia'. Editors: Department of Conservation and Environment, Perth, pp. 25-33.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a. A Methodology for the Evaluation of Wetlands on the Swan Coastal Plain, Western Australia. Draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth, Western Australia.

Department of Biodiversity, Conservation, and Attractions. 2017. A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia.

Department of Water and Environment Regulation. 2022. Perth Groundwater Map. Data.

Emerge Associates 2023a. Water Balance Assessment: Wattle Grove South MRS Amendment. Prepared for Hesperia Pty Ltd.

Emerge Associates 2023b. Environmental Review: City of Gosnells Town Planning Scheme No. 6 Amendments 166 and 169. Prepared for the City of Gosnells.

Environmental Protection Authority. 2018. Environmental Factor Guideline – Inland Waters. Environmental Protection Authority, Perth, WA.

Environmental Protection Authority. 2022. Environmental values and pressures for the Greater Brixton Street Wetlands on the Swan Coastal Plain. Environmental Protection Authority, WA.

Heddle, E. M., Loneragan, O.W., & Havel, J.J. 1980. Vegetation Complexes of the Darling System, Western Australia. In Department of Conservation and Environment, Atlas of Natural Resources, Darling System, Western Australia.

Horizon Heritage Management (Horizon Heritage) 2021. Site Verification Assessment for Registered Aboriginal Sites DPLH 4342 Brentwood Road Quarry and DPLH 4343 Brentwood Road Swamp. February 2021

Hyd2o Hydrology. 2024. Wattle Grove South: District Water Management Strategy. Unpublished report prepared for Hesperia.

Lane, P. and Evans, K. 2019. Geology of the Proposed Yule Brook Regional Park in Lambers, H (ed.), A Jewel in the Crown of a Global Biodiversity Hotspot. Kwongan Foundation and the Western Australian Naturalists' Club Inc., Western Australia.

Main Roads. 2023. Tonkin Highway Corridor – Roe Highway to Kelvin Road. Available from: https://www.mainroads.wa.gov.au/projects-initiatives/all-projects/metropolitan/tonkin-highway-corridor/

Tauss, C. and Weston, A. S. 2010. The flora, vegetation, and wetlands of the Maddington-Kenwick Strategic Employment Area.

V & C Semeniuk Research Group. 2001. Hydrological study of the Greater Brixton Street Wetlands.

Western Australian Planning Commission (WAPC) 2005. Guidelines for the Determination of Wetland Buffer Requirements. Government of Western Australia.

Woodman Environmental Consulting Pty Ltd. 2021. Tonkin Grade Separated Interchanges, Biological Survey and Targeted Black Cockatoo Habitat Assessment, Unpublished report prepared for Main Roads Western Australia.

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Appendix A: Detailed assessment of Resource Enhancement Wetland UFI 8037

Detailed assessment of Resource Enhancement Wetland UFI 8037

Assessment element		Details	
Wetland location / Lot details		• Lot 301 – zoned Primary Regional Road. • Lot 302 – zoned 'Rural' (Water Corporation easement). • Lot 303 - zoned 'Rural' (turf farm). • Dampier to Bunbury Natural Gas Pipeline (DBNGP) easement (D207286). • Lot 107 – zone 'Rural' predominantly cleared small rural landholding. • Lot 106 – zone 'Rural' predominantly cleared small rural landholding.	
Wetland details			
Name		Palusplain: seasonally waterlogged flat.	
UFI		8037.	
Area		0.86 hectares.	
Preliminary desktop questions			
Land uses		**International, national, or regional significance**	
Current ownership	Mixed: Private (turf farm), Main Roads WA.	Conservation significance	No.
Current land use	Mixed: Turf farm, Water Corporation easement, DBNGP easement and Tonkin Highway reserve.	Ramsar	No.
Past land use	Rural.	Conservation reserve (system 6)	No.
Surrounding land use	Tonkin Highway, rural lots.	Bush Forever	No.
Existing management	Unknown.	Conservation estate	No.
Fire history/regime	No known fires in past 10 years.	Other	No.
Scientific value			
Scientific, geo-heritage or geo-conservation values		No.	
Fauna			
Threatened fauna		• Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) VU. • Carnaby's cockatoo (*Calyptorhynchus latirostris*) EN. • Baudin's cockatoo (*Calyptorhynchus baudinii*) – Vu. • Quenda (*Isoodon fusciventer*) Priority 4 (P4).	
Source		DBCA threatened fauna database records within 1 km of the REW UFI 8037.	
Threatened Ecological Communities related to fauna		No.	
Flora			
Vegetation condition		Completed degraded.	
Is the wetland vegetation predominantly in good condition?		No.	
Vegetation complex (Heddle et al., 1980)		Guildford complex.	
% remaining vegetation complex:		5.87%.	
Threatened ecological communities		No.	

