



REGIONAL WEED MANAGEMENT PLAN

1.1 PLAN TITLE: Willow Management Plan for the Sydney Region

1.2 PLAN PROPONENTS

Regional Weeds Advisory Committee: Sydney West Blue Mountains, South West Sydney, Sydney North and Sydney Central Weeds Committees

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1.3 NAME OF PLANT(S)

WONS YES

Botanical name(s):

Salix cinerea

Salix nigra

Salix fragilis

Common name(s):

Grey Sallow, Pussy Willow

Black Willow

Crack Willow

1.4 PLAN PERIOD (not to exceed five years)

Starting date: July 1 2008

Completion date: June 30 2013

1.5 AREA OF OPERATION:

This plan extends over the Local Control Authorities (LCA's) represented on the Sydney Central, South West Sydney, Sydney North and Sydney West – Blue Mountains Regional Weeds Committees.

1.6 AIM:

To reduce the impact of Black Willow, Crack Willow and Pussy Willow on terrestrial and aquatic ecosystems within the Sydney region.

1.7 OBJECTIVES:

1. To continue to identify high, medium and low priority areas of works, based on characteristics such as; willow type and method of spread, biodiversity values, location in catchment.
2. To reduce infestations of *Salix cinerea*, *S.nigra*, and *S fragilis* in high priority areas by 75% by 2013.
3. To contain infestations of *Salix cinerea*, *S.nigra*, and *S fragilis* in medium and low priority areas by 2013.
4. To ensure best practise follow up rehabilitation works are carried out on all willow control sites.
5. To target enforcement activities in high priority areas, and areas adjacent to where works on *Salix cinerea*, *S.nigra*, and *S fragilis* will be carried out.

6. To increase awareness of the impacts, identification and control methods of *Salix cinerea*, *S.nigra*, and *S fragilis*.

7. To ensure a continued strategic focus to control *Salix cinerea*, *S.nigra*, and *S fragilis*, through continued; surveys, monitoring, research and evaluation.

2.0 STAKEHOLDERS

*LCA's of the Sydney Weeds Committees, *Blue Mountains Local Weeds Committee, *Department of Environment and Climate Change (DECC), Hawkesbury Nepean Catchment Management Authority (HNCMA), Sydney Metropolitan Catchment Management Authority (SMCMA), *Department of Lands (DOL), *Department of Housing (DOH), *Mt Annan Botanic Gardens, *Sydney Water Corporation (SWC), *RailCorp, Dept of Primary Industry (DPI), *Roads and Traffic Authority (RTA), *Sydney Catchment Authority (SCA) *Department of Defence (DOD).

* Key land managers who are critical to the success of this Plan

3.0 BACKGROUND and JUSTIFICATION

With the potential to invade and monopolise numerous habitats, Willows have been identified as a high priority weed for the Sydney Region ^(1 & 2). A Weed of National Significance, the impact of Willows on the environment can be devastating, through their ability to;

- Spread their roots into the bed of a watercourse, slowing the flow of water and reducing aeration.
- Form thickets which divert water outside the main watercourse or channel, causing flooding and erosion where the creek banks are vulnerable.
- Create a flush of organic matter when they drop their leaves in autumn, reducing water quality and available oxygen, and directly threatening aquatic plants and animals. This, together with the amount of water willows use, damages stream health ⁽³⁾.

Across the Sydney region, Willows are found growing in a variety of ecosystems, including;

- Tidally fluctuating brackish waters of the Hawkesbury and Parramatta Rivers (*S. fragilis*);
- Riparian habitats along the Nepean, Grose, MacDonal, Colo and Parramatta Rivers (*S. nigra*); and,
- Cool temperate creeks, wetlands, and hanging swamps on all catchments flowing into the Grose and Jamison Valleys in the World Heritage Listed Greater Blue Mountains National Park (*S. cinerea*).

Since its introduction into Australia in 1962, **Black Willow**, *S.nigra* has spread aggressively along Sydney rivers and streams. Viable seed is spread by wind for more than 50km, branches break off readily and take root, and germination and growth is rapid on bare wet sites. Some 50km of the Colo, 26km of the Hawkesbury-Nepean, 26km of the Grose, 42km of Cattai, large sections of the Wingecarribee and Wollondilly Rivers, and numerous small tributaries in the lower Blue Mountains are heavily infested by *Salix nigra*.

Pussy Willow, *Salix cinerea* has invaded both disturbed and undisturbed situations on all major drainage lines of the upper Grose and Jamison Valleys of the Blue Mountains. It is so aggressive that it has even become a common weed of roadside drains. These populations are almost certain to spread into the World Heritage Listed Greater Blue Mountains National Park, and have the potential to dominate most of the riparian and wet environments.

