Annual Plant Assessment

Port of Brisbane

Prepared by:

RPS AUSTRALIA EAST PTY LTD

743 Ann Street
PO Box 1559
Fortitude Valley, QLD, 4006

T: +61 7 3237 8899
F: +61 7 3237 8833
E: liz.fisher@rpsgroup.com.au

Client Manager: Liz Fisher
Report Number: PR117445-1
Version / Date: Rev 0 / July 2013

Prepared for:

PORT OF BRISBANE PTY LTD

3 Port Central Avenue
Locked Bag 1818
Port of Brisbane, QLD, 4178

T: +61 7 3258 4935
F: +61 7 3258 4703
E: rachael.attard@portbris.com.au
W: portbris.com.au

IMPORTANT NOTE

Apart from fair dealing for the purposes of private study, research, criticism, or review as permitted under the Copyright Act, no part of this report, its attachments or appendices may be reproduced by any process without the written consent of RPS Australia East Pty Ltd. All enquiries should be directed to RPS Australia East Pty Ltd.

We have prepared this report for the sole purposes of Port of Brisbane Pty Ltd ("**Client**") for the specific purpose of only for which it is supplied ("**Purpose**"). This report is strictly limited to the purpose and the facts and matters stated in it and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

This report is presented without the assumption of a duty of care to any other person (other than the Client) ("**Third Party**"). The report may not contain sufficient information for the purposes of a Third Party or for other uses. Without the prior written consent of RPS Australia East Pty Ltd:

(a) This report may not be relied on by a Third Party; and

(b) RPS Australia East Pty Ltd will not be liable to a Third Party for any loss, damage, liability or claim arising out of or incidental to a Third Party publishing, using or relying on the facts, content, opinions or subject matter contained in this report.

If a Third Party uses or relies on the facts, content, opinions or subject matter contained in this report with or without the consent of RPS Australia East Pty Ltd, RPS Australia East Pty Ltd disclaims all risk and the Third Party assumes all risk and releases and indemnifies and agrees to keep indemnified RPS Australia East Pty Ltd from any loss, damage, claim or liability arising directly or indirectly from the use of or reliance on this report.

In this note, a reference to loss and damage includes past and prospective economic loss, loss of profits, damage to property, injury to any person (including death) costs and expenses incurred in taking measures to prevent, mitigate or rectify any harm, loss of opportunity, legal costs, compensation, interest and any other direct, indirect, consequential or financial or other loss.

Document Status

Version	Purpose of Document	Orig	Review	Review Date
A	Draft for Review	NF	LF	08/07/2013
B	Draft for Review	CO	LF	19/07/2013
0	Final for Submission	LF	LF	19/07/2013

Approval for Issue

Name	Signature	Date
Liz Fisher		19/07/2013

Contents

Tables

Figures

Appendices

Summary

RPS has been commissioned by the Port of Brisbane Pty Ltd (PBPL) to participate in an annual weed monitoring program at the Port of Brisbane. The program's aim is to undertake a survey of weeds along Lucinda, Port West and Port Gate Drains, T1-3 Overflow and the Car Precinct areas at the Port. The monitoring program will specifically target weed species listed by the Australian Quarantine and Inspection Service (AQIS), the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) and Brisbane City Council (BCC). In addition to this, the survey also monitors the occurrence and abundance of species considered to be exotic, including locally occurring weeds.

The weed monitoring program is currently conducted annually, during post-summer months (March / April / May). To date, a total of 23 plant surveys have been conducted along Lucinda Drain, 10 along Port Gate Drain and 12 along the T1-3 Overflow and Car Precinct areas; with Port West surveyed for the first time in 2013. This annual report provides the results of the 2013 monitoring program, as well as recommendations with respect to the ongoing management of weeds along Lucinda, Port Gate and Port West Drains, as well as the T1-3 Overflow and Car Precinct areas.

Summary of Findings

Lucinda Drain

Appendix 3 contains a list of flora species recorded at Lucinda Drain for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 91 plant species were recorded. This consisted of 37 native / planted species and 54 exotic species;
- Out of the 54 exotic species, none were AQIS-listed weed species;
- Broad-leaf Pepper (*Schinus terbinthifolia*) and Lantana (*Lantana camara*), both declared Class 3 pests under the LP Act were recorded in the previous May 2012 survey and again during the recent May 2013 survey;
- Prickly Pear (*Opuntia stricta*), a Class 2 declared pest under the LP Act was recorded in the previous 2012 survey and again recorded in the recent May 2013 survey;
- Chinese Elm (*Celtis sinensis*) and Groundsel Bush (*Baccharis halimifolia*), Class 3 and 2 declared weeds respectively were recorded in the last 2012 survey, but were not recorded in the recent 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

Port Gate Drain

Appendix 3 contains a list of flora species recorded at Port Gate Drain for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 43 plant species were recorded. This consisted of 17 native / planted species and 26 exotic species;
- Out of the 26 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper and Lantana, both declared Class 3 pests under the LP Act were recorded in the previous May 2012 survey and again during the recent May 2013 survey;
- Camphor Laurel (*Cinnamomum camphora*), a Class 3 declared weed under the LP Act was not recorded in the previous May 2012 survey, but was recorded in the recent 2013 survey along the drain;

- Groundsel Bush, a Class 2 declared pest under the LP Act was recorded in the previous May 2012 survey and again during the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

T1-3 Overflow Area

Appendix 3 contains a list of flora species recorded at the T1-3 Overflow Area for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 47 plant species were recorded. This consisted of 10 native / planted species and 37 exotic species;
- Out of the 37 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper a declared Class 3 pest under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;
- Fireweed (*Senecio madagascariensis)* a declared Class 2 pest under the LP Act was recorded in the previous 2012 survey and again recorded the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

Car Precinct Area

Appendix 3 contains a list of flora species recorded at the Car Precinct Area for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 72 plant species were recorded. This consisted of 19 native / planted species and 53 exotic species;
- Out of the 53 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper a declared Class 3 pest under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;
- Groundsel Bush, a declared Class 2 pests under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;
- Fireweed, a Class 2 declared weed under the LP Act that was last recorded in the area in 2011 was recorded in the recent May 2013 survey;
- Giant Parramatta Grass (*Sporobolus fertilis*), which is a Class 2 declared weed under the LP Act was recorded in the previous 2012 survey, but was not recorded in the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

Port West

Appendix 3 contains a list of flora species recorded at Port West Drain for the 2013 survey. The following points summarise the findings of the recent May 2013 survey:

- 43 plant species were recorded. This consisted of 12 native / planted species and 31 exotic species;
- Out of the 31 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper and Lantana, all declared Class 3 weeds under the LP Act, were recorded during the recent May 2013 survey; and
- Groundsel Bush, a Class 2 declared pest under the LP Act was recorded during the recent May 2013 survey.

Summary of Recommendations

Recommendations regarding the short and long-term management of exotic species within the Lucinda, Port West and Port Gate Drains, T1-3 Overflow and Car Precinct areas are provided. Overall, all maintenance activities are to continue as scheduled and should be extended to include exotic species removal, particularly those declared under the LP Act. Some of the declared species are located on banks, so the method of removal should be sensitive to bank stability (e.g. stem injection or cut and paint).

As previously recommended, all areas within the Lucinda, Port West and Port Gate Drains, T1-3 Overflow and Car Precinct areas should be maintained regularly. It is also recommended that more integrated and long-term management of the weed species within the survey area is implemented through continuing to increase the native plant cover.

1.0 Introduction

1.1 Background

RPS has been commissioned by the Port of Brisbane Pty Ltd (PBPL) to undertake an annual weed monitoring program along Lucinda Drain, Port Gate Drain, Port West Drain, T1-3 Overflow and Car Precinct Areas at the Port of Brisbane. Lucinda Drain and Port Gate Drain are located on land formally described as Lot 99 on SP238079 and Lot 732 on SP142208, respectively. The T1-3 Overflow and Car Precinct areas are located on land formally described as Lot 99 on SP238079. Port West Drain is located on land formally described as Lot 713 on SP110608 and Lot 716 on SP110610. The survey areas are located within the Wynnum-Manly Ward of Brisbane City Council (BCC).

RPS has been involved in the biannual weed monitoring program since 2001. In 2001, weed surveys were initially conducted biannually along Lucinda Drain, with surveys along Port Gate Drain only commencing in 2007. In response to a potential weed incursion threat from imported vehicles, the areas known as the Car Precinct and T1-3 Overflow Area were added to the monitoring program in 2008 and surveyed quarterly for the first year.

Following a review by PBPL and in consultation with Australian Quarantine and Inspection Service (AQIS), a number of changes were made to the monitoring program in 2011. The surveys are still undertaken at the four previous locations however, the frequency has been reduced to one survey per year. This survey is undertaken in the post summer months (March - May). AQIS have recommended one target weed list to be used for all survey areas and reporting will involve the preparation of one document. In addition, in 2013 Port West has been added to the survey due to the identification of pest species by stakeholders.

To document the weed surveys, RPS has produced detailed weed reports since 2001. Initially, these were presented as two separate documents – one for Lucinda and Port Gate Drains and another for the Car Precinct and T1-3 Overflow Area. However, as requested by PBPL all current documentation is produced as a single report. This report is the 23rd report that has been prepared for Lucinda Drain, the tenth report for the Port Gate Drain, the seventh report for the T1-3 Overflow and Car Precinct areas and the first report for the Port West Drain.

1.2 Scope of Works

The primary objective of this weed survey is to contribute to a long-term, annual monitoring program at the Port of Brisbane. AQIS listed weed species will be specifically targeted because of their potential to enter the country via containers and other materials shipped and unloaded at the Port of Brisbane. Additionally, the program will monitor other species considered to be exotic or invasive, particularly species declared under the *Land Protection (Pest and Stock Route Management*) *Act 2002* (LP Act), those species listed by Brisbane City Council (BCC), and locally occurring weed species (hereafter referred to as exotic species or invasive natives).

In particular, the scope of work for this weed monitoring program includes:

- Identify species declared or listed by AQIS, LP Act or BCC;
- Monitor the occurrence and abundance of exotic invasive species;
- Assess the extent of exotic invasive species;
- Report the findings of the current survey;
- Undertake a comparative analysis of the 2012 and 2013 survey results where possible; and
- Provide recommendations for on-going weed management along the drains.

1.3 Site Description

The weed monitoring focuses on the Lucinda, Port Gate and Port West Drains, the T1-3 Overflow and Car Precinct areas at the Port of Brisbane. Lucinda Drain is located along the eastern side of the Port of Brisbane (Lot 99 on SP 238079) and provides drainage for stormwater run-off from the adjacent hardstand areas (**Figure 1.1**). This drain discharges through the Lucinda Weir, and experiences tidal influence from the Boat Passage.

Lucinda Drain is a constructed drainage channel comprising of a concrete filled geo-textile sandwich approximately 2.5 km in length. The berms of the channel consist of sand above the geo-textile sandwich. The western bank of the drain (adjacent to Lucinda drain) undergoes regular maintenance involving the spraying of noxious weeds. The eastern bank of the drain has an irregular maintenance program, but identified weeds are removed on an annual basis.

Port Gate Drain is located at Port Gate in the south-west section of the Port of Brisbane. The drain provides for stormwater run-off from the adjacent hardstand areas, and partially receives tidal waters from the Boat Passage (**Figure 1.2**). It is separated into two portions by Howard Smith Drive which prevents tidal flow from entering the part of the southern drain. Unlike Lucinda Drain, the top banks of Port Gate Drain (especially in the northern portion of the drain) consists of either concrete, gravel or compacted earth, which allows for only sparse vegetation growth. Thus, the majority of vegetation is located at the southern end of the drain.

The T1-3 Overflow and Car Precinct areas lie parallel to one another in the south-western portion of Lot 99 on SP238079 (**Figure 1.3**). The Queensland Rail freight line separates the two areas. The T1-3 Overflow area is situated along Port Drive and extends around a large hardstand car parking area. This area includes a constructed drain located in the very northern region (**Figure 1.3**).

The T1-3 Overflow area consists of landscaped gardens and lawn on its western side, and a sandy / gravel area on its eastern side. The primary purpose of the T1-3 Overflow is to absorb and filter excess stormwater that potentially flows from surrounding hardstand areas. The constructed drain in the northern section consists of a concrete channel, which is designed to pipe stormwater runoff that has entered nearby stormwater drains into the Brisbane River.

The Car Precinct area is directly west of a large vehicle storage area (**Figure 1.3**). It includes an area extending from the road overpass (situated at the northern end of the site) and incorporates the edge of the lake adjacent to the Visitors Centre.

The Car Precinct area is a constructed drainage channel that comprises a grass-lined trench, with a series of concreted chutes that channel stormwater runoff from the hardstand vehicle storage facility to the east of the drain. The trench provides drainage for excess water that may overflow from nearby areas, which is distributed either south through a stormwater outlet that flows into the lake, or north via a series of underground pipes and open drains into the Brisbane River.

Port West Drain is located off Lytton Road, approximately 2 km south of the Port (**Figure 1.4**). It consists of a narrow drain / watercourse flanked by mangroves. On the eastern side of the drain a narrow corridor (15 m) of mangroves and riparian vegetation remains between the drain and the construction activities occurring on the adjacent lot, Lot 719 on SP110610. While on the western side, the no riparian community occurs and the mangrove community extends substantially further (30-100m) buffering the drain from industrial buildings on the western side of the drain.

It is understood that Lucinda and Port Gate Drains, the T1-3 Overflow and Car Precinct areas currently undergo maintenance (including mowing and spraying for exotic species) which is facilitated by the PBPL. Re-construction works of the Port West drain have recently been undertaken, however there is no scheduled maintenance work for the Port West drain.

