Department for Environment and Heritage

Guide to the Roadside Vegetation Survey Methodology in South Australia

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GUIDE TO THE ROADSIDE VEGETATION SURVEY METHODOLOGY IN SOUTH AUSTRALIA

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This project was complex and involved input from many members of a multi-disciplinary team. The officer engaged to develop the data collection methodology was Dr Adrian Stokes. Development of the mapping (spatial data) methodology was conducted by Sandy Carruthers and Greg Wilkins, GAR Unit (Planning SA). Oracle database programming was conducted by Anh Lai, Data Support Unit, Planning SA. Lee Heard (Planning SA) and Tim Reynolds (TSA) jointly managed the project and provided important ongoing input to all stages of the development of the methodology. An informal reference group was convened on three occasions to discuss progress of the project. This group comprised the following people: Adrian Stokes, Lee Heard, David Goodwins (Planning SA), Tim Reynolds, Jill Tidemann (TSA), Peter Lang (Department of Environment, Heritage and Aboriginal Affairs (DEHAA)), Tony Robinson (DEHAA), Simon Lewis (DEHAA), Glen Williams (Adelaide Hills Council) and Andrew Crompton (private consultant). The valuable contributions of the following people (in alphabetical order) are also gratefully acknowledged: Tim Croft, Nick Cundell, Mike Hyde, Sandy Kinnear, Robyn Lawrence, Iain Malcolm, Ross Manthorpe, Rob Middleton, Roger Playfair, Karen Parry, Meg Robertson, Gary Saunders, Sally Wheldrake, and all staff in the Enivonmental Unit of TSA. [1]

The project was conducted under the auspices of the Biological Survey Coordinating Committee.

[1] At the time of the original methodology Development staff were located in Planning SA, Tranpsort SA and Department for Environment, Heritage and Aboriginal Affairs. Subsequently the staff in Planning SA have been transferred to Department for Environment and Heritage and there have been name changes to Department for Environment and Heritage and the Transport Services Division – Transport Energy and Infrastructure (DTEI). DEHAA staff involved in the Native Vegetation Act and Regulations have been transferred to the Native Vegetation Section, Department for Water, Land and Biodiversity Conservation (DWLBC).

1. INTRODUCTION

1.1 Background

Native vegetation found in road reserves in South Australia has significant conservation value. It represents important remnants of pre-European settlement vegetation. To minimise impact on this important vegetation, road managers need comprehensive information on the conservation value of roadside vegetation and the locations of sites that are of particularly high importance. Vegetation inventory information, collected using a standard survey methodology, can greatly enhance and support roadside vegetation management planning.

This roadside vegetation survey methodology enables the rapid, systematic collection of data describing vegetation in road reserves. The vegetation characteristics that are recorded have been selected to enable an assessment of the ecological value and conservation significance of the vegetation. These characteristics also provide information necessary for making appropriate roadside management decisions.

A detailed description of the background and developmental process for this methodology for this methodology is provided in Stokes *et al.* (1998b).

1.2 Structure of the Methodology

A full roadside vegetation survey methodology consists of a hierarchy of components that build towards a comprehensive knowledge of the vegetation and its condition. The main components are:

1. A “drive-by” roadside vegetation survey that briefly describes and maps all the vegetation present on selected roadsides. This type of rapid assessment collects data that can be used to determine the ecological significance of different remnants and the extent of weed invasion. Most information is collected while in a vehicle driving along roads.

2. An analysis of the information to assign a category of overall importance, to each vegetation segment. The information is then used to generate management recommendations for the roadside vegetation in the survey area. Combined, the rapid assessment and the analysis produce a comprehensive general overview of the remnant native roadside vegetation, providing the framework for the collection of more detailed botanical information.

3. A detailed botanical survey that re-visits high quality areas (“Reference Sites”) identified during the “drive-by” survey, to collect detailed floristic and structural data describing the vegetation associations identified during the rapid assessment. The methods used during this phase conform to the standard procedures for the Biological Survey of South Australia (Heard & Channon, 1997).

Other follow up components that contribute to a comprehensive inventory of both the fauna and flora may include:

- recording information describing populations of threatened species (for the Threatened Plant Species Population Database);
- recording information describing collections of other significant plant species (for the Opportunistic Sightings Database);
- fauna survey (for the Biological Survey or Opportunistic Sightings Databases);
- other specific studies (e.g. distribution of dieback and mistletoe).

Another component of the methodology involves using the data collected during the “drive-by” assessment to identify sites suitable for other projects. For example, sites containing high quality vegetation with few weeds may be identified as potential sites for intensive management to protect and enhance biodiversity values (e.g. Trees for Life “Bushcare” sites), or wide, unvegetated road reserves linking patches of remnant vegetation may be identified as potential revegetation sites.

This manual describes the standard procedures to conduct a “drive-by” roadside vegetation survey for South Australia, including instructions for pre-survey planning and post-survey procedures. It also provides details of the analysis process.

This survey methodology involves dividing roadsides into relatively homogeneous segments according to the indigenous and non-indigenous vegetation that is present, and its condition (extent of weed invasion). Information is recorded for a number of attributes describing the vegetation, its condition, and disturbances to that vegetation within each segment. Data collected in the field is entered and maintained in the Roadside Vegetation Database (RVD), an Oracle database which is linked to the Geographical Information System (GIS) within the Department for Environment and Heritage. The RVD has been especially designed for data collected using this methodology, and overcomes a number of problems with the collection, entry, storage and maintenance of roadside vegetation data in South Australia. This database is a part of the Environmental Database of South Australia (EDBSA) and is therefore electronically linked to the bulk of the biological survey data in South Australia.

The following expertise is needed to conduct the “drive-by” survey:

- the ability to identify dominant plant species and recognise major alien (weed) species; and
- an understanding of the plant community concept (structural formation and floristic composition).

Instructions for the detailed botanical survey are provided in the “Guide To A Native Vegetation Survey Using The Biological Survey Of South Australia Methodology” (Heard & Channon 1997), available from the BSM Group, Department for Environment and Heritage. For information regarding the Threatened Plant Species Population Database and the Opportunistic Sightings Database, Biological Survey and Research, Biodiversity Branch, DEH.

1.3 Outputs from the Roadside Vegetation Database

1.3.1 Mapping

The primary outputs from the RVD using the GIS are maps displaying the information collected during the “drive-by” assessment (refer to Figure 1 for an example). Every segment defined during the survey can be displayed on a map of the existing road network, with colour-coding used to represent the category for each attribute in each segment.

The GIS used in conjunction with the RVD needs only the start and end point tripmeter (or odometer) readings for each vegetation segment to allow each segment to be spatially displayed (mapped). Each road is defined as a “route” which is then divided into segments according to the tripmeter readings. The vegetation data for each segment is stored in RVD and accessed by Arc/Info for spatial display.

Until now, GIS mapping of roadside vegetation data in South Australia has relied upon labour intensive entry and editing, with every vegetation segment requiring individual attention to complete the spatial layer. This new approach, significantly reduces the time and cost of this component from roadside vegetation surveys, and thereby reduces the time and resources required.

All data collected during the “drive-by” survey, the results of analyses performed in Oracle and Arc/Info, and specified combinations of any attributes and/or analysis results can be displayed on maps. This provides a valuable planning tool, in that users can request a map showing all segments that meet certain criteria. For example, a map could be produced showing all segments of roadside vegetation that were wider than 6m and that contained grassland dominated by indigenous species.

This methodology also allows the data and analysis results to be extracted and loaded onto the personal computers based GIS ArcView. This enables consultants and their clients (e.g. District Councils) to obtain copies of all of the data and to be able to customise their own outputs. Updates of the data can then be obtained from the EIA Branch, DEH when necessary.

1.3.2 Reports

Computer generated reports are available from the RVD that summarise the data collected during the "drive-by" survey. The reports that are available are outlined in Section 8.4.2.2.

1.4 Advantages of the methodology

The advantages of using this survey methodology are many, including:

- Contractors undertaking different regional surveys need not spend time developing their own methodology.
- The field sheets and data entry screens for the Roadside Vegetation Database are user-friendly.
- The GIS method for mapping the roadside vegetation is sophisticated and requires very little GIS editing time (an aspect that was previously very time consuming).
- The RVD is fully integrated within the EDBSA and uses powerful GIS procedures to maintain, analyse and display data. This means that organisations (e.g. district councils) that instigate a roadside survey do not have to develop their own database or mapping system.
- For those users who do wish to perform their own mapping or analysis, the data can be made available in a format suitable for the PC-based GIS ArcView. This provides great flexibility to the user, enabling ready access to data and the rapid production of maps showing any attribute or combination of attributes that were collected in the field.
- Integration of the RVD with the EDBSA means that much data maintenance is automatic. For example, plant species names in the RVD are linked to the Flora database, which means that they are automatically updated if the taxonomy of a species is changed in the future.
- Data can be efficiently accessed to search for and spatially display segments of roadside that match certain characteristics.
- Data collected by different observers in different parts of the State is fully compatible, constituting an important database of biological information that crosses district council and State Government administrative boundaries.

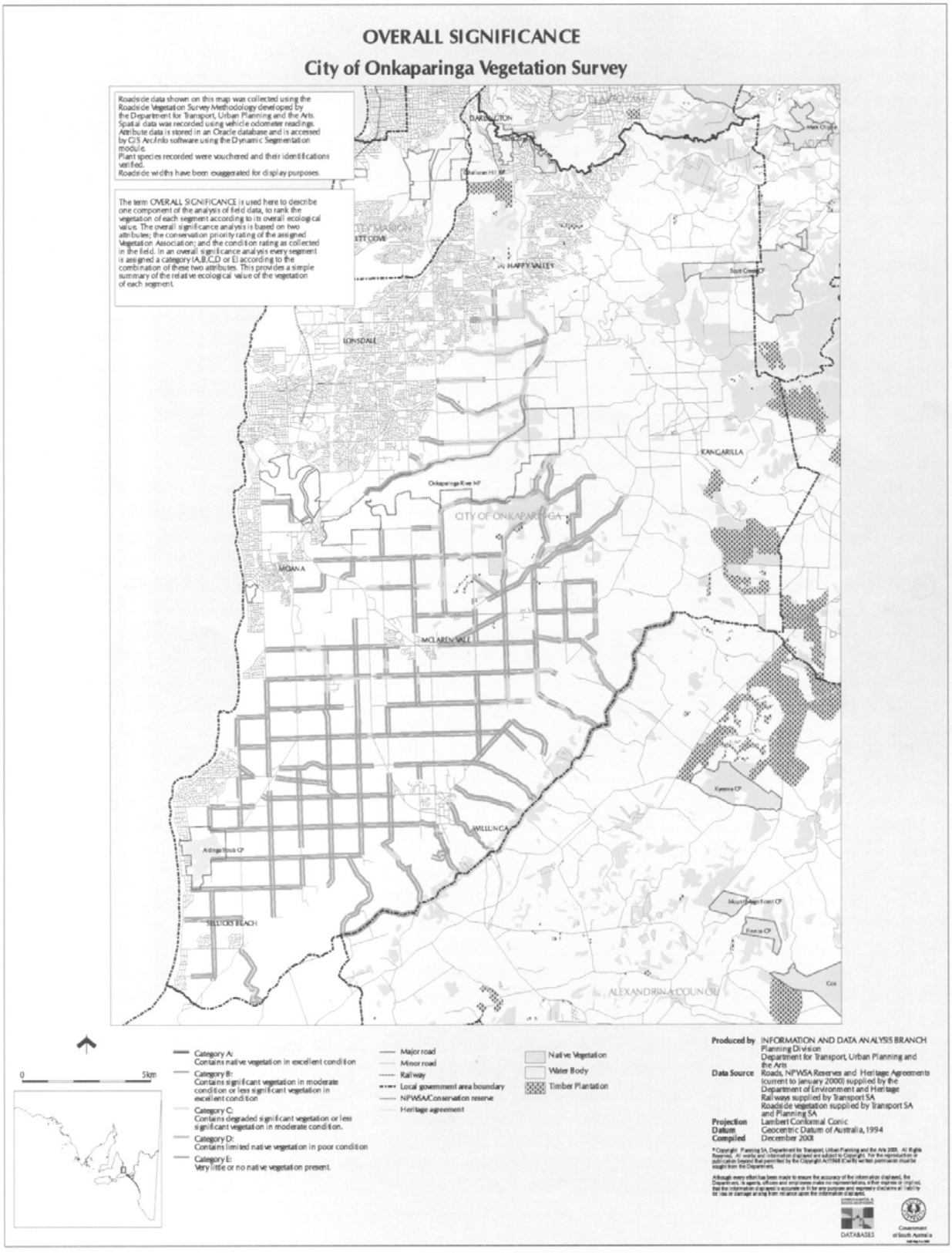


Figure 1: Example of map showing results of roadside vegetation survey

2. PRE-SURVEY PREPARATION

The following sections describe the preparation required before commencing a “drive-by” survey.

2.1 Planning, Liaison and Services

When planning a roadside vegetation survey, existing information from the EDBSA can provide background. Prior to commencing a survey or in the initial planning stages contact the BSM and EIA Branch, DEH to discuss what data and services the Department can offer. In addition a meeting with this Department early in the planning process enables timetables to be planned in advance to fit your project into existing BSM and EIA Branch schedules, and will ensure that post-survey requirements are incorporated into your project timetable.

Discussions with the BSM and EIA Branch should also include costs of different aspects of the project to enable an accurate budget to be prepared that accounts for costs such as data entry, data validation and map production. At this time a survey number from the RVD should also be requested.

As Local Governments have responsibility for the management of remnant vegetation in road reserves, surveyors should liaise with relevant councils before and during a survey. If work is to be carried out on arterial roads on which Transport Services Division (DTEI) shares responsibility with Local Government, then the survey should also be discussed with the Contract and Services Section, TSA (refer to Appendix 10)

2.2 Permits and other permission

Under the National Parks and Wildlife Act any person, including Department for Environment and Heritage (DEH) employees, who intends to collect native flora from a road reserve is required to apply for a permit to take protected species for scientific purposes. Permits are issued by Biological Survey and Monitoring, DEH, based at Plant Biodiversity Centre, Hackney Road, Adelaide (refer to Appendix 2b and Appendix 10). Permits issued under the NPW Act also satisfy the exemption requirements of the Native Vegetation Act.

If fauna surveys are conducted as part of follow-up programs, a number of permits are required. Contact DEH for further information.

2.3 Planning plant identifications

Plant specimens collected during field work must be identified by an experienced plant identification expert. Liaise with the State Herbarium (refer to contact list in Appendix 10), and ensure that all necessary arrangements for specimen handling are completed well before commencing the survey.

2.4 Study Area and Field Maps

Determine the boundary of your survey area and identify all 1:50 000 mapsheets that occur within the area. Generally, standard 1:50 000 topographic maps are the most useful maps for conducting the field work in the agricultural regions, however the survey process can be aided by an study area overview map from the EIA Branch showing features such as:

- the road network;
- remnant native vegetation and other landcover types;
- locations of previously surveyed Biological Survey sites;
- locations of records from the Threatened Plant Species Population Database;
- locations of sites in Transport Services Division (DTEI)’s Roadside Sites of Significance Database, where available;
- locations of Bushcare sites, where available;
- floristic mapping of remnant native vegetation, where available;
- other information such as cadastre, Hundred boundaries, district council boundaries, environmental associations (Laut et al. 1977), mapsheet boundaries.

The overview map can be particularly helpful for planning the sequence in which roads are surveyed. Discuss map options with the EIA Branch.

2.5 Familiarisation with flora of study area

During the survey, collection of vegetation data is greatly facilitated by familiarity with the dominant plant species and vegetation associations that are present in an area. This familiarity ensures that the assessor knows what species may be encountered, and therefore streamlines plant identification in the field.

This familiarity can be obtained through the following process:

1. Conduct a review of published information relevant to the flora of the region.
2. Consult relevant databases, especially plant species lists from Biological Survey sites and records in the Threatened Plant Species Population Database.
3. Access Herbarium Region lists or prepare a list of plants that may be encountered in the region.
4. Consult with relevant experts, including the State Herbarium and local botanists.
5. Spend a few days on reconnaissance in the field obtaining an overview of the vegetation that will be encountered and compiling a small field herbarium of the dominant overstorey species and weeds in the region (refer to Section 6 for details).

2.6 Equipment needed

To conduct the “drive-by” component of the survey, the main equipment will be required is a motor vehicle with an accurate odometer (with tripmeter facility). Although any vehicle can be used to conduct the “drive-by” survey, data collection is easiest in a vehicle that maximises the view of the roadside vegetation. High clearance 4-wheel drive vehicles, with greater elevation than conventional vehicles, are good for this purpose. Other main items include the field datasheets designed to ease the data collection process and topographic mapsheets, which assist the recording of calibration point locations. A list of equipment which assists the “drive-by” survey process is provided in Table 2.1.

Table 2.1: List of Equipment

General Items

- An accurate odometer (with a standard tripmeter facility)*.
- Field maps (topographic maps and/or overview maps from Department for Environment and Heritage).
- Field datasheets (Main Datasheet, Calibration Sheet, Voucher Sheet, Species Code Sheet).
- Code Look-Up Sheet (preferably laminated).
- Roof mounted rotating flashing yellow light/s.
- Orange traffic safety jackets.
- Vehicle warning sign (e.g. “Vegetation Survey - Vehicle Frequently Stopping”)

Stationary Items

- HB pencils, eraser, and pencil sharpener (not pens, as much of the Main Datasheet is updated as a road is traversed).
- Clipboards (2).

- Medium bulldog clips.
- Lever arch folder for completed sheets.
- Hole punch.

Plant Collection

- Plant Collection Permit (see Appendix 2b)
- Plant identification aids, including:

  botanical reference books
  Plant species list (available by Herbarium Region)
  ideally, a small field herbarium containing common overstorey and alien species
  list of previously recorded vegetation associations and their constituent species (literature sources, DEH and from the EDBSA, Department for Environment and Heritage where available).

- Plant vouchering equipment:

  press and straps
  cardboard dividers
  newspaper
  plastic bags, paper envelopes etc.
  pre-printed sequentially numbered sticky voucher labels (from BSM)
  hand trowel.

*Specialised odometers are available that have a greater accuracy than standard odometers and that can be "frozen" and re-started at the same reading, enabling backtracking of the vehicle during the "drive-by" survey. However, such odometers are expensive to purchase and to install, and have therefore not been specified as a requirement of this methodology. For people interested in such odometers, refer to Appendix 10.

2.7 "Getting your eye in"

Particularly for those people who have not previously used this methodology, data collected at the beginning of a survey is unlikely to be consistent with data collected when you are more familiar with the methodology. The interpretation of attributes such as understorey condition, and the judgment of when to change segments, will inevitably change with experience.

Some tips for this process are:

- briefly trial the methodology during your reconnaissance trip, thereby ensuring that you do not start "cold" when actually beginning the survey
- do not hurry to collect data quickly when you first begin - go slowly to enable concentration on the details of the methodology
- be prepared to discard early data and re-survey the first road if the inconsistencies are substantial.

It is suggested that between a half and one day familiarisation with the method may typically be required before consistency is attained. This process of "getting your eye in" will be easier if you are familiar with the vegetation and have a field herbarium, as this will permit a greater focus on the methodology. If possible, it would also be valuable for new users to undertake their familiarisation on roads where data has been already collected, to compare their data with that collected by experienced user(s).

2.8 Planning your routes

For maximum efficiency during surveying, it is best to plan your routes to minimise the time spent driving between end points and start points of successive roads. The overall speed and efficency at which the survey is conducted can be dramatically lowered if long drives between end points and new start points are regularly required.

