A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia

December 2017

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Executive Summary

The Swan Coastal Plain, Western Australia contains globally distinct and unique wetlands that support a range of important ecological and cultural values. In 1996, wetlands occupied greater than 25 per cent of the land surface on the Swan Coastal Plain, from Wedge Island to Dunsborough (Hill *et al.* 1996a). Approximately, 73 per cent of wetlands currently mapped on the Swan Coastal Plain have been degraded and have an assigned management category of Multiple Use. Only 21 per cent of wetlands are in a relatively undisturbed condition and have an assigned management category of Conservation. An analysis of Landsat satellite imagery from 1992-2012 indicated that approximately four ha of perennial vegetation within wetlands was lost per day on the Swan Coastal Plain.

The Department of Biodiversity, Conservation and Attractions is the current custodian of the wetland mapping dataset for the Swan Coastal Plain of Western Australia. Mapping including boundaries, types and management categories for wetlands on the Swan Coastal Plain is publicly available through the *Geomorphic Wetlands Swan Coastal Plain* dataset. This dataset as well as other wetland information can be accessed through links provided at www.dpaw.wa.gov.au/management/wetlands.

A methodology for the evaluation of wetlands on the Swan Coastal Plain, Western Australia provides a single, consistent method on how to evaluate wetlands across the Swan Coastal Plain. The outcome of the evaluation process for each wetland is the identification of a wetland management category.

Wetland evaluation is the process of assessing a wetland's values by considering information about its attributes and functions. Wetland evaluation is a scientific assessment of wetland values and does not consider the potential implications of the evaluation on current or future land uses. The process of evaluation is independent of decisions about protection and management, which are the responsibility of land managers and regulators, but does provide a description of values upon which subsequent decisions on protection and management can be based.

The methodology on which this document is based has been endorsed by the WA Wetlands Coordinating Committee and was distributed for public information and feedback in August 2013. The Wetlands Coordinating Committee includes representatives of the Department of Biodiversity, Conservation and Attractions; Department of Water and Environmental Regulation; Department of Primary Industries and Regional Development; Department of Planning, Lands and Heritage; Western Australian Local Government Association; the voluntary conservation movement and independent wetland scientists.

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1 Introduction

1.1 Wetland definitions

Wetlands can be described using various definitions. The *Wetlands Conservation Policy for Western Australia* (Government of Western Australia 1997) has adopted the wetland definition used by the Ramsar Convention on Wetlands (UNESCO 1971) which includes:
"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth to which at low tide does not exceed six metres."

The *Environmental Protection Act 1986* defines a wetland as:
"an area of seasonally, intermittently or permanently waterlogged or inundated land, whether natural or otherwise, and includes a lake, swamp, marsh, spring, dampland, tidal flat or estuary."

Waterways are defined by the Department of Water and Environmental Regulation (DWER) as:
"any river, creek, stream, or brook, including its floodplain and estuary. This includes systems that flow permanently, for part of the year or occasionally; and parts of the waterway that have been artificially modified".

For the purposes of geomorphic wetland mapping and evaluation, and in this document, the term wetland includes waterways, unless otherwise specified.

1.2 Purpose and objectives of this document

The purpose of this document is to describe a single methodology for evaluating wetlands on the Swan Coastal Plain, Western Australia. The Department of Biodiversity, Conservation and Attractions (DBCA) is currently the agency with custodianship of wetland inventory datasets, including evaluation, for most wetland types (e.g. lake, sumpland, dampland, palusplain and paluslope), and DWER is the lead agency for waterways (e.g. channel, floodplain and estuary).

For the purposes of wetland mapping on the Swan Coastal Plain, particularly as utilised by Western Australian government agencies, this methodology supersedes previously used evaluation systems including, Environmental Protection Authority Bulletin 686: *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area* (Environmental Protection Authority 1993), *Wetlands of the Swan Coastal Plain Volume 2A: Wetland Mapping, Classification and Evaluation* (Hill *et al.* 1996a) and *Evaluation of Wetlands on the Southern Swan Coastal Plain* (V & C Semeniuk Research Group 1998). This methodology has been developed by integrating the previous evaluation systems, to form a single and comprehensive wetland evaluation methodology. The methodology has also been developed to be consistent with *Framework for mapping, classification and evaluation of wetlands in Western Australia* (Department of Environment and Conservation 2007). The overarching framework recognises that wetland values need to be interpreted within a regional context; however, the overall evaluation principles are consistent across Western Australia.

The classification and evaluation of wetlands contributes to an inventory of wetlands in the region. This enables strategic planning, so that wetlands of high conservation significance can be identified and their condition maintained or improved where possible through management and decision-making. The Swan Coastal Plain region is subject to pressures from development and urbanisation, and the prioritisation of areas for management is important for the protection of wetlands. In 2008, the Environmental Protection Authority published Guidance Statement No. 33 *Environmental guidance for planning and development* (Environmental Protection Authority 2008) to provide guidance to stakeholders on the considerations relating to wetland conservation that can be taken into account in urban and regional planning. *State Planning Policy 2.9 Water Resources* (Western Australian Planning Commission 2006) also provides information and policy measures relating to the protection and management of wetlands.

Wetland values and areas can change, either through natural or anthropogenic processes. Where the assigned management category for a wetland as shown in the *Geomorphic Wetlands Swan Coastal Plain* dataset (herein 'GWSCP dataset') is considered to be inaccurate, a modification to the management category for the wetland (or part thereof) can be requested. DBCA is the current custodian of the GWSCP dataset and is responsible for maintaining and updating the dataset with new information (as it becomes available) to reflect current wetland values. Requests to modify the management category of a wetland within the GWSCP dataset should be accompanied by a documented evaluation of the wetland undertaken using this evaluation methodology and be submitted to DBCA. Requests to modify the geomorphic wetland boundary of a wetland within the GWSCP dataset should consider the guidance provided in the information sheet *Wetland identification and delineation: information for mapping and land use planning on the Swan Coastal Plain* (Department of Biodiversity Conservation and Attractions 2017) available at www.dpaw.wa.gov.au/management/wetlands. DBCA obtains technical advice from DWER in regard to modification requests involving waterway, floodplain and estuary type wetland areas.

In summary, the objectives of this document are to provide:

- a single evaluation methodology for wetlands on the Swan Coastal Plain that supersedes the previous evaluation systems
- a transparent method to assign a wetland management category, as a basis for guiding the level of wetland management and protection
- additional guidance about the evaluation of wetlands in complex situations such as connected wetland systems.

1.3 Scope of application

This methodology has been developed to provide a consistent approach to evaluation in consideration of the range of environmental characteristics, and the high level of human induced disturbances that have impacted many of the Swan Coastal Plain wetlands.

The evaluation method provides clear and justifiable criteria for the assessment of an individual wetland's attributes (biological, physical, social and cultural), functions and values. It requires the site-specific collection of data on, and evaluation of, an individual wetland's (or portion of an individual wetland's) attributes, functions and values. This approach is consistent with a Stage 3 assessment as outlined in *Framework for mapping, classification and evaluation of wetlands in Western Australia* (Department of Environment and Conservation 2007). A Stage 3 evaluation methodology should only be applied when the area has been identified as wetland and a scientific delineation of the wetland boundary has been undertaken (Department of Environment and Conservation 2007). The results can then be used as a basis for decision making on wetland protection and management.

1.4 Who should use this document

This document provides technical guidance for environmental consultants, local government authorities, state government agencies, non-government organisations including natural resource management groups, community groups and industry.

Wetland assessments should be coordinated and led by professionals with specific expertise in wetland processes, for example wetland ecology, hydrology and sedimentology. Specialised desktop, field, and laboratory investigation skills are required to accurately complete an evaluation. An understanding of the dynamic nature of wetlands and their response to seasonal conditions and longer term climate variability is particularly important.

It is acknowledged that landowners, local government authorities, non-government organisations and community groups may require assistance in completing the evaluation, particularly when wetland areas of conservation value are identified. The Wetlands Section of DBCA can be contacted (wetlands@dbca.wa.gov.au) to provide additional information to assist interpretation and effective use of the methodology.

2 Background information

2.1 Regional context

Located in the south-west of Western Australia, the Swan Coastal Plain region is a low lying plain of approximately 15,100 km^2, including the city of Perth. Geographically, the Swan Coastal Plain stretches from Jurien Bay in the north to Dunsborough in the south. It is bounded by the Indian Ocean to the west and a series of scarps to the east (Gingin, Darling and Whicher Scarps). The region has a Mediterranean climate characterised by hot dry summers, cool wet winters and an annual rainfall range of 500-900 mm.

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into natural regions of similar geology, landform, vegetation, fauna and climate (Thackway and Cresswell 1995). The Swan Coastal Plain IBRA region is divided into two subregions – the low lying coastal plain in the west (Swan Coastal Plain subregion) and the higher plateau in the north east (Dandaragan Plateau subregion) (Figure 1).

The Swan Coastal Plain is the most populous and developed region of Western Australia and as a result has significant environmental issues (Environmental Protection Authority 2007). These issues are mainly due to the growing population and the use of land for residential, industry and agriculture (Environmental Protection Authority 2007).

The Swan Coastal Plain is situated in the South West Botanical Province of Western Australia which is one of 34 global biodiversity hotspots (Conservation International 2007). The South West Botanical Province supports forests, woodlands, shrublands and heath which are characterised by high endemism among plants and reptiles. For example, the Western Swamp Tortoise is Australia's most endangered reptile and is endemic to two shallow seasonal claypan wetlands north of Perth. The South West Botanical Province supports an estimated 8,000 taxa of vascular plants, representing two thirds of the estimated plant taxa in Western Australia (Beard *et al.* 2000). It is estimated that approximately 80 per cent of the plant taxa in the South West Botanical Province are endemic (Beard *et al.* 2000).

In a global context, the Swan Coastal Plain contains unique features due to its geology, geomorphology and climate. As such, Semeniuk and Semeniuk (2001) have proposed that the wetlands on the Swan Coastal Plain are globally distinct and unique in that their origin and features are not represented elsewhere. This global importance should be recognised when making decisions about the protection and management of wetlands on the Swan Coastal Plain.

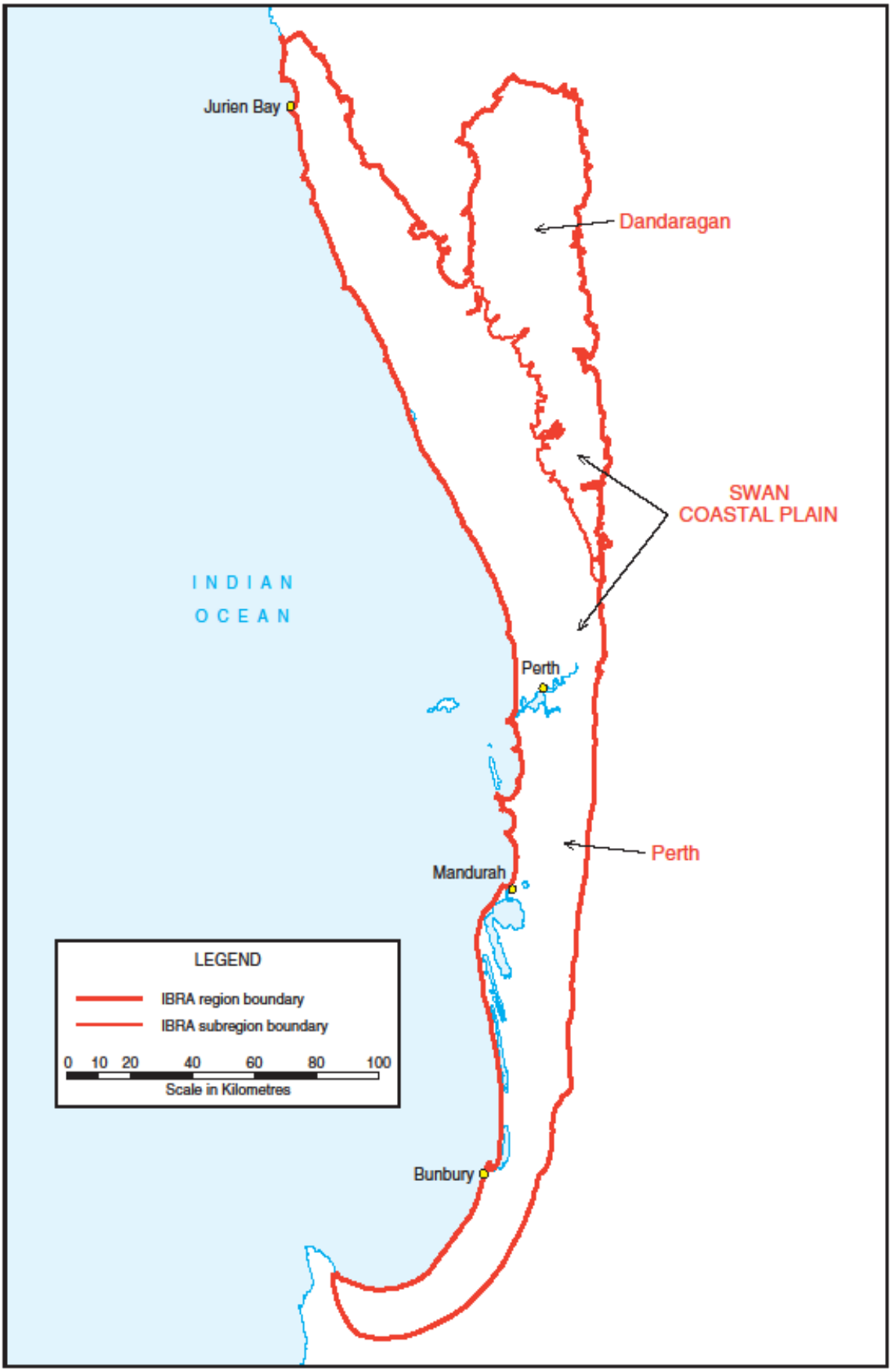

Figure 1. The boundary of the Swan Coastal Plain.

2.2 Threats to wetlands

A large proportion of the wetlands on the Swan Coastal Plain have been lost or degraded due to human activities (Hill *et al.* 1996a). An analysis of Landsat satellite imagery from 1992-2012 indicated that approximately four ha of perennial vegetation within wetlands was lost per day on the Swan Coastal Plain (Department of Parks and Wildlife 2013). The remaining wetlands are under increasing pressure from land uses, predominantly urban development, agriculture and industry.

Examples of activities that have the potential to threaten wetlands on the Swan Coastal Plain include:

- clearing, filling or draining
- excavation, dredging, mining
- introduction of exotic plants and animals
- fire management
- discharge of stormwater or effluent
- abstraction of surface or groundwater
- land and groundwater contamination
- pollutants (e.g. herbicides and pesticides)
- agricultural practices
- recreational activities.

Climate change is a significant threat to wetlands in the south-west of Western Australia. Climate models predict that the south-west will experience an increase in temperatures and evaporation rate, decline in annual rainfall, and an increase in the frequency and/or severity of extreme weather events. The changes are predicted to alter natural hydrological cycles, affecting species and ecosystems that are dependent on surface water and groundwater, including wetlands and waterways. The south-west is already drying, with higher average temperatures and reduced average winter rainfall and runoff, resulting in impacts to wetlands (Environmental Protection Authority 2007). The impacts of current and future climate change should be incorporated into water and wetland related planning and management.

2.3 Wetland mapping

Wetlands cover more than 25 per cent of the Swan Coastal Plain, with approximately three quarters of these occurring as seasonally waterlogged flats or basins. The GWSCP dataset displays the location, boundary, geomorphic type and management category of wetlands mapped on the Swan Coastal Plain from Moore River to Dunsborough. The information contained within the GWSCP dataset was originally digitised from *Wetlands of the Swan Coastal Plain Volume 2B Wetland Mapping, Classification and Evaluation: Wetland Atlas* (Hill *et al.* 1996b) and *Evaluation of Wetlands on the Southern Swan Coastal Plain* (V & C Semeniuk Research Group 1998), which were captured at a scale of 1:25,000. Wetland mapping does not exist north of Moore River or in the south-east of the Swan Coastal Plain.

The use of the GWSCP dataset as a tool for planning and decision making has been endorsed by the Wetlands Coordinating Committee, Environmental Protection Authority and the Department of Planning, Lands and Heritage (DPLH) on the basis that it represents the most comprehensive record of wetland mapping, classification and evaluation work available for the Swan Coastal Plain. The Wetlands Coordinating Committee includes representatives from DBCA, DWER, DPLH, Department of Primary Industries and Regional Development, Western Australian Local Government Association, voluntary conservation organisations, and independent wetland scientists. The GWSCP dataset is used by the Environmental Protection Authority and DPLH as a basis to guide planning and decision making.

DBCA is the current custodian of the *Consanguineous suite* dataset. The concept of consanguineous suites (natural wetland groups) was developed by Semeniuk (1988) and refers to the grouping of wetlands into assemblages based on their similarities.

