

INTERIM RECOVERY PLAN NO. 251

# WAVY-LEAVED SMOKEBUSH

(*Conospermum undulatum*)

INTERIM RECOVERY PLAN

2008-2013



April 2008

Department of Environment and Conservation  
Kensington



Australian Government



Government of  
Western  
Australia



Department of  
Environment and Conservation

Our environment, our future



## FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked Vulnerable (VU), this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate in April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

## IRP PREPARATION

This IRP was prepared by Craig Douglas<sup>1</sup>, Nicole Willers<sup>2</sup>, Vanessa Clarke<sup>3</sup> and David Mitchell<sup>4</sup>.

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## ACKNOWLEDGMENTS

The following people provided assistance and advice in the preparation of this IRP:

|                 |  |
|-----------------|--|
| Amanda Shade    | Assistant curator of displays and development, Botanic Gardens Parks Authority |
| Bob Elkins      | Technical Assistant, Botanic Gardens and Parks Authority                       |
| Andrew Crawford | Technical Officer, Threatened Flora Seed Centre, DEC                           |
| Kelly Poultney  | Technical Officer - DRF Database, Species and Communities Branch, DEC          |
| Colin Yates     | Senior Research Scientist, Science Division, DEC                               |
| Andrew Brown    | Threatened Flora Coordinator, Species and Communities Branch, DEC              |

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC's Species and Communities Branch for assistance.

**Cover photographs** by Val English.

## CITATION

This IRP should be cited as:

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**SUMMARY**

|                         |                              |                          |   |
|-------------------------|------------------------------|--------------------------|---|
| <b>Scientific Name:</b> | <i>Conospermum undulatum</i> | <b>Common Name:</b>      | Waxy-leaved smokebush   |
| <b>Family:</b>          | Proteaceae                   | <b>Flowering Period:</b> | August-October  |
| <b>DEC Region:</b>      | Swan                         | <b>DEC Districts:</b>    | Swan Coastal and Perth Hills  |
| <b>Shires:</b>          | Kalamunda and Gosnells       | <b>Recovery Team:</b>    | Swan Region Threatened Flora and Communities Recovery Team (SRTFRT) |

**Illustrations and/or further information:** Brown, A., Thomson-Dans, C. and Marchant, N. (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia. Pp 117; Bennett, E.M. (1995). *Flora of Australia Volume 16, Elaeagnaceae, Proteaceae 1*. CSIRO Australia. Melbourne. Pp 266; Department of Environment and Conservation (2007) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Accessed December 2007. <http://www.calm.wa.gov.au/science>

**Current status:** *Conospermum undulatum* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1997 and is currently ranked as Vulnerable (VU) under World Conservation Union (IUCN 1994) Red List criteria B1+2c, due to its occurrence over an area of less than 20,000 km<sup>2</sup>, populations being severely fragmented and a continuing decline in area and quality of habitat. The main threats are further land clearing, poor habitat quality, road and firebreak maintenance, inappropriate fire regimes, weeds, recreational activities and rabbit grazing. The species is listed as VU under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

*Conospermum undulatum* is recorded from 25 populations comprising 83 subpopulations. However, only 20 populations currently contain extant plants. The species is known from the Shires of Kalamunda and Gosnells in DEC's Swan Coastal and Perth Hills Districts.

**Description:** *Conospermum undulatum* is an erect shrub to 1.5 m tall with distinctive fibrous, longitudinally fissured stems and hairless leaves to 12 cm long and 3.8 cm wide. Leaves taper towards the base and have three distinct, parallel veins and characteristic wavy margins. The woolly flowers have long, white hairs, and are produced in inflorescences held well above the leaves. The fruit are covered with tan orange hairs. *C. undulatum* differs from *C. triplinervium* in its smaller habit, wavy margined leaves and emergent inflorescences with longer hairs. *C. undulatum* never develops a thick trunk which is typically multi-stemmed, rather than single stemmed.

**Habitat requirements:** *Conospermum undulatum* occurs on sand and sandy clay soils, often over laterite, on flat or gently sloping sites between the Swan and Canning Rivers. A few records are from slightly swampy habitat.

**Habitat critical to the survival of the species, and important populations:** Habitat critical to the survival of *Conospermum undulatum* includes the area of occupancy of important populations; areas of similar habitat surrounding important populations (i.e. sand and sandy clay soils, often over laterite, on flat or gently sloping sites), these areas provide potential habitat for natural range extension and/or for allowing pollinators or biota essential to the continued existence of the species to move between populations; and additional occurrences of similar habitat that may contain important populations of the species or be suitable sites for future translocations or other recovery actions intended to create important populations; and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

In the context of the EPBC Act's definition of population, it is considered that the collection of populations and Subpopulations listed in this IRP are likely to constitute two "geographically distinct regional populations". These occur in two bioregions (SWA and JF). Therefore both of these "regional populations" should be considered important populations and all known habitat for wild populations considered critical to the survival of the species.

**Benefits to other species or ecological communities:** *Conospermum undulatum* occurs in bushland areas that contain occurrences of four Threatened Ecological Communities (TECs). In most cases the TEC 'SCP 20a' (*Banksia attenuata* woodland over species rich dense shrublands) occurs with *C. undulatum*, however occurrences of 'SCP 3c' (*Eucalyptus calophylla* – *Xanthorrhoea preisii* woodlands and shrublands), 'SPC 20b' (*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain) and 'SCP 8' (Herb rich shrublands in clay pans) have also been recorded. These TECs contain an assemblage of plants that are restricted in area and are only found in a few locations. Two other threatened and four priority flora species have populations in bushland areas that contain *C. undulatum* and these will benefit from recovery actions put in place to protect *C. undulatum*.

Recovery actions implemented to improve the quality or security of the habitat of *Conospermum undulatum* will also improve the status of remnant vegetation in which it is located.

**International obligations:** This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under

that convention. *Conospermum undulatum* is not listed under any specific international treaty however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

**Indigenous consultation:** Involvement of the Indigenous community is being sought through the Indigenous Management Advisory Group (INRMAG) of the Swan Catchment Council and the Department of Indigenous Affairs (DIA) to assist in the identification of cultural values for land occupied by *Conospermum undulatum*, or groups with a cultural connection to land that is important for the species' conservation and to determine whether there are any issues or interests identified in the plan. A search of the DIA Aboriginal Heritage Sites Register has identified that there are six registered sites of Aboriginal significance at or near populations of the species covered by this IRP

The INRMAG has had the opportunity to provide culturally appropriate input into this recovery plan. Where registered sites co-occur with *Conospermum undulatum*, specific advice has been sought (INRMAG 2007).

The INRMAG recognises that the DEC through the Recovery Plan process, seeks to conserve and protect areas of natural remnant vegetation. The INRMAG recognise that together we share similar goals of seeking to manage these areas for conservation and seek to include and support Aboriginal interest and involvement in the management and planning process.

Opportunities may also exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged. Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

**Social and economic impact:** The implementation of this recovery plan has the potential to cause some social and economic impact as many populations of *Conospermum undulatum* occur on private property and their protection has the potential to affect future development on these sites. Where populations are located on private property, recovery actions refer to continued liaison between stakeholders with regards to these areas.

**Affected interests:** Stakeholders potentially affected by the implementation of this plan include the Shire of Kalamunda, the City of Gosnells, Main Roads WA, Water Corporation, Department of Agriculture and Food, Department for Planning and Infrastructure (DPI), Westralia Airports Corporation, Ministry for Education and owners of private property.

**Evaluation of the plan's performance:** DEC in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

**Completed Recovery Actions:** The following recovery actions have been completed:

1. Land managers and private land owners with populations on their property have been made aware of the threatened nature of this species, its location and their legal obligations to protect the species.
2. Declared Rare Flora (DRF) markers have been installed at Subpopulations 1b, 4j and 18m.
3. Fencing of Populations 3, 5, 6, 12 and 23, and Subpopulations 1b+c, 1i, 4a, 4b, 4d, 4q, 8a, 10d, 10e, 10f, 13a-c, 16b-j, 18g, 18h and 19e has been undertaken along with partial fencing of Subpopulations 1a, 10c, 18c-f, 18i and 18j.
4. The Department for Planning and Infrastructure's (DPI) Bush Forever program includes as regionally significant bushland thirteen sites that contain *Conospermum undulatum*.
5. Survey for *Conospermum undulatum* was undertaken between 1990 and 1996 by Wildflower Society WA members, consultant botanists, CALM staff and Department of Environmental Protection staff.
6. In 1997, survey and monitoring of all known populations was undertaken, assessing their conservation value and searching nearby areas of suitable habitat for new populations.
7. In 2005, extensive surveys of known populations and areas likely to support *Conospermum undulatum* were undertaken.
8. In 2005, research on the phenology of *Conospermum undulatum* and weed soil seed bank dynamics was completed at the Perth International Airport (PIA) site. A brief examination of genetic and morphological variation within *C. undulatum* and between *C. undulatum* and *Conospermum triplinervium* was conducted. *Ex situ* cultivation of *C. undulatum* was also investigated.
9. In 2005 research into levels of genetic variation between the PIA population, and nearby populations of *Conospermum undulatum* and *C. triplinervium* was completed.
10. Seed from *Conospermum undulatum* is stored in DEC's Threatened Flora Seed Centre (TFSC).