If funding is not adequate to complete all the roads in your study area, you may need to prioritise roads to choose a subset for surveying. Some possible means of prioritising are:

- consult relevant personnel (e.g. Works Managers in Local Councils), and assess the priority of roads in terms of some relevant criterion such as the likelihood of future maintenance or upgrading activities or the intensity of current vegetation management practices;
- use “Roadside Vegetation in South Australia” (Palmer & Lewis 1987) to choose roads containing “dense” native vegetation; data in this publication should, however, be used with caution due to changes in vegetation since its publication and due to some vegetation types (especially native grasslands, open grassy woodlands and sedgelands) not having been readily recognised by these methods;
- survey only road reserves of a given width, for example 3 chains (60m); these can be located using Palmer & Lewis 1987 or cadastral maps;
- use other published reports to identify regions or roads that may be targeted (refer to Appendix 12, a bibliography of roadside vegetation reports and related surveys in South Australia).

2.9 Speed of survey

The pace at which you conduct the “drive-by” survey will initially be slow. As you become more familiar with the various aspects (especially identifying plants, assessing condition, and deciding when to change segments), you will speed up

When you start, you may cover only a few kilometres in an hour. However, this will increase as you become increasingly familiar with the methodology. As a general guide, you should aim to eventually achieve a speed during actual surveying (i.e. excluding time spent driving between roads) of between 10-15 km/hr. This rate is likely to be lower in some habitats, for example in some mallee communities that contain *Eucalyptus sp*. that are difficult to distinguish without close inspection. The speed of survey will also vary within a region. Stretches of road that are very heterogeneous and require constant checking of vegetation and regular segment changes can be very slow, yet this may be made up for on some long stretches of homogeneous vegetation.

3. DATASHEETS

Most of the data are recorded on the sheet titled Roadside Vegetation Survey (referred to in this manual as the "Main Datasheet"). There are three other sheets that must be maintained in the field, each involving a small amount of time. However, despite involving little time, the information collected for these sheets is critical to the integrity of the entire dataset. In particular, if the data for the Calibration Sheet is not collected correctly for a given road, then the spatial accuracy is reduced markedly and in some cases this may mean all the information for that road becomes useless.

The following is a brief description of each sheet, and Section 5 provides detailed instructions for completing each.

3.1 Main Datasheet

Each copy of the Main Datasheet (Appendix 4) allows for the recording of data for nine segments of a road (including both left and right sides). For each of these segments, the start and end points of which are defined using the car's tripmeter (or odometer), a number of specific attributes (features) are recorded. These are the attributes that will be used to assess the conservation value and management requirements of the roadside vegetation. Most roads will consist of a large number of segments which will result in a large number of main datasheets being used. Section 5.1 provides detailed guidelines on completing the Main Datasheet.

3.2 Calibration Sheet

Digital road networks for South Australia are maintained by DEH and Transport Services Division (DTEI). These are stored electronically as part of the EDBSA and accessed by the GIS. They are referred to as the road layers of the EDBSA. The Transport Services Division (DTEI) digital road network is used as the basis for Transport Services Division (DTEI) surveys (even though the field mark up is done on DEH 1:50,000 topographic maps) while Council surveys have been based upon the DEH road layer (as described in Section 1.3.1).

During fieldwork, the tripmeter (or odometer) of the survey vehicle will be used to measure distances travelled and, thereby, record locations of identified features. Neither the road layer available in the EDBSA nor the distances measured using the tripmeter will be totally accurate; therefore **they must be matched and then calibrated with obvious map features (preferably road intersections) to ensure that they are accurate relative to each other.** Aspects like topography cause differences in the road distance measured when driving the road versus the road distance measured along a flat base on a map or computer (digital representation of the road network). Refer to Figure 1a and 1b.

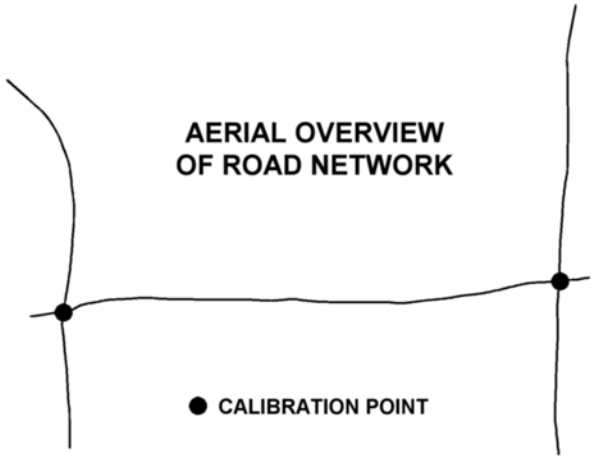


Figure 1a: Example of the aerial view of a real world road network situation.

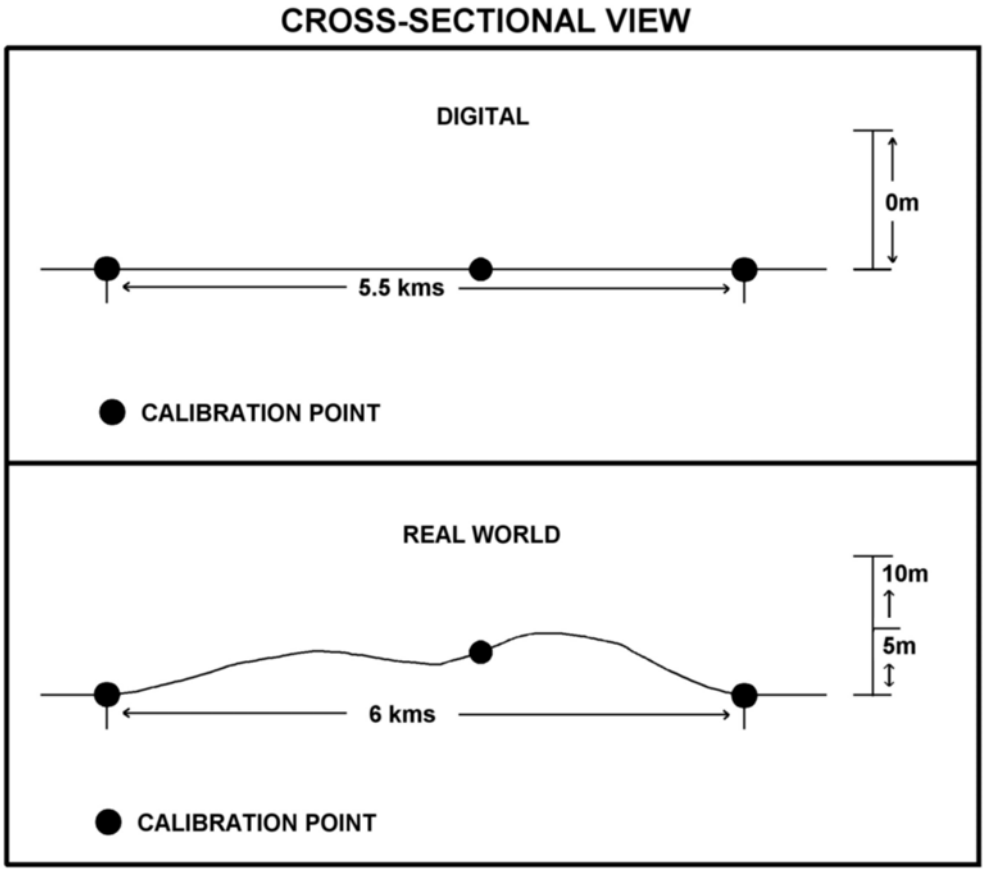


Figure 1b: Example of the cross-sectional view of a real world road network situation.
(Note the difference in road distance measured by vehicle along the road [when topography has an influence] versus the distance when measured on the digital or map layer.)

As an example of the importance of calibration, consider a stand of vegetation that occurs at a bend in a road. If the tripmeter readings alone were used to map this vegetation, then the inaccuracies would probably result in the vegetation being mapped before or after the bend. By calibrating the tripmeter and road layer, this provides **relative accuracy** in the mapping (even though the absolute accuracy of the tripmeter readings and the road layer are unchanged), resulting in the vegetation stand being displayed at approximately the correct location on maps. (refer to Figure 1c)

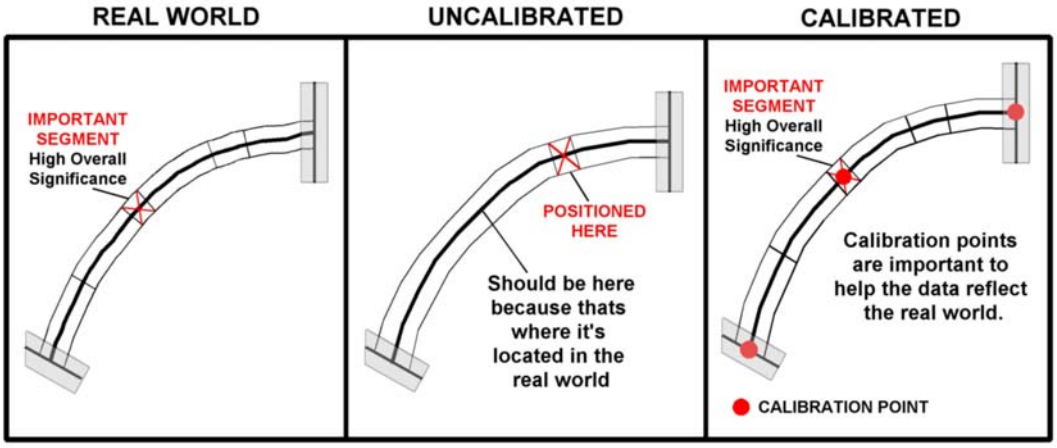


Figure 1c: Example of the real world situation, unclaibrated data position and calibrated data position

The Calibration Sheet (Appendix 5) is simply used to record the tripmeter reading at points on the road that are marked by the surveyor on the corresponding road on to 1:50 000 topographic map (e.g. road junctions, major bends). **These calibration points must be features that can be easily located on the road network on the 1:50,000 topographic maps (e.g. road intersections) as these generally reflect what is in the digital road network (which is the digital layer that the spatial data entry is completed on)**. **Features such as speed limit signs, maintenance markers, gates, ridges and culverts are <u>not</u> useful as calibration points as they <u>can not</u> be located on the digital road network coverage.** The calibration done during spatial data entry, compares the length of the road as represented in the digital road network with the distance recorded by the tripmeter and adjusts the measuring system on the digital network to reflect the odometer readings.

Approximately 5 –10 calibration points per 20 km of road is preferred. Any less will lessen the accuracy of the data being collected. Situations that require particular attention are hilly areas and long road lengths. However even short road lengths must have calibration points.

When using a global positioning system (GPS) receiver to collect the calibration points there are a few things to take into consideration. The new Calibration table outlines the required information for data transfer into electronic form. See Calibration Data sheet in Appendix 5.

Refer to Section 5.2, for detailed guidelines on collecting calibration data and completing the Calibration Sheet.

3.3 Voucher Sheet

For plant species whose identity is uncertain, samples (voucher specimens) of the plant are collected to enable identification after field work.

The Voucher Sheet (Appendix 6) is used to keep a record of all vouchers collected during the “drive-by” survey and any pre-survey reconnaissance trips. It allows easy recognition of voucher specimens for the plant identification / verification process. The voucher sheet and species code sheets are then updated when the vouchers have been formally identified. This then facilitates the updating of the plant records on the Main Datasheets resulting in the correct names being entered into the database.

Section 5.3 provides detailed guidelines on completing the Voucher Sheet. Guidelines on the correct procedure for collecting voucher specimens are provided in Section 6. These guidelines should also be followed when preparing specimens for a field herbarium to be used during the “drive-by” survey (see Section 2.5).

For voucher specimens that provide important distribution records, a datasheet for the Opportunistic Sightings Database should also be completed (refer to Section 6.3 for guidelines). To determine if you have any specimens that meet this criteria consult with the survey plant identification expert undertaking the plant voucher identifications / verifications or the State Herbarium.

3.4 Species Code Sheet

The data on the Main Datasheet are recorded as one, two or three letter codes allowing rapid data recording. Standard State-wide codes are not provided for plant species because this would be impractical. Species codes, are defined instead by surveyors during specific regional surveys. As a result only a short regional list need be consulted when choosing appropriate codes, rather than a list for the State. Each time a new overstorey or alien species is recorded, its name and a unique code are written on the Species Code Sheet for that survey. It is important not to confuse species codes with the understorey type codes provided on the accompanying Code Look-up Sheet (Appendix 7).

Refer to Section 5.4 for detailed guidelines on assigning codes and completing the Species Code Sheet.

4. DEFINING SEGMENTS

Roads are divided into segments to map changes in roadside vegetation. Distance readings from the car's tripmeter (or odometer) are used to define the start and end points of segments, and this information is used by the mapping process to spatially display segments (as described in Section 1.3.1). New segments are primarily defined by a change in the vegetation type. This will usually involve a complete change in the dominant / codominant overstorey species, although it may occasionally involve a substantial shift in the relative abundance of two or three codominant overstorey species (particularly with mallee eucalypts), or a substantial change in the dominant / codominant understorey species. However, avoid changing segments regularly in response to minor variations in relative abundance as this will usually contribute little valuable data while complicating the analysis after field work. If you are undertaking a Roadside Vegetation Survey with a Threatened species focus then refer to the section below on the Threatened Plant Species for a variation to this methodology for defining segments.

Changes in many other attributes (refer to Section 5.1) may also trigger a segment change, for example:

- road surface
- width of roadside vegetation
- structural type
- density/distribution of native overstorey
- understorey type
- overview condition of the understorey (i.e. extent of alien plant (weed) invasion, presence of significant soil (sand) deposition)
- major alien species

As a rule of thumb, the minimum segment length should not be less than 100m. That is, avoid starting a new segment if the change lasts for less than 100m. Generally, variation over shorter distances should be considered as part of the heterogeneity of the vegetation. However, occasionally segments shorter than 100m cannot be avoided, for example, when small but important patches of remnant vegetation surrounded by alien vegetation are encountered or when the roadside survey needs to pay particular attention to the distribution of threatened plant species (see Section 4.1).

In general, the more often segments are changed, the more sensitive the data will be to subtle variations in the vegetation, yet the more time consuming field work and data entry will be. The "Condition" attribute enables the extent of within-segment patchiness of alien plant invasion to be assessed, thereby reducing the need for regular segment changes in response to this attribute. Within-segment patchiness of the distribution of the dominant / codominant overstorey can be recorded using the "Density/Distribution" attribute.

Significant patterns over very short distances can be recorded in the Comments column under comment type "CON" (e.g. "Excellent patch of understorey at 10.1 km"), rounding the distance to the nearest fifty metres (refer to Section 5.1.12).

For each segment, information is collected describing a number of features ("Attributes") of the segment and its vegetation. These attributes will be recorded separately for the left and right sides of the road. For ease of data collection, **segment changes (tripmeter readings) always apply to both sides of the road**. This means that the change in attribute(s) that triggers a new segment may only occur on one side of the road, with the attributes on the other side remaining unchanged.

4.1 Threatened Plant Species[2]

(Only to be used when doing a Threatened Species Roadside Vegetation Survey)

Where the methodology needs to pay particular attention to threatened species, then new segments are primarily defined by the presence of and / or a change of threatened species or change in composition then the change in dominant / codominant overstorey species or understorey species and other changes indicated above (under Section 4.0). This means that when another threatened species (taxon) appears then a new segment is defined. For example, when surveying a roadside the initial segment may be defined by the *Eucalyptus petiolaris E. cladocalyx* woodland over *Allocasuarina muelleriana*, *Melaleuca uncinata*, *Xanthorrhoea semiplana* and *Acacia spinscens*. When the threatened species *Pultenaea tricophylla* is observed then a new segment is commenced even where nothing else has changed. If a second threatened species (taxon), such as *Acacia imbricata*, appears at a distance of 50m or greater, then another new segment is defined.

In the case of **Threatened species roadside surveys the minimum segment length should not be less than 50m.** This is a guide as it is difficult to estimate the distance on most vehicle odometers accurately (unless specifically adapted) when less than 100m, however it is possible to judge when at 50m intervals on a 100m odometer if care is taken.

If there is at least a 100m gap / break between two individuals of the same threatened species then these two individuals are considered to be two populations hence two segments.

If there is only one individual of a threatened plant species (taxon) then you estimate that the segment began 25m before that individual and then 25m forward to make a 50m segment. Where there are multiple species (e.g. *Acacia imbricata* and *Acacia pinguifolia*) and there is only 25m of *Acacia imbricata* before *Acacia pinguifolia* appears, this is treated as one segment with both species present.

Always round odometer (tripmeter) measurements to 0.25 increments for the threatened plant species segments.

[2] A threatened plant species is a plant species that has a conservation significance rating of endangered (E) or vulnerable (V) ((International Union for Conservation of Nature and Nature Resources 1994). Species can be considered threatened at national, state and regional levels depending on the ratings assigned to each level. Species can be threatened at one or more levels.

5. CONDUCTING THE SURVEY

5.1 Completing the Main Datasheet

The main datasheet records information on the road, the survey, segment lengths and describes the features of the segment in terms of the vegetation association description, condition of the vegetation, major alien species, disturbances, reference sites, emergent species and comments. Standard codes for completing the Main Datasheet are listed on the Code Look-up Sheet (Appendix 8). Species codes are defined by the surveyor and recorded on the Species Code Sheet (Section 5.4; Appendix 7). Use sharp HB pencils to complete the datasheets as these are easier to rub out for changes and can be photocopied. Blank and completed examples of the Main Datasheet are provided in Appendix 4.

For all adaptations to the standard methodology such as the Threatened Plant Species or Phytophthora methodologies the standard items in the main datasheet must be completed in addition to the extra items required for specific purposes (refer to the end of Section 5.1 for the extra items required).

5.1.1 Road information

Before commencing on a road, complete the following details on the top of a new Main Datasheet:

Survey No. This will be a unique number **assigned by the database administrators** (refer to contact list in Appendix 10) for each regional survey. Slash out unused boxes.

Road Order Assign sequential numbers (starting with 1) to the roads covered during your regional assessment. Ensure that the road numbers are unique. Slash out unused boxes. The road order number needs to be recorded beside each road surveyed on the relevant topographic (field) maps.

Date The date the road was assessed, in format DD-MM-YY

Observers Record the initials of up to three observers, with the initials of the person completing the datasheet entered first and the driver of the vehicle (typically the person providing least input to observations and data collection) entered last.

Use three initials if you have three; if an observer has only two initials then write these in and slash out the surplus box.

Sheet *X* of *N* Most roads will be divided into many segments and will require more than one Main Datasheet. Write 1, 2, 3,...,*N* etc into the first of the two boxes on successive sheets until the road has been completed, then fill in the second box on each sheet when the total number of sheets for the road is known.

Road Name If the road does not have a name, slash through this box. The name may be a formal name for a major road, e.g. Bordertown to Frances Rd or Sturt Highway, or a local name on a small road e.g. Jimmy's Road. Enter only the name (Jimmy's) not the type (Rd).

Road Type Enter the relevant code for the road type e.g. Road, Lane; codes are listed on the Code Look-up Sheet (Appendix 8).

TSA Road No. Only fill this in if your the road is a Transport Services Division (DTEI) road. Enter the five digit road code used by TSA to define their roads (refer to contact list in Appendix 10 if a TSA contact is needed).

5.1.2 Starting a road

When starting a road, use a sharp HB pencil to write the road order on the field 1:50,000 map. Draw a large cross with the centre placed exactly over the start point, and label the cross with the road order, a zero, and "START" (e.g. "1-0-START", refer to Figure 2 for an example).

Note: **The starting calibration point number** should be 0 **not 1**. Remember the start and end points are best done at road intersections.

At the starting point, zero the tripmeter of your vehicle so that the starting point for each road is zero.

5.1.3 Tripmeter (or Odometer)

The term "tripmeter reading" is used in this methodology for the distance reading obtained from the tripmeter or odometer of the survey vehicle.