The GWSCP dataset and the *Consanguineous suite* dataset are available for viewing via Landgate's public map viewer Locate and downloading via the WA government data portal.

3 Wetland science

3.1 Classification of wetlands

The geomorphic classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) has been adopted by the Wetlands Coordinating Committee as the primary classification system for mapping wetlands in Western Australia. The geomorphic classification system classifies wetlands into types based on the shape of the host landform and the water permanence of the hydrological regime. Combining the landform types that are the basis to wetlands on the Swan Coastal Plain (e.g. basins, flats, and slopes) with the various types of hydrological regime (e.g. permanently inundated, seasonally inundated and seasonally waterlogged) provides the simple nomenclature of wetlands (Semeniuk 1987).

The major wetland types identified on the Swan Coastal Plain are lake, sumpland, dampland, palusplain, paluslope, creek, river, floodplain and estuary (Figure 2). For example, Table 1 demonstrates that sumplands have a host landform of 'basin' and water permanence of 'seasonal inundation', and palusplain areas have a host landform of 'flat' and water permanence of 'seasonal waterlogging'. Further differentiation between wetlands of the same classification is possible by the use of wetland descriptors such as water quality, size, shape and vegetation (Hill *et al.* 1996a).

Table 1. The classification of wetlands formed by combining hydrological attributes and landform types (adapted from Semeniuk 1987).

Hydrology	**Host landform**				
	Basin	Flat	Slope	Highland	Channel
Marine / tidal influence	Estuary - waterbody	Estuary - peripheral			Estuary - waterbody
Permanent inundation	Lake				River
Seasonal inundation	Sumpland	Floodplain			Creek
Intermittent inundation	Playa	Barlkarra			Wadi
Seasonal waterlogging	Dampland	Palusplain	Paluslope	Palusmont	Trough

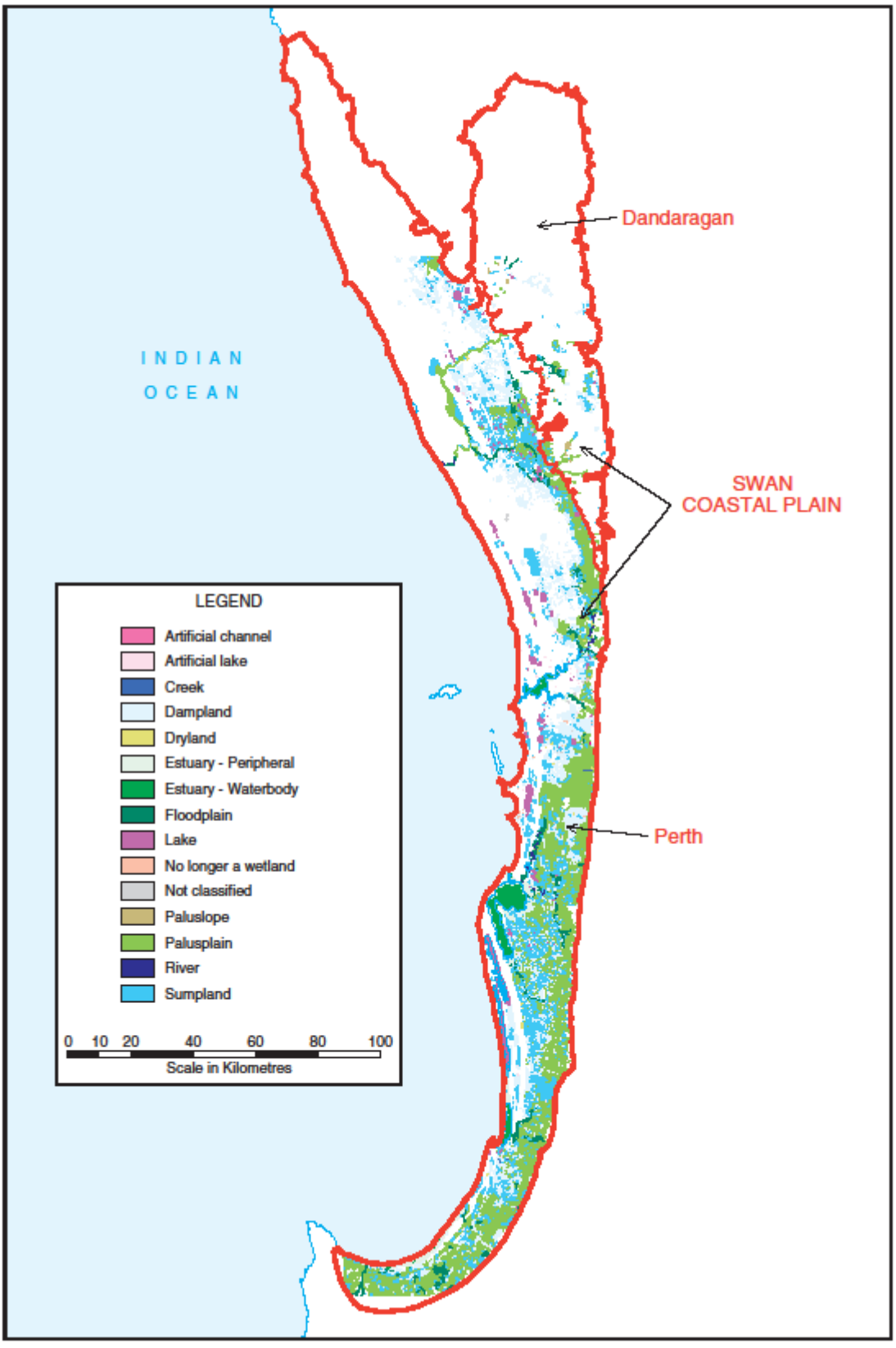

Figure 2. Wetland types on the Swan Coastal Plain (Department of Environment and Conservation 2008)

3.2 Natural grouping of wetlands - consanguineous suites

Wetlands on the Swan Coastal Plain vary in size, shape, hydrology, stratigraphy and vegetation. The variation in wetlands can be attributed to physical setting and developmental processes. When regional features such as geomorphic setting, origin and hydrology are common to groups of wetlands, similarities are evident and wetlands can be seen to be related, or 'consanguineous' (Semeniuk 1988). For example, the Spearwood Dunes are dominated by linear basin wetlands (lakes and sumplands); the Bassendean Dunes by round to irregular basin wetlands (sumplands and damplands); and the Pinjarra Plain by flats and channel wetlands (palusplains and creeks).

The theory of consanguineous suites was developed by Semeniuk (1988) and refers to the natural grouping of wetlands. There are 62 recognised wetland consanguineous suites on the Swan Coastal Plain (Department of Parks and Wildlife 2016). These suites (see Figure 3) have been identified using a set of criteria based on the wetland's classification, geometry, stratigraphy, inferred origin and hydrology (Semeniuk 1988).

Where consanguineous suites occur in defined boundaries they are referred to as 'consanguineous suite domains'. On the Swan Coastal Plain, consanguineous suite domains can occur more than once (e.g. Keysbrook), or in a single locality (e.g. Lake Pinjar). The Keysbrook consanguineous suite occurs on the Pinjarra Plain in 11 domains whilst the Lake Pinjar consanguineous suite only occurs in one domain which is located at Lake Pinjar on the Bassendean Dunes.

Wetlands of the same type can be found in different consanguineous suites and support visible differences in characteristics. For example, sumplands in the Riverdale consanguineous suite vary in size, shape, sediments, vegetation and hydrology compared to other sumplands occurring in other consanguineous suites.

Consanguineous suites provide a valuable framework to assess the attributes of numerous wetlands in a single suite by examining only one or two wetlands in the field. In a region where there are hundreds of wetlands, this type of statistical sampling is useful. Comparative environmental studies benefit from the consanguineous suites statistical sampling method to assess whether a wetland type occurring within a geomorphic unit or region is common or unusual and so enabling the identification of a key wetland (Semeniuk 1988). When assessing the representativeness of an individual wetland in a consanguineous suite, regional significance can be determined by calculating the extent of the wetland type within the suite retaining important values. For instance, only 1.3 per cent of the original extent of palusplain in the Keysbrook consanguineous suite still supports a high level of values, attributes and functions (Department of Parks and Wildlife 2016).

Consanguineous suites are also a means of identifying linked hydrological systems. The knowledge of hydrological and hydrochemical processes identified for each suite of wetlands can be used to determine rare processes that may predict unusual water chemistry.

Data on wetlands occurring in each consanguineous suite on the Swan Coastal Plain has been calculated from the GWSCP and *Consanguineous suite* datasets. Additional information on consanguineous suites is available in Appendix D and at www.dpaw.wa.gov.au/management/wetlands.

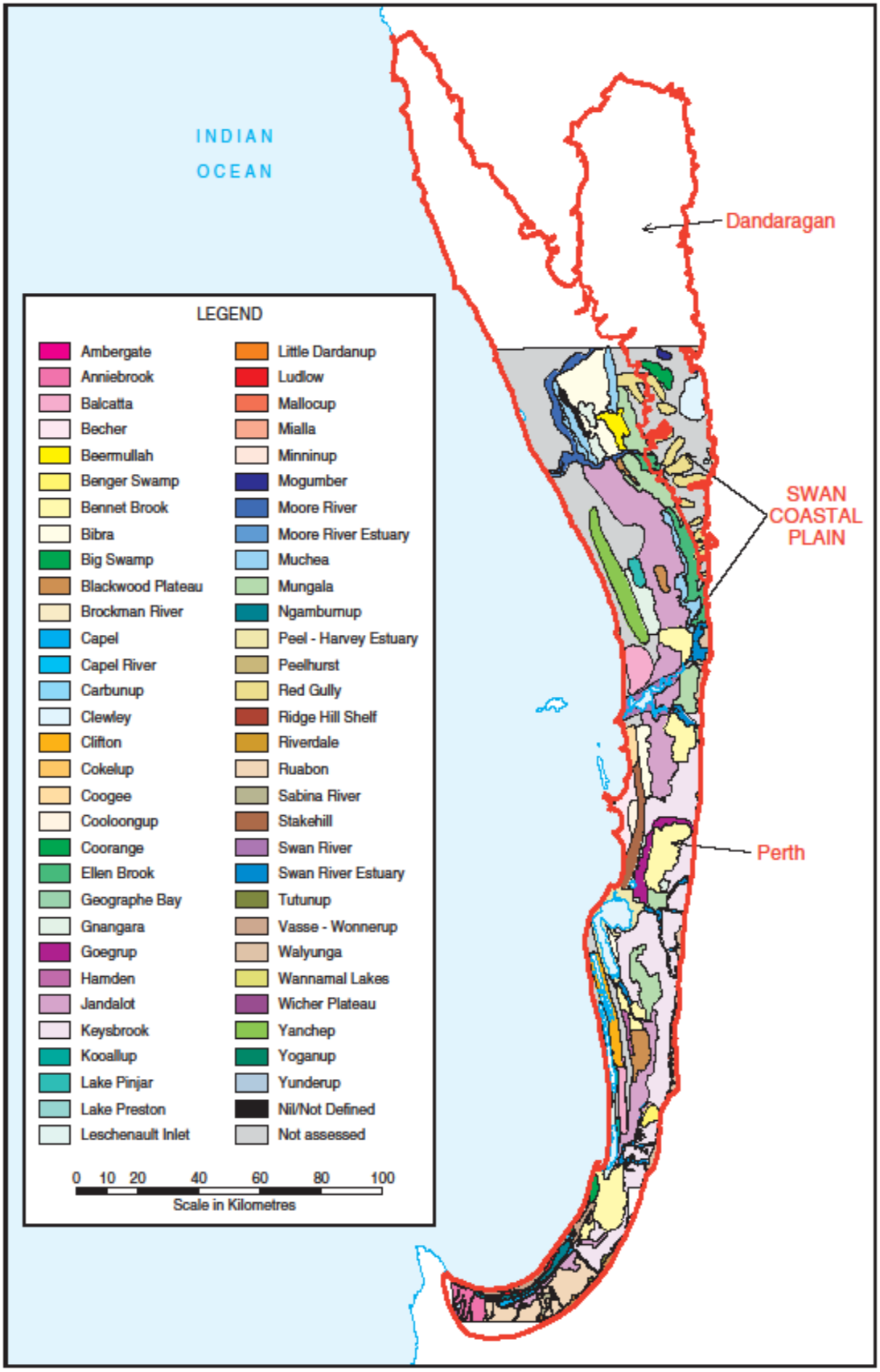

Figure 3. Wetland consanguineous suite mapping on the Swan Coastal Plain (Department of Environment and Conservation 2006).

4 Wetland evaluation

Wetland evaluation is the process of assessing a wetland's values by considering information about its attributes and functions. Wetland evaluation is a scientific assessment of wetland values and does not consider the potential implications for current and future land uses. The process of evaluation is independent of protection and management but does provide a description of values upon which subsequent decisions on protection and management can be based.

4.1 Attributes, functions and values

Evaluation requires the assessment of attributes, functions and values. The attributes, functions and values taken into consideration in this wetland evaluation methodology have been compiled through a review of the existing systems of assessment and takes into consideration both biological/physical and cultural/social characteristics. The evaluation terms attributes, functions and values have been adopted for use in the framework (Department of Environment and Conservation 2007) and this methodology. It is recognised that in other work, such as guidelines developed for the Ramsar Convention on Wetlands (Department of the Environment, Water, Heritage and the Arts 2008), the terms 'critical components', 'ecological processes' and 'benefits and services' are applied. The definitions of attribute, function and value applicable to this methodology are outlined below.

Attribute

Wetland attributes are a characteristic or a combination of characteristics or components which do not necessarily support a use (adapted from Hill *et al.* 1996a). Wetland attributes may be divided into ecosystem or human use and may include:

- diversity of flora/fauna
- habitat features
- size of the wetland
- area of open water
- soil type.

Function

Wetland functions are the physical, hydrological/hydrogeological, chemical and biological processes occurring within a wetland (adapted from Environmental Protection Authority 2008). Functions may include:

- water detention or conveyance
- groundwater recharge
- nutrient cycling
- nutrient and pollution adsorption (improving water quality)
- absorbing carbon (contributing to the mitigation of climate change)
- supporting groundwater dependent ecosystems.

Value

A wetland value is a beneficial use of the environment (including social and economic values that derive from the environment) or an ecosystem health condition. An ecosystem health condition is a condition of the ecosystem that is relevant to the maintenance of ecological structure, functions or processes and which requires protection from the effects of environmental harm (Environmental Protection Authority 2008). The environmental values of a wetland relate to its attributes and functions and can be divided into values which benefit the ecosystem or human uses.

Environmental and ecosystem values:

- flood mitigation
- biological productivity
- habitat for rare or threatened communities or species.

Human use values:

- social, such as scenery, public amenity

- recreational activities including swimming, canoeing, boating, fishing, bush-walking, nature appreciation.
- cultural, such as Aboriginal heritage protection
- economic, such as water supply, commercial fishing, tourism opportunities.

Broad evaluation criteria

The wetland attributes, functions and values applicable to this methodology are assessed against three broad evaluation criteria: representativeness, scarcity and naturalness. The criteria have been compiled through a review of previous systems of wetland assessment on the Swan Coastal Plain.

Representativeness: refers to how characteristic the attributes, functions or values of a particular wetland are of wetlands within a particular group such as its consanguineous suite.

Scarcity: refers to how rare or uncommon a wetland or wetland characteristic is in a defined area, such as a consanguineous suite domain.

Naturalness: refers to the degree to which the wetland attributes, functions and values are in their natural state and whether they have been altered or modified.

4.2 Wetland management categories

Wetlands on the Swan Coastal Plain have been evaluated using one of the existing wetland evaluation methodologies. The outcome of the evaluation has led to each individual wetland or wetland portions being assigned one of three wetland management categories.

Wetland management categories provide a basis for guidance on the nature of the management and protection a wetland should be afforded, as described within Guidance Statement No. 33 *Environmental guidance for planning and development* (Environmental Protection Authority 2008). Wetlands on the Swan Coastal Plain have been assigned either a Conservation, Resource Enhancement or Multiple Use management category. Table 2 outlines the description and recommended management objectives for each wetland management category (Environmental Protection Authority 2008). Approximately 21 per cent of the wetlands on the Swan Coastal Plain are assigned Conservation category, 6 per cent are assigned Resource Enhancement category and the majority of wetlands (73 per cent) are assigned Multiple Use category as displayed in Figure 4 (Department of Parks and Wildlife 2016).

Table 2. Wetland management categories and objectives applied to the Swan Coastal Plain (Environmental Protection Authority 2008).

Management Category	General Description	Objectives
Conservation	Wetlands which support a high level of attributes and functions.	To preserve and protect their existing conservation values through various mechanisms including: – reservation in national parks, Crown reserves and state owned land – wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been modified or degraded, but still support substantial attributes and functions.	To manage, restore and protect towards improving their conservation value and hydrological/hydrogeological regime. These wetlands have the potential to be restored or rehabilitated to Conservation category focusing on wetland functions, structure and biodiversity value.
Multiple Use	Wetlands with few remaining important attributes and functions.	The use, development and management of these wetlands should be considered in the context of ecologically sustainable development and best management practice catchment planning. Their role in managing the natural hydrological and hydrogeological regime of the general area should be maintained.