#### Ongoing and future recovery actions

11. Staff from DEC's Swan Region assess development applications for bushland containing *Conospermum undulatum* and participate in environmental impact assessment and statutory planning processes. This action is ongoing.
12. The SRTFCRT is overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.
13. Staff from DEC's Swan Region regularly monitor all populations.

**IRP objective:** The objective of this IRP is to maintain or improve the conservation status of *Conospermum undulatum* during the term of this plan by abating identified threats.

**Criteria for success:** The IRP will be successful if all of A, B and C are achieved.

- A. The total number of mature plants and/or the area of occupancy is maintained or increased over the term of the plan.
- B. There is an increase of 10% or more in the total number of mature plants and/or area of occupancy under secure conservation tenure.
- C. Results of research conducted as per recommendations in this IRP (e.g. appropriate fire regimes, pollinator habitat, recruitment requirements, survey and monitoring) is applied in habitat management over 20% or more of the known area of occupancy of the species.

**Criteria for failure:** The IRP will be considered to have failed if either A or B are met.

- A. The number of mature plants and/or the area of occupancy have decreased by ten percent or more over the term of the plan.
- B. There has otherwise been a decline in the species, or worsening of the nature of threatening processes, leading to increased concern over the long term survival of the species.

### Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Liaise with relevant land managers regarding management of bushland containing *Conospermum undulatum*
4. Install DRF markers
5. Fence Subpopulations
6. Collect seed and other material to preserve genetic diversity
7. Undertake weed control
8. Develop and implement a rabbit control strategy
9. Reassess population numbering and size based on tenure
10. Assess development applications for lands containing *Conospermum undulatum*
11. Increase area of *Conospermum undulatum* in the conservation estate
12. Conduct further surveys
13. Develop and implement a fire management strategy
14. Promote awareness
15. Develop and implement fire and soil disturbance trials
16. Obtain biological and ecological information
17. Map habitat critical to the survival of *Conospermum undulatum*
18. Review the plan and need for further recovery actions

## 1. BACKGROUND

### History

*Conospermum undulatum* was collected by James Drummond in 1839 and described by John Lindley the same year. Further collections were made between 1901 and 2007 and the species is now known from 25 mostly small populations between Maddington and Maida Vale. Prior to European settlement it is likely to have had a continuous distribution within its current range. It is however located in an area of Perth that is rapidly being developed for housing and industry and this has resulted in the fragmentation of much of the remnant bushland in which the plant occurs. The species was declared as Rare Flora in 1997.

### Description

*Conospermum undulatum* is an erect shrub to 1.5 m tall with distinctive fibrous, longitudinally fissured stems and hairless leaves to 12 cm long and 3.8 cm wide. Leaves taper towards the base and have three distinct, parallel veins and characteristic wavy margins. The woolly flowers have long, white hairs, and are produced in inflorescences held well above the leaves. The fruits are covered with tan orange hairs. *Conospermum undulatum* differs from *Conospermum triplinervium* in its smaller habit, wavy margined leaves and emergent inflorescences with longer hairs. *C. undulatum* never develops a thick trunk and is typically multi-stemmed, rather than single stemmed.

### Distribution and habitat

*Conospermum undulatum* is a geographically restricted species known from 25 historical populations between the Swan and Canning Rivers. However, only 20 populations currently contain extant plants. Habitat is sand and sandy clay soils, often over laterite, on flat or gently sloping sites in *Banksia* and jarrah/marri woodland. A few records are from slightly swampy habitats. Species associated with *Conospermum undulatum* include *Banksia menziesii*, *B. attenuata*, *B. grandis*, *Eucalyptus marginata*, *Corymbia calophylla*, *Allocasuarina fraseriana*, *Xanthorrhoea preisii*, *X. gracilis*, *Isopogon drummondii*, *Hakea conchifolia*, *H. lissocarpa*, *Dryandra lindleyana*, *Lambertia multiflora* var. *darlingensis*, *Hibbertia hypericoides*, *Adenanthos cygnorum*, *Anigozanthos manglesii* and *Stirlingia latifolia*.

### Summary of population land vesting, purpose and tenure

| Pop. No. & Location        | DEC District | Shire/City | Vesting            | Purpose            | Manager            |
|----------------------------|--------------|------------|--------------------|--------------------|--------------------|
| 1a. Maida Vale             | Perth Hills  | Kalamunda  | Shire of Kalamunda | Recreation Reserve | Shire of Kalamunda |
| 1b. Gooseberry Hill        | Perth Hills  | Kalamunda  | Unvested Reserve   | Road Reserve       | Shire of Kalamunda |
| 1c. Maida Vale             | Perth Hills  | Kalamunda  | Unvested Reserve   | Road Reserve       | Shire of Kalamunda |
| 1d. Maida Vale             | Perth Hills  | Kalamunda  | Unvested Reserve   | Road Reserve       | Shire of Kalamunda |
| 1e. Maida Vale             | Perth Hills  | Kalamunda  | Minister for Works | Pump Station       | Water Corporation  |
| 1f. Maida Vale             | Perth Hills  | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 1g. Maida Vale             | Perth Hills  | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 1h. Maida Vale             | Perth Hills  | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 1i. Maida Vale             | Perth Hills  | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 2. High Wycombe            | Swan Coastal | Swan       | Freehold           | Private Property   | Landholders        |
| 3. High Wycombe (Extinct)  | Swan Coastal | Kalamunda  | Shire of Kalamunda | Recreation Reserve | Shire of Kalamunda |
| 4a. High Wycombe           | Swan Coastal | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 4b. High Wycombe           | Swan Coastal | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 4c. High Wycombe (Extinct) | Swan Coastal | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 4d. High Wycombe           | Swan Coastal | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 4e. High Wycombe (Extinct) | Swan Coastal | Kalamunda  | Freehold           | Private Property   | Landholders        |
| 4f. Maida Vale (Extinct)   | Swan Coastal | Kalamunda  | Unvested Reserve   | Road Reserve       | Shire of Kalamunda |