The value entered in this column is the tripmeter reading for the end of the segment. Hence this field will be blank when a segment is being traversed and is filled in **when the segment is ended** (refer to Section 4).

Record the tripmeter reading, in kilometres, **rounded to the nearest fifty metres** (e.g. 17.10, 17.15 or 17.20) by estimating the distance between the 100m intervals on the tripmeter. Attempts to obtain greater accuracy from the tripmeter are unrealistic.

If the survey vehicle does not have a tripmeter, note the odometer reading at the start of the road and record readings at the end of each segment. At the conclusion of field work, convert the readings to the appropriate format by subtracting each tripmeter reading from the starting reading. In this final form, the data can be entered onto the Roadside Vegetation Database.

Note: Because the accurate definition of segments relies upon the tripmeter reading, no backtracking of the vehicle can be done during the "drive-by" survey (unless you have a specialised odometer; refer to Section 2.6). Most of this assessment is done with the vehicle not moving at great speed, therefore it is usually possible to stop the vehicle in time to walk back to any features that need inspection.

5.1.4 Surface

Record whether the road surface is sealed (S) or unsealed (U).

5.1.5 Width

For both sides of the road, estimate the distance from the edge of the road* to the outside of the road reserve, and record which of the following three categories it falls into: 0-6m (A), 6-15m (B), >15m (C). For unsealed roads, record the distance from the outside of the shoulder to the edge of the road reserve. **Remember that changes in the width of the roadside mean a new segment is required**. Width of roadside is often an important factor in determining appropriate conservation management.

Note: * The definition of a road includes the road pavement and any shoulder or unvegetated drain at the edge of the road pavement. If the edge of the road reserve corridor is not fenced, making it difficult to see the roadside width then refer to the relevant topographic mapsheet (1:50,000 with cadastral overlay) to determine the most appropriate roadside width from the road reserve's marked cadastral boundary.

5.1.6 Vegetation Association Description

There are four components to the description of the vegetation: Dominant Overstorey Species, Structural Type, Density/Distribution and Understorey Type.

The Dominant Overstorey Species, Structural Type and Density/ Distribution refer to the overstorey, which is defined as the tallest stratum that has a cover of 5%. As described in the following sections, if the tallest stratum has a cover less than 5%, then this is defined as an emergent stratum (Section 5.1.11) and the tallest layer below this with cover 5% is the overstorey. The Understorey type refers only to the understorey.

Codes for Dominant Overstorey Species are assigned during the survey and recorded on the Species Code Sheet. The standard codes for the categories of the other three attributes are listed on the Code Look-up Sheet, and definitions for each category are in Appendix 3. It is important to remember not to confuse understorey type codes for species codes or vice versa.

Dominant Overstorey Species

These are the species that dominate the overstorey. Record up to three dominant / codominant species in the overstorey, listing them in order of relative cover where Dominant Species 1 has the greatest cover. If uncertain about the identity of a species, assign an appropriate code and collect a voucher specimen (refer to Sections 5.3 and 6).

If the tallest stratum has a cover of less than 5%, this is not the overstorey and the species in this stratum should not be recorded here (refer to Emergent Species, Section 5.1.11).

Only include species that occur in the same stratum. If you wish to record species that occur in a lower stratum, this should be done under Comments, as comment type *UND (Section 5.1.12). For example, *Acacia pycnantha* trees occurring as a dominant stratum below an overstorey of *Eucalyptus viminalis* should be recorded as an understorey of low trees (refer to Understorey Type, below). If details of the species name needs to be recorded then this can go under Comments (eg. *UND *Acacia pycnantha*).

A general code can be defined, and no voucher specimen collected, if there is insufficient material available to enable identification or if accurate information is not needed. For example, mown (or closely slashed) grasses that cannot be identified can be recorded as Graminae sp. (Gs) (although it is better to have accurate identification if possible), and alien eucalypts in a plantation can be recorded as *Eucalyptus* sp. (Esp).

For vegetation dominated by alien species, including non-indigenous plantations, you **should record** the dominant alien species names(s) **under both Dominant Overstorey Species and Major Alien Species** (section 5.1.8). This can be to a **genus level** such as ***Pinus sp*****,** ***Eucalyptus sp*****.** or ***Acacia sp.*** This information is required, as it assists in determining appropriate management for that segment and adjacent roadsides.

Where the roadside is a Built-up area, ie. Built-up structural type, dominant overstorey species do not need to be recorded for those segments.

Structural Type

Record the structural type, using the Code Look-Up Sheet, by determining the dominant life form in the overstorey. Refer to Appendix 3.1 for definitions of each structural type.

This attribute is assigned to all vegetation associations, including

alien or non-indigenous types. For alien or non-indigenous types the Plantation category is used where more than 1 row of planted species occurs and/or at a density of >5 %. Where it is obvious the species are planted but not in a plantation formation (only 1 row and at a density of <5% i.e. 1 m canopy every 20 m or a 5 m canopy every 100m) then this referred to as "Plantings" (PL) in the "Disturbance" column, the species are noted in the "Emergent" column and the "Structural Type" used reflects what the dominant formation is, other than the plantings (e.g. Grassland).

Where the species are not planted but wild grown, for example, a non-plantation area of alien pines or olives, they are recorded as the formation they occur as, which may be a shrubland, woodland or forest. Areas of blackberries, gorse or broom would be recorded as shrublands; and areas consisting of mainly alien grasses would be recorded as grassland. Information on the structural type for alien species vegetation communities assists in determining appropriate management strategies.

For areas around towns and settlements where pavements, property frontages and gardens dominate the roadsides the BU – Built-up code is available. In some areas, native vegetation may persist so it is important to consider whether the vegetation reflects a structural vegetation type with disturbances like property frontages or whether it has become so disturbed that only the Built-up code is appropriate.

For areas that are stream, creek and river crossings, which do not have vegetation cover then use the code WC – Watercourse (drainage lines, not vegetated, but containing water or dry creekbed).

The information recorded here should be a description of the structure as it is seen in the field and should not pre-empt the vegetation association analysis (Section 8.2). For example, although vegetation dominated by *Lomandra* spp. is likely to be classified as a *tussock grassland* during the analysis, it is recorded as V - *sedgeland* in the field.

This is a required field - a code must be entered on the Main Datasheet.

Density/Distribution

Record whether the overstorey is continuous, fragmented (patchy) or scattered (using the Code Look-up Sheet; refer to Appendix 3.2 for detailed descriptions).

Record segments in the Built-up and Plantation structural types as Continuous.

This is a required field - relevant information must be entered on the Main Datasheet.

Understorey Type

Record the type of dominant understorey present, using the Code Look-Up Sheet (refer to Appendix 3.3 for detailed descriptions). Record up to two dominant / codominant understorey types, in order of relative cover (where Understorey Type 1 has the greatest cover and Understorey Type 2 has the second greatest cover). **This attribute refers primarily to the general type of dominant / codominant understorey present (e.g. tussock grasses) not the species present.**

However if you wish to record the dominant understorey species because they characterise a particular vegetation type (e.g. *Melaleuca uncinata* (Broombush) under mallee), you may do this in the Comments

column under comment type *UND, eg. *UND *Melaleuca uncinata*. Refer to instructions under Comments (Section 5.1.12) for guidelines.

Codes are provided for specifying an exotic (i.e. alien) understorey. Note that these can be used in conjunction with the codes for indigenous understorey, for example a segment with the codes GE and GN indicates an understorey dominated by exotic (alien) grasses and native tussock grasses.

In grassland situations, strata below the grassland overstorey may not be easily observed from the survey vehicle. In these cases the surveyors are encouraged to investigate 'on foot'. It is quite possible that there may be a lower strata of native and / or exotic (alien) grasses or herbs, in which case GE, GN, JE or JN can be recorded as the understorey type.

For areas where sand deposition (sand drift) has occurred, covering the understorey species to such an extent that this sand drift is the dominant / codominant understorey, use the code **BS – Bareground, sand**. This code has been created specially for use in these situations (i.e. areas of the Murray Mallee).

For areas where leaf litter appears and covers the ground especially around mallee species, use the code **LL – Leaf Litter.**

The code **B - Bare ground / plant litter** is no longer a valid code as from September 2003. In cases where there is only bare ground as the understorey type the code **BG – Bare ground** is used.

It is also important to record the understorey type in plantation situations. In many cases the dominant understorey is often exotic (alien) grasses or herbs, so these should be recorded.

Leave these fields blank for segments in the Built-up structural type.

Understorey Species

Record the dominant / codominant understorey species. **This includes dominant / codominant native and introduced species.** Record up to five dominant / codominant species in the understorey, listing them in order of relative cover where Species 1 has the greatest cover and Species 5 has the least. In deciding on the dominant / codominant species consider all stratums in the understorey. For example in a *Eucalyptus baxteri* Woodland the understorey dominants may be *Banksia ornata*, *Xanthorrhoea caespitosa* and *Pteridium esculentum* at the highest shrub stratum with no obvious species dominating in the mid shrub stratum and groundcover levels. As a result only *Banksia ornata*, *Xanthorrhoea caespitosa* and *Pteridium esculentum* would be recorded. However in a *Eucalyptus oleosa / E. gracilis* Mallee over chenopod shrubs, there may be *Rhagodia parabolica* dominating at the highest shrub stratum, *Enchylaena tomentosa* at the mid stratum and *Avena barbata* and *Bromus rubens* at the lowest stratum level. In this case the dominant / codominant understorey species would be recorded as *Rhagodia parabolica, Enchylaena tomentosa*, *Avena barbata* and *Bromus rubens*.

Note: This section was previously an optional however it is now recognised as essential part of the methodology and critically important for the analysis phase when determining vegetation associations. Recording understorey species in addition to "understorey type " provides additional information to assist in determining appropriate

vegetation associations and conservation significance, particularly where there is a lot of native vegetation of good condition.

5.1.7 Condition of Understorey

This records the extent to which alien vegetation has replaced the native understorey. This is assessed relative to the probable "pre-European" settlement state of the vegetation. The pre-European settlement state can be deduced from adjacent vegetation, and from an understanding of the original vegetation types that were present in a region.

Alien vegetation includes any plant species that are not indigenous to the survey region. This includes Australian natives that are not indigenous to the region. For example, *Acacia baileyana* (Cootamundra Wattle) which is alien to South Australia, and *Acacia longifolia* var *sophorae* (Coastal Wattle) which is indigenous to some regions of South Australia yet alien to other regions such as the non-coastal areas of the Adelaide Hills.

For vegetation types in which it is difficult to distinguish between upper and lower strata, the "condition" attribute in the "drive-by" survey is applied to all strata rather than only the understorey. This is particularly applicable in grasslands and sedgelands, and can also be applied to structural types such as low shrublands that are invaded by alien species.

The definitions of the condition categories are:

1	Excellent	Very little or no sign of alien vegetation in the understorey*; close resemblance to probable pre-European condition
2	Good	High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation
3	Moderate	Substantial invasion of aliens, but native understorey* persists; for example, may be a low proportion of native species and high native cover, or high proportion of native species and low native cover
4	Poor	The understorey* consists predominantly of alien species, although a small number of natives persist
5	Very poor	The understorey* consists only of alien species
6	Soil deposition (Sand drift)	Soil / sand smothering the understorey plants resulting in condition being unable to be assessed - alien species some to none apparent.
9	Not Relevant	Not relevant to assess condition as Built-up, Bareground or Water course.

*Or all strata if upper and lower strata are difficult to distinguish eg. grasslands, sedgelands, low shrublands.

As the assessment of 'Condition' focuses on the extent to which alien vegetation (introduced species) have replaced the native understorey, it has been necessary to provide a special category (category 6) for situations where soil deposition (sand drift) has made this assessment impossible. These soil deposition (sand drift) situations are found particularly in parts of the Murray Mallee and Eyre Peninsula, where in many cases the soil deposition is recent with alien species not yet apparent. Where it is not possible to use the 1-5 (Excellent-Very poor) codes due to soil deposition obscuring (covering) the understorey plants then use code 6.

Where 'Built-up' (usually only in and around town boundaries), Bareground or Watercourse occurs as a 'Structural Type' the special code 9 is to be used. Only in these situations is the presence of aliens species not relevant, as generally there is no native vegetation present with either only alien (introduced) species (i.e. garden plants or weeds), bareground (including rock and sand with no plants or plant litter present), water or artificial surfaces (i.e. gravel, concrete, paving or bitumen).

There are fields for three ratings of Condition on the datasheet - the Overview, the Minimum and the Maximum.

Overview

A subjective assessment of the overall level of weed invasion along the entire segment*. This will often be updated by the assessor as the segment is traversed.

Best (Minimum) / Worst (Maximum)

The Best (minimum) column is used to indicate the best condition that occurs for the segment hence containing the lowest number code. The Worst (maximum) column is used to indicate the worst condition that occurs for the segment hence containing the highest number code.

These attributes record the variation in alien invasion along the length of the segment, enabling the surveyor to document within-segment variability and reducing the need for regular segment changes in response to short term changes in understorey condition.

For each segment, the Minimum rating records the condition of the vegetation that is least invaded by aliens (i.e. in the best condition), and the Maximum rating records the condition of the vegetation that is most invaded by aliens (i.e. in the poorest condition).

For example, if a segment consists of good (category 2) vegetation alternating with patches of poor (category 4) vegetation, then this is recorded as Minimum = 2, Maximum = 4.

If the extent of alien invasion is homogeneous within a segment, the Minimum and Maximum will be the same as the Overview. For example, there may be a substantial invasion of aliens, but with a reasonable amount of native understorey scattered uniformly along the segment; this would be recorded as Overview = 3, Minimum = 3, Maximum = 3.

Note: * It is important to note that the Overview Condition rating is an overall assessment along the entire segment, **not** the average of the Best (Minimum) and Worst (Maximum) ratings or the most frequently occurring condition rating. For example, a segment that has a consistently high alien invasion with occasional patches of excellent understorey may be recorded as having Best (Minimum) = 1, Worst (Maximum) = 4 and Overview = 4. In another example, where poor vegetation is alternating with good vegetation (Best [Minimum] = 2, Worst [Maximum] = 4), the Overview may be assessed as 3.

5.1.8 Major Alien Species

Record the major alien species within the segment, up to a maximum of five. If a substantial change in the alien species composition occurs, a new segment may be started.

"Major" alien species include those that have the most cover or are most abundant, in addition to those that may have been identified before the survey as "target" species that are to be recorded whenever they occur, regardless of cover or abundance. Defining such target species should be done in consultation with key managers, particularly pest plant officers, before commencing field work.

Include alien species that are present in the overstorey, such as alien pines.

When each new alien species is recorded, write the name and a unique two letter code on the Species Code Sheet. If uncertain about the identification of an alien plant, assign an appropriate code and collect a voucher specimen. Only one voucher specimen should be required for each unknown species, and the same code can be used whenever the species is encountered. Vouchers of alien species are usually collected only for the purpose of identification, unless it is suspected that a species represents a new record for the relevant Herbarium region. In this case, a voucher specimen should be lodged at the Herbarium and a datasheet should be completed for the Opportunistic Sightings Database (refer to Appendix 11).

Alien vegetation includes any plant species that are not indigenous to the survey region. This includes Australian natives that are not indigenous to the region. For example, *Acacia baileyana* (Cootamundra Wattle) which is alien to South Australia, and *Acacia longifolia* var. *sophorae* (Coastal Wattle) which is indigenous to some regions of South Australia yet alien to other regions such as the non-coastal areas of the Adelaide Hills.

5.1.9 Disturbances

Using the Code Look-up Sheet, record the code for the major disturbances that are apparent in the roadside vegetation, up to a maximum of three. This section refers to human interventions such as tracks, borrow pits and grazing, not weed invasion that is recorded through "Condition". Codes are described in Appendix 3.5 (in manual).

Plantings (PL) is used where it is obvious the species are planted but do not occur in a plantation formation[#]. Plantings refers to only 1 row and at a density of < 5% cover (i.e. 1m canopy every 20m or a 5m canopy every 100m). Record "PL" in the "Disturbance" column and record the species in the "Emergent" column. Note that the "Structural Type" used for the segment must reflect what the dominant formation (structural type) is, other than the plantings (e.g. Grassland).

Note - [#]The Plantation category, is used, in the "Structural Type" where more than 1 row of planted species occurs and / or at a density of > 5 % cover (except where very small seedlings).

For areas of **sand drift** (soil deposition) several new categories have been created to pick up areas of recent drift (in the last 12-24 months) and areas where sand drift is observed as having occurred historically (has occurred prior to the last 24 months, but does not include sand drift prior to European settlement 1836). Disturbance categories for sand drift (SD) are;

SDR – sand drift, recent (in last <24 months). Characterised by deposits of windblown raw sand, fresh weeds (none to little plant litter or standing dead plant matter) over raw sand and a stronger soil colouration.

SDP – sand drift, previous (> 24 months old but < 200 years old). Characterised by old deposits of soil that appear to have some organic matter (plant litter) on the surface (including stand dead plant material), more established weeds, perennial plants, hummocky landform pattern and more oxidised soil colour (e.g. dull soil colour) where bare soil is partially exposed.

To cover the situations where soil deposits have been removed from the roadside corridor through earthworks, specially for the purpose of removing sand drifts, use the code **EAS – Earthworks, scalping**.

For areas where Fertiliser or Nutrient Drift has occurred smothering the roadside vegetation e.g. Dynamic Lifter drift or pulverised cow manure / silage, has been blown on to the roadside vegetation then use the code **FND – Fertiliser / nutrient drift**.

5.1.10 Potential Site

Consider whether the segment meets the criteria for a potential "Bush For Life" Site, Reference Site, Rehabilitation Site, Revegetation Site or a Roadside Significance Site to occur there. In some cases the segment may meet the criteria for three of these site types such as a "Bush For Life" Site, Reference Site and a Roadside Significance Site. If this is the case then these three site types should be recorded. Refer to Appendix 3.7 for codes, definitions and criteria for the site types. Codes are also provided on the Datasheet (Potential Site column) and the Code Look-up Sheet.

Place a slash in this column if the segment is not suitable as a potential site of any kind.

5.1.11 Emergent Species

Occasionally, the tallest stratum consists of isolated plants at densities too low to justify categorisation as the dominant overstorey stratum, however it is still desirable to note their presence.

In these cases, the scattered individuals (if cover < 5%) should be recorded as emergent species and the stratum below these "emergent" plants should be recorded as the dominant overstorey (if cover 5%). Emergent species are recorded by placing the correct species code in this column (refer to Section 5.1.6 for instructions on recording dominant species and assigning codes). If there are up to 3 emergent species to record then place the additional species codes after the *EME prefix in the Comments section.

A cut-off value of 5% cover for emergent species has been adopted for this methodology. If the tallest layer has <5% cover then it should be defined as an emergent stratum, with the overstorey defined as the tallest stratum that has a cover of 5% (as described in Section 5.1.6 under Structural Type). This is the standard used in the vegetation component of the Biological Survey of South Australia to define an emergent stratum.

As a rule of thumb, 5% cover represents 1/20th of the road reserve being occupied by a tree, mallee or shrub canopy. This could mean (in a narrow roadside) one individual with a 5m diameter canopy every 100m, or a 10m diameter individual every 200m, or a 20m diameter individual every 400m.

Refer to Appendix 3.2 for a diagrammatic explanation of this attribute.

5.1.12 Comments

This section is intended for recording general observations that may influence interpretation of data collected for each segment. It also augments standard data collected using the methodology.

To maximise the value of information recorded in this section, comments are "flagged" systematically, by prefixing with an asterisk and a three letter code, according to the issue which they relate too. After data entry, the database can be searched to locate these systematic comments.

If you wish to record extra information relating to any of the standard attributes on the Main Datasheet, use the flags indicated on the datasheet at the top of each column (e.g. *WID, *DOM, *STR, *UND, *CON, *ALI, *DIS, *REF and *EME).

