



Department of **Biodiversity,
Conservation and Attractions**

RCM Project

Threatened and Priority Flora Report Form - Field Manual

Prepared by:

Gillian Stack, Senior Project Officer, Department of Environment and Conservation, Species and Communities Branch, Locked Bag 104 Bentley Delivery Centre WA 6983

Prepared for:

Significant Species and Communities Resource Condition Monitoring Project, DEC

Version 1.3 (August 2017)

Revision History Log

Version #	Revision Date	Author	Changes
1.1	12/7/2013	M. Smith	Change Department of Environment and Conservation to Department of Parks and Wildlife. Update Departmental District boundaries.
1.2	13/10/2014	J Kuehs	Updated form example
1.3	24/08/2017	J Donaldson	Change Department of Parks and Wildlife to Department of Biodiversity, Conservation and Attractions.

Table of Contents

1	Overview.....	1
2	Introduction.....	1
3	Completing the TPRF	2
3.1	General Principles.....	2
3.1.1	Complete as much as possible; emphasis on bordered sections.....	2
3.1.2	Extra details	2
3.1.3	If you don't know, leave it blank	2
3.1.4	Populations and subpopulations	2
3.1.5	Choosing a time to assess threatened taxa.....	3
3.1.6	Gaining permission to access threatened flora populations	4
3.2	Taxon and Observer Identity.....	4
3.3	Location Details	5
3.4	Observation Details.....	7
3.5	Threats.....	9
3.6	Habitat Information.....	9
3.7	Additional Information	10
4	Data management.....	11
5	List of acronyms	12
6	References	12
7	Appendix 1 – Observer role and organisation	14
8	Appendix 2 – Map of DBCA Districts and Regions	15
9	Appendix 3 – Plant count methods.....	17
10	Appendix 4 – Threats and threat agents	21
11	Appendix 5 – Landform.....	25
12	Appendix 6 – Rock type	31
13	Appendix 7 – Soil Type.....	32
14	Appendix 8 – Soil Colour	33
15	Appendix 9 – Vegetation structure charts (NVIS)	34
16	Appendix 10 – Management actions.....	35
17	Appendix 11 - Example of completed TPRF	36

1 Overview

Monitoring is the repeated measurement of a factor or range of factors over time to determine change. The Rare Flora Report Form (RFRF) has been used as the mainstay of rare flora monitoring in Western Australia. It collects data from occasional and repeated observations of populations of Declared Rare Flora and priority species. The form has been used predominantly by Department of Biodiversity, Conservation and Attractions (DBCA) staff, but can be used by anybody visiting rare and priority flora populations, including NRM professionals, environmental consultants, wildflower enthusiasts and other members of the public.

The data that has been collected over the years can be used to draw some conclusions about the effectiveness of management, but these conclusions are constrained by wide variability in interpretation of fields and terms and uncertainty about the rigour of observation. After extensive consultation with stakeholders, the *Resource Condition Monitoring (RCM) Significant Native Species and Ecological Communities Project* reviewed and revised the RFRF and the associated database (DEFL) during 2008-2009. These changes have tightened definitions of fields and terms, and give a more detailed indication of effort applied during observation.

The revised form is the Threatened and Priority Flora Report Form (TPRF), and the redeveloped database will be known as the Threatened and Priority Flora Database (Note the new database is still currently being developed therefore the existing DEFL database will continue to be used until the redevelopment has been completed). The information collected and stored through these tools is used to:

- highlight those populations in need of urgent management action;
- monitor management effectiveness; and
- provide data to support any changes to conservation status.

The review identified that it is also desirable to capture more detailed information for each population to address important knowledge gaps. For example, increasing the level of confidence about the population's status (stable, expanding, declining), or identifying the causes of decline and effective recovery techniques. This can be achieved through careful design of detailed monitoring protocols. These identify the monitoring question, the methodology by which it will be addressed, and the analysis that will be performed on data obtained to influence management decisions. For more information on developing or accessing existing monitoring protocols see DBCA's monitoring webpages [Monitoring protocols](#). These monitoring protocols, carefully designed to answer specific questions, are particularly important for Critically Endangered taxa, which most urgently need these answers to guide management. While desirable for all threatened taxa, it is not realistic to hope to achieve this detailed level of monitoring for all Threatened and Priority Flora populations known in Western Australia.

The Department encourages the regular gathering of good quality basic information about all threatened flora populations and submission of this data on the TPRF. This field manual provides information to support best-practice completion of the TPRF. Completing the TPRF in a standard way, to a high degree of accuracy, ensures that the data collected is consistent, comparable and reliable. This data can then be used to support and evaluate management decisions, which in turn contributes to the long-term conservation of Western Australia's unique rare species.

2 Introduction

There are several different methods for submitting TPRFs. Individual TPRFs can be printed and submitted as a paper form, or completed on a field computer using custom-built software and submitted electronically. A hard copy of all TPRFs (and attachments) received must be filed for audit purposes. Please ensure attachments are physically attached to the relevant TPRF to prevent information from being misdirected.

This field manual provides explanations for the terms used on the form, to ensure consistent understanding across all users. This is necessary because of the variety of flora in Western Australia, and the wide variety of techniques used to observe their biological characteristics. It also sets out how to collect, record and submit information via any of these methods.

This manual can and should be used by anyone submitting TPRFs to DBCA.

3 Completing the TPRF

3.1 General Principles

3.1.1 Complete as much as possible; emphasis on bordered sections

All fields on the revised TPRF represent valuable information about the population or species. However, the most important fields have been indicated with a border. If you have to prioritise effort to meet time constraints, please put the effort into these fields and leave the others blank. The fields on the reverse side of the form contain detailed habitat information, which does not usually vary over time. This does not need to be completed on every occasion, but effort should be made to complete it well once, for each population.

Many fields of the TPRF provide a list of specific terms from which one can be chosen. This enables the data to be searched more easily in the database. If more than one term could apply, choose the most applicable or most common one, and provide more detail in the most applicable Notes fields (Population Notes, Habitat Notes and Other Comments).

3.1.2 Extra details

There is often extra information that is valuable and may be specific to the species under observation, but which cannot be captured by choosing from specific terms. For this reason the form has several 'Notes' fields – Population Notes, Habitat Notes and Other Comments. Please choose the most relevant and capture details there. For example, Population Notes may contain information including more detail about the reproductive state of plants ("fruit may be ripe in approximately 3 weeks"), or that while most plants are healthy (indicated in tickbox), "20% are senescent". Information captured in the Habitat Notes field might include the altitude of the population, the size of loose rock fragments, the density of leaf litter, restriction of species to the north facing slopes or a description of the range of landform elements that the population covers if more than one. Other Comments can capture information about management actions required or completed, other data captured and how to locate that data, and any other comments about the observation. In the new database it will be possible to see comments made on all TPRFs that apply to a Population.

3.1.3 If you don't know, leave it blank

Try to complete as much of the report form as you can. However please do not complete a field if you do not know the answer with reasonable confidence.

3.1.4 Populations and subpopulations

In biological terms, a population is a discrete group of interbreeding individuals of a species. In the current situation of fragmented vegetation remnants, it is difficult to say which groups of individuals were once interconnected as a population and which were not. For the purposes of threatened flora management and monitoring, populations are defined as management units of closely associated plants.

DBCFA has split many populations into subpopulations for management purposes, sometimes differentiated by the tenure of the land they occupy. This is because different tenures can imply different threats, management practices and subsequent management requirements. These populations and subpopulations have been numbered by the administrators of the Threatened Flora Database. The numbering system is not generally known or used outside of the Department however using it enables the recording of detailed information against only one subpopulation, where access has not been gained to other tenures at the same time. Information should be recorded against each "management unit" to enable data to be assigned to respective subpopulations.

The guidelines applied when determining threatened and priority flora population numbers include:

- plants more than 500 m from a known population are considered to be a new population;
- plants within 500 m of a known population are considered to be part of that population;
- within a recognised population, plants that occur on different land tenure parcels, or those that have considerable, recognisable separation between them (eg, plants occur on either side of a river, or on close but distinct peaks or outcroppings) are considered to be separate subpopulations.

These guidelines are applied flexibly according to what makes most sense in that particular situation.

For the purposes of this field manual, the term '(sub)population' is inclusive of populations and subpopulations as applicable.

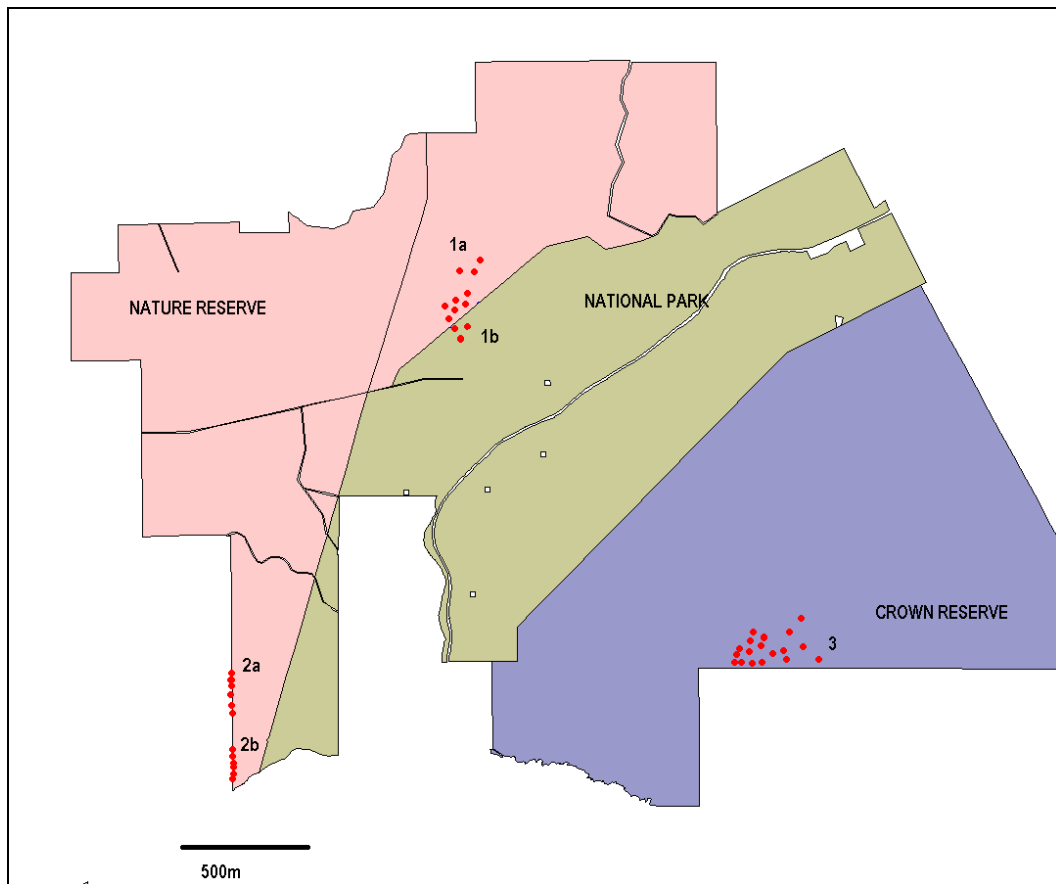


Figure 1. Example of plant populations and subpopulations as defined by the above database guidelines - Note individual plants are marked as a red dot. Population 1 is split into two subpopulations based on a difference in land tenure. Population 2 is split into two subpopulations based on a recognisable separation of plants in the population. Population 3 is a separate population as it is more than 500m from the other known populations.

IMPORTANT NOTE: due to the nature of the TPFL database, if a record can not be attributed to one subpopulation, it must be entered as a partial survey of the whole population. For example, a single TPRF that refers to plants on road and rail reserve (say, Pop 3a and 3b), but not the plants on adjacent private property (Pop 3c), will be recorded as a partial survey of Population 3. If similar information was presented on two TPRFs that reported the details of Population 3a and 3b separately, they would be attributed to those subpopulations, and could be recorded as full surveys if that box was ticked in the Area Assessment field.

3.1.5 Choosing a time to assess threatened taxa

The TPRF provides a reporting mechanism for observations from both surveys and regular monitoring efforts. A survey is not usually repeated, and is conducted to determine the presence or absence of a species. Monitoring is the repeated measurement of a factor or range of factors over time to determine change.

The TPRF can be completed by anyone, so can capture observations made opportunistically, or as part of a planned survey or monitoring program. A monitoring program will ideally be guided by a Monitoring Protocol, which will establish the timing and parameters of observations (see the document 'Designing a Monitoring Project for Significant Native Flora Species' on DBCA's [Monitoring website](#)).

Where there is no Monitoring Protocol, or the population has not previously been surveyed, the following advice is provided. Many surveys are intended to gather information towards assessing whether the species is present or absent. These surveys are generally best done when the taxon is in

flower to enable accurate species identification. Monitoring plants in flower supports plant counts by enhancing plant visibility and differentiating mature plants from juveniles.