Representatives			
% area wetlands in same suite assigned Conservation mgt category		1.5.	
% area wetlands with same classification and suite assigned Conservation mgt category		1.3.	
Is the wetland rare:		No.	
Site assessment questions			
Geomorphology		**Wetland Processes**	
Geomorphic unit	Bassendean Sand over sandy clay to clayey sand of the Guildford Formation.	Wetland salinity.	Unknown.
Can all areas of the wetland be visited?	No. Turf farm was not accessible – observations made from adjacent areas and aerial photographs.	Groundwater dependence.	• Over 90% of the mapped REW has no native vegetation during the construction of the Tonkin Highway, rural land use/turf farm and the installation of the Water Corporation pipeline and the DBNGP. • The native vegetation present is limited to a 0/08 ha area of scattered trees within a rural paddock.
		Surface water present.	No.
Slope	Minimal.	Artificial drainage features.	No drains present. Evidence of infilling of the wetland body.
		Wetland processes occurring.	Potential infiltration into the superficial aquifer.
Describe any human induced alterations	Fill, excavation, alienation on boundaries, structural control.	Alteration of processes.	Highly altered. Current and historical land uses have disrupted natural hydrology and the native vegetation.
% geomorphology altered	>90%	Impact of alteration of processes.	Wetland natural attributes highly altered.
		Is the wetland part of a hydrological linkage?	No.
		Is the wetland part of an ecological linkage?	No
Habitats			
Is the wetland important for maintaining genetic and ecological diversity?		No.	
Does the wetland support/likely to support fauna at vulnerable life stages?		No.	
Fauna habitats present		The REW UFI 8037 was historically cleared for initially rural land use and subsequently the construction of Tonkin Highway, and the installation of the Water Corporation pipeline and the DBNGP and the turf farm.	
Fauna observed		No.	

Comments on habitat diversity	Native vegetation highly disturbed with over 90% of the mapped REW area in a cleared state.
Flora	
Significant flora species	• No Priority (or significant) Flora was recorded during the site flora and vegetation survey (AECOM 2020 & Woodman Environmental 2021).
Vegetation unit description(s)	• Cleared turf farm/Tonkin Highway reserve and Water Corporation and DBNGP easements. • Open paddocks with *Eucalyptus camaldulensis* (Red River Gum).
% of wetland boundary surrounded by land dominated by native vegetation	<90%
Compare wetland flora diversity	Very low.
Evidence of disturbance in last 24 months	No significant additional disturbance since 2008.
Fauna	
Evidence of native fauna species.	Nil.
Does the wetland function/potentially function as refuge.	Unlikely.
Potential fauna habitat utilisation; feeding/breeding/roosting/movement.	Predominantly disturbed turf farm and Tonkin Highway reserve.
Fauna diversity compared to similar wetlands.	Very low to none.
Cultural	
Is the wetland identified on national, state, regional or local heritage list	No.
Is the wetland identified for Aboriginal heritage value	• The wetland is within one heritage site: Brentwood Road Swamp (Site ID 4343), which was recorded in 1973 and listed on the Register for Aboriginal Sites as an artefact scatter with an unreliable location. • The substantial disturbance and the significant historical development (i.e., Tonkin Highway, DBNGP installation and the turf farm) it is unlikely the heritage values persist. • A site assessment was undertaken by Horizon Heritage Management (2021) to verify the location of the registered heritage site. This assessment concluded the Brentwood Road Swamp (Site ID 4343) is a heavily disturbed and altered environment with no cultural material evident during the site verification assessment nor through Traditional Owner visit to the site in December 2022 (Horizon Heritage 2021).
Are there any identified important social values	No.
Identify passive and active recreational use	No.
Education and scientific	
Is there an educational institution known to use wetland for educational purposes?	No.
Is there potential for wetland to be used in the future for educational purposes?	No.

