Invasive Species Project 20-0608

SWAN ENVIRONMENTAL WEED STRATEGY

Annual Report (Year 1)
30 June 2007

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ACRONYMS

SCC - Swan Catchment Council
DEC – Department of Environment and Conservation
DAFWA – Department of Agriculture and Food Western Australia
EWAN – Environmental Weeds Action Network
EWSWA – Environmental Weed Strategy for Western Australia
LGA – Local Government Authority
DPI – Department for Planning and Infrastructure
MRWA – Main Roads Western Australia
WWF – World Wide Fund for Nature
PBP – Perth Biodiversity Project
WALGA – Western Australia Local Government Association
WONS – Weed of National Significance

Definition of weed

The term "weed" within the scope of this project covers all types of environmental weeds including declared, undeclared, terrestrial and aquatic (non-marine) species.

SUMMARY

The Swan NRM Region covers 770,000 hectares and 33 Local Government areas in the southwest of Western Australia. It contains unique biodiversity assets and supports a range of land uses. Environmental weeds pose a significant threat to the remaining biodiversity. Challenges lies in protecting these assets from existing established weeds and preventing new weeds from establishing. Without a systematic approach of prioritising and managing these species, efforts to minimise their impact will remain fragmented and uncoordinated.

This project aims to provide a regional strategic approach to managing the impacts of environmental weeds across the Region, with a focus on key individual species impacting on high-value biodiversity assets. Project outcomes will include a prioritised list of environmental weeds, development of strategic plans for six key individual weeds, which will provide models for future development of similar plans, and establishment of a framework for a web-based database. This report outlines the progress toward or completion of these outcomes and associated milestones as required by the Swan Catchment Council.

The following outputs/milestones have been completed and are described in this report:

- assessment of environmental weeds impacting on biodiversity in the Swan NRM Region with a draft prioritised weed species list;
- selection of six key species for strategic planning;
- strategic plans for two key individual weed species;
- progress toward development of database and
- progress toward implementation of strategies, including 100 hectares of weed control/management

BACKGROUND

In 2006 the Swan Catchment Centre (SCC) secured funding from the Natural Heritage Trust to implement priority activities identified in its Investment Plan and NRM Strategy. Written tenders were sought in April 2006 for the delivery of a project to prioritise and develop a strategic plan for environmental weed species in the Swan NRM Region. In accordance with SCC requirements the Department of Environment and Conservation (DEC) were the successful tenders with the project *Invasive Weed Species* (Project Number 20-0608). This Project directly contributes to achieving SCC Resource Condition Targets and Management Action Targets relating to reduction in the impacts of regionally significant invasive species by 2020. It achieves priorities outlined in the Environmental Weed Strategy for Western Australian (CALM 1999) and the Swan Region NRM Strategy (Swan Catchment Council 2004).

DEC was the successful tenderer through meeting criteria based on previous experience, technical skill, demonstrated management capability and ability to liaise with stakeholders. A project team consisting of DEC weed management professionals was formed to oversee the project. Members include Greg Keighery, Kate Brown and David Mitchell. After appointing a Project Officer, a works program was developed in accordance with the Project brief.

The main objective of the project is to provide direction and a regional strategic approach to managing the impacts of environmental weeds across the Swan NRM Region. It will allow land managers to direct resources into priority weed species, therefore maximizing investment of resources. It will necessitate working closely with and consulting a range of organisations and stakeholders including the WA State Weeds Committee, Environmental Weeds Action Network (EWAN), Perth Biodiversity Project (WALGA) and other sub-regional NRM organisations.

The project will lead to an Environmental Weed Strategy for the Swan NRM Region, which will provide a focus for regional implementation of the EWSWA. No other similar Regional plans have yet been developed in Western Australia and it is hoped this plan will provide a template for similar Regional and catchment-based weed strategies to be developed.

While no similar plans currently exist in WA, other Australian states and New Zealand have developed region-wide strategies. The methodology and structure behind these vary and each can serve as templates or case studies that can be applied to other areas. This strategy will most closely be aligned to several studies undertaken in Victoria, using a biodiversity asset based approach to prioritise weeds and management actions. These studies are the *Regional Prioritysetting for Weed Management on Public Land in Victoria* 2006 (Platt *et al.* 2005) and *Interim Guidelines and Procedures for Managing the Environmental Impacts of Weeds on Public Lands in Victoria 2006* (Environmental Weeds Working Group 2006).

OBJECTIVES

Main objective:
The project aims to provide a regional strategic approach to managing the impacts of environmental weeds across the Swan NRM Region.