It is also desirable to assess a (sub)population at other times of year to determine the condition of the population and any threats which may be evident in other seasons. It is desirable to collect fruiting specimens if these are not represented in the WA Herbarium. These extra assessments must be balanced against other workloads, given the primary need to understand the conservation status of each population through plant counts.

EPA Guidance Statement Number 51 should be referred to for more information specific to survey for environmental impact assessment in Western Australia.

3.1.6 Gaining permission to access threatened flora populations

Prior to survey you must identify the land manager of the area you wish to survey. It is necessary for all people assessing threatened and priority flora populations to gain permission for access to land. Land tenure details can be sought from GIS. Local Government Authority offices may be able to assist with land manager contact details, such as an address for correspondence.

Access to rail reserves is controlled by Brookfield Rail's District Superintendents, who need to know why people are on the reserve, and give permission or protection depending on how close to the running line persons or machinery are likely to go. Trains scheduled to be operating in the area will be alerted to the possible presence of people on the reserve. Reflective vests are recommended while operating on the rail reserve. Road reserves are accessible without permission, but it is wise to wear a reflective vest and turn on beacon lights if available to maximise visibility, and ensure you are pulled safely off the road.

3.2 Taxon and Observer Identity

Taxon: The scientific name of the taxon that this TPRF relates to (note common names are not acceptable). The WA Herbarium's FloraBase website <http://florabase.dpaw.wa.gov.au/> can be searched for current, acceptable names.

TPFL Pop. No: The population or subpopulation number that the Threatened and Priority Flora Database (TPFL) has attributed to the occurrence of this taxon at this location. This should be left blank if you are unsure of the population number.

Observation Date: The date the observation was made in the field.

Conservation Status: The conservation status of the taxon in Western Australia, if known. This may be Threatened (T) for species listed as Declared Rare Flora, or Priority 1 to 4 (P1, P2, P3 or P4). If desired, the conservation status of WA flora taxa can be sought on the WA Herbarium's FloraBase website <http://florabase.dpaw.wa.gov.au/>.

New population: Tick this box if this record is for a new (sub)population. If unknown leave blank. Note that the 'TPFL Pop. No.' field should also be left blank for all new (sub)populations.

Observer/s: The name of the person/people who made the observations.

Phone: A contact phone number for one observer who could clarify details submitted if required for entry or verification of data into TPFL. This phone number will not be retained in the database.

Role: The role of the observer (eg, conservation officer, volunteer, consultant etc). A list of available terms is available at [Appendix 1](#). If your role does not fit within the available terms, please specify your role.

Organisation: Any organisation or body the observer is employed by or affiliated with in connection with this observation (eg, DBCA, a catchment council, Wildflower Society, consultancy etc). A list of available terms is available at [Appendix 1](#). If your organisation type does not appear within the available terms, please specify your organisation.

3.3 Location Details

Description of Location: Even if a GPS coordinate has also been recorded, it is very important to capture this information well at every visit. This improves confidence that the details recorded in this TPRF can be compared to others from the same place (GPS coordinates can be inaccurate). Provide at least the nearest town/named locality, and the distance and direction to that place (as per Herbarium requirements for specimens). A closer description is also highly desirable, using named reference points as much as possible. For example, '30km NE of Wubin; 2.4km north east of Goodlands Rd along Great Northern Highway, and then 50m west into bushland'. Estimates should be as accurate as possible, and where possible refer to local markers to assist rediscovery (eg, near the corner fence post, or adjacent to rock outcrop). A supplementary map is desirable for descriptions without named reference points (eg, tracks within a nature reserve) or where named reference points can be flexible (eg, tracks on stations).

Population location information needs to be detailed enough to not only allow relocation, but to permit the determination of land ownership or vesting. This is essential for management purposes, as the land manager must be informed of the presence of threatened flora if it is to be protected under legislation and managed appropriately.

Reserve No: Indicate the number of the Crown Reserve that this (sub)population occurs on if applicable.

DBCA District: The DBCA District that this (sub)population falls within. A map of the DBCA District boundaries is provided in [Appendix 2](#).

LGA: The Local Government Authority that this (sub)population falls within - eg, Shire of Cue, City of Geraldton, Town of Cambridge.

Land manager present: Tick box if the land manager was present for part or all of the observation period.

Datum: Record the datum associated with the geocode coordinates. The datum used by a GPS can often be found in its Setup screen, or by following the manual. This can also be set to a preferred option – generally GDA94. The datum used by a map will be recorded near the title and legend.

GDA (Geocentric Datum of Australia): This replaced the earlier Australian Geodetic Datum, and is the preferred option for coordinates collected.

Geographic coordinates (latitude/longitude): Geocentric Datum of Australia 1994 (**GDA94**)

Grid coordinates (UTMs - easting/northing): Map Grid of Australia 1994 (**MGA94**)

AGD (Australian Geodetic Datum): This system predates the current Geocentric Datum of Australia – the first version was established in 1966, and revised in 1984.

Geographic coordinates (latitude/longitude): Australian Geodetic Datum 1984 (**AGD84**)

Grid coordinates (UTMs - easting/northing): Australian Map Grid 1984 (**AGM84**)

WGS84 (World Geodetic System 1984): This system is global rather than Australia-specific, and is considered to be roughly equivalent to GDA94. A slight difference between the two systems is caused by Australia's tectonic drift northeasterly. This was 77cm at 2005, and increasing at ca 7cm per year (ICSM 2006). For coordinates expected to be accurate at a distance of 2m or greater, this difference is not particularly problematic.

Coordinates: Nominate whether the coordinates are recorded in:

Decimal degrees (eg, 31.99373°S; 115.88268°E);

Degrees/Minutes/Seconds (eg, 31° 59' 37.4"S; 115° 52' 57.7"E); or

Universal Transverse Mercator units (UTMs – eg, 0394453mE; 6459714mN; Zone 50).

Geographic coordinates (latitude/longitude) record a position on the Earth's curved surface, while the grid coordinates record a position projected onto a flat surface.

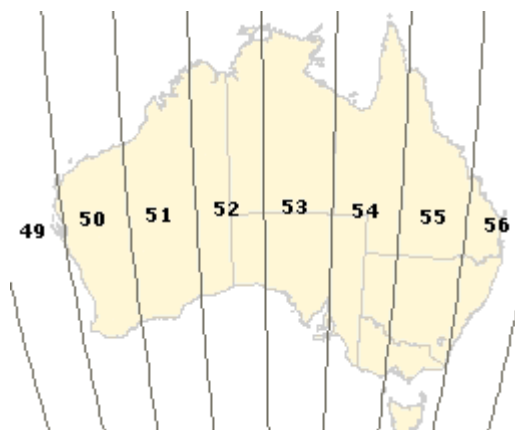
Note regarding coordinates: The coordinate recorded here is regarded as a single point within the (sub)population for the purposes of locating the population in a GIS layer. Ideally, this point would be recorded from well within the population boundary rather than at the edge. Where individual plant locations have been recorded and/or population boundaries (see boundary polygon captured), these can be attached to the report form – refer to the 'Attached' field of the form. For more information on how to name and store other spatial information files (eg, individual plant locations or boundary polygon information) see the ['Standard Operating Procedure 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and a spatial data' on](#)

[DBCA's website.](#)

Lat/Northing: Record the geocode's southern reading – either Latitude or Northing (eg, 31.99373°S; or 31° 59' 37.4"S; or 6459714mN).

Long/Easting: Record the geocode's eastern reading – either Longitude or Easting (eg, 115.88268°E; or 115° 52' 57.7"E; or 0394453mE).

Zone: This is essential to interpret grid coordinates (eastings/northings) provided as UTM's. The world is divided into sixty zones to correct for distortion when transferring rounded global surfaces to flattened map surfaces. Western Australia falls within Zones 49, 50, 51 and 52, moving west to east. GPS units or maps displaying UTM coordinates will also provide the Zone.



[Image sourced from Geoscience Australia (2007)]

Method used: Record the method used to obtain the coordinates (GPS, differential GPS or map).

No. satellites: If GPS or differential GPS was used, please indicate the number of satellites the GPS was reading from at the time. This is usually prominently displayed on the GPS. (Note: it is recognised that this value is only a partial indicator of signal quality, but it was deemed the most readily accessible value on a range of different makes of GPS, and a better articulation of signal quality would require completion of too many fields. A set of these is captured automatically using the field computer-delivered TPRF).

Boundary polygon captured: Indicate whether a population boundary polygon was captured on this occasion using a GPS. A population boundary may be mapped with a GPS to produce a polygon that may be viewed with other spatial data using GIS software. For more information on how to name and store these and other spatial information files (eg, individual plant locations) see [Standard Operating Procedure 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and aspatial data](#) on DBCA's website. In the 'Other Comments' section the name of the file and where the data is stored should be recorded so that others may be able to locate the data in future. Copies of population boundaries should be sent to the Flora Administrative Officer at Species and Communities for backup storage.

Map used: If a map was used to derive coordinates, please indicate the name of the map and map series if relevant.

Map scale: Indicate the scale of the map used (eg 1:25,000).

Land Tenure: Nominate the land tenure this (sub)population occurs on.

SLK: Straight Line Kilometres is a system of marking used by Main Roads WA (MRWA). All main roads have SLK markers (small white posts with numbers and yellow caps) placed every two kilometres on the left side of the road from its starting point. For threatened flora (sub)populations on main road verges, referring to this system of marking makes it easy for MRWA operators to avoid these populations during maintenance operations.

Pole: Pole numbers are a similar system of marking used by Brookfield Rail. The poles used by the old telegraph lines that ran along rail lines are marked by a numbering system. The lines have been removed, but the poles are often still present and the numbers used as the basis for identifying points

along the line for maintenance. These poles are usually about 80m apart, with between 12 and 14 poles per kilometre. The numbering is stencilled on the pole (eg, 322/04 tp or 328/12 tp). As these old telegraph poles deteriorate, they are being replaced by markers placed every 250m. The marker posts are white with the distance marked in black (eg, 322.250 or 322.750).

3.4 Observation Details

Area Assessment: Indicate whether this was an edge survey, partial survey or full survey. The survey extent could apply to a subpopulation or a whole population, as nominated at the **TPFL Pop. No.** field of the TPRF.

Edge survey: A quick visit to the site of the (sub)population, sufficient to confirm ongoing presence of the taxon and macro-change – eg, the grading of a population, or whether affected by recent fire. The purpose of this survey might be to collect minimal details while also checking the reproductive state of a (sub)population targeted for seed collection.

Partial survey: A survey where only part of the (sub)population was observed. It may be that part of the (sub)population was observed in detail, but time constraints halted the survey before the full extent of the (sub)population could be determined.

Full survey: Sufficient time and effort were spent determining the limits of the (sub)population, and details recorded on this TPRF apply to the whole extent of the (sub)population.

Area observed (m²): Indicate the approximate area observed in metres squared - eg, an area roughly 200 m long x 50 m wide would be 10,000 m²). Note that the area observed may be very different to the area occupied by plants.

Effort:

Time spent surveying (minutes): Indicate the length of time spent on survey on this occasion. Eg, if two people surveyed the population for 45 mins, record 90 mins. Do not include time spent completing other tasks on site – eg, seed collection or weed control. Note that this field will be used to derive Number of minutes spent per 100 m², which is intended as a measure of effort, or thoroughness of inspection.

No. of minutes spent / 100 m²: Divide the total Area surveyed (note that this is not the area occupied by population) by 100 to give the 100 m² value. The Time spent surveying divided by that number will give the Number of minutes spent per 100 m².

If completing a high effort survey of the full extent of the population, please also record a GPS coordinate from within the distribution of plants. This coordinate will be used in the database as the location point that appears in GIS data if the population count is used as the source of plant count information in the TPFL 'population details' area.

Pop'n count accuracy: Indicate whether count is Actual, Extrapolation or Estimate.

Method: If possible, indicate the specific method used to obtain plant counts. **Please see [Appendix 3](#) for more details of specific Plant Count Methods.**

What counted: Indicate whether the numbers in the population count table refer to Individual plants, Clumps (where individuals can not be distinguished) or Clonal stems. Ideally counts or estimates will be made of individual plants, but it is difficult to identify individuals of some taxa. These may be clonal, like rhizomatous species or mallees, or just grow very densely. See Appendix 3 for more information about plant count methods.

Total population structure: Please record information as **either** a Detailed count **or** a Simple count. It is important to record the lifestage classes separately whenever possible (even if only estimating numbers), and to record dead plants (if they can be identified) as well as live plants, as this extra effort provides much more information on the demographic dynamics within the population and population health. Please record the count as numbers rather than percentages for entry into the database. For example, if 200 plants are estimated to be present, with about 80% of those mature and 20% juvenile, record 160 mature and 40 juvenile plants, with the relevant count method entered in that field.

Individual plants are readily distinguished in many taxa, but are less apparent in others (eg, where individuals are dense and overlapping, or by clonal behaviour where plants may be connected underground).

A **Detailed count** will detail the number of plants in each lifestage class (mature, juvenile and seedling).

Mature: A mature plant is one which has the potential to contribute to the reproduction of the population, by flowering and seeding or producing clonal material.