DBCA methodology secondary wetland evaluation criteria - UFI 8037

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
Geomorphology					
1	Representativeness	≤ 20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	H	-	40.1% of Sumpland wetlands on the Swan Coastal Plain are classified as 'Conservation' category.
2		≤ 20% of wetlands in the same consanguineous suite are assigned Conservation by area.	H	H	12.6% of wetlands in the Mungala consanguineous suite are classified as 'Conservation' category.
3		≤ 20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	H	-	29.3% of Sumpland wetlands in the Mungala consanguineous suite are classified as 'Conservation' category (by area).
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H	-	
5	Naturalness	Alteration to the wetland's geomorphology by % area:		L	The wetlands geomorphology has been significantly altered and infilled through historical rural land use and development of adjacent infrastructure, including Tonkin Highway and the Water Corporation pipeline and DBNGP. The wetland is in a 'Completely Degraded' condition and contains no remnant native vegetation or fauna habitat.
		< 25% altered	H		
		25-75% altered	I		
		> 75% altered.	L		
6	Scarcity	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H	-	
7		The wetland is the best example of its type in its consanguineous suite.	H	-	There are examples of more intact wetland areas within the Swan Coastal Plain, including adjacent Greater Brixton Street Wetlands.
Wetland processes					
8	Representativeness	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection, recharge/discharge, hydrological storage, support for groundwater dependent ecosystems).	H	L	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		The wetland's vegetation, geomorphology, hydrology, or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge, hydrological storage, support for groundwater dependent ecosystems).	I		
		The wetland's vegetation, geomorphology, hydrology, or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	L		
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H	-	
10	Naturalness	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained.	H	L	
		The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated.	I		
		The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	L		
11	Scarcity	The wetland exhibits unusual processes compared to other wetlands of the same type in the consanguineous suite.	H	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
Linkages					
12	Representativeness	The wetland is a hydrological link in a larger or more complex and intact system.	H	-	
13	Naturalness	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas.	H	L	The wetland is not within a mapped ecological linkage or directly linked to areas of intact native vegetation. It is located within 500 m of 'Conservation Category Wetlands' (GBSW), however, it is separated by Tonkin Highway reserve and surrounding rural/residential areas.
		The wetland is part of a fragmented ecological linkage or wildlife corridor.	I		
		The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	L		
14	Scarcity	The wetland has unusual hydrological, hydrogeological, hydrochemical, or ecological linkages with adjacent wetlands or bushland	H	-	
Habitats					
15	Representativeness	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H	-	A conservation category wetland is located within 400 m of the wetland which appears undisturbed (also within the Jandakot consanguineous suite)
16		The wetland contains evidence of surface water or groundwater expression that is vital for maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H	-	There are no significant water bodies that exist within the area. The wetland has been historically infilled as a result of anthropogenic impacts including the establishment of rural paddocks, the construction of Tonkin Highway and Water Corporation pipeline/ DBNGP which resulted in the infilling and clearing of the mapped wetland area.
		The wetland contains evidence of surface water or groundwater expression that is important for maintaining populations of native aquatic or terrestrial flora or fauna.	I		
17		The wetland provides a nursery for native fauna populations or maintains fauna	H	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		populations at a vulnerable stage of their life cycle.			
18	Naturalness	The wetland supports habitats that are unaltered, or the wetland has been altered and its natural habitats are maintained.	H	L	
		The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to naturally regenerate or be rehabilitated after weed control, if required.	I		
		The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	L		
19	Scarcity	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H	-	
Flora					
20	Representativeness	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state.	H	L	The wetland has been subject to degrading processes. The area is predominately cleared, with a small portion containing scattered trees. The native vegetation is entirely cleared, and the wetland infilled.
		The wetland supports a reduced diversity of native flora due to human induced disturbances.	I		
		The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	L		
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by:		H	The wetland is mapped within the Pinjarra 968 vegetation association, of which 6.61% is remaining of its pre-European extent on the Swan Coastal Plain. However, the majority of
		≤ 30% of the pre-European extent	H		