Crack Willow, *Salix fragilis* is a major weed in riparian habitats on the lower reaches of the Hawkesbury River and other parts of the Blue Mountains / Sydney West region. At this stage Crack Willow it is only spreading downstream, unlike the seeding willows *S. cinerea* and *S. nigra*, which are expanding their range upslope and upwind. Increasing urbanisation and associated higher stormwater runoff, peak flows, flash flooding, and silt loads in the region are providing ideal conditions for further spread of *S. fragilis* beyond its current range.

A considerable amount of works to control Willows has already been carried out across the region. This plan aims to continue to control remaining willows and carry out follow up works in previously worked areas. Follow up works and works to rehabilitate previously infected river and stream banks is recognised as being critical to achieving the aim of the plan.

3.3 Distribution of Infestations

Considerable distribution mapping for Willows has been carried out by the Sydney Weeds Committees during 2007. Please refer to the map on the following page.

The Sydney West Blue Mountains Weeds Committee established priority areas of works based on variables, such as; impact on willow type and method of spread, biodiversity values, location in catchment. These SWBM priority areas of works are displayed in the map also.

The mapping identified key players, whom significant involvement is required to close gaps in the on-ground component of the project, including Penrith Lakes, Crown Lands & DECC.

Put Map Here

3.4 Weed Biology

The following information has taken been from the WONS Weed Management Guide for Willows ⁽³⁾ and the WONS Willows Strategic Plan ⁽⁴⁾.

Weed	Characteristics
Black Willow (<i>Salix nigra</i>)	<ul style="list-style-type: none">- Distinguished by deeply fissured bark and equal colouring on both sides of leaf.- Grows up to 20m tall Crown conical when young, broad when old in isolation- Usually with a single prominent stem- Spreads aggressively from seed and rooted branches
Pussy Willow (<i>Salix cinerea</i>)	<ul style="list-style-type: none">- Most seriously invasive willow in Australia.- Large and spreading shrub or small tree with twigs or branches that are hard to break- Is highly invasive in swamps, drainage lines and other moist sites including lowland and mountain streams.- Forms hybrids with other shrub willows.- Both sexes are present.- Reproduction is almost exclusively by seed that is capable of very wide dispersal.
Crack Willow (<i>Salix fragilis</i>)	<ul style="list-style-type: none">- Single- or multi-stemmed tree- Most widespread and abundant willow in Australia- Spreads almost exclusively by plant parts so it is only associated with streams.- Fragile branches, break easily and spread aggressively downstream along rivers.- It is not known to produce viable seed at this stage.

For more information, see the following,

WONS Willow Identification Resources Sheets,

http://www.weeds.org.au/WoNS/willows/docs/Willow_identification-Resource_Sheet2.pdf

The National Willows Best Practice Manual,

<http://www.weeds.org.au/WoNS/willows/>

WONS Weed management Guide,

http://www.weeds.crc.org.au/documents/wmg_willow.pdf

4.0 LEGISLATIVE and REGULATORY SITUATION

4.1 Current Declaration

No declaration changes are required as part of this plan.

All three willows are declared as Class 5 weeds across the region, however, *S. nigra* and *S. cinerea* are listed as Class 3 weeds in the Blue Mountains local government area.

For current information on noxious weed declarations please see,

<http://www.dpi.nsw.gov.au/agriculture/farm/pest-weeds-management/weeds/noxweed>

5.0 CONSIDERATIONS and OPPORTUNITIES

5.1 Financial support to carry out the plan

To assist in the implementation of this plan, funding will be sought from various state and federal government agencies for on-ground works and to develop education and awareness raising programs.

5.2 Species Management

The following information has taken been from the WONS Weed Management Guide for Willows, see