The project seeks to:
- Assess and prioritise environmental weeds impacting on biodiversity in the Swan NRM Region
- Set targets for the management of high prioirty invasive species throughout the Region
- Develop strategic plans for the control and eradication of high priority invasive species
- Commence implementation of strategic plans for these high priority invasive species
- Establish an environmental weed database as a tool for ongoing monitoring and management of priority invasive species.

OUTCOMES

Outcomes due in this annual report:

1. **Assess and prioritise environmental weeds impacting on biodiversity and review current weed management in the Swan NRM Region;**
2. **Identify and prioritise key weed species;**
3. **Strategic plans for two key individual weed species;**
4. **Progress toward development of database and**
5. **Progress toward implementation of strategies, including 100 hectares of weed control/management (due October 2007)**

The methodology and progress toward, or completion of outcomes, are listed in the following.

OUTCOME 1: Assess and prioritise environmental weeds impacting on biodiversity and review current weed management in the Swan NRM Region

A draft prioritised environmental weed list for the Swan NRM Region, was completed by Greg Keighery in consultation with other Project team members in February 2007. It contains 909 taxa, 891 species from 452 genera and 118 families. The content was collated from a range of sources, including: the Environmental Weed Strategy for WA (CALM 1999), *Florabase* (Western Australian Herbarium 2007), botanical surveys, published reports, area management plans, Perth Biodiversity Project Natural Area Initial Assessments and friends groups.

A prioritization framework was developed from an adaptation of other documents such as the Environmental Weed Strategy for WA (CALM 1999) and *Regional Priority-setting for Weed Management on Public Land in Victoria* (Platt *et al.* 2005). The following criteria were used to rate species as high, medium or low priorities for management: invasiveness, ecological impact, and current and potential distribution. Where there are significant gaps in knowledge, the category "Further Assessment Required" (FAR) was used. The prioritized list will form a major part of the weed strategy and will identify the highest priority weeds for the Region, thereby guiding weed management across the Region.

Particular emphasis was placed on ensuring all relevant stakeholders were properly engaged and consultated. The draft list was widely disseminated, and a workshop held on 30 March 2007 to review the structure, fields and content of the list. Stakeholders invited to attend and/or comment, included:

- EWAN
- DEC – Swan River Trust, Urban Nature, Regional Parks Unit, District/Regional staff, Species and Communities Unit, Science Division
- LGAs
- WWF
- SCC members
- Other government agencies (Water Corporation)
- Sub-regional NRM groups
- DAFWA
- Weed contractors
- CSIRO
- Environmental consultants
- Botanic Gardens and Parks Authority (BGPA)
- Educators and trainers
- Friends groups and
- Community members.

The workshop was attended by members of SERCUL (South East Regional Centre for Urban Landcare), EWAN, Local Government, DEC – Urban Nature, Districts, Science Division, members of the community, friends groups, CSIRO, BGPA and Murdoch TAFE (Department of Technical and Further Education) . A major outcome of the discussion was inclusion of another field in the list for Australian and WA native species, which occur as weeds outside their native range. It was suggested that without this field, certain species might be used inappropriately in landscaping or revegetation programs. The workshop also highlighted the difference in rating species at a NRM Regional level compared to a local or site specific level.

An example of the prioritised list is given in Appendix 1 with an explanation of the data fields and codes used.

Another key component of the strategy will be identifying key areas for protection both on and off reserve from environmental weed invasion. Much work has already been undertaken to assess the Region's biodiversity assets, these assets include regionally significant bushland (Bush Forever Sites), Threatened Ecological Communities, sites containing significant or rare flora/fauna and areas of ecological linkages and regionally significant remnant vegetation. Relevant information can be collated from a number of sources (eg. PBP, DEC) and data layers combined to give a spatial model of priority areas requiring protection.

The WA Local Government Association (WALGA) was contacted regarding a capacity survey being conducted of local government natural area managers as part of the Perth Biodiversity Project (PBP). This survey is designed to gain an understanding of local government capacity, understanding and actions regarding natural area protection and management including environmental weed control. However, the survey results will not be available until the second half of 2007.

OUTCOME 2: Identify and prioritise key weed species

At least six key weed species needed to be selected for the preparation of individual strategic control and eradication plans. This has been completed, with the six priority species listed in Table 1. Several steps were involved in the selection process, as described below.