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		30-50% of the pre-European extent.	I		Pinjarra vegetation association has been historically cleared, including with the wetland area. Subsequently, there is no remnant native vegetation within the wetland.
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is:		L	The wetland lacks remnant vegetation and is predominately cleared or in 'Completely Degraded' condition.
		≥ 75% Good, Very Good, Excellent or Pristine	H		
		25-75% Good, Very Good, Excellent or Pristine	I		
		< 25% Good, Very Good, Excellent or Pristine.	L		
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H	L	The amendment area is predominately cleared as a result of historical clearing and associated 'Rural' land uses. Most of the vegetation surrounding the mapped wetland area is in a 'Completely Degraded' condition. The vegetated areas mostly consist of scattered planted trees (i.e., Red River Gum trees). The is two small patches (0.38 ha UFI 8026 & 0.32 UFI 8027) of remnant native vegetation associated with the mapped 'Conservation Category Wetlands' located 500 m from UFI 8037.
		The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	I		
		The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	L		
24	Scarcity	The wetland supports an occurrence of declared rare, priority 1, priority 2, priority 3 or priority 4 flora, or an occurrence of three or more significant flora taxa.	H	-	
25		The wetland is likely to support declared rare, priority 1, priority 2, priority 3 or priority 4 flora; however, the occurrence cannot be located, or its habitat has been altered and is no longer in a natural state.	I	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
26		The wetland supports an occurrence of a threatened ecological community, priority 1 or priority 2 ecological community.	H	-	
27		The wetland supports an occurrence of a priority 3 or priority 4 ecological community.	I	-	
Fauna					
28	Representativeness	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages.	H	-	
		The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	I		
29		The wetland supports a permanent or seasonal feeding, breeding, roosting, or watering site for regionally significant native fauna.	H	-	
		The wetland supports a permanent or seasonal feeding, breeding, roosting, or watering site for regional or local fauna but only in association with other surrounding natural areas.	I		
30	Naturalness	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type.	H	L	The wetland area and associated native vegetation have been infilled and cleared. There is minimal to no fauna habitat such as Quenda and the three threatened black cockatoo species. Within the Water Corporation / DBNGP cleared easement there are planted red river gum trees. The red river gum trees, are not preferred breeding or nesting trees for the three threatened black cockatoo species.
		The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	I		
		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L		
31	Scarcity	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Australian Government (e.g. EPBC Act 1999, JAMBA, CAMBA, RoKAMBA Agreements) or the State	H	H	The planted red river gums provide low quality Carnaby's, Baudin's, and Forest Red-tailed black Cockatoo foraging habitat trees.

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		(e.g. threatened or specially protected fauna listed under the Wildlife Conservation Act 1950).			
32		The wetland supports a breeding, roosting, refuge or feeding site for priority 1, priority 2, priority 3 or priority 4 fauna.	H	-	
33		The wetland supports an occurrence of a threatened ecological community, priority 1 or priority 2 ecological community.	H	-	
34		The wetland supports an occurrence of a priority 3 or priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I	-	
Cultural					
35	Representativeness	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H	-	The wetland is not identified on the State Heritage Register.
36		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list or the wetland supports other known local heritage values.	I	-	The wetland is not identified on the Municipal Heritage list.
37		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value.	H	H	The wetland is within one heritage site: Brentwood Road Swamp (Site ID 4343).
38		The wetland is important to the local community for its natural values.	H	-	The wetland has been substantially cleared and developed, and as such is not considered important to the community based on its natural values.
39		The wetland is or has the potential to be a site for public or private based recreation.	I	-	The wetland has been substantially developed including the construction of Tonkin Highway, and the installation of the DBNGP and a Turf farm, and, as such, cannot be utilised for public or private recreation.
40		The wetland is the subject of a recognised ecological restoration / rehabilitation project by a community group, landowner or land manager that aims to improve the	H	I	• The wetland is within one heritage site: Brentwood Road Swamp (Site ID 4343), which was recorded in 1973 and listed on