http://www.weeds.crc.org.au/documents/wmg_willow.pdf

Control technique	
Chemical	<ul style="list-style-type: none"> - Herbicides available for woody weeds are effective in controlling willow. - Trees can be killed by stem injection, application to leaves and stems, bark (chemical girdling) and cut and paint methods - In dry conditions herbicide can also be applied by basal bark spraying and treatment of seedlings. - Stem injection is an important option for avoiding chemical runoff and protecting native vegetation. - In general, herbicide should be applied from summer to early autumn, although stem injection or cut and paint application is effective year round. - Trees should be left undisturbed for at least 12 months after herbicide application to ensure a successful kill. - The cut-stump method should only be used to kill willows that can be easily and safely disposed of (i.e. smaller specimens). - All material should be removed to prevent regeneration from pieces. The cut surface of the removed stem should also be painted with herbicide for safe disposal. - Minimal transport of branches and stems will help avoid broken fragments being spread. - Willow wood chips can take root and grow so trees for chipping should be killed prior to removal. - New infestations can occur when trees are cut and moved away from waterways with heavy equipment. Small pieces of branch embedded in the attached soil may take root or enter the water to float away to new sites. - Foliar spraying should only be used to kill willows less than 2 m tall before the start of leaf fall and where herbicides will not affect native plants or make contact with water bodies
Mechanical	<ul style="list-style-type: none"> - Elimination of young seedlings is a cost effective way of keeping waterways free of potential blockages, erosion and streambed change. - Hand pulling of seedlings less than 0.5 m tall is the most practical and environmentally safe way of removing young plants. - Leaving small roots in the ground does not lead to suckering or regrowth. - Using large machinery such as excavators or bulldozers to remove larger trees and root systems is not recommended except in dry areas. - In wet areas bulldozers push broken branches into the ground and thus generate numerous new plants.
Disposal	<ul style="list-style-type: none"> - Trees killed while they are standing (ie by stem injection) should be left for 12months before they are removed. - They can then be cut at a suitable height and stacked away from watercourses. If it is necessary to remove live trunks and limbs from the site, stack them to dry above flood level, taking care to minimise the spread of small pieces. - Smaller twigs should be bagged and disposed of at tip facilities so that they do not sprout and cause further problems
Follow up	<ul style="list-style-type: none"> - Regrowth from stumps, pieces of stems or seeds will need to be followed up with monitoring and further control for 3–5 years after the initial effort. - Check that treated trees have died, and remove trees that could cause problems if they become snared elsewhere by floods. Look for the spread of any new willows and follow up with substantial re-assessments at least every five years.

*Please refer to the NSW DPI *Noxious and Environmental Weed Control Handbook* for lists of the current chemicals registered for use for Willows.

<http://www.dpi.nsw.gov.au/data/assets/>

Control of all Willows will be undertaken in accordance with the *NSW Noxious Weeds Act 1993*, *Noxious Weed Act 1993*, *Protection of the Environment Operations Act (1997)*, and the *Pesticides Act (1999)*.

5.3 Links to other Strategies

This plan is a direct outcome of both the ***Draft Hawkesbury Nepean and Sydney Metropolitan Weeds Strategies***, the strategies which guide the actions of the Sydney Weeds Committees. The goals and objectives of both of these strategies are consistent with the goals and objectives outlined in the ***Australian Weeds Strategy***.

The plan meets several 'Desired Outcomes' of the **NSW Weeds Strategy**:

- The development and implementation of programs to reduce environmental degradation and the loss of biodiversity through weed invasions;
- The implementation and monitoring of weed control programs on public and State-owned and Crown Land to ensure that objectives are achieved in an efficient and cost effective manner;
- An effective and efficient system for delivery of noxious weeds control and the enforcement of weeds legislation.

The plan also contributes to the Natural Resource Commissions (NRC) Statewide target; 'By 2015 there is a reduction in the impact of invasive species'.

5.4 Extension and Education

The main focus of continuing education and extension activities will be to increase the skills of relevant council and public authority staff, bushcare volunteers and private landholders in the identification and control of Willows. This will be carried out by:

- Training of staff and volunteers in each organisation.
- Media articles in local newspapers.
- Production of educational material to be sent to private landholders.

5.5 Barriers and Contingencies

The following barriers were identified in meeting the objectives of this plan, these have been considered and contingencies have been incorporated into the action plan.

1. Ease of spread of the weed and reinfestation (Action 6.6 – 6.11)
2. High cost of mechanical removal (6.2, 6.10)
3. Reluctance of landholders to control willows (6.12 – 6.14)
4. Disinterest of private landholders, hobby farmers and absent rural landholders (6.12 - 6.14)
5. Lack of awareness and skills in willow identification and control (6.13)