This facility is particularly useful for recording additional information describing the vegetation in a segment, as an aid to subsequent interpretation. For example, understorey species that characterise a particular vegetation association can be recorded to augment the information in Understorey Type 1 and 2. Thus "*UND *Melaleuca uncinata* dominant" recorded in the comments section of a segment

indicates that *M. uncinata* (Broombush) dominates the understorey. Such a comment greatly facilitates interpretation of the vegetation information that may otherwise list only "Shrubs – other native".

Many other standard codes have been defined and are listed on the Code Look-Up Sheet and in Appendix 3.6. For example, *SIG can be used to flag information regarding any known species of conservation significance that occur in the segment, and *ADJ can be used if the surveyor wishes to record any information regarding land use on adjacent land. If you require additional codes, discuss this with the BSM (see contact list, Appendix 10), as other surveys may have encountered similar situations. In some cases, you may need to define codes that are specific to your survey, however you must ensure that such codes are listed and explained in the survey documentation (Survey Summary section, Appendix 9).

Important point events can be recorded in the Comments using the tripmeter reading, however such readings will only be approximate therefore you should prefix any tripmeter reading with "~" to indicate this, e.g. "Outstanding patch of native understorey at ~15.1km".

Although the comments column on the datasheet is not long, the space on the database for this section is large. Therefore, as long as information that does not fit in the comments column is recorded somewhere convenient (e.g. on the bottom or the reverse of the datasheet, rather than a scrap of paper), many comments can be recorded.

If used systematically to enable efficient retrieval of information, the comments section can enable a surveyor to greatly increase the scope of a roadside vegetation survey. This should be discussed with the client prior to each survey, to ascertain whether there is particular information that is not covered by the standard attributes that should be recorded systematically under Comments. **Note, however, that information recorded under Comments will only be available as aids in the interpretation of data, and the extent to which they can be incorporated into the data during analysis is limited.**

Generally, you should not change a segment based upon information stored in Comments.

5.1.13 Finishing a Road

When the end of a road is reached, record the final tripmeter reading for the current segment in the Tripmeter column, write "END" in the next blank Tripmeter column and cross through the remaining columns.

On the field 1:50 000 topographic map being used for the calibration points, use a sharp pencil to draw a large cross exactly over the end point, and label the cross with the road order, the calibration point number (refer to Section 5.2), and "END" (e.g. "1-10-END") (Figure 2). It is important to **use a road intersection as an end-point** and to **make sure that the end of segment (end of the road order) and the calibration end-point are the same.**

5.1.14 Threatened Plant Species Method

Specially adapted main datasheets are provided for the Threatened Plant Species Method and the Phytophthora Method. Please contact the BSM Group at the Department for Environment and Heritage, for copies of these.

Threatened Species These are species that have a conservation significance rating of endangered or vulnerable at national state or regional levels (Research into which species are threatened, those relevant to the study [national, state or regional threatened species], the identification of these species must be prior to commencing the drive-by survey). Record up to five threatened species in any segment, listing them in order of relative cover and abundance (where possible) in the "Understory species" columns in the

stippled row below the row for the left-hand side or right-hand side of the road accordingly to whichever side of the road these species are observed on. Remember that where a threatened species appears or disappears then a new segment needs to be created.

Number of Individuals Record the number of individuals for each threatened species listed in the segment, in the "Major Alien species" column in the stippled row below the row for the left-hand side or right-hand side of the road accordingly to whichever side of the road this is relevant too. Exact numbers of individuals for each threatened species within the segment may require inspection of the area on foot, as it may be difficult to count the number of individuals from a vehicle on the roadside.

Any extra information that needs to be recorded specifically for the threatened plant species can be made under the Comment Type "SIG" (Plants of Conservation Significance). Refer to section 5.1.12 for instructions.

It should be noted that the recording of the segment length via the odometer (tripmeter) allows for the area of occupancy for those threatened species within that segment to be calculated (as long as these species occur continuously within that segment).

5.1.14 Phytophthora Method

(Contact the BSM Group, DEH for details of this methodology)

5.2 Completing the Calibration Sheet

The calibration sheet simply records the calibration point numbers and the tripmeter readings recorded at readily identified features marked on the appropriate topographic (field) maps. This information is essential for maintaining relative accuracy between the database's road network and the tripmeter readings (see explanation in section 3.2)

For each Calibration Sheet, record the following information at the top of the sheet:

Survey No. As described in Section 5.1.1

Sheet *X* of *N* To keep track of how many Calibration Sheets were used during a survey, write 1, 2, 3,...,*N* etc into the first of the two boxes on successive sheets, leaving the second box blank. When the survey has been completed, fill in the second box on each sheet with the total number of sheets used.

Observers As described in Section 5.1.1

During the assessment, follow your progress on each road using the field map(s). Mark the start point on the map as described under "Starting A Road". When an easily located landmark is reached, mark this distinctly on the map with a cross, and label the cross with a sequential calibration code for the road (i.e. 1-1 = road 1 calibration point 1; 1-2 = road 1 calibration point 2;...;2-1 = road 2 calibration point 1, etc) (Figure 2).

Calibration points will usually be intersections with other roads, but they may be sharp bends in the road or any other distinct landmarks that is permanent and can be precisely located on the field map. Be sure that the calibration point for which a tripmeter reading is taken is of the corresponding point on the map where it is physically marked.

Note: It is imperative that locations marked on the map to be used for calibration are correct. Double check the map with surrounding features, using a topographic map if possible. If you are unsure, do not include the location. Errors in the placement of calibration points and therefore incorrect tripmeter readings will significantly decrease spatial accuracy.

Approximately 5-10 calibration points per 20 km are preferred. Any fewer may result in reduced spatial accuracy of the data being collected. As mapping products are essential to roadside vegetation surveys achieving the best relative accuracy is critical.

Calibration points coordinates are required to be collected using a global positioning system (GPS).

Note that calibration data for many roads may be recorded on a single Calibration Sheet.

Enter the following data onto the Calibration Sheet:

Visit Date	
Road Order (Route)	The road order (e.g. 1) as recorded on the main sheet(s) for that road
Calibration Point	The calibration point number (starting at 1 and increasing sequentially) that was written on the field map
Tripmeter reading	Record the tripmeter reading in kilometres to the nearest 50 or 100 metres (e.g. 17.1 or 17.15) (Note - This is entered into the database into in metres)
RRD	Tripmeter reading in kilometres (office use only)
Location Description	Provide a short description of the location of the calibration point through reference to features on the field map. It is also very useful if calibration point position can be taken with a Global Position System (GPS) device with coordinates and datum recorded on the calibration sheets. Location description was an optional field but is now a compulsory, as it aids in the spatial data entry by clarifying the nature of the calibration point.
Segment Number	Number of the segment that the calibration point occurs in
Maintenance Marker Number	For DTEI roads
Waypoint Number	Number that you assign to the position in your GPS
MGA Zone	From GPS (download from GPS)
Datum	From GPS – it is standard to use GDA94 compliant datums such as WSG84 or GDA94.
Easting	From GPS (download from GPS)
Northing	From GPS (download from GPS)
Mapsheet Number	Mapsheet number (mapno) to assist with the spatial entry process

Note: It is particularly useful if the calibration point positions, stored in the GPS device, can be downloaded into a file and provided to the EAR Unit as a .CSV file when the correctly marked maps are provided for spatial data entry.

Blank and completed examples of this sheet are provided in Appendix 5.

When the end of a road is reached, record the tripmeter reading on the Calibration Sheet as the last calibration point. Mark the point on the map as described under Section 5.1.13 “Finishing A Road”.

5.3 Completing the Voucher Sheet

It is recommended that surveyors voucher extensively while familiarising themselves with the flora of the study area (refer to Section 2.5), to facilitate the "drive-by" survey component. Unlike the vegetation component of the Biological Survey of South Australia, the need for vouchering during the "drive-by" assessment has been minimised to reduce the time and effort required during field work. Nevertheless, it is still necessary for the integrity of the data to voucher when the identification is uncertain.

For each Voucher Sheet, record the following information at the top of the sheet.

Survey No. As described in Section 5.1.1

Observers As described in Section 5.1.1

Sheet *X* of *N* To keep track of how many Voucher Sheets were used during a survey, write 1, 2, 3,...,*N* etc into the first of the two boxes on successive sheets, leaving the second box blank. When the survey has been completed, fill in the second box on each sheet with the total number of sheets used.

For each voucher specimen (refer to Section 6 for detailed instructions regarding vouchering), enter the following:

Field name A preliminary identification assigned to the species in the field, e.g. "*Danthonia* hairy", "*Eucalyptus odorata/microcarpa*?", "Tall saltbush"

Voucher no. A sequential number unique to each voucher specimen collected during the survey. It is helpful to pre-print the voucher numbers onto sticky labels prior to the survey.

Date The voucher specimen was collected, in format DD-MM-YY

Road order The road order (e.g. 1) as recorded on the Main Datasheet(s) for the road on which the specimen was collected

The other fields on this sheet (Determiner and Final Name) are completed after vouchers have been identified. Blank and completed examples of this sheet are provided in Appendix 6.

For voucher specimens that are of note, such as for regional distribution records, these should be lodged with the Herbarium. In this situation an Opportunistic Sightings Database form should be completed and voucher specimens relabelled with an Opportunistic Sightings Database voucher label before lodging. To assist in determining the AMG Coordinates, for the Opportunistic Sightings form, mark the location of the collection on the field map or record a Geographical Positioning System (GPS) reading. Use of Opportunistic Sightings forms and labels makes certain that the vouchers are recorded for entry into the database. These forms and voucher labels are available from Biological Survey and Research, DEH (see Appendix 10 for contact details).

5.4 Completing the Species Code Sheet

For each Species Code Sheet, record the following information at the top of the sheet:

Survey No. As described in Section 5.1.1

Sheet *X* of *N* To keep track of how many Species Code Sheets were used during a survey, write 1, 2, 3,...,*N* etc into the first of the two boxes on successive sheets, leaving the second box blank. When the survey has been completed, fill in the second box on each sheet with the total number of sheets used.

Observers As described in Section 5.1.1

Each time a new overstorey or major alien species is encountered, write its name in the column labelled **"Common name / Scientific name / Voucher number plus field name"**, and assign a **unique** code in the Code column. During field work, the purpose of this sheet is to facilitate the selection of unique codes for observed species, therefore you can enter any name (or other identifying information) that will assist you in creating unique codes. Scientific names can be entered after field work, when all voucher specimens have been identified

The Code Sheet has two sections, **Native plants** and **Alien plants**, to facilitate rapid selection of correct codes during field work. Assessors can assign any codes for the plant species recorded during their regional survey. It is easiest to assign a two letter code, using the initials of the generic and specific names, e.g. *Eucalyptus camaldulensis* = Ec. Do not assign the same code to a native and an alien species as this will cause confusion.

For unidentified species that have been vouchered, enter the field name plus voucher number (refer to Section 5.3) in the column labelled "Common name / Scientific name / Voucher number plus field name".

Although code definition is at the discretion of the surveyors, the codes must be legible and distinctive on the both the Main Datasheet and the Species Code sheet. In particular, it is vital to ensure that:

- only unique codes are used - e.g. if *Eucalyptus odorata* and *Eucalyptus obliqua* are both recorded during a survey, ensure that they are assigned different codes;
- codes are easily distinguished on the Main Datasheet - for example if "Pc" and Pe" look similar in your handwriting, then either avoid such similar codes or perhaps use upper case ("PC" and "PE");
- written codes are contained fully within the box on the Main Datasheet. In particular, ensure that the letters j, y, g, p and q do not go over the bottom line;
- codes do not overlap with understorey type codes; and
- all codes are written down as soon as they are assigned, rather than waiting until later when you are likely to forget which species was represented by which code.

Blank and completed examples of the Species Code Sheet are provided in Appendix 7.

5.5 Checking field sheets

Sheets completed in the field must be checked for completeness, consistency in the use of correct codes and accuracy as soon as possible after data collection while the roads are still fresh in the memory. This is best done at the end of each road. Check:

- that there are no blanks in fields that should contain data;
- that codes are in the appropriate columns;
- that codes have been used appropriately (ie. that is the understorey type codes haven't been used instead of the species codes);
- that all species codes have been accurately recorded on the Species Code Sheet(s);
- that all codes on the sheets have been defined correctly;
- that the calibration points have been recorded correctly on the map and the calibration sheet;
- legibility;
- accuracy and completeness of survey, road, date and observer information at the top of each sheet; and
- accuracy and completeness of voucher labelling and information.

Figure 2: Example of field map with starting, finishing and calibration points marked

6. PLANT COLLECTION (VOUCHERING)

6.1 What to voucher

During the “drive-by” assessment, voucher specimens should be collected of any dominant overstorey or major alien species whose identity is uncertain. Each specimen should be provided with a unique voucher number, within that survey, so that plant records can be correlated with a particular species when verified later by the plant determiner or the State Herbarium.

Collection of voucher specimens for the Herbarium is not a primary aim of the “drive-by” assessment. Specimens are usually collected only for the purpose of identification / verification. However, you may collect many vouchers and descriptions for species of interest if you wish to augment the normal data collection. For interesting records, including ones that are an important distribution record, you should complete data sheets for the Opportunistic Sightings Database (OSD) and label with an (appropriate Opportunistic Sightings voucher label (refer to Section 5.3 and 6.3 for guidelines). In the case of rare or threatened plant taxa, you should complete a datasheet for the Threatened Plant Population Database (contact BSM, DEH for more information).

Field work during the assessment will be greatly facilitated by familiarity with the dominant overstorey and alien species of the region (Section 2.5). It is, therefore, recommended that a reconnaissance of the region is conducted, and that this includes the collection of vouchers of all or most of the species that are likely to be recorded and the assembly of these into a **Field Herbarium** to be used during the survey. This will greatly reduce the time spent on identification and vouchering during the “drive-by” assessment.

6.2 How to voucher

An ideal sample should contain flower or buds, leaf, fruit, bark (if a distinctive tree or shrub) and be enough material to cover a Herbarium sheet (A3 size paper) while being represented by as few pieces as possible so as not to be too bulky. Paper envelopes are useful for containing fruits and smaller specimens, however, it is important to attach these to the voucher label on the specimen, so they are not lost in transit.

Smaller annuals and ephemerals should be represented by a whole plant, including basal area and roots. This is particularly important for Graminae (Poaceae), Cyperaceae and Juncaceae. Care should be taken to leave bulbs in the ground, where possible, for Orchids and lilies, to ensure their populations remain viable. For smaller annuals and ephemerals collect a number of individuals where specimens are very small, again collecting specimens with roots.

Tag each specimen as it is collected with a voucher number (sticky label) preferably placed away from parts that need to be examined in the identification process. Envelopes are often preferable for small specimens. Record the voucher number and field name on the Voucher Sheet (Section 5.3). On the Species Code Sheet, record the “field name” and assign a code to be entered on the Main Datasheet (Section 5.4).

Larger specimens can be placed directly into a plastic bag until ready to transfer to a press. To assist in the drying process, especially if plants are wet, it is a good idea to lightly wrap newspaper around each specimen. Smaller ones should be kept in a small snap-top bag, with a little paper if the plant is wet.

Plants are best pressed by no later than the end of the day’s field work. The papers should be changed if the specimens were damp when collected or are succulent. This helps prevent specimens becoming mouldy in the press. Succulent plants are best kept in a separate press to facilitate changing papers. Use only one folded full newspaper sheet for each specimen, but cardboard dividers should be used frequently, particularly between bulky specimens.

In order to enable accurate records to be kept, and to enable datasheets for the OSD and TPPD to be correctly completed, you must ensure that you **accurately** record the location of any specimens in the

field. This can be done either by marking the location on the field map, to enable accurate coordinates to be obtained later, or by using a Geographical Positioning System (GPS).

At the conclusion of the “drive-by” assessment, deliver the presses containing the voucher specimens, with a photocopy of the Voucher Sheet, to the person contracted to finalise the identifications (Plant Determiner). This should be arranged prior to the commencement of a survey.

When identification has been completed, the Voucher Sheet and the Species Code Sheet are updated accordingly and all species records can then be entered into the database using the correct species name.

6.3 Opportunistic Sightings and Threatened Plant Population Databases

After specimens have been identified, determine those for which you should complete a datasheet for either the OSD or TPPD.

For native species, complete an OSD datasheet (Appendix 11) if, after identification, the taxon collected is considered to be “interesting” (e.g. if a TPPD datasheet was completed, or if the taxon is a new or unusual record for the region). Generally, you are not expected to complete OSD datasheets for weeds unless the specimen is a new record for the region.

Complete a datasheet for the TPPD if the identified taxon is rated as rare or threatened nationally or threatened at the State level (Lang and Kraehenbuehl 1987, 1994).

Because the decision to complete these datasheets is often made after field work and plant identifications have been completed, it is critical that you **accurately** record the location of any specimens in the field (Section 5.3 and 6.2). This enables the individual or population to be re-located if additional data are required.

7. POST-SURVEY

7.1 Prior to data entry

Before the data collected in the field can be entered onto the Roadside Vegetation Database, a number of steps are required.

1. All field sheets and calibration maps must be checked for completeness and any inconsistencies in the use of codes, as soon as possible after data collection (Section 5.5).

2. Plant identification must be completed (refer to Section 6), and any "interesting" specimens lodged with the Herbarium.

3. Correct plant IDs must be updated onto the Voucher Sheet **and** onto the Species Code Sheet.

4. Before data entry, provide the Roadside Vegetation Project Coordinator, BSM (refer to contact list in Appendix 10) with all plant species names (Species Code sheet) recorded during the survey. This Species Code sheet should be provided as a table (or file) sorted on the plant code, to facilitate data entry. These will then be added to the appropriate look-up table in the database. Any other new codes that may be needed for other attributes should also be discussed with the Roadside Vegetation Project Coordinator at this stage.

5. Before data entry, provide the Roadside Vegetation Project Coordinator, BSM (refer to contact list in Appendix 10) with observer initials and full observer names.

6. For the spatial data entry in the EIA Branch, highlight the routes and calibration points on the field maps so that these may be readily observed. Another helpful tool is to download the GPS waypoints for the calibration point coordinates and provide the Calibration sheet data in a comma delimited text file (.CSV). The file would include the survey number, visit date, road order, calibration point, tripmeter reading, location description, waypoint number, datum, zone, easting, northing and mapsheet number.

7.2 Data entry and validation

Data is entered onto the Roadside Vegetation Database (refer to the "Guide to Data Entry", Stokes *et al.* 1998a). Currently data entry occurs within the BSM Group, however remote data entry via the Internet is proposed for the future. Please consult with the Roadside Vegetation Project Coordinator, BSM Group. Data entry should be managed by each Roadside Survey Coordinator in consultation with the Roadside Vegetation Project Coordinator. The BSM Group may have a contact list of people experienced in entering data onto the Roadside Vegetation Database that could be sub-contracted for data entry, if required.

When Roadside Vegetation Database data entry has been completed, validation reports are produced to enable all data on the database to be checked against the original Main Datasheets for correctness. **The person responsible for most of the data collection in the field should be available to participate in this process.** After validation, identified errors in the data on the database must be corrected.

In addition, the spatial data entry also needs to be checked through the calibration check process. A list summarising the road lengths from the computer (Arclength) and the tripmeter readings (Measurelength) will be supplied to the survey coordinator. This then needs to be checked against the maps, to make sure the calibration points are in the correct position. Any corrections then need to updated onto the spatial data through the EIA Branch.

7.3 Analysis and output production

Refer to Section 8 for detailed instructions on data analysis and production of outputs. **The person with primary responsibility for the botanical aspects of conducting the survey must conduct some analysis at this stage.** This involves the conversion of the raw vegetation data into vegetation association information and forms the basis of subsequent analysis performed automatically by the Roadside Vegetation Database and GIS.