| <b>Pop. No. &amp; Location</b>   | <b>DEC District</b> | <b>Shire/City</b> | <b>Vesting</b>         | <b>Purpose</b>                  | <b>Manager</b>          |
|----------------------------------|---------------------|-------------------|------------------------|---------------------------------|-------------------------|
| <b>4g. Forrestfield</b>          | Swan Coastal        | Kalamunda         | Minister for Transport | Road Reserve                    | MainRoads WA            |
| <b>4h. High Wycombe</b>          | Swan Coastal        | Kalamunda         | WAPC                   | Proposed reserve                | DEC                     |
| <b>4i. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4j. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4k. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4l. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4m. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Unvested reserve       | Road Reserve                    | Shire of Kalamunda      |
| <b>4n. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4o. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4p. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4q. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Shire of Kalamunda     | Parkland and Recreation Reserve | Shire of Kalamunda      |
| <b>4r. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Shire of Kalamunda     | Parkland and Recreation Reserve | Shire of Kalamunda      |
| <b>4s. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>4t. High Wycombe</b>          | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>5. High Wycombe</b>           | Swan Coastal        | Kalamunda         | Ministry for Education | School site                     | Department of Education |
| <b>6. High Wycombe</b>           | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>7. High Wycombe (Extinct)</b> | Swan Coastal        | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>8a. Maida Vale</b>            | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>8b. Maida Vale</b>            | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>9. Forrestfield</b>           | Perth Hills         | Kalamunda         | Shire of Kalamunda     | General Rural                   | Shire of Kalamunda      |
| <b>10a. Forrestfield</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>10b. Forrestfield</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>10c. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>10d. Forrestfield</b>         | Perth Hills         | Kalamunda         | Unvested Reserve       | Road Reserve                    | Shire of Kalamunda      |
| <b>10e. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>10f. Forrestfield</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>10g. Forrestfield</b>         | Perth Hills         | Kalamunda         | Shire of Kalamunda     | Recreation Reserve              | Shire of Kalamunda      |
| <b>11a. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>11b. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>11c. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>11d. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>11e. Wattle Grove</b>         | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>12. Wattle Grove</b>          | Perth Hills         | Kalamunda         | Freehold               | Private Property                | Landholders             |
| <b>13a. Maddington</b>           | Swan Coastal        | Gosnells          | Minister for Transport | Road Reserve                    | Main Roads WA           |
| <b>13b. Maddington</b>           | Swan Coastal        | Gosnells          | Minister for Transport | Road Reserve                    | Main Roads WA           |
| <b>13c. Maddington (Extinct)</b> | Swan Coastal        | Gosnells          | Minister for Transport | Road Reserve                    | Main Roads WA           |
| <b>14. Martin (Extinct)</b>      | Perth Hills         | Gosnells          | Unvested reserve       | Road Reserve                    | City of Gosnells        |
| <b>14b. Martin</b>               | Perth Hills         | Gosnells          | Unvested reserve       | Shire Reserve                   | City of Gosnells        |
| <b>15. Welshpool (Extinct)</b>   | Swan Coastal        | Canning           | Freehold               | Private Property                | Landholders             |
| <b>16a. Orange Grove</b>         | Perth Hills         | Gosnells          | Shire of Kalamunda     | Regional Park                   | Shire of Kalamunda      |
| <b>16b. Orange Grove</b>         | Perth Hills         | Gosnells          | City of Gosnells       | General Rural                   | City of Gosnells        |
| <b>16c. Orange Grove</b>         | Perth Hills         | Gosnells          | City of Gosnells       | General Rural                   | City of Gosnells        |
| <b>16d. Orange Grove</b>         | Perth Hills         | Gosnells          | City of Gosnells       | General Rural                   | City of Gosnells        |
| <b>16e. Orange Grove</b>         | Perth Hills         | Gosnells          | City of Gosnells       | General Rural                   | City of Gosnells        |
| <b>16f and g. Orange Grove</b>   | Perth Hills         | Gosnells          | WAPC                   | Proposed reserve                | DEC                     |
| <b>16h. Orange Grove</b>         | Perth Hills         | Gosnells          | Freehold               | Private Property                | Landholders             |

| Pop. No. & Location                     | DEC District | Shire/City | Vesting                                      | Purpose  | Manager                            |
|---|--------------|------------|--|--|------------------------------------|
| <b>16i. Orange Grove</b>                | Perth Hills  | Gosnells   | Freehold                                     | Private Property                                 | Landholders                        |
| <b>16j. Orange Grove</b>                | Perth Hills  | Gosnells   | Freehold                                     | Private Property                                 | Landholders                        |
| <b>16k. Orange Grove</b>                | Perth Hills  | Gosnells   | Unvested reserve                             | Road Reserve                                     | City of Gosnells                   |
| <b>17. High Wycombe</b>                 | Swan Coastal | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>18a. Forrestfield</b>                | Swan Coastal | Kalamunda  | Minister for Works                           | Sanitary Processing                              | Water Corporation                  |
| 18b. Forrestfield (Extinct)             | Swan Coastal | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>18c. Forrestfield</b>                | Swan Coastal | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>18d. Forrestfield</b>                | Swan Coastal | Kalamunda  | WAPC   | Proposed Reserve                                 | DPI                                |
| <b>18e. Forrestfield</b>                | Swan Coastal | Kalamunda  | DPI  |  | DPI                                |
| <b>18f. Forrestfield</b>                | Swan Coastal | Kalamunda  | DPI  |  | DPI                                |
| <b>18g. Forrestfield</b>                | Swan Coastal | Kalamunda  | FESA   | Fire training school                             | FESA                               |
| <b>18h. Forrestfield</b>                | Perth Hills  | Kalamunda  | Department of Agriculture and Food           | Research Station                                 | Department of Agriculture and Food |
| <b>18i. Forrestfield</b>                | Perth Hills  | Kalamunda  | Shire of Kalamunda                           | Rubbish Tip                                      | Shire of Kalamunda                 |
| <b>18j. Forrestfield</b>                | Perth Hills  | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>18k. Forrestfield</b>                | Perth Hills  | Kalamunda  | Shire of Kalamunda                           | Rubbish Tip                                      | Shire of Kalamunda                 |
| <b>18m. Kewdale</b>                     | Swan Coastal | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>18n. Forrestfield</b>                | Swan Coastal | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>18o. Forrestfield</b>                | Swan Coastal | Kalamunda  | Conservation Commission of Western Australia | Conservation of Flora and Fauna (Nature Reserve) | DEC                                |
| <b>18p. Forrestfield</b>                | Swan Coastal | Kalamunda  | Minister for transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>19a. Wattle Grove</b>                | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>19b. Wattle Grove</b>                | Perth Hills  | Kalamunda  | Unallocated Crown Land                       | Government requirements                          | DPI                                |
| <b>19c. Wattle Grove</b>                | Perth Hills  | Kalamunda  | WAPC   | Proposed Reserve                                 | DEC                                |
| <b>19d. Wattle Grove</b>                | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>19e. Wattle Grove</b>                | Perth Hills  | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>20a. Maida Vale</b>                  | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>20b. Maida Vale</b>                  | Perth Hills  | Kalamunda  | Shire of Kalamunda                           | Municipal Purposes                               | Shire of Kalamunda                 |
| <b>21. Maida Vale</b>                   | Perth Hills  | Kalamunda  | Minister for Transport                       | Road Reserve                                     | Main Roads WA                      |
| <b>22a. Forrestfield</b>                | Perth Hills  | Kalamunda  | Unvested reserve                             | Road Reserve                                     | Shire of Kalamunda                 |
| <b>22b. Forrestfield</b>                | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>23. Maida Vale</b>                   | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |
| <b>24a. Perth International Airport</b> | Swan Coastal | Belmont    | Commonwealth of Australia                    | Perth International Airport                      | Westralia Airports Corp.           |
| <b>24b. Perth International Airport</b> | Swan Coastal | Belmont    | Commonwealth of Australia                    | Perth International Airport                      | Westralia Airports Corp.           |
| <b>25. Lesmurdie</b>                    | Perth Hills  | Kalamunda  | Freehold                                     | Private Property                                 | Landholders                        |

Populations in **bold text** are considered to be important populations; DPI: Department of Planning and Infrastructure.

## Biological and ecology

*Conospermum undulatum* is a long-lived shrub that resprouts from rootstock following disturbance such as fire. Flowering is between August and October.

The species has a low seed set and appears to have poor seed dispersal, observed from the frequent clumping of plants in populations (Close and Dixon 2005). Seed viability ratios for *Conospermum undulatum* indicate significant levels of infertile seeds with ratios of non-viable to viable seed being 2.63:1. High levels of seed infertility may be due to a lack of pollinators, however low seed set and low capacity to compete for pollinators



is indicative of *C. undulatum* being a facultative seeder and is consistent with its capacity to re-sprout following fire events (Close and Dixon 2005).

The germination rate for untreated fresh seed is 11%, increasing to 33% when gibberellic acid is applied and no after-ripening response is observed up to 3 months post harvest. This response to gibberellic acid indicates that *C. undulatum* seed has physiological-imposed dormancy (Close and Dixon 2005).

A high degree of variability in the leaf morphology of *Conospermum undulatum* in the population at the Perth International Airport (PIA) site has led to speculation that plants in this population are genetically distinct from other *C. undulatum* populations and that plants at the PIA site may be hybrids between *C. undulatum* and *C. triplinervium*. However, genetic analysis using amplified fragment length polymorphisms (AFLP) indicates no statistically significant differentiation between this and other populations.

Clear genetic differentiation exists between *Conospermum undulatum* at the PIA and a sampled population of *C. triplinervium* from a nearby location. This finding supports these being different species and the Perth International Airport (PIA) population of *C. undulatum* not being of hybrid origin. The high degree of morphological difference between *C. undulatum* at PIA and other nearby populations of this species is most likely due to a plastic response of this species to environmental variation not to genetic drift or hybridisation with *C. triplinervium* (Close *et. al.* 2005).

Moderate to high levels of intra population genetic diversity in *Conospermum undulatum* is consistent with an out crossing reproductive system and more generally with the strategy of plants such as *C. undulatum* that resprout following disturbance (Close *et. al.* 2005).