The EWSWA (CALM 1999) identified all known weed species in Western Australia and provided a ranking for these based on invasiveness, distribution and impacts on biodiversity. Subsequent work (Keighery 2005) identified a list of the most significant actual and potential species for terrestrial and aquatic/wetland ecosystems for all WA's IBRA Bioregions, including the Weeds of National Significance. Appendix 3 lists these species for the Swan Coastal Plain and Jarrah Forest IBRA Bioregions.

The Project team then prioritised species from those listed previously as the most significant weeds in the IBRA Bioregions that make up the Swan NRM Region.

Six key species were selected for the preparation of more detailed strategic control and eradication plans. Their selection was based on: criteria used in the EWSWA (CALM 1999) ranking process (invasiveness, distribution and impact), life form, consideration of assets threatened, community interest and capacity for involvement, existing understanding of biology and control, likelihood of success, spread across the Swan NRM Region, management objective (from eradication to containment and protection of high value biodiversity assets) and how best the strategic plans could be used as a model for developing similar plans in the future across the south-west of Western Australia.

A matrix of the selection criteria are shown in Table 1. The list includes two National Alert List species (yellow soldiers and white weeping broom), one Declared Weed species (arum lily), one grass (haas grass),one other herb (Geraldton carnation weed) and one sedge (spike rush).

Table 1: Selection matrix for the six key invasive weed species selected for strategic control and eradication planning.

Species	**Life form**	**Occurrence-** Swan Coastal Plain (SCP) Jarrah Forest (JF)	**Habitat-** Wetland (W) Terrestrial (T)	**Management objective-** Eradicate (E) Control (C)	**Distribution-** Actual (A) Potential (P)	**Comments on selection process** (Declared, WONS, National Alert List, invasiveness, level of awareness)
Arum lily (*Zantedeschia aethiopica*)	Herb - Tuberous	SCP & JF	W/T	C	A	Declared. Serious weed. Already widespread. Different life form. Control rather than eradication. Well known. High level of public interest.
Geraldton carnation weed (*Euphorbia terracina*)	Herb	SCP (JF potential)	T	C	A/P	Highly invasive, high potential for spread. Different life form and biology. Limited control information. Particular threat to Swan Coastal Plain vegetation (including TECs).
Spiny rush (*Juncus acutus*)	Sedge	SCP & JF	W	C	A/P	Different life form. Highly invasive. Spread across both IBRA Bioregions and into western wheatbelt and Avon NRM Region.
Haas grass (*Tribolium uniolae*)	Grass	SCP	W/T	E & C	A/P	Possible to eradicate on the Swan Coastal Plain. Widespread in Perth Hills. Poorly known.
Yellow Soldiers (*Lachenalia reflexa*)	Herb - Bulbous	SCP	T	C-E	A/P	Highly invasive, potential to become serious weed SCP. Possible to eradicate mid term timelines. Good control information available.
White Weeping Broom (*Retama raetam*)	Shrub	SCP	T	E	P	On National Alert List. Different life form. Possible to eradicate before further spread. Poorly recognised.

OUTCOME 3: Key individual species strategic plans

For two of the six selected species, wite weeping broom and haas grass, individual strategic plans have been drafted in preparation for stakeholder revie (see attached documents). In the second half of 2007 DEC will put these draft strategic plans out for review by the SCC and all stakeholder groups involved in implementation.

These strategic plans outline management objectives, priorities and targets and identify the high biodiversity value assests under direct and indirect threat. As outlined in the Project brief, these strategic plans have an operational focus – with site specific, short and long term on-ground actions listed. They have been developed with a framework for monitoring and evaluation, to allow for adaptive management as new information comes to hand. Some of the performance indicators for monitoring and evaluation include spatial mapping of populations, inventories of plant/population numbers and quadrat-based monitoring to assess the effectiveness of control programs.

The first steps in preparing these strategies were to review relevant literature and draw upon the knowledge of a range of stakeholders. Current herbarium collection data was sought from the WA Herbarium and enquiries made with other staff from DEC. Calls for information on the locations or current management of the species were made via electronic resources (including the *NAMN* newsletter, EEN newsletter), print media (*Greenpages*, *Bushland News,The Swan*), in presentations and through working relationships with other agencies (e.g. Greening Australia WA, EWAN, Local Governments, DPI, BGPA and CSIRO). The response was excellent and resulted in greater general awareness and recognition of the target species and numerous new populations being identified. In these early stages of information gathering, valuable partnerships were also established.