8. DATA ANALYSIS

8.1 Introduction

A number of standard analytical procedures have been developed for data collected using the Roadside Vegetation Survey methodology and stored in the Roadside Vegetation Database. This analysis is conducted after data entry has been completed and validated (Stokes *et al.* 1998a).

The two principal steps involved in the analysis are:

- Vegetation association analysis, involving a simple analysis of the vegetation data; and
- Overall significance analysis, including interpretation in the context of management requirements.

The first step requires input from the surveyor(s) in interpreting the vegetation data. The second step is automated, requiring no input from the surveyor(s).

8.2 Vegetation Association analysis

8.2.1 General

The dominant species, structural type and understorey data are used to define a **vegetation association** for each segment. Each association is assigned a priority rating of relative conservation significance.

A vegetation association is defined for this methodology as an array of plant species "of which the dominant stratum has a qualitatively uniform floristic composition and which exhibits a uniform structure as a whole" (Beadle and Costin 1952). Each association has a description which typically includes one or more characteristic species that are dominant in the overstorey, and a structural description. Some associations may also include understorey information if this is characteristic of the association type. For example, segments that have *Eucalyptus leucoxylon* and *E. camaldulensis* as dominant species, with woodland as the structural type and "GN" (native grasses) as an understorey type may be assigned to a vegetation association described as "*E. leucoxylon* / *E. camaldulensis* Woodland with grassy understorey".

Because many combinations of dominant species, structural type and understorey will be repeated in more than one segment, the analysis is performed using a list (produced by the Oracle database) of the unique combinations of these attributes. This means that the analysis does not involve working through the entire dataset to enter an association for each individual segment. An association name is entered for each unique combination, and this is automatically linked back to the main data so that all segments with the same combination are assigned the same association name and conservation priority rating.

Section 8.2.4 provides detailed instructions on conducting this analysis.

8.2.2 Some guidelines

- A variety of published and unpublished sources should be consulted when determining association type, however contractors have the discretion to identify new associations if they are confident of their validity. New associations should be discussed with relevant botanists before being finalised and entered onto the Roadside Vegetation Database.
- Although assignation to a distinct association should be done if possible, the linear nature of roadside vegetation and the length of defined segments means that a mix of vegetation types is often recorded in one segment. In these circumstances, do not try to force vegetation into associations - simply have general categories such as "Mixed eucalypt woodland", "Mixed mallee", "Mixed eucalypt mallee/woodland" and "Mixed woodland with species of conservation significance in the overstorey".

- Grassland sites will often be difficult to categorise. If a formally defined association name is not suitable, the following general categories are suggested: “Grassland dominated by native species”, “Grassland dominated by alien species” and “Grassland dominated by both native and alien species”. Such categories can still be assigned conservation priority ratings (Section 8.2.3), with the condition rating providing an indication of the actual extent of alien species present.
- Other vegetation dominated by non-indigenous species should usually be assigned general names, e.g. Blackberry thickets may be “Shrubland dominated by alien species”, and dense Salvation Jane may be “Herbland dominated by alien species”; more detail may be specified if desired, e.g. “Blackberry Shrubland” and “Salvation Jane Herbland” respectively.
- Plantations may be divided into types if desired, for example “locally indigenous” and “locally alien”; “hardwood” and “softwood”.
- Any Built-up segments should simply be recorded as “Built-up” under Vegetation Association.

8.2.3 Conservation priority rating of vegetation associations

Each vegetation association is assigned a **conservation priority rating** based primarily upon the extent of its protection in National Parks and Wildlife Reserves and Heritage Agreements (Neagle 1995 and Davies 1982) and its remnancy (i.e. contemporary extent relative to pre-European extent). Definitions of conservation priority ratings are provided in Table 8.1.

Conservation priority ratings cross the spectrum from non-significant alien vegetation (rating 5) to very high priority vegetation types such as native grasslands and box grassy woodlands (rating 1). The moderate rating (rating 3) refers to common, adequately conserved native vegetation associations. Note that these ratings and descriptions do not correspond closely with those of Neagle (1995) because this methodology includes alien vegetation “associations” whereas Neagle’s included only native vegetation.

Table 8.1: Categories of conservation priority rating for vegetation associations.

Rating	Description
1	Very high conservation rating; includes any associations whose Conservation Status was identified by Neagle 1995 as Poor or Nil; typically includes associations that are most extensively cleared and/or most degraded.
2	High conservation rating; includes associations whose Conservation Status was identified by Neagle 1995 as either Moderate or Reasonable; typically includes associations that are moderately cleared; may include mixed native vegetation that includes significant species in the overstorey.
3	Moderate conservation rating; includes relatively common associations whose Conservation Status was identified by Neagle as either Reasonable or Excellent; may include mixed native vegetation that contains common species in the overstorey.
4	Low conservation rating; may include some mixed native ± alien vegetation that cannot be categorised readily into a formal association type.
5	Of no conservation significance; very little or no native vegetation.
9	Nil Conservation Rating; of no conservation significance; very little or no native vegetation.

Neagle (1995) and Davies (1982) are key sources for determining the conservation priority rating for associations. However, other information and personal knowledge are also important, as Neagle and Davies concentrated on representation in reserves and Heritage Agreements rather than remnancy or extent of threats. Furthermore, their association names do not always coincide with those defined by other workers.

Conclusions regarding conservation priority ratings should be justified in written survey reports.

The category 9 – Nil Conservation Rating should only be used for 'Built-up', 'Bare ground' or 'Watercourse' situations where no vegetation association exists.

The rating assigned to plantations may vary according to species composition - for example, plantations that consist of locally indigenous species and include understorey may be assigned a high rating, whereas plantations of alien species may be assigned a low rating. Such factors should be considered when the initial vegetation association analysis is being conducted.

8.2.4 Analysis procedure (including computer support)

The following steps are involved in performing the vegetation association analysis. The following description assumes a basic knowledge of using personal computers to manipulate data files and data. Please consult your Roadside Vegetation Project Coordinator for any clarification.

1. A list of all unique combinations of the attributes Dominant Species (up to three), Structural Type, Understorey Type (up to two) and Understorey species will be provided to you by the Roadside Vegetation Project Coordinator within the BSM Group (Rvr060 & Rvr080 – Unique Combination Reports) A file of the species names recorded in the survey will also be provided (Rvr050 – Species Report) to aid interpretation of the unique combination files. These reports are produced from the database as a comma delimited text (CSV) files; if you would prefer to receive the data in a different format, talk to your Roadside Vegetation Project Coordinator.
2. Assign a vegetation association to each combination of dominant species, structural type and understorey type (according to the guidelines in Sections 8.2.1 and 8.2.2) and prepare an Association Description for each (as in Section 8.2.2).
3. When you have finished assigning associations, compile a list of all association descriptions recorded and assign a unique number (starting with 1) to each; this is the Association Number.
4. For each association, determine its Conservation Priority Rating (according to the guidelines in Section 8.2.3).
5. Prepare a comma delimited (CSV) text file that lists the details of each association, comprising the following five fields

   1.. Association Number.
   2. Association Description
   3. Conservation Priority Rating.
   4. A reference indicating where each association was originally described (which, for new associations, may simply be "This study").
   5. Survey Number (which should be an identical entry for every row in the table, containing the number assigned to your survey by the Roadside Vegetation Project Coordinator).

Note: It is important to have a file of SAFlora (species names from the SAFlora database) loaded into your MSWord dictionary to aid checking the plant species names when compiling the vegetation descriptions. Structural names used in the vegetation descriptions need to comply with the SA Structural Vegetation Formations list (see Appendix 10.) and should be in titlecase e.g. Open Woodland.

6. Using a copy of the original CSV file that contained the list of unique combinations of dominant species, structural type, understorey type and understorey species, add a single column entitled "Association number", in which you should list the association number of the association that was assigned to each combination*.
7. Deliver these two CSV files to your Roadside Vegetation Project Coordinator, who will get them loaded into the Roadside Vegetation Database. This completes the vegetation analysis component of this methodology.

***Important:** The table containing the unique combinations and their assigned association numbers must be in the same structure as the original table obtained from the BSM Group, except for the

addition of a single field for Association Number. In particular, it is imperative that the lists of species names are not altered in any way. Any data manipulation must be conducted in a copy of the original file to protect the integrity of the data.

8.3 Overall Significance analysis and management implications

8.3.1 General

The data collected using this methodology enable an assessment of the *relative ecological value* of the vegetation in each segment. It excludes factors such as contiguity with other vegetation, value as a wildlife corridor and landscape values.

Issues relating to the management of roadside vegetation fall into two general categories:
- Care required during construction and maintenance works.
- Management of ecological values via weed management, revegetation etc.

With respect to the former, a simple analytical approach has been developed that automatically generates a rating of **overall significance** to rank all segments of vegetation that were surveyed.

With respect to the latter, this is considered in terms of the **condition** (extent of weed invasion) of the vegetation.

8.3.2 Overall significance

The analysis of overall significance ranks vegetation segments according to their overall ecological value, as described in Table 8.2. This is based on a combination of two attributes: the conservation priority rating for the vegetation association, and the overview condition rating for the segment (Section 5.1.7). Every segment is assigned a category (A, B, C, D or E) according to the combination of these two attributes, as detailed in Table 8.3. The extra code, F, has been included to cover soil deposition (sand drift) situations, where it has been impossible to assess condition while the Z rating is only applicable to areas that are Built-up, Bare Ground or Watercourse (creeklines, not vegetated, either a dry creekbed or containing water).

The overall significance rating provides a simple summary of the relative ecological value of the vegetation in each segment. This analysis and its interpretation are simple, and users can consult width and density/distribution data later to compare the importance of different segments with similar characteristics.

Table 8.2: Descriptions of the categories of overall significance.

Category	Description
A	Should not be disturbed; contains a high priority vegetation association in excellent or good condition
B	Should not be disturbed; contains a high priority vegetation association in moderate condition or a lower priority association in excellent condition
C	Disturbance should be avoided whenever possible; contains a high priority vegetation association in poor condition or a lower priority association in moderate condition
D	May be disturbed, subject to further assessment and planning; contains limited native vegetation in poor condition
E	May be disturbed; very little or no native vegetation present.
F	May be of conservation significance - affected by sand drift. Requires further assessment prior to any works.
Z	Not relevant to overall significance. Area is either Built-up, Bare Ground or a Watercourse.

Table 8.3: Matrix of overall significance values, as determined by the conservation priority and overview condition ratings

Note: For the conservation priority rating, rating 1 represents the highest conservation value; for condition, rating 1 represents the best condition (least weed invaded); and for overall significance, category A represents the most significant (ecologically most important) vegetation. Brackets indicate that this combination is unlikely to occur.

			Conservation priority rating					
			1	2	3	4	5	9
Condition	Excellent	1	A	A	B	(C)	(C)	
	Good	2	A	B	B	(C)	(D)	
	Medium	3	B	B	C	D	(D)	
	Poor	4	C	C	D	E	E	
	Very poor	5	C	D	D	E	E	
	Sand Drift	6	C	C	F	F	F	
	Not relevant	9						Z

Note:

- that vegetation associations of highest priority are never rated lower than Category C;
- that vegetation associations of priority rating 2 condition 5 are rated Category D;
- that vegetation of moderate priority rating in excellent condition is rated only B;
- that low priority vegetation should never be in “excellent” (rating 1) or “good” (rating 2) condition.

8.3.3 Management required

With respect to the second management issue above - i.e. weeding, revegetation etc - the **condition** rating (i.e. extent of weed invasion) is applicable, and can be interpreted as in Table 8.4.

Table 8.4: Interpretation of the condition attribute to indicate the management implications of each category.

Note: this relates to the understorey for most vegetation, and to all strata for vegetation in which upper and lower strata are difficult to distinguish (e.g. grasslands).

Condition category	Management implications
1	Excellent native vegetation, requires vigilance for weed invasion and possibly a low level weeding program.
2	Good quality native vegetation that requires active management to maintain integrity.
3	Moderate quality native vegetation that requires active management to arrest further decline.
4	Poor quality, containing little native vegetation; depending on native species present, may require intensive management to prevent complete invasion by aliens; extensive revegetation required to restore.
5	Very little or no native vegetation; extensive revegetation required to restore.

8.3.4 Analysis procedure (including computer support)

This analysis requires no input from the user. When the results of the vegetation analysis have been entered onto the Roadside Vegetation Database (Section 8.2.4), an Overall Significance category is automatically generated for every segment.

The condition rating was entered during data entry and requires no further analysis.

8.4 Other analyses

8.4.1 Width

Wide roadsides are of greater value than narrow roadsides of comparable composition. A further analytical step is available that appends the overall significance rating with a 1, 2 or 3 according to whether the roadside vegetation is >15m, 6-15m or <6m wide respectively. Thus, for example, category A1 vegetation is category A vegetation that is greater than 15 m wide, category A2 vegetation is category A vegetation that is between 6 and 15m wide, etc.

As with the analysis of overall significance, this analysis is performed automatically, requiring no input from the user. The resulting categories of Overall Significance / Width for every segment are available for displaying on maps or printing in reports.

8.4.2 Outputs

8.4.2.1 Maps

Maps can be produced to display, for every segment, any of the attributes that were recorded in the field, the results of any analysis, and other specified information such as combinations of different attributes (as described in Section 1.3.1). Please discuss your map requirements with EIA Branch staff.

8.4.2.2 Reports

Reports are available that provide full print-outs or summaries of data and analysis results. Please discuss your report requirements with BSM and EIA Branch staff. The following standard reports are

available for each survey from the Roadside Vegetation Database and can be printed for you, or saved to a file, by the Roadside Vegetation Project Coordinator in the BSM Group.

Validation Report	Output of all data collected, used to check data entered onto database; useful for consulting details of all data collected for every segment; can be produced for entire survey or for selected roads.
Summary information by a survey	Provides a number of statistics for each vegetation association: the number of segments in which each association was recorded; the total distance over which each association was recorded; the distance over which vegetation was recorded in each overview condition category for each association; and the distance over which vegetation was recorded with different combinations of understorey types for each association. (Rvr170 – Summary Report by Survey, Rvr290 – Summary Report by Rail Survey)
Statistics summary	Provides the following summary statistics for the survey: total number of segments defined (left and right sides of roads), total distance of roadside surveyed, maximum and minimum segment lengths, and average segment length.
List of species	Lists every species recorded on the survey, along with common name, NSX code and the code used during field work (Rvr050 – Species recorded in a survey)
Roadside Marker Report	Provides information from the survey that is required to analyse the data to determine locations for placing roadside markers under the Roadside Marker Scheme.(contact Contracts and Services, Transport Services Division, DTEI.

8.4.2.3 GIS Datasets

If you wish to obtain a copy of the entire dataset from your survey or all the datasets for your study area, for analysis and display in ArcView, ArcGIS or other PC-based GIS software such as MapInfo, please talk to the Roadside Vegetation Project contact in EIA Branch to arrange this.

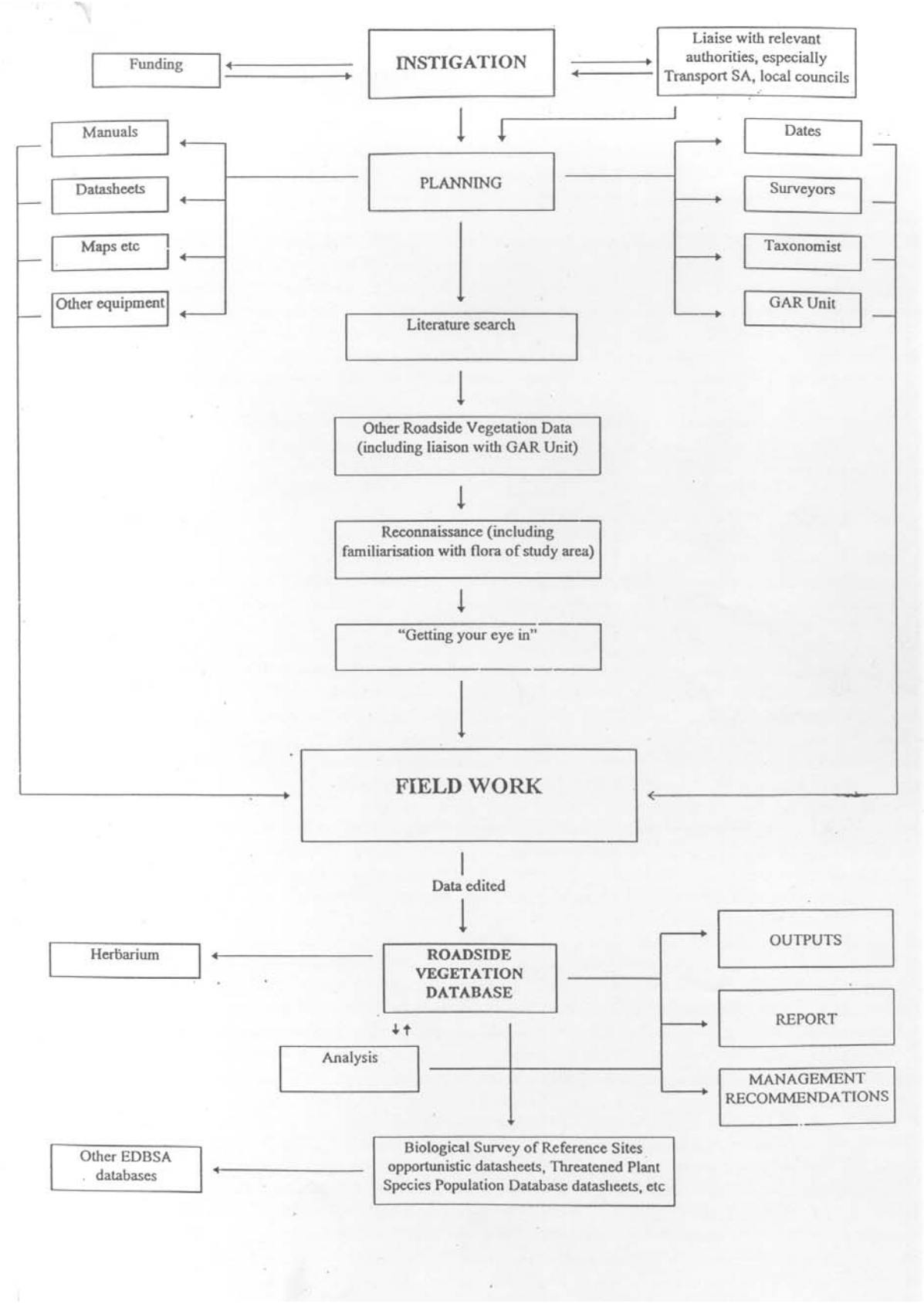
APPENDICES

Appendix 1: Glossary

Alien	Plant taxa that are not *indigenous* to the region in which the survey is being conducted. This includes plants that are not *indigenous* to Australia, and includes plants that are *indigenous* to Australia but are not *indigenous* to the survey region.
Assessment	*Survey* procedure that collects data providing a more superficial overview of an environmental system than a full vegetation *survey*.
Attribute	The different columns within a data table which contain descriptive information about the geographic feature for which information is being stored; for example the attributes recorded for a road may include the road name, road width and road surface type.
"Drive-by" survey	*Survey* conducted predominantly while driving along roads in a vehicle; this *assessment* is less detailed than a full vegetation *survey* and is primarily oriented towards collecting management-related information.
Geographical Information System (GIS)	An organised collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyse and display all forms of geographically referenced information. Certain complex spatial operations are possible with a GIS that would be very difficult, time consuming, or impractical otherwise. (Definition adapted from Environmental Systems Research Institute Inc. (1991) ARC/INFO User's Guide 6.0 ARC/INFO Data Model, Concepts, & Key Terms).
Indigenous	For this survey, indigenous plants are those which are known or presumed to have occurred in the survey region before European colonisation.
Layer	Information describing a single set of geographic objects such as roads, parcels, soil units or forests in a given area. A GIS layer contains both the spatial (location) and attribute (descriptive) data for geographic features.
Native	In this manual, synonymous with indigenous.
Odometer/Tripmeter	The *odometer* is the device in a vehicle that measures distance travelled; most vehicles also have a *tripmeter* that can be re-set to zero and is therefore easier to use during the "drive-by" survey.
Overstorey	For this survey, the tallest vegetation layer (stratum) that has a canopy cover 5%.
Pavement	On sealed roads, the bitumen surface of the road.
Road reserve	Linear parcels of land that were established for the purpose of providing transport corridors; most contain sealed or unsealed

	roads; usually delineated by fences in the agricultural region of South Australia.
Shoulder	On sealed roads, this is the gravel area from the edge of the bitumen surface to the drainage channel.
Survey	Generic term for the collection of data describing environmental systems; the Roadside Vegetation Survey includes a *"drive-by"* component, a subsequent full vegetation *survey* of selected sites (conducted according to the standard procedures for the Biological Survey of South Australia), and other components.
Stratum (plural strata)	An identifiable, discrete layer of vegetation caused by the presence of many plants, usually with similar growth habit, of approximately the same height.
Understorey	For this survey, any vegetation layers (*strata*) below the *overstorey*.
Vegetation association	For this survey, an array of plant species "of which the dominant *stratum* has a qualitatively uniform floristic composition and which exhibits a uniform structure as a whole" (Beadle and Costin 1952).