## Threats

*Conospermum undulatum* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1997 and is ranked as Vulnerable (VU) under World Conservation Union (IUCN 1994) Red List criterion B1+2c, due to the area of occurrence being less than 20,000 km<sup>2</sup>, the populations being severely fragmented and a continuing decline in the area and quality of habitat. The main threats are continuing land clearing, degraded natural habitat, road and firebreak maintenance, lack of fire, weeds, recreational activities and rabbit grazing. The species is listed as VU under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **Land clearing.** The area where *Conospermum undulatum* occurs is undergoing rapid urbanization with approximately 23 percent of known plants being located on subdivided blocks and many other populations affected by clearing for urban development. Three populations and five subpopulations are now extinct due to land clearance.
- **Degraded natural habitat.** Most plants of *Conospermum undulatum* are located in degraded natural vegetation remnants.
- **Road and firebreak maintenance.** Approximately 16% of *Conospermum undulatum* plants are located on road reserves and some others are located on or border firebreaks. These plants are threatened by road and firebreak maintenance and spraying of verge vegetation with herbicide.
- **Lack of fire.** The vegetation remnants in which some populations of *Conospermum undulatum* occur have not been burnt for a long period of time. Existing plants are senescing, causing a decline in reproductive output.
- **Weeds** are a threat to most populations of *Conospermum undulatum*. Weed species compete for resources and weed competition reduces seedling survival.
- **Recreational activities.** Horse riding, motor biking and four-wheel driving threaten several populations. These activities directly damage *Conospermum undulatum* plants and also cause soil disturbance which encourages weed invasion.
- **Rabbit grazing.** *Conospermum undulatum* is susceptible to grazing by rabbits and, while mature plants have some capacity to resprout, seedlings are particularly vulnerable.

## Summary of population information and threats

| Pop. No. & Location | Land Status            | Date / No. of Plants              | Condition | Threats   |
|---------------------|------------------------|-----------------------------------|-----------|---|
| 1a. Maida Vale      | Recreation Reserve     | 1998 1644<br>2005 1592            | Healthy   | Uncontrolled access, weeds, firebreak maintenance         |
| 1b. Gooseberry Hill | Shire Road Reserve     | 1990 300<br>1997 120<br>2002 362  | Healthy   | Firebreak maintenance, weeds                              |
| 1c. Maida Vale      | Shire Road Reserve     | 1990 200<br>1998 508              | Healthy   |   |
| 1d. Maida Vale      | Shire Road Reserve     | 1990 35<br>2002 11                | Moderate  | Road maintenance, weeds                                   |
| 1e. Maida Vale      | Pump Station           | 1990 50<br>2002 57                | Healthy   | Uncontrolled access, weeds, land clearing                 |
| 1f. Maida Vale      | Private Property       | 1998 5<br>2005 33                 | Poor      | Weeds   |
| 1g. Maida Vale      | Private Property       | 1998 60<br>2006 0                 | Unknown   |   |
| 1h. Maida Vale      | Private Property       | 1998 80<br>2002 80                | Healthy   | Land clearing   |
| 1i. Maida Vale      | Private Property       | 1998 90<br>2005 177 [1]           | Healthy   | Land clearing   |
| 2. High Wycombe     | Private Property       | 1990 100<br>2006 139              | Healthy   |   |
| 3. High Wycombe     | Recreation Reserve     | 1990 15<br>2006 0                 | Extinct   | Uncontrolled access, weeds                                |
| 4a. High Wycombe    | Private Property       | 1990 100<br>2005 62               | Moderate  | Firebreak maintenance, weeds, land clearing               |
| 4b. High Wycombe    | Private Property       | 1990 100<br>1997 30               | Moderate  | Firebreak maintenance, uncontrolled access, weeds         |
| 4c. High Wycombe    | Private Property       | 1990 100<br>2006 0                | Extinct   |   |
| 4d. High Wycombe    | Private Property       | 1990 100<br>1997 2                | Poor      | Land clearing, poor habitat health, weeds                 |
| 4e. High Wycombe    | Private Property       | 1997 0                            | Extinct   | Poor habitat health                                       |
| 4f. Maida Vale      | Shire Road Reserve     | 1997 0<br>2006 0                  | Extinct   | Road maintenance, weeds, poor habitat health              |
| 4g. Forrestfield    | MainRoads WA Reserve   | 1990 50<br>2002 2                 | Poor      | Road and firebreak maintenance, weeds                     |
| 4h. High Wycombe    | WAPC                   | 1990 130*<br>1997 300*<br>2006 76 | Healthy   | Weeds, firebreak maintenance, uncontrolled access         |
| 4i. High Wycombe    | Private Property       | 1990 130*<br>1997 300*            | Moderate  | Uncontrolled access, firebreak maintenance                |
| 4j. High Wycombe    | Private Property       | 1990 130*<br>1997 300*            | Moderate  | Uncontrolled access, firebreak maintenance                |
| 4k. High Wycombe    | Private Property       | 1990 400<br>1995 400<br>1997 300* | Moderate  | Uncontrolled access, firebreak maintenance, land clearing |
| 4l. High Wycombe    | Private Property       | 1990 50<br>2006 20                | Healthy   | Weeds, uncontrolled access, road maintenance              |
| 4m. High Wycombe    | Shire Road Reserve     | 1997 3<br>2006 7                  | Healthy   | Road maintenance, weeds, uncontrolled access              |
| 4n. High Wycombe    | Private Property       | 1997 1<br>2005 103                | Healthy   | Firebreak maintenance, prescribed burns                   |
| 4o. High Wycombe    | Private Property       | 1996 30 (20)<br>2005 161          | Healthy   | Road and firebreak maintenance, weeds, land clearing      |
| 4p. High Wycombe    | Private Property       | 2000 50<br>2005 142 (10)          | Healthy   | Weeds, firebreak maintenance                              |
| 4q. High Wycombe    | Shire Parkland Reserve | 2003 12<br>2005 120               | Healthy   | Uncontrolled access, inappropriate fire regimes           |
| 4r. High Wycombe    | Shire Parkland Reserve | 2003 7                            |           | Inappropriate fire regimes                                |
| 4s. High Wycombe    | Private Property       | 2003 35                           |           | Weeds, road works   |
| 4t. High Wycombe    | Private Property       | -                                 |           |   |
| 5. High Wycombe     | School site            | 1990 10<br>2000 15                | Healthy   | Weeds, land clearing                                      |
| 6. High Wycombe     | Private Property       | 1990 10                           | Moderate  | Firebreak maintenance, uncontrolled access,               |