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		wetland's natural, heritage, cultural or social values.			the Register for Aboriginal Sites as an artefact scatter with an unreliable location. The substantial disturbance and the significant historical development (i.e., Tonkin Highway, DBNGP installation and the turf farm) it is unlikely the heritage values persist. • A site assessment was undertaken by Horizon Heritage Management (2021) to verify the location of the registered heritage site. • A reliable location for the site will be determined following DPLH consideration of the results of the site assessment. The site is a registered Aboriginal heritage site and as such is afforded protection under the AH Act.
		The wetland is likely to support heritage, cultural or social values; however, the values cannot be confirmed, or the values have been disturbed and are no longer as important or significant.	I		
		The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	L		
Scientific and Educational					
41	Representativeness	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential education or research site. Note: the wetland must still support the relevant teaching or research characteristics.	H	-	The wetland is located on predominately private property, comprising a Turf Farm and rural residential land use, as well as Tonkin Highway in the west and the DBNGP. The wetland is therefore highly disturbed and unlikely to be of interest in studying for ecological or hydrological purposes.
		The wetland has the potential to be used as a study or research site.	I		
42		The wetland supports known scientific, geo-heritage or geo-conservation values.	H	-	

Appendix B: Detailed assessment of Resource Enhancement Wetland UFI 15257

Detailed assessment of Resource Enhancement Wetland UFI 15257

Assessment element		Details	
Wetland location / Lot details		• Lots 501, 146, 12 & 7 - zoned 'Rural' predominantly cleared small rural landholdings. • Lot 302 – zoned 'Rural' (Water Corporation easement). • Dampier to Bunbury Natural Gas Pipeline (DBNGP) easement (D207286).	
Wetland details			
Name		Palusplain: seasonally waterlogged flat.	
UFI		15257.	
Area		30.33 hectares (approximately 2.06 ha area is within the amendment area).	
Preliminary desktop questions			
Land uses		**International, national, or regional significance**	
Current ownership	Mixed: Private (rural landholdings), Main Roads WA.	Conservation significance	No.
Current land use	Mixed: Small rural lots, Water Corporation easement, DBNGP easement and Tonkin Highway reserve.	Ramsar	No.
Past land use	Rural.	Conservation reserve (system 6)	No.
Surrounding land use	Tonkin Highway, rural lots.	Bush Forever	No.
Existing management	Unknown.	Conservation estate	No.
Fire history/regime	No known fires in past 10 years.	Other	No.
Scientific value			
Scientific, geo-heritage or geo-conservation values		• No.	
Fauna			
Threatened fauna		• Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) VU. • Carnaby's cockatoo (*Calyptorhynchus latirostris*) EN. • Baudin's cockatoo (*Calyptorhynchus baudinii*) – Vu. • Quenda (*Isoodon fusciventer*) Priority 4 (P4).	
Source		DBCA threatened fauna database records within 1 km of the REW UFI 15257.	
Threatened Ecological Communities related to fauna		No.	
Flora			
Vegetation condition		Completed Degraded.	
Is the wetland vegetation predominantly in good condition?		No.	
Vegetation complex (Heddle et al., 1980)		Southern River & Guildford Complex.	
% remaining vegetation complex:		• Southern River - 16.8% • Guildford Complex - 5.87%.	
Threatened ecological communities		No.	
Representatives			

% area wetlands in same suite assigned Conservation mgt category		1.5.	
% area wetlands with same classification and suite assigned Conservation mgt category		1.3.	
Is the wetland rare:		No.	
Site assessment questions			
Geomorphology		**Wetland Processes**	
Geomorphic unit	Bassendean Sand over sandy clay to clayey sand of the Guildford Formation.	Wetland salinity.	Unknown.
Can all areas of the wetland be visited?	Yes.	Groundwater dependence.	Approximately 90% of the mapped REW UFI 15257 has no native vegetation.
		Surface water present.	No.
Slope	Minimal.	Artificial drainage features.	No drains present.
		Wetland processes occurring.	Potential infiltration into the superficial aquifer.
Describe any human induced alterations	Fill, excavation, alienation on boundaries, structural control.	Alteration of processes.	Highly altered. Current and historical land uses have disrupted natural hydrology and the native vegetation.
% geomorphology altered	>90%	Impact of alteration of processes.	Wetland natural attributes highly altered.
		Is the wetland part of a hydrological linkage?	No.
		Is the wetland part of an ecological linkage?	No
Habitats			
Is the wetland important for maintaining genetic and ecological diversity?		No.	
Does the wetland support/likely to support fauna at vulnerable life stages?		No.	
Fauna habitats present		The REW UFI 15257 was historically cleared for initially rural land use and subsequently the construction of Tonkin Highway and the installation of the Water Corporation pipeline and the DBNGP. Water Corporation and the DBNGP easements are maintained as cleared paddocks with planted trees along the fence line.	
Fauna observed		No.	
Comments on habitat diversity		Native vegetation highly disturbed with 90% of the mapped REW area has been historically cleared. The cleared areas are maintained as open paddocks.	
Flora			
Significant flora species		No Priority (or significant) Flora was recorded during the site flora and vegetation survey (AECOM 2020 & Woodman Environmental 2021).	
Vegetation unit description(s)		• Within the Tonkin Highway reserve and Water Corporation easement:	