4.3 Information sources

Data collection provides the information necessary for an accurate evaluation of a wetland. Information can be obtained from a variety of sources including literature reviews (e.g. reports, journal articles, databases and maps), aerial photography and site visits. Consultation with landowners or community members is also useful for obtaining information on the wetland.

New information may become available (e.g. new national or state environmental registers, agreements or studies) and should be consulted to complete an evaluation. Potential information sources for the wetland attributes, functions and values assessed in this evaluation methodology are outlined in Appendix B.

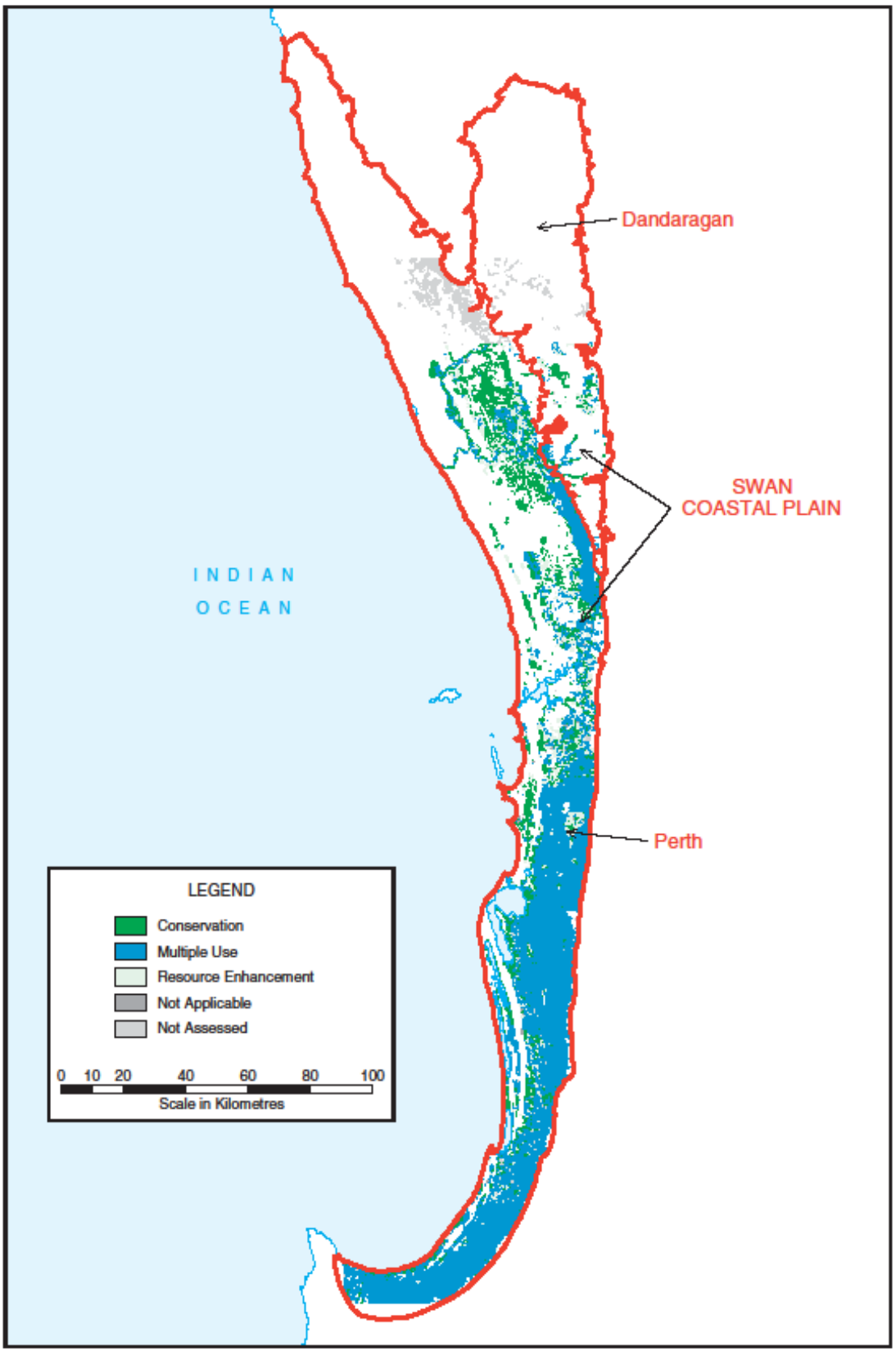

Figure 4. Wetland management categories across the Swan Coastal Plain (Department of Environment and Conservation 2008)

5 Evaluation process

5.1 Considerations before deciding to evaluate a wetland

Landowners may consider undertaking a wetland evaluation with the aim of modifying the management category of a wetland to enable land development. The evaluation methodology described in this document is based on the wetland's current attributes, functions and values, and does not take into account any proposed development or land use change. Wetland evaluation can be time-consuming and costly, so the decision to commission or undertake a wetland evaluation should be considered carefully. Unless the current management category is obviously incorrect, the decision to undertake an evaluation should be discussed with DBCA beforehand.

For waterways (i.e. channel, floodplain, estuary and estuary peripheral wetland types) and other wetlands that are parts of waterways, wetland evaluation may not be the most appropriate process. *Identifying and establishing waterways foreshore areas (*Department of Water 2012) indicates that the proponent of a change in land use near a waterway will identify a foreshore area to protect and maintain its features, functions and values. The management category of wetlands near a waterway is one of many criteria considered for identifying a foreshore area. For example, a landowner may undertake a wetland evaluation that results in a wetland's management category being modified to Multiple Use. However, at subsequent stages of land planning, this Multiple Use category wetland may also be included in the foreshore area, perhaps as it is integral to the hydrology of the waterway. In such a case, the landowner may have wasted time and resources undertaking a wetland evaluation that could have been better allocated to identifying a foreshore area. When considering evaluation to change the management category of a waterbody or wetland area that forms part of a waterway, users should refer to *Determining foreshore reserves* (Water and Rivers Commission 2001) and *Identifying and establishing waterways foreshore areas (*Department of Water 2012) or contact the relevant regional office (details available on DWER's website).

Users should be aware that requests for modifications to the management category of a wetland in the dataset requires significant time to assess and process. To reduce the potential for delays, modification requests should be submitted well before applications to develop, subdivide or rezone land, or any outline development plan or structure plan.

Wetland conditions usually vary during the year. The collection of certain information (such as vegetation condition, flora surveys, photographs and hydrology) should be undertaken after the main period of rainfall. In some circumstances, a request may not be able to be processed until the appropriate season if there is inadequate information based on a poorly timed field evaluation. Evaluators should be mindful of seasonal variation when assessing and describing the condition of wetlands.

5.2 Procedure for evaluating a wetland

The wetland evaluation methodology for the Swan Coastal Plain is a two tiered approach. This approach has been adopted to avoid detailed evaluations being undertaken where it may not be necessary. The two tiers of evaluation are:

Preliminary evaluation – if any one of the preliminary evaluation criteria is met the wetland is automatically assigned as Conservation category and no further evaluation is required. Failure to meet the preliminary criteria does not preclude a wetland from being assigned Conservation category in the secondary evaluation.

Secondary evaluation – if the wetland does not meet the preliminary evaluation criteria for automatic assignment as Conservation category, the secondary evaluation should be conducted to determine the management category.

The procedure for conducting a wetland evaluation is outlined in Figure 5 and in the following steps:

1. Preliminary desktop and site assessment
   Obtain the latest aerial photographs at a minimum scale of 1:25,000 and relevant maps including current wetland mapping of the GWSCP dataset at an appropriate scale. Determine which wetland areas require evaluation. Refer to Appendix B to obtain relevant wetland information sources and Appendix D for wetland statistics.

   Complete the preliminary desktop and site assessment questions in the *Wetland evaluation desktop and site assessment form* (Appendix C). The preliminary assessment does not require a full site assessment (step 3); however, a site visit can be undertaken at this stage, particularly to confirm vegetation condition. Ascertaining the wetland's condition and values will ensure that an accurate preliminary evaluation can be undertaken, potentially minimising the overall data required for collection.

2. Preliminary evaluation
   Use the information obtained during step 1 to complete the preliminary evaluation outlined in section 5.4 and Table 3. If the wetland meets any one of the preliminary evaluation criteria then it should be assigned as Conservation category. If the wetland does not meet any of the preliminary evaluation criteria steps 3 to 5 should be completed.

3. Full site assessment
   Undertake the full site assessment by visiting the wetland and completing the remaining questions in the *Wetland evaluation desktop and site assessment form*. Record any additional observations and collect photographs and samples if necessary.

   Some questions in the full site assessment include a comparison of the attributes, functions and values of the subject wetland to those of other wetlands in the vicinity. Consider identifying wetlands of the same type in the same consanguineous suite and in the surrounding area.

4. Secondary evaluation
   Use the information recorded in the *Wetland evaluation desktop and site assessment form* to complete the secondary evaluation. The secondary evaluation is outlined in section 5.5 Table 4.

5. Proportional scoring to a management category
   Use the proportional scoring method outlined in section 5.5 Table 5 to tally the scores and determine the appropriate wetland management category.

6. Submission to DBCA
   The results of the evaluation along with the information in the *Wetland evaluation desktop and site assessment form* should be submitted to DBCA regardless of the evaluation outcome. This enables DBCA to maintain current information on the wetlands of the Swan Coastal Plain.

   If the results of the evaluation indicate that the values of the wetland are not consistent with the current mapped management category then a request to modify the GWSCP dataset can be submitted. Submissions should include confirmation that the landowner consents to the wetland mapping review, written confirmation is requested e.g. email or signed letter. Refer to section 6 for reporting requirements.

The following material should be submitted with the evaluation documentation:

- on-ground colour photographs of the wetland from all directions, including within the wetland core, across the wetland boundary and across lot boundaries showing:
    - all vegetation units throughout the wetland
    - the range of vegetation condition across the wetland
    - any other relevant features of the wetland, including any alterations to geomorphology (e.g. drains, fill)
- a clear, recent (i.e. less than two years old, if available) colour aerial photograph/s of the area (with the date noted), overlaid with the following:
    - the current wetland mapping with the location and direction of photograph points illustrated
    - the current and proposed wetland mapping, including wetland boundaries and management categories
- a description and map of the vegetation units and condition in accordance with a reconnaissance survey (Environmental Protection Authority 2016).

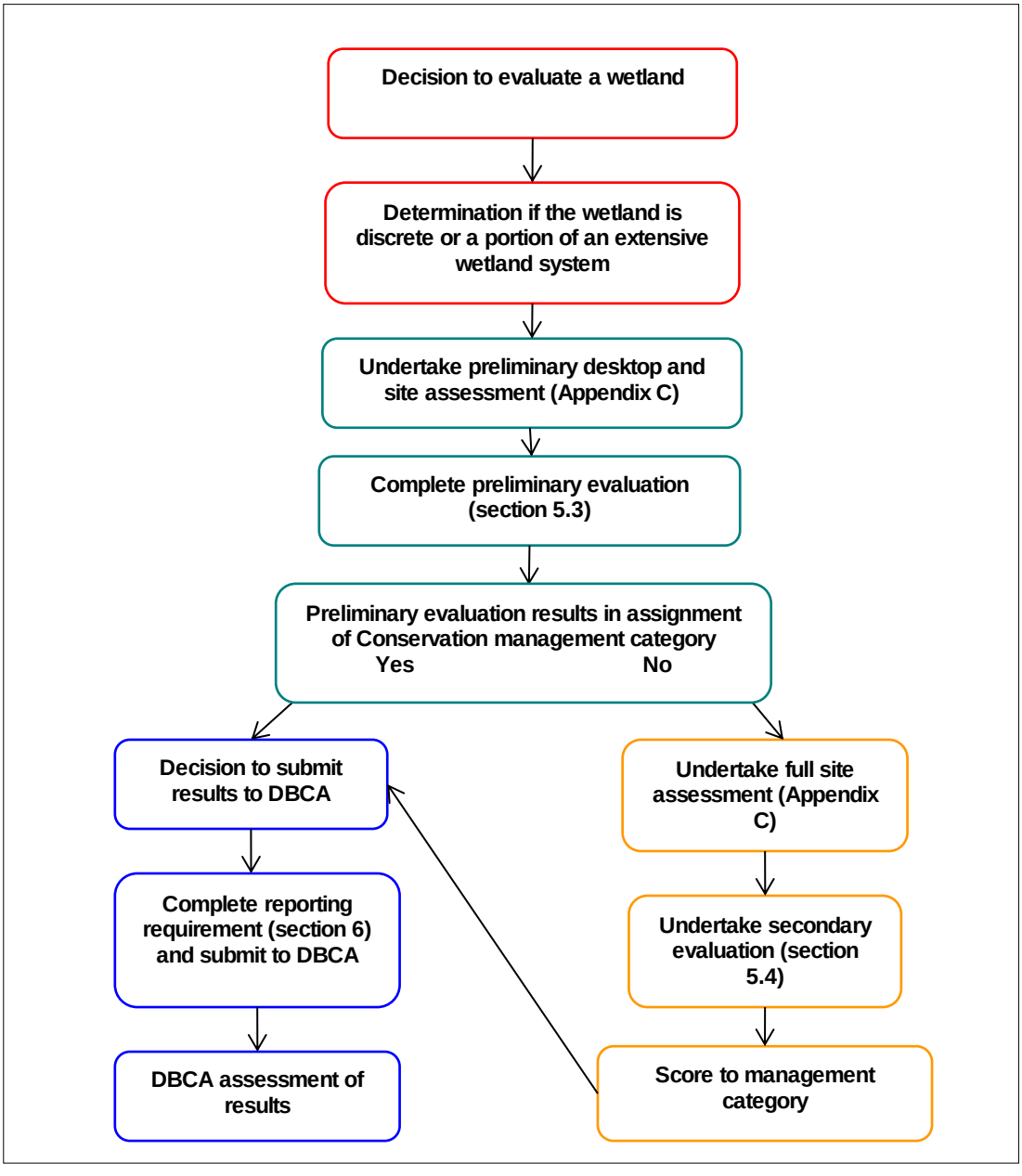

Figure 5. Procedure for conducting a wetland evaluation.

5.3 Evaluation of wetland portions

The Swan Coastal Plain is a unique setting with an array of processes and landforms resulting in wetlands with varying shapes and sizes. Some wetlands are discrete with distinct boundaries, but some types, such as floodplain and palusplain wetlands, can cover large areas and include smaller areas of other wetland types.

In many instances, only a portion of a wetland has been disturbed or modified. Where the undisturbed portion of a wetland continues to support a high level of values, attributes and functions, the values of this area should be recognised. Furthermore, disturbed portions may still support a variety of natural functions, for example waterbirds may continue to use the wetland regardless of partial clearing. Wetland vegetation is often resilient and if the wetland has not been significantly altered (e.g. filled or drained), the vegetation within a disturbed portion of a wetland may naturally regenerate.

Wetland evaluation considers the inter-related values of a wetland and a management category should ideally represent the entire geomorphic wetland without being constrained to cadastral boundaries or changes in land uses. Previous evaluation systems (Hill *et al.* 1996a; V & C Semeniuk Research Group 1998) emphasised the need, where possible, for wetlands to be assigned one management category, regardless of varying conditions in the wetland, as the wetland's functions and processes are considered inter-related.

The process of evaluating wetlands with such variability, coupled with the high level of disturbances on the Swan Coastal Plain, means that this evaluation method is not always suitable. In recognition of the high level of disturbances on the Swan Coastal Plain, wetlands with varying areas of value have previously been evaluated and assigned multiple management categories. This methodology requires the evaluation of a whole wetland as a single unit, rather than portions, except where the wetland meets the criteria outlined in 5.2.1 and 5.2.2 below.

5.3.1 Extensive wetlands

Extensive wetlands, greater than 70 hectares, are located on the eastern side of the Swan Coastal Plain in the Pinjarra Plain and Bassendean Dune geomorphic units. These wetlands are typically flat or gently undulating waterlogged systems and have been subject to clearing, draining and development for land uses, predominately agriculture. As a result, most of these systems no longer function as wetlands or are highly modified. Where portions of the wetland remain intact, they are often within reserves and invariably exist as a small vegetated portion of the larger wetland system.

In recognition of the representativeness of the remaining intact portions of extensive wetlands and the practicalities of evaluating large areas with variable land uses, they were mapped and evaluated separately in previous evaluation systems (Hill *et al.* 1996a; V & C Semeniuk Research Group 1998). The boundary of these portions does not represent the geomorphic boundary of the wetland but delineates the areas of relative high value. Typically, the management category boundaries of portions of extensive wetlands are delineated by cadastral boundaries or areas representing a change in land use (refer to Figures 6 and 7). It is important to identify and understand that a wetland portion is part of an extensive wetland, with wetland processes occurring outside this portion in the extensive system.