| Pop. No. & Location     | Land Status          | Date / No. of Plants         | Condition | Threats   |
|-------------------------|----------------------|------------------------------|-----------|---|
|                         |                      | 1997 11                      |           | weeds   |
| 7. High Wycombe         | Private Property     | 1990 300<br>1997 0<br>2006 0 | Extinct   |   |
| 8a. Maida Vale          | Private Property     | 1990 10<br>2001 4            | Healthy   | Firebreak and powerline maintenance, weeds, uncontrolled access, disease    |
| 8b. Maida Vale          | Private Property     | 1990 10<br>2005 4            | Healthy   | Weeds, firebreak maintenance, inappropriate fire regimes                    |
| 9. Forrestfield         | Shire lands          | 1990 20<br>2006 0            | Extinct   | Land clearing and development   |
| 10a. Forrestfield       | Recreation Reserve   | 1990 100<br>2000 30          | Good      | Road works, uncontrolled access, weeds                                      |
| 10b. Forrestfield       | Recreation Reserve   | 2000 0<br>1990 30            |           | Road works, uncontrolled access, weeds                                      |
| 10c. Wattle Grove       | Recreation Reserve   | 1990 50<br>2006 331          | Healthy   | Road works, firebreak maintenance, weeds, uncontrolled access, grazing      |
| 10d. Forrestfield       | Shire Road Reserve   | 1990 70<br>2000 80           | Good      | Road works, firebreak maintenance, weeds, uncontrolled access, grazing      |
| 10e. Wattle Grove       | Recreation Reserve   | 1990 55<br>2006 10           | Healthy   | Firebreak maintenance, uncontrolled access, weeds                           |
| 10f. Forrestfield       | Recreation Reserve   | 1998 2<br>2006 0             | Disturbed | Firebreak maintenance, drainage, weeds, uncontrolled access, chemical drift |
| 10g. Forrestfield       | Recreation Reserve   | 2006 13                      | Healthy   | Weeds   |
| 11a. Wattle Grove       | Private Property     | 1990 10<br>2005 0            |           | Weeds   |
| 11b. Wattle Grove       | Private Property     | 1990 40<br>2006 7            | Moderate  | Firebreak maintenance, uncontrolled access, weeds                           |
| 11c. Wattle Grove       | Private Property     | 1990 250<br>2005 100         | Healthy   | Firebreak maintenance   |
| 11d. Wattle Grove       | Private Property     | 1990 250<br>2005 107         |           |   |
| 11e. Wattle Grove       | Private Property     | 1997 26*<br>2006 12          | Healthy   | Firebreak maintenance   |
| 12. Wattle Grove        | Private Property     | 1990 50<br>2005 72           | Moderate  | Weeds, inappropriate fire regimes   |
| 13a. Maddington         | MainRoads WA Reserve | 1997 240<br>2006 655         | Healthy   | Road and firebreak maintenance, weeds, uncontrolled access                  |
| 13b. Maddington         | MainRoads WA         | 1997 10                      | Healthy   | Road and firebreak maintenance, weeds, uncontrolled access                  |
| 13c. Maddington         | MainRoads WA         | 1997 0                       | Extinct   |   |
| 14a. Martin             | City Road Reserve    | 1990 1<br>2006 0             | Extinct   | Road maintenance, weeds   |
| 14b. Martin             | Shire Reserve        |                              | Unknown   |   |
| 15. Welshpool           | Private Property     | 1997 0<br>2005 0             | Extinct   |   |
| 16a. Orange Grove       | Regional Park        | 1990 500<br>2006 463         | Healthy   | Uncontrolled access, weeds  |
| 16b. Orange Grove       | City lands           | 1990 150<br>2006 80          | Healthy   | Firebreak maintenance, weeds, rubbish dumping                               |
| 16c. Orange Grove       | City lands           | 1997 100*<br>2006 209        | Healthy   | Firebreak maintenance, weeds, rubbish dumping                               |
| 16d. Orange Grove       | City lands           | 1997 100*<br>2006 120        | Healthy   | Firebreak maintenance, weeds, rubbish dumping                               |
| 16e. Orange Grove       | City lands           | 1997 100*<br>2006 8          | Healthy   | Firebreak maintenance, weeds, rubbish dumping                               |
| 16f and g. Orange Grove | WAPC                 | 1990 250<br>2006 911         | Healthy   | Weeds, uncontrolled access  |
| 16h. Orange Grove       | Private Property     | 1990 125<br>2006 236         | Healthy   | Weeds, uncontrolled access  |
| 16i. Orange Grove       | Private Property     | 1997 300*<br>1990 125        | Healthy   | Weeds, uncontrolled access  |
| 16j. Orange Grove       | Private Property     | 1997 10<br>2005 17           | Poor      | Weeds, uncontrolled access, grazing   |
| 16k. Orange Grove       | City of Gosnells     | 2006 31                      | Healthy   | Road maintenance  |
| 17. High Wycombe        | MainRoads WA Reserve | 1998 14<br>2006 94           | Healthy   | Rubbish dumping, uncontrolled access, firebreak maintenance                 |

| Pop. No. & Location                     | Land Status                                     | Date / No. of Plants              | Condition | Threats  |
|---|---|-----------------------------------|-----------|--|
| <b>18a. Forrestfield</b>                | Sanitary Processing                             | 1990 700<br>1997 265<br>2006 1159 | Healthy   | Firebreak maintenance, uncontrolled access, road works, weeds                      |
| 18b. Forrestfield                       | Private Property                                | 1990 50<br>1997 0                 | Extinct   |  |
| <b>18c. Forrestfield</b>                | Private Property                                | 1990 150<br>2006 97               | Healthy   | Firebreak maintenance, uncontrolled access, weeds, rubbish dumping                 |
| <b>18d. Forrestfield</b>                | WAPC  | 1990 75<br>2006 15                | Healthy   | Uncontrolled access, inappropriate fire regime                                     |
| <b>18e. Forrestfield</b>                | DPI   | 1990 100<br>2006 42               | Healthy   | Uncontrolled access, inappropriate fire regime                                     |
| <b>18f. Forrestfield</b>                | DPI   | 1990 75<br>2006 134               | Healthy   | Uncontrolled access, inappropriate fire regime                                     |
| <b>18g. Forrestfield</b>                | FESA fire training school                       | 1990 750<br>1997 770<br>2002 750  |           |  |
| <b>18h. Forrestfield</b>                | Dept. of Agriculture and Food Experimental Farm | 1990 125<br>1997 200              | Healthy   | Inappropriate fire regime  |
| <b>18i. Forrestfield</b>                | Shire Rubbish Tip                               | 1990 50                           | Healthy   | Firebreak maintenance, weeds   |
| <b>18j. Forrestfield</b>                | MainRoads WA Reserve                            | 1990 200<br>2002 61               | Moderate  | Road and firebreak maintenance, weeds  |
| <b>18k. Forrestfield</b>                | Shire Rubbish Tip                               | 1990 600<br>1997 90               |           | Firebreak maintenance, uncontrolled access, weeds                                  |
| <b>18m. Kewdale</b>                     | MainRoads WA Reserve                            | 1990 2<br>2000 7                  | Healthy   | Road maintenance, weeds  |
| <b>18n. Forrestfield</b>                | MainRoads WA Reserve                            | 1990 100<br>2006 232              | Healthy   | Road maintenance, uncontrolled access, rubbish dumping, inappropriate fire regime  |
| <b>18o. Forrestfield</b>                | Nature Reserve                                  | 2006 416                          | Healthy   | Uncontrolled access, rubbish dumping, inappropriate fire regime                    |
| <b>18p. Forrestfield</b>                | MainRoads WA Reserve                            | 2006 151                          | Healthy   | Uncontrolled access, inappropriate fire regime                                     |
| <b>19a. Wattle Grove</b>                | Private Property                                | 1990 10<br>2001 0                 |           | Urban development, firebreak maintenance, uncontrolled access, poor habitat, weeds |
| <b>19b. Wattle Grove</b>                | Unallocated Crown Land                          | 1990 50<br>2005 63                | Healthy   | Firebreak and powerline maintenance, uncontrolled access, weeds                    |
| <b>19c. Wattle Grove</b>                | WAPC  | 2005 25                           | Healthy   |  |
| <b>19d. Wattle Grove</b>                | Private Property                                | 2005 12                           | Moderate  | Firebreak maintenance, weeds, disease  |
| <b>19e. Wattle Grove</b>                | MainRoads WA Reserve                            | 2005 7                            | Healthy   | Firebreak maintenance, weeds   |
| <b>20a. Maida Vale</b>                  | Private Property                                | 2000 28                           | Healthy   |  |
| <b>20b. Maida Vale</b>                  | Shire Municipal Purposes                        | 2000 2                            |           |  |
| <b>21. Maida Vale</b>                   | MainRoads WA Reserve                            | 2001 1                            |           |  |
| <b>22a. Forrestfield</b>                | Shire Road Reserve                              | 2003 3*                           |           |  |
| <b>22b. Forrestfield</b>                | Private Property                                | 2003 3*                           |           |  |
| <b>23. Maida Vale</b>                   | Private Property                                | 2005 39                           | Moderate  |  |
| <b>24a. Perth International Airport</b> | International Airport                           | 1990 21<br>2004 0                 |           | uncontrolled access  |
| <b>24b. Perth International Airport</b> | International Airport                           | 2005 200                          | Healthy   | Rabbit grazing   |
| <b>25. Lesmurdie</b>                    | Private Property                                | 2005 13 (3)                       | Healthy   | Land clearing  |

Populations in **bold text** are considered important populations; Note: \* = total for all subpopulations, ( ) = number of seedlings

### Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments and/or land clearing in the immediate vicinity of populations of *Conospermum undulatum* require assessment. No developments or clearing should be approved unless the proponents can demonstrate that their actions will not have a significant impact on the species, its habitat or potential habitat or on the local hydrology, such that drainage in the habitat of the species would be altered.

## Habitat critical to the survival of the species, and important populations

Habitat critical to the survival of *Conospermum undulatum* includes the area of occupancy of important populations; areas of similar habitat surrounding important populations (i.e. sand and sandy clay soils, often over laterite, on flat or gently sloping sites), these areas provide potential habitat for natural range extension and/or for allowing pollinators or biota essential to the continued existence of the species to move between populations; and additional occurrences of similar habitat that may contain important populations of the species or be suitable sites for future translocations or other recovery actions intended to create important populations; and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

All known plants of *Conospermum undulatum* are found in fragmented remnant bushland in an area that is around 9 km by 8 km (72 km<sup>2</sup>). The populations and subpopulations referred to in this IRP are a reflection of this fragmentation, and often reflect changes in ownership or tenure of land across otherwise contiguous groups of plants, and are not analogous to a ‘population of a species’ as defined under the EPBC Act.

In the context of the EPBC Act’s definition of population, it is considered that the collection of populations and subpopulations listed in this IRP are likely to constitute two “geographically distinct regional populations” that occur in two bioregions (SWA and JF). Therefore both of these “regional populations” should be considered important populations and all known habitat for wild populations considered critical to the survival of the species.