Appendix 2: Flow diagram of the survey process



Appendix 2b: Plant Specimen Collection – Permit Requirements

Under the National Parks and Wildlife Act (SA) 1972, Section 47 (1 & 2), native plants are protected:
. on any reserve;
. on any other Crown land;
. on any land reserved for or dedicated to public purposes;
or
. on any forest reserve

Reserves are not confined to National Parks and Wildlife reserves, but include such areas as roadsides, council reserves, railway reserves, cemeteries etc.

Plants cannot be collected on private land without the consent of the owner of the land.

Under the Native Vegetation Act (SA) 1991 (Exemption 3(1)(n): taking of seeds and specimens) exemption from approval is provided where the clearance comprises the taking of-
(i) a specimen; or
(ii) a cutting for propagation; or
(iii) such part of a plant as is required in order to obtain the seeds of the plant,

and does not cause substantial damage to the plant.

Cutting off a substantial branch to obtain seed or a specimen is not exempt. Collection of whole plants is not exempt (see permit requirements below).

A Scientific Permit, administered by the Biodiversity Survey and Monitoring Group, DEH SA, provides the means to collect plant specimens, including herbarium vouchers, seeds and whole plants, for scientific research purposes. An approved scientific permit covers the requirements of both the National Parks and Wildlife Act and the Native Vegetation Act with respect to this type of collecting.

A Scientific Permit **will not** be required where:
. the collection of specimens occurs on private land (definition includes pastoral leases) and does not result in substantial damage to a plant (ie removal of more than 20% of the seed stock or more than 5% of the foliage from any one plant), and the approval of the land-holder is obtained.

A Scientific Permit **will** be required where:
. The collection occurs on lands as detailed under Section 47 in the NPW Act (see above), and on private land where the collection involves 'substantial damage' such as where collection requirements exceed the proportions outlined above up to and including the removal of whole plants (as is often required for the collection of adequate herbarium specimens).

A Permit to Collect Native Plant Material, administered under the 'Take From the Wild Program' by the Biodiversity Conservation Programs Section of National Parks and Wildlife SA, is required to collect seed, fruit, cuttings etc when required for land management oriented activities such as revegetation programs, or where the material is required for commercial use such as nursery propagation or for food consumption.

Appendix 3: Descriptions of codes used by Roadside Vegetation Survey Methodology

Appendix 3.1: Structural Type (Vegetation Association Description)

F	Forest
W	Woodland
K	Mallee
S	Shrubland
P	Mat plants
H	Hummock grassland
G	Grassland (tussock)
V	Sedgeland
J	Herbland
X	Fernland
PL	Plantation
BU	Built-up
BG	Bare ground
WC	Watercourse

Explanation:
The overstorey (i.e. the tallest stratum that has a cover 5%) of each structural type is dominated by plants of characteristic life form, as follows:

Forest - Dominated by trees*, cover >30%.

Woodland - Dominated by trees*, cover 5% and <30%.

Mallee - Dominated by mallees, i.e. plants from genus *Eucalyptus*, multi-stemmed, arising from lignotuber.

Shrubland - Dominated by shrubs, i.e. plants that are woody, perennial, with foliage occupying all or part of total plant height, and with multiple stems and branches arising from a rootstock or very short common trunk. Generally <5m tall. Includes genus *Xanthorrhoea*.

Mat plants - Herbaceous or woody plants of prostrate habit, with major stems growing along the ground. Rarely exceed 10 cm in height. Examples of mat plants are *Kunzea pomifera*, *Myoporum parvifolium*, *Carpobrotus rossi* and *Mimulus repens.*

Hummock grassland - Dominated by plants from the genera *Triodia* and *Plectrachne* (Graminae).

Grassland (tussock) - Dominated by genera from family Graminae (Poaceae), other than hummock grasses.

Sedgeland - Dominated by sedges or sedge-like plants, i.e. plants that are herbaceous, usually perennial, erect, generally tufted, arising from stolons, tubers, bulbs, rhizomes or seeds. Leaf sheath never split. Includes Juncaceae, Restionaceae, Typhaceae and Xyridaceae; also includes genera *Lomandra* and *Dianella* (Lilliaceae), *Lepidosperma* and *Gahnia* (Cyperaceae).

Herbland - Dominated by herbs, i.e. plants that are herbaceous or slightly woody, annual or sometimes perennial, erect or creepers, rarely exceeding 0.5m in height.

Fernland - Dominated by ferns and/or fern allies, i.e. non-vascular cryptograms of classes Filicopsida and Lycopsida. This category includes *Ophioglossum* spp., *Lycopodium* spp., *Selaginella* spp. and *Isoetes* spp.

Plantation - Dominated by plants that have been deliberately planted, either with indigenous or non-indigenous species; includes revegetation using direct seeding and planting of seedlings. Plantation category is used where more than 1 row of planted species occurs and / or at a density of >5 % (except where very small seedlings). “Understorey” may be remnant indigenous vegetation.

Built-up - Buildings, pavement, parks and gardens, property frontages, etc.

Bare Ground – Areas such as quarry / borrow pits (or scraps) where no to little vegetation is apparent and the dominant cover is bare ground.

Watercourse – River Murray, drainage lines not vegetated, but containing water or dry creekbed.

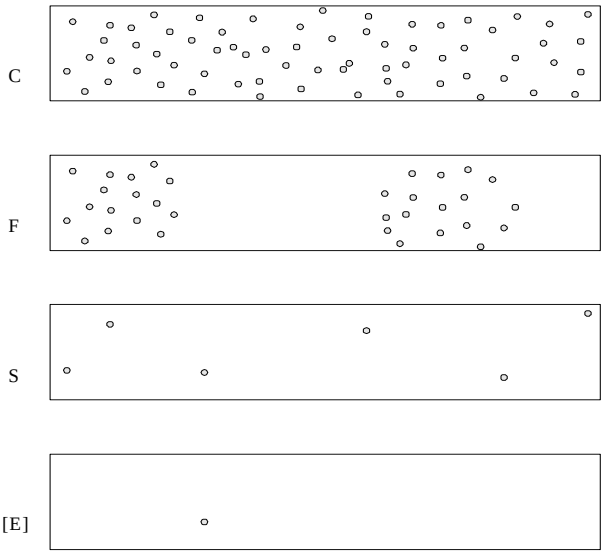
***Trees** - woody; perennial; erect; canopy raised well above the ground. Depth of canopy is usually less than or equal to two thirds of the total tree height. Single stemmed, or if multi-stemmed, fewer than five individual trunks resulting from branching of a single short trunk, that is not a mallee-like lignotuber. Height usually >2m.

Ref: Adapted from Forward, L.R., and Robinson, A.C. (eds) (1996). *A Biological Survey of the South Olary Plains South Australia*, *1991-1992*. Department of Environment and Natural Resources, South Australia.

Appendix 3.2: Density / Distribution (Vegetation Association Description)

C	Continuous
F	Fragmented
S	Scattered

Explanation



C - Continuous - a continuous, approximately uniform coverage of individuals in the overstorey, with little sign of human-induced thinning or fragmentation by human-induced "clearings".

F - Fragmented - patches of continuous overstorey interspersed with human-induced breaks or "clearings"; clearings and/or overstorey patches are too short to warrant definition of separate segments; indicates human-induced within segment variability (patchiness) of overstorey distribution. Note that the understorey may be uniform or may change coincidentally with overstorey.

S - Scattered - consistent scattering of remnant overstorey individuals, although extensive clearing by humans has occurred. This requires an assessment of whether the density is natural or human-induced - naturally very open communities should be recorded as **continuous** because their openness has not been caused by clearance or other human disturbances.

[E - Emergent species - if the tallest layer has <5% cover then it should be considered to be an emergent stratum, with the overstorey defined as the tallest stratum that has a cover of 5%. If an emergent stratum is present, record a species code for the dominant species in the stratum (refer to Section 5.1.11). Note that this very low density of individuals in the stratum may be natural or the result of extensive clearance.**]**

*The cut-off value of 5% is the standard used in the vegetation component of the Biological Survey of South Australia to define an emergent stratum. As a rule of thumb for estimating 5% cover, this represents 1/20th of the road reserve occupied by tree/mallee/shrub canopy, which could mean one individual with a five-metre diameter canopy every 100m, or a 10-meter diameter individual every 200m, or a 20-meter diameter individual every 400m.

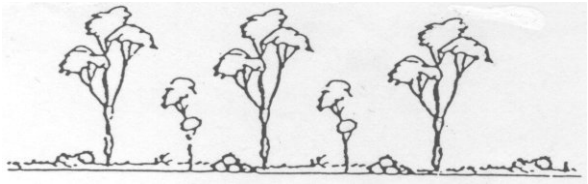
Appendix 3.3: Understorey Type (Vegetation Association Description)

LT	Low Trees
SC SH SO SE	Shrubs- chenopod /semi succulent Shrubs – heath Shrubs – other native Shrubs – exotic (alien)
PN PE	Mat plants- native Mat plants – exotic (alien)
H	Hummock grasses
GN GE	Grasses – (native tussock) Grasses – exotic (alien)
VN VE	Sedges – native Sedges – exotic (alien)
JN JE	Herbs – native Herbs – exotic (alien)
CN CE	Vine / climber / creeper – native Vine / Climber / creeper- exotic (alien)
X	Ferns
B	Bareground / plant litter
BS	Bareground, sand
XX	Other

Explanation

General note: "Native" and "Exotic" as used in these codes and definitions should be considered synonymous with "indigenous" and "alien" respectively as used in the rest of this manual and defined in the Glossary (Appendix 1). "Native" and "Exotic" are used in these codes for reasons of data integrity within the Roadside Vegetation Database.

Low trees - Tree layer (refer to definition of "trees" in Appendix 3.1) below the overstorey and generally above the level of a shrub understorey; e.g. *Acacia pycnantha* or *Allocasuarina verticillata* under *Eucalyptus viminalis* Open Forest/Woodland in the Adelaide Hills. Refer to diagram below.



Shrubs - chenopod / semi-succulent - Indigenous species from the family Chenopodiaceae; (the term "semi-succulent" is from Specht 1972).

Shrubs - heath - Indigenous sclerophyllous shrubs, usually less than 2m tall, commonly with ericoid leaves, generally with denser cover eg. >30% (adapted from McDonald et al, 1990 and Specht, 1972).

Shrubs – other native – native shrubs other than chenopod and heath; includes Melaleuca spp., Acacia spp., Xanthorrhoea spp.

Shrubs - exotic - Alien shrub species.

Mat plants - native - Refer to definition of mat plant in Appendix 3.1.

Mat plants - exotic - Refer to definition of mat plant in Appendix 3.1.

Grasses - hummock - Native grasses from the genera *Triodia* and *Plectrachne*.

Grasses - native tussock - Native plants from family Graminae (Poaceae), other than hummock grasses.

Grasses - exotic - Alien grass species from family Poaceae (Graminae).

Sedges - native - Refer to definition of sedge in Appendix 3.1; includes genera *Lomandra* and *Dianella* (Liliaceae), and *Lepidosperma* and *Gahnia* (Cyperaceae).

Sedges - exotic - Refer to definition of sedge in Appendix 3.1; includes *Juncus acutus* and *J. articulatus*.

Herbs - native - Refer to definition of herb in Appendix 3.1.

Herbs - exotic - Refer to definition of herb in Appendix 3.1; includes *Echium plantagineum* (Salvation Jane).

Vine / climber / creeper - native - Climbing, twining, winding or scrambling plants; excludes mat plants which have their major stems growing along the ground; examples are *Billardiera* spp., *Cassytha* spp., *Hardenbergia* spp.

Vine / climber / creeper - exotic - Includes *Myrsiphyllum asparagoides* (Bridal Creeper).

Ferns - Refer to definition of fern in Appendix 3.1.

Other - Use this category to flag any understorey structure that does not fit into any of the defined categories. Record a description and possible definition, to be discussed with database administrators and users regarding a possible new category to be added to the database.

Appendix 3.4: Condition Of Understorey

The definitions of the condition categories are:

1	Excellent	Very little or no sign of alien vegetation in the understorey*; close resemblance to probable pre-European condition
2	Good	High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation
3	Moderate	Substantial invasion of aliens, but native understorey* persists; for example, may be a low proportion of native species and high native cover, or high proportion of native species and low native cover
4	Poor	The understorey* consists predominantly of alien species, although a small number of natives persist
5	Very poor	The understorey* consists only of alien species
6	Soil deposition (Sand drift)	Soil / sand smothering the understorey plants resulting in condition being unable to be assessed - alien species some to none apparent.
9	Not Relevant	Not relevant to assess condition as Built-up, Bareground or Water course.

*Or all strata if upper and lower strata are difficult to distinguish eg. grasslands, sedgelands, low shrublands.

Appendix 3.5: Disturbances

AT	Access track through vegetation
BH	Bee Hives
BN	Burning of vegetation
BQ	Borrow / Quarry Pit
CA	Campsite
CL	Clearing
CR	Coppice regrowth
DR	Drains
EA	Earthmoving / Earthworks
EAS	Earthworks, scalping
FND	Fertiliser / nutrient drift
FP	Firebreak - ploughed
FS	Firebreak - slashed
GR	Grazing
LP	Lopping
PF	Property frontage
PL	Plantings
PW	Power Lines
RA	Active rabbit warren
RD	Rubbish Dumping
SL	Slashing
SDP	Sand drift, previous (>24months)
SDR	Sand drift, recent (<24months)
SP	Stockpile (road materials)
SR	Spraying
TE	Telecommunications easement
WS	Wayside stop (parking bay)
WP	Water pipeline

Explanations:

(Many of these codes are self explanatory, although a few need clarification.)

AT - access track - access track running **longitudinally** along the road reserve rather than latitudinally across the road reserve; thus tracks, roads, laneways etc into properties should not be recorded.

BU - burning - this may include large scale wildfire burns, small scale burning off of understorey or litter and branches, or burnt fuel breaks.

CR - coppice regrowth - the sprouting of many trunks when the main trunk of a tree or mallee is lopped near the base. (Contrast with LP - lopping).

FND – fertiliser / nutrient drift – signs of fertiliser and / or nutrient drift present smothering the vegetation.

GR - grazing - signs of grazing by stock, feral animals or native wildlife e.g. Macropods

LP - lopping - the cutting of limbs and branches to lower the height of the canopy; typically under powerlines.

PF - property frontage - may include lawns, plantings, driveways, etc.; too short to justify a separate "Built Up" segment.

PL - plantings - deliberate plantings, either of alien or locally indigenous species, that are scattered. One row and occurring at a density of <5% (i.e. 1 m canopy every 20 m or a 5 m canopy every 100m).

SDP - sand drift, previous (> 24 months old but < 200 years old). Characterised by old deposits of soil that appear to have some organic matter (plant litter) on the surface (including stand dead plant material), more established weeds, perennial plants, hummocky landform pattern and more oxidised soil colour (e.g. dull soil colour) where bare soil is partially exposed.

SDR - sand drift, recent (in last 12-24 months). Characterised by deposits of windblown raw sand, fresh weeds (none to little plant litter or standing dead plant matter) over raw sand and a stronger soil colouration.

SL - slashing - includes rough slashing and close mowing.

SP - stockpile - road construction materials, e.g. gravel dumps.

Appendix 3.6: Potential Site

BUS	"Bush For Life" Site
REF	Reference Site
REH	Rehabilitation Site
REV	Revegetation Site
RSS	Roadside Significance Site

Explanation:

BUS "Bush For Life" Site
Relatively intact high value bushland, which has suffered minimal disturbance and can be readily rehabilitated. The term ""Bush For Life"" referred to here is based on the program developed by Trees For Life (SA) for the rehabilitation and sustainable management of indigenous vegetation. "Bush For Life" involves minimal disturbance, integrated management techniques and is a community-based program involving small teams of trained bush-care workers. A "Bush For Life" Site is therefore determined by the significance of the vegetation and its "Bush For Life" management potential, and may also be identified as a Significant Site and / or Reference Site.

REF Reference Site
Representative example of a plant community proposed for detailed on-ground assessment. Reference Site assessments will conform to the standard procedures for the Biological Survey of South Australia [refer to Heard & Channon (1997)] and will collect physical and vegetation (floristic and structural) data describing the features of the site. These sites should be surveyed during Spring.

REH Rehabilitation Area
An area of partially degraded native vegetation, which could be rehabilitated through the implementation of a weed control and management program. An example could be an area where there is relatively intact native overstorey with the understorey being gradually depleted through the invasion of alien plant species due to previous disturbances.

REV Revegetation Site
An area which is potentially suitable for revegetation. Generally, the key characteristics of a Revegetation Site will be the absence of remnant indigenous flora, a wide roadside (i.e. > 10 metres), absence of services which could be affected, and unimpaired road user safety.

RSS Roadside Significant Site
Vegetation of high ecological and conservation value. Conservation significance may be determined at a regional, State or national level. Ecological value is influenced by regional or local remnancy, adjacent land-use, site dimensions (particularly roadside width), and intactness or condition. Significant Sites are recorded on the Roadside Significant Sites Database and shall be marked on site with Roadside Markers.

Appendix 3.7 Codes for flagging information recorded under Comments on Main Datasheet

ADJ	Adjacent land-use
ADM	Administration road issues
ALI	Major alien species
BUS	Bushcare site (potential)
CON	Condition of understorey
DIE	Presence of dieback
DIS	Disturbance to roadside corridor
DOM	Dominant species
EME	Emergent species
MIS	Mistletoe infestation
NSP	Noteworthy native species
REF	Reference site
REH	Rehabilitation area (potential)
REG	Regenerating native plant species
REV	Revegetation site (potential)
RMS	Roadside Marker Scheme
RSD	Roadside and road surface condition
RSS	Roadside Significant site (potential)
SED	Seed source
SIG	Plants of conservation significance
STR	Structural type
UND	Understorey structure or species
WID	Roadside width

Explanation:

(Many of these codes are self explanatory, although a few need clarification.)

RMS – for including comments or information on existing Roadside Marker scheme markers positions eg. Noting the start and end odometer reading or GPS positions in the segment.

NSP - Noteworthy native species comment type is the flag to use when the surveyor thinks there are observations of native species that are important to record and these will not be included in the main datasheet columns (dominant overstorey, understorey or emergent species) or generally are not of conservation significance.