Client: Port of Brisbane Pty Ltd	**Lucinda Drain Survey Area**
Compiled by: CO — Date: 20/05/2013	**Figure 1.1** — Project: Port of Brisbane Annual Plant Assessment
Approved by: LF — Date: 20/05/2013	Source: Aerial Imagery: Google 2008

0 0.1 0.2 0.4 Kilometers

Datum: GDA94

RPS

Tracking number: PR117445-1 20/05/2013

Client: Port of Brisbane Pty Ltd	**Port Gate Drain Survey Area**
Compiled by: CO — Date: 20/05/2013	
Approved by: LF — Date: 20/05/2013	**Figure 1.2** — Project: Port of Brisbane Annual Plant Assessment

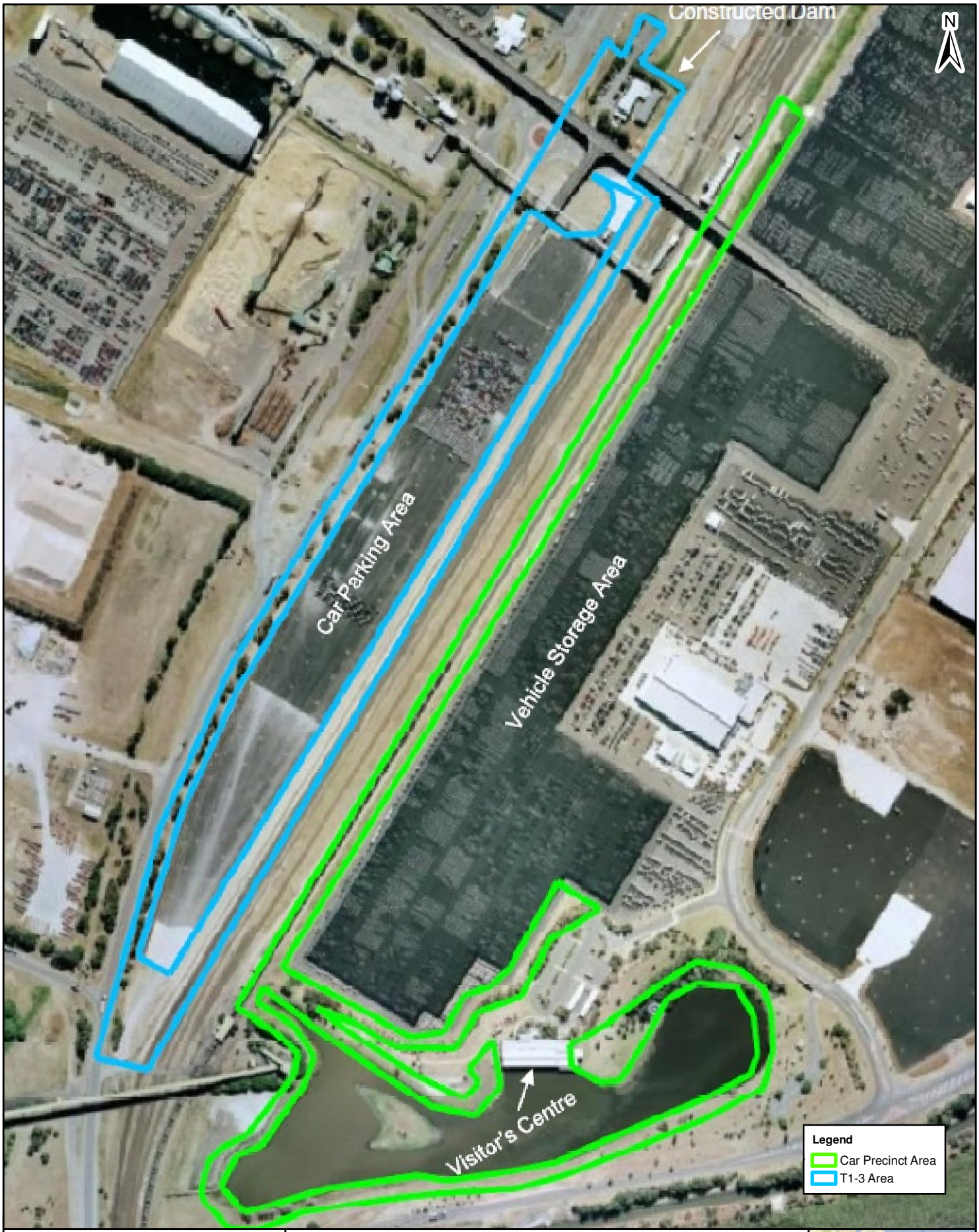
0 60 120 240 Meters

Datum: GDA94

RPS

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013



Client: Port of Brisbane Pty Ltd	**T1-3 and Car Precinct Survey Area**
Compiled by: CO — Date: 20/05/2013	**Figure 1.3** — Project: Port of Brisbane Annual Plant Assessment
Approved by: LF — Date: 20/05/2013	Source: Aerial Imagery: Google 2008

0 50 100 200 Meters

Datum: GDA94

RPS

Tracking number: PR117445-1 20/05/2013

Client: Port of Brisbane Pty Ltd

Compiled by:	CO	Date:	20/05/2013
Approved by:	LF	Date:	20/05/2013

0 45 90 180 Meters

Datum: GDA94

RPS

Port West Drain Survey Area

Figure 1.4

Project: Port of Brisbane Annual Plant Assessment

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013

2.0 Methodology

2.1 Weed Monitoring Schedule

The weed monitoring program is currently conducted on an annual basis for all four sites, during the post-summer months (March / April / May). The weed monitoring surveys were previously undertaken on a biannual basis during both the post-summer and post-winter (October / November) months (**Table 2.1**). Early monitoring for T1-3 Overflow and Car Precinct areas was undertaken on a quarterly basis, with a baseline study occurring in the month of February 2008 (**Table 2.1**).

RPS has conducted a total of 23 plant surveys along Lucinda Drain, ten along Port Gate Drain, and twelve along the T1-3 Overflow and Car Precinct areas (**Table 2.1**). Port West Drain was surveyed for the first time in 2013. The latest weed monitoring survey within the survey areas was conducted by two ecologists on the 7th May 2013 and the 8th May 2013.

Table 2.1: Monitoring Schedule of Survey Areas

Year	Season	Lucinda Drain	Port Gate Drain	T1-3 Overflow Area	Car Precinct Area	Port West
2001	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2002	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2003	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2004	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2005	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2006	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	-	-	-	-
2007	Post-Summer	✓	-	-	-	-
	Post-Winter	✓	✓	-	-	-
2008	Summer (February)	-	-	✓	✓	-
	Post-Summer	✓	✓	✓	✓	-
	Winter	-	-	✓	✓	-
	Post-Winter	✓	✓	✓	✓	-
2009	Summer (December)	-	-	✓	✓	-
	Post-Summer	✓	✓	✓	✓	-
2010	Post-Winter	✓	✓	✓	✓	-
	Post-Summer	✓	✓	✓	✓	-
2011	Post-Summer	✓	✓	✓	✓	-
2012	Post-Summer	✓	✓	✓	✓	-
2013	Post Summer	✓	✓	✓	✓	✓

2.2 Target Species

AQIS has identified potential 'weeds of interest' within the Port of Brisbane area, based on potential threats to both natural and agricultural systems (**Appendix 1)**. Exotic species declared under the LP Act and those species listed by BCC as environmental weeds were also targeted.

2.3 Plant Survey

The plant survey conducted along Lucinda, Port Gate and Port West Drains, T1-3 Overflow and Car Precinct areas consisted of survey transects, using the random meander methodology for sampling of all exotic and invasive species encountered. All surveys were conducted on-foot to ensure that extensive coverage of the areas was achieved.

The plant survey along the Lucinda Drain consisted of sampling exotic and invasive species encountered along a 2 m wide transect that traversed the entire length of the drain's eastern bank. A complete transect along the western bank of Lucinda Drain was not possible as a result of access issues caused by dense vegetation and narrow banks. However, a visual inspection of the western bank was performed intermittently, where access to the drain was possible.

A 2 m wide transect traversing the entire length of the western bank of the Port Gate Drain was established and surveyed successfully. A complete transect along the eastern bank of the Port Gate Drain was not possible as a result of access issues caused by dense vegetation and narrow banks. However, a visual inspection of the eastern bank was possible from the western bank of Port Gate Drain.

The plant survey along the T1-3 Overflow area consisted of a 2 m wide transect, running the entire length of the eastern, northern, western and southern boundaries of the hardstand area. Another transect was established along both banks of the constructed drain just north of the hardstand area.

The plant survey around the Car Precinct area consisted of two transects, which traversed the western and southern boundary of the vehicle storage area, and one non-linear transect that traversed the edge of the lake adjacent to the Visitors Centre.

The plant survey along Port West Drain consisted of sampling exotic and invasive species encountered along two 20 m wide transects, one on either side of the drain.

Weed identification was undertaken using available flora and botanical reference material. Samples of weed species unable to be identified in situ, or with the assistance of field guides, were pressed and sent to the Queensland Herbarium for identification. The presence/absence of any declared AQIS, LP Act, and BCC-listed weeds, and other exotic species that occurred along each transect was recorded (**Appendix 2**).

2.4 Survey Limitations

The detectability of plants and the ability to accurately identify plants to species level varies greatly with the time of year, prevailing climatic conditions and the presence of reproductive material (e.g. flowers, fruit, and seed capsules). Consequently, the survey conducted should not be regarded as conclusive evidence that certain AQIS, LP Act, or BCC declared / listed plants do not occur within the areas inspected. However, every effort has been made to detect these species in habitat and areas considered suitable.

3.0 Results

3.1 Lucinda Drain

Appendix 3 contains a list of flora species recorded at Lucinda Drain for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 91 plant species were recorded. This consisted of 37 native / planted species and 54 exotic species;
- Out of the 54 exotic species, none were AQIS-listed weed species;
- Broad-leaf Pepper (*Schinus terbinthifolia*) and Lantana (*Lantana camara*), both declared Class 3 pests under the LP Act were recorded in the previous May 2012 survey and again during the recent May 2013 survey;
- Prickly Pear (*Opuntia stricta*), a Class 2 declared pest under the LP Act was recorded in the previous 2012 survey and again recorded in the recent May 2013 survey;
- Chinese Elm (*Celtis sinensis*) and Groundsel Bush (*Baccharis halimifolia*), Class 3 and 2 declared weeds respectively were recorded in the last 2012 survey, but were not recorded in the recent 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

3.2 Port Gate Drain

Appendix 3 contains a list of flora species recorded at Port Gate Drain for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 43 plant species were recorded. This consisted of 17 native / planted species and 26 exotic species;
- Out of the 26 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper and Lantana, both declared Class 3 pests under the LP Act were recorded in the previous May 2012 survey and again during the recent May 2013 survey;
- Camphor Laurel (*Cinnamomum camphora*), a Class 3 declared weed under the LP Act was not recorded in the previous May 2012 survey, but was recorded in the recent 2013 survey along the drain;
- Groundsel Bush, a Class 2 declared pest under the LP Act was recorded in the previous May 2012 survey and again during the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

3.3 T1-3 Overflow Area

Appendix 3 contains a list of flora species recorded at the T1-3 Overflow Area for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 47 plant species were recorded. This consisted of 10 native / planted species and 37 exotic species;
- Out of the 37 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper a declared Class 3 pest under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;

- Fireweed (*Senecio madagascariensis)* a declared Class 2 pest under the LP Act was recorded in the previous 2012 survey and again recorded the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

3.4 Car Precinct Area

Appendix 3 contains a list of flora species recorded at the Car Precinct Area for both the 2012 and 2013 surveys. The following points summarise the findings of the recent May 2013 survey:

- 72 plant species were recorded. This consisted of 19 native / planted species and 53 exotic species;
- Out of the 53 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper a declared Class 3 pest under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;
- Groundsel Bush*,* a declared Class 2 pests under the LP Act was recorded in the previous 2012 survey and again during the recent May 2013 survey;
- Fireweed, a Class 2 declared weed under the LP Act that was last recorded in the area in 2011 was recorded in the recent May 2013 survey;
- Giant Parramatta Grass (*Sporobolus fertilis*), which is a Class 2 declared weed under the LP Act was recorded in the previous 2012 survey, but was not recorded in the recent May 2013 survey; and
- Exotic species diversity, abundance and coverage have increased in comparison to the survey results of May 2012.

3.5 Port West Drain

Appendix 3 contains a list of flora species recorded at Port West Drain for the 2013 survey. The following points summarise the findings of the recent May 2013 survey:

- 43 plant species were recorded. This consisted of 12 native / planted species and 31 exotic species;
- Out of the 31 exotic species, none were AQIS listed weeds;
- Broad-leaf Pepper and Lantana, all declared Class 3 weeds under the LP Act, were recorded during the recent May 2013 survey; and
- Groundsel Bush*,* a Class 2 declared pest under the LP Act was recorded during the recent May 2013 survey.

4.0 Discussion

4.1 Lucinda Drain

4.1.1 Weed Species Observed

The 23rd weed monitoring survey along Lucinda Drain has identified a total number of 91 flora species, of which 54 are considered exotic. No AQIS listed weed species (**Appendix 1**) were recorded during the May 2013 plant survey, however, three LP Act declared species were recorded (**Table 4.1**)

Table 4.1: Class and abundance of weed species (under LP Act) recorded during Lucinda Drain survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	*Opuntia stricta*	Prickly Pear	Low abundance along the eastern bank
3	*Lantana camara*	Lantana	Low abundance along the eastern bank
	Schinus terebinthifolia	Broad-leaf Pepper Tree	High abundance along the western bank

Note: LP Act declared plants must be managed according to their classification as follows:

- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix 4 and **Appendix 5** provides GPS co-ordinates and locations of the above-mentioned declared species along Lucinda Drain. There were seventeen individual occurrences of LP Act Class 3 Broad-leaf Pepper Tree and one occurrence of Lantana, and two occurrences of LP Act Class 2 Prickly Pear. The majority of Broad-leaf Pepper Trees observed were juveniles, which indicates that regeneration is occurring along the western bank and further treatment is required.

In comparison to the GPS co-ordinates recorded in the previous survey, the overall diversity of LP Act declared species has decreased by two species; however, the general abundance has increased. The decrease in weed diversity may be a result of successful weed management of particular species or general survey limitations (i.e. the species is present but not detected / false absence records). The increase in weed abundance may be a result of favourable weather conditions (as discussed in **Section 4.6)** and the lack of recent maintenance.

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. It is recommended that declared species are removed, including individuals that have been previously planted within this area (i.e. Broad-leaf Pepper Tree). It is noted that a number of declared species are located along the banks of the drain and therefore appropriate removal techniques must be employed to prevent bank instability (e.g. stem injection, lopping etc). Fact sheets for declared pests identified within the survey area are provided in **Appendix 6**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, were identified during the recent survey and are provided in **Table 4.2**. These species have been previously recorded along Lucinda Drain.

Table 4.2: BCC listed flora species recorded during the recent Lucinda Drain survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Ficus elastica	Rubber Tree	Environmental Weed	R
Lantana spp.	Lantana (all species)	Environmental Weed	C
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Ricinus communis	Castor Oil Plant	Noxious Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Senna pendula var. glabrata	Easter Cassia	Environmental Weed	R
Solanum nigrum	Blackberry Nightshade	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- C**lass E (early detection and eradication) –** Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C (containment and reduction) –** landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R (reduce population as part of routine maintenance) –** landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.1.2 Comparison between the Lucinda Drain Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of the diversity and abundance of all exotic plants recorded during the 2013 survey, compared to previous surveys, indicates that there is a variation between both the number and type of exotic species recorded.

Table 4.3 and **Figure 4.1** highlights the number of exotic species identified in the previous plant surveys of Lucinda Drain since the commencement of the monitoring program in February 2001.