However, given that *Conospermum undulatum* is ranked as VU, and the very high level of fragmentation of this species (including Subpopulations containing very low numbers of plants, small area, and containing highly disturbed habitat) there is a decision making, or operational, value in recognizing that some of the populations and Subpopulations (as listed in the IRP) provide a greater contribution to the long term survival of the species than others.

Using relatively simple selection criteria including size of population, connectedness to adjacent subpopulations and position in the species range identifies the following populations and Subpopulations as the most important: 1a, 1b, 1c, 1d, 1f, 1g, 1h, and 1i; 2; 4a, 4b, 4d, 4h, 4i, 4j, 4k, 4m, 4n, 4o, 4p, 4q, and 4s; 10a, 10c, 10d, and 10e; 11 c, and 1d; 12; 13a, and 13b; 16a, 16b, 16c, 16d, 16e, 16f, 16g, 16h, 16i, and 16k; 17; 18a, 18c, 18d, 18e, 18f, 18g, 18h, 18i, 18j, 18k, 18m, 18n, 18o and 18p; 19b, 19c, 19d, and 19e; 23; 24a, and 24b; and 25.

This list provides initial guidance on the relative importance of populations and subpopulations and in future may be modified based on new or specific site information. Similarly decisions on protection or management of any population or subpopulation should be based on site-specific information in conjunction with a whole of species consideration.

## Benefits to other species or ecological communities

*Conospermum undulatum* occurs in bushland areas that contain occurrences of four Threatened Ecological Communities (TECs). In most cases it is TEC ‘SCP 20a’, however occurrences of ‘SCP 3c’, ‘SCP 20b’ and ‘SCP 8’ have also been recorded. These TECs are listed in the table below and contain an assemblage of plants that are restricted in area and are found in very few locations.

### TECs recorded within bushland areas in which *Conospermum undulatum* occurs

| Community type | TEC Title   | Ranking (Western Australia) |
|----------------|---|-----------------------------|
| SCP 20a        | <i>Banksia attenuata</i> woodland over species rich dense shrublands  | Endangered                  |
| SCP 3c         | <i>Eucalyptus calophylla</i> – <i>Xanthorrhoea preisii</i> woodlands and shrublands                                 | Critically Endangered       |
| SCP 20b        | <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain | Endangered                  |
| SCP 8          | Herb rich shrublands in clay pans   | Vulnerable                  |

SCP – Swan Coastal Plain. For a description of the TEC categories see DEC (2007)

Recovery actions implemented to improve the quality or security of the habitat of *Conospermum undulatum* will also improve the status of remnant *Banksia* and jarrah/marri woodland in which it is located. Two other

threatened and four priority flora species occur in bushland that contains *C. undulatum*. These are listed in the table below.

#### Conservation-listed flora species occurring in habitat of *Conospermum undulatum*

| Species name                                       | Conservation Status and ranking (Western Australia) | Ranking (EPBC Act, 1999) |
|--|---|--------------------------|
| <i>Macarthuria keigheryi</i>                       | DRF, Endangered                                     | Endangered               |
| <i>Dryandra mimica</i>                             | DRF, Vulnerable                                     | Endangered               |
| <i>Isopogon drummondii</i>                         | Priority 3  |                          |
| <i>Olax scalariformis</i>                          | Priority 3  |                          |
| <i>Stachystemon axillaris</i>                      | Priority 4  |                          |
| <i>Verticordia lindleyi</i> subsp. <i>lindleyi</i> | Priority 4  |                          |

DRF – Declared Rare Flora; for a description of Priority categories see Atkins (2008)

#### International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention. *Conospermum undulatum* is not listed under any specific international treaty and this IRP does not affect Australia's obligations under any other international agreements.

#### Indigenous consultation

Involvement of the Indigenous community is being sought through the Indigenous Management Advisory Group (INRMAG) of the Swan Catchment Council and the Department of Indigenous Affairs (DIA) to assist in the identification of cultural values for land occupied by *Conospermum undulatum*, or groups with a cultural connection to land that is important for the species' conservation and to determine whether there are any issues or interests identified in the plan. A search of the DIA Aboriginal Heritage Sites Register has identified that there are six registered sites of Aboriginal significance at or near populations of the species covered by this IRP (see table below).

The INRMAG has been consulted and subsequently has had the opportunity to provide culturally appropriate input into this recovery plan. Where registered sites co-occur with *Conospermum undulatum*, specific advice has been sought (INRMAG 2007).

The INRMAG recognises that the DEC, through the Recovery Plan process, seeks to conserve and protect areas of natural remnant vegetation. The INRMAG recognise that together we share similar goals of seeking to manage these areas for conservation and seek to include and support Aboriginal interest and involvement in the management and planning process.

Opportunities may also exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged. Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

#### Sites of Aboriginal significance containing populations of *Conospermum undulatum*

| Site ID | Site Name                   | Site Type                                       | Aboriginal Clan    | Populations of <i>Conospermum undulatum</i> affected |
|---------|-----------------------------|---|--------------------|--|
| 3719    | Munday Swamp                | Ceremonial, Mythological, Artefacts / Scatter   | Bibbulmun - wadjuk | Subpopulation 4r                                     |
| 4033    | High Wycombe: Wittenoom Rd. | Artefacts / Scatter                             | Bibbulmun - wadjuk | Subpopulation 4r                                     |
| 3773    | Welshpool Reserve           | Camp  | Bibbulmun - wadjuk | Subpopulations 10a, b, c, e and f                    |
| 3264    | White Road, Orange Grove    | Skeletal material / Burial, Artefacts / Scatter | Bibbulmun - wadjuk | Subpopulation 16f, g, h and i                        |
| 4081    | Roe Freeway – Wattle Grove  | Artefacts / Scatter                             | Bibbulmun - wadjuk | Subpopulation 18m                                    |
| 3644    | Midland Road, Maida Vale    | Artefacts / Scatter                             | Bibbulmun - wadjuk | Population 21 and 23                                 |

#### Social and economic impact

The implementation of this recovery plan has the potential to cause some social and economic impacts, as many populations of *Conospermum undulatum* occur on private property and their protection has the potential to affect future development on these sites. Where populations are located on private property, recovery actions refer to continued liaison between stakeholders with regards to these areas, and where development is proposed on private property containing *C. undulatum*, the aim is to protect the populations through the statutory land use planning and environmental impact assessment processes.

### **Affected interests**

Stakeholders potentially affected by the implementation of this plan include the Shire of Kalamunda and the City of Gosnells, Main Roads WA, Water Corporation, Department of Agriculture and Food and Department for Planning and Infrastructure (DPI), Westralia Airports Corporation, Ministry for Education and owners of private property.

### **Evaluation of the plan's performance**

DEC in conjunction with the Swan Region Threatened Flora and Ecological Communities Recovery Team (SRTFCRT) will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following four years of implementation.

## **2. RECOVERY OBJECTIVE AND CRITERIA**

### **IRP objective**

The objective of this IRP is to maintain or improve the conservation status of *Conospermum undulatum* during the term of this plan by abating identified threats to populations.

### **Criteria for success**

The IRP will be successful if all of A, B and C are achieved.

- A. The total number of mature plants and/or the area of occupancy is maintained or increased over the term of the plan.
- B. There is an increase of 10% or more in the total number of mature plants and/or area of occupancy under secure conservation tenure.
- C. Results of research conducted as per recommendations in this IRP (e.g. Appropriate fire regimes, pollinator habitat, recruitment requirements, survey and monitoring) is applied in habitat management over 20% or more of the known area of occupancy of the species.

### **Criteria for failure**

The IRP will be considered to have failed if either A or B are met.

- A. The number of mature plants and/or the area of occupancy have decreased by ten percent or more over the term of the plan.
- B. There has otherwise been a decline in the species, or worsening of the nature of threatening processes, leading to increased concern over the long term survival of the species.

## **3. RECOVERY ACTIONS**

### **Completed recovery actions**

All land managers and landowners have been made aware of the threatened nature of the species, its location and their legal obligations to protect it.

Declared Rare Flora (DRF) markers have been installed at Subpopulations 1b, 4j and 18m.

Fencing of Populations 3, 5, 6, 12 and 23 and Subpopulations 1bc, 1i, 4a, 4b, 4d, 4q, 8a, 10d, 10e, 10f, 13a-c, 16b-j, 18g, 18h and 19e, and partial fencing of Subpopulations 1a, 10c, 18c-f, 18i and 18j has been undertaken.

Populations 2 and 6 and Subpopulations 1a-c, 1e, 1h-i, 4e-f, 4h-k, 4r, 10a-f, 13a-c, 16f-i, 18a, 18d-i, 18k, 18o, 19a and 24b are in sites identified by the DPI Bush Forever program.