	○ Stands of *Corymbia calophylla* (Marri) and non-native eucalypt *Eucalyptus camaldulensis* (Red River Gum) over non-native eucalypt *Casuarina cunninghamiana* subsp. *cunninghamiana, Melaleuca preissiana, Jacksonia sternbergiana* and **Schinus terebinthifolia* over introduced species. • Cleared paddocks with *Eucalyptus camaldulensis* (Red River Gum).
% of wetland boundary surrounded by land dominated by native vegetation	<90%
Compare wetland flora diversity	Very low.
Evidence of disturbance in last 24 months	No significant additional disturbance since 2008.
Fauna	
Evidence of native fauna species.	Nil.
Does the wetland function/potentially function as refuge.	Unlikely.
Potential fauna habitat utilisation; feeding/breeding/roosting/movement.	• Planted trees existing within a historically disturbed rural landholdings and infrastructure corridor(s) (Tonkin Highway reserve, Water Corporation pipeline & DBNGP easements) with no native understorey. • The easements are maintained as open paddock areas with planted trees along the fenced boundary.
Fauna diversity compared to similar wetlands.	Very low to none.
Cultural	
Is the wetland identified on national, state, regional or local heritage list	No.
Is the wetland identified for Aboriginal heritage value	No heritage sites within REW UFI 15257.
Are there any identified important social values	No.
Identify passive and active recreational use	No.
Education and scientific	
Is there an educational institution known to use wetland for educational purposes?	No.
Is there potential for wetland to be used in the future for educational purposes?	No.