Table 4.3: Number of Exotic Species recorded per survey along Lucinda Drain

Survey	Number of Exotic Species Recorded
February 2001 Biannual Plant Survey	37
October 2001 Biannual Plant Survey	35
February 2002 Biannual Plant Survey	27
November 2002 Biannual Plant Survey	35
May 2003 Biannual Plant Survey	27
November 2003 Biannual Plant Survey	36
March 2004 Biannual Plant Survey	27
October 2004 Biannual Plant Survey	29
April 2005 Biannual Plant Survey	33
November 2005 Biannual Plant Survey	37
March 2006 Biannual Plant Survey	35
October 2006 Biannual Plant Survey	41
March 2007 Biannual Plant Survey	24
November 2007 Biannual Plant Survey	33
March 2008 Biannual Plant Survey	46
November 2008 Biannual Plant Survey	45
March 2009 Biannual Plant Survey	40
November 2009 Biannual Plant Survey	43
March 2010 Biannual Plant Survey	55
November 2010 Biannual Plant Survey	54
April 2011 Annual Plant Survey	58
May 2012 Annual Plant Survey	44
May 2013 Annual Plant Survey	**54**

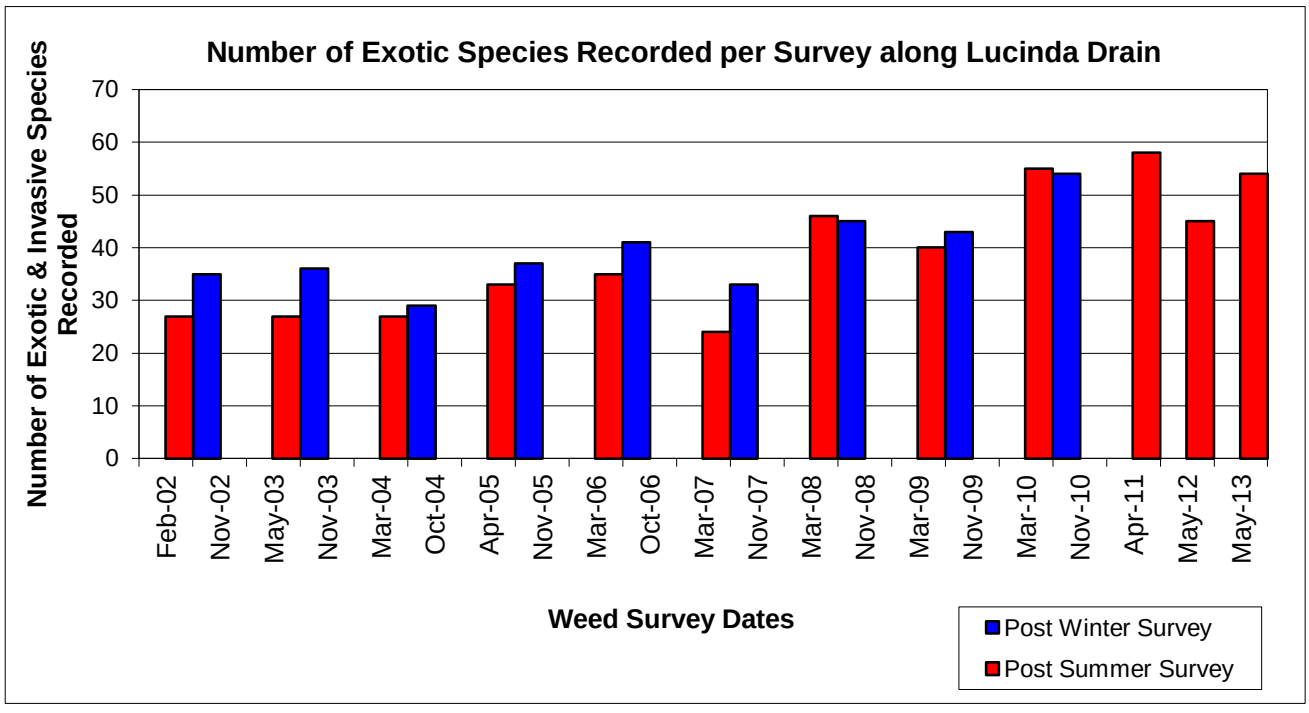


Figure 4.1: Number of exotic species recorded per survey along Lucinda Drain

Table 4.4 outlines the number of exotic species within each family that were recorded this year, as well as previous surveys.

Table 4.4: Number of exotic species by family in Lucinda Drain

Family	Number of Exotic Species Present								
	Annual Survey			Biannual Survey					
	May 2013	May 2012	April 2011	November 2010	March 2010	November 2009	March 2009	November 2008	March 2008
AGAVACEAE	0	1	0	1	0	0	0	1	1
AMARANTHACEAE	0	0	2	1	1	0	1	1	2
ANACARDIACEAE	1	1	1	1	1	1	1	1	1
ASCLEPIADACEAE	0	0	1	0	0	0	0	0	0
ASPARAGACEAE	0	0	0	0	0	0	1	0	1
ASTERACEAE	6	7	13	14	10	13	9	10	9
ARECAEAE	1	0	0	0	0	0	0	0	0
BORAGINACEAE	0	0	0	1	1	0	0	0	0
BRASSICACEAE	2	0	1	2	1	1	0	1	1
CACTACEAE	1	1	0	1	1	1	1	1	0
CAESALPINIACEAE	1	1	0	0	1	0	0	0	0
CAMPANULACEAE	0	0	0	0	0	0	0	0	0
COMMELINACEAE	1	1	1	1	2	1	0	0	2
CONVOLVULACEAE	3	2	2	2	3	1	1	2	1
CUPRESSACEAE	0	1	-	-	-	-	-	-	-
CYPERACEAE	1	1	0	0	3	0	0	0	1
EUPHORBIACEAE	3	3	6	3	3	1	1	0	1
FABACEAE	7	4	12	8	5	6	6	8	6
LAURACEAE	0	0	0	0	0	0	0	0	0
LORANTHACEAE	0	0	0	0	0	0	1	0	0
MALVACEAE	1	1	3	2	2	1	1	1	2
MORACEAE	1	1	1	1	1	1	0	0	0
ONAGRACEAE	2	0	1	2	1	2	1	2	1
OXALIDACEAE	0	0	1	1	1	0	1	1	1
PASSIFLORACEAE	1	1	1	0	0	0	0	0	0
PLANTAGINACEAE	1	1	1	1	1	1	0	1	1
POACEAE	14	11	10	9	8	6	7	7	8
PORTULACACEAE	1	1	2	2	2	2	2	2	1
PRIMULACEAE	0	0	0	1	0	1	1	1	1
RUBIACEAE	0	0	1	1	1	0	0	0	1
SAPINDACEAE	1	0	1	1	0	0	0	0	0
SOLANACEAE	2	2	1	1	2	1	2	1	1
ULMACEAE	0	1	1	0	0	0	0	0	0
VERBENACEAE	3	2	2	5	4	3	3	4	3

Note: Shading indicates dominant family recorded for the monitoring period

From the data contained within **Table 4.3**, **Table 4.4** and **Figure 4.1**, the following can be deduced:

- The diversity, abundance and coverage of exotic species has increased since the last survey (May, 2012), which may be attributed to the favourable weather conditions as outlined in **Section 4.6.** Furthermore, the 2012 maintenance schedule was undertaken shortly before the monitoring survey which included very low abundance records for that monitoring period. This was not the case for the recent May 2013 survey. Based on previous observations and knowledge of the exotic incursion within this area, Lucinda Drain does not appear to have undergone recent weed maintenance prior to the 2013 survey and as such higher abundance data was recorded for this monitoring year.
- The dominant family type recorded this year was similar to last year's survey, with the Poaceae (grasses) providing the greatest number of exotic species. Species from the Poaceae family have pioneer characteristics and are generally the first species to grow back following a disturbance (e.g. maintenance activities and extreme weather conditions).

4.2 Port Gate Drain

4.2.1 Weed Species Observed

The tenth weed monitoring survey along the Port Gate Drain identified a total number of 43 flora species, of which 26 are considered exotic. No AQIS listed weed species (**Appendix 1**) were recorded during the May 2013 plant survey, however, four LP Act declared species were recorded (**Table 4.5**).

Table 4.5: Class and abundance of weed species (under LP Act) recorded during Port Gate drain survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	*Baccharis halimifolia*	Groundsel Bush	Moderate abundance along the western bank
3	*Schinus terebinthifolia*	Broad-leaf Pepper	High abundance along the western bank
	Cinnamomum camphora	Camphor Laurel	Low abundance along the western bank
	Lantana camara	Lantana	Low abundance

Note: LP Act declared plants must be managed according to their classification as follows:

- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix 4 and **Appendix 5** provides GPS co-ordinates and locations of the above-mentioned declared species along the Port Gate Drain. There were fifteen individual occurrences of LP Act Class 2 Groundsel Bush, ten individual occurrences of LP Act Class 3 Broad-leaf Pepper and one individual occurrence of both LP Act Class 3 Lantana and Camphor Laurel recorded this year. In comparison to the GPS co-ordinates recorded in the previous survey, the overall abundance and diversity of LP Act declared species has increased substantially. This may be the result of favourable weather conditions as outlined in **Section 4.6** or the lack of recent maintenance conducted within the Port Gate Drain.

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. It is recommended that declared species are removed. It is noted that a number of declared species are located along the banks of the drain and therefore appropriate removal techniques must be employed to prevent bank instability (e.g. stem injection, lopping etc). Fact sheets for declared pests identified on the site are provided in **Appendix 6**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, were identified during the recent survey and are provided in **Table 4.6**. These species have been previously recorded along Port Gate Drain.

Table 4.6: BCC listed exotic flora species recorded during the Port Gate drain survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Lantana spp.	Lantana (all species)	Environmental Weed	C
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- C**lass E (early detection and eradication) –** Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C (containment and reduction) –** landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R (reduce population as part of routine maintenance) –** landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.2.2 Comparison between the Port Gate Drain Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of the diversity and abundance of all exotic plants recorded during the current survey compared to previous surveys indicates that there is a variation between both the number and type of exotic recorded.

Table 4.7 and **Figure 4.2** highlight the number of exotic species identified in the previous and current plant surveys of Port Gate Drain since the commencement of the monitoring program in November 2007.

Table 4.7: Number of exotic species recorded per survey along the Port Gate drain

Survey	Number of Exotic Species Recorded
November 2007 Biannual Plant Survey	29
March 2008 Biannual Plant Survey	36
November 2008 Biannual Plant Survey	39
March 2009 Biannual Plant Survey	28
November 2009 Biannual Plant Survey	31
March 2010 Biannual Plant Survey	28
November 2010 Biannual Plant Survey	40
April 2011 Annual Plant Survey	22
May 2012 Annual Plant Survey	20
May 2013 Annual Plant Survey	**26**

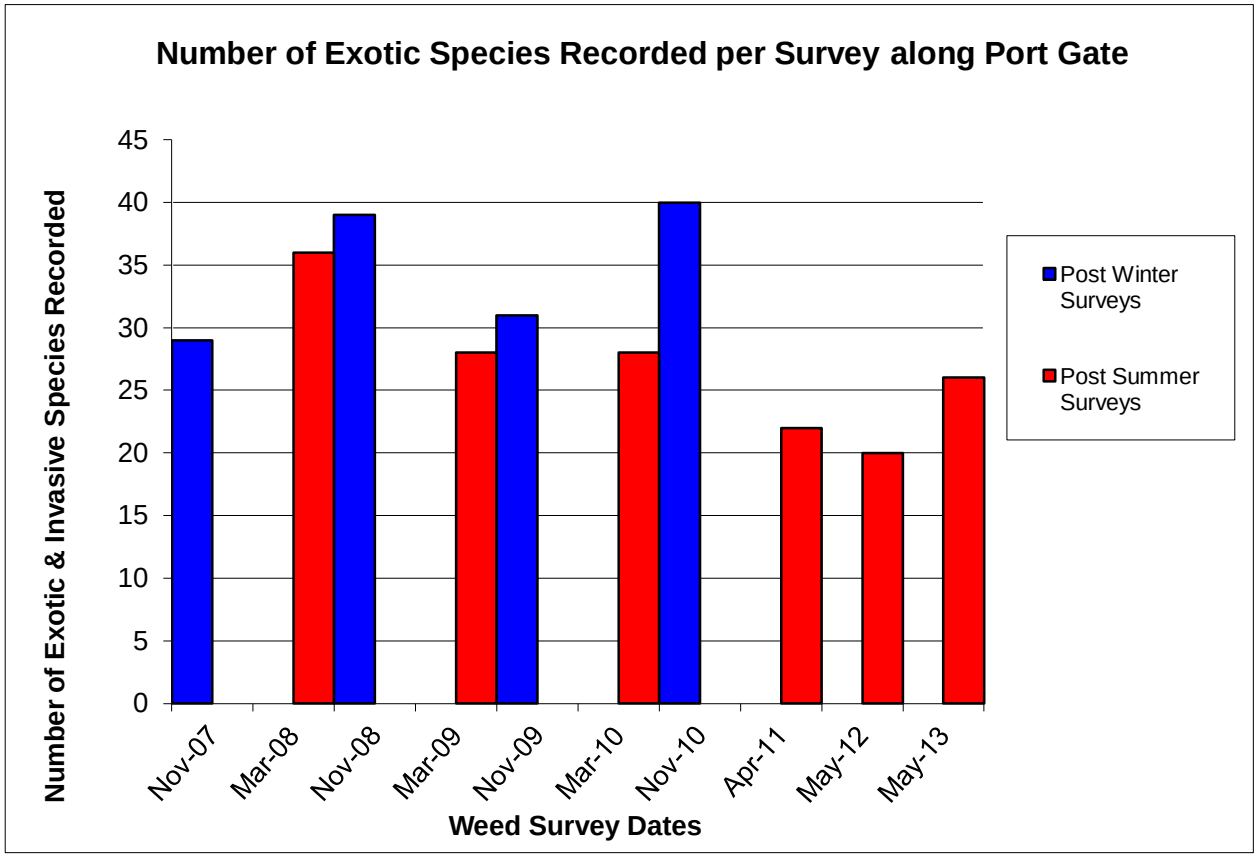


Figure 4.2: Number of exotic species recorded per survey along Port Gate Drain

Table 4.8 compares the number of exotic species within each family that were recorded in the current and previous surveys.

Table 4.8: Number of exotic species by family for Port Gate Drain

Family	Number of Exotic Species Present									
	Annual Survey			Biannual Survey						
	May 2013	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Nov 2008	Mar 2008	Nov 2007
AMARANTHACEAE	0	0	0	0	0	0	0	0	1	0
ANACARDIACEAE	1	1	1	1	1	1	1	1	0	0
ASCLEPIADACEAE	1	1	0	0	0	0	1	1	1	1
ASTERACEAE	6	4	5	7	7	8	4	9	5	5
BORAGINACEAE	0	0	0	0	0	0	1	1	0	0
BRASSICACEAE	0	0	0	2	0	1	1	0	0	0
CONVOLVULACEAE	1	0	1	1	1	1	1	1	1	1
CYPERACEAE	0	0	2	3	0	0	0	0	2	0
CUPRESSACEAE	0	1	0	0	0	0	0	0	0	0
EUPHORBIACEAE	0	1	0	1	3	1	1	1	2	0
FABACEAE	4	3	8	10	6	6	8	8	7	6
LAURACEAE	1	0	0	1	1	1	0	1	0	0
MALVACEAE	1	0	0	0	0	0	0	0	0	0
MYRTACEAE	0	0	0	0	0	0	0	0	1	1
PAPAVERACEAE	0	0	0	0	0	0	0	0	0	1
PASSIFLORACEAE	1	0	0	0	0	0	0	0	1	1
PHYTOLACCACEAE	0	0	0	0	0	0	0	0	1	1
PLANTAGINACEAE	0	0	1	1	1	1	1	1	0	0
POACEAE	7	6	9	14	5	5	7	9	9	7
PORTULACACEAE	1	1	1	0	1	1	1	1	1	1
PRIMULACEAE	0	1	0	1	0	1	0	1	0	1
SOLANACEAE	1	0	0	1	1	2	0	0	1	1
VERBENACEAE	1	1	1	2	2	2	1	3	2	1

Note: Shading indicates dominant family recorded for the monitoring period

From the data contained within **Table 4.7** and **Table 4.8**, as well as **Figure 4.2**, the following can be inferred:

- Exotic species abundance, diversity and coverage have all increased since the previous survey (May 2012) which may be attributed to favourable weather conditions as discussed in **Section 4.6**. Furthermore, the 2012 maintenance schedule was undertaken shortly before the monitoring survey which included very low abundance records for that monitoring period. This was not the case for the recent May 2013 survey. Based on previous observations and knowledge of the exotic incursion within this area, Port Gate Drain does not appear to have undergone recent weed maintenance prior to the 2013 survey and as such higher abundance data was recorded for this monitoring year.
- The Poaceae family was again recorded as the dominant family at the Port Gate Drain for the recent survey. This dominance could be attributed to the overall harsh conditions that surround the drain. Species from the Poaceae family have pioneer characteristics and are generally the first species to grow back following a disturbance (e.g. maintenance activities).