Evaluating an extensive wetland into portions allows for recognition of the potentially high value and perceived representativeness of the former extensive system. The following procedure should be adhered to when evaluating an extensive wetland:

1. Refer to the GWSCP dataset, Hill *et al.* (1996b) or other endorsed wetland mapping to identify the presence of an extensive wetland.

2. Use aerial photography and/or a site assessment to delineate the boundary of the remnant wetland vegetation or portion of the extensive wetland with a potentially high conservation value.

3. Complete steps 1 and 2 of this evaluation procedure which outlines that the preliminary site assessment and desktop questions in the *Wetland evaluation desktop and site assessment form* (Appendix C) should be completed prior to commencing the preliminary evaluation.

   With reference to the preliminary evaluation, if a wetland supports vegetation in Good or better condition using the vegetation condition scale outlined in Appendix B and ≤10 per cent of wetlands with the same type are assigned Conservation management category within the Swan Coastal Plain (by area) then it is automatically assigned a Conservation management category. For example, only 3.8 per cent of the palusplain area on the Swan Coastal Plain is currently assigned a Conservation management category (Department of Parks and Wildlife 2016). As such, all remnant portions of palusplain wetlands which support vegetation in a Good or better condition are valuable in terms of their representativeness and should be assigned Conservation.

4. If the extensive wetland portion does not support vegetation in a Good or better condition using the scale outlined in Appendix B then steps 3-6 of the evaluation procedure should be completed.

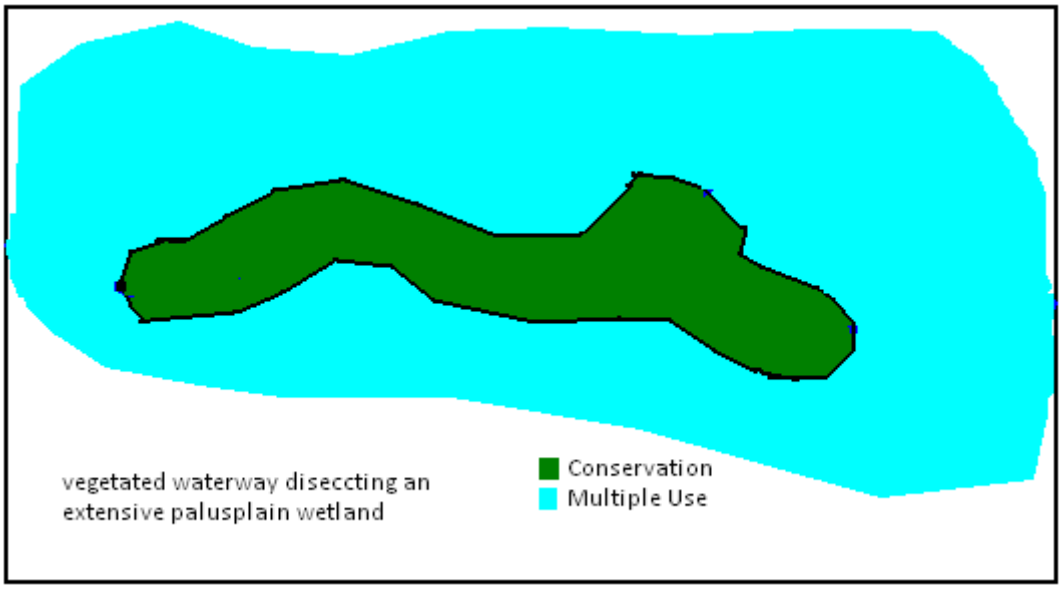

Figure 6. An extensive palusplain system with areas of varying value located in a paddock.

In Figure 6, a portion mapped in green supports a high level of values, attributes and functions including remnant native vegetation and the remainder is cleared supporting a low level of values. As a result of the varying areas of value, the wetland has been divided and evaluated into two separate areas and management categories.

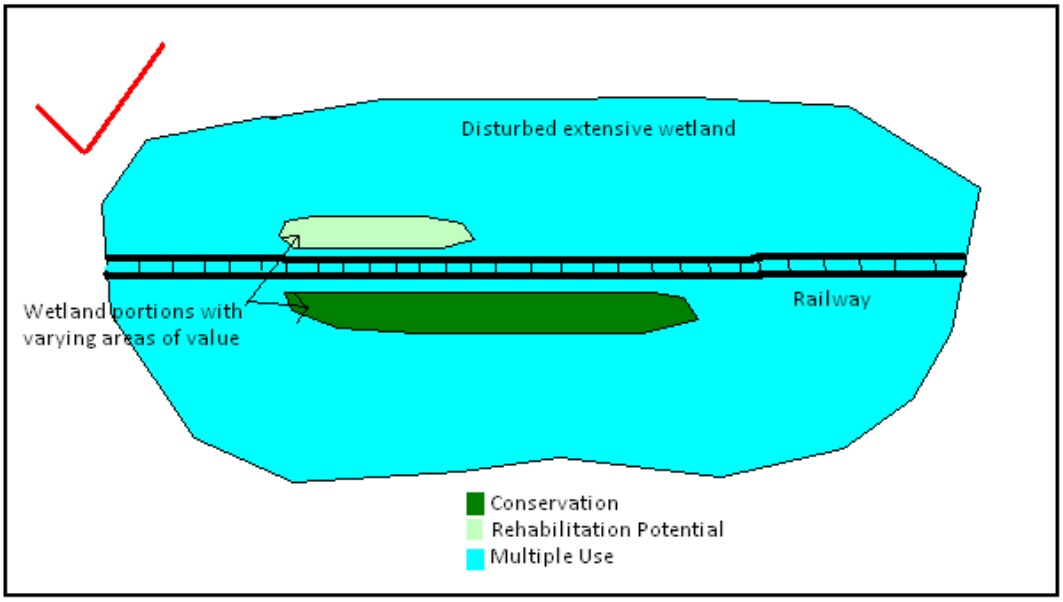

Figure 7. An extensive palusplain system dissected by a railway with portions located in the railway reserve.

The extensive palusplain illustrated in Figure 7 supports areas of varying value, including the presence of remnant vegetation within the railway reserve while the remaining wetland area is cleared. The portions of wetland with potentially high values can be evaluated separately from the extensive palusplain system. After a preliminary and secondary evaluation, the northern portion is found to support an intermediate level of values and the southern portion supports a high level of values, resulting in the assignment of Resource Enhancement and Conservation category respectively.

5.3.2 Other wetlands with varying areas of value

If it is identified that the wetland is not an extensive system but has been partially disturbed and supports varying areas of value it may be acceptable to evaluate and assign the wetland into multiple management categories. When assessing the values of a wetland and whether the existing disturbances justify separating into portions, parameters such as the type, location and degree of disturbance, and the viability of wetland characteristics such as size, shape and source of water should be considered.

Circumstances where it may be acceptable to evaluate portions of a wetland separately include:

1. The remnant portion is not reliant on the disturbed portion to maintain its natural attributes and functions.

2. Disturbance is affecting the wetland's natural attributes, functions and values of a portion of the wetland to a degree that they are unable to be rehabilitated.

3. The separate portions of the wetland are considered to be a viable size and shape (e.g. larger, round, ovoid and even irregular wetlands are more viable than small, linear and elongate portions, due to the negative influence of edge effects).

Where portions of a wetland have been developed, some areas may no longer be functioning as wetland. In these cases, a review of the wetland's classification may be appropriate (e.g. to 'no longer a wetland'). Refer to the information sheet *Wetland identification and delineation: information for mapping and land use planning on the Swan Coastal Plain* (Department of Biodiversity Conservation and Attractions 2017) for guidance relating to wetland identification and delineation.

Examples of evaluating wetlands with varying areas of value in three common Swan Coastal Plain scenarios are illustrated below. These wetlands were initially identified not to be extensive systems (see section 5.3.1) and the decision whether to evaluate the wetlands as a whole or into portions was assessed on a case by case basis.

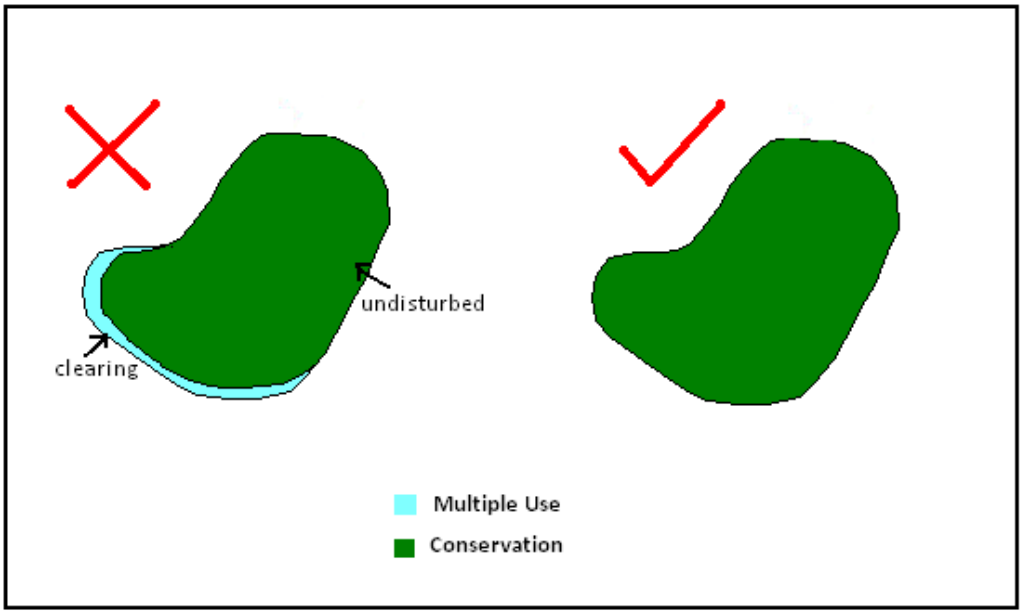

Figure 8. An intact wetland with a disturbed edge.

Figure 8 shows a relatively small area (e.g. less than 0.5 ha) of disturbance that is unlikely to significantly impact the natural attributes, functions, processes and values of the wetland as a whole. In this case, the wetland should be evaluated as one geomorphic unit and assigned one wetland management category.

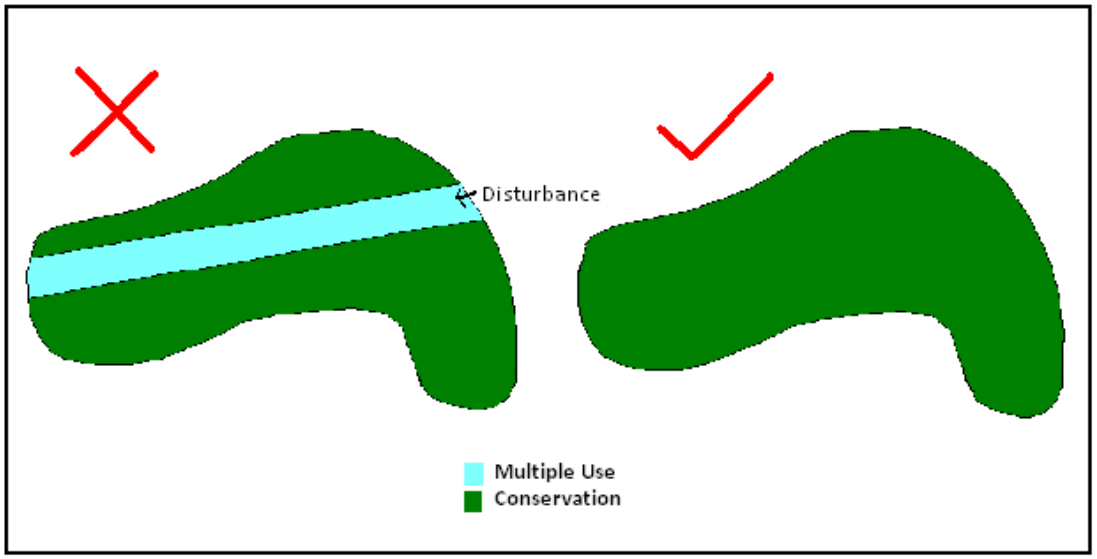

Figure 9. A wetland with varying areas of value and a linear disturbed area.

In Figure 9, the type and degree of disturbance is not considered to detrimentally impact on the wetlands natural attributes, functions, processes and values and can potentially be rehabilitated. As the location of the disturbance is through the centre of the wetland it is not considered viable to dissect the wetland into different portions, especially if the wetland is small to medium in size (e.g. up to two ha). In this case, the wetland should be evaluated as one geomorphic unit and assigned one wetland management category.

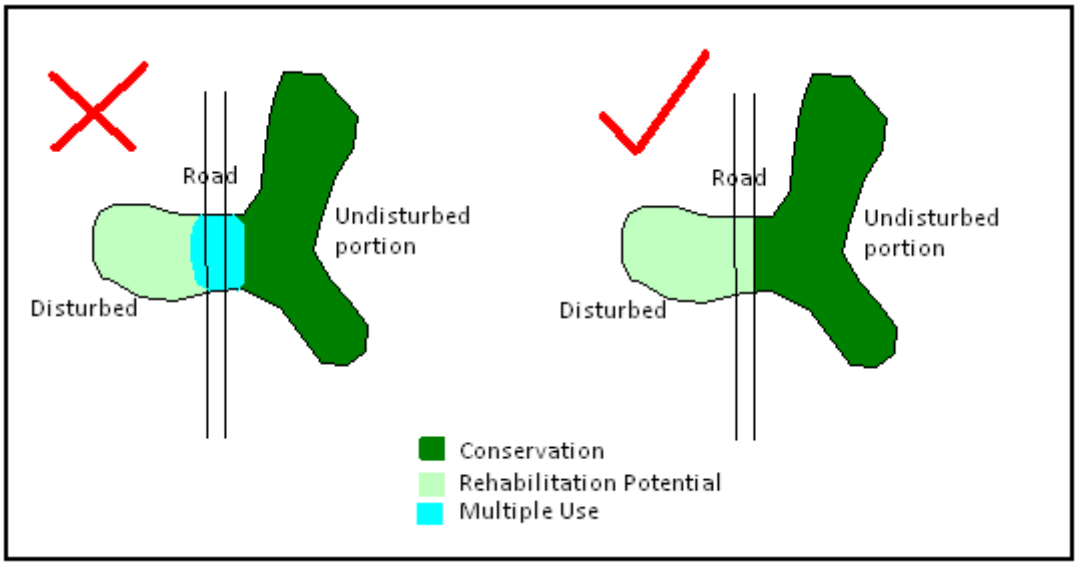

Figure 10. A wetland with varying areas of value associated with three different land uses.

Figure 10 shows an irregular-shaped wetland, of 25-100 hectares in area, with moderate disturbance including a road in the eastern third of the wetland. The disturbance is restricted to a discrete portion of the wetland and in consideration of the wetland size and shape, it is acceptable to evaluate and assign management categories to portions. However, in this instance, evaluating the wetland into a third portion (i.e. Multiple Use category over the road) is not warranted as the scenario on the right better reflects the hydrological relationship between the two portions.

5.4 Preliminary evaluation scoring

The preliminary evaluation provides an initial assessment to determine if the individual wetland or wetland portion is of high conservation value.

Using the information collected during step 1 of the evaluation procedure and on the *Wetland evaluation desktop and site assessment form,* assess the wetland by answering a 'yes' or 'no' to each preliminary evaluation criterion (Table 3). If a 'yes' can be answered to any one of the criteria then the wetland is considered to support the highest level of values, attributes and functions. Wetlands supporting a high level of values, attributes and functions are automatically assigned to Conservation management category.

For wetlands that are assigned to a Conservation management category under the preliminary evaluation, a secondary evaluation is not required; however, a full site assessment and secondary evaluation is encouraged so additional information on the values of the wetland can be obtained. The additional information may assist in management planning and monitoring of the wetland.

Failure to meet any one of the below preliminary evaluation criteria in no way precludes assignment of a wetland to Conservation management category during the secondary evaluation.

5.4.1 Criteria

Answer 'yes' or 'no' in the right column to each criterion below. The criterion should be left blank if a 'yes' or 'no' answer cannot be determined.

Table 3. Preliminary evaluation criteria.

No.	Criteria	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.	
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.	
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, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, threatened and specially protected fauna listed under the *Wildlife*	

No.	Criteria	Y/N
	Conservation Act 1950).	
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 threatened ecological community • a confirmed occurrence of a priority 1 or priority 2 ecological community • a confirmed occurrence of a declared rare (threatened) flora species.	
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.	
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 geoheritage and geoconservation.	
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) • ≤ 10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) • ≤ 10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) • best representative of its type within its consanguineous suite domain.	

Note: If a wetland does not satisfy any of the above preliminary evaluation criteria or, does satisfy the preliminary evaluation criteria but is not considered be commensurate with the values of a Conservation management category wetland then a secondary evaluation including a full site assessment, is required.