Juvenile: A juvenile has lost its cotyledon leaves but has not yet flowered. For IUCN purposes, a flowering orchid is regarded as mature, and a vegetative one is considered immature, to reflect their reproductive potential that year. Enter these non-flowering (immature) plants in the Juvenile box.

Seedling: A seedling is less than 12 months old, and still has cotyledon leaves present.

(Note: it can be difficult to be sure whether a seedling is the target species without a reference photo. If given the opportunity, please photograph seedlings suspected to be threatened or priority species and save and store the information in accordance with recommendations in the [Standard Operating Procedure 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and aspatial data](#) once the identity has been confirmed with age).

A **Simple count** will include all plants, undifferentiated into lifestage. This is appropriate if differentiation is difficult or unreliable, such as when plants are out of flower, or if time does not permit this level of attention.

Dead: Dead plants can be hard to identify, but if it is possible (they are distinctive, recently dead or individually tagged), this knowledge is valuable. Don't record dead plants that can not be identified as the target species.

Area of population (m²): Record the area that the population occupies.

Note: This section is intended to record details of transects as well as quadrats where present.

Quadrats present – No.: Indicate the number of quadrats and/or transects present at the (sub)population, if applicable.

- **Size:** Indicate the size of the individual quadrats and/or length, width of observation zone and observation interval of transects present.

Data attached: Indicate whether data from these quadrats and/or transects is attached to the TPRF.

Total area of quadrats (m²): Indicate the total square meterage covered by all quadrats and/or transects combined. This information will make it possible to compare counts from year to year, even if additional quadrats or transects are installed.

Quadrat totals: Include summary data of all plants recorded from combined quadrats/transects examined at that (sub)population site.

Reproductive state: Record which reproductive features can be seen on the plants at the time of observation. This information can be useful for timing future visits, such as for seed collection.

Clonal: evidence that plants reproduce asexually (eg, runners).

Vegetative: plants without reproductive material (flowers or fruits at any stage of development).

Flowerbud: flowers developing but not yet open for pollination.

Flower: flowers open for pollination.

Immature fruit: fruit/seed developing but not yet ripe.

Fruit: ripe fruit.

Dehisced fruit: old fruit that has released its seed.

Percentage in flower: If plants are in flower, record the percentage of total plants in the (sub)population that are in flower (ie, not the amount of an individual that is covered by flower). This information is useful for demographic purposes, and where applicable, response to fire.

Condition of plants: Use the options given to record the condition of most of the plants.

Note: the options provided are exclusive – only one option may be chosen. More detail can be recorded in Population Notes.

Population Notes: Record more detail if desired. For example, comments on Condition of plants may be similar to 'most mature plants senescent but most juveniles healthy', or '80% moderate, 20% poor'. This field may also include information regarding reproductive state of plants (eg, 'fruit may be ripe in ca 3 weeks'), the ruleset applied when counting taxa whose individuals are difficult to identify, or

anything else related to the plants of this taxa at this site.

3.5 Threats

Threat type and information: Nominate the most important threats. A list of threat and agent terms available in the database is provided at [Appendix 4](#).

For each threat, notes can be made to record detail useful for management (eg, location, area affected, samples taken etc). Rate each threat's current impact on the (sub)population, its potential impact and the timeframe in which you might expect that potential impact to occur. Capturing the potential level of impact is most useful for threats which may have changing impact over time if left unmanaged, such as weeds or disease. This includes threats which may not be impacting the population already (rating of 0) but which are considered likely to impact in the future (eg, dieback known to be present uphill of this population). It is not necessary to rate the potential impact of stochastic events such as road maintenance or flood events, which may have an unpredictable level of impact or time to onset.

It is acknowledged that these ratings are subjective without quantitative data about impact of a threat on mortality or reproductive capacity of a species, rates of spread at this site etc, but they are intended to give a sense of priority to management actions.

Threat impact: 0=Nil, 1=Low, 2=Medium, 3=High, 4=Extreme

Time to potential impact: 1=<12mths, 2=<5yrs, 3=5yrs+

3.6 Habitat Information

It is anticipated that habitat information could be captured well once and then only revised if habitat characteristics change. This section of the TPRF is therefore of less importance than the preceding sections, and may be omitted if time is limited or existing information is adequate.

IMPORTANT NOTE: If you wish to update or enhance habitat information present in TPFL, please complete **all** habitat fields at the same time, as only one source can be used to populate the set of habitat fields in the Population Details area of TPFL.

To facilitate standardisation of what is meant by different terms, existing published definitions have been adopted. Many of these have been sourced from the Australian Soil and Land Survey Field Handbook (McDonald, Isbell, Speight, Walker and Hopkins 1998), with additional geomorphic wetlands sourced from Hill, Semeniuk, Semeniuk and Del Marco (1996). National Vegetation Inventory System (NVIS) was recognised as a generally accepted standard for description of Australian vegetation.

The number of habitat terms listed on the TPRF was kept brief and general so that the form could be printed on a single page if desired. Details of more specific terms available in TPFL are detailed in the Appendices of this Field Manual to be noted on the TPRF if desired. Therefore, information with different levels of precision can be accommodated on the TPRF and in TPFL.

Landform: Nominate the landform most plants occur on. There are both general and more specific options available. A list of these is provided at [Appendix 5](#). If a more specific term is chosen, enter in the Specific Landform Element field. If the (sub)population occurs across more than one landform element, please nominate the landform most plants occur on and provide details of others in Habitat Notes.

Rock Type: Nominate the rock type present, if known. If identified rock type is not present in options available, specify. A longer list than is available on the form is provided at [Appendix 6](#). If a term not listed on the form is chosen, enter in the Specify other field.

Loose Rock: Indicate the approximate quantity of rock fragments present on soil surface. This includes any type of loose rock, such as gravel, quartz fields etc.

Soil Type: Nominate soil type, as determined by instructions in [Appendix 7](#), sourced from the Australian Soil and Land Survey Field Handbook (McDonald *et al.* 1998). There are both general and more specific options available. A list of these is also provided at [Appendix 7](#). If a more specific term

is chosen, enter in the Specify other field.

Soil Colour: Nominate soil colour. There are both general and more specific options available. A list of these is provided at [Appendix 8](#). If a more specific term is chosen, enter in the Specify other field.

Drainage: Nominate drainage characteristics of the site. This is not necessarily evident on the particular observation date, but may be known from previous experience or records.

Well drained includes areas that are not inundated at any time of year.

Seasonally inundated includes areas that are covered by water at some times of the year, but not for the rest of the year. For example, winter-wet areas, seasonal lagoons or intermittent lakes that may only fill occasionally.

Permanently inundated includes permanent lakes or rivers.

Tidal includes those areas where inundation is dictated by lunar cycles rather than seasonal cycles.

Condition of soil: Record general moisture level of soil. Unlike previous field, this is directly observable on the observation date.

Note: the options provided are exclusive – only one option may be chosen.

Vegetation Structure: Record up to four vegetation layers that are the most representative of the vegetation community. Each layer can accommodate up to three dominant species. A table detailing the appropriate terms for the structural formations (eg, closed forest, woodland, open shrubland, isolated clumps of sedges etc) is provided at [Appendix 9](#). This is taken from the 'Field Survey for Vegetation Classification' chapter in the 2009 *Australian Soil and Land Survey Field Handbook* (the 'Yellow book'). This chapter provides national guidelines and methods for the capture, interpretation and classification of vegetation data and information that meet the requirements of the National Vegetation Information System (NVIS). For more information including a PDF download of the relevant chapter, refer to http://adl.brs.gov.au/brsShop/html/brs_prod_90000003792.html

Associated Species: Note species that occur in the habitat, other than the dominant species already nominated in Vegetation Structure. This information provides a fuller picture of the diversity present.

Condition of habitat: Use the options given to record the condition of most of the habitat.

It is acknowledged that choice between the condition types provided is subjective with or without reference to benchmark descriptions of each condition type. The terms given here for habitat condition were drawn from the Bush Forever Condition Scale, but the descriptions used by that Scale were designed for the Swan Coastal Plain and do not apply equally across other regions of the state. The same terms are offered here to convey a general sense of condition.

Note: the options provided are exclusive – only one option may be chosen. More detail can be added in Habitat Notes if desired.

Habitat Notes: Record any other habitat information here if desired. This may include more detailed habitat condition information (eg, 'most habitat Very good, with Degraded areas near paths'). A description of the range of landform elements that the population covers could be recorded here if applicable. Salinity, dieback or similar could be recorded here if they are not considered to be a direct threat (and thus are not recorded in the Threats section of TPRF), but could be important through secondary habitat changes. Include habitat details important to this species and not already captured, such as the size of loose rock fragments, density of leaf litter, or restriction of species to the north facing slopes.

3.7 Additional Information

Fire History: If the season/month and year of the most recent fire is known or can be interpreted with some confidence, note it here.

Fire Intensity: As above.

No signs of fire: Check this option if there is little or no visible evidence of fire at the site (eg, no charring, dead sticks and leaves still present on vegetation, heavy leaf litter presence, etc).

Fencing: Indicate the presence and/or need for fencing or fencing maintenance at the site. Further comments about state or type of fencing can be made in Other Comments.

Roadside Markers: Indicate the presence and/or need for Threatened Flora marker installation, maintenance or repositioning at the site. Details of what repositioning is needed can be recorded in Other Comments, as can GPS coordinates for the DRF markers.

Other Comments: Record any other information that you would like to capture. This may include (but is not limited to) management actions that are required, management actions that have been completed (include date of completion), liaison with stakeholders, and/or details of other data that have been captured and how an interested party could access it. A list of Management action terms available in TPFL are provided in [Appendix 10](#).

If GIS shapefiles were captured, record their name, contents and where they are stored in the other comments section so that others may be able to locate the data in future. For more information on how to name and store information files see [Standard Operating Procedure 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and aspatial data on DBCA's website](#). Electronic copies of this data should be sent to Species and Communities Branch for back-up storage.

Specimen Details: If a specimen has been collected on this occasion, please provide the Collectors Number and the Herbarium it will be submitted to. For specimens submitted to the Western Australian Herbarium and assigned a unique barcode, it will be possible to subsequently annotate that collection's barcode in the appropriate (sub)population's details in TPFL.

Please note: it is highly desirable that a voucher specimen is collected and stored in the WA Herbarium for every threatened flora population. This ensures correct identification of that taxon at that site. This helps to ensure management resources are allocated effectively and also facilitates identification of each population after taxonomic revision. Specimens only need to be collected for new populations or if no voucher exists or a better specimen is required. Please only indicate specimen details on this form if collected that day.

PLEASE NOTE: **You are not permitted to take specimens of Threatened Flora (Declared Rare Flora) unless you have a DRF permit** issued through DBCA's Species and Communities Branch. If you do not have a DRF permit, take good quality photos of flowers, fruits and leaves instead and attach copies of the photos to the TPRF.

For priority flora and common species a Scientific or Otherwise Prescribed Purposes licence is required to collect from Crown land. Please contact DBCA's Wildlife Licensing Section for more information on general [flora licensing](#).

Attached: Please provide details of any additional information attached to the TPRF (eg, topographic map, GIS-based map, GIS datapoints, field notes etc). Please physically attach them to the TPRF so that there is no confusion as to which TPRF they belong to. If GIS data is attached please specify what the data is (e.g. individual plant locations or population boundaries) in the 'Other Comments' section.

Copy Sent To: Note anybody who has received a copy of this TPRF apart from the Flora Administrative Officer, Species and Communities Branch (eg, DBCA's regional offices, a research facility, a Wildflower Society Branch or NRM region office).

Submitter of Record: Record the name of person who completed the TPRF. Note: this is not always the observer, but may be someone the details were passed on to.

Role: The role of the person who completed the TPRF (eg, volunteer, botanist). A list of available terms is available at [Appendix 1](#). If your role does not fit within the available terms, please specify your role.

Date: Date the TPRF was completed. (Not necessarily the same as the date the observations took place).

4 Data management

The effort spent gathering data will return best value if the information obtained can be located again

when needed. Long-established practice sees paper-based records filed. Electronically submitted TPRFs are printed and filed in the same way, as hard-copy records are needed for audit purposes.

However, some information (eg, GIS files, translocation measurement data) is much more useful in digital form so that it can be manipulated through GIS, statistics or other software packages. File naming conventions and a standardised directory (folder) structure would contribute greatly to making this information accessible to other users across space and time.

A Standard Operating Procedure has been drafted to support improved data management and accessibility – [SOP 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and aspatial data](#) on DBCA's website. This could effectively be used to store all threatened flora data, including TPRFs, field notes, reports, translocation measurement data and photos as well as GIS data. It is well worth taking the time to establish good data management practices and then continue to follow them. Copies of files should be sent to the Flora Administrative Officer at Species and Communities for backup storage.