As this information was being collected, field survey and mapping was undertaken. This allowed a better understanding of the extent of the species both at a local and regional scale. Gaps in knowledge were identified, and in the case of white weeping broom, trials were established to obtain data on best practice control methods. Predictive climate modeling for both species was undertaken and data on the Region's biodiversity assets was gathered. Once all information was collated and analysed, priorities, objectives and recommendations could be developed which formed the basis of the strategies.

These species represent different life forms, biologies and ecologies, invade different habitats and vary in extent in the Region. As such, they present a range of problems for management that provide the opportunity to develop model approaches for a rang eof other invasive weed species.

The first strategy developed has been for white weeping broom (*R. raetam*). This is a drought-tolerant legumous shrub on the National Alert List of environmental weeds and is targeted for eradication. The majority of WA populations occur in the Swan NRM Region on the western side of the Swan Coastal Plain, and although currently in low numbers and restricted in distribution, it has the potential to greatly increase in abundance and substantially expand its range. In addition, its long-lived soil seed bank makes it particularly problematic to manage. If no short-term action is taken to eradicate white weeping broom, it will dominate and degrade many high conservation value coastal and inland plant communities within the Region, along the midwest and southern coastlines. Some Local Governments have commenced control on their own lands. With early intervention and appropriate investment it is possible to eradicate the species from the Swan NRM Region.

The second strategy has been developed for the highly invasive haas grass (*T.uniolae*). Along with different biology, ecology and distribution, management objectives and priorities for this species vary greatly to white weeping broom. Several isolated populations occur on the eastern side of the Swan Coastal Plain, but the grass is most well established and in greatest abundance on the Darling Scarp/Plateau. Populations are radiating outwards and it has the potential to increase greatly in abundance within its current distribution. While it is highly invasive and has significant impacts on native plant communities including threatened ecological communities, it is poorly recognised and rarely controlled. The main management objectives are eradication in the particular management areas of the Swan Coastal Plain and the high value biodiversity conservation areas on the Darling Scarp/Plateau along with containment of spread and control in other sites.

For both strategies, the main focus is on prioritising management with the aim of protecting the Swan NRM Region's high value biodiversity assets. These assets include regionally significant bushland, Threatened Ecological Communities and sites with rare and significant flora or fauna.

The following outputs have been completed:

- Two individual species strategic control and eradication plans – white weeping broom (*R. raetam*) and haas grass (*T. uniolae*).
- Information is being gathered on the other four key species, with two of these plans already in progress.

OUTCOME 4: Database, Monitoring and Evaluation

This will be developed as a relational database housed with the WA Herbarium's *Florabase*, to provide on-line information on environmental weed species in the Swan NRM Region. It will provide a range of data on species' rankings, biology and management, including distribution, control methods and site details, all of which will be searchable electronically.

The database will incorporate some design features of *Weedbase* released with the EWSWA (CALM 1999), however, it will be developed as a new database with several structural layers and updated information.

The following summarises the database components:

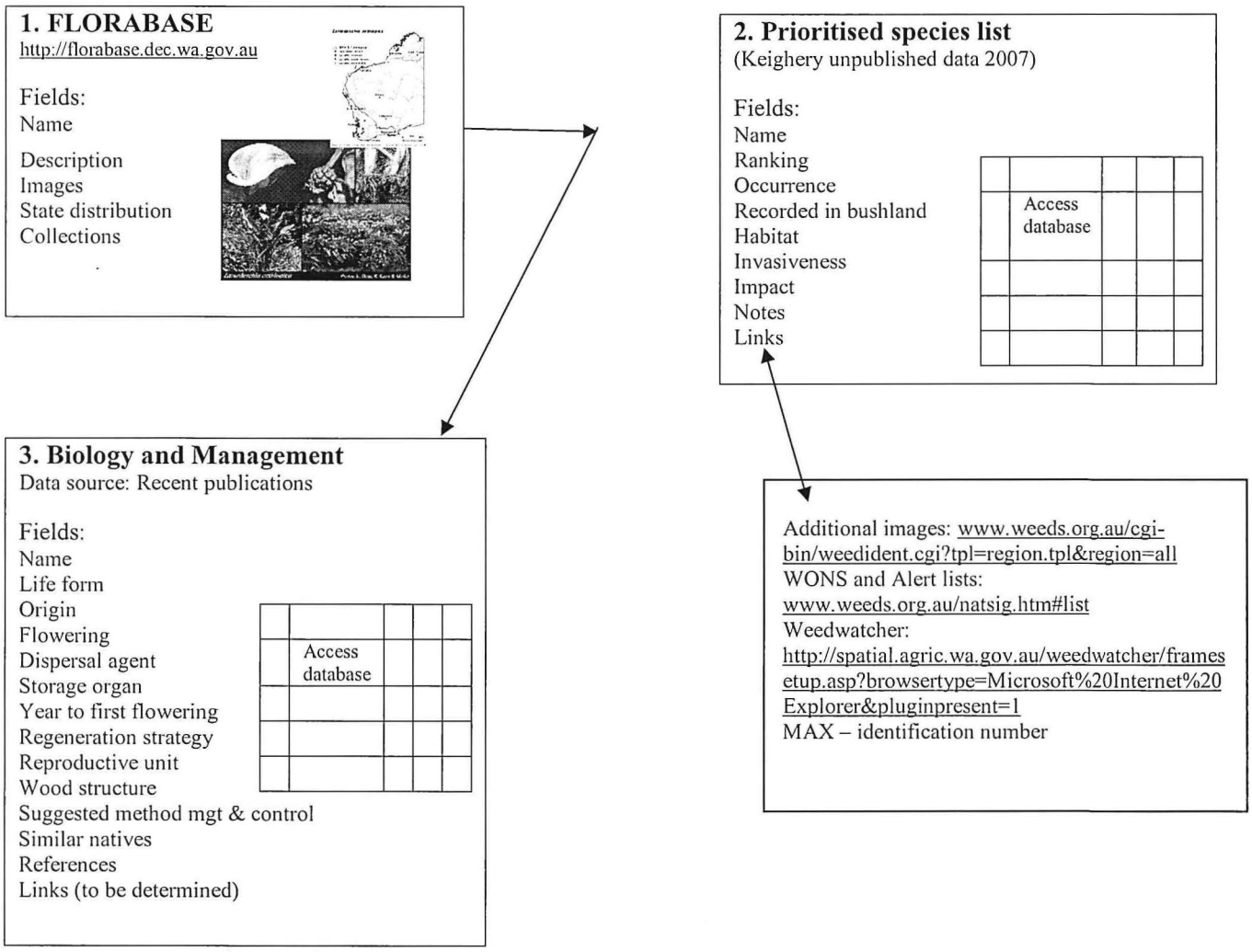
- Data sources – it will deliver expert information from Greg Keighery (DEC), recent publications and the strategic plans for the six key invasive weed species developed through this Project. The aim is also to link to a number of collaborative sources of information such as *Florabase* (Western Australian Herbarium 2007).
- Data engine - Microsoft Access. Will have the capacity for expansion and be web-aware.
- Development – development will occur with advice/liaison with the WA Herbarium to allow compatibility with *Florabase* and MAX.
- Fields - developed by Greg Keighery, Brown & Brooks (2002), Karen Bettink.
- Distribution – available as a downloadable hardcopy on SCC and DEC websites.
- Data entry/importing – initially overseen by Greg Keighery, K.Brown & K.Bettink. Information then updated only by database custodian (custodian yet to be confirmed).
- Reports/Queries – reports and maps will be able to be produced from on-screen prompts.
- Budget for development – budgeted amounts from the SCC Project as well as BCI funding will be used to employ a consultant for development of the database.
- Ongoing maintenance – provision of annual funding for maintenance of the database needs to be discussed further.
- Acknowledgements – main contributors and data sources can be presented on the database opening page (with description, logo and link to webpage if applicable).

- Contributors/acknowledgements for SCC, DEC (*Florabase*), NHT and EWAN as required. References for new information to the biology and management tables can be added in the reference field.
- Opening page – to include details of what the database is, what it seeks to do and why it was developed. Provide other general information, including database is a follow-on product from the information resource developed in the EWSWA (CALM 1999), a "Go to Contacts" link for more information, a "Go to Citation" link for information on how to cite references.
- Design – Figure 1 shows an example of the proposed database structure including tables, fields, relationships and links to web pages.

The following outputs have been completed:

Progress to date on the database – proposed structure of database has been developed with relationships between the Swan NRM Region environmental weed species list, biology, management and control information and species-based information for the six selected key species.

Figure 1: Proposed database structure, with *Florabase* as the initial search engine.