4.3 T1-3 Overflow Area

4.3.1 Weed Species Observed

The twelfth weed monitoring survey along the T1-3 Overflow identified a total number of 47 flora species, of which 37 are considered exotic species. No AQIS listed species were recorded during the May 2013 survey, however, two LP Act declared species were recorded (**Table 4.9**).

Table 4.9: Class and abundance of weed species (under LP Act) recorded during T1-3 survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	*Senecio madagascariensis*	Fireweed	Low abundance recorded along the southern drain
3	*Schinus terebinthifolia*	Broad-leaf Pepper	Low abundance recorded along the drain

Note: LP Act declared plants must be managed according to their classification as follows:

- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix 4 and **Appendix 5** provides GPS co-ordinates and locations of declared species within the T1-3 Overflow area. There was one individual occurrence of LP Act Class 2 Fireweed and one individual occurrence of LP Act Class 3 Broad-leaf Pepper recorded this year. In comparison to the GPS co-ordinates recorded in the previous survey, diversity of LP Act declared species has remained consistent and abundance has decreased. This may be a result of successful weed management of these species or general survey limitations (i.e. the species is present but no detected / false absence records).

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and are encouraged to remove Class 3 species. If any of these LP Act declared species are found in this area, consideration should be given to remove individuals and control further establishment. Fact sheets for LP Act declared pests identified previously on the site are provided in **Appendix 6**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, were identified during the current survey and are provided in **Table 4.10**. These species have all been recorded previously in the T1-3 overflow area.

Table 4.10 BCC listed exotic flora species recorded during the T1-3 overflow survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Leucaena leucocephala	Leucaena	Environmental Weed	C
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Melinis repens	Red Natal Grass	Special Investigation	-
Solanum nigrum	Blackberry Nightshade	Special Investigation	-
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and

- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- C**lass E (early detection and eradication) –** Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C (containment and reduction) –** landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R (reduce population as part of routine maintenance) –** landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.3.2 Comparison between the T1-3 Overflow Area Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of diversity and abundance of all exotic plants results recorded during the 2013 survey compared to the previous surveys indicates that there is a variation between the number and type of exotic species recorded.

Table 4.11 and **Figure 4.3** highlights the number of exotic species identified in the previous plant surveys of the T1-3 Overflow area since the commencement of the monitoring program in February 2008.

Table 4.11: Number of exotic species recorded per survey along the T1-3 Overflow area

Survey	Number of Exotic Species Recorded
Baseline Survey (February 08)	48
March 2008 Quarterly Plant Survey	37
June 2008 Quarterly Plant Survey	39
September 2008 Quarterly Plant Survey	42
December 2008 Quarterly Plant Survey	55
March 2009 Biannual Plant Survey	39
November 2009 Biannual Plant Survey	56
March 2010 Biannual Plant Survey	55
November 2010 Biannual Plant Survey	47
April 2011 Annual Plant Survey	46
May 2012 Annual Plant Survey	33
May 2013 Annual Plant Survey	**37**

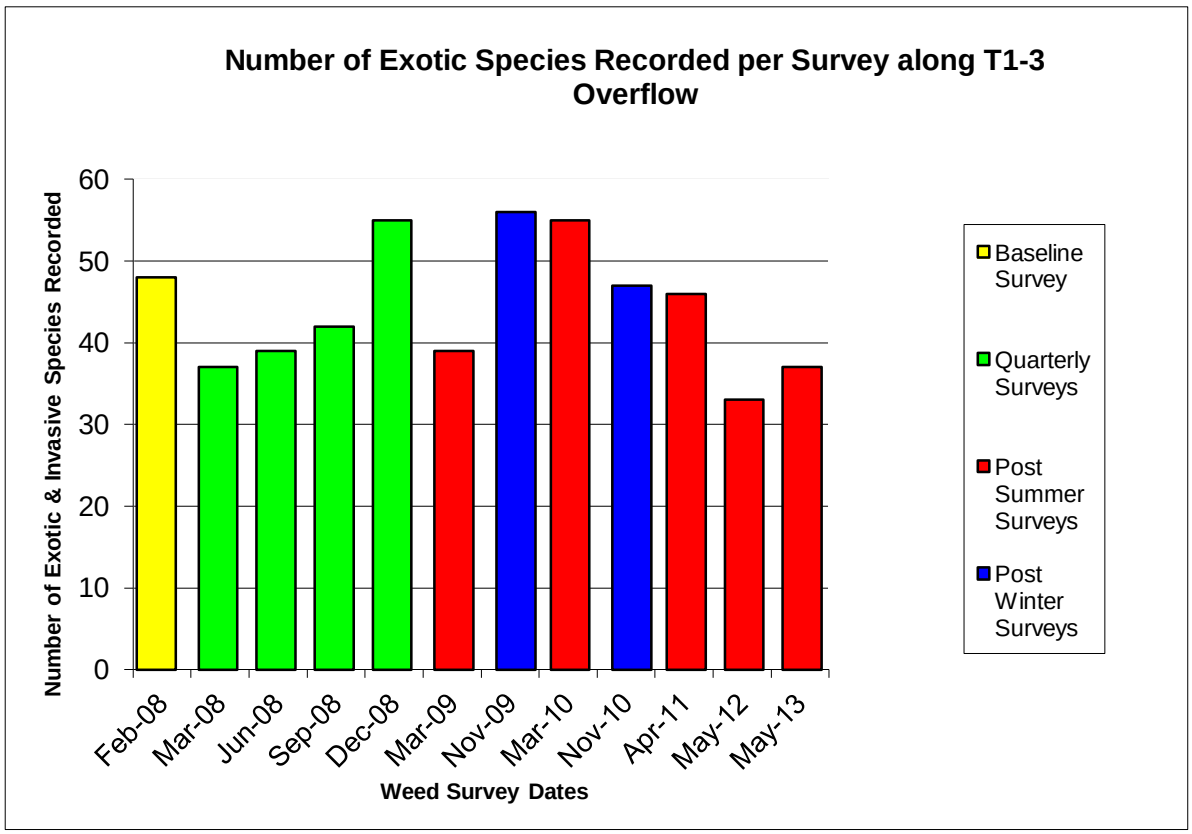


Figure 4.3: Number of exotic species recorded per survey along T1-3 Overflow Area

Table 4.12 outlines the numbers of exotic species within each family that were recorded in the recent May 2013 survey, in comparison to previous surveys.

Table 4.12: Number of exotic species by family for T1-3 Overflow

Family	Number of Exotic Species											
	Annual Survey			Biannual Survey				Quarterly Surveys				Baseline Survey
	May 2013	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	Feb 2008
AMARANTHACEAE	1	0	3	2	3	2	1	2	2	2	2	2
ANACARDIACEAE	1	1	0	0	0	0	0	1	0	0	0	0
APIACEAE	0	0	1	1	0	0	1	1	1	1	1	1
ASTERACEAE	6	6	9	10	8	12	6	9	12	9	8	6
BORAGINACEAE	0	0	0	0	1	0	1	1	0	0	0	1
BRASSICACEAE	1	0	1	2	2	2	0	2	2	2	1	1
CARYOPHYLLACEAE	0	0	1	1	0	1	0	1	1	0	0	0
CHENOPODIACEAE	0	0	0	2	1	1	0	2	0	1	0	1
COMMELINACEAE	1	0	2	1	1	0	1	0	1	1	1	0
CONVOLVULACEAE	0	1	-	-	-	-	-	-	-	-	-	-
CYPERACEAE	2	2	0	0	2	4	1	1	1	1	0	3
EUPHORBIACEAE	3	2	1	2	2	2	2	1	0	1	1	2
FABACEAE	7	6	10	10	8	10	5	10	5	5	8	11
MALVACEAE	0	1	1	1	1	1	1	1	1	1	1	2
MYRSINACEAE	1	-	-	-	-	-	-	-	-	-	-	-

Family	Number of Exotic Species											
	Annual Survey			Biannual Survey				Quarterly Surveys				Baseline Survey
	May 2013	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	Feb 2008
ONAGRACEAE	3	2	2	2	3	3	2	3	2	2	1	1
OXALIDACEAE	0	0	0	0	1	0	0	1	0	0	0	0
PAPAVERACEAE	0	0	0	0	0	0	0	0	0	0	0	1
PLANTAGINACEAE	0	0	1	1	1	1	1	1	1	1	1	1
POACEAE	8	8	5	9	10	8	7	8	8	7	6	8
POLYGONACEAE	0	0	0	1	1	1	1	1	0	0	0	0
PORTULACACEAE	0	0	2	1	2	2	1	2	1	1	2	2
PRIMULACEAE	0	0	1	1	1	1	1	1	1	1	1	1
RUBIACEAE	0	0	1	1	1	1	1	1	1	1	1	1
SOLANACEAE	1	2	4	1	1	1	1	1	1	1	1	2
TAMARICACEAE	0	0	0	1	1	1	1	1	0	0	0	0
VERBENACEAE	2	1	1	2	2	2	3	2	1	1	1	1

Note: Shading indicates dominant family recorded for the monitoring period

From the data contained within **Table 4.11** and **Table 4.12** as well as **Figure 4.3** the following can be inferred:

- The diversity, abundance and coverage have increased since the last (May 2012) survey. This could be attributed to the favourable weather conditions as discussed in **Section 4.6**. Furthermore, the 2012 maintenance schedule was undertaken shortly before the monitoring survey which included very low abundance records for that monitoring period. This was not the case for the recent May 2013 survey. Based on previous observations and knowledge of the exotic incursion within this area, the T1-3 Overflow area does not appear to have undergone recent weed maintenance prior to the 2013 survey and as such higher abundance data was recorded for this monitoring year.
- The Poaceae family was again recorded as the dominant family at the T1-3 Overflow Area for the recent survey. This dominance could be attributed to the overall harsh conditions that surround the vicinity. Species from the Poaceae family have pioneer characteristics and are generally the first species to grow back following a disturbance (e.g. maintenance activities).

4.4 Car Precinct Area

4.4.1 Weed Species Observed

The twelfth weed monitoring survey around the Car Precinct area identified a total number of 72 flora species, of which 53 species are considered exotic. There are no AQIS listed species recorded in the Car Precinct area, however three LP Act declared species were recorded (**Table 4.13**).

Table 4.13: Class and abundance of weed species (under LP Act) recorded during Car Precinct Area survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	*Baccharis halimifolia*	Groundsel Bush	Low abundance recorded on southern lake shore
	Senecio madagascariensis	Fireweed	High abundance recorded along the eastern drain bank
3	*Schinus terebinthifolia*	Broad-leaf Pepper	High abundance recorded on southern lake shore

Note: LP Act declared plants must be managed according to their classification as follows:

- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix 4 and **Appendix 5** provides GPS co-ordinates and locations of the LP Act declared species identified. There were four individual occurrences of LP Act Class 2 Groundsel Bush and twelve individual occurrences of LP Act Class 2 Fireweed. The highest abundance was that of LP Act Class 3 Broad-leaf Pepper which occurred fourteen times across the Car Precinct area. In comparison to the GPS co-ordinates recorded in the previous survey there has been an overall increase in both diversity and abundance of LP Act declared species in the Car Precinct area. This may be attributed to favourable weather conditions as discussed in **Section 4.6** and/or the lack of recent maintenance proceeding the 2013 survey of the Car Precinct Area.

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and encouraged to remove Class 3 species. Therefore, consideration should be given to the removal of these declared species and the control of further establishment. Fact sheets for declared species are provided in **Appendix 6**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, were identified during the current survey (**Table 4.14**). These species have been previously recorded in the Car Precinct area.

Table 4.14: BCC listed exotic flora species recorded during the Car Precinct survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Ipomoea indica	Morning Glory	Environmental Weed	C
Macroptilium atropurpureum	Siratro	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis minutiflora	Molasses Grass	Environmental Weed	R
Melinis repens	Red Natal Grass	Special Investigation	-
Neonotonia wightii	Glycine	Environmental Weed	C
Ricinus communis	Castor Oil Plant	Noxious Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Solanum nigrum	Blackberry Nightshade	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- C**lass E (early detection and eradication) –** Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C (containment and reduction) –** landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R (reduce population as part of routine maintenance) –** landholders are urged to look out for infestations and plan for their removal during routine maintenance.

4.4.2 Comparison between the Car Precinct Area Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. An analysis of the diversity and abundance of all exotic plants recorded during the 2013 survey compared to previous surveys, indicates that there is a variation between both number and type of exotic species recorded.

Table 4.15 and **Figure 4.4** highlights the number of exotic species identified in the 2013 and previous plant surveys of the Car Precinct area since the commencement of the monitoring program in February 2008.