5 List of acronyms

DBCA	Department of Biodiversity, Conservation and Attractions
DEFL	Declared Flora database (replaced by TPFL)
DRF	Declared Rare Flora (taxa listed and protected under the <i>Wildlife Conservation Act 1950</i>)
IUCN	International Union
NRM	Natural Resource Management
NVIS	National Vegetation Inventory System (Executive Steering Committee for Australian Vegetation Information 2003)
RFRF	Rare Flora Report Form (replaced by TPRF)
SOP	Standard Operating Procedure
TPFL	Threatened and Priority Flora database (replaces DEFL)
TPRF	Threatened Flora Report Form (replaces RFRF)

6 References

- Carlile, P., Bui, E., Moran, C., Minasny, B. and McBratney, A.B. (2001) Estimating soil particle size distributions and percent sand, silt and clay for six texture classes using the Australian Soil Resource Information System point database. CSIRO Land and Water Technical Report 29/01
- Environmental Protection Authority Guidance for the Assessment of Environmental Factors Western Australia (in accordance with the Environmental Protection Act 1986) No. 51 (June 2004) *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*. Environmental Protection Authority, Western Australia.
- Geoscience Australia (2007) *User Guide - NATMAP RASTER 2003* [Internet], Australian Government - Geoscience Australia. Available from: <http://www.ga.gov.au/nmd/products/maps/raster250k/help/helpabout1.jsp> [Accessed 4 May 2009].
- Hnatiuk, R.J., Thackway, R. and Walker, J. (2008) Field Survey For Vegetation Classification in 2009 Australian soil and land survey field handbook(Third edition), National Committee on Soil and Terrain, CSIRO publishing Melbourne.
- Hill, A.L., Semeniuk, C.A., Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain – Wetland Mapping, Classification and Evaluation - Vol 2a*. Water and Rivers Commission and Department of Environmental Protection, Western Australia.
- Intergovernmental Committee on Survey and Mapping (ICSM) (2006) *Geocentric Datum of Australia Technical Manual V2.3*. [Internet], ICSM. Available from: <http://www.icsm.gov.au/gda/gdatm/index.html> [Accessed 30 August 2008].
- IUCN (2006) *Guidelines for Using the IUCN Red List Categories and Criteria: Version 6.2*. Prepared by the Standards and Petitions Working Group of the IUCN Species Survival Commission

Biodiversity Assessments Sub-Committee.

IUCN (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1998). *Australian Soil and Land Survey – Field Handbook, Second Edition*, CSIRO, Australia, Canberra.

7 Appendix 1 – Observer role and organisation

The following terms are available in the TPFL database for use.

If you wish to record an observer's role, please choose one of these terms. If the role clearly does not fit within any of these terms, please specify.

Observer role:

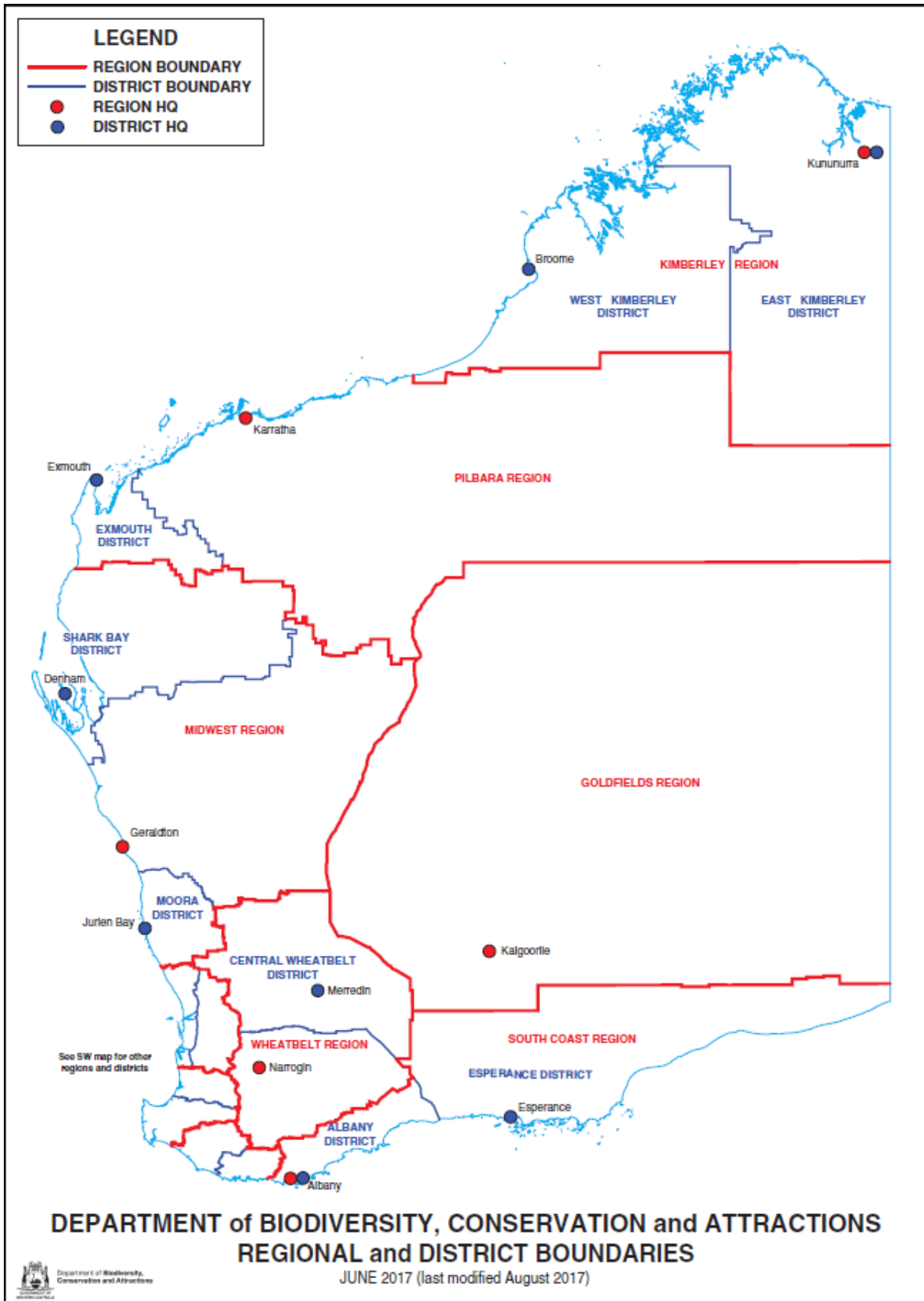
Botanist
Conservation employee
Conservation officer
Ecologist
Nature conservation coordinator
Program leader - nature conservation
Project officer
Regional ecologist
Research scientist
Student
Technical officer
TPFL Administrators
Volunteer

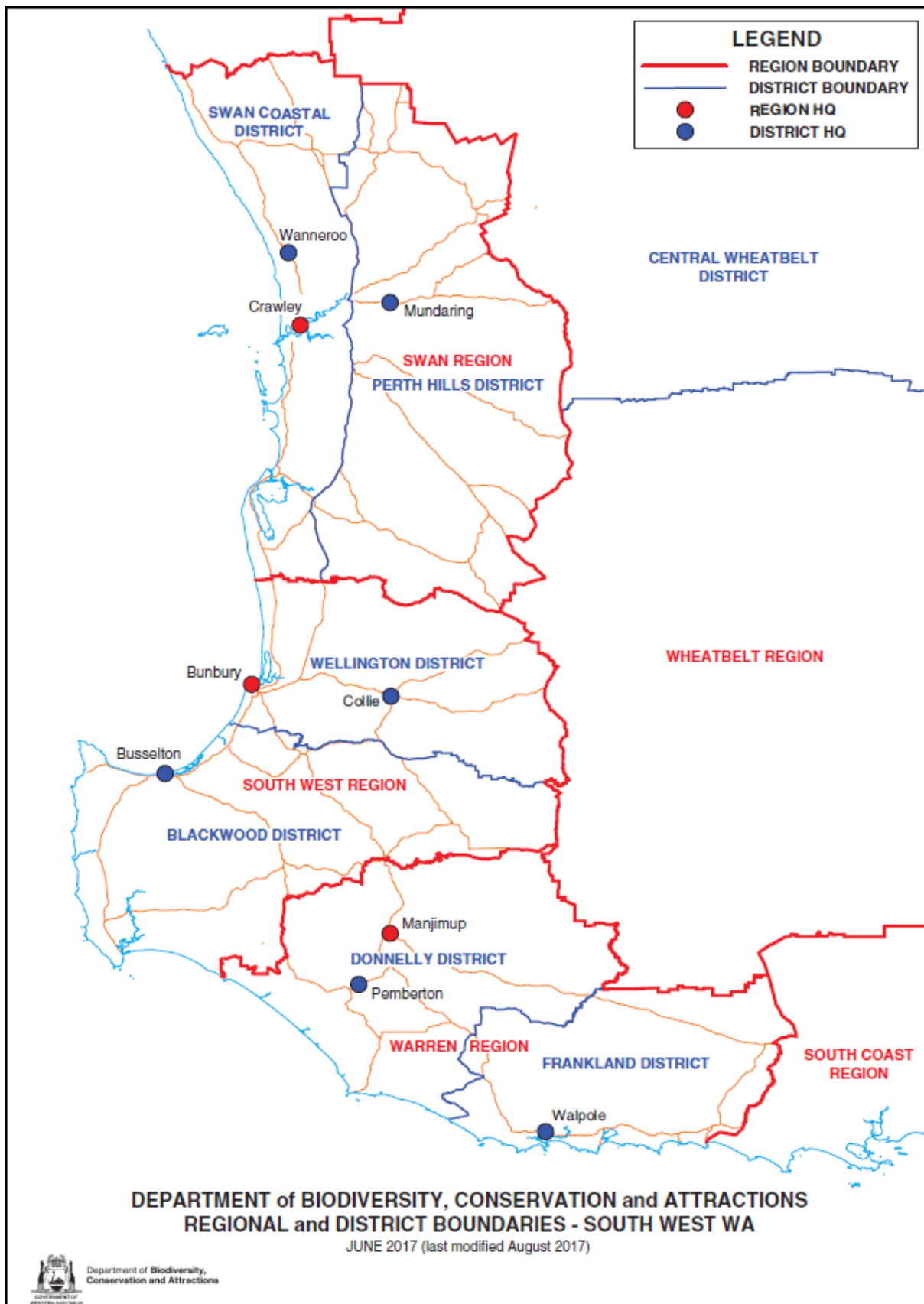
If you wish to record an observer's organisation, please choose one of these terms where possible, with specific reference to your group/organisation. If your organisation does not fit within any of these terms, please specify.

Observer organisation:

Botanic Gardens and Parks Authority
Community Group – please specify
Consulting Company – please specify
Department of Biodiversity, Conservation and Attractions (DBCA) - Nature Conservation Division
DBCA - Science Division
DBCA - Regional Services Division
Local Government Authority – please specify
Non-Government Organisation – please specify
State Government Department – please specify
University – please specify
Wildflower Society

8 Appendix 2 – Map of DBCA Districts and Regions





9 Appendix 3 – Plant count methods

Nominating the method used to derive a plant count is intended to give a better understanding of the likely reliability of each observation. This is useful when interpreting that data to detect abundance trends in a population.

Abundance information derived from defined samples of a population (eg quadrats, transects, traverses) are considerably more accurate than population-wide counts for large or widespread populations, or whose individual plants are difficult to detect. Defined quadrats, transects and traverses are useful for gathering information about long-term natural population dynamics, the effect of threatening processes and the effect of management recovery work. To maximise repeatability and comparability of data over time, it is best if sites are permanently marked. While there is an investment of time necessary to define and establish these sample areas initially, the improvement in information is well worth the effort, particularly for Critically Endangered species.

Ideally counts or estimates will be made of individual plants, but it is difficult to identify individuals of some taxa. These may be clonal, like rhizomatous species or mallees, or just grow very densely. For each of these taxa a ruleset that fits the characteristics of that taxon must be developed to define what will be counted. Some taxa may even require different rulesets for different populations, although the more commonality is maintained, the more widely the results can be compared. This ruleset can be documented in the Population Notes field on the form.

A solution for many taxa is that counts be made of 'clumps', requiring a definition of what is considered to be a single clump (eg, all plants separated by less than a metre of open ground). Within that 'clump', it may be possible to make out some visually distinct tufts or 'subclumps'. These need to be recorded as well, as they may increase or decrease more than the numbers of clumps. This figure can be entered in the Juvenile box on the TPRF. For analysis of the abundance trend, the numbers of subclumps within each clump should be retained for comparison from year to year. It was not possible to store this information in the Threatened Flora Database, and needs to be retained by the appropriate district according to recommendations in the [Standard Operating Procedure 1.4 File Management: Naming convention, directory structure, storage and creation of metadata for spatial and aspatial data](#). It is recognised that this method using clumps and their visually distinct subclumps is rough, but it may be applied reasonably successfully in many instances. Measurement of the area occupied by densely growing species was considered but discarded for standard practice, as variation between observers is likely to make interpretation of these figures unreliable.