Between 1990 and 1997, surveys for *Conospermum undulatum* were undertaken in areas of suitable habitat on the Swan Coastal Plain, resulting in the discovery of two new subpopulations.

In 2005, further surveys of areas likely to support *Conospermum undulatum* were undertaken by CALM staff and members of the Wildflower Society of Western Australia (WSWA). These surveys resulted in the discovery of seven new populations.

In 2005, research into the biological and ecological parameters affecting the conservation of *Conospermum undulatum*, genetic differentiation between the Perth International Airport (PIA) population and nearby populations and the degree of genetic divergence between *C. undulatum* and *C. triplinervium* was undertaken for Westralia Airports Corporation.

DEC's Threatened Flora Seed Centre (TFSC) has 159 seeds in storage that were collected from Subpopulation 18g in 2001.

### **Ongoing and future recovery actions**

Staff from DEC's Swan Region assess development applications for bushland containing *Conospermum undulatum* and participate in environmental impact assessment and statutory planning processes. This action is ongoing.

The SRTFCRT is overseeing the implementation of this IRP and will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies.

Staff from DEC's Swan Region regularly monitor all populations.

Where recovery actions are implemented on lands other than those managed by DEC, permission has been, or will be, sought from appropriate land managers prior to actions being undertaken. The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any recovery action if funding is available and other opportunities arise.

#### **1. Coordinate recovery actions**

The Swan Region and Swan Coastal District, under the general guidance of the SRTFCRT, will continue to coordinate the implementation of recovery actions for *Conospermum undulatum* and will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies.

**Action:** Coordinate recovery actions  
**Responsibility:** DEC Swan Region under the general guidance of the SRTFCRT  
**Cost:** \$1,600 annually

#### **2. Monitor populations**

Monitoring of factors such as population stability (expansion or decline), weed invasion, habitat degradation, pollinator activity, seed production, recruitment, and longevity is essential. Significant and "at risk" populations will be inspected annually and rare flora report forms completed. Other populations will be inspected on an as-needs basis and at least every five years. This action is particularly relevant to populations on private property



where rates of owner turnover can be high. Monitoring information will be provided to DEC's Species and Communities Branch (SCB).

Location descriptions, including GPS points, for many populations require reassessment as many are outdated or appear incorrect. Where possible, accurate GPS polygons should be taken for each population and subpopulation.

Information gained from this monitoring will be used in the review of population and subpopulation identification and numbering in action 9, mapping of critical habitat in action 18, and in determining priorities for recovery action for this species.

**Action:** Monitor populations  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Swan Region)  
**Cost:** \$10,000 annually

### 3. Liaise with relevant land managers regarding management of bushland containing *Conospermum undulatum*

Staff from DEC's Swan Regional Office will continue to liaise with staff from the Shire of Kalamunda and the City of Gosnells, Main Roads WA, Water Corporation, Department of Agriculture and Food and DPI, Westralia Airports Corporation, Ministry for Education and private property owners. This is to ensure that plants are not accidentally damaged or destroyed and to provide advice on how best to manage the species on their lands. Liaison is required with Westralia Airports Corporation to ensure the continued implementation of rabbit control within the Perth International Airport Conservation Area and to ensure that control is conducted in a manner that maximises its effectiveness in the protection of *Conospermum undulatum*.

Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas that are habitat for *Conospermum undulatum*.

**Action:** Liaise with relevant land managers  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Swan Region)  
**Cost:** \$12,000 annually

### 4. Install DRF markers

Declared Rare Flora (DRF) markers provide discrete signage of populations, especially alongside roads, to alert people managing these areas to the presence of the DRF, so as to prevent accidental damage to the plants or their habitat. DRF markers are required at populations 14, 17 and 23 and Subpopulations 1c-e, 4g, 4k, 4l, 4o, 8b, 10a+d, 11b, 16b-i, 13a-b, 18i, 18j, 18n and 22a and b. DRF markers at Subpopulation 16a need replacing. The installation of these markers will be undertaken during the flowering period of *Conospermum undulatum* to ensure that all plants on road verges and firebreaks are between the markers.

**Action:** Install DRF Markers  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts)  
**Cost:** \$8,200 in the first year. \$2,000 maintenance in year 3 and 5.

### 5. Fence subpopulations

Fencing is required at Subpopulation 1d, 4g, 4k, 8b and 10a. Subpopulations 1a, 1i, 18c-f, 18i, 18j are only partially fenced and require further fencing to be installed. Fenced areas will ideally include a buffer of surrounding habitat. Liaison with land managers will be undertaken by district staff to determine the type of fencing. Funding assistance may be sought from various sources.

**Actions:** Fence subpopulations  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts)  
**Cost:** \$8,100 annually in the years 1-4.

## 6. Collect seed and other material to preserve genetic diversity

DEC's TFSC has a small accession of seed from *Conospermum undulatum*. However, further collections are required. Collections should aim to sample and preserve the maximum range of genetic diversity (which should be determined by an appropriate molecular technique such as genetic fingerprinting). The "Germplasm Conservation Guidelines for Australia" produced by the Australian Network for Plant Conservation (ANPC) should be used to guide to collection (ANPC 1997).

**Actions:** Collect seed and other material to preserve genetic diversity  
**Responsibility:** DEC (TFSC), and BGPA  
**Cost:** \$2,300 annually in years 1-5.

## 7. Undertake weed control

Weeds are a threat to several populations of *Conospermum undulatum*. Weeds reduce population health and reproductive output, and increase the frequency and intensity of fire. The following actions will be implemented:

1. Determine which weeds are present and develop a prioritized weed control program;
2. Select appropriate herbicides;
3. Control invasive weeds by hand removal or spot spraying around *Conospermum undulatum* plants when weeds first emerge; and
4. Schedule weed control to include spraying at other threatened flora populations within the Swan Region.

The tolerance of most native plant species to herbicides is not known and weed control programs will need to be undertaken in conjunction with research, or in an adaptive management framework.

**Action:** Undertake weed control  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Science Division)  
**Cost:** \$18,600 annually

## 8. Develop and implement a rabbit control strategy

Rabbit control is being conducted at *Conospermum undulatum* Subpopulations 24a and b by Westralia Airports Corporation. However, it is recommended that a rabbit control strategy be developed and implemented for all populations.

**Action:** Develop and implement a rabbit control strategy  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Swan Region)  
**Cost:** \$12,000 in the first year; \$9,800 annually in years 2-5.

## 9. Reassess population numbering and size based on tenure

Populations and subpopulations are based on clustering of occurrences, and land tenure. However, location descriptions for many sites are outdated or incorrect, and in some cases changes to tenure and ownership are not recorded. It is recommended that populations of *Conospermum undulatum* are reassessed to ensure that tenure boundaries are accurately reflected.

**Action:** Reassess population numbering and size based on tenure  
**Responsibility:** DEC (Swan Region, SCB, and SRTFCRT)  
**Cost:** \$5,000 in years 1 and 2.

## 10. Assess development applications for lands containing *Conospermum undulatum*

DEC staff will continue to assess development proposals for lands containing *Conospermum undulatum* and participate in environmental impact assessment and statutory planning processes.

**Action:** Assess development applications for lands containing *Conospermum undulatum*  
**Responsibility:** DEC (Swan Region and Environmental Assessment Branch)  
**Cost:** \$5,000 annually in years 1-5.

### 11. Increase the number of populations of *Conospermum undulatum* in the conservation estate

Currently, only one subpopulation of *Conospermum undulatum*, accounting for 7.3% of the total number of plants, is located in protected conservation tenure (Nature Reserve). Bush Forever has identified thirteen sites of regionally significant vegetation that contain *Conospermum undulatum* and it is possible that other sites containing populations of the species could be acquired for conservation.

**Action:** Increase the number of populations of *Conospermum undulatum* in the conservation estate  
**Responsibility:** DEC (Swan Region) with the WAPC  
**Cost:** \$1,800 in the first year; \$500 annually in years 2-5 (this does not include purchase price)

### 12. Conduct further surveys

It is recommended that areas of potential habitat be surveyed for the presence of *Conospermum undulatum* during its flowering period. All surveyed areas will be recorded and the presence or absence of *C. undulatum* documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, wildflower societies and naturalists clubs could be involved in surveys supervised by DEC staff.

**Action:** Conduct further surveys  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Swan Region)  
**Cost:** \$4,300 in years 2 and 4.