SIG – Used record plants of conservation significance (i.e. rated plants)

Appendix 4. Roadside Vegetation Survey - Main Datasheet

- 4.1: Blank template
- 4.2: Completed example

4.1: Blank template

ROADSIDE VEGETATION SURVEY

Survey No. ☐☐☐ Road Order ☐☐☐☐

Date ☐☐ ☐☐ ☐☐ (DD MM YY) Observers (3 initials) ☐☐☐ ☐☐☐ ☐☐☐ Sheet ☐ of ☐ Data Entrant (3 initials) (Office use only) ☐☐☐

Road Name ☐ Road Type ☐☐☐☐ TSA Road No. RN ☐☐☐☐☐

					Vegetation Association Description *DOM- Overstorey			*STR-		*UND-		Understorey species *UND-					Condition of Understorey *CON-			Major alien species *ALI-					Disturbances *DIS-			*BUS- *REF- *REH- *REV- *RSS-	*EME-	Comments (use appropriate code prefixes for datasheet items, for additional comments use codes on Definition sheet) eg *NSP-
Segment	Tripmeter (end of segment reading only)	Surface	Side	Width *WID-	Dominant species 1	Dominant Species 2	Dominant Species 3	Structural type	Density/ Distribution	Understorey type 1	Understorey type 2	Species 1	Species 2	Species 3	Species 4	Species 5	Overview	Best (Minimum)	Worst (Maximum)	Species 1	Species 2	Species 3	Species 4	Species 5	Disturbance 1	Disturbance 2	Disturbance 3	Potential Site	Emergent species	
1			L																											
			R																											
2			L																											
			R																											
3			L																											
			R																											
4			L																											
			R																											
5			L																											
			R																											
6			L																											
			R																											
7			L																											
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8			L																											
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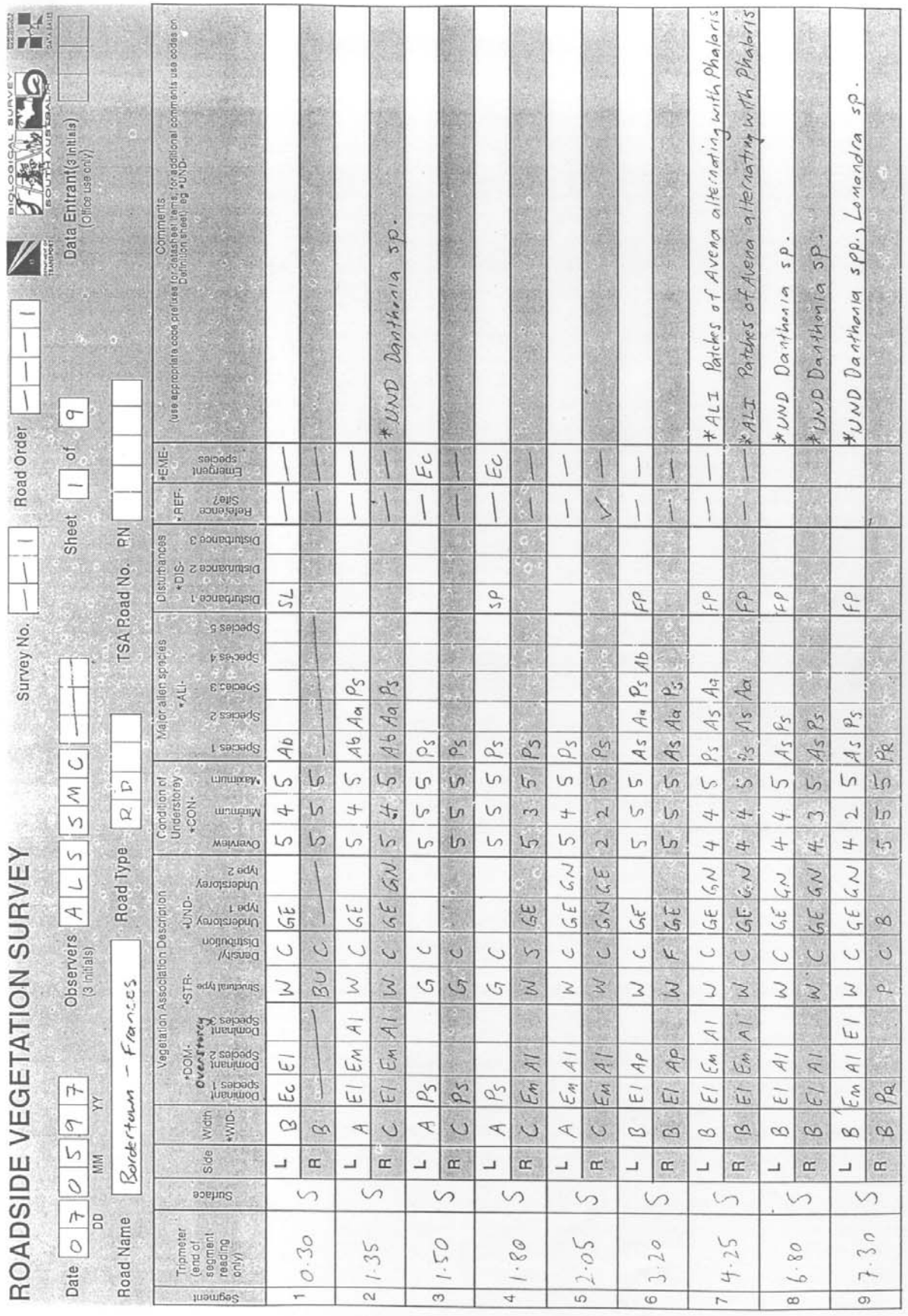
9			L																											
			R																											11.9.03

4.2: Completed example



ROADSIDE VEGETATION SURVEY

Date 07/09/97 (DD MM YY) Observers (3 initials) ALS Survey No. —|—|1 Road Order —|—|—|1 Sheet 1 of 9 Data Entrant (3 initials)

Road Name Boordertown - Frances Road Type RD TSA Road No. RN

Segment	Tripmeter (end of segment reading only)	Surface	Side	Width *WID-	Vegetation Association Description: Dominant Species 1	Dominant Species 2	Dominant Species 3 *DOM- Overstorey	Structural Type *STR-	Density/ Distribution	Understorey Type 1 *UND-	Understorey Type 2	Condition of Understorey *CON-: Overview	Minimum	Maximum	Major alien species *ALI-: Species 1	Species 2	Species 3	Species 4	Species 5	Disturbances *DIS-: Disturbance 1	Disturbance 2	Disturbance 3	*REF- Reference Site?	*EME- Emergent species	Comments (use appropriate code prefixes for datasheet items; for additional comments use codes on Definition sheet) eg *UND-
1	10.30	S	L	B	Ec	EI		W	C	GE		5	4	5	Ab					SL			—	—	
			R	B	—	—		BU	C	—	—	5	5	5	—								—	—	
2	1.35	S	L	A	EI	Em	AI	W	C	GE		5	4	5	Ab	Aa	Ps						—	—	
			R	C	EI	Em	AI	W	C	GE	GN	5	4	5	Ab	Aa	Ps						—	—	*UND Danthonia sp.
3	1.50	S	L	A	Ps			G	C			5	5	5	Ps								—	Ec	
			R	C	Ps			G	C			5	5	5	Ps								—	—	
4	1.80	S	L	A	Ps			G	C			5	5	5	Ps					sp			—	Ec	
			R	C	Em	AI		W	S	GE		5	3	5	Ps								—	—	
5	2.05	S	L	A	Em	AI		W	C	GE	GN	5	4	5	Ps								—	—	
			R	C	Em	AI		W	C	GN	GE	2	2	5	Ps								V	—	
6	3.20	S	L	B	EI	Ap		W	C	GE		5	5	5	As	Aa	Ps	Ab		FP			—	—	
			R	B	EI	Ap		W	F	GE		5	5	5	As	Aa	Ps						—	—	
7	4.25	S	L	B	EI	Em	AI	W	C	GE	GN	4	4	5	Ps	As	Aa			FP			—	—	*ALI Patches of Avena alternating with Phalaris
			R	B	EI	Em	AI	W	C	GE	GN	4	4	5	Ps	As	Aa			FP			—	—	*ALI Patches of Avena alternating with Phalaris
8	6.80	S	L	B	EI	AI		W	C	GE	GN	4	4	5	As	Ps				FP					*UND Danthonia sp.
			R	B	EI	AI		W	C	GE	GN	4	3	5	As	Ps									*UND Danthonia sp.
9	7.30	S	L	B	Em	AI	EI	W	C	GE	GN	4	2	5	As	Ps				FP					*UND Danthonia spp., Lomandra sp.
			R	B	PR			P	C	B		5	5	5	PR										

Appendix 5. Calibration Sheet

- 5.1: Blank template
- 5.2: Completed example

5.1: Blank Template

Visit date	Route	Calib Point No.	Trip.	RRD	Location Description	Seg No.	MM No.	Waypoint No.	Zone	Datum	Easting	Northing

5.2: Completed example

ROADSIDE VEGETATION SURVEY - CALIBRATION SHEET

Survey No. — — 3 Sheet 1 of 6 Observers (3 Initials) SML RMP

Road No.	Point No.	Tripmeter	Location Description (optional)
1	1 (END)	1.3	
2	1	1.15	
2	2 (END)	2.1	
3	1	1.2	
3	2	3.85	
3	3	4.4	
3	4 (END)	6.55	
4	1	0.7	
4	2	1.95	
4	3 (END)	3.7	
5	1	1.75	
5	2	2.60	
5	3 (END)	4.65	
6	1 (END)	2.1	
7	1	2.7	
7	2	3.2	
7	3	4.8	Major intersection
7	4	8.05	
7	5 (END)	10.4	
8	1	2.4	
8	2	7.25	
8	3	9.15	
9	1	5.25	
9	2 (END)	7.55	
10	1	1.9	
10	2 (END)	2.7	
11	1 (END)	1.4	
12	1 (END)	3.05	
13	1 (END)	1.2	
14	1	5.95	
14	2	8.0	
14	3 (END)	10.45	

Road No.	Point No.	Tripmeter	Location Description (optional)
15	1	2.3	
15	2	4.3	
15	3 (END)	7.75	
16	1	1.6	
16	2	3.45	
16	3	5.75	
16	4	6.95	
16	5	10.25	
16	6 (END)	11.6	
17	1 (END)	0.75	
18	1 (END)	1.35	
19	1 (END)	4.65	
20	1 (END)	2.15	
21	1	3.1	
21	2	5.3	
21	3	7.5	
21	4 (END)	9.3	
22	1	4.25	
22	2	7.8	
22	3	11.15	
22	4 (END)	14.75	
23	1	1.95	
23	2	6.1	
23	3	7.8	
23	4 (END)	11.95	
24	1	3.35	
24	2 (END)	6.55	
26	1	4.15	
26	2	6.65	
26	3	10.45	
26	4	15.1	
26	5	21.0	
26	6 (END)	22.25	

Appendix 6. Voucher Sheet

- 6.1: Blank template
- 6.2: Completed example

6.1: Blank template

ROADSIDE VEGETATION SURVEY - VOUCHER SHEET
Survey No _ _ _ Observers _ _ _ / _ _ _ Sheet _ of _

Determiner	Final Name (Final ID)	Field Name	Voucher No.	Date	Road Order
			RV-001		
			RV-002		
			RV-003		
			RV-004		
			RV-005		
			RV-006		
			RV-007		
			RV-008		
			RV-009		
			RV-010		
			RV-011		
			RV-012		
			RV-013		
			RV-014		
			RV-015		
			RV-016		
			RV-017		
			RV-018		
			RV-019		
			RV-020		
			RV-021		
			RV-022		
			RV-023		
			RV-024		
			RV-025		
			RV-026		
			RV-027		
			RV-028		
			RV-029		
			RV-030		
			RV-031		
			RV-032		
			RV-034		
			RV-035		
			RV-036		
			RV-037		
			RV-038		
			RV-039		
			RV-040		
			RV-050		
			RV-051		
			RV-052		
			RV-053		
			RV-054		
			RV-055		
			RV-056		
			RV-057		
			RV-058		
			RV-059		
			RV-060		

6.2: Completed example

ROADSIDE VEGETATION SURVEY - VOUCHER SHEET

Survey No 1 _ _ Observers AES/SMc Sheet 1 of 1

Determiner	Final Name (Final ID)	Field Name	Voucher No.	Date	Road Order
PL	E. microcarpa	Eucalyptus microcarpa	RV-001	07-05-97	1
PL	E. microcarpa	E. microcarpa ?(2)	RV-002	07-05-97	1
RT	Scabiosa atropurpurea	Alien species 'A'	RV-003	07-05-97	1
PL	E. odorata	E. gracilis ?	RV-004	07-05-97	3
RT	Rumex crispus	Alien species 'C'	RV-005	07-05-97	3
RT	Oenothera stricta	Yellow plant	RV-006	07-05-97	3
RT	Piptatherum miliaceum	Millet	RV-007	08-05-97	4
PL	E. dumosa	E. dumosa ?	RV-008	08-05-97	4
RT	Ulmus sp.	Exotic tree 'C'	RV-009	08-05-97	4
RT	Lagurus ovatus	Pussy tail	RV-010	14-05-97	5
LH	M. uncinata	Melaleuca uncinata?	RV-011	14-05-97	5
RT	Lactuca serriola	Exotic species D.	RV-012	14-05-97	5
RT	Plantago lanceolata	Black headed exotic	RV-013	14-05-97	5
PL	E. odorata	E. odorata ?	RV-014	15-05-97	5
RT	Sisymbrium officinale	Branched weed	RV-015	15-05-97	6
RT	Lomandra sororia	Lomandra sp.	RV-016	15-05-97	6
RT	Lepidosperma concavum	Lomandra sp2.	RV-017	15-05-97	6
RT	Dorthoria setacea	Dorthoria sp.	RV-018	15-05-97	7
RT	Graminae sp.	Graminae sp.	RV-019	15-05-97	7
			RV-020		
			RV-021		
			RV-022		
			RV-023		
			RV-024		
			RV-025		
			RV-026		
			RV-027		
			RV-028		
			RV-029		
			RV-030		
			RV-031		
			RV-032		
			RV-034		
			RV-035		
			RV-036		
			RV-037		
			RV-038		
			RV-039		
			RV-040		
			RV-050		
			RV-051		
			RV-052		
			RV-053		
			RV-054		
			RV-055		
			RV-056		
			RV-057		
			RV-058		
			RV-059		
			RV-060		

Appendix 7: Species Code Sheet

- 7.1: Blank template
- 7.2: Completed example (at completion of field work, **before** completion of plant identifications and entry of correct names onto sheet)

7.1: Blank template

ROADSIDE VEGETATION SURVEY - SPECIES CODE SHEET

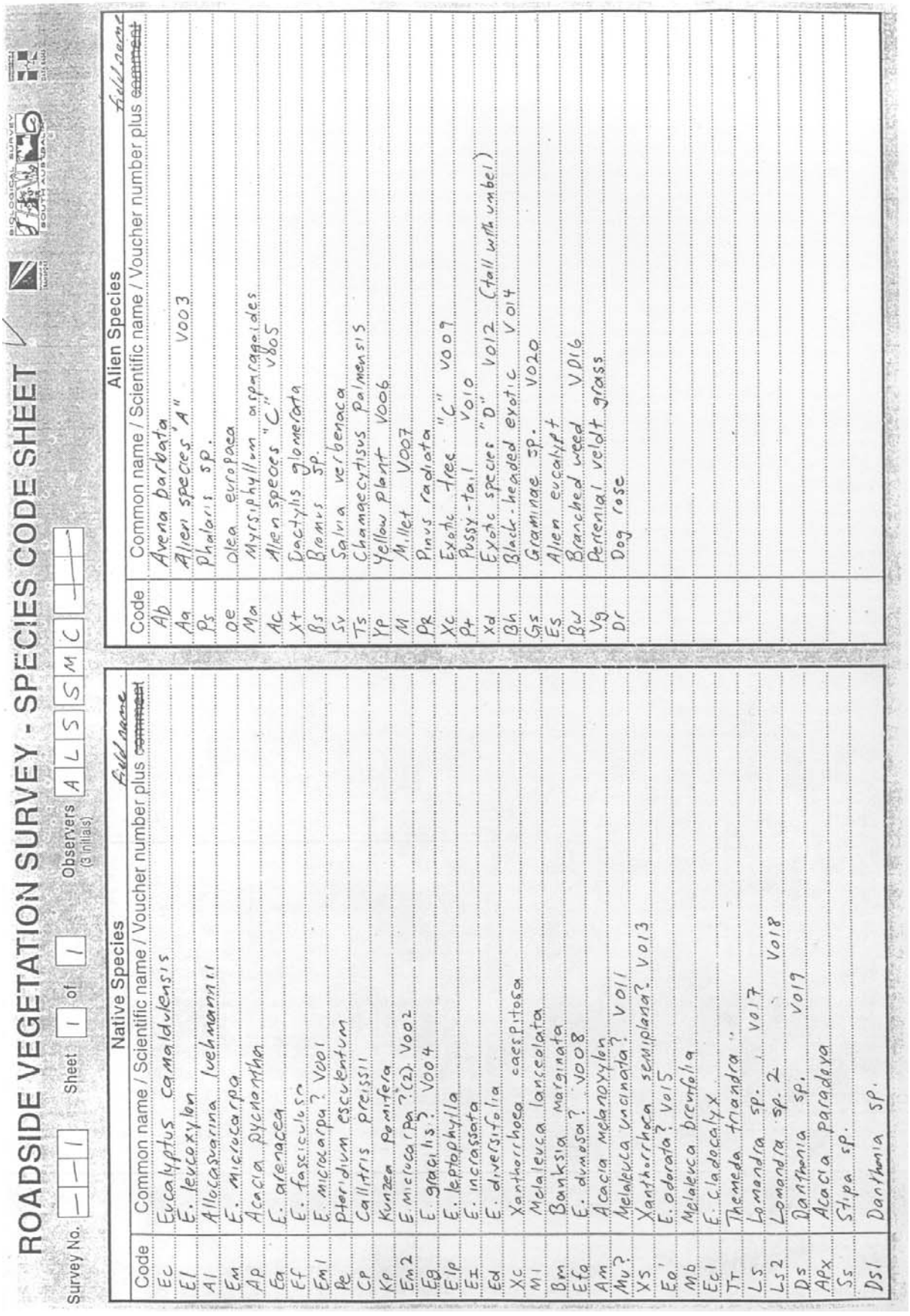
Survey No. ☐☐☐ Sheet ☐ of ☐ Observers (3 initials) ☐☐☐ ☐☐☐ ☐☐☐

Code	Species Common name / Scientific name / Voucher number plus field name

Code	Species Common name / Scientific name / Voucher number plus field name

11.9.03

7.2: Completed example (at completion of field work, before completion of plant identifications and entry of correct names onto sheet)



ROADSIDE VEGETATION SURVEY - SPECIES CODE SHEET

Survey No. — — | Sheet 1 of 1 | Observers (3 initials) A L S | S M C

Native Species *Field name*

Code	Common name / Scientific name / Voucher number plus ~~comment~~
Ec	Eucalyptus camaldulensis
El	E. leucoxylon
Al	Allocasuarina luehmannii
Em	E. microcarpa
Ap	Acacia dycnantha
Ea	E. arenacea
Ef	E. fasciculosa
Em1	E. microcarpa? V001
Pe	Pheridium esculentum
Cp	Callitris preissii
Kp	Kunzea pomifera
Em2	E. microcarpa? (2) V002
Eg	E. gracilis? V004
Elp	E. leptophylla
Ei	E. incrassata
Ed	E. diversifolia
Xc	Xanthorrhoea caespitosa
Ml	Melaleuca lanceolata
Bm	Banksia marginata
Efa	E. dumosa? V008
Am	Acacia melanoxylon
Mu?	Melaleuca uncinata? V011
Xs	Xanthorrhoea semiplana? V013
Eo'	E. oleorata? V015
Mb	Melaleuca brevifolia
Ec1	E. cladocalyx
Tt	Themeda triandra
Ls	Lomandra sp. V017
Ls2	Lomandra sp. 2 V018
Ds	Danthonia sp. V019
APx	Acacia paradoxa
Ss	Stipa sp.
Dsl	Danthonia sp.