If using the rulesets discussed above, or if monitoring is developed using, for example transects, quadrats, tagging of individual plants or other permanent and standardised methods to monitor a species, monitoring protocols should be developed. Documentation of monitoring protocols will ensure that techniques applied in subsequent monitoring events are the same, and allows different staff to continue monitoring using the same methods, in the event of staff changes. A DBCA document to guide staff when developing flora monitoring is available on DBCA's website: *Designing a Monitoring Project for Significant Native Flora and Threatened Ecological Communities 1.7*.

The following terms are available in the Threatened and Priority Report Form. A brief description of each term has been provided below, with some guidance on how to undertake the different methods as well as recommended reading which should be consulted prior to choosing the count method.

POPULATION COUNT METHODS

Actual count - individuals

A count of all individuals seen while observing a population. Usually involves marking of individuals (eg with flagging tape or using a differential GPS) to prevent counting twice, unless population is small area or plants are very visible.

This method has often been used in monitoring of rare flora in WA. It is difficult to compare results from a range of years as different observations are more or less thorough about locating individuals or observing peripheral areas looking for outliers.

It is generally more accurate on small and discrete populations, and less accurate on large or widely dispersed populations. If using this method for larger populations, error estimates - Standard Deviations are required.

Actual count – clumps

Used for counting plants where it is difficult to determine where one individual stops and another begins – eg, clonal plants or mallees where separate stems at the surface may be connected underground, or dense shrubs where ground stems can not be seen.

A ruleset is developed for each species to identify how counts will be made. For example, for a *Synaphea* the ruleset may define the distance from a central, larger plant within which all surface stems are deemed to be the same plant. Defining the area occupied has been found not to be effective in determining change of abundance of larger shrubby plants, but for a moss, a method of determining area with some mapping of zones of density may be more appropriate. It is acknowledged that there will be difficulties in developing rulesets for this diverse group of plants. As long as one method is (carefully) selected, clearly documented and then adhered to, the ability to detect change in abundance will improve.

Partial count - spatially defined subset of population

An actual count of individuals occurring within a spatially defined subset of the population. This sort of count could be applied when it is not possible to complete an observation of the whole population, perhaps due to time or access constraints. An observer may start an actual count of individuals, but not reach the full extent of the population in the time available, or access to other plants may be limited by a flooded waterway.

Note that if the area observed is not defined spatially, the count must be considered an Estimate.

Extrapolated counts

An extrapolated count is basically a count of a known proportion of a population, and is used to limit surveying impacts on survey-vulnerable populations/habitat. Different methods for undertaking extrapolated counts are detailed below.

Extrapolated count - quadrat-based

A more accurate way to ascertain changes in abundance of perennial vegetation over time is to establish permanently marked sample areas (quadrats) within a population. These are precisely defined, so there can be much greater confidence that repeated observation is of the same plants.

Where quadrat/s are established in a population, the count derived from those quadrats could be used to extrapolate a count for the whole population, allowing for changes in density.

Please note that using only one quadrat can give a very misleading population estimate. Several quadrats should be placed over the site to represent the range of plant densities (stratified sampling) or a good effort made to put the quadrat in a representative or average area. Alternatively, quadrats should be placed near known threatened process (eg salinity, dieback) or edge the population to monitor changes in the most sensitive areas. Alternatively, plants may be tagged with permanent metal tags, hence individual plant health (including decline/death) can be recorded.

Populations should have permanent quadrats marked out, their size dependent on plant density and plant form, so that changes in a known sample of each population can be accurately monitored.

Recommended Reading:

- Establishing Vegetation Quadrats DEC Standard Operating Procedure 6.1 (available on DBCA's website).
- Designing a Monitoring Project for Significant Native Flora and Threatened Ecological Communities 1.7 (available on DBCA's website).
- Barker, P. 2001. *A Technical Manual for Vegetation Monitoring*. Resource Management and Conservation, Department of Primary Industries, Water and Environment. Hobart. This document has several sections that help to decide how many quadrats are required in order to have sufficient statistical power, and describes how to calculate how many quadrats to use to ensure you have captured all the species/plants) using species/accumulation curves.
- Elzinga, C.L., Salzer, D.W., Willoughby, J.W. and Gibbs, J.P. 2001 *Measuring and Monitoring Plant and Animal Populations*. Blackwell Science. Athenaeum Press Ltd., Gateshead.

Extrapolated count - transect-based

Like quadrats, transects greatly improve accuracy of looking at abundance trends. They are particularly useful in scattered or very large populations.

Where transect/s are installed at a population, the count derived from those transects could be used to extrapolate a count for the whole population, allowing for changes in density.

Recommended Reading:

- Establishing Vegetation Transects DEC Standard Operating Procedure 6.2 (available on DBCA's website).
- Designing a Monitoring Project for Significant Native Flora and Threatened Ecological Communities 1.7 (available on DBCA's website).
- Elzinga, C.L., Salzer, D.W., Willoughby, J.W. and Gibbs, J.P. 2001 *Measuring and Monitoring Plant and Animal Populations*. Blackwell Science. Athenaeum Press Ltd., Gateshead.

Extrapolated count – traverse

A traverse may be applied when a transect or quadrat is not appropriate – for example, in difficult to access, steep and/or densely vegetated terrain. The exact path may change each observation, but aims to pass through a similar amount of vegetation.

A count can then be extrapolated for the whole population. During subsequent monitoring, surveyors need to use (and document) the same methodology each time to estimate the population size but can and probably should use different transverses. Alternatively in very difficult terrain or with survey-vulnerable population, the initial surveyors can designate a section of the population which can act as a monitoring cell for Extrapolated Count methods in subsequent monitoring of the whole population.

A GPS or DGPS (Differential GPS) can be used to record both the track and position of the plants and the data analysed using a GIS program. Note that the GPS tracking recording may need to be adjusted to every 2 seconds (check default tracking setting) for that track path and length to be relatively accurate and record the position of the plant on the mid-point of the track rather than moving the GPS around to capture the exact position of the plants.

Extrapolated count - look around

After an observation of the population, a count of individuals in an undefined subset area can be made, and a count then extrapolated for the whole population, allowing for density variation. Slightly more reliable than an Estimate, this offers more information than presence/absence.

Estimate

An estimate is an approximate idea of plant numbers based on a superficial observation. Estimates are often undertaken in classes (such as none, less than 10, tens, hundreds, thousands). This method has low reliability, but offers more information than just presence/absence, and can be used to determine larger scale changes in plant numbers.

This technique may be utilised particularly by consultants or others reporting on Threatened or Priority Flora in the course of other tasks, as the time required to complete a more thorough count may not be available. In larger regions like the Goldfields this is considered essential minimum information, as the distances involved inhibit re-survey by the conservation staff.

Area of population (m²)

This records the area that the population occupies. For a more accurate record, GPS circumnavigation can be undertaken by walking around the boundary of the population and calculating the area using a GPS, or DGPS. Data can then be entered into a GIS program to calculate area. This method usually underestimates the population area as densities on the boundary of populations is usually much sparser than at the centre, so it is likely that the surveyor will inadvertently intrude on the population either by missing some outlying plants or by trying to keep plants in sight. If aerial photography is easily and accurately interpretable, you can use the sections of the traverse that have no plants, to interpret the population boundary.

When undertaking plant counts, consideration of the following may also be required;

- Boundary mapping (see Section 3.3 of manual);
- Extent of population (see Section 3.4 of manual);
- Estimating count errors (see Section 3.4 of manual); and
- Variability (see Section 3.4 of manual).

10 Appendix 4 – Threats and threat agents

The following terms are available in the TPFL database for use. These terms are provided to enhance search ability of data, so a new term should only be created if it does not fit at all within one of the existing terms. Highly specific threats that are distinct from available threats (but are unlikely to be useful for queries) should be captured within these terms wherever possible, with the specific differences recorded in the threat details.

Consideration should also be given to how the information is most usefully interpreted. For example, the weed species listed under Threat agents are not intended to be a comprehensive list of all weeds in WA, but rather a listing of those most likely to be specifically queried for control programming purposes. If it seems unlikely that a control program will be implemented as the weed is uncommon or has low impact, it could be captured as a weed (type), with the specific species and perhaps distribution notes recorded in the details rather than create a new term for that species in the database.

Threats

Altered hydrology	Lack of recruitment
Altered surface drainage - accumulating	Senescence
Altered surface drainage - draining	Low seed production
Disruption physico-chemical stratification	Low germination of seedlings
Groundwater decline	High mortality of seedlings
Groundwater rise	Displacement/predation of pollinators/dispersers
Sea water incursion	Land management activities
Waterlogging	New construction/upgrade
Surface changes affecting food supply	Maintenance- clearing/slashing/herbicide
Altered water quality	Maintenance- impacts on drainage
Salinisation of water	Track/firebreak maintenance
Nutrient enrichment of water	Fence construction/maintenance
Acidification of water	Intentional burns and fire management
Alkalisiation of water	Recreation infrastructure
Contamination of water	Loss of ecosystem integrity
Altered soil chemistry	Loss of key fauna species
Salinisation of soil	Loss of key flora species
Nutrient enrichment of soil	Breakdown of key processes
Acidification of soil	Displacement/predation of TEC component
Alkalisiation of soil	Decreased water infiltration
Contamination of soil	Loss of essential fungi
Climate change	Loss of soil microfauna
Drying climate	Fragmentation
Altered seasonality in rainfall	Fragmentation within vegetated area
Increasing temperature	Landscape fragmentation
Climate changes increasing disease risk	Loss of gene flow
Disease	Edge effect – large edge to area ratio
Plant death	Population structure
Lowered reproduction	Very small population/s
Loss of habitat	Very few population/s
Disease spread	Very restricted range
Erosion/sedimentation	All plants immature
Erosion	All plants senescent
Loss of topsoil	Resource extraction
Surface subsidence	Flower cutting
Siltation	Vegetation cutting
Inappropriate fire regimes	Logging (past or present)
Fire in inappropriate season	Firewood collection
Too frequent fire	Dewatering
Too infrequent fire	Disturbance from exploration
Too high intensity fire	Dust causing vegetation damage
Too low intensity fire	Gravel/sand extraction
Flora impacts	Water quality impacts
Native flora competition	Clearing
Weed competition	Complete vegetation clearing
Weed invasion	Overstorey removal/reduction
Habitat incursion	Understorey removal/reduction
Soil disturbance (trampling)	
Track creation	
Grazing	
Vegetation damage	
Water column disturbance (turbidity)	

Threat Agents

Hydrology	Native flora
Cave diving	Weed
Groundwater extraction	Grass weed
Groundwater drainage	African lovegrass
Decreased recharge	Couch
Increased recharge	Kikuyu
Water movement	Perennial veldt grass
Groundwater rise	Annual veldt grass
Inflows	Oat
Stormwater runoff	Bulb/corm/tuber weed
Pathogen	Arum lily
Fungus/canker	Bridal creeper
Phytophthora spp.	Freesia
Armillaria luteobubalina	Sparaxis
Aerial canker	Watsonia
Human movement	Herb weed
On-road traffic	Capeweed
Off-road vehicle (car)	Geraldton carnation weed
Off-road motorbike	Onion weed
Pedestrian, mountain bike	Ruby dock
Boat	Aquatic/wetland weed
Maintenance equipment	Bulrush/Typha
Dumped garden refuse	Water hyacinth
Dumped rubbish	Woody weed
Fire protection measures	Blackberry
Resource harvestors	Date palm
Licensed collectors	Pine
Unlicensed collectors	Tagasaste
Natural force	Victorian teatree
Water	Land managers
Wind	Road manager
Fauna (vert & invert)	Main Roads WA
Native fauna	Shire/LGA
Introduced fauna	Rail manager
Stock	Water utility
Kangaroo	Gas utility
Pig	Power utility
Goat	Phone utility
Rabbit	DBCA
Horse	FPC
Camel	Private land manager (non-commercial)
Deer	Agricultural enterprise
Cattle	Development enterprise
Sheep	Mining enterprise
Bird	
Invertebrate	
Fish	
Cane toad	

These are some examples of detailed threat information as it could be recorded.