Table 4.15: Number of exotic species recorded per survey around the Car Precinct Area

Survey	Number of Exotic Species Recorded
Baseline Survey (February 08)	40
March 2008 Quarterly Plant Survey	44
June 2008 Quarterly Plant Survey	48
September Quarterly 2008 Plant Survey	49
December 2008 Quarterly Plant Survey	59
March 2009 Biannual Plant Survey	46
November 2009 Biannual Plant Survey	54
March 2010 Biannual Plant Survey	47
November 2010 Biannual Plant Survey	52
April 2011 Annual Plant Survey	30
May 2012 Annual Plant Survey	51
May 2013 Annual Plant Survey	**53**

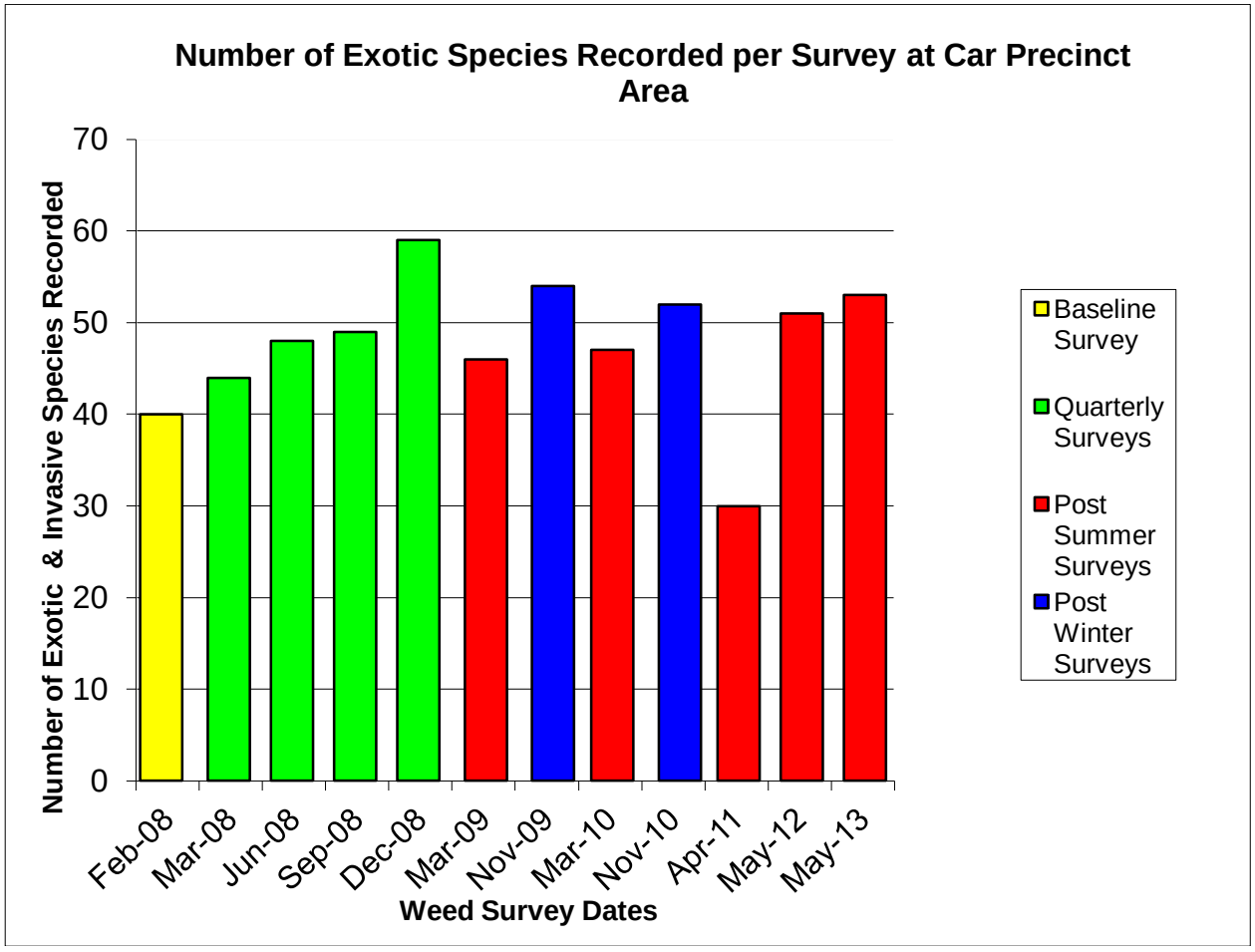


Figure 4.4: Number of exotic species recorded per survey at the Car Precinct Area

Table 4.16 outlines the numbers of exotic species within each family that were recorded in the recent May 2013 survey, in comparison to previous surveys.

Table 4.16: Number of exotic species by family for the Car Precinct Area

Family	Number of Exotic Species											
	Annual Survey			Biannual Survey				Quarterly Surveys				Baseline Survey
	May 2013	May 2012	Apr 2011	Nov 2010	Mar 2010	Nov 2009	Mar 2009	Dec 2008	Sept 2008	Jun 2008	Mar 2008	February 2008
AGAVACEAE	0	1	0	0	0	0	0	0	0	0	0	0
AMARANTHACEAE	2	2	1	2	2	1	1	2	1	1	2	3
ANACARDIACEAE	1	1	1	1	1	0	1	1	1	1	1	1
APIACEAE	1	1	0	0	0	0	0	0	0	0	0	0
APOCYNACEAE	0	0	0	0	0	0	0	0	0	0	0	1
ASTERACEAE	12	11	5	10	6	11	9	12	14	13	11	8
BALSAMINACEAE	1	0	0	0	0	0	0	0	0	0	0	0
BORAGINACEAE	0	0	1	1	1	0	1	1	1	0	0	0
BRASSICACEAE	1	0	1	2	1	2	0	2	2	2	0	1
CARYOPHYLLACAE	0	0	0	0	0	1	0	0	0	0	0	0
CHENOPODIACEAE	0	0	0	0	0	0	0	2	0	0	0	0
COMMELINACEAE	1	1	1	0	1	1	1	1	1	1	1	0
CONVOLVULACEAE	2	1	1	2	2	2	2	2	2	2	2	2
CYPERACEAE	2	2	3	4	4	5	4	4	1	2	2	2
EUPHORBIACEAE	3	2	2	3	3	1	2	1	2	3	0	3
FABACEAE	8	8	8	11	6	8	6	9	5	5	7	5
MALVACEAE	1	2	1	1	1	2	1	0	1	1	1	1
MELIACEAE	1	1	0	0	0	0	0	0	0	0	0	0
MORACEAE	0	1	0	0	0	0	0	0	0	0	0	0
ONAGRACEAE	2	1	3	4	3	3	3	3	2	1	1	1
OXALIDACEAE	0	0	0	0	0	0	0	0	0	0	0	1
PASSIFLORACEAE	1	0	0	0	0	0	0	0	0	0	0	0
PLANTAGINACEAE	0	0	0	1	1	1	1	1	1	1	1	0
POACEAE	9	10	7	12	9	9	7	10	10	9	9	6
POLYGONACEAE	0	1	1	1	1	1	1	1	0	1	1	0
PORTULACACEAE	1	1	0	1	2	2	2	1	0	1	1	2
PRIMULACEAE	0	0	0	1	0	1	0	1	1	1	1	1
RUBIACEAE	0	0	1	0	0	0	0	0	0	0	0	1
SOLANACEAE	2	2	1	1	1	1	2	2	1	1	1	1
VERBENACEAE	2	2	0	2	2	2	2	2	3	2	2	0

Note: Shading indicates dominant family recorded for the monitoring period

From the data contained within **Table 4.15** and **Table 4.16**, as well as **Figure 4.4**, the following can be implied:

- The number of exotic species, as well as abundance and coverage recorded in the recent May 2013 survey has increased in comparison to the May 2012 survey results. This could be attributed to the favourable weather conditions as discussed in **Section 4.6**. Furthermore, the 2012 maintenance schedule was undertaken shortly before the monitoring survey which included very low abundance records for that monitoring period. This was not the case for the recent May 2013 survey. Based on previous observations and knowledge of the exotic incursion within this area, the Car Park Precinct Area does not appear to have undergone recent weed maintenance prior to the 2013 survey and as such higher abundance data was recorded for this monitoring year.
- The Asteraceae family remains the dominant family for the May 2013 survey. The species in this family are resilient and have the ability to grow successfully in disturbed areas.

4.5 Port West Drain

4.5.1 Weed Species Observed

The first weed monitoring survey around the Port West Drain identified a total number of 43 flora species, of which 31 species are considered exotic. There are no AQIS listed species recorded in the Port West Drain, however, three LP Act declared species were recorded (**Table 4.17**).

Table 4.17 Class and abundance of weed species (under LP Act) recorded during Port West Drain survey

LP Act Class	Botanical Name	Common Name	Abundance & Location
2	*Baccharis halimifolia*	Groundsel Bush	high abundance along the eastern bank
3	*Schinus terebinthifolia*	Broad-leaf Pepper	High abundance along the eastern bank
	Lantana camara	Lantana	High abundance

Note: LP Act declared plants must be managed according to their classification as follows:

- **Class 2** – landholders are required by law to attempt to keep their land free of these species; and
- **Class 3** – landholders may be required to control these species if their land is located adjacent to 'environmentally significant species' such as national parks or reserves.

Appendix 4 and **Appendix 5** provides GPS co-ordinates and locations of the LP Act declared species identified. There were eleven individual occurrences of LP Act Class 2 Groundsel Bush and eighteen individual occurrences of LP Act Class 3 Lantana. The highest abundance was that of LP Act Class 3 Broad-leaf Pepper which occurred twenty-nine times across the Port West Drain.

Under the LP Act, landholders are obliged to attempt to remove Class 2 species and encouraged to remove Class 3 species. Therefore, consideration should be given to the removal of these declared species and the control of further establishment. Fact sheets for declared species are provided in **Appendix 6**.

Several species that are listed as environmental / noxious weeds by BCC, some of which are also listed under the LP Act, were identified during the current survey and are listed in **Table 4.18**.

Table 4.18 BCC listed exotic flora species recorded during the Port West Drain survey

Scientific Name	Common Name	BCC Weed Category[1]	BCC Classification[2]
Chloris gayana	Rhodes Grass	Environmental Weed	R
Megathyrsus maximus var. maximus	Guinea Grass	Environmental Weed	C
Melinis repens	Red Natal Grass	Special Investigation	-
Neonotonia wightii	Glycine	Environmental Weed	C
Ricinus communis	Castor Oil Plant	Noxious Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Solanum nigrum	Blackberry Nightshade	Special Investigation	-

[1]Three BCC weed categories exist:

- **Noxious Weeds:** These species are toxic to animals or humans. Where these plants occur, arrangements must be made to have them removed;
- **Environmental Weeds:** These species are recognised by BCC as having damaging effects on the environment in the Brisbane area; and
- **Special Investigation:** These species have been identified by BCC as potentially invasive and they are being investigated.

[2]BCC noxious / environmental weeds must be managed according to their classification as follows:

- C**lass E (early detection and eradication) –** Landholders are encouraged to regularly check properties to detect any early infestations. Where an infestation has occurred, immediate removal is required, followed by continual monitoring of growth;
- **Class C (containment and reduction) –** landholders are urged to remove the parent plant or source of infestation and if removal is not immediately possible, prevent seeding by using the appropriate control method for the species (often not effective with large trees) and schedule for the earliest possible removal. Any small surrounding infestation should also be removed. It is recommended that removal occurs from the top of a catchment downstream and from the outside of a large infestation inwards; and
- **Class R (reduce population as part of routine maintenance) –** landholders are urged to look out for infestations and plan for their removal during routine maintenance.

Table 4.19 lists the exotic species present by family. The dominant family present along Port West Drain is the Asteraceae family with seven species recorded in the May 2013 survey. The Asteraceae family is the largest family of flowering plants with over 20 000 species.

Table 4.19: Number of exotic species by family recorded for the Port West Drain survey

Family	Number of Exotic Species May 2013
AGAVACEAE	1
AMARANTHACEAE	0
ANACARDIACEAE	1
APIACEAE	0
APOCYNACEAE	0
ASCLEPIADACEAE	1
ASTERACEAE	7
BALSAMINACEAE	0
BORAGINACEAE	0
BRASSICACEAE	0
CAESALPINIACEAE	1
CAMPANULACEAE	1
CARYOPHYLLACAE	0
CHENOPODIACEAE	0
COMMELINACEAE	0
CONVOLVULACEAE	1
CYPERACEAE	1
EUPHORBIACEAE	2
FABACEAE	3
MALVACEAE	0
MELIACEAE	0
MORACEAE	0
ONAGRACEAE	0
OXALIDACEAE	0
PASSIFLORACEAE	2
PLANTAGINACEAE	0
POACEAE	5
POLYGONACEAE	0
PORTULACACEAE	0
PRIMULACEAE	0
RUBIACEAE	0
SOLANACEAE	3
VERBENACEAE	2

4.6 Weather Conditions

The following graph (**Figure 4.5**) shows the rainfall recorded at the Port of Brisbane, as well as the long-term rainfall and temperature averages (taken from the Brisbane Airport).

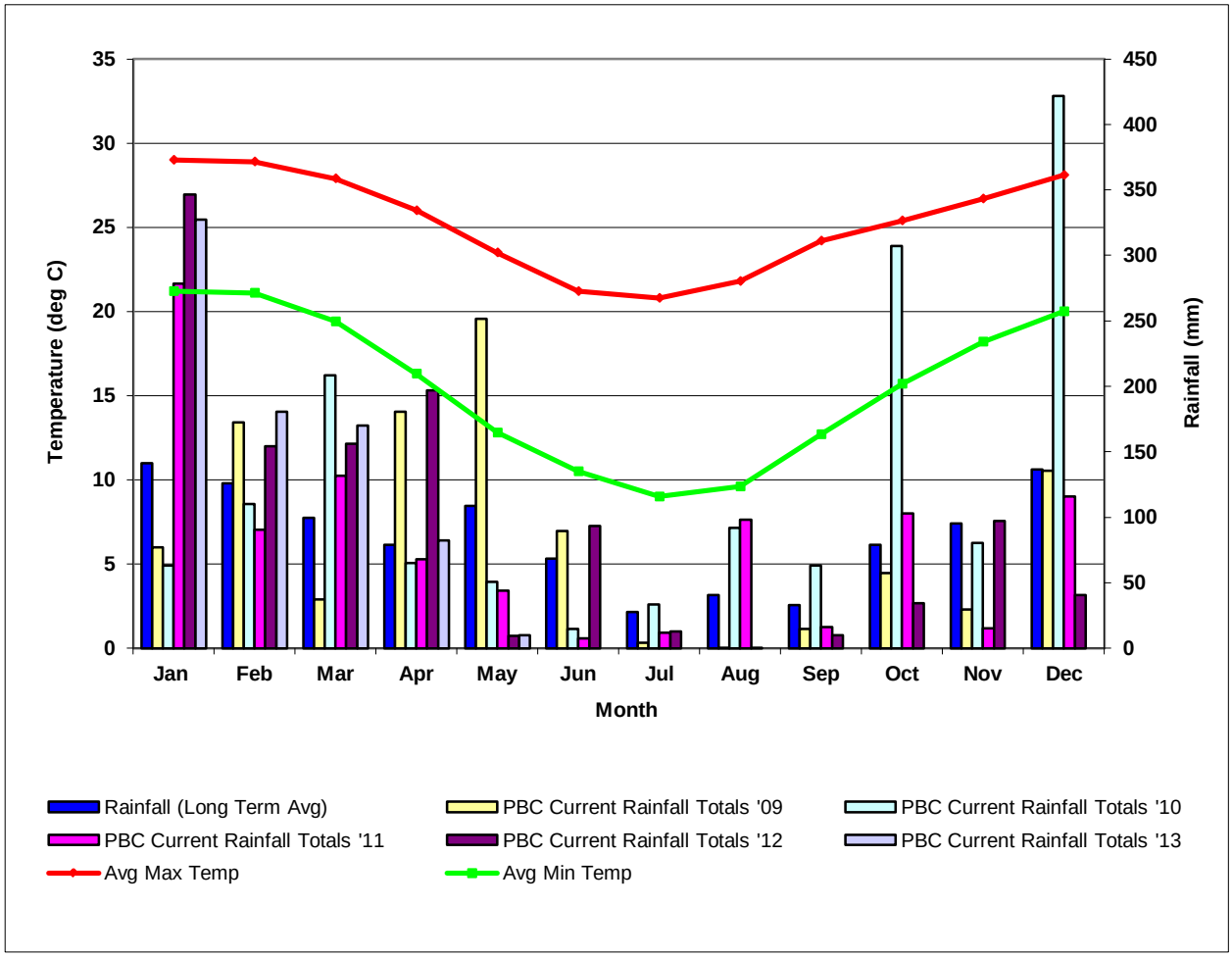


Figure 4.5: Long-term climatic averages compared with the Port of Brisbane rainfall data

The following can be derived from this data with respect to the plant growth around Lucinda, Port West and Port Gate Drains, the T1-3 Overflow area and the Car Precinct area:

- The 2012 winter months experienced extremely low rainfall compared to the long-term average whereas the 2013 summer months had excessive rainfall, exceeding the long-term average for three months and doubling it in January 2013.; and

  The rainfall in the months preceding the 2013 survey either exceeded or were the same as the long term average which combined with warm temperatures contributed to the greater plant growth that was encountered across all five monitoring areas.