5.5 Secondary evaluation scoring

A secondary evaluation provides additional information on the wetland's attributes, functions and values. Using the information collected in steps 1-3 and on the *Wetland evaluation desktop and site assessment form,* complete the secondary evaluation outlined in Table 4.

Assess the individual wetland by considering all the criteria listed under each attribute/function/value. Criterion are scored as H = high value, I = intermediate value, L = low value. Note, at least one score (H, I or L) should be recorded for each attribute/function/value with the exception of Scientific and Educational, and Cultural. It is also possible for a wetland to meet more than one score in each attribute/function/value. Criterion that only have a high score should not be changed to intermediate or low – if the high score is not met, the criterion should not be scored. Scores can be tallied into Table 5.

It is important that scores are justified by providing the relevant information in the *Wetland evaluation desktop and site assessment form*. In addition, comments can be added to the template under the relevant criteria to emphasise or further demonstrate that the wetland meets the allocated score.

Refer to Appendix A for examples on how to apply the secondary evaluation.

5.5.1 Criteria

Score the secondary evaluation criteria and tally the number of H, I and L recorded for each attribute/function/value.

Table 4. Secondary evaluation criteria.

Attributes/ functions/ values	General criteria	Criteria	Score
Geomorphology			
1	Representativeness	≤ 20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤ 20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤ 20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
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: < 25% altered 25-75% altered > 75% altered. Note: Alteration of geomorphology refers to a modification of the landform, for example by filling, excavation, drains. Clearing of vegetation in itself does not constitute a change in geomorphology.	 **H** **I** **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). 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). 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.	**H** **I** **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	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
		process typical of the wetland's geological setting).	
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. 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. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions. Note: processes to consider include hydrological, hydrogeological, sedimentological, chemical, biological.	**H** **I** **L**
11	Scarcity	The wetland exhibits unusual processes compared to other wetlands of the same type in the consanguineous suite.	**H**
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. The wetland is part of a fragmented ecological linkage or wildlife corridor. 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.	**H** **I** **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**
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. The wetland contains evidence of surface water or groundwater expression that is important for maintaining populations of native aquatic or terrestrial flora or fauna.	**H** **I**
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	**H**
18	Naturalness	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. The wetland supports habitats that are altered; however, the habitats are still identifiable and have the potential to naturally regenerate or be	**H** **I**

Attributes/ functions/ values	General criteria	Criteria	Score
		rehabilitated after weed control, if required. 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. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	**H** **I** **L**
21		The wetland is identified in a vegetation complex (Heddle *et al.* 1980) which is represented by: ≤ 30% of the pre-European extent 30-50% of the pre-European extent. Note: statistics can be obtained from Local Biodiversity Program (2013) – to allow for vegetation type and extent mapping error due to the mapping scale used, the extent of remnant vegetation is considered an overestimate. The 30% and 10% thresholds are assessed at actual 40% and 15% levels.	**H** **I**
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	**H** **I** **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	**H** **I** **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**
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**

Attributes/ functions/ values	General criteria	Criteria	Score
Fauna			
28	Representativeness	The wetland is an ecological refuge for regionally significant fauna species or fauna assemblages. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	**H** **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or 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.	**H** **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. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type. The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	**H** **I** **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**
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**
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**
37		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value.	**H**
38		The wetland is important to the local community for its natural values.	**H**
39		The wetland is or has the potential to be a site for public or private based recreation.	**I**

Attributes/ functions/ values	General criteria	Criteria	Score
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. 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. 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.	**H** **I** **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. The wetland has the potential to be used as a study or research site.	**H** **I**
42		The wetland supports known scientific, geoheritage or geoconservation values.	**H**

Table 5. Secondary evaluation criteria scores tally.

Attributes/functions/values	Scores		
	High	**Intermediate**	**Low**
Geomorphology			
Wetland processes			
Linkages			
Habitats			
Flora			
Fauna			
Cultural			
Scientific and educational			
Total score			
Defining attributes/functions/values			
Applicable management category			

5.5.2 Assigning a management category

Application of the scores recorded in Table 5 will lead to a wetland or wetland portion being assigned to one of the three wetland management categories applied on the Swan Coastal Plain: Conservation, Resource Enhancement or Multiple Use, as described in Table 6. The wetland's management category should be determined by the score which receives the highest tally.

Table 6. Assignation of the wetland's management category.

Highest total score	Indicates	Applicable wetland management category
H	The wetland supports a high level of attributes, functions and values.	Conservation
I	The wetland supports an intermediate level of attributes, functions and values.	Resource Enhancement
L	The wetland supports a low level of attributes, functions and values.	Multiple Use

Where equal numbers of a total score occur, a conservative approach should be applied and the score with the higher level of attributes and functions determines the wetland's management category. For example, if the total scores of intermediate and low are equal then application of the precautionary principle indicates that the wetland has intermediate values, attributes and functions and the wetland should be assigned a Resource Enhancement management category.

There may be some instances where a wetland records the highest number of low scores; however, the combined score of high and intermediate is greater than the low score and suggests that the wetland may retain higher values, particularly when the wetland scores across a range of attributes/functions/values. These situations can be considered on a case by case basis and may warrant the wetland being assigned to Resource Enhancement management category.

The applicable wetland management category and the attribute/function/value which received the highest score and is primarily responsible for the outcome can be recorded in Table 5. The defining attribute, function or value determined in Table 5 should be acknowledged with the assigned management category. For instance if a wetland receives a number of high scores in geomorphology but the highest number of intermediate scores overall, it should be assigned Resource Enhancement management category and the defining attribute, function or value, in this case geomorphology, acknowledged against the management category. This is to ensure that the reason behind assignment of the wetland's management category is acknowledged and can be considered in protection and management measures.

The results of the secondary evaluation do not override the results of the preliminary evaluation. In some situations it may be considered that the results of the preliminary evaluation and/or secondary evaluation do not represent the current values, attributes and functions of the wetland. In these situations detailed justification on how the evaluation results were determined and why they are considered to be inaccurate should be submitted to DBCA.

6 Reporting requirements and mapping modifications

The results of the preliminary and secondary evaluation along with the information in the *Wetland evaluation desktop and site assessment form* should be submitted to the Wetlands Section of DBCA regardless of the evaluation outcome. This will ensure that the most up to date information on Swan Coastal Plain wetlands is maintained. The GWSCP dataset is updated every three months.

If the results of the preliminary or secondary evaluation indicate that the wetland's mapped management category is incorrect then a request to modify the GWSCP dataset can be submitted. Requests should be submitted to the Principal Coordinator, DBCA Wetlands Section with detailed justification and documentation consistent with this methodology (i.e. 'Wetland evaluation desktop and site assessment form' and the evaluation criteria templates).

In assessing requests to modify a wetland's management category DBCA and DWER will consider all facets of the wetland's functions and attributes and will not be confined to the scope of information presented. Associated development proposals or future land uses will not be considered in the evaluation process.

7 Glossary

Attribute: Wetland attributes are a characteristic or combination of characteristics which do not necessarily support a use (adapted from Hill *et al.* 1996a).

Best representative: The most outstanding example of a particular wetland characteristic within a defined area or setting. For example, a wetland may be the best representative example in the consanguineous suite if it is the most intact of its type or if it is the only remaining example.

Bioregion; Interim Biogeographic Regionalisation for Australia (IBRA): A framework for conservation planning and sustainable resource management. IBRA bioregions represent a landscape based approach to classifying the land surface from a range of data on environmental attributes including climate and geomorphology (Thackway and Cresswell 1995).

Biodiversity hotspots (global): Regions that contain a great diversity of endemic species and at the same time have been significantly impacted and altered by human activities. The only Australian Biodiversity Hotspot is the south-west of Western Australia (Mittermeier *et al.* 2005).

Bush Forever: Regionally significant areas of bushland within the Perth Metropolitan Region designated for protection under Bush Forever (Government of Western Australia 2000b).

Bushland: Land on which there is vegetation which is either a remainder of the natural vegetation of the land, or, if altered, is still representative of the structure and floristics of the natural vegetation, and provides habitat for native fauna (Government of Western Australia 2000b).

CAMBA: The China-Australia Migratory Birds Agreement is an agreement between the Government of Australia and the Government of the People's Republic of China for the protection of migratory birds and their environment (Commonwealth of Australia 1995b).

Catchment: The area around a wetland or waterway that contributes surface run-off or groundwater to the wetland or waterway (Environmental Protection Authority 2008).

Community: Any grouping of populations of different species found living together; essentially, the biological component of an ecosystem.

Consanguineous suite: Area/s defining a group of wetlands with common or interrelated features (Semeniuk 1988).

Consanguineous suite domain: Discrete areas containing consanguineous, closely occurring wetlands (Semeniuk 1988).

Declared rare flora: Flora species with protection under s23c of the *Wildlife Conservation Act 1950*.

Diversity: The relative number of different flora and/or fauna species or communities that occur in close association in an area.

Ecological community: A naturally occurring biological assemblage that occurs in a particular type of habitat. The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

Ecological linkage: Part of a network of native vegetation that maintains some ecological functions of natural areas and counters the effects of habitat fragmentation (Environmental Protection Authority 2008); non-contiguous natural areas that connect larger natural areas by forming stepping stones that allow the movement over time of organisms between these larger areas (Western Australian Local Government

Association and Perth Biodiversity Project 2004); natural corridors proposed as linkages between declared public open spaces such as local, regional or national parks, stream reserves, wetlands and beaches (Alan Tingay and Associates 1998).

Ecological refuge: Restricted environments that have been isolated for extended periods of time, or are the last remnants of such areas. They may be of high significance for fauna species or faunal assemblages with very restricted distributions, or support fauna species well outside their normal range (Environmental Protection Authority 2008).

Edge effects: Adverse effects on the health of natural areas as a result of an interface with developed or cleared areas. The edges of natural areas are prone to weed infestation, pests and diseases, altered drainage and water regimes, trampling, rubbish and other impacts (Environmental Protection Authority 2008).

Environment: Living things, their physical, biological and social surroundings, and interactions between all of these. The social surroundings are the aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by the physical or biological surroundings (Environmental Protection Authority 2008).

Environmentally sensitive area: Area of the State specified in a notice, or an area of the State of a class specified in a notice, declared by the Minister for the Environment under s.51B of the *Environmental Protection Act 1986* to be an environmentally sensitive area. The exemptions for prescribed purposes outlined in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* from the requirement for a clearing permit do not apply in environmentally sensitive areas, and thus these areas have a higher level of protection.

Evaluation: The process of assessing and documenting a wetland's values by considering and collecting information about its attributes and functions.

Extensive wetland: A wetland that is generally greater than 70 hectares in size (Hill *et al.* 1996a).

Fauna: Species belonging to the animal kingdom.

Fauna assemblage: A collection of animal species inhabiting a particular area.

Flora: All the vascular plant taxa (including species, subspecies, varieties, hybrids and ecotypes) in a given area (Environmental Protection Authority 2016).

Floristic community type: Floristic assemblage as defined by Gibson *et al.* (1994). The presence or absence of individual taxa in standard areas (plots, sites, quadrats) is used to define floristic groupings based on shared species (Environmental Protection Authority 2003a).

Function: Wetland functions are the physical, chemical and biological processes occurring within a wetland (adapted from Environmental Protection Authority 2008).

Geoconservation: Conservation of Earth science features (geological, geomorphological, pedological and hydrological) that are of sufficient significance to warrant preservation for purposes of heritage, science or education (Semeniuk and Semeniuk 2001).

Geoheritage: Globally, nationally, state-wide to local features of geology, at a scale that are intrinsically important sites, or culturally important sites, that offer information or insights into the formation or evolution of the Earth, or into the history of science, or that can be used for research, teaching or reference (Brocx and Semeniuk 2007).

Geomorphology: Landscape features and shape, at various spatial scales.

Groundwater: Water under the land surface that occupies the pores and crevices of soil or rock (Environmental Protection Authority 2008).

Habitat: The natural environment of an organism or a community, including all biotic and abiotic elements (Environmental Protection Authority 2003a).

Hydric soil: Soil that has formed under conditions of saturation or inundation long enough to develop anaerobic conditions in the upper part.

Hydrogeology: The hydrological and geological science concerned with the occurrence, distribution, quality and movement of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.

Hydrology: The movement of water into and within a wetland or waterway from the surrounding landscape or catchment.

Impact (environmental)**:** The effect that a human-caused or natural activity has on living organisms and their non-living environment that can either be adverse or beneficial (Environmental Protection Authority 2008).

JAMBA: The Japan-Australia Migratory Birds Agreement is an agreement between the Government of Japan and the Government of Australia for the protection of migratory birds in danger of extinction and their environment (Commonwealth of Australia 1995a).

Landform: A combination of slope and elevation producing a particular shape and form of the land surface (Environmental Protection Authority 2008).

Landscape: The appearance of the land whether natural or altered, including its shape, texture and colours (Environmental Protection Authority 2008).

Land use: The active or passive use to which the land is put by its owner, lessee, manager or occupier (Environmental Protection Authority 2008).

Native vegetation: Indigenous aquatic, wetland or terrestrial vegetation, including most dead vegetation, but does not include vegetation in a plantation, nor, for the purposes of Division 2 Part V of the EP Act, most vegetation that was intentionally sown, planted or propagated unless as required under the Act (Environmental Protection Authority 2008).

Perth Metropolitan Region: Area on the Swan Coastal Plain as defined in the Perth Metropolitan Region Scheme.

Population: The entire aggregation of components that are the subject of a study. This may be all the individuals in a biological population, or a particular group or habitat, but it may equally relate to a non-biological entity such as quadrats.

Precautionary principle: Principle applied to err on the side of caution when the prediction of environmental impacts is uncertain (Environmental Protection Authority 2008).

Priority ecological community: Possible threatened ecological communities that do not meet survey criteria are added to DBCA's lists under priorities 1, 2 and 3. Ecological communities that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently

removed from the threatened list, are placed in priority 4. These ecological communities require regular monitoring.

Priority fauna: Animal taxa, lists of which are maintained by DBCA, that are either under consideration as threatened fauna but are in need of further survey to adequately determine their status, or are adequately known but require monitoring to ensure that their conservation status does not decline, or are dependent on ongoing conservation action.

Priority flora: Plant taxa, lists of which are maintained by DBCA, that are either under consideration as threatened flora but are in need of further survey to adequately determine their status, or are adequately known but require monitoring to ensure that their conservation status does not decline.

Ramsar Convention: The Convention on Wetlands of International Importance, signed in Ramsar (Iran) in 1971, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

RoKAMBA: The Republic of Korea-Australia Migratory Bird Agreement is an agreement between the Government of Australia and the Government of the Republic of Korea for the protection of migratory birds and their environment (Commonwealth of Australia 2007).

Rehabilitation: The return of the original characteristics of a natural area that has been disturbed.

Significant fauna: Include but are not necessarily limited to species protected by international agreements or treaties, specially protected fauna, priority fauna, short range endemic species, species with declining populations or declining distributions, species at the extremes of their range, isolated outlying populations and undescribed species.

Significant flora: Includes but is not limited to flora with any of the following characteristics:
- declared rare flora or priority flora
- keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species
- relic status
- anomalous features that indicate a potential new discovery
- representative of the range of a species including the extremes of the range, recently discovered range extensions, or isolated outliers of the main range
- a restricted subspecies, variety or naturally occurring hybrid
- local endemism or a restricted distribution.

Specially protected fauna: Animal species listed under the *Wildlife Conservation Act 1950* including threatened species and other species in need of special protection.

Stakeholder: Any organisation, government entity, group or individual that has an interest in a particular issue.

Surface water: Water flowing or held in waterways and wetlands on the surface of the landscape.

Systems 1-12: Twelve geographic areas that cover Western Australia and which were identified by the Conservation through Reserves Committee set up by the Environmental Protection Authority in the 1970s.

Threat: An occurrence, activity or institutional process or structure, that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community (ANZECC 2000).

Threatened ecological community: An ecological community which is found to fit into one of the following categories; presumed totally destroyed, critically endangered, endangered or vulnerable.

Threatened species: All or any species whose conservation status is considered insecure, including species in the 'critically endangered', 'endangered' and 'vulnerable' categories. Such species are listed as 'specially protected' under the *Wildlife Conservation Act 1950* or as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999*.

Value: A beneficial use of the environment (including social and economic values that derive from the environment); or an ecosystem health condition (Environmental Protection Authority 2008).

Vegetation: The combinations of plant species within a given area, and the nature and extent of each combination.

Vegetation complex: A vegetation classification term used in Heddle *et al.* (1980) and based on the pattern of vegetation at a regional scale as it reflects the underlying key determining factors of landforms, soils and climate (Environmental Protection Authority 2003a).

Waterway: Any river, creek, stream or brook, including its floodplain or estuary. This includes systems that flow permanently, for part of the year or occasionally, and parts of the waterway that have been artificially modified (Department of Water 2012).

Water regime: The pattern of when, where and to what extent water is present in a wetland. The components of water regime are the timing, duration, frequency, extent and depth, and variability of water presence (Boulton and Brock 1999).