Threat type and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Refer to field manual for list of threats. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Rate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
<ul style="list-style-type: none"> Fire (Response...) Plant was burnt in the spring of 2008. Seedling production is profuse but there is no noticeable resprout or epicomic growth behaviour. Seedlings are concentrated in the area of existing population indicating dispersal is not far from adult plant. All adult plants have been removed and habitat is open as fire intensity was high leaving only the seedling cohort. Seedlings are on average 10cm in height. 	<u>L</u>	<u>H</u>	<u>M</u>
Jarrah Dieback There are symptoms of Jarrah Dieback in the vicinity of the population. Currently the plant appears unaffected although a potential front is approx 20m upslope. It is possible the infestation has not invaded the area of the plant root system Species being affected: <i>Banksia grandis</i> , <i>Pododcapus drouyniana</i> , <i>Patersonia sp</i> , <i>Bossiaea ornate</i> , <i>Persoonia longifolia</i>	<u>N</u>	<u>H</u>	<u>S</u>
<ul style="list-style-type: none"> Feral Animals There are obvious signs of pig activity in the area through scats and diggings. Soil is being disturbed around the root system and there is a high possibility that soil is being pushed downslope advancing the Phytophthora front. Rabbit droppings were also noticed but there is no sign of grazing on the plants 	<u>H</u>	<u>H</u>	<u>S</u>
Weeds There is a blackberry infestation approx 15m upstream of approx 20x10m in area.	<u>L</u>	<u>E</u>	<u>S</u>
<ul style="list-style-type: none"> Hydrological (Drought, Salinity...) Drought deaths are occurring in plants on the upper banks of the swamp systems which are drying out. In some plants there are signs of drought stress but they are still alive. The full sum of deaths constitute less than 1% of the population which is estimated to be approx 500 plants. 	<u>L</u>	<u>L</u>	<u>L</u>
Insect attack There is a larvae which is burrowing up through the pith of the stems via entry through the upper apicals. It is yellow and approx 2cm long. The tips of the plants above the entry point are dying but the plant remains healthy. At this stage its effect on the population is not significant. A specimen of the grub was taken.	<u>L</u>	<u>?</u>	<u>?</u>
Other (illegal clearing, fragmentation etc) A machine has undertaken roadworks involving drain clearing and slashing. Population has been impacted on with unknown number of plants taken. The DRF markers are in place and visible. It was determined that the population is actually a sub-population of population 1 as it is within 100m and no tenure change or physical barrier exists between the populations.	<u>M</u>	<u>?</u>	<u>S</u>

11 Appendix 5 – Landform

The following terms are available in the TPFL database for use. They are also being used by the Threatened and Priority Fauna database and Report Form and the TEC Occurrence Report Form.

The terms listed below in **bold** text represent ‘umbrella’ terms that can be used to encompass the terms listed below it. These terms generally follow the morphological types as listed in McDonald *et al.* (1998, p13). The ‘umbrella’ terms are the only ones listed individually on the Threatened and Priority Flora Report Form (TPRF) due to space considerations. However, a line exists on the TPRF for the more accurate terms to be specified if the user is familiar with them. The more accurate terms do convey more information about the landform, and so are preferred when time and expertise allow. The terms are listed in this document in the same order as they appear on the TPRF.

Two references were the main source for the standard definitions of these landform terms, and these are cited where relevant. These were the Australian Soil and Land Survey Field Handbook (McDonald *et al.* 1998) and Wetlands of the Swan Coastal Plain – Wetland Mapping, Classification and Evaluation - Vol 2a (Hill *et al.* 1996). Both were endorsed as the source of landform terms by this project’s Reference Group. A few terms left undefined by those texts have been retained for use by request (eg claypan), and definitions for these have been sought elsewhere.

Some example landform profiles are given below in Figure 1. As stated in that Figure, note that the boundary between crest and slope elements is at the end of the curvature of the crest. Each slope element is treated as if it were straight. A simple slope has a relatively even gradient from top to bottom. If the slope gradient changes significantly, it is divided into upper, mid- and lower slope as appropriate.

Please note that wetlands have been listed under the landform type that they occur in, as detailed in Table 1. Each landform term can only be listed under one umbrella term. Their landform type was chosen as the umbrella in order to accommodate varying water longevity. That is, the landscape will be the same whether or not it is wet at the time of observation.

Table 1 indicates the wetland types described by Hill *et al.* on the basis of water permanence and landform. (Adapted from Hill *et al.* 1996, p37)

	LANDFORM				
WATER LONGEVITY	BASIN (Closed Depression)	CHANNEL (Open Depression)	FLAT	SLOPE	HIGHLAND (Hill)
Permanent inundation	lake	river	-	-	-
Seasonal inundation	sumpland	creek	floodplain	-	-
Intermittent inundation	playa	wadi	barlkarra	-	-
Seasonal waterlogging	dampland	trough	palusplain	paluslope	palusmont

Landform Terms

Crest: “landform element that stands above all, or almost all points in the adjacent terrain.”
(McDonald *et al.* 1998, p13)

Hill crest: “very gently inclined to steep crest, smoothly convex, eroded mainly by creep and sheet wash. A typical element of mountains, hills, low hills and rises.” (McDonald *et al.* 1998, p31)

Dune crest: “crest built up or eroded by the wind (see also *Dune*).” (McDonald *et al.* 1998, p30)

Note: *Dune* is listed under **Ridge**.

Summit surface: “very wide level to gently inclined crest with abrupt margins, commonly eroded by water-aided mass movement or sheet wash.” (McDonald *et al.* 1998, p33) Note: a ‘plateau’ would fall within this type of landform.

Mesa: “(Spanish: “table”), flat-topped tableland with one or more steep sides, ... formed by erosion; during denudation, or downcutting and stripping, areas of harder rock in a plateau act as flat protective caps for portions of underlying land situated between such places as

[stream valleys](#), where erosion is especially active. This results in a [table mountain](#) (mesa) or fortress hill ([butte](#))." (Britannica Online Encyclopedia, accessed March 2009. <http://www.britannica.com/EBchecked/topic/376530/mesa>)

Hill: "compound landform element comprising a narrow crest and short adjoining slopes, the crest length being less than the width of the landform element." (McDonald *et al.* 1998, p18)

Note: if plants are limited to the crest of the landform element, a term from the 'Crest' list should be chosen. If the plants extend also onto the short adjoining slopes, a term from the 'Ridge' or 'Hill' lists (as appropriate) should be chosen.

Tor: "steep to precipitous hillock, typically convex, with a surface mainly of bare rock, either coherent or comprising subangular to rounded large boulders (exhumed core-stones, also themselves called tors) separated by open fissures; eroded by sheet wash or water-aided mass movement." (McDonald *et al.* 1998, p34)

Palusmont: "seasonally waterlogged highlands and hills. (After Latin *palus* = marshy, and *montanus* = mountain; hence the term refers to hills and highlands that are seasonal wetlands)." (Hill *et al.* 1996)

Ridge: "compound landform element comprising a narrow crest and short adjoining slopes, the crest length being greater than the width of the landform element." (McDonald *et al.* 1998, p19)

Note: if plants are limited to the crest of the landform element, a term from the 'Crest' list should be chosen. If the plants extend also onto the short adjoining slopes, a term from the 'Ridge' or 'Hill' lists (as appropriate) should be chosen.

Breakaway: "steep maximal mid-slope or upper slope, generally comprising both a very short scarp (free face) that is often bare rockland, and a stony scarp-foot slope (debris slope); often standing above a pediment." (McDonald *et al.* 1998, p25)

Dune: "moderately inclined to very steep ridge or hillock built up by the wind. This element may comprise *Dunecrest* and *Duneslope*." (McDonald *et al.* 1998, p30) Note: *Dune crest* is listed under **Crest**. See *Swale* for the depression between dunes.

Embankment: "ridge or slope built up by human activity." (McDonald *et al.* 1998, p30)

Saddle: "point between two areas of higher elevation", named for the way "the surface resembles a saddle that curves up in one direction, and curves down in a different direction". (Wikipedia, accessed March 2009. http://en.wikipedia.org/wiki/Mountain_pass - 'saddle' listed as alternative name).

Outcrop: "refers to any exposed area of rock that is inferred to be continuous with underlying bedrock." (McDonald *et al.* 1998, p101)

Outcrop – on Crest: exposed area of rock inferred to be continuous with underlying bedrock, occurring on a *Crest*.

Outcrop – on Slope: exposed area of rock inferred to be continuous with underlying bedrock, occurring on a *Slope*.

Outcrop – on Ridge: exposed area of rock inferred to be continuous with underlying bedrock, occurring on a *Ridge*.

Outcrop – on Flat: exposed area of rock inferred to be continuous with underlying bedrock, occurring on a *Flat*.

Gnamma hole: "small holes of varying shape, diameter and depth, found in hard granite outcrops and in the decomposed granite of a breakaway, which can and usually does hold water." (Geoscience Australia, accessed March 2009.

http://www.ga.gov.au/mapspeccs/topographic/v5/appendixA_files/Waterbodies.jsp#Waterbodies%20Gnamma%20Hole%20Point)

Slope: "planar landform element that is neither a crest nor a depression and has an inclination greater than about 1%." (McDonald *et al.* 1998, p15)

Note: the following five definitions (in *italicised text*) and the note on class of slope combine to indicate which one of the available slope terms (listed below the definitions in normal text) applies

best. Please see Figure 1 for example profiles illustrating each of these slope elements. Remember that each slope element is treated as if it were straight. A simple slope has a relatively even gradient from top to bottom. If the slope gradient changes significantly, it is divided into upper, mid- and lower slope as appropriate.

Hillslope: “gently inclined to precipitous slope, commonly simple and maximal, eroded by sheet wash, creep, or water-aided mass movement. A typical element of mountains, hills, low hills and rises.” (McDonald et al. 1998, p31)

Simple slope: “slope element adjacent below a crest or flat and adjacent above a flat or depression.” (McDonald et al. 1998, p15)

Upper slope: “slope element adjacent below a crest or flat but not adjacent above a flat or depression.” (McDonald et al. 1998, p15)

Mid-slope: “slope element not adjacent below a crest or flat and not adjacent above a flat or depression.” (McDonald et al. 1998, p15)

Lower slope: “slope element not adjacent below a crest or flat but adjacent above a flat or depression.” (McDonald et al. 1998, p15)

Gentle/Steep: (Note: measuring the exact degree of a slope will not significantly assist management of flora and it not expected that people reporting on Threatened and Priority Flora will do so. However, this figure represents an approximate guide for those that would like one for background knowledge). McDonald et al. (1998, p12) suggest 40% tangent or 23° as an average figure for ‘steep’ slopes, applied over an observation span of no less than 20m. We could consider a slope of less than that grade as ‘gentle’, and more than that, ‘steep’.

Upper slope gentle

Upper slope steep

Mid-slope gentle

Mid-slope steep

Lower slope gentle

Lower slope steep

Cliff: “very wide cliffed (greater than 72°) maximal slope usually eroded by gravitational fall as a result of erosion of the base by various agencies; sometimes built up by marine organisms (cf. *Scarp*)”. (McDonald et al. 1998, p25) Note: *Scarp* is defined in Glossary.

Paluslope: “seasonally waterlogged slope. (After Latin *palus* meaning marshy; the term refers to slopes which are similar in wetness to dampland basins, ie wetland slopes).” (Hill et al. 1996)

Flat: “planar landform element that is neither a crest nor a depression and is level or very gently inclined (less than 3% tangent approximately).” (McDonald et al. 1998, p18)

Plain: “large very gently inclined or level element, of unspecified geomorphological agent or mode of activity.” (McDonald et al. 1998, p32)

Valley flat: “small, gently inclined to level flat, aggraded or sometimes eroded by channelled or over-bank stream flow, typically enclosed by hillslopes” (McDonald et al. 1998, p34)

Scald: “flat, bare of vegetation, from which soil has been eroded or excavated by surface wash or wind.” (McDonald et al. 1998, p32)

Claypan: “a dense, compact, slowly permeable layer in the [subsoil](#) having a much higher [clay](#) content than the overlying material, from which it is separated by a sharply defined boundary. Claypans are usually hard when dry, and plastic and sticky when wet. They limit or slow the downward movement of [water](#) through the [soil](#). (Wikipedia, accessed March 2009. <http://en.wikipedia.org/wiki/Claypan>)

Floodplain: “seasonally inundated flat.” (Hill et al. 1996)

Barlkarra: “intermittently flooded flat. (North-west Australian aboriginal word referring to grassy flats/plains that are flooded from time to time).” (Hill et al. 1996)

Palusplain (Winter-wet flat): “seasonally waterlogged flat. (After Latin *palus* meaning marshy; the term refers to flats which are similar in wetness to dampland basins).” (Hill et al. 1996)

Depression - open (valley): “Depression - landform element that stands below all, or almost all points in the adjacent terrain. An open depression extends at the same elevation, or lower, beyond the locality where it is observed” (McDonald et al. 1998, p15)

Gorge: “deep and narrow, steep-sided, usually rocky river valley.” (Geoscience Australia,

accessed March 2009.

http://www.ga.gov.au/mapspeccs/250k100k/appendixA_files/Framework.jsp#Framework%20Gorge%20Point).

Gully: "open depression with short precipitous walls and moderately inclined to very gently inclined floor or small stream channel, eroded by channelled stream flow and consequent collapse and water-aided mass movement." (McDonald *et al.* 1998, p31)

"A gully is a channel more than 0.3m deep." (McDonald *et al.* 1998, p95) [A rill is a channel up to 0.3m deep].

Swale: "(i) linear, level-floored open depression excavated by wind, or left relict between ridges built up by wind or waves, or built up to a lesser height than them;

(ii) long, curved open or closed depression left relict between *scrolls* built up by channelled stream flow." (McDonald *et al.* 1998, p33) Note: *scrolls* defined in Glossary.