OUTCOME 5: Progress toward implementation of strategies, including 100 hectares of weed control/management (due October 2007)

The Project budget allows limited funding for implementing the strategies, particularly on-ground works. However, from the project budget, recommendations from the haas grass and white weeping broom strategies have been or are currently being implemented, including:

- Liaison with key stakeholders to undertake control of each species on various land tenures (for example, MRWA, Town of Victoria Park and City of South Perth were contacted regarding herbicide spraying of white weeping broom on non-DEC managed lands).
- White weeping broom nominated for exclusion from production and sale in the Code of Practice for the Horticulture Industry, as part of Biosecurity Legislation being developed.
- Establishment of field-based research trials to determine the most effective control methods for white weeping broom. These trials were commenced in December 2006 with the help of the Town of Cambridge, on a large population in a degraded, isolated block of land in Floreat. Ten replicates of six different treatments were tested. Preliminary results have been obtained, but these trials will not be completed until December 2007.
- Draft haas grass information brochure developed.

In addition to these actions, facilitating and brokering partner organizations to undertake management on their lands has made progress toward achieving some of the management targets. However, with the limited resource capacity of some organizations, other sources of funding to undertake these works are required in the future.

DEC's Biodiversity Conservation Initiative has provided significant funding over 2006/2007, which will continue into 2007/2008, and has allowed key on-ground actions to be implemented with partner organisations. Project proposals were successful in gaining $60,000, $80,000 and $4,000 for control of yellow soldiers, haas grass and white weeping broom respectively. On-ground actions included survey, mapping, herbicide control and monitoring.

Table 2 lists the on-ground works completed for each species, including location, partner oraganisation and area treated. The total area of weed control/management undertaken to date is over 104 Hectares.

Table 2: On-ground works completed as part of strategy implementation.

SPECIES/ACTION	LOCATION	PARTNER ORGANISATION	AREA TREATED (HA)	DATE COMPLETED
Haas grass				
Herbicide spraying	Lloyd Hughes Reserve, Kelmscott	City of Armadale/Gosnells	5 + 2 extra as follow up	Oct & Nov 2006
Herbicide spraying	Nan McMillan Reserve & Padbury Rd/Greenmount NP	Friends of Nan McMillan Reserve/Shire of Mundaring/DEC	9	Oct/Nov 2006
Herbicide spraying	Brixton St Wetlands	DEC	8 + 8 extra as follow up	Aug & Oct 2006
Herbicide spraying	Greater Brixton St Wetlands	DPI	6	Oct 2006
Herbicide spraying	North Harvey	Shire of Harvey/MRWA	4	June 2007
Yellow soldiers				
Herbicide spraying	Mt Henry Peninsula Bushland	Friends of Mt Henry Bushland	12	August 2006
Herbicide spraying	Woodvale Nature Reserve	DEC Science Division	34	August 2006
Herbicide spraying	Lake Cooloongup	DEC Regional Parks Unit	4	August 2006
White weeping broom				
Manual removal	Two Rocks	DEC-SCC Project	0.5	Sept 2006
Manual removal	South Perth	City of South Perth	0.1	Sep-Oct 2006
Manual removal	Bold Park & Kings Park	BGPA	1	Aug-Dec 2006
Herbicide spraying	Munster	Water Corporation	9	May 2007
Manual removal	West Coast Highway	DEC-SCC Project/City of Nedlands	0.5	Sep 2006
TOTAL			**104.1 HA**	

CONTINUING WORK – July 2007 to June 2008

Work on the following outcomes has commenced and will be completed by June 2008:

- strategic control and eradication plans for the other 4 key species identified;
- stakeholder review and finalization of the two existing strategic plans
- continued implementation of the two existing strategic plans;
- development of a regional environmental weed strategy;
- continuation of weed control toward a 200 hectare target and
- development of the relational on-line database.

REFERENCES

Brown, K. and Brooks, K. (2002) *Bushland Weeds: A practical guide to their management.* Environmental Weeds Action Network (Inc.), Greenwood, Western Australia.

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Swan Catchment Council (2004) *Swan Region Strategy for Natural Resource Management.* Swan Catchment Council, Midland, Western Australia

Western Australian Herbarium (2007) *Florabase*, http://florabase.dec.wa.gov//

Appendix 1: Example of prioritised environmental weed list for the Swan NRM Region (Greg Keighery, DEC, unpublished data 2007). Note rankings are only relevant for the Swan Catchment Council NRM Region.