Alien Species *Field name*

Code	Common name / Scientific name / Voucher number plus ~~comment~~
Ab	Avena barbata
Aa	Alien species "A" V003
Ps	Phalaris sp.
Oe	Olea europaea
Ma	Myrsiphyllum asparagoides
Ac	Alien species "C" V005
Xt	Dactylis glomerata
Bs	Bromus sp.
Sv	Salvia verbenaca
Ts	Chamaecytisus palmensis
Yp	Yellow plant V006
M	Millet V007
Pr	Pinus radiata
Xc	Exotic tree "C" V009
Pt	Pussy-tail V010
Xd	Exotic species "D" V012 (Tall with umbel)
Bh	Black-headed exotic V014
Gs	Gramineae sp. V020
Es	Alien eucalypt
Bw	Branched weed V016
Vg	Perennial velvet grass
Dr	Dog rose

Appendix 8: Code Look-Up Sheet

CODES & DEFINITION SHEET FOR THE ROADSIDE VEGETATION SURVEY

Roadtype

AVE	Avenue
CRES	Crescent
CT	Court
DR	Drive
HWY	Highway
LANE	Lane
PDE	Parade
RD	Road
ST	Street
TCE	Terrace
TRAC	Track

Width

A	0-6m
B	6-15m
C	>15m

Structural type

F	Forest
W	Woodland
K	Mallee
S	Shrubland
P	Mat plants
H	Hummock grassland
G	Grassland
V	Sedgeland
J	Herbland
X	Fernland
PL	Plantation
BU	Built up
BG	Bare ground

Density/Distribution

C	Continuous
F	Fragmented
S	Scattered

Understorey type

LT	Low Trees
SC	Shrubs - chenopod / semi succulent
SH	Shrubs - heath
SO	Shrubs - other native
SE	Shrubs - exotic (alien)
PN	Mat plants - native
PE	Mat plants - exotic (alien)
H	Hummock grasses
GN	Grasses - native (tussock)
GE	Grasses - exotic (alien)
VN	Sedges - native
VE	Sedges - exotic (alien)
JE	Herbs - exotic (alien)
JN	Herbs - native
X	Ferns
CN	Vines/Climbers/creepers - native
CE	Vines/Climbers/creepers - exotic (alien)
LL	Leaf Litter (plant litter)
B	Bare ground/litter (not valid from Sept 2003)
BS	Bare ground (sand)
BG	Bare ground
XX	Other

Condition of understorey

1	Excellent	Very little or no sign of alien vegetation in the understorey*; resembles probable pre-European condition.
2	Good	High proportion of native species and native cover in the understorey*; reasonable representation of probable pre-European vegetation.
3	Moderate	Substantial invasion of aliens, but native understorey* persists; for example, may be a low proportion of native species and a high native cover, or high proportion of native species and low native cover.
4	Poor	The understorey* consists predominantly of alien species, although a small number of natives persist.
5	Very Poor	The understorey* consists only of alien species.
6	Soil deposition (Sand drift)	Soil/sand smothering the understorey plants resulting in condition being unable to be assessed, alien species not yet apparent.

*Or all strata if upper and lower strata difficult to distinguish

Disturbances

AT	Access track through vegetation	GR	Grazing
ATB	Access tracks (bike trails)	LP	Lopping
ATH	Access tracks (horses)	PF	Property frontage
ATM	Access tracks (motor cycles)	PI	Pipeline
ATW	Access tracks (walking)	PL	Plantings
BH	Bee Hives	PW	Power line
BN	Burning of vegetation	RA	Active rabbit warren
BQ	Borrow /Quarry Pit	RD	Rubbish Dumping
CA	Campsite	SDR	Sand drift, recent (<24 months)
CL	Clearing (human influence)	SDP	Sand drift, previous (>24 months)
CR	Coppice regrowth	SL	Slashing
DR	Drains	SP	Stockpile
EA	Earthmoving / earthworks	SR	Spraying
EAS	Earthworks - scalping	TE	Telecommunications easement
FP	Firebreak-ploughed	WP	Water pipeline
FS	Firebreak-slashed	WS	Wayside stop

Potential Site

BUS	Bushcare Site	REV	Revegetation Site
REF	Reference Site	RSS	Roadside Significant site
REH	Rehabilitation Area		

Comment type

ADJ	Adjacent land use
ADM	Administration road issues
ALI	Dominant alien species
BUS	Bushcare site (potential)
CON	Condition of understorey
DIE	Presence of dieback
DIS	Disturbances to roadside corridor
DOM	Dominant species
EME	Emergent species
MIS	Mistletoe infestation
NSP	Noteworthy native plant species
REF	Reference site
REH	Rehabilitation area (potential)
REG	Regenerating native plant species
REV	Revegetation site (potential)
RSD	Roadside and road conditions
RSS	Roadside Significant site (potential)
SED	Seed source
SIG	Plants of conservation significance
STR	Structural type
UND	Understorey structure or species
WID	Roadside width

11.9.03

Appendix 9: Survey Summary Details Proforma

- Not currently available.

Appendix 10: South Australian Structural Vegetation Formations

Life Form/Height Class	Percentage Foliage Cover of Tallest Stratum			
	Dense (70-100%)	Mid-dense (30-70%)	Sparse (10-30%)	Very sparse (<10%)
Trees > 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees 5-10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Trees <5m	Very Low Closed Forest	Very Low Open Forest	Very Low Woodland	Very Low Open Woodland
Mallee (>3m)	Closed Mallee	Mallee	Open Mallee	Very Open Mallee
Low Mallee (<3m)	Closed Low Mallee	Low Mallee	Open Low Mallee	Very Open Low Mallee
Shrubs > 2m	Tall Closed Shrubland	Tall Shrubland	Tall Open Shrubland	Tall Very Open Shrubland
Shrubs 1-2m	Closed Shrubland	Shrubland	Open Shrubland	Very Open Shrubland
Shrubs < 1m	Low Closed Shrubland	Low Shrubland	Low Open Shrubland	Low Very Open Shrubland
Mat plants	Closed Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grasses	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland
Grasses (Tussock)	Closed (Tussock) Grassland	(Tussock) Grassland	Open (Tussock) Grassland	Very Open (Tussock) Grassland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Ferns	Closed Fernland	Fernland	Open Fernland	Very Open Fernland

[Note: Table originally derived from Specht (1972) and Muir (1977)]

Trees - woody; perennial; erect; canopy raised well above the ground. Depth of canopy is usually less than or equal to two thirds of the total tree height. Single stemmed, or if multistemmed, fewer than five individual trunks resulting from branching of a single short trunk, that is not a mallee-like lignotuber. Height usually >2m.
Mallees - genus *Eucalyptus**;*** multi-stemmed, trunks arising from lignotuber. Low mallee - < 3m. Mallee - > 3m
Shrubs- woody; perennial; erect, procumbent or weeping; foliage occupies all or part of total plant height; multiple stems and branches arising from a rootstock or very short common trunk; generally <5m tall.
Mat Plants - Herbaceous or woody plants of prostrate habit, with major stems growing along the ground. Rarely exceeds 10 cm in height. Examples of mat plants are *Kunzea pomifera*, *Myoporum parvifolium*, *Carpobrotus rossii* and *Mimulus repens*.
Hummock Grass - Genera *Triodia* or *Plectrachne* only.
Grasses (Tussock) - family Poaceae (Gramineae); leaf sheath always split. Includes all non-hummock grasslands. The brackets surrounding Tussock indicate it is an optional word in the description, depending on the species present.
Sedges - herbaceous, usually perennial, erect, generally tufted; arise from stolons, tubers, bulbs, rhizomes or seeds. Leaf sheath never split. Includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae and Xyridaceae and other sedge-like forms.
Herbs - herbaceous or slightly woody; annual or sometimes perennial; erect or creepers; rarely exceeds 0.5m height**.**
Ferns - Ferns and fern allies, i.e. non-vascular cryptogams of classes Filicopsida and Lycopsida. This category includes *Ophioglossum* spp., *Lycopodium* spp., *Selaginella* spp. and *Isoetes* spp.

Source: Adapted from Forward L. R. & Robinson A.C. (1996) A Biological Survey of the South Olary Plains, South Australia, Department of Environment and Natural Resources, and updated from Heard L. and Channon C. (1997) *Guide to a Native*

Vegetation Survey Using the Biological Survey of South Australia. Information and Data Analysis Branch, Department of Housing and Urban Development.

Appendix 11: Useful contacts and services available

Table A.1: Contacts (subject to change)

Biological Survey and Monitoring (BSM), Department for Environment and Heritage (DEH)	Roadside Vegetation Survey methodology and database information ph. 08 8222 9472
Environmental Information and Analysis (EIA) Branch, Enviornmental Information, DEH	Roadside Vegetation Survey spatial data and GIS information Ph. 08 8463 3972
Transport Service Division, Transport, Energy and Infrastructure	Roadside Marker advice and information, Contracts and Standards Transport Services Division ph. 08 8343 2027
Native Vegetation Section, Land and Biodiversity Services, Department for Water, Land and Biodiversity Conservation	Roadside Vegetation Management Plans and roadside vegetation advice ph. 08 8124 4745
The Biological Survey Coordinating Committee	Manager, Biological Survey and Monitoring Science and Conservation Department for Environment and Heritage (DEH) ph. 08 8222 9470
Biological Databases of SA	Care of the BSM, DEH ph. 08 8222 9443
The Vegetation Mapping and Analysis Group	Care of the BSM and EIA, DEH ph. 08 8303 0715
Local Government Association of SA	ph. 08 8224 2000
Specialised Odometers	Neil Morris Auto Instruments - ph. 08 8362 4881 Colin Bartholomew - ph. 08 8266 1296
Safety Lights / Signs	Heatpac Safety Signs and Equipment Ph 08 8234 0322

Table A.2: Services available

Services available from Government Departments to support roadside vegetation surveys.

Note: Fees may be charged for some services - it is advisable to clarify costs before making an application to fund a survey and again in the initial stages of survey planning.

BSM Group, Department for Environment and Heritage
MS Word documents
- voucher list template (for recording vouchered plant specimens and names)
- appropriate survey manuals, analysis guides, etc
- complete listing of all of the codes and definitions that are available for various attributes collected on the survey

EIA Branch, Department for Environment and Heritage
Plots/Maps
- pre-survey: hardcopy overview paper plots showing roads, other linear features, landcover, cadastral boundaries, previous survey sites, floristic survey mapping (1:40 000), structures, drainage and topography. These may not be available for all areas.
- post-survey: hardcopy maps showing all the segments defined during fieldwork and displaying information recorded for each and results of data analysis
- ARcGIS or MapInfo roadside vegetation dataset for the Roadside Vegetation Survey Area or all roadside vegetation data for that project area (i.e. includes other organisations' surveys)

BSM Group, Department for Environment and Heritage
Data entry and editing
- currently data entry occurs within the BSM Group, however remote data entry via the Internet is planned in the future
- the BSM Group can provide an introduction to data entry and assistance with problems; provision must be made in the budget for data entry time. The BSM Group may have a contact list of people experienced in entering data onto the Roadside Vegetation Database that could be sub-contracted for data entry, if required.
- survey coordinator must allow some of their time for data validation after data entry
- survey coordinator must allow time for the calibration check based on summary tables provided by the BSM Group.

Data analysis
- production of tables and other files needed for analysis of vegetation data
- automatic analysis of overall significance of vegetation

Printing
- data validation reports
- reports summarising previous data and analysis results especially previously recorded plant associations and their constituent species
- reports summarising data collected during whole survey and for individual roads

General
- advice on survey planning
- advice on pre-existing data

Contract and Services, Transport Services Division, Tranpsort Energy and Infrastructure (DTEI)
- advice on pre-existing and planned surveys especially on arterial roads
- advice on sites listed in the Roadside Sites of Significance Database
- advice on significant sites marked with a Roadside Marker
- advice on TSA policies and activities with respect to roadside vegetation
- advice on survey planning

Biological Survey and Monitoring Group, DEH
- advice on general survey issues in South Australia
- advice on locations of rare or threatened species

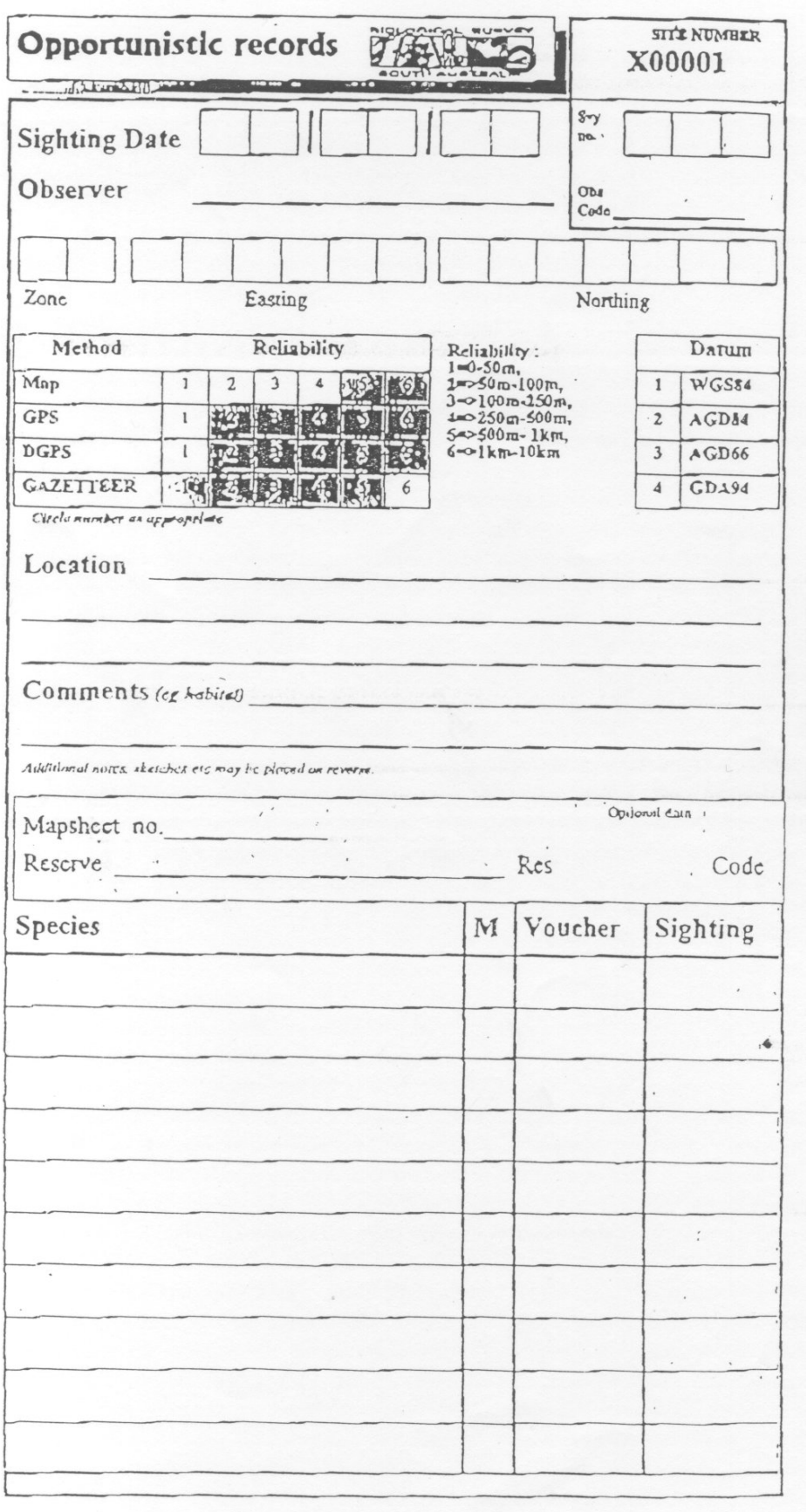
Native Vegetation Section, DWLBC
- advice on vegetation management issues including requirements under the *Native Vegetation Act 1991*

- Advice on Roadside Vegetation Management Plans and requirements

State Herbarium, Plant Biodiversity Centre, DEH

- assistance with identification of plant specimens

Appendix 12: Datasheet for the Opportunistic Sightings Database



Opportunistic records

SITE NUMBER X00001

Sighting Date

Observer

Sry no.

Obs Code

Zone Easting Northing

Method	Reliability					
Map	1	2	3	4	5	6
GPS	1	2	3	4	5	6
DGPS	1	2	3	4	5	6
GAZETTEER	1	2	3	4	5	6

Circle number as appropriate

Reliability:
1=0-50m,
2=>50m-100m,
3=>100m-250m,
4=>250m-500m,
5=>500m-1km,
6=>1km-10km

Datum	
1	WGS84
2	AGD84
3	AGD66
4	GDA94

Location

Comments (eg habitat)

Additional notes, sketches etc may be placed on reverse.

Optional data

Mapsheet no.

Reserve Res Code

Species	M	Voucher	Sighting

Appendix 13: Bibliography

Appendix 13.1 Companion documents for this methodology

Stokes, A.L., Heard, L.M.B, Parry, K, Kajar, L.. and Graham, K. (2004) The Roadside Vegetation Methodology for South Australia: Guide to Data Entry. Geographic Analysis and Research Unit, SA Department of Transport, Urban Planning and the Arts.

Stokes, A.L., Heard, L.M.B, Reynolds, T. and Carruthers, S. (1998) The Roadside Vegetation Methodology for South Australia: Documentation of Methodology Development. Geographic Analysis and Research Unit, SA Department of Transport, Urban Planning and the Arts.

Stokes, A. L., Reynolds, T. M., Heard, L.M.B. and Carruthers, S. M. (1998) Development of a methodology for the rapid systematic survey of vegetation along road corridors in South Australia In Proceedings from the 19th Australia Roads Research Board (ARRB) Conference, Transport 98:, Sydney, Australia.

Carruthers, S., Heard, L. and Stokes A. (1998) Mapping Roadside Vegetation Effectively Using GIS. GIS User, Issue Number 27, April- May 1998

Appendix 13.2 Roadside Vegetation and Related Earlier Vegetation Survey References

Bellchambers, K. (1990) Management of the Roadside Vegetation on Kangaroo Island. Kangaroo Island Roadside Vegetation Steering Group.

Bennet, A.F. (1990) *Habitat Corridors - Their Role in Wildlife Management and Conservation.* Department of Conservation and Environment, Melbourne.

Christie, G. And Barnes, M. (1995) North East Hills Native Vegetation Survey - Volunteer Information Booklet. University of South Australia, School of Human and Environmental Science, Salisbury Campus, South Australia.

Crawford, C. (1994) Remnant Vegetation on Roadside and Reserves of the District Council of Stirling. District Council of Stirling.

Davies, R.J.P. (1982) The Conservation Of Major Plant Associations in South Australia. Conservation Council of South Australia.

Department of Environment and Natural Resources. (1997) *Guidelines for the Management of Roadside Vegetation.* The Government of South Australia.

District Council of Onkaparinga. *Roadside Vegetation Management*. Woodside, South Australia.

Donato, D. (1991) *Murray Mallee Roadside Vegetation Management Plan.* Murray Mallee Roadside Vegetation Steering Group, District Councils of Lameroo, Peake, Pinnaroo, Karoonda – East Murray, and Browns Well, South Australia.

Farmar-Bowers, Q. (1996) Biodiversity and roads: managing our journey to Mount Ararat. Pp55-69 in Proceedings Roads 96 Conference, Part 6.

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