5.0 Recommendations

Early detection and intervention is the best and most cost-effective way to prevent the establishment of new and emerging weeds, and should be given high priority in weed management programs. The following sections provide recommendations for management of exotic species along each of the drains. As no AQIS listed species have been detected, recommendations addressing AQIS listed weed species have not been given.

5.1 Lucinda Drain

Recommendations relating to the management of the banks of the Lucinda Drain and of the inflow of stormwater have been made in previous reports. In addition to these, the following recommendations are made:

- Continue existing maintenance programs along the eastern bank and western bank of Lucinda Drain. This should include regular mowing and spot spraying / hand pulling of weeds, as well as other weed removal techniques;
- Ensure attempts are made to remove all declared species listed under the LP Act (see **Appendix 4** and **Appendix 5** for locations). As there may be bank stability issues associated with the removal of some of these species, it is recommended that a stem injection removal technique is employed. This method will ensure the tree (and associated root structure) remains in situ for as long as possible, whilst simultaneously ensuring all seeding / propagule material is controlled. Also, the routine management of this area should include appropriate maintenance of these species;
- Removal of declared species should be conducted in accordance with the relevant fact sheet provided by the Queensland Department of Agriculture, Fisheries and Forestry (**Appendix 6**); and
- Continue programmed monitoring of the diversity and status of plant species along the banks of the Lucinda Drain through annual plant surveys.

The positive effects of native vegetation cover, in relation to potentially suppressing or decreasing exotic vegetation cover, have been observed along Lucinda Drain in previous surveys, especially with respect to species from the Casuarinaceae family. These canopy species provide shading and ground cover (from dropped organic material), which aids in decreasing the amount of understorey weed species. Thus, the long-term management of exotic species present at Lucinda Drain should be incorporated into a program of integrated weed management, including actions such as:

- Suppression of exotic species through mulching and shading via the planting of a native canopy and understorey;
- Planting density of native species that still allows access for the regular maintenance program; and
- Increasing the native understorey diversity to increase competition for resources.

5.2 Port Gate Drain

In comparison to Lucinda Drain, Port Gate Drain has different environmental conditions and disturbance regimes, which require a slightly different management approach. Where areas surrounding the drain are concreted, the establishment of native plants to shade out exotic vegetation is limited. However, for areas of the drain (i.e. the southern region) where it is possible for native plants to be established, it is recommended that a long-term weed management approach is adopted, which incorporates rehabilitation in order to re-establish native species that will ultimately out-compete exotic species.

The long-term management of exotic species present at Port Gate Drain should incorporate:

- Implementation of weed control strategies such as mechanical removal through mowing. Chemical weed removal should be kept to a minimum and only used when necessary. It should only involve spot spraying using an environmentally sensitive herbicide during low flow periods;
- Ensure attempts are made to remove all declared species listed under the LP Act (see **Appendix 4** and **Appendix 5** for locations);
- Continue scheduled maintenance programs along the drain; and
- Continue to monitor the weed status of the drain at regular intervals.

5.3 T1-3 Overflow Area and Car Precinct Area

The following summarises the recommendations relating to the management of the T1-3 Overflow and Car Precinct Area:

- All survey areas are to be regularly maintained. Less visible areas (i.e. the eastern side of the T1-3 Overflow and the western side of the Car Precinct Area) should be maintained as often as the other sections of the survey area, where practical and when required;
- Regular maintenance of all survey areas should include mowing and spot spraying / hand pulling of weeds, and other suitable weed removal techniques;
- Climatic conditions (rainfall) should also be a consideration when assessing the frequency of maintenance activities (i.e. increasing the frequency of maintenance activities during favourable growing conditions);
- Ensure attempts are made to remove all declared species listed under the LP Act. Their specific identification and removal should be included as part of routine maintenance and management of the broader area. **Appendix 4** and **Appendix 5** provides the locations of LP Act declared weeds and factsheets are provided in **Appendix 6**;
- A recommended planting schedule of native species and appropriate densities should be prepared for the northern drain in the T1-3 Overflow area; and
- Programmed monitoring of the diversity and abundance levels of exotic species should be continued within the T1-3 Overflow and Car Precinct Area through annual surveys.

5.4 Port West Drain

Management recommendations relating to Port West Drain are as follows:

- Ensure attempts are made to remove all declared species listed under the LP Act (see **Appendix 4** and **Appendix 5** for locations);
- Implementation of non-invasive weed removal techniques should be employed. Chemical weed removal should be kept to a minimum and only used when necessary. It should only involve spot spraying using an environmentally sensitive herbicide during low flow periods;
- Conduct weed monitoring within six months of weed removal and continue to monitor the weed status of the drain at regular intervals; and
- Continue to monitor the diversity and abundance levels of exotic species through annual surveys.

6.0 References

Auld, B.A. & Medd, R.W. (1999). *Weeds: an illustrated botanical guide to the Weeds of Australia*. Inkata Press, Sydney.

Blood. K*. et. al.* (2001). *Environmental Weeds: A Field Guide for South-East Australia*. C.H Jerram & CRC for Weed Management Systems, Victoria.

Department of Natural Resources (DNR). (2000). *Weed Pocket Guide*. Qld Government Press, Brisbane.

Johns, L. (2006). *Field Guide to Common Saltmarsh Plants of Queensland*. Department of Primary Industries & Fisheries, Brisbane.

Kleinschmidt, H., Holland, A. & Simpson, P. (1996). *Suburban Weeds* 3rd ed. Department of Primary Industries, Brisbane.

Lamp, L. & Collet, C. (1989). *Field Guide to Weeds in Australia*. Inkata Press, Sydney.

Navie, S., Markwell, B. Playford, J. & Adkins, S. (2002). *Suburban and Environmental Weeds CD: Identification and Information for South-east Queensland*. University of Queensland, Brisbane.

Queensland Museum. (2003). *Wild Plants of Greater Brisbane*. Queensland Museum Press, Brisbane.

Richardson, F.J., Richardson, R.G. & Shepherd, R.C.H. (2006). *Weeds of the South-East: An Identification guide for Australia.* F.J. Richardson & R.G. Richardson, Victoria.

RPS. (2012). *Plant Assessment Report – Port of Brisbane.* May 2012, Brisbane.

Sainty, G.R. & Jacobs, S.W.L. (1994). *Water plants in Australia – A Field Guide*. Sainty & Assoc, Darlinghurst.

Tothill, J.C. & Hacker, J.B. (1996). *The Grasses of Southern Queensland*. Tropical Grassland Society of Australia, Brisbane.

Appendix 1

AQIS Weed Target Species List

Family	Botanical Name	Common Name	Author	Comments
ACANTHACEAE	Asystasia gangetica subsp. micrantha	Chinese Violet	(Nees) Ensermu	Rubber, coffee, oil-palm plantations, environmental weed.
	Blechum pyramidatum	Browne's Blechum, Green Shrimp Plant, Blackweed	(Lam.) Urb	Pastures, gardes, disturbed areas, rainforest understoreys.
ASTERACEAE	Austroeupatorium inulaefolium	Austroeupatorium	(H.B.K.) King & Robinson	Tea, rubber, rosella and other plantation crops; roadsides; environmental weed in secondary forests.
	Bidens biternata	Yellow Flowered Blackjack, Five Leaved Blackjack	Merr. and Sherff.	Weed of disturbed and cultivated areas, paddy fields.
	Chromolaena odorata	Siam Weed, Christmas Bush	(L.) King & Robinson	Pastures, oil palm, rubber, coffee, cashew, fruit, maize, forestry. Toxic to livestock. Major environmental weed: secondary forests, roadsides, disturbed sites.
	Hieracium aurantiacum	Orange Hawkweed	CRC Weed Management	Potential threat to alpine country and temperate tablelands of eastern Australia.
	Hieracium pilosella	Mouse-eared Hawkweed	DPIW, TAS	Major weed in pasture and native vegetation and is a serious threat to grasslands and alpine environments.
	Hieracium praeltum	King Devil	-	-
	Mikania micrantha	Mile-a-Minute	H.B.K.	Cocoa, coconut, orchards, rubber, oil palm, sugarcane, vegetables, upland rice, pastures; serious environmental weed
BORAGINACEAE	Cordia curassavica	Black Sage	Roem. and Shult.	Environmental weed.
CAPPARIDACEAE	Cleome rutidosperma	Fringed Spider Flower	Weeds Australia	Environmental weed of crops.
CHENOPODIACEAE	Bassia scoparia	Kochia	CRC Weed Management	Invades crops and pastures.
CYPERACEAE	Cyperus teneristolon	-	CRC Weed Management	Semi-arid agricultural crops and damp grasslands. Environmental weed.
	Schoenoplectus juncoides	-	(Roxb.) Palla	Rice, freshwater and tidal swamps.
	Trianoptiles solitaria	Subterranean Cape Sedge	CRC Weed Management	Grows in seasonally damp areas.
EQUISETACEAE	Equisetum ramosissimum	Horsetail, Scouring Rush	Desf. subsp. debile (Vauch.) Hauke	Rice terraces and bunds, tea plantations.
EUPHORBIACEAE	Croton hirtus	-	L'Herit	Rubber plantations; crops including mung beans, peanuts, soybeans, papaya, vegetables and tobacco.
FABACEAE	Mucuna pruriens	Velvet Bean, Cow-Itch	DC.	Weed of pastures and a wide range of dryland crops; smothering habit

Family	Botanical Name	Common Name	Author	Comments
				and ability to climb to tree tops makes a significant potential environmental weed. Irritant hairs can kill livestock if ingested and cause severe skin reaction if touched.
HALORACEAE	Myriophyllum spicatum	Eurasian Watermilfoil	L.	Serious weed of lakes, water-storages, canals and rivers. Affects fish and shellfish production and recreational use of water bodies
HYDROCHARITACEAE	Lagarosiphon major	Lagarosiphon	CRC Weed Management	Aquatic plant that can dominate freshwater lakes, dams and slow-moving streams.
LAMIACEAE	Clerodendrum chinense	Stickbush, Glory Bower, Honolulu Rose, Spanish Jasmine	(Osbeck) Mabb.	Disturbed forests, roadsides, gardens, pastures, plantations, environmental weed.
	Leucas aspera	Pansi-pansi, Feng Chao Cao	(Willd.) Link	Fields, dandy grasslands, wasteland, roadsides, overgrazed areas.
LIMNOCHARITACEAE	Limnocharis flava	Yellow Bur-head, Yellow Sawah Lettuce	(L.) Buchenau	Serious weed of rice and wetlands. Used as a green vegetable.
LYTHRACEAE	Rotala indica	Toothcup	(Willd.) Koehne	Rice fields, river banks, ditches and moist environments
MELASTOMACEAE	Clidemia hirta	Koster's Curse, Soap Bush	(L.) D. Don.	Cocoa, tea, coconut, oil palm and rubber plantations, cultivated areas, pastures, secondary forest and woodlands; other disturbed sites.
	Miconia calvescens	Miconia, Velvet Tree	DC.	Coastland, disturbed areas, natural forests, planted forests, riparian zones, scrub / shrublands, urban areas, wetlands.
MIMOSACEAE	Acacia karroo	Karroo Thorn	DPIF	Rangelands and open grasslands, suppresses the growth of agricultural productivity.
	Neptunia plena	Water Dead and Awake, Water Sensitive	(L.) Benth.	Wetlands, swamps and marshes, water-logged or flooded areas.
NYCTAGINACEAE	Boerhavia erecta	Erect Tar Vine	L.	Peanuts, sorghum, rice and other annual crops; weed of cultivated land, pastures and coastal environments.
OROBANCHACEAE	Aeginetia indica	Ye Gu	L.	Parasitizes bamboo shoots and crops such as rice, maize and sugarcane. Grassy lowlands, wet, swampy ground, forests, roadsides.
	Orobanche ramosa	Branched Broomrape	DAFF	Serious pest of crops and pastures.
PIPERACEAE	Piper aduncum	Spiked Pepper, False Karva	L.	Karva crops, grazing lands, abandoned gardens.
POACEAE	Digitaria insularis	-	(L.) Mes ex	Pineapples; unpalatable weed of

Family	Botanical Name	Common Name	Author	Comments
			Ekman	pastures, headlands,
	Echinochloa glabrescens	A barnyard grass	Munro ex Hook. f.	Rice, maize.
	Eragrostis japonica	Japanese Lovegrass, Pond Lovegrass	(Thunb.) Trin.	Arable lands and rice fields.
	Imperata conferta	Cogongrass, Lalang Jawa	(Presl.) Ohwi	Coconut, roadsides, hillsides, streams and trails in dense or open forest.
	Leptochloa chinensis	Red Sprangletop, Feathergrass	(L.) Nees.	Rice, cotton, soybean, maize, sugarcane, pineapple, sweet potato, vegetables, peanuts, tea, bananas.
	Nasella tenuissima	Mexican feather Grass	Territory and Municipal Services	Pastures and native grasslands. Highly invasive.
	Sacciolepis interrupta	-	(Willd.)	Rice, irrigation channels, wetlands. Potential environmental weed.
RUBIACEAE	Paederia foetida	Lesser Malayan Stinkwort	L.	Sugarcane, secondary forest; climbs over shrubs and trees - potential environmental weed.
SALVINIACEAE	Salvinia cucullata	Salvinia	Roxb.	Rice, waterways, wetlands.
SCROPHULARIACEAE	Limnophila sessiliflora	Ambulia, Asian Marshweed, Shi Long Wei	(Vahl) Blume	Ponds, swamps, rice fields, wet places along streams.
	Striga asiatica	Witchweed	(L.) O. Ktze.	Serious root parasite on rice, maize, sorghum, sugarcane, millet; also on some broadleaf crops including sunflower, tomatoes, some legumes.