Wetland: See section 2.2 for definition. In the context of this document the term wetland is applied to incorporate the entire geomorphic wetland area or any specific portion of a geomorphic wetland which has been selected.

Wetland characteristic: Those properties of a wetland that describe the area in the simplest and most objective possible terms e.g. wetland size, species present, soils and water quality. Functions, uses or attributes of a wetland are the products of its characteristics, singly or in combination (Hill *et al.* 1996a).

Wetland management category: The management category assigned to a wetland based on the evaluation of its attributes and functions. It provides guidance on the nature of management and protection the wetland should be afforded. The categories that have been used on the Swan Coastal Plain in Western Australia are Conservation, Resource Enhancement and Multiple Use.

Wetland processes: The dynamic physical, hydrological, chemical and biological processes occurring within a wetland, including interactions between wetland organisms, within the physical/chemical environment.

Wetland type: The result of applying the geomorphic classification system on a wetland, for example dampland, palusplain, sumpland, lake.

Wetland vegetation: Vegetation which is adapted to inundated or waterlogged conditions that often form overlapping zones along a gradient from the deepest part of a wetland.

Wildlife corridor: A strip of habitat connecting populations of fauna and flora separated from human induced disturbances such as roads, buildings.

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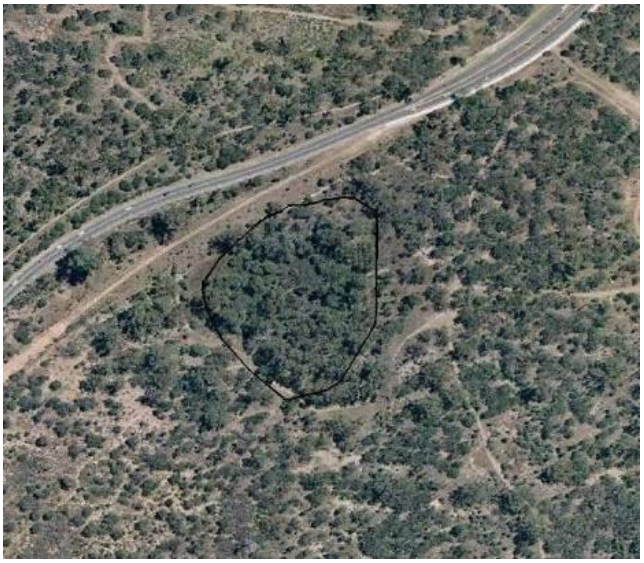
Appendix A Examples of applying the evaluation methodology

Examples on how to evaluate and assign a wetland management category to a wetland or a portion of a wetland against the preliminary evaluation method and secondary evaluation method are provided below.

Example 1



The above wetland is classified as a sumpland and occurs in the Stakehill consanguineous suite (S.4). The wetland has been evaluated using the preliminary evaluation as demonstrated below.

Preliminary evaluation

No.	Criteria	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**
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.	Y
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,	

No.	Criteria	Y/N
	Environment Protection and Biodiversity Conservation Act 1999, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, threatened and specially protected fauna listed under the *Wildlife Conservation Act 1950*).	Y
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 threatened ecological community • a confirmed occurrence of a priority 1 or priority 2 ecological community • a confirmed occurrence of a declared rare (threatened) flora species.	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.	Y
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 geoheritage and geoconservation.	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) • ≤ 10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) • ≤ 10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) • best representative of its type within its consanguineous suite domain.	N

This wetland scored three 'Yes' answers in the preliminary evaluation indicating that it supports the highest level of values, attributes and functions. The wetland should automatically be assigned Conservation category and no further assessment (i.e. full site assessment or secondary evaluation) is required.

The wetland scored three 'Yes' answers due to equal to or greater than 90 per cent of the wetland supporting vegetation in a good or better vegetation condition using the Keighery scale (1994), being located in a Bush Forever site and supporting a breeding, refuge or critical feeding site for populations of a priority fauna species.

Example 2

The black line in Example 2 represents the original wetland boundary of an extensive dampland occurring in the Jandakot consanguineous suite. Due to the varying areas of value in the dampland, including development and clearing, the portion of dampland highlighted in yellow has been selected to be assessed against the preliminary and secondary evaluation criteria.

Preliminary evaluation

No.	**Criteria**	**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. *Note: The wetland is located in the Gibbs Road Swamp System; however, the entire geomorphic wetland currently does not retain the values for which it was originally listed. The wetland will therefore not be automatically assigned a Conservation management category due to this criterion.*	**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**
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, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA, RoKAMBA) or the State (for example,	**N**

No.	Criteria	Y/N
	threatened and specially protected fauna listed under the *Wildlife Conservation Act 1950*).	
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 threatened ecological community • a confirmed occurrence of a priority 1 or priority 2 ecological community • a confirmed occurrence of a declared rare (threatened) flora.	**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.	**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 geoheritage and geoconservation.	**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) • ≤ 10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) • ≤ 10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) • best representative of its type within its consanguineous suite domain.	**N**

The wetland is located within an area identified in the *Directory of Important Wetlands in Australia*; however, the entire geomorphic wetland is not considered to meet the Directory's criteria. Therefore, the wetland did not meet any of the preliminary evaluation criteria and a full site assessment and a secondary evaluation has been undertaken.

Secondary evaluation

Attributes/ functions/ values	General criteria	Criteria	Score
Geomorphology			
1	Representativeness	≤ 20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤ 20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤ 20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
4		The wetland is outstanding in some geomorphic aspect, for example size, origin, height relative to sea level, depth, age.	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
5	Naturalness	Alteration to the wetland's geomorphology by % area: < 25% altered 25-75% altered > 75% altered.	 **H** **I** **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). 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). 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.	**H** **I** **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. 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. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	**H** **I** **L**
11	Scarcity	The wetland exhibits unusual processes compared to other wetlands of the same type in the consanguineous suite.	**H**
Linkages			
12	Representativeness	The wetland is a hydrological link in a larger or more complex and intact system.	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
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. The wetland is part of a fragmented ecological linkage or wildlife corridor. 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.	**H** **I** **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**
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. The wetland contains evidence of surface water or groundwater expression that is important for maintaining populations of native aquatic or terrestrial flora or fauna.	**H** **I**
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	**H**
18	Naturalness	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. 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. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	**H** **I** **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. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	**H** **I** **L**
21		The wetland is identified in a vegetation complex (Heddle *et al.* 1980) which is represented by:	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
		≤ 30% of the pre-European extent 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: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	**H** **I** **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	**H** **I** **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**
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. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	**H** **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or 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.	**H** **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. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type. The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	**H** **I** **L**

Attributes/ functions/ values	General criteria	Criteria	Score
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**
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**
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**
37		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value.	**H**
38		The wetland is important to the local community for its natural values.	**H**
39		The wetland is or has the potential to be a site for public or private based recreation	**I**
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. 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. 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.	**H** **I** **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. The wetland has the potential to be used as a study or research site.	**H** **I**

Attributes/ functions/ values	General criteria	Criteria	Score
42		The wetland supports known scientific, geoheritage or geoconservation values.	**H**

Tally of the scores recorded during the secondary evaluation.

Attributes/functions/values	Scores		
	High	**Intermediate**	**Low**
Geomorphology		**I**	
Wetland processes		**II**	
Linkages		**I**	
Habitats		**I**	
Flora	**II**	**II**	**I**
Fauna	**I**	**III**	
Cultural		**I**	**I**
Scientific and educational			
Total score	**3**	**11**	**2**
Defining attributes/functions/values	Flora and fauna		
Applicable management category	Resource Enhancement		

Results from the secondary evaluation indicate that the wetland recorded the most intermediate scores and therefore supports an intermediate level of attributes, functions and values. Accordingly, the wetland should be assigned a Resource Enhancement management category - Flora.

The intermediate scores were dominant in the fauna attribute/function/value. Fauna combined with flora, which received two high scores, are the recommended attributes/functions/values to focus on maintaining through management practices.

Example 3

All of the land in the above example is classified as a palusplain and is identified in the Keysbrook consanguineous suite. To evaluate this palusplain it has been divided into two portions to reflect the varying areas of value, including the presence of remnant vegetation. The wetland portions have been

evaluated using the preliminary and secondary evaluation methods. The preliminary evaluation has been conducted for the area of remnant vegetation delineated in yellow.

Preliminary evaluation

No.	**Criteria**	**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**
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.	Y
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, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, threatened and specially protected fauna listed under the *Wildlife Conservation Act 1950*).	**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 threatened ecological community • a confirmed occurrence of a priority 1 or priority 2 ecological community • a confirmed occurrence of a declared rare (threatened) flora species.	Y
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.	Y
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 geoheritage and geoconservation.	**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	

No.	Criteria	Y/N
	management category within the Swan Coastal Plain (by area) • ≤ 10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) • ≤ 10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) • best representative of its type within its consanguineous suite domain.	Y Y Y N

The remnant vegetated portion of the wetland scored six 'Yes' answers. The remnant vegetated portion of the wetland, which is delineated in yellow, supports a high level of attributes, functions and values and should automatically be assigned a Conservation management category.

The remaining cleared area of wetland has also been evaluated using the preliminary evaluation method, as follows.

Preliminary evaluation

No.	Criteria	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**
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**
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, *Environment Protection and Biodiversity Conservation Act 1999*, migratory bird agreements such as JAMBA, CAMBA and RoKAMBA) or the State (for example, threatened and specially protected fauna listed under the *Wildlife Conservation Act 1950*).	**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:	**N**

No.	Criteria	Y/N
	• an occurrence of a threatened ecological community • a confirmed occurrence of a priority 1 or priority 2 ecological community • a confirmed occurrence of a declared rare (threatened) flora species.	
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.	**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 geoheritage and geoconservation.	**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) • ≤ 10% of all wetlands in the same consanguineous suite are assigned Conservation management category (by area) • ≤ 10% of wetlands of the same type in its consanguineous suite are assigned Conservation management category (by area) • best representative of its type within its consanguineous suite domain.	**N**

The cleared portion of the palusplain scored all 'No' answers and therefore a secondary evaluation was undertaken.

Secondary evaluation

Attributes/ functions/ values	General criteria	Criteria	Score
Geomorphology			
1	Representativeness	≤ 20% of wetlands of the same type are assigned Conservation on the Swan Coastal Plain by area.	**H**
2		≤ 20% of wetlands in the same consanguineous suite are assigned Conservation by area.	**H**
3		≤ 20% of wetlands of the same type in the same consanguineous suite are assigned Conservation by area.	**H**
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: < 25% altered 25-75% altered > 75% altered.	 **H** **I** **L**
6	Scarcity	The wetland exhibits unusual geomorphology or unusual internal geomorphic features compared to other wetlands of the same type in the	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
		consanguineous suite.	
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). 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 and support for groundwater dependent ecosystems). 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.	**H** **I** **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. 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. The wetland is subject to altered wetland processes to the extent that the wetland no longer supports natural attributes and functions.	**H** **I** **L**
11	Scarcity	The wetland exhibits unusual processes compared to other wetlands of the same type in the consanguineous suite.	**H**
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. The wetland is part of a fragmented ecological linkage or wildlife corridor. 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.	**H** **I** **L**
14	Scarcity	The wetland has unusual hydrological, hydrogeological, hydrochemical	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
		or ecological linkages with adjacent wetlands or bushland.	
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**
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. The wetland contains evidence of surface water or groundwater expression that is important for maintaining populations of native aquatic or terrestrial flora or fauna.	**H** **I**
17		The wetland provides a nursery for native fauna populations, or maintains fauna populations at a vulnerable stage of their life cycle.	**H**
18	Naturalness	The wetland supports habitats that are unaltered or the wetland has been altered and its natural habitats are maintained. 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. The wetland is altered and as a result is no longer supporting natural habitats which can be rehabilitated.	**H** **I** **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. The wetland supports a reduced diversity of native flora due to human induced disturbances. The wetland supports a significantly reduced diversity of native flora species due to human induced disturbances.	**H** **I** **L**
21		The wetland is identified in a vegetation complex (Heddle *et al.* 1980) which is represented by: ≤ 30% of the pre-European extent 30-50% of the pre-European extent.	 **H** **I**
22	Naturalness	Using the vegetation condition scale outlined in Appendix B, the wetland's vegetation condition by area is: ≥ 75% Good, Very Good, Excellent or Pristine 25-75% Good, Very Good, Excellent or Pristine < 25% Good, Very Good, Excellent or Pristine.	 **H** **I** **L**
23		The wetland or ≥ 50% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	**H**

Attributes/ functions/ values	General criteria	Criteria	Score
		The wetland or 10-50% of the wetland boundary is surrounded by land dominated by remnant native vegetation. The wetland or < 10% of the wetland boundary is surrounded by land dominated by remnant native vegetation.	**I** **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**
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. The wetland has the potential to be an ecological refuge but is disturbed and its attributes and functions require rehabilitation.	**H** **I**
29		The wetland supports a permanent or seasonal feeding, breeding, roosting or 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.	**H** **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. The wetland supports a reduced diversity of fauna compared to other wetlands of the same type. The wetland supports limited attributes and functions for fauna populations due to human induced disturbances.	**H** **I** **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**
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	**I**

Attributes/ functions/ values	General criteria	Criteria	Score
		significant fauna.	
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**
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**
37		The wetland or its immediate surrounds is identified on a national, State or local list or register for its Aboriginal cultural value.	**H**
38		The wetland is important to the local community for its natural values.	**H**
39		The wetland is or has the potential to be a site for public or private based recreation.	**I**
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. 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. 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.	**H** **I** **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. The wetland has the potential to be used as a study or research site.	**H** **I**
42		The wetland supports known scientific, geoheritage or geoconservation values.	**H**

Tally of the scores recorded during the secondary evaluation.

Attributes/functions/values	**Scores**		
	High	**Intermediate**	**Low**
Geomorphology	**III**	**I**	
Wetland processes		**I**	**I**
Linkages			**I**
Habitats			**I**
Flora	**I**		**III**
Fauna			**I**
Cultural			
Scientific and educational			
Total score	**4**	**2**	**7**
Defining attributes/functions/values	Geomorphology		
Applicable management category	Multiple Use		

Results from the secondary evaluation indicate that the majority of the wetland's attributes, functions and values have low scores, although the wetland's representativeness in its geomorphic setting resulted in three high scores. The wetland recorded seven low scores (exceeding the sum of the high and intermediate scores) and therefore supports a low level of attributes, functions and values. Accordingly, the wetland should be assigned a Multiple Use management category - Geomorphology.

Appendix B Wetland information sources

Data collection and wetland information resources are necessary for an accurate evaluation of a wetland. Information should be obtained from a variety of sources including literature reviews (e.g. reports, journal articles, databases and maps), aerial photography and site visits. Consultation with landowners or community members is also useful for obtaining information on the wetland.

New information may become available (e.g. national or state environmental registers, agreements or studies) and should be consulted. Potential information sources for the wetland attributes, functions and values assessed in this evaluation methodology are outlined below.

Wetland mapping

- Wetland mapping information including current locations, boundaries, classifications, management categories and unique feature identifier numbers (UFI's) are available on the GWSCP dataset, which is available for viewing and downloading via Locate and data.wa.gov.au. The WA government data portal also includes other relevant biological, physical and planning datasets that may assist in completing a wetland evaluation.

- Original wetland mapping and systems of assessment for the Swan Coastal Plain can be obtained from the following sources:
  - *Wetlands of the Swan Coastal Plain Volume 2A: Wetland Mapping Classification and Evaluation, Main Report* (Hill *et al.* 1996a) and *Wetlands of the Swan Coastal Plain Volume 2B Wetland Mapping, Classification and Evaluation – Wetland Atlas* (Hill *et al.* 1996b) available from DBCA's library DBCA Library.
  - *Evaluation of Wetlands on the Southern Swan Coastal Plain* (V & C Semeniuk Research Group 1998) available from DBCA's library.
  - *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area* Bulletin 686 (Environmental Protection Authority 1993) available from www.epa.wa.gov.au.

International, national and regional significance

- Ramsar Convention: Wetlands identified in the *Convention on Wetlands of International Importance* (UNESCO 1971) are of international significance. Information on Ramsar wetlands can be obtained from www.ramsar.org.

  Alternatively, the Department of the Environment and Energy website: www.environment.gov.au > Databases and maps > Australian Wetlands Database, and DBCA's website also contains information on the Ramsar Convention www.dpaw.wa.gov.au/management/wetlands.

  The WA government data portal includes Ramsar wetland mapping data.wa.gov.au.

- *Directory of Important Wetlands in Australia*: The Directory identifies and recognises Australia's nationally important wetlands. Information on the Directory as well as mapping displayed in the electronic Australian Wetlands Database is available on the Department of the Environment and Energy website www.environment.gov.au > Databases and maps > Australian Wetlands Database.

  DBCA's website also contains information on the Directory www.dpaw.wa.gov.au/management/wetlands.