KEY: Explanation of fields and codes

FIELD	DESCRIPTION	CODE	
FAMILY	Plant family		
NAME_ID	Max name identification number		
SPECIES_CODE	Max name identification alpha code		
Wd	Weed species	*	weed
Plant Name			
Common Name	Common or vernacular names, taken from Keighery *et al.* 2007 [2] and MAX [3]		
CURR	Name currency according to WA Census 22/08/2006	Y N	current not current
SWA	Swan IBRA Bioregion	Y	presence
JF	Jarrah Forest IBRA Bioregion	Y	presence
SCC	Swan Catchment Council	Y	presence
ENV	Environmental weed, i.e. occurring and reproducing (naturalized) in reasonably intact bushland [1]	Y	presence
Aq	Aquatic habitat	Y	presence
Dp	Dampland habitat	Y	presence
Terr	Terrestrial habitat	Y	presence
Hy	Capacity to hybridize with native species	Y	capable of hybridizing
Notes	General information		
Ecological Impact	Ecological impact of species within the Swan NRM Region, from low impact (causes minimal disruption to ecological processes or loss of biodiversity) to high (causes acute disruption of ecological processes, dominates and/or significantly alters vegetation structure)	L M H U	low impact species medium impact species high impact species unknown
Potential Distribution	Area of potential habitat in the Region that could be occupied	L M E U	limited moderate extensive unknown
Current Distribution	Area of potential habitat in the Region currently occupied	L M E U	limited moderate extensive unknown
Invasiveness	Rate of dispersal and/or establishment in native vegetation	S M R U	slow moderate rapid unknown
Rating	The risk each species poses to environmental assets in the Region, based on invasiveness, ecological impact, current and potential distribution	H M L U FAR	high medium low unknown further assessment required
Current status, actions and recommendations	E.g. WONS, Declared, Alert list, current level of management, further research and/or survey required		N/A

[1] Keighery, G. and Longman, V. (2004). The naturalized vascular plants of Western Australia 1: Checklist, Environmental Weeds and Distribution in IBRA regions. *Plant Protection Quarterly* Vol 19(1) 2004

[2] Keighery BJ Keighery GJ Longman VM and Clarke KA (2007, in prep.) *Native and Weed Flora of the Southern Swan Coastal Plain.*

[3] Department of Conservation and Land Management (2005) MAX Version 3.1.4.218

FAMILY	NAME ID	SPECIES_ CODE	Wd	Plant Name	Common Name	CUR	SWA	JF	SCC	ENV	Aq	Dp	Terr	Hy	Notes	Ecol. Impact	Potential Distr.	Invasive-ness	Rating	Current status, actions and recommendations
Acanthaceae	19716	THUALA	*	*Thunbergia alata*	Thunbergia	Y	Y	Y	Y				Y		minor creek line weed along Darling Scarp	L	L		L	
Agavaceae	14580	AGAAMEAME	*	*Agave americana* var. *americana*	Century Plant	N	Y	Y	Y	Y			Y		spread slowly via rhizomes	M	M	M	M	
Agavaceae	-20133	AGAAMEPI	*	*Agave americana* var. *picta*	Century Plant	N	Y		Y	Y			Y		spread slowly via rhizomes	L	L	S	L	
Agavaceae	18379	AGASIS	*	*Agave sisalana*	Sisal	Y	Y		Y	Y			Y		eradicated from Rottnest	L	L		L	
Agavaceae	18378	FURFOE	*	*Furcraea foetida*	Cuba Hemp	Y	Y		Y	Y			Y		spread slowly via rhizomes	L	L		L	
Agavaceae	18406	FURSEL	*	*Furcraea selloa*	Furcraea	Y	Y		Y	Y			Y		spread slowly via rhizomes	L	L		L	
Agavaceae	16992	YUCALO	*	*Yucca aloifolia*	Yucca	Y	Y	Y	Y				Y		spread slowly via rhizomes	L	L		L	Used in horticulture
Agavaceae	-20269	YUCFIL	*	*Yucca filamentosa*	Yucca	N	Y	Y	Y				Y		spread slowly by rhizomes	L	L		L	Used in horticulture
Aizoaceae	2794	CARAEQ	*	*Carpobrotus aequilaterus*	Angular Pigface	Y	Y	Y	Y	Y			Y	Y	hybridizes with native species	U	U		U	
Aizoaceae	2795	CAREDU	*	*Carpobrotus edulis*	Hottentot Fig	Y	Y		Y	Y			Y	Y	gap filler, widespread in coastal/near coastal sites	H	H	R	H	
Aizoaceae	-20311	CARXEV	*	*Carpobrotus edulis x Sarcozona* sp. (GK 13949)	Pigface	N	Y		Y				Y			L	L		L	
Aizoaceae	-20324	CAREDUXV	*	*Carpobrotus edulis x virescens* (ST Blake 20982)	Pigface	N	Y		Y				Y			L	L		L	
Aizoaceae	2800	DROCAN	*	*Drosanthemum candens*	Redondo Creeper	Y	Y		Y				Y			L	L		L	
Aizoaceae	11571	GALPUBPUB	*	*Galenia pubescens* var. *pubescens*	Coastal Galenia	Y	Y	Y	Y				Y			L	L		L	
Aizoaceae	8359	LAMMUL	*	*Lampranthus multiradiatus*	Lampranthus	N	Y		Y				Y			L	L		L	
Aizoaceae	2813	MESCRY	*	*Mesembryanthemum crystallinum*	Ice Plant, Iceplant	Y	Y	Y	Y	Y			Y		serious weed of offshore islands	H	H		H	
Aizoaceae	-20366	PSITEN	*	*Psilocaulon tenue*	Wiry Noonflower		Y		Y				Y			L	L		L	
Aizoaceae	2820	TETDEC	*	*Tetragonia decumbens*	Sea Spinach	Y	Y	Y		Y			Y		dominant on beaches throughout region	H	H	R	H	
Aizoaceae	13551	TETNIG	*	*Tetragonia nigrescens*	Black-fruited Sea Spinach	Y	Y		Y				Y			L	L		L	
Alismataceae	154	ALILAN	*	*Alisma lanceolatum*	Water Plantain	Y	Y		Y	Y	Y				major aquatic weed of Harvey River	U	H		FAR	