Appendix 2

Plant Survey Data Sheets

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
AGAVACEAE					
Agave sp.	Agave	s	-		
AIZOACEAE					
Carpobrotus glaucescens [n]	Pigface	c	-		
Sesuvium portulacastrum [n]	Sea Purslane	c	-		
AMARANTHACEAE					
Alternanthera pungens	Khaki Weed	c	-		
Amaranthus quitensis	South American Amaranthus	h	-		
Amaranthus viridis	Green Amaranthus	h	-		
Gomphrena celosioides	Gomphrena Weed	h	-		
ANACARDIACEAE					
Schinus terebinthifolia	Broad-leaf Pepper	t	3		
ASCLEPIADACEAE					
Gomphocarpus physocarpus	Balloon Cotton Bush	s	-		
ASPARAGACEAE					
Asparagus aethiopicus cv. *Sprengeri*	Asparagus Fern	v	3		
ASTERACEAE					
Ageratum houstonianum	Blue Billy-Goat	h	-		
Ambrosia artemisiifolia	Annual Ragweed	h	2		
Baccharis halimifolia	Groundsel Bush	s	2		
Bidens pilosa	Cobblers Pegs	h	-		
Calyptocarpus vialis	Creeping Cinderella Weed	c	-		
Cirsium vulgare	Spear Thistle	h	-		
Conyza bonariensis	Flaxleaf Fleabane	h	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
Conyza pusilla	Canadian Fleabane	h	-		
Crassocephalum crepidioides	Thickhead	h	-		
Emilia sonchifolia	Emilia	h	-		
Hypochaeris radicata	Flatweed	h	-		
Parthenium hysterophorus	Parthenium Weed	h	2		
Senecio sp. *(lautus)*	Fireweed	h	-		
Soliva pterosperma	Bindii	h	-		
Sonchus oleraceus	Rough Sow Thistle	h	-		
Sphagneticola trilobata	Singapore Daisy	c	3		
Tagetes minuta	Stinking Roger	h	-		
AVICENNIACEAE					
Avicennia marina [n]	Grey Mangrove	t	-		
BORAGINACEAE					
Heliotropium amplexicaule	Blue Heliotrope	h	-		
BRASSICACEAE					
Brassica tourneforii	Wild Turnip	s	-		
Lepidium africanum	Common Peppercress	h	-		
CACTACEAE					
Opuntia sp.	Prickly Pear	s	2		
CAESALPINIACEAE					
Crotalaria paniculata	Poor Mans Gold	h	-		
Senna pendula var *glabrifolia*	Easter Cassia	s	-		
CARYOPHYLLACEAE					

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
Cerastium glomeratum	Sticky Mouse-eared Chickweed	h	-		
CASUARINACEAE					
*Casuarina equisetifolia**	Coastal Sheoak	t	-		
*Allocasuarina littoralis**	Black Sheoak	t	-		
CONVOLVULACEAE					
Cuscuta campestris	Dodder	v	-		
Convolvulus arvensis	European Bindweed	c	-		
Ipomoea sp. *(alba)*	-	v	-		
Ipomoea cairica	Mile-a-Minute	v	-		
Ipomoea pes-caprae [n]	Goats Foot Convolvulus	v	-		
CYPERACEAE					
Cyperus congestus	Clustered Flatsedge	a	-		
Cyperus eragrostis	Umbrella Sedge	a	-		
EUPHORBIACEAE					
Chamaesyce maculata	Caustic Weed	h	-		
Euphorbia hirta	Asthma Plant	h	-		
Euphorbia prostrata	Caustic Creeper	c			
Euphorbia sp.	Spurge	h	-		
Macaranga tanarius [n]	Macaranga	t	-		
Phyllanthus virgatus	Creeping Phyllanthus	h	-		
FABACEAE					
Crotalaria pallida	Rattle Pod	h	-		
Desmodium uncinatum	Silver-leafed Desmodium	v	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
Macroptilium atropurpureum	Siratro	v	-		
Macroptilium lathyroides	Phasey Bean	s	-		
Medicago polymorpha	Burr Medic	c	-		
Medicago sativa	Lucerne	h	-		
Melilotus indicus	Sweet Melilotus	h	-		
Neonotonia wightii	Glycine	v	-		
Sesbania cannabina	Sesbania Pea	s	-		
Trifolium repens	White Clover	c	-		
LAURACEAE					
Cinnamomum camphora	Camphor Laurel	t	3		
MALVACEAE					
Hibiscus tiliaceus [n]	Cotton Tree	t	-		
Modiola caroliniana [n]	Red Flower Mallow	c	-		
Sida cornifolia	Flannel Weed	h	-		
Sida rhombifolia	Common Sida	h	-		
MIMOSACEAE					
Acacia aulacocarpa [n]	Hickory Wattle	t	-		
MYRTACEAE					
Eucalyptus robusta [n]	Swamp Mahogany	t	-		
Lophostemon confertus [n]	Brush Box	t	-		
Melaleuca linariifolia [n]	Flax-leafed Paperbark	t	-		
Melaleuca quinquenervia [n]	Paperbark Teatree	t	-		
ONAGRACEAE					

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
Oenothera drummondii [n]	Beach Evening Primrose	h	-		
Oenothera laciniata	Cut-leaf Evening Primrose	h	-		
OXALIDACEAE					
Oxalis corniculata	Creeping Oxalis	c	-		
PANDANACEAE					
Pandanus tectorius [n]	Screw Pine	t	-		
PASSIFLORACEAE					
Passiflora cairica	Stinking Passion Vine	v	-		
Passiflora subpeltata	White Passion Vine	v	-		
PLANTAGINACEAE					
Plantago lanceolata	Lamb's Tongue	h	-		
Plantago major	Great Plantain	h	-		
POACEAE					
Brachiaria decumbens	Signal Grass	g	-		
Brachiaria mutica	Para Grass	g	-		
Cenchrus ciliaris	Buffel Grass	g	-		
Cenchrus echinatus	Mossman River Grass	g	-		
Chloris gayana	Rhodes Grass	g	-		
Chloris truncata	Windmill Grass	g	-		
Chloris virgata	Feather-top Rhodes Grass	g	-		
Cynodon dactylon	Couch Grass	g	-		
Dichanthium aristatum	Angleton Grass	g	-		
Digitaria ciliaris	Summer Grass	g	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
Eleusine indica	Crowsfoot Grass	g	-		
Hemarthria uncinata	Mat Grass	g	-		
Imperata cylindrica [n]	Blady Grass	g	-		
Melinis repens	Red Natal Grass	g	-		
Melinis minutiflora	Molasses Grass	g	-		
Poa annua	Winter Grass	g	-		
Panicum effusum	Hairy Panic	g	-		
Megathyrsus maximus var. maximus	Green Panic	g	-		
Paspalum dilatatum	Paspalum	g	-		
Phragmites australis [n]	Common reed	g	-		
Sorghum halepense [n]	Johnson grass	g	-		
Typha orientalis [n]	Typha	a	-		
Urochloa mosambicensis	Sabi Grass	g	-		
PORTULACACEAE					
Portulaca pilosa	Hairy pigweed	c	-		
PRIMULACEAE					
Anagallis arvensis	Scarlet Pimpernel	c	-		
PROTEACEAE					
Banksia integrifolia [n]	Coastal Banksia	t	-		
SAPINDACEAE					
Cardiospermum halicacabum	Balloon Vine	v	-		
Cupaniopsis anacardioides [n]	Tuckeroo	t	-		
Dodonaea triquetra	Hop Bush	s	-		

Family / Species	Common Name	Form	Declaration Category (LP Act)	Presence	Abundance
SOLANACEAE					
Solanum nigrum	Brazilian Nightshade	h	-		
VERBENACEAE					
Lantana camara	Lantana	s	3		
Lantana montevidensis	Creeping Lantana	c	3		
Verbena bonariensis	Purple Top	h	-		
Verbena aristigera	Mayne's Pest	h	-		
Vitex trifolia var *trifolia* [n]	Coastal Vivax	s	-		

* = Native

** = Native Weed

Appendix 3

2013 Survey Results

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
AGAVACEAE											
Agave sp.	Agave	-	X	-		-		-	X	-	X
AIZOACEAE											
Carpobrotus glaucescens*	Pigface*	-	X	X	X	X	-	-	-	-	-
Sesuvium portulacastrum*	Sea Purslane*	-	X	-	X	X	-	-	X	X	X
Tetragonia tetragonioides	New Zealand Spinach	-	-	-	-	-	-	-	-	-	-
AMARANTHACEAE											
Alternanthera denticulata*	Lesser Joyweed*	-	-	-	-	-	-	-	X	X	X
Alternanthera pungens	Khaki Weed	-	-	-	-	-	-	-	-	-	-
Amaranthus quitensis	South American Amaranthus	-	-	-	-	-	-	-	-	-	-
Amaranthus viridis	Green Amaranths	-	X	-	-	-	-	X	X	X	-
Gomphrena celosioides	Gomphrena Weed	-	-	-	-	-	-	-	X	X	-
ANACARDIACEAE											
Schinus terebinthifolius	Broad-leaf Pepper	3	X	X	X	X	X	X	X	X	X
APIACEAE											
Cyclospermum leptophyllum	Slender Celery	-	-	-	-	-	-	-	X	X	-
Centella asiatica*	Pennywort*	-	-	-	-	-	-	-	-	-	-
APOCYNACEAE											
Cynanchum carnosum*	Mangrove Wax Flower Vine*	-	X	X	-	-	-	-	-	-	-
Parsonsia straminea*	Common Silkpod*	-	X	-	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
ASCLEPIADACEAE											
Gomphocarpus physocarpus	Balloon Cotton Bush	-	X	-	X	X	-	-	-	-	X
ASPARAGACEAE											
Asparagus aethiopicus cv. sprengeri	Asparagus Fern	3	-	-	-	-	-	-	-	-	-
ASTERACEAE											
Ageratum houstonianum	Blue Billy-Goat Weed	-	X	-	-	-	X	X	X	X	X
Ambrosia artemisiifolia	Annual Ragweed	2	-	-	-	-	-	-	-	-	-
Ambrosia tenuifolia	Lacy Ragweed	-	-	-	-	-	-	-	-	-	-
Aster subulatus	Wild Aster	-	-	-	-	X	-	-	X	X	-
Baccharis halimifolia	Groundsel Bush	2	X	-	X	X	-	-	X	X	X
Bidens pilosa	Cobblers Pegs	-	X	X	X	X	X	X	X	X	X
Calyptocarpus vialis	Creeping Cinderella Weed	-	-	-	-	-	-	-	X	X	-
Cirsium vulgare	Spear Thistle	-	-	-	-	-	-	-	-	-	-
Conyza bonariensis	Flax-leaf Fleabane	-	X	-	-	X	-	-	-	-	X
Conyza pusilla	Canadian Fleabane	-	-	-	-	-	-	-	-	-	-
Conyza sumatrensis	Tall Fleabane	-	X	X	X	X	X	X	X	X	-
Cotula australis*	Carrot Weed*	-	X	X	-	-	-	-	X	-	-
Crassocephalum crepidioides	Thickhead	-	-	-	-	-	-	-	X	X	-
Gamochaeta calviceps	Cudweed	-	-	-	-	-	-	-	-	-	-
Emilia sonchifolia	Emilia	-	-	-	-	X	-	-	-	-	-
Hypochaeris radicata	Flatweed	-	-	-	-	-	-	-	-	-	-
Nerium oleander	Oleander	-	-	-	-	-	-	-	X	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Onopordum acanthium	Scotch Thistle	-	X	-	X	-	X	X	X	X	X
Parthenium hysterophorus	Parthenium	2	-	-	-	-	-	-	-	-	-
Pseudognaphalium luteoalbum	Jersey cudweed	-	-	-	-	-	-	-	-	-	-
Senecio madagascariensis	Fireweed	2	-	-	-	-	X	X	X	X	-
Sonchus oleraceus	Rough Sow Thistle	-	X	X	-	-	X	X	X	X	X
Sphagneticola trilobata	Singapore Daisy	3	-	-	-	-	-	-	-	-	-
Synedrella nodiflora	Cinderella Weed	-	-	X	-	-	-	-	-	-	-
Tagetes minuta	Stinking Roger	-	-	X	-	-	-	-	X	X	X
Tridax procumbens	Tridax Daisy	-	-	X	-	-	-	-	X	X	-
Wollastonia biflora*	Yellow Daisy *	-	-	X	-	-	-	-	-	-	-
ARECACEAE											
Syagrus romanzoffiana	Cocos Palm	-	-	X	-	-	-	-	-	-	-
AVICENNIACEAE											
Avicennia marina*	Grey Mangrove*	-	X	X	X	X	-	-	-	-	X
BALSAMINACEAE											
Impatiens walleriana	Imaptiens	-	-	-	-	-	-	-	-	X	-
BORAGINACEAE											
Heliotropium amplexicaule	Blue Heliotrope	-	-	-	-	-	-	-	-	-	-
BRASSICACEAE											
Brassica tourneforii	Wild Turnip	-	-	X	-	-	-	-	-	-	-
Cakile maritime	-	-	-	-	-	-	-	-	-	-	-
Lepidium africanum	Common Peppercress	-	-	X	-	-	-	X	-	X	-
CACTACEAE											