### 13. Develop and implement a fire management strategy

A fire management strategy should be prepared and implemented to reduce the impact of prescribed and wildfire in areas that are habitat for *Conospermum undulatum*. It is recommended that this strategy include advice to landowners on how best to manage asset protection measures while conserving *C. undulatum*. A fire management strategy will include site specific wildfire response.

**Action:** Develop and implement a fire management strategy  
**Responsibility:** DEC (Perth Hills and Swan Coastal Districts, Swan Region) with relevant authorities.  
**Cost:** \$6,000 once, in the first year; \$4,300 in years 2-5

### 14. Promote awareness

The importance of biodiversity conservation and the protection of *Conospermum undulatum* will be promoted to the public. This will be achieved through an information campaign using local print and electronic media and by setting up poster displays. An A4 sized information sheet that provides a description of the species and information about threats and recovery actions will be developed for *C. undulatum* and distributed to local land owners, relevant authorities and volunteer organizations, libraries and schools within targeted areas. It is hoped that the poster will result in the discovery of new populations. Formal links with local naturalist groups and interested individuals should also be encouraged.

To minimize the risk of deliberate destruction, it is recommended that the exact location of *C. undulatum* be kept from the general public. Such information should, however, be given to relevant landowners, Shire and City staff and government authorities to prevent accidental destruction of plants.

**Action:** Promote awareness  
**Responsibility:** DEC (Perth Hills and Swan Coastal District, Swan Region, SCB and Strategic Development and Corporate Affairs Division)  
**Cost:** \$1,600 in the first year; \$600 annually thereafter

**15. Develop and implement fire and soil disturbance trials**

DEC's Swan Regional staff will, in consultation with private landowners, relevant shires and government departments, conduct research into the effectiveness of fire and mechanical soil disturbance in stimulating germination of soil-stored *Conospermum undulatum* seed. The results of research trials will be monitored and will be used to develop fire management strategies.

**Action:** Develop and implement fire and soil disturbance trials  
**Responsibility:** DEC (Science Division, Perth Hills and Swan Coastal District, Swan Region)  
**Cost:** \$6,500 in years 1, 3 and 5

**16. Obtain biological and ecological information**

Improved knowledge of the biology and ecology of *Conospermum undulatum* will provide a better scientific basis for its management and should include:

1. Optimal fire and mechanical disturbance regime to maximise population size and health.
2. Appropriate herbicides for weed control that will not adversely affect *Conospermum undulatum*.
3. Seed and germination biology, such as rate of seed set and size of soil seed banks.
4. Age structure of *Conospermum undulatum* populations.
5. Susceptibility to *Phytophthora* spp.
6. Hybridisation between *Conospermum undulatum* and *Conospermum stoechadis* and *Conospermum triplinervium*.
7. Genetic differentiation between *Conospermum undulatum*, *Conospermum stoechadis* and *Conospermum triplinervium* using a higher number of genetic markers and with sampling from a broader range of populations of *C. undulatum* than in previous investigations by Close *et. al.* 2005.

**Action:** Obtain biological and ecological information  
**Responsibility:** DEC (Science Division, Perth Hills and Swan Coastal District, Swan Region)  
**Cost:** \$7,500 per year in year 2, \$27,300 in year 3 and \$18,800 in year 4

**17. Map habitat critical to the survival of *Conospermum undulatum***

It is a requirement of the EPBC Act (1999) that spatial data relating to critical habitat be determined. Although habitat critical to the survival of the species is described in Section 1, the area has not yet been mapped and this will be addressed under this action.

Where possible, monitoring of populations under action 2, and description of any new populations under action 12, should include GIS mapping.

**Action:** Map habitat critical to the survival of *Conospermum undulatum*  
**Responsibility:** DEC (Swan Region Swan Coastal District and Perth Hills District)  
**Cost:** \$3,000 in the third year

**18. Review the plan and need for further recovery actions**

At the end of the five-year term of this IRP the plan will be reviewed and the need for further recovery actions assessed.

**Action:** Review the plan and need for further recovery actions  
**Responsibility:** DEC (Perth Hills and Swan Coastal District, Swan Region) through the SRTFCRT  
**Cost:** \$1,500 in the fourth year

**Summary of recovery actions**

| Recovery Actions | Priority | Responsibility | Completion date |
|------------------|----------|----------------|-----------------|
|------------------|----------|----------------|-----------------|

| Recovery Actions   | Priority | Responsibility   | Completion date                             |
|--|----------|--|---|
| Coordinate recovery actions  | High     | DEC Swan Region  | Ongoing                                     |
| Monitor populations  | High     | DEC (Perth Hills and Swan Coastal Districts, Swan Region)  | Ongoing                                     |
| Liaise with relevant land managers regarding management of bushland containing <i>C. undulatum</i> | High     | DEC (Perth Hills and Swan Coastal Districts, Swan Region)  | Ongoing                                     |
| Install DRF Markers  | High     | DEC (Perth Hills and Swan Coastal Districts)   | 2008  |
| Fence Subpopulations   | High     | DEC (Perth Hills and Swan Coastal Districts)   | 2012  |
| Collect seed and other material to preserve genetic diversity                                      | High     | DEC (TFSC), and BGPA   | 2013  |
| Undertake weed control   | High     | DEC (Perth Hills and Swan Coastal Districts, Science Division)   | Ongoing                                     |
| Develop and implement a rabbit control strategy  | High     | DEC (Perth Hills and Swan Coastal Districts, Swan Region)  | Develop by 2008 with implementation ongoing |
| Reassess population numbering and size based on tenure   | High     | DEC (Swan Region, SCB) through the SRTFCRT   | 2010  |
| Assess development applications for lands containing <i>Conospermum undulatum</i>                  | High     | DEC (Swan Region and Environmental Assessment Branch) through the SRTFCRT  | Ongoing                                     |
| Increase area of <i>Conospermum undulatum</i> in the conservation estate                           | High     | DEC (Swan Region) with the WAPC  | 2013  |
| Conduct further surveys  | High     | DEC (Perth Hills and Swan Coastal Districts, Swan Region)  | Ongoing                                     |
| Develop and implement a fire management strategy   | High     | DEC (Perth Hills and Swan Coastal Districts, Swan Region) with relevant authorities.                                   | Develop by 2008 with implementation ongoing |
| Promote awareness  | Moderate | DEC (Perth Hills and Swan Coastal District, Swan Region, SCB and Strategic Development and Corporate Affairs Division) | Ongoing                                     |
| Develop and implement fire and soil disturbance trials   | Moderate | DEC (Science Division, Perth Hills and Swan Coastal District, Swan Region)   | 2013  |
| Obtain biological and ecological information   | Moderate | DEC (Science Division, Perth Hills and Swan Coastal District, Swan Region)   | 2012  |
| Map habitat critical to the survival of <i>Conospermum undulatum</i>                               | Moderate | DEC (Swan Region Swan Coastal District and Perth Hills District)   | 2011  |
| Review the plan and need for further recovery actions  | Moderate | DEC (Perth Hills and Swan Coastal District, Swan Region) and the SRTFCRT   | 2013  |

#### 4. TERM OF PLAN

##### Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If the taxon is still ranked VU after five years, the need for further recovery actions and an update of this IRP will be assessed.

##### Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

#### 5. REFERENCES

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- Kelly, A.E., Taylor, A., Langley, M.A., Spooner, A., Coates, D.J. (1993). Declared rare flora and other plants in need of special protection in the metropolitan area, Wildlife Management Program 10. Department of Conservation and Land Management, Perth, Western Australia. pp 55.

## 6. TAXONOMIC DESCRIPTION

Excerpt from: Lindley, I. (1839-1840). *A Sketch of the vegetation of the Swan River Colony*. In: Appendix to the first 23 Volumes of Edwards Botanical Register, London.

Erect *shrub* to 1.5 m tall. *Leaves* ascending, oblanceolate to spatulate, 1.4-12 cm long 4-38 mm wide, glabrous; *margins* undulate; *apex* acute; central and marginal *veins* prominent. *Inflorescence* an interrupted, spicate panicle; *peduncle* 25.5-40 cm long puberulous to villous; *branchlets* ovate, 2-3.1 mm wide; base and sides densely tomentose; apex ± velutinous. *Perianth*, white-woolly; tube 2.8-4.5 mm long; upper lip ovate, 1.8-2.4 mm long, 1-1.2 mm wide, glabrous, with an acute apex, lower lip united for 1-1.8 mm, woolly lobes narrowly oblong, 1.5-1 mm long, 0.2-0.3 mm wide, woolly with an acute apex. *Nut* approx. 2.5 mm long, approx. 3 mm wide, dark tan, velutinous, circumference hairs approx. 1.8 mm long, orange; *central tuft* 1.8-2 mm long, pale orange.