- *Bush Forever* outlines regionally significant areas of bushland and wetland. Volume 2 contains information on flora, fauna, geomorphology and consanguineous suites for the Perth Metropolitan Region. Volume 1 *Policies, Principles and Processes* (Government of Western Australia 2000a) and Volume 2 *Directory of Bush Forever Sites* (Government of Western Australia 2000b) are available from www.planning.wa.gov.au. *Bush Forever* mapping is also available on the WA government data portal data.wa.gov.au.

Swan Bioplan identifies and describes regionally significant areas for the Swan Coastal Plain outside of the *Bush Forever* study site. Environmental Protection Bulletin 12 - *Swan Bioplan* – Peel Regionally Significant Natural Areas is available from http://www.epa.wa.gov.au.

- *Conservation Reserves for Western Australia Systems 1, 2, 3, 5* (Department of Conservation and Environment 1976) is available from DBCA's library.

- *Conservation Reserves for Western Australia, The Darling System – System 6* (Department of Conservation and Environment 1983) is available from DBCA's library.

- *A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region* (Pen 1997) is available from DBCA's library.

- *Environmental Significance of Wetlands in the Perth to Bunbury Region* (Le Provost *et al.* 1987) is available from DBCA's library.

Geological information

- *Atlas of Australian Soils for Western Australia* is available from Department of Primary Industries and Regional Development www.dpird.wa.gov.au.

- Information on geology, geoheritage and topography is available from the WA government data portal data.wa.gov.au.

  There is currently no system for formal recognition of geoheritage. The Geological Society of Australia has identified approximately 150 significant geological sites in WA. Refer to the Geological Society of Australia for up to date information on geoheritage sites in WA www.gsa.org.au.

- Reference article: *Geoheritage and geoconservation – history, definition, scope and scale* (Brocx and Semeniuk 2007).

- Information on consanguineous suites is available on DBCA's website www.dpaw.wa.gov.au/management/wetlands. In addition consanguineous suite information can be obtained from Hill *et al.* (1996a) and *Bush Forever* (Government of Western Australia). The *Consanguineous suite* dataset (Department of Environment and Conservation 2006) is available to view and download via the WA government data portal data.wa.gov.au.

Wetland processes

- Wetland processes can include any physical, hydrological, ecological or chemical processes occurring in a wetland. Examples of processes which can occur in a wetland on the Swan Coastal Plain include:
  - physical: weathering, erosion, sedimentation.
  - hydrological: recharge and discharge mechanisms, hydroperiod, upwelling, reserve flow at the margin or between seasons.
  - ecological: food webs, nutrient cycling (e.g. O, N, P, K).
  - chemical: factors affecting water quality, water chemistry, salinity, acidity.

Waterways and hydrology

- Hydrological catchments and watercourse mapping is available on the WA government data portal data.wa.gov.au.

- Information on groundwater and surface water can be obtained from the DWER's Perth Groundwater Atlas and Hydrogeological Atlas available from www.dwer.wa.gov.au.

- Reference material available at www.dwer.wa.gov.au (publications search):
  - *Stormwater Management Manual for Western Australia (*Department of Water 2004-2007)
  - *Decision Process for Stormwater Management in WA: draft for consultation* (Department of Water 2016)
  - *Identifying and establishing waterways foreshore areas* (Department of Water 2012)
  - *Determining foreshore reserves* (Water and Rivers Commission 2001).

Linkages

- Information on ecological linkages and wildlife corridors for the Perth Metropolitan Region is available in *Bush Forever* (Government of Western Australia 2000b) and *Conservation Reserves for Western Australia, The Darling System – System 6* (Department of Conservation and Environment 1983).

- The technical report *South West Regional Ecological Linkages* is produced by the Western Australian Local Government Association available at www.walga.asn.au.

- Environmental Protection Authority (2003b) Bulletin 1108 *Greater Bunbury Region Scheme* available from www.epa.wa.gov.au contains information on ecological linkages and wildlife corridors for the Bunbury region.

- The electronic dataset *Regional Ecological Linkages for the Perth Metropolitan Region* is available from the Western Australian Local Government Association www.walga.asn.au.

Flora

- Information on declared rare, priority and other significant flora and threatened and priority ecological communities on the Swan Coastal Plain can be obtained from DBCA's website www.dbca.wa.gov.au.

- Guidance on undertaking flora surveys is available at www.epa.wa.gov.au:
  - Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment
  - Guidance Statement No. 6 *Rehabilitation of Terrestrial Ecosystems.*

- *Bush Forever* (Government of Western Australia 2000b) includes specific information on flora and vegetation communities for *Bush Forever* sites. The vegetation condition scale (Keighery 1994), outlined below is also explained in *Bush Forever* (Government of Western Australia 2000b).

Vegetation condition scale (Keighery 1994)

Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

- Information on native vegetation complexes and the pre-European vegetation extent is available from the WA government data portal or the Local Biodiversity Program http://pbp.walga.asn.au.

- Reference material
  - *A Floristic Survey of the Southern Swan Coastal Plain* (Gibson *et al.* 1994).
  - *Remnant vegetation on the Alluvial Soils of the Eastern Side of the Swan Coastal Plain* (Keighery and Trudgen 1992).
  - *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (Western Australian Local Government Association and Perth Biodiversity Project 2004).
  - Vegetation of the Darling System in *Atlas of Natural Resources, Darling System, Western Australia.* (Heddle *et al.* 1980).

- Libraries
  Specific area reports outlining the flora and vegetation of a particular site may also be found in libraries including DBCA's library. In addition, public libraries may have online catalogues listing available reports or articles.

Fauna

- Information on threatened or specially protected and priority fauna, threatened and priority ecological communities and migratory birds can be obtained from DBCA's website www.dbca.wa.gov.au.

- Guidance on fauna surveys is available at www.epa.wa.gov.au:
  Environmental Protection Authority (2010b), *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, Environmental Protection Authority, Perth.

- Information on fauna including migratory bird agreements is available on the Department of the Environment and Energy website www.environment.gov.au.

- Migratory bird agreements
  JAMBA: Agreement between the Australian Government and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment (Commonwealth of Australia 1995b) available at: www.austlii.edu.au/au/other/dfat/treaties/1981/6.html.
  CAMBA: Agreement between the Australian Government and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (Commonwealth of Australia 1995a) available at: www.austlii.edu.au/au/other/dfat/treaties/1988/22.html.
  ROKAMBA: Agreement between the Australian Government and the Government of the Republic of Korea on the Protection of Migratory Birds Canberra (Commonwealth of Australia 2007) available at: www.austlii.edu.au/au/other/dfat/treaties/2007/24.html.

- Libraries
  Specific area reports outlining the fauna of a particular site may also be found in libraries including DBCA's library. In addition, public libraries may have online catalogues listing available reports or articles.

Cultural

- Information on Aboriginal cultural values can be obtained from the Department of Planning, Lands and Heritage *Aboriginal Heritage Inquiry System* website www.dplh.wa.gov.au.

- Australian heritage places inventory lists heritage sites in the Commonwealth Heritage List, National Heritage List, Register of the National Estate, WA Heritage Register and World Heritage List. Available from www.dplh.wa.gov.au.

- A Municipal Inventory is a list of local cultural heritage significance in the local government. Local governments are required under Section 45 of the *Heritage of Western Australia Act 1990* to prepare such lists and may be obtained from the relevant local government authority. The local government authority may know of community groups that use or manage the wetland for social purposes.

- Reference material
  - *Report on an Investigation into Aboriginal Significance of Wetlands and Rivers in the Perth-Bunbury Region* (O'Connor *et al.* 1989). Available from DBCA's library.
  - *An Investigation into the Aboriginal Significance of Wetlands and Rivers in the Busselton-Walpole Region* (O'Connor *et al.* 1995). Available from DBCA's library.
  - *Sense of Place: A Response to an Environment, the Swan Coastal Plain Western Australia* (Seddon 1972).
  - *Swamp: Walking the wetlands of the Swan Coastal Plain* (Chinna 2014).

- The WA government data portal data.wa.gov.au also contains a number of datasets to obtain mapping for the above information.

Science and Education

- Nearby educational institutions may have information about wetland use for teaching or research purposes. Educational signage and interpretative material may provide useful information.

- Reference material
  Report on an Investigation into Scientific and Educational Values of Wetlands and Rivers in the Perth-Bunbury Region (Coffey 1990). Available from DBCA's library.

Appendix C Wetland evaluation desktop and site assessment form

The *Wetland evaluation desktop and site assessment form* has been designed to simplify the collection and processing of information required to complete a wetland evaluation on the Swan Coastal Plain. The form includes a general information section and two questionnaires:

1) Preliminary desktop and site assessment questions: complete prior to commencement of the preliminary evaluation.

2) Full site assessment questions: complete if the preliminary evaluation indicates that a secondary evaluation is required. The full site assessment questions should be completed before commencing the secondary evaluation. **It is important** that the information provided justifies the scoring of the selected evaluation criteria.

Information sources to assist in the collection of wetland data are outlined in Appendices B and D.

GENERAL INFORMATION

Assessor details

Name/s:

Date/s of site visit:

Agency/Company:

Contact number:

Email address:

Weather during site visit:

Land ownership and contact details

Landowner:

Land manager (if different to owner):

Consultant (if applicable):

Contact for site visit:

Landowner permission received for site access: yes / no

Landowner consent to a mapping review has been provided: email / letter

Property details

Location (e.g. lot, street, suburb):

Latitude and longitude/MGA:

Wetland details

Name:

Unique feature identifier number/s:

Hill *et al.* (1996) map sheet number and wetland identification number/s (WIN):

Consanguineous suite:

Area (hectares) of the wetland:

Area (hectares) subject to this evaluation:

Is the wetland being assessed as a portion of a wetland with varying areas of value: yes / no.

Mapped management category: Conservation / Resource Enhancement / Multiple Use.

Wetland type:

Hydrology	**Host landform**			
	Basin	Flat	Slope	Channel
Marine / tidal influence	Estuary - waterbody	Estuary - peripheral		Estuary - waterbody
Permanent inundation	Lake			River
Seasonal inundation	Sumpland	Floodplain		Creek
Seasonal waterlogging	Dampland	Palusplain	Paluslope	

PRELIMINARY DESKTOP AND SITE ASSESSMENT QUESTIONS

Land uses

Current ownership of wetland: private / local government / other government

Current land use:

Past land use:

Surrounding land use:

Existing management:

Fire history / regime:

International, national or regional significance

Indicate whether the wetland is identified (permanent or interim) on one of the following international, national or state registers or listings.

Conservation significance	**Y/N**
Ramsar Convention on Wetlands (UNESCO 1971)	
Directory of Important Wetlands in Australia (Environment Australia 2001)	
Conservation Reserves for Western Australia Systems 1, 2, 3, 5 (Department of Conservation and Environment, 1976)	
Conservation Reserves for Western Australia, The Darling System – System 6 (Department of Conservation and Environment, 1983)	
A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton – Walpole Region (Pen 1997)	
The Environmental Significance of Wetlands in the Perth to Bunbury Region (Le Provost *et al.* 1987)	
Bush Forever (Government of Western Australia 2000)	
Swan Bioplan (Environmental Protection Authority 2010a)	
Environmental Protection (Western Swamp Tortoise Habitat) Policy Approval Order 2002	
Conservation estate (e.g. National Park, Nature Reserve, A Class Reserve)	
Other (list):	

Does the wetland retain the values for which it was originally registered or listed, describe:

Fauna

Note the presence (recorded or observed) or evidence of fauna within and one kilometre surrounding the wetland that is listed by the Australian Government (e.g. *Environment Protection and Biodiversity Conservation Act 1999, CAMBA, RoKAMBA, JAMBA*) or State (e.g. threatened or specially protected fauna under the *Wildlife Conservation Act 1950*) or priority fauna or priority or threatened ecological communities related to fauna which are listed by DBCA.

Species / name of ecological community	**Significance** (e.g. *EPBC Act, CAMBA)*	**Observations** (e.g. population size, age, evidence, activities, habitat requirements)	**Source of information** (e.g. observation, literature, DBCA)

Scientific value

List any scientific values including geoheritage or geoconservation values that the wetland may contain (e.g. important sediments or geological features, fossils, pollen records, stromatolites, thrombolites, evidence of evolutionary processes, evidence of a change in climate, unique flora or fauna adaptations).

Scientific, geoheritage or geoconservation values	**Significance and observations**	**Source of information** (e.g. observation, literature, DBCA, WA Museum)

Flora

Use aerial photography and a site visit to determine the condition of the vegetation within and 50 metres surrounding the wetland. Using the *Bush Forever* vegetation condition scale (Appendix B) provide a map delineating the vegetation condition within the wetland and calculate the percentage area.

Vegetation condition	**Total area (%) within the wetland**	**Area (%) 50 metres surrounding the wetland**
Pristine		
Excellent		
Very Good		
Good		
Degraded		
Completely Degraded		

Using this information is the wetland dominated by vegetation in a Good or better condition: yes / no

What vegetation complex (Heddle *et al.* 1980) does the wetland belong to:

Using the information sources outlined in Appendix B, what extent of the vegetation complex is remaining on the Swan Coastal Plain: < 10% / 10-30% / >30%

List any occurrences of priority and threatened ecological communities related to flora and wetland systems which are known to occur within and five kilometres surrounding the wetland. If they are located within or adjacent to the wetland display their boundary in the attached map.

Name of ecological community	**Significance** (e.g. priority, threatened)	**Observations** (e.g. condition, area, habitat type)	**Source of information** (e.g. observation, literature, DBCA)

List any occurrences of declared rare flora or priority flora known to occur within and one kilometre surrounding the wetland and display their location in the attached map.

Species	**Significance** (e.g. declared rare, priority 1)	**Population measure** (number, single record, abundance comment)	**Observations** (e.g. habitat type, flowering season)	**Source of information** (e.g. literature, DBCA, surveyed population, Herbarium record)

Representativeness

Using the data in Appendix D record the corresponding area.

	% area
What is the % area of wetlands with the same classification assigned a Conservation management category on the Swan Coastal Plain (Table 7)	
What is the % area of wetlands in the same consanguineous suite assigned a Conservation management category (Table 8)	
What is the % area of wetlands with the same classification in the same consanguineous suite assigned a conservation management category (Table 9)	

Is the wetland rare? (e.g. only wetland in its consanguineous suite, best wetland example in its consanguineous suite or region, only Conservation management category wetland in the consanguineous suite or region, primary saline wetland within a consanguineous suite predominated by freshwater):

Photographs and maps

The following material should be submitted:

- on-ground colour photographs of the wetland from all directions, including within the wetland core, across the wetland boundary and across lot boundaries showing:
  - all vegetation units throughout the wetland
  - the range of vegetation condition across the wetland
  - any other relevant features of the wetland, including any alterations to geomorphology (e.g. drains, fill)

- a clear, recent (i.e. less than two years old, if available) colour aerial photograph/s of the area (with the date noted), overlaid with the following:
  - the current wetland mapping with the location and direction of photograph points illustrated
  - the current and proposed wetland mapping, including wetland boundaries and management categories

- a description and map of the vegetation units and condition in accordance with a reconnaissance survey (Environmental Protection Authority 2016).

FULL SITE ASSESSMENT QUESTIONS

Geomorphology

What geomorphic unit does the wetland belong to (e.g. Pinjarra Plain, Bassendean Dune):

Can all areas of the wetland be visited? yes / no. Comment:

Describe the wetland's surface soil (e.g. peat, quartz sand):

What is the slope of the wetland: flat / gentle undulations / steep banks / other

Indicate whether any of the following human induced alterations have occurred to the wetland's geomorphology.

Human induced alterations	Y/N - describe
fill	
excavation	
partition	
alienation along boundaries	
damming	
structural control	
mining	
dredging	
drains	
other	

What extent (%) of the wetland's geomorphology is altered: < 10 / 10-25 / 25-50 / 50-75 / 75-90 / > 90
Note: clearing of vegetation in itself does not constitute a change in geomorphology.

Compare the wetland's geomorphology to other wetlands of the same type in the same consanguineous suite domain. List any differences, similarities or unusual characteristics observed:

Additional notes:

Wetland processes

The wetland is: fresh (< 1,000 mg/L) / hyposaline (1,000-10,000 mg/L) / saline (10,000-100,000 mg/L) / hypersaline (> 100,000 mg/L) / unknown

The wetland is: groundwater dependant / perched / both / unknown. State whether inferred or based on data:

Did the wetland contain surface water at the time of the survey or evidence of inundation: yes / no.
Explain:

Does the wetland contain artificial attributes and functions that alter the natural hydrological regime (e.g. detention basins, artificial drains or channels (inflow or outflow), water bores or pumps): yes / no. Describe the features/functions, their impact on the hydrology and show on the map:

Identify the processes occurring in the wetland (e.g. sedimentological, hydrological, hydrogeological, chemical). Identify whether they are inferred or observed:

To what extent have each of these processes been altered : negligible / low / medium / high / unknown. Describe:

Have alterations to the processes affected the wetland's natural attributes and functions: no / low impacts / high impacts. Describe:

Compare the wetland's processes to other wetlands of the same type. List any differences, similarities or unusual characteristics observed:

Linkages

Describe if the wetland is part of a hydrological link in a larger or more complex system (e.g. wetland linked to estuary ecology, wetland linked to river system, part of a wetland chain):

Is the wetland part of an ecological linkage or wildlife corridor or, is it connected by vegetation or waterways to other nearby bushland or wetlands? If yes, describe:

Is a portion of the wetland vegetated and as a result functions as a fragmented ecological linkage or wildlife corridor? If yes, describe:

Habitats

List any native fauna (e.g. frogs, oblong turtle) or flora (e.g. macrophytes, algae) observed to be dependent on the wetland's surface water.