River: "permanently inundated channel of variable size and shape. (Established term, from Latin *rivus*, a stream." (Hill *et al.* 1996)

Riverbank (Bank, stream bank): "very short, very wide slope, moderately inclined to precipitous, forming the marginal upper parts of a *stream channel* and resulting from erosion or aggradation by channelled stream flow." (McDonald *et al.* 1998, p25)

Creek: "seasonally inundated channel of variable size and shape." (Hill *et al.* 1996)

Wadi: "intermittently flooded channel of variable size and shape. (Arabic term referring to drainage channels in desert environments that flash flood during the occasional storm)." (Hill *et al.* 1996)

Trough: "seasonally waterlogged channel of variable size and shape." (Hill *et al.* 1996)

Estuary: "*stream channel* close to its junction with a sea or lake, where the action of channelled stream flow is modified by tides and waves. The width typically increases downstream." (McDonald *et al.* 1998, p30)

Stream channel: "linear, generally sinuous open depression, in parts eroded, excavated, built up and aggraded by channelled stream flow. This element comprises *stream bed* and *banks*." (McDonald *et al.* 1998, p33) Note: *stream bed* defined in Glossary.

Swamp (open): "almost level closed, or almost closed depression with a seasonal or permanent water table at or above the surface, commonly aggraded by overbank stream flow and sometimes biological (peat) accumulation." (McDonald *et al.* 1998, p33)

Drainageline: a subset of wetlands, generally associated with open depressions.

Note: this is a general term, included for people who are unable to be more specific, but wish to record some habitat details.

Depression – closed: "Depression - landform element that stands below all, or almost all points in the adjacent terrain. A closed depression stands below all such points"

(McDonald *et al.* 1998, p15)

Pit: "closed depression excavated by human activity." (McDonald *et al.* 1998, p32)

Lagoon: "closed depression filled with water that is typically salt or brackish, bounded at least in part by forms aggraded or built up by waves or reef-building organisms." (McDonald *et al.* 1998, p31)

Lake: 1) "permanently inundated basin of variable size and shape. (Established term, from *lacus*, a hollow)." (Hill *et al.* 1996)

2) "large water-filled closed depression." (McDonald *et al.* 1998, p31)

Lakebed: the substrate at the bottom or edges of a lake.

Sumpland (swamp): "seasonally inundated basin of variable size and shape. (After 'sump' meaning site of water retention, ponding or accumulation. The term is fortuitously similar to 'sumpf' the German term for swamp)." (Hill *et al.* 1996)

Playa: 1) "large, shallow, level-floored closed depression, intermittently water-filled, but mainly dry due to evaporation, bounded as a rule by flats aggraded by sheet flow and channelled stream flow." (McDonald *et al.* 1998, p32)

2) "intermittently flooded basin of variable size and shape. (Established term referring to intermittently flooded basin; usually in arid environments such basins are 'salt lakes')." (Hill *et al.* 1996)

Swamp (closed): "almost level closed, or almost closed depression with a seasonal or permanent water table at or above the surface, commonly aggraded by overbank stream flow and sometimes biological (peat) accumulation." (McDonald *et al.* 1998, p33)

Dampland: "seasonally waterlogged basin of variable size and shape. (After 'damp' meaning

moist or wet. Thus it refers to a dampness or waterlogging of soils of some basin wetlands)." (Hill *et al.* 1996)

Wetland: "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh or saline, eg waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries." (Wetlands Advisory Committee 1977; cited in Hill *et al.* 1996, Glossary).

Note: this is a general term, included for people who are unable to be more specific, but wish to record some habitat details.

Cave: "A natural cavity in rock, large enough for a human to enter. The extent of a cave system which may have more than one entrance and consist of many chambers and passages. The term still applies if the cavity is totally filled with water. If the cavity is filled with sediment or ice, (making it impenetrable), then qualification of the term is required." (G.K. Smith, accessed March 2009. <http://wasq.iinet.net.au/glossary.html>)

Figure 1 illustrates example landform profiles. (Extracted from McDonald *et al.* 1998, p14).

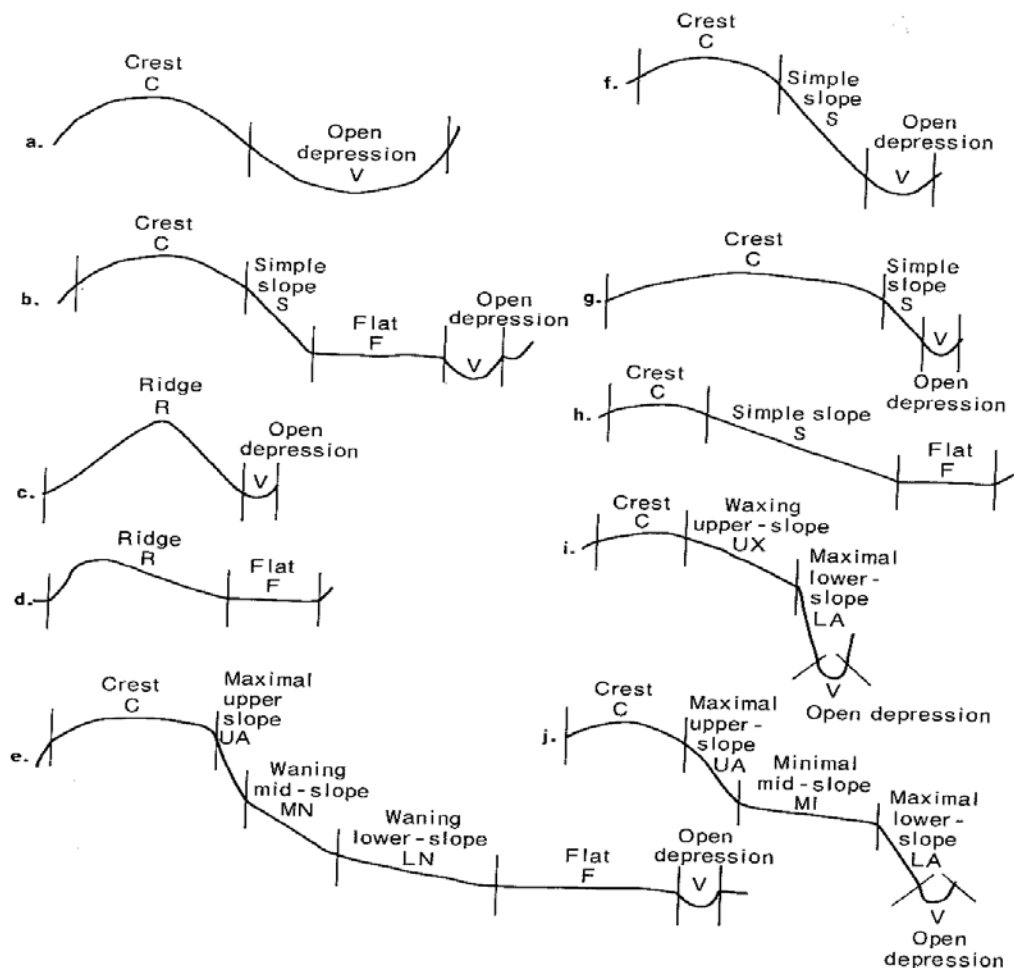


Figure 1 Examples of profiles across terrain divided into morphological types of landform element. Note that the boundary between crest and slope elements is at the end of the curvature of the crest. Each slope element is treated as if it were straight.

GLOSSARY

Aggradation: “the presence of material deposited on a pre-existing surface as a result of wind and/or water erosion.” (McDonald *et al.* 1998, p96)

Bar (stream bar): “elongated , gently to moderately inclined low ridge built up by channelled stream flow; part of a *stream bed*.” (McDonald *et al.* 1998, p25)

Erosion: ‘removal of surface soil from an area by various agents, including wind, water (sheet wash, high stream flow, wave action) or mass movement.’ (McDonald *et al.* 1998, pp92-96)

NB: concerned with recording accelerated erosion (follows the destruction or loss of protective cover often resulting from man’s influence on the soil, vegetation or landform) rather than natural or geologic erosion (type and rate of movement of land surface material in its undisturbed natural environment). (McDonald *et al.* 1998, p92)

Inundation: “includes flooding from over-bank flow, inundation from local runoff and overland flow.” (McDonald *et al.* 1998, p96)

Scarp: “very wide steep to precipitous maximal slope eroded by gravity, water-aided mass movement or sheet flow (*cf. Cliff*).” (McDonald *et al.* 1998, p32)

Scroll: “long, curved very low ridge built up by channelled stream flow and left relict by channel migration.” (McDonald *et al.* 1998, p33)

Stream bed: “linear, generally sinuous open depression forming the bottom of a *stream channel* eroded and locally excavated, aggraded or built up by channelled stream flow. Parts that are built up include *bars*.” (McDonald *et al.* 1998, p33)

REFERENCES

Hill, A.L., Semeniuk, C.A., Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain – Wetland Mapping, Classification and Evaluation - Vol 2a*. Water and Rivers Commission and Department of Environmental Protection, Western Australia.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, and J., Hopkins, M.S. (1998) *Australian Soil and Land Survey – Field Handbook, Second Edition*. CSIRO, Canberra, Australia.

Geoscience Australia (Accessed March 2009) *National Topographic Databases Structure and Specifications (250K and 100K): Appendix A - Feature Type Dictionary*. Geoscience Australia, Australian Government. http://www.ga.gov.au/mapspeccs/250k100k/appendix_a.jsp

Smith G.K. (Accessed March 2009) *Glossary of Caving Terms*. Western Australian Speleological Group. <http://wasg.iinet.net.au/glossary.html>

12 Appendix 6 – Rock type

The following terms are available in the TPFL database for use. If you wish to record a rocktype not present in this list, please specify.

Banded ironstone
Basalt
Calcrete
Chert
Dolerite
Gneiss
Granite
Greenstone
Gypsum
Ironstone
Laterite
Limestone
None
Quartz
Quartzite
Sandstone
Schist
Shale
Siltstone
Slate
Spongelite
Unknown

13 Appendix 7 – Soil Type

The following terms are available in the TPFL database for use. The definitions provided are of the behaviour of the moist bolus as detailed in the Australian Soil and Land Survey Field Handbook (McDonald *et al.* 1998). Some additional terms are provided following Carlile *et al.* (2001 - CSIRO Technical Report), plus peat and gypsum from user request.

Sand: “Coherence nil to very slight, cannot be moulded; sand grains of medium size; single sand grains adhere to fingers.” (McDonald *et al.* 1998, p118)

Loamy sand: “Slight coherence; sand grains of medium size; can be sheared between thumb and forefinger to give minimal ribbon of about 5mm.” (McDonald *et al.* 1998, p118)

Clayey sand: “Slight coherence; sand grains of medium size; sticky when wet; many sand grains stick to fingers; will form minimal ribbon of 5-15mm; discolours fingers with clay stain.” (McDonald *et al.* 1998, p118)

Sandy loam: “Bolus coherent but very sandy to touch; will form ribbon of 15-25mm; dominant sand grains are of medium size and are readily visible.” (McDonald *et al.* 1998, p119)

Fine sandy loam: Bolus coherent and fine sand can be felt and often heard when manipulated; sand grains clearly evident under a x10 hand lens. (McDonald *et al.* 1998, p119-120)

Loam: “Bolus coherent and rather spongy; smooth feel when manipulated but with no obvious sandiness or ‘silkeness’; may be somewhat greasy to the touch if much organic matter present; will form ribbon of about 25mm.” (McDonald *et al.* 1998, p119)

Silty loam: “Coherent bolus; very smooth to often silky when manipulated; will form ribbon of about 25mm.” (McDonald *et al.* 1998, p119)

Sandy clay loam: “Strongly coherent bolus, sandy to touch; medium size sand grains visible in finer matrix; will form ribbon of 25-40mm.” (McDonald *et al.* 1998, p119)

Clay loam: “Coherent plastic bolus, smooth to manipulate; will form ribbon of 40-50mm.” (McDonald *et al.* 1998, p119)

Fine sandy clay loam: “Coherent plastic bolus; medium size sand grains visible in finer matrix; will form ribbon of 40-50mm.” (McDonald *et al.* 1998, p119)

Silty clay loam: “Coherent smooth bolus, plastic and often silky to the touch; will form ribbon of 40-50mm.” (McDonald *et al.* 1998, p119)

Light clay: “Plastic bolus; smooth to touch; slight resistance to shearing between thumb and forefinger; will form ribbon of 50-75mm.” (McDonald *et al.* 1998, p119)

Sandy clay: Plastic bolus; sandy to touch.

Silty clay: Plastic bolus; silky to touch.

Clay: (Parent term incorporating the medium-heavy clays)

Light medium clay: “Plastic bolus; smooth to touch; slight to moderate resistance to ribboning shear; will form ribbon of about 75mm.” (McDonald *et al.* 1998, p119)

Medium clay: “Smooth plastic bolus; handles like plasticine and can be moulded into rods without fracture; has moderate resistance to ribboning shear; will form ribbon of 75mm or more.” (McDonald *et al.* 1998, p120)

Medium heavy clay: “Smooth plastic bolus; handles like plasticine; can be moulded into rods without fracture; has moderate to firm resistance to ribboning shear; will form ribbon of 75mm or more.” (McDonald *et al.* 1998, p120)

Heavy clay: “Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; has firm resistance to ribboning shear; will form ribbon of 75mm or more.” (McDonald *et al.* 1998, p120)

Peat: An accumulation of partially decayed organic matter, inhibited from decaying fully by acidic and anaerobic conditions. Forms in wetlands.