Appendix 3: The most significant environmental weeds Keighery (2005) for the two IBRA Bioregions, Swan Coastal Plain and Jarrah Forest, that occur in the Swan NRM Region.

Location IBRA Region/Ecosystem	Actual	Potential
Swan Coastal Plain **Terrestrial weed species**	*1. Ehrharta calycina* *2. Zantedeschia aethiopica* *3. Asparagus asparagoides* *4. Ehrharta calycina* *5. Freesia hybrid* *6. Euphorbia terracina* *7. Bromus diandrus* *8. Moraea flaccida* *9. Gladiolus caryophyllaceus* *10. Avena spp*	*1. Cenchrus ciliaris* *2. Lachenalia reflexa* *3. Lycium ferocissimum* *4. Hyparrhenia hirta* *5. Ferraria crispa* *6. Retama raetam* *7. Cynosurus echinatus* *8. Cyanella hyacinthoides* *9. Babiana disticha* *10. Rhamnus alaternus*
Swan Coastal Plain **Aquatic/Wetland weed species**	*1. Juncus acutus* *2. Carex divisa* *3. Isolepis hystrix* *4. Sparaxis bulbifera* *5. Cynodon dactylon* *6. Typha orientalis* *7. Stenotaphrum secundatum/Pennisetum clandestinum* *8. Schinus terebinthifolia* *9. Cotula bipinnata* *10. Bacopa monnieri*	*1. Bacopa caroliniana* *2. Salvinia molesta* *3. Ludwigia peruviana* *4. Colocasia esculentum* *5. Equisetum arvensis* *6. Hydrocotyle ranunculoides* *7. Sagittaria platyphylla* *8. Lagerosiphon major* *9. Ludwigia longifolia* *10. Bacopa caroliniana*
Jarrah Forest **Terrestrial weed species**	*1. Watsonia spp* *2. Zantedeschia aethiopica* *3. Asparagus asparagoides* *4. Acacia spp (decurrens,/longifolia/dealbata, pycnantha)* *5. Freesia hybrid* *6. Euphorbia terracina* *7. Rubus spp* *8. Carduus pycnocephalus* *9. Gladiolus undulatus (or spp)* *10. Avena spp*	*1. Polygala myrtifolia* *2. Pittosporum undulatum* *3. Asparagus scandens* *4. Hyparrhenia hirta* *5. Ferraria crispa* *6. Genista spp* *7. Tribolium uniolae* *8. Leptospermum laevigatum* *9. Chrysanthemoides monilifera spp. monilifera* *10. Olea europaea*
Jarrah Forest **Aquatic/Wetland weed species**	*1. Juncus acutus* *2. Carex divisa* *3. Isolepis hystrix* *4. Sparaxis bulbifera* *5. Psoralea pinnata* *6. Typha orientalis* *7. Hesperantha falcata* *8. Schinus terebinthifolia* *9. Crassula natans* *10. Cortaderia selloana*	*1. Bacopa caroliniana* *2. Salvinia molesta* *3. Ludwigia peruviana* *4. Alternanthera philoxeroides* *5. Colocasia esculenta* *6. Hydrocotyle ranunculoides* *7. Sagittaria platyphylla* *8. Lagerosiphon major* *9. Ludwigia longifolia* *10. Myriophyllum aquaticum*