Species	**Observations (e.g. form, population size, location in the substrate, habitat type)**

Is the wetland important for maintaining the genetic and ecological diversity in a regional or local context: yes / no. Describe:

Describe whether the wetland supports or is likely to support fauna populations at a vulnerable stage of their life cycle (e.g. turtle eggs, tadpoles) or provides a nursery for fauna (e.g. nursery for cygnets):

Select the various habitats located within and 50 metres surrounding the wetland.

large trees with canopy	trees with hollows	dead wood	low dense shrubland	scattered shrubland
fringing sedges/rushes	scattered sedges/rushes	inundated sedges/rushes	submerged aquatic vegetation	samphire/salt marsh
seasonally inundated grasslands	mud flats	shallow open water	deep open water	islands (natural or man-made)
rocky outcrops	sandy substrate	heavy leaf litter	feral fauna burrows	thickets scrub
other:	other:	other:	other:	other:

Compare the wetland's habitats to other habitats of wetlands of the same type, consanguineous suite or the surrounding area. Describe any differences, similarities or unusual characteristics observed:

Determine whether habitat diversity is the result of disturbance or natural complexity (i.e. is the diversity evident in the wetland a result of disturbance e.g. fire, sedimentation, excavations or drains). Describe these habitat features:

Additional notes:

Flora

Confirm the occurrence or believed to be occurrence of threatened or priority ecological communities, declared rare flora and priority flora recorded during the desktop assessment. Note any additional observations or occurrences and include advice on search effort in any area of suitable habitat for these communities or species:

List any significant flora confirmed to be present within the wetland or whether it is a known location for significant flora.

Species	**Observations** (e.g. population's size, percentage cover, flowering/fruiting activity)	**Known or new occurrence?**

List the dominant flora species located within the wetland in each growth form layer and estimate their cover in the wetland. Provide a map delineating the vegetation units within the wetland in accordance with a reconnaissance survey (Environmental Protection Authority 2016).

Growth form layer	**Dominant species**	**Percentage cover** (to the nearest 10%)
Trees over 30 m		
Trees 10-30 m		
Trees under 10 m		
Mallee over 8 m		
Mallee under 8 m		
Shrub over 2 m		
Shrubs 1-2 m		
Shrubs under 1 m		
Herbs		
Sedges/rushes		
Grasses		
Open water		
Bare ground		
Other		

List the most common weed species occurring in the wetland:

Use aerial photography and the site visit to determine the percentage of the wetland boundary which is surrounded by land dominated by native vegetation. Describe any observations: 100-75% / 75-50% / 50-10% / < 10%

Using site observations, compare the diversity of native flora in the wetland to other wetlands of the same type. List reference sites used. Does the wetland have a high diversity of native flora: yes / no / similar Explain:

Has the vegetation been changed by direct disturbance during the last 24 months? For example, grazing, clearing, ploughing, fire: yes / no.

If yes, provide details, including information regarding the type of disturbance, extent and nature of the impact to the vegetation e.g. continuous or periodic, and if periodic, the last known occasion.

Identify whether any form of clearing is legal. If yes, is regeneration evident? If regeneration is not evident, outline the potential for regeneration and rehabilitation of vegetation if disturbance (a) continues and (b) ceases.

Has the flora diversity or composition changed in the last 24 months due to human induced disturbances? If yes, provide information.

Fauna

Document all other observations and evidence (e.g. tracks and scats) of native fauna species utilising the wetland as a feeding, breeding, roosting or refuge site.

Species	**Native / introduced**	**Observations** (e.g. habitat type, populations size, age)	**Source of information** (e.g. observation, literature, DBCA)

Does the wetland function or have the potential to function as an ecological refuge: yes / no.

Comment on whether fauna are residing in the wetland for feeding, breeding and roosting purposes or if they migrate between other natural wetlands or bushlands.

Using site observations compare the fauna occurring in the wetland to other wetlands of the same type.

Does the wetland support a variety of fauna species compared to the other wetlands: yes / no / similar. Explain:

Cultural

Is the wetland identified (either interim or permanently) on a national (e.g. National Heritage List), state (e.g. Heritage Council of Western Australia), regional or local heritage list: yes / no.

Document all heritage values for the wetland and its immediate surrounds. Display their location on the attached map.

Is the wetland identified for its Aboriginal cultural value (interim or permanently) e.g. by the Department of Planning, Lands and Heritage: yes / no.

Document the Aboriginal cultural values of the wetland and its immediate surrounds. Display the location on the attached map.

Are there any important social values of the wetland to the national, state, regional or local community (e.g. friends group, iconic picnic area):

Select the passive and active recreational based activities which currently or potentially occur in or directly surrounding the wetland.

bushwalking	dog walking	bird watching
photography	spiritual	picnic
play equipment	bike riding	horse riding
swimming	canoeing	boating
wind sailing	hunting	fishing
4 wheel driving		

Additional notes:

Education and scientific

Is there a primary, secondary or tertiary education institution or scientific organisation which is known or is previously known to use the wetland for educational or scientific purposes: yes / no / unknown. Details:

Is there potential for the wetland to be used in the future for education by one of these institutions: yes / no / unknown.

Appendix D Wetland statistics

Statistics calculated from the *Geomorphic Wetlands Swan Coastal Plain* dataset and the *Consanguineous Suites* dataset are outlined below in tables 7-9. The statistics have been calculated to assist in completing the preliminary and secondary evaluations. The data presented below represents the most current data at the time of publication. Updates of the data may occur periodically and be displayed on DBCA's website.

Table 7. Statistics from the *Geomorphic Wetlands Swan Coastal* Plain dataset indicating the percentage by area of the management categories assigned to each wetland type on the Swan Coastal Plain (Department of Parks and Wildlife 2016).

Wetland type	Management category assignations (%)				
	Conservation	Resource Enhancement	Multiple Use	Not Applicable	Not Assessed
Artificial channel	0.0	100.0	0.0	0.0	0.0
Artificial lake	0.7	1.2	11.5	0.0	86.7
Creek	24.8	37.7	37.5	0.0	0.0
Dampland	29.3	26.6	43.9	0.0	0.2
Dryland	0.0	1.2	0.7	98.0	0.0
Estuary-peripheral	53.2	3.3	43.4	0.0	0.0
Estuary-waterbody	99.8	0.0	0.2	0.0	0.0
Floodplain	48.9	13.0	38.0	0.0	0.1
Lake	92.4	4.8	2.7	0.0	0.0
No longer a wetland	0.0	0.0	0.0	100.0	0.0
Not classified (not assessed)	19.5	2.1	2.2	0.0	76.2
Paluslope	26.0	12.4	60.2	0.0	1.4
Palusplain	3.8	1.4	94.7	0.0	0.1
River	97.1	0.0	2.9	0.0	0.0
Sumpland	40.1	21.4	38.2	0.0	0.4

Table 8. Statistics from the *Geomorphic Wetlands Swan Coastal Plain* dataset indicating the percentage by area of all wetlands in each consanguineous suite assigned a Conservation management category (Department of Parks and Wildlife 2016).

Consanguineous suite	Total area of all wetlands	Total area of CCW	% CCW in each consanguineous suite
Ambergate	178.8	0.0	0.0
Anniebrook	4953.7	19.3	0.4
Balcatta	1776.3	643.8	36.2
Becher	189.7	126.9	66.9
Beermullah	4545.1	397.4	8.7
Benger Swamp	2490.9	515.5	20.7
Bennett Brook	32495.2	2715.0	8.4
Bibra	6466.6	4263.9	65.9
Big Swamp	674.6	52.3	7.8
Blackwood Plateau	151.4	23.1	15.3

Consanguineous suite	Total area of all wetlands	Total area of CCW	% CCW in each consanguineous suite
Brockman River	1426.2	765.9	53.7
Capel	2735.8	188.4	6.9
Capel River	1051.9	114.9	10.9
Carbunup	1023.5	126.7	12.4
Clewley	2370.7	828.4	34.9
Clifton	4481.3	3499.1	78.1
Cokelup	246.1	94.8	38.5
Coogee	263.1	174.9	66.5
Cooloongup	1455.6	1455.6	100.0
Coorange	1113.6	969.7	87.1
Ellen Brook	13927.3	509.5	3.7
Geographe Bay	59.5	11.5	19.2
Gnangara	2399.3	1419.9	59.2
Goegrup	7632.7	1948.0	25.5
Hamden	1066.8	392.4	36.8
Jandakot	20579.2	4467.2	21.7
Keysbrook	110831.1	1620.5	1.5
Kooallup	212.8	12.8	6.0
Lake Pinjar	2268.0	1172.6	51.7
Lake Preston	3367.9	3304.3	98.1
Leschenault Inlet	4025.2	3187.41	79.2
Little Dardanup	2265.9	1277.1	56.4
Ludlow	429.0	18.9	4.4
Mallocup	38.9	0.0	0.0
Mialla	43.8	3.2	7.4
Minninup	340.8	62.7	18.4
Mogumber	662.0	21.8	3.3
Moore River	5033.8	1154.0	22.9
Moore River Estuary	43.9	39.7	90.4
Muchea	5542.5	2257.5	40.7
Mungala	25978.6	3262.4	12.6
Ngamburnup	605.2	7.1	1.2
Not Assessed	2413.2	1078.1	44.7
Not Defined	419.0	186.6	44.5
Peel-Harvey Estuary	18409.0	16757.5	91.0
Peelhurst	15.9	12.7	79.9
Red Gully	1039.4	476.8	45.9
Ridge Hill Shelf	60.7	17.9	29.6
Riverdale	5107.0	982.1	19.2
Ruabon	21626.1	376.9	1.7
Sabina River	1972.1	15.1	0.8
Stakehill	952.2	819.4	86.1
Swan River	10224.1	1602.0	15.7

Consanguineous suite	Total area of all wetlands	Total area of CCW	% CCW in each consanguineous suite
Swan River Estuary	4305.6	4097.9	95.2
Tutunup	1112.8	61.0	5.5
Vasse-Wonnerup	4296.4	1635.4	38.1
Walyunga	933.24	182.92	19.6
Wannamal lakes	826.2	500.0	60.5
Wicher Plateau	36.2	20.0	55.4
Yanchep	1411.5	1128.8	80.0
Yoganup	70.2	19.7	28.1
Yunderup	9.0	0.6	6.7

Table 9. Statistics from the *Geomorphic Wetlands Swan Coastal Plain* dataset indicating the percentage, by area, of each wetland type in each consanguineous suite assigned a Conservation management category (Department of Parks and Wildlife 2016).

Consanguineous suite	Percentage of each wetland type assigned Conservation management category									
	Creek	Dampland	Estuary-peripheral	Estuary-waterbody	Floodplain	Lake	Paluslope	Palusplain	River	Sumpland
Ambergate	0	0	0	0	0	0	0	0	0	0
Anniebrook	0	0	0	0	68.1	0	0	0.3	0	8.9
Balcatta	0	3.7	0	0	0	92.0	0	0	0	24.2
Becher	0	58.0	0	0	0	0	0	0	0	71.5
Beermullah	0	62.1	0	0	3.2	100.0	0	7.7	0	52.0
Benger Swamp	0	0	0	0	0	0	0	0	0	31.6
Bennett Brook	68.1	9.4	20.5	100.0	68.6	98.7	0	4.6	100.0	19.6
Bibra	0	87.0	0	0	0	73.8	0	10.5	0	65.8
Big Swamp	0	7.6	0	0	0	0	0	11.5	0	0
Blackwood Plateau	0	0	0	0	0	0	0	20.0	0	11.6
Brockman River	0	2.5	0	0	95.5	0	0	39.2	0	89.0
Capel	0	0	0	0	5.2	0	0	6.4	0	23.8
Capel River	0	0	47.7	0	0	0	0	1.9	0	0
Carbunup	0	0	0	0	43.3	0	0	1.0	0	25.1
Clewley	0	18.2	0	0	0	100.0	0	30.0	0	47.4
Clifton	0	33.6	0	0	0	97.8	0	0	0	24.7
Cokelup	0	0	0	0	0	0	0	23.8	0	61.3
Coogee	0	0	0	0	0	86.8	0	0	0	59.2
Cooloongup	0	100.0	0	0	0	100.0	0	0	0	98.5
Coorange	0	51.1	0	0	68.4	100.0	0	100.0	0	55.0
Ellen Brook	0	0	0	0	35.5	100.0	0	2.5	0	42.3
Geographe Bay	0	19.1	0	100.0	0	0	0	0	0	0
Gnangara	0	28.9	82.3	0	100.0	79.5	0	0	0	63.8
Goegrup	0	17.3	100.0	0	56.9	100.0	0	7.1	99.9	48.6

Consanguineous suite	Percentage of each wetland type assigned Conservation management category									
	Creek	Dampland	Estuary-peripheral	Estuary-waterbody	Floodplain	Lake	Paluslope	Palusplain	River	Sumpland
Hamden	0	8.2	0	0	0	0	0	44.1	0	46.5
Jandakot	0	38.2	3.5	0	0	78.2	0	1.8	0	35.9
Keysbrook	0	5.4	94.3	0	36.8	6.7	0	1.3	0	9.1
Kooallup	0	0	100.0	0	0	100.0	0	0	0	36.1
Lake Pinjar	0	100.0	0	0	0	0	0	0	0	51.7
Lake Preston	0	0	0	0	0	99.8	0	0	0	66.6
Leschenault Inlet	0	0	62.4	99.0	100.0	26.4	0	2.1	0	4.2
Little Dardanup	28.2	51.9	0	0	92.8	0	31.6	32.8	0	58.7
Ludlow	0	0	6.9	0	0	0	0	0.3	0	0
Mallocup	0	0	0	0	0	0	0	0	0	0
Mialla	0	0	0	0	0	0	0	0	0	66.2
Minninup	0	0	0	0	0	100.0	0	0	0	12.6
Mogumber	0	2.6	0	0	0	0	0	0	0	7.0
Moore River	0	57.4	0	0	60.3	0	0	18.2	80.7	61.1
Moore River Estuary	0	0	0	0	91.1	0	0	0	89.0	0
Muchea	0	79.3	0	0	25.6	0	0	13.5	0	58.8
Mungala	0	11.6	100.0	100.0	56.4	61.2	0	4.1	0	29.3
Ngamburnup	0	2.0	100.0	0	0.1	0	0	0.4	0	13.9
Not Assessed	0	18.7	0	0	0	93.8	0	12.0	0	88.5
Not Defined	0	2.7	0	0	0	92.5	0	0	0	20.9
Peel-Harvey Estuary	0	99.0	70.8	99.9	63.3	89.9	0	4.0	87.1	69.2
Peelhurst	0	11.2	0	0	0	0	0	0	0	0
Red Gully	0	2.0	0	0	99.5	0	0.8	46.3	0	67.3
Ridge Hill Shelf	0	0	0	0	0	30.8	0	0	0	48.8
Riverdale	0	27.5	0	0	0	27.7	0	3.5	0	40.6

Consanguineous suite	Percentage of each wetland type assigned Conservation management category									
	Creek	Dampland	Estuary-peripheral	Estuary-waterbody	Floodplain	Lake	Paluslope	Palusplain	River	Sumpland
Ruabon	0	1.3	0	0	17.9	0	0	1.4	0	14.3
Sabina River	0	0	0	100.0	0	0	0	1.4	0	0
Stakehill	0	35.2	0	0	0	0	0	0	0	88.4
Swan River	0	2.4	28.9	100.0	43.2	83.7	0	7.1	97.6	27.7
Swan River Estuary	0	5.8	75.0	100.0	45.1	38.4	0	0	0	47.3
Tutunup	0	0	0	0	25.2	0	0	0	0	0
Vasse-Wonnerup	0	0	26.0	99.6	1.2	0	0	0.6	0	16.1
Walyunga	6.5	21.8	0	0	99.9	0	78.8	10.4	100.0	35.9
Wannamal lakes	0	100.0	0	0	0	100.0	0	9.1	0	79.8
Wicher Plateau	0	0	0	0	0	0	0	0	0	55.8
Yanchep	0	100.0	0	0	0	98.6	0	0	0	35.6
Yoganup	0	0	0	0	0	0	0	21.1	0	45.9
Yunderup	0	7.8	0	0	0	0	0	0	0	0