DBCA methodology secondary wetland evaluation criteria - 15257

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
Geomorphology					
1	Representativeness	≤ 20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	H	H	3.8% of Palusplain wetlands on the Swan Coastal Plain are classified as 'Conservation' category.
2		≤ 20% of wetlands in the same consanguineous suite are assigned Conservation by area.	H	H	12.6% of wetlands in the Mungala consanguineous suite are classified as 'Conservation' category.
3		≤ 20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	H	H	4.1% of Palusplain wetlands in the Mungala consanguineous suite are classified as 'Conservation' category (by area).
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	H	-	
5	Naturalness	Alteration to the wetland's geomorphology by % area:		L	The wetlands geomorphology has been significantly altered through historical rural land use and development of adjacent infrastructure, including the infilling of the wetland area to establish the Tonkin Highway and the Water Corporation pipeline / DBNGP. The wetland is in a 'Completely Degraded' condition and contains no remnant native vegetation or fauna habitat.
		< 25% altered	H		
		25-75% altered	I		
		> 75% altered.	L		
6	Scarcity	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the consanguineous suite.	H	-	
7		The wetland is the best example of its type in its consanguineous suite.	H	-	
Wetland processes					
8	Representativeness	The wetland is an important component of the natural hydrological cycle providing natural functions (e.g. flood protection, recharge/discharge, hydrological storage, support for groundwater dependent ecosystems).	H	L	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		The wetland's vegetation, geomorphology, hydrology, or sediments are modified; however, the wetland is still a component of the hydrological cycle providing natural and artificial functions (e.g. flood remediation, recharge/discharge, hydrological storage, support for groundwater dependent ecosystems).	I		
		The wetland's vegetation, geomorphology, hydrology, or sediments are modified to the extent that the wetlands hydrological functions are artificial such as storage, or the wetland has been disconnected from the natural hydrological cycle and no longer provides natural attributes and functions.	L		
9		The wetland supports a representative process (e.g. wetland process typical of the wetland's hydrological setting, sediment accretionary process typical of the wetland's geomorphic setting or hydrochemical process typical of the wetland's geological setting).	H	-	
10	Naturalness	The wetland is not subject to altered wetland processes or, is subject to altered wetland processes and the wetland's natural attributes and functions are maintained.	H	L	
		The wetland is subject to altered wetland processes and the wetland's natural attributes and functions have been changed; however, they have the potential to be rehabilitated.	I		
		The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	L		
11	Scarcity	The wetland exhibits unusual processes compared to other wetlands of the same type in the consanguineous suite.	H	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
Linkages					
12	Representativeness	The wetland is a hydrological link in a larger or more complex and intact system.	H	-	
13	Naturalness	The wetland is part of a continuous ecological linkage or wildlife corridor, or a regionally significant ecological linkage or wildlife corridor connecting bushland or wetland areas.	H	I	The wetland forms part of a larger network, as it is adjacent to the GBSW. However, the surrounding land use has been subject to substantial clearing and degradation, including construction of Tonkin Highway, Water Corporation pipeline and the DBNGP, resulting in fragmentation of the wetland.
		The wetland is part of a fragmented ecological linkage or wildlife corridor.	I		
		The wetland is disturbed and isolated, surrounded by either a built or highly disturbed environment with no nearby native vegetation or waterways to support an intact or fragmented ecological linkage or wildlife corridor.	L		
14	Scarcity	The wetland has unusual hydrological, hydrogeological, hydrochemical or ecological linkages with adjacent wetlands or bushland	H	-	
Habitats					
15	Representativeness	The wetland is isolated from other undisturbed wetlands or bushland and as a result, maintains important ecological or genetic fauna or flora diversity within its consanguineous suite domain.	H	-	The wetland does not maintain important ecological or genetic fauna or flora diversity.
16		The wetland contains evidence of surface water or groundwater expression that is vital for maintaining regionally significant populations of native aquatic or terrestrial flora or fauna.	H	-	There is no evidence of surface water or groundwater features that may be important for maintaining aquatic or terrestrial flora or fauna.
		The wetland contains evidence of surface water or groundwater expression that is important for maintaining populations of native aquatic or terrestrial flora or fauna.	I		
17		The wetland provides a nursery for native fauna populations or maintains fauna	H	-	The wetland is not considered to provide a nursery for fauna given the lack of native vegetation and habitat values.

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		populations at a vulnerable stage of their life cycle.			
18	Naturalness	The wetland supports habitats that are unaltered, or the wetland has been altered and its natural habitats are maintained.	H	L	Given the substantial level of disturbance and development already having occurred, the wetland is not considered to support natural habitats that can be rehabilitated.
		The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to naturally regenerate or be rehabilitated after weed control, if required.	I		
		The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	L		
19	Scarcity	The wetland supports habitats that are unusual compared to other wetlands of the same type on the Swan Coastal Plain.	H	-	
Flora					
20	Representativeness	The wetland's current diversity of native flora is similar to what would be expected in an unaltered state.	H	L	
		The wetland supports a reduced diversity of native flora due to human induced disturbances.	I		
		The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	L		
21		The wetland is identified in a vegetation complex (Heddle et al. 1980) which is represented by:		H	The wetland is mapped within the Pinjarra 968 vegetation association, of which 6.61% is remaining of its pre-European extent on the Swan Coastal Plain. However, the majority of Pinjarra vegetation association has been historically cleared, including with the wetland area. Subsequently, there is no remnant native vegetation within the wetland.
		≤ 30% of the pre-European extent	H		
		30-50% of the pre-European extent.	I		
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is:		L	The wetland is predominately cleared in a 'Completely Degraded' condition.
		≥ 75% Good, Very Good, Excellent or Pristine	H		