6.0 ACTION PLAN

ACTION PLAN FOR CONTROL	PERFORMANCE INDICATOR	WHO	ADDRESSES WHICH OBJECTIVES (Number)
Surveying, Monitoring and evaluation			
6.1 Continue to carry out surveys and mapping to record the distribution of Willows,.	Distribution mapping carried out by 2008 and updated annually.	Sydney Weeds Committees	1
6.2 Continue to determine high, medium and low priority areas of works, based on characteristics such as; willow type and method of spread, biodiversity values, location in catchment.	Priority areas of works determined for the region by 2009	Sydney Weeds Committees	1
6.3 Continue to determine adequate containment lines to prevent further spread.	Containment lines identified by 2009	Sydney Weeds Committees	1
6.4 Record areas of works at a regional level in geographical information system.	GIS is used to store information on locations of regional works being carried out on an annual basis.	Sydney Weeds Committees	7
6.5 Review Willows plan to incorporate new information and data.	Willows Plan reviewed and any new information incorporated by 2011.	Sydney Weeds Committees	7
On-ground works			
6.6 Carry out control works using current best practise techniques, to reduce Willows in <u>high</u> priority areas on public land.	Works in high priority areas on public land begin by 2008.	Sydney-wide LCA's, state agencies Sydney Weeds Committees, bushcare.	2
6.7 Carry out works using current best practise techniques, to contain Willows in <u>medium</u> and <u>low</u> priority areas on public land.	Containment works in med and low priority areas on public land begin by 2010	Sydney-wide LCA's, state agencies Sydney Weeds Committees, bushcare	3

6.8 Engage agencies such as Penrith Lakes, Crown Lands & DECC to carry out on-ground works in priority areas.	Penrith Lakes, Crown Lands & DECC carry out works in locations identified as gaps in the project.	Sydney Weeds Committees	2
6.9 Carry out works to contain Willows, to broadscale containment lines.	Works to contain Willows within containment lines begin by 2010 Willows are contained at Windsor bridge in the Hawkesbury region.	Sydney-wide LCA's, state agencies.	3
6.10 Carry out research, participate in trials and disseminate information which establishes improved Willow control techniques.	Information on best practice techniques distributed.	Sydney Weeds Committees, DPI	7
6.11 Carry out best practise follow up rehabilitation works at all willow control sites.	Follow up works are carried out on all willow control sites. Information on best practice rehabilitation techniques is distributed.	Sydney Weeds Committees, DPI	4
Enforcement			
6.12 Target enforcement activities in high priority areas or in areas adjacent to where works are being carried out.	Private property inspections carried in high priority areas. Private property inspections carried out in areas adjacent to where works are being carried out.	Sydney-wide LCA's, private landholders	5
Education			
6.13 Provide information in Willow identification and appropriate control to the community, local industry and LCA staff.	Willow education programs targeting private land holders are implemented. Willow educational material is distributed to	Sydney-wide LCA's, DECC, DPI, Sydney Weeds Committees	6

	<p>private landholders. Information on Willow identification and management is distributed to agency staff, especially regulatory officers, health and building / development control officers and parks staff.</p> <p>Willows material included in weed displays in conjunction with local festivals, tree giveaways, etc.</p> <p>Articles in Mayoral columns.</p> <p>Willows included in regional weed brochures, WEEDeck and the committees' website.</p>		
<p>6.14 Implement incentives programs to encourage proactive private property control of Willows.</p>	<p>LCA's, DECC and CMAs are encouraged to implement incentives programs.</p> <p>Incentives programs implemented to control Willows on private land.</p>	<p>SWS & SC LCA's, CMAs, DECC, SWS & SC Weeds Committees, private landholders.</p>	<p>6</p>

7.0 MONITOR and REVIEW PROCESS

This plan is designed to be monitored and reviewed on an ongoing basis. Mapping has been incorporated into the plan to both continue to determine the extent of Willow infestations and to record areas of works by members of the Sydney Weeds Committees; this will be updated on an annual basis.

Council and agency staff will also carry out monitoring on the ground via their regular field inspections and progress meetings with contractors.

Please refer to surveying, monitoring and evaluation section in action plan.

8.0 BENEFITS

Controlling Willows will have a positive effect on aquatic and terrestrial ecosystems in the region, with potential benefits of;

- Enhanced biodiversity
- Reduced impact on water quality and stream hydrology
- Increased community awareness

9.0 RESOURCES

1. Sydney Metro CMA, 2006: Sydney Metropolitan CMA Regional Weeds Strategy.
2. Hawkesbury Nepean CMA, 2006: Hawkesbury Nepean CMA Regional Weeds Strategy.
3. CRC for Australian Weed Management, (2007): WONS Weed Management Guide for Willows.
4. Agriculture & Resource Management Council of Australia & New Zealand, Australian & New Zealand Environment & Conservation Council and Forestry Ministers, (2000): Weeds of National Significance Willow (*Salix* taxa, excluding *S. babylonica*, *S. x calodendron* and *S. x reichardtii*) Strategic Plan. National Weeds Strategy Executive Committee, Launceston
5. National Willows Taskforce (2006): Willow Identification, An essential skill for successful willow management.