Gypsum: Although gypsum is a mineral component of soil rather than a soil type like the others, it has such a distinctive effect on soil behaviour that it is also listed. It is flocculent and a key component of plaster of paris – when dry it is like fine powder, and when wet it is like goo. It is generally found as dunes or flats near the edges of salt lakes in lower rainfall areas, and the soil profile is generally clayey at depth. Gypsum locks up nutrient in the soil, inhibiting plant uptake. Good condition gypsum soils often have a blue-green algal layer on top that holds together the surface of the soil, and provides some nitrogen. Gypsum soils support a distinctive suite of species, as relatively few flora species have the ability to survive in those conditions. (Pers. comm. G. Keighery 2008)

14 Appendix 8 – Soil Colour

The following terms are available in the TPFL database for use.

Red

Pink

Red-orange

Red-brown

Orange

Yellow

Yellow-orange

Yellow-brown

Brown

Brown-black

Black

Red-black

Grey

Grey-black

Cream

White

15 Appendix 9 – Vegetation structure

Broad Floristic Formations. Refer to Field Survey for Vegetation Classification' in the 2009 *Australian Soil and Land Survey Field Handbook* (the 'Yellow book')

Cover Characteristics									
	Foliage cover	100 - 70	70 - 30	30 - 10	<10	=0	0-5		
	Crown Cover (%)	>80	80 - 50	50 - 20	20 - 0.25	<0.25	0-5		
	Cover code	D	O	S	V	I	L		
Level III, Broad Floristic, Code	Broad Floristic Group of dominant stratum	Height Ranges (m)	Broad Floristic Formation Classes (in each class name, replace the 'X' with the particular taxonomic name from either the dominant genus or genus groups making up the dominant stratum; not all classes require a separate taxonomic name, e.g. <i>mallee woodland</i>); in other cases the 'X' name is optional, e.g. <i>chenopod shrubland</i> versus <i>Atriplex chenopod shrubland</i> or <i>Atriplex shrubland</i>)						
w1.0	Trees: Dominant genus e.g. eucalypt	2->50	Closed X forest	Open X forest	X woodland	Open X woodland	Isolated X trees	Isolated clumps of X trees	X trees
w1.1	Trees: Rainforest	2->50	Closed X forest	Open X forest	X woodland	Open X woodland	Isolated X trees	Isolated clumps of X trees	X trees
w1.2	Trees: Planted/cultivated non-food (plantation, timber, cellulose, oil, Christmas trees, urban etc.)	2->50	Closed X forest	Open X forest	X woodland	Open X woodland	Isolated X trees	Isolated clumps of X trees	X trees
w1.3	Trees: Planted/cultivated food (fruits, nuts, horticulture)	2->50	Closed X forest	Open X forest	X woodland	Open X woodland	Isolated X trees	Isolated clumps of X trees	X trees
w1.4	Trees: Planted/cultivated (landscaped/urban/suburban/rural, suburban gardens, nurseries)	2->50	Closed X forest	Open X forest	X woodland	Open X woodland	Isolated X trees	Isolated clumps of X trees	X trees
w2.0	Woody plant (indeterminate tree or shrub)	0.1-10	Closed X woody plants	Open X woody plants	X woody plants	Open X woody plants	Isolated X woody plants	Isolated clumps of X woody plants	X woody plants
w2.1	Mallee (tree or shrub)	0.1-30	Closed X-mallee	Open X-mallee	X-mallee	Open X-mallee	Isolated X-mallee	Isolated clumps of X-mallee	X-mallee
w3.0	Shrub: (conifer, dicot, cycad, grass-tree, tree-fern etc)	<20	Closed X shrubland	X shrubland	Open X shrubland	Sparse X shrubland	Isolated X shrubs	Isolated clumps of X shrubs	X shrubs
w3.1	Heath shrub	<3	Closed X-heathland	X-heathland	Open X-heathland	Sparse X-heathland	Isolated X-heath shrubs	Isolated clumps of X-heath shrubs	X-heath shrubs
w3.2	Chenopod shrub	<3	Closed X chenopod shrubland	X chenopod shrubland	Open X chenopod shrubland	Sparse X chenopod shrubland	Isolated X chenopod shrubs	Isolated clumps of X chenopod shrubs	X chenopod shrubs
w3.3	Samphire shrub	<3	Closed X samphire shrubland	X samphire shrubland	Open X samphire shrubland	Sparse X samphire shrubland	Isolated X samphire shrubs	Isolated clumps of X samphire shrubs	X samphire shrubs
g1.0	Hummock grass	<2	Closed X hummock grassland	X hummock grassland	Open X hummock grassland	Sparse X hummock grassland	Isolated X hummock grasses	Isolated clumps of X hummock grasses	X hummock grasses
g2.0	Tussock grass	<3	Closed X tussock grassland	X tussock grassland	Open X tussock grassland	Sparse X tussock grassland	Isolated X tussock grasses	Isolated clumps of X tussock grasses	X tussock grasses
g3.0	Other grass	<3	Closed X grassland	X grassland	Open X grassland	Sparse X grassland	Isolated X grasses	Isolated clumps of X grasses	other X grasses
g4.0	Sedge	<3	Closed X sedgeland	X sedgeland	Open X sedgeland	Sparse X sedgeland	Isolated X sedges	Isolated clumps of X sedges	X sedges
g5.0	Rush	<3	Closed X rushland	X rushland	Open X rushland	Sparse X rushland	Isolated X rushes	Isolated clumps of X rushes	X rushes
h1.0	forb	<2	Closed X forbland	X forbland	Open X forbland	Sparse X forbland	Isolated X forbs	Isolated clumps of X forbs	X forbs
f1.0	Fern (excluding tree ferns)	<2	Closed X fernland	X fernland	Open X fernland	Sparse X fernland	Isolated X ferns	Isolated clumps of X ferns	X ferns
m1.0	Bryophyte	<2	Closed X bryophyteland	X bryophyteland	Open X bryophyteland	Sparse X bryophyteland	Isolated X bryophytes	Isolated clumps of X bryophytes	X bryophytes
l1.0	Lichen	<5	Closed X lichenland	X lichenland	Open X lichenland	Sparse X lichenland	Isolated X lichens	Isolated clumps of X lichens	X lichens
c1.0	Surface crusts (dwarf mosses, lichens, liverworts, algae)	< 0.05	Closed X crusts	X crusts	Open X crust	Sparse X crusts	Isolated X crusts	Isolated clumps of X crusts	X crusts
v1.0	Vine	0.5->30	Closed X vineland	X vineland	Open X vineland	Sparse X vineland	Isolated X vines	Isolated clumps of X vines	X vines
a1.0	Aquatic non-woody, (fresh or brackish, submerged, floating or emergent)	<2	Closed X aquatic bed	X aquatic bed	Open X aquatic bed	Sparse X aquatics	Isolated X aquatics	Isolated clumps of X aquatics	X aquatics
a2.0	Seagrass (marine)	<2	Closed X seagrass bed	X seagrass bed	Open X seagrass bed	Sparse X seagrass bed	Isolated X seagrass bed	Isolated clumps of X seagrass bed	X seagrass bed
a3.0	Algae (fresh or brackish)	Record thickness of layer	Closed X algae	X algae	Open X algae	Sparse X algae	Isolated X algae	Isolated X clumps of algae	X algae
a4.0	Algae (marine)	< 30m	Closed X marine algae	Marine X algae	Open marine X algae	Sparse X marine algae	Isolated X marine algae	Isolated X marine algae	X marine algae
b1.0	Bare surface (rock, salt pan, beach, dune, eroded soil, un-vegetated water surface)	0	Closed bare X	Bare X	Open bare X	Sparse bare X	Isolated bare X	Isolated bare X patches	Bare X

16 Appendix 10 – Management actions

The following terms are available in the TPFL database for use.

- Weed control
- Feral animal control
- Disease hygiene
- Disease control
- Fencing
- DRF markers
- Access management
- Improve security of tenure
- Hand pollination
- Stimulate germination
- Seed/cutting collection
- Habitat rehabilitation
- Survey potential habitat
- Research - specific questions
- Monitoring - specific needs
- Translocation
- Fire management
- Drainage management
- Promotion of species to public
- Mapping
- Other infrastructure

17 Appendix 11 - Example of completed TPRF



Department of
Parks and Wildlife



Threatened and Priority Flora Report Form

Version 1.2 August 2013

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DPaW website at <http://dpaw.wa.gov.au/> under Standard Report Forms

TAXON: <i>Banksia bella</i>	TPFL Pop. No.: _____
OBSERVATION DATE: 17/12/2013	CONSERVATION STATUS: P3 New population <input type="checkbox"/>
OBSERVER/S: Jane Smith	PHONE: 9123 4567
ROLE: Conservation Officer	ORGANISATION: DPaw

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place): Northern Nature Reserve, 10km north east of Bindoon, Occurs on south boundary of reserve, 1.2 km from the main access. track off Valley Road, Plants occur Cclose to firebreak and up to 10m in form the track.		Reserve No.: 11223
DPaw DISTRICT: Perth District	LGA: Shire of Toodyay	Land manager present: <input type="checkbox"/>
DATUM: GDA94 / MGA94 <input checked="" type="checkbox"/> AGD84 / AMG84 <input type="checkbox"/> WGS84 <input type="checkbox"/> Unknown <input type="checkbox"/>	COORDINATES: (If UTM coords provided, Zone is also required) DecDegrees <input type="checkbox"/> DegMinSec <input checked="" type="checkbox"/> UTM <input type="checkbox"/> Lat / Northing: 30° 30' 0" Long / Easting: 115° 30' 0" ZONE: _____	METHOD USED: GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/> No. satellites: 4 Boundary polygon captured: <input type="checkbox"/> Map used: _____ Map scale: _____
LAND TENURE: Nature reserve <input checked="" type="checkbox"/> Timber reserve <input type="checkbox"/> Private property <input type="checkbox"/> Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/> National park <input type="checkbox"/> State forest <input type="checkbox"/> Pastoral lease <input type="checkbox"/> MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/> Conservation park <input type="checkbox"/> Water reserve <input type="checkbox"/> UCL <input type="checkbox"/> SLK/Pole _____ to _____ Specify other: _____		

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/>	Area observed (m ²): 60															
EFFORT: Time spent surveying (minutes): 45	No. of minutes spent / 100 m ² : 75															
POP'N COUNT ACCURACY: Actual <input checked="" type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>	Count method: Actual Count <small>(Refer to field manual for list)</small>															
WHAT COUNTED: Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>																
TOTAL POP'N STRUCTURE:	Area of pop (m ²): 10 <small>Note: Pls record count as numbers (not percentages) for database.</small>															
<table border="1"> <thead> <tr> <th></th> <th>Mature:</th> <th>Juveniles:</th> <th>Seedlings:</th> <th>Totals:</th> </tr> </thead> <tbody> <tr> <td>Alive</td> <td>6</td> <td>0</td> <td>1</td> <td>7</td> </tr> <tr> <td>Dead</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table>		Mature:	Juveniles:	Seedlings:	Totals:	Alive	6	0	1	7	Dead	0	0	0	0	
	Mature:	Juveniles:	Seedlings:	Totals:												
Alive	6	0	1	7												
Dead	0	0	0	0												
QUADRATS PRESENT: No. _____ Size _____ Data attached <input type="checkbox"/>	Total area of quadrats (m ²): _____															
Summary Quad. Totals: Alive																
REPRODUCTIVE STATE: Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input checked="" type="checkbox"/> Immature fruit <input type="checkbox"/> Fruit <input type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: 100%																

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information: <small>Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)</small>	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
• Track/firebreak maintenance. Two plants are close to edge of reserve boundary	N	H	S
• Weed competition, Small patch of velt grass withing population	L	H	M
•	---	---	---

Please return completed form to **Species And Communities Branch DPaw,**
Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database



Threatened and Priority Flora Report Form

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>	0-10% <input type="checkbox"/>	Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	30-50% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input checked="" type="checkbox"/>	Quartz <input type="checkbox"/>	50-100% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____		Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element:				
	(Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Open Eucalyptus woodland _____
 2. Acacia shrubland _____
 3. _____
 4. _____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

Hakea scoparia, Melaleuca cordata, Petrophile sp.

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT: _____

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Suitable habitat exists in other areas of the reserve. Recommend surveying these areas in future to if more plants can be found.

DRF PERMIT/ LICENCE No: Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licencing pages on DPaW's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: JS005 WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Jane Smith Role: Cons Officer Signed: _____ Date: 19/12/2013

Please return completed form to **Species And Communities Branch DPaW,**
 Locked Bag 104, BENTLEY DELIVERY CENTRE WA 6983

RECORDS: Please forward to **Flora Administrative Officer,** Species and Communities Branch.

Record entered by: _____ Sheet No.: _____ Record Entered in Database