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		25-75% Good, Very Good, Excellent or Pristine	I		
		< 25% Good, Very Good, Excellent or Pristine.	L		
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	H	I	The wetland within the amendment area is highly disturbed due to surrounding land uses. A portion of the wetland outside of the amendment area is surrounded by native vegetation within the GBSW.
		The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	I		
		The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	L		
24	Scarcity	The wetland supports an occurrence of declared rare, priority 1, priority 2, priority 3 or priority 4 flora, or an occurrence of three or more significant flora taxa.	H	-	There is no evidence of the wetland supporting the occurrence of any Threatened or Priority flora.
25		The wetland is likely to support declared rare, priority 1, priority 2, priority 3 or priority 4 flora; however, the occurrence cannot be located, or its habitat has been altered and is no longer in a natural state.	I	-	
26		The wetland supports an occurrence of a threatened ecological community, priority 1 or priority 2 ecological community.	H	-	
27		The wetland supports an occurrence of a priority 3 or priority 4 ecological community.	I	-	
Fauna					
28	Representativeness	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages.	H	-	The wetland is highly disturbed and comprises predominately private rural land uses, with a lack of remnant vegetation providing fauna habitat.
		The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	I		
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or	H	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		watering site for regionally significant native fauna.			
		The wetland supports a permanent or seasonal feeding, breeding, roosting or watering site for regional or local fauna but only in association with other surrounding natural areas.	I		
30	Naturalness	The wetland's current diversity of native fauna is similar to what would be expected in an unaltered state, or the wetland supports diverse fauna compared to other wetlands of the same type.	H	L	
		The wetland supports a reduced diversity of fauna compared to other wetlands of the same type.	I		
		The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	L		
31	Scarcity	The wetland is likely to support a breeding, roosting, refuge or feeding site for populations of fauna listed by the Australian Government (e.g. EPBC Act 1999, JAMBA, CAMBA, RoKAMBA Agreements) or the State (e.g. threatened or specially protected fauna listed under the Wildlife Conservation Act 1950).	H	H	The wetland supports a small portion of low quality Carnaby's, Baudin's, and Forest red-tailed black Cockatoo foraging habitat, specifically planted river gum trees.
32		The wetland supports a breeding, roosting, refuge or feeding site for priority 1, priority 2, priority 3 or priority 4 fauna.	H	-	
33		The wetland supports an occurrence of a threatened ecological community, priority 1 or priority 2 ecological community.	H	-	
34		The wetland supports an occurrence of a priority 3 or priority 4 ecological community or a breeding, roosting, refuge or feeding site for significant fauna.	I	-	
Cultural					

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
35	Representativeness	The wetland or its immediate surrounds is identified for its natural values on a national or State heritage list or the wetland supports other known regional heritage values.	H	-	The wetland is not identified on the State Heritage Register.
36		The wetland or its immediate surrounds is identified for its natural values on a municipal heritage list, or the wetland supports other known local heritage values.	I	-	The wetland is not identified on the Municipal Heritage list.
37		The wetland or its immediate surrounds is identified on a national, State, or local list or register for its Aboriginal cultural value.	H	-	The wetland is not identified as an Aboriginal Heritage Place.
38		The wetland is important to the local community for its natural values.	H	-	The wetland has been substantially cleared and developed, and as such is not considered important to the community based on its natural values.
39		The wetland is or has the potential to be a site for public or private based recreation.	I	-	The wetland has been substantially developed and, as such, cannot be utilised for public or private recreation.
40		The wetland is the subject of a recognised ecological restoration / rehabilitation project by a community group, landowner or land manager that aims to improve the wetland's natural, heritage, cultural or social values.	H	L	It is possible that the wetland once supported heritage, cultural or social values however given the substantial disturbance and development present, it is unlikely that these values persist.
		The wetland is likely to support heritage, cultural or social values; however, the values cannot be confirmed, or the values have been disturbed and are no longer as important or significant.	I		
		The wetland did support heritage, cultural or social values; however, these have been significantly disturbed and are no longer important or the values have been removed.	L		
Scientific and Educational					
41	Representativeness	The wetland supports known important teaching or research characteristics and for this reason is an existing or potential	H	-	

Attributes/ functions/ values	General criteria	Criteria	Possible score	Assigned score	Comments
		education or research site. Note: the wetland must still support the relevant teaching or research characteristics.			
		The wetland has the potential to be used as a study or research site.	I		
42		The wetland supports known scientific, geo-heritage or geo-conservation values.	H	-	