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Opuntia sp.	Prickly Pear	2	-	X	-	-	-	-	-	-	-
CAESALPINIACEAE											
Senna pendula var glabrifolia	Easter Cassia	-	-	X	-	-	-	-	-	-	X
CAMPANULACEAE											
Lobelia erinus	Lobelia	-	-	-	-	-	-	-	-	-	X
Wahlenbergia graniticola	Granite Bluebell*	-	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
CARYOPHYLLACEAE											
Cerastium glomeratum	Sticky Mouse-eared Chickweed	-	-	-	-	-	-	-	-	-	-
Polycarpon tetraphyllum	Four-leaved Allseed	-	-	-	-	-	-	-	-	-	-
CASUARINACEAE											
Casuarina equisetifolia*	Coastal Sheoak*	-	X	X	X	X	-	-	-	-	X
Casuarina littoralis*	Black Sheoak*	-	X	X	-	-	-	-	-	-	-
CHENOPODIACEAE											
Atriplex muelleri*	Annual Saltbush*	-	-	-	-	-	-	-	-	-	-
Dysphania littoralis*	Red Crumbweed*	-	-	X	-	X	-	-	-	-	-
Chenopodium ambrosioides	Mexican Tea / Kerosene Plant	-	-	-	-	-	-	-	-	-	-
Chenopodium sp.	-	-	-	-	-	-	-	-	-	-	-
Einadia sp.*	-	-	-	-	-	-	-	-	-	-	-
Enchylaena tomentosa*	Ruby Saltbush*	-	X	X	X	-	-	-	-	-	X
Sarcocornia quinqueflora*	Bead Weed*	-	X	X	X	X	-	-	-	-	X
Suaeda australis*	Sea Blite*	-	X	-	-	-	-	-	-	-	X
COMMELINACEAE											
Commelina benghalensis	-	-	X	X	-	-	-	X	X	X	-
Commelina diffusa (C. cyanea)*	Wandering Jew*	-	X	X	-	-	-	-	-	-	-
CONVOLVULACEAE											
Convolvulus arvensis	European Bindweed	-	X	-	-	-	-	-	-	-	-
Cuscuta campestris	Dodder	-	-	-	-	-	-	-	-	-	-
Ipomoea sp. (alba)	White Ipomoea	-	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Ipomoea cairica	Coastal Morning Glory	-	-	X	-	X	-	-	-	X	X
Ipomoea indica	Purple Morning Glory	-	-	X	-	-	X	-	X	X	-
Ipomoea pes-caprae*	Goats Foot Convolvulus *	-	-	-	-	-	-	-	-	-	-
Ipomoea quamoclit	Cypress Vine	-	X	X	-	-	-	-	-	-	-
CUPRESSACEAE											
Callitris endlicheri*	Black Cypress Pine*	-	-	X	-	-	-	-	-	-	-
Callitris sp.*	Cypress Pine*	-	X	X	X	-	-	-	-	-	-
CYPERACEAE											
Carex appressa*	Tall Sedge*	-	-	-	-	-	-	-	-	-	-
Cyperus aggregatus	-	-	-	-	-	-	-	-	-	-	-
Cyperus brevifolius	Mullumbimby Couch		X	X	-	-	-	-	X	X	-
Cyperus congestus	Clustered Flatsedge	-	-	-	-	-	X	X	-	-	-
Cyperus difformis*	Dirty Dora*	-	-	-	-	-	-	-	X	X	-
Cyperus eragrostis	Umbrella Sedge	-	-	-	-	-	-	-	X	X	-
Cyperus haspan*	Flat Sedge*	-	-	-	-	-	-	-	X	X	-
Cyperus polystachyos*	Bunchy Sedge*	-	X	X	-	X	X	X	X	X	-
Cyperus rotundus	Nut Grass	-	-	-	-	-	X	X	-	-	X
Cyperus vaginatus*	Stiff Flat Sedge*	-	-	-	-	-	X	X	X	X	-
Fimbristylis dichotoma*	Fringe Rush*	-	-	-	X	X	-	-	-	-	-
Fimbristylis ferruginea*	-	-	-	-	X	-	X	X	-	-	-
Isolepis cernua*	Nodding Club Rush*	-	-	X	-	-	-	-	-	-	-
Isolepis nodosa*	Knobby Club Rush*	-	-	-	-	-	-	-	-	-	-
Isolepis inundata*	Swamp Club Rush*	-	-	-	X	X	-	-	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Schoenoplectuslitoralis*	-	-	-	-	-	X	-	-	-	-	-
Schoenoplectus mucronatus*	Scripus Club Rush*	-	-	-		-	-	-	X	X	-
Schoenoplectus validus*	Club Rush*	-	-	-	X	X	-	-	-	-	-
EUPHORBIACEAE											
Chamaesyce maculata	Caustic Weed	-	X	X	-	-	X	X	X	X	-
Chamaesyce nutans	Nodding Spunge	-	-	-	-	-	X	X	-	-	-
Euphorbia hirta	Asthma Plant	-	-	-	-	-	-	-	-	-	-
Euphorbia prostrata	Caustic Creeper	-	X	X	-	-	-	X	-	X	-
Euphorbia cyathophora.	Painted Spurge	-	-	-	-	-	-	-	-	-	X
Macaranga tanarius*	Macaranga*	-	X	X	-	-	X	X	X	-	-
Phyllanthus tenellus	-	-	-	-	-	-	-	-	-	-	-
Phyllanthus virgatus*	Creeping Phyllanthus*	-	X	X	-	-	-	-	-	-	-
Ricinus communis	Castor Oil Plant	-	X	X	X	-	-	-	X	X	X
FABACEAE											
Canavalia rosea*	Coastal Jack Bean*	-	X	X	-	-	-	-	X	X	-
Centaurium erythraea	Common Centaury	-	-	-	-	-	-	-	-	-	-
Crotalaria incana	Woolly Rattle Pod	-	-	-	-	-	-	-	-	-	-
Crotalaria lanceolata	Lance-leaf Rattle Pod	-	-	-	-	-	-	-	X	X	-
Crotalaria pallida	Rattle Pod	-	-	-	-	-	-	-	-	-	-
Cullen tenax*	Emu Foot*	-	-	-	-	-	-	X	-	-	-
Desmodium uncinatum	Silver Leafed Desmodium	-	-	-	-	-	-	-	-	-	-
Indigofera hirsute	Hairy Indigo	-	-	X	-	-	-	-	-	-	-
Indigofera linifolia*	-	-	-	-	-	-	-	X	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Indigofera spicata	Creeping Indigo	-	-	-	-	-	-	-	X	X	-
Leucaena leucocephala	Leucaena	-	-	X	-	X	-	X	-	X	X
Macroptilium atropurpureum	Siratro	-	X	X	X	X	X	X	X	X	-
Macroptilium lathyroides	Phasey Bean	-	X	X	X	X	X	X	X	X	X
Medicago lupulina	Black Medic	-	-	-	-	-	-	-	-	-	-
Medicago polymorpha	Burr Medic	-	-	-	-	-	-	X	X	X	-
Medicago sativa	Lucerne	-	-	-	-	-	-	-	-	-	-
Melilotus albus	Bokhara	-	-	-	-	-	-	-	-	-	-
Melilotus indicus	Sweet Melilotus	-	-	-	-	-	-	-	-	-	-
Neonotonia wightii	Glycine	-	-	X	-	-	-	-	X	X	X
Sesbania cannabina	Sesbania Pea	-	X	-	X	-	X	-	X	-	-
Stylosanthes hamata	Verano Stylo	-	X	X	-	-	-	X	-	-	-
Stylosanthes humilis	Townsville Stylo	-	-	X	-	X	X	X	X	X	-
Trifolium repens	Clover	-	-	-	-	-	X	-	-	-	-
Trifolium fragiferum	Strawberry Clover	-	-	-	-	-	X	X	-	-	-
Vigna marina*	Yellow Beach Bean*	-	X	X	-	-	-	-	-	X	-
JUNCACEAE											
Juncus kraussii*	Jointed Rush*	-	-	-	-	-	-	-	-	-	-
Juncus usitatus*	Pale Reed*	-	-	-	-	-	-	-	X	X	-
LAURACEAE											
Cinnamomum camphora	Camphor Laurel	3	-	-	-	X	-	-	-	-	-
Cryptocaria sp.*	Laurel Tree*		-	-	-	-	-	-	-	-	-
LEMNACEAE											

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Spirodela punctata*	Duck Weed*	-	-	-	-	-	-	-	-	X	-
LORANTHACEAE											
Amyema sp.*	A Mistletoe*	-	-	X	-	-	-	-	-	-	-
LOMANDRACEAE											
Lomandra sp.*	Lomandra*		X	X	-	-	-	-	-	-	-
MALVACEAE											
Hibiscus tiliaceus*	Cotton Tree*	-	X	X	-	-	-	-	-	-	-
Malvastrum americanum	Spike Malvastrum	-	-	-	-	-	X	-	X	-	-
Sida cornifolia	Flannel Weed	-	X	X	-	X	-	-	-	-	-
Sida rhombifolia	Common Sida	-	-	-	-	-	-	-	X	X	-
MELIAECE											
Melia azedarach	White Cedar	-	-	-	-	-	-	-	-	X	-
MIMOSACEAE											
Acacia concurrens*	Black Wattle*	-	-	-	-	-	-	-	-	-	X
Acacia disparrima*	Hickory Wattle*	-	-	-	-	-	-	-	-	-	-
Acacia leiocalyx*	Curracabah*	-	X	X	-	-	-	-	-	-	-
MORACEAE											
Ficus elastica	Rubber Tree	-	X	X	-	-	-	-	X	-	-
MYRSINACEAE											
Anagallis arvensis	Scarlet Pimpernel	-	-	-	-	-	-	X	-	-	-
MYRTACEAE											
Eucalyptus robusta*	Swamp Mahogany*	-	X	X	-	-	-	-	-	-	-
Eucalyptus tereticornis*	Qld Blue Gum*	-	-	-	-	-	-	-	-	-	X

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Leptospermum sp.*	Tea Tree*		X	X	-	-	-	-	-	-	-
Lophostemon confertus*	Brush Box*	-	X	X	-	-	-	-	-	-	-
Melaleuca linariifolia*	Flax-leafed Paperbark*	-	X	X	-	-	-	-	-	-	-
Melaleuca quinquenervia*	Broad-leaved Paperbark*	-	X	X	-	-	-	-	-	X	-
Melaleuca salicina*	Willow Bottlebrush*	-	-	-	-	-	-	-	-	-	X
Melaleuca viminalis*	Weeping Bottlebrush*	-	X	X	-	-	-	-	-	-	-
ONAGRACEAE											
Ludwigia longifolia	Longlife Ludwigia	-	-	-	-	-	X	X	-	X	-
Ludwigia peploides*	Water Primrose*	-	-	-	-	-	-	-	X	X	-
Ludwigia peruviana	-	-	-	-	-	-	-	-	-	-	-
Oenothera drummondii subsp. drummondii	Beach Primrose	-	-	X	-	-	X	X	-	-	-
Oenothera laciniata	Cut-leaf Evening Primrose	-	-	X	-	-	-	X	-	X	-
OXALIDACEAE											
Oxalis corniculata	Creeping Oxalis	-	-	-	-	-	-	-	-	-	-
PAPAVERACEAE											
Argemone ochroleuca var. ochroleuca	Mexican Poppy	-	-	-	-	-	-	-	-	-	-
PANDANACEAE											
Pandanus tectorius*	Screw Pine*	-	X	X	-	-	-	-	-	-	-
PASSIFLORACEAE											
Passiflora cairica	Stinking Passion Vine	-	-	-	-	-	-	-	-	-	-
Passiflora foetida	-	-	-	-	-	X	-	-	-	-	X
Passiflora suberosa	Corky Passion Vine	-	-	-	-	-	-	-	-	-	X

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Passiflora subpeltata	White Passion Flower	-	X	X	-	-	-	-	-	X	-
PHYTOLACCACEAE											
Phytolacca octandra	-	-	-	-	-	-	-	-	-	-	X
PLANTAGINACEAE											
Plantago lanceolata	Lamb's Tongue	-	X	X	-	-	-	-	-	-	-
POACEAE											
Andropogon virginicus	Whisky Grass	-	-	-	X	-	X	-	-	-	-
Brachiaria decumbens	Signal Grass	-	X	X	-	X	-	-	-	-	-
Brachiaria mutica	Para Grass	-	X	X	-	-	-	-	-	-	-
Cenchrus ciliaris	Buffel Grass	-	-	-	-	-	-	-	-	-	-
Cenchrus echinatus	Mossman River Grass	-	X	X	-	X	X	X	X	X	-
Chloris gayana	Rhodes Grass	-	X	X	-	X	X	X	X	X	X
Chloris truncata*	Windmill Grass*	-	X	X	-	-	X	X	-	-	-
Chloris virgata	Feather-top Rhodes Grass	-	-	-	-	-	-	-	-	-	-
Cymbopogon refractus*	Barbed Wire Grass*	-	-	-	X	-	-	-	-	-	-
Cynodon dactylon	Couch Grass	-	X	X	-	X	X	X	X	X	X
Dichanthium aristatum	Angleton Grass	-	-	-	-	-	-	-	-	-	-
Dichanthium sericeum*	Queensland Blue Grass*	-	-	X	-	X	-	X	-	X	-
Digitaria ciliaris	Summer Grass	-	-	-	X	-	-	-	-	-	-
Echinochloa colona	Awnless Barn Grass	-	-	X	X	-	-	-	-	-	-
Echinochloa telmatophila	Swamp Barnyard Grass	-	-	-	-	-	-	-	-	-	-
Eleusine indica	Crowsfoot Grass	-	-	-	-	-	-	-	-	-	-
Eragrostis tenuifolia	Elastic Grass	-	-	-	-	-	X	X	-	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Eragrostis spectabilis*	Purple Lovegrass*	-	-	-	-	-	-	-	-	X	-
Eriochloa crebra*	Cup Grass*	-	X	-	-	X	-	-	-	-	-
Hemarthria uncinata*	Mat Grass*	-	-	-	-	-	-	-	-	-	-
Imperata cylindrica*	Blady Grass*	-	-	-	X	-	-	-	-	-	-
Lolium x hybridum	A Ryegrass	-	-	-	-	-	-	-	-	-	-
Leersia hexandra*	Swamp Club Rush*	-	-	-	X	X	-	-	-	-	-
Melinis minutiflora	Molasses Grass	-	-	-	X	-	-	-	X	X	-
Melinis repens	Red Natal Grass	-	X	X	-	X	X	X	X	X	X
Poa annua	Winter Grass	-	-	-	-	-	-	-	-	-	-
Panicum effusum*	Hairy Panic*	-	-	-	-	-	-	-	-	-	-
Panicum larcomianum	-	-	-	-	-	-	-	-	-	-	-
Panicum miliaceum	Millet Panic	-	-	-	-	-	-	-	-	-	-
Megathyrsus maximus var. maximus	Guinea Grass	-	X	X	X	X	-	X	X	X	X
Megathyrsus var. pubiglumis	Green Panic	-	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	Paspalum	-	X	X	X	X	-	-	-	-	-
Paspalum distichum	Water Couch	-	X	X	-	-	-	-	-	X	-
Phragmites australis*	Common Reed*	-	X	X	X	X	X	-	X	X	X
Polypogon monspeliensis	Beard Grass	-	-	X	-	-	-	-	X	-	-
Setaria sphacelata	South African Pigeon Grass	-	X	X	-	-	X	X	X	X	-
Sorghum halepense	Johnson Grass	-	-	-	-	-	-	-	-	-	-
Sporobolus africanus	Parramatta Grass	-	-	X	-	-	-	-	-	-	-
Sporobolus fertilis	Giant Parramatta Grass	2	-	-	-	-	-	-	X	-	-

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
*Sporobolus virginicus**	Salt Couch*	-	X	X	X	X	-	-	-	-	-
*Urochloa decumbens**	Signal Grass	-	-	-	-	-	-	-	-	X	-
Urochloa mosambicensis	Sabi Grass	-	X	X	-	-	X	X	X	X	-
Zoysia macarantha*	Prickly Couch*	-	-	X	-	-	-	-	-	-	-
POLYGONACEAE											
Persicaria decipiens*	Slender Knotweed*	-	-	-	-	-	X	X	X	X	-
Persicaria lapathifolia*	Pale Knotweed*	-	-	-	-	-	X	X	-	-	-
Rumex crispus	Curled Dock	-	-	-	-	-	-	-		-	-
Rumex brownii*	Swamp Dock*	-	-	-	-	-	-	-		-	-
PORTULACACEAE											
Portulaca oleracea	Pigweed	-	X	X	X	X	-	-	X	X	-
Portulaca pilosa	Hairy Pigweed	-	-	-	-	-	-	-	-	-	-
PROTEACEAE											
Banksia integrifolia*	Coastal Banksia*	-	-	X	-	-	-	-	-	-	-
RHIZOPHORACEAE											
Rhizophora stylosa*	Stilted Mangrove*	-	-	-	-	-	-	-	-	-	X
RUBIACEAE											
Richardia brasiliensis	Mexican Clover	-	-	-	-	-	-	-	-	-	-
SAPINDACEAE											
Cardiospermum halicacabum	Balloon Vine	-	-	X	-	-	-	-	-	-	-
Cupaniopsis anacardioides*	Tuckeroo*	-	-	-	-	-	-	-	-	-	-
Dodonaea triquetra*	Hop Bush*	-	X	-	-	-	-	-	-	-	-
SCROPHULARIACEAE											

SPECIES	COMMON NAME	LP Act CLASS	LUCINDA DRIVE		PORT GATE		T1-3		CAR PRECINCT		PORT WEST
			2012	2013	2012	2013	2012	2013	2012	2013	2013
Misopates orontium	Lesser Snapdragon	-	-	-	-	-	-	-	-	-	-
SOLANACEAE											
Datura stramonium	Common Thornapple	-	-	-	-	-	-	-	-	-	-
Physalis minima	Wild Gooseberry	-	-	-	-	-	-	-	X	-	-
Solanum chrysotrichum	Devil's Fig	-	X	X	-	-	-	-	-	X	X
Solanum mauritianum	-	-	-	-	-	-	-	-	-	-	X
Solanum seaforthianum	Brazilian Nightshade	-	-	-	-	-	-	-	-	-	-
Sonanum dulcamara	Climbing Nightshade	-	-	-	-	-	X	-	-	-	-
Solanum nigrum	Blackberry Nightshade	-	X	X	-	X	X	X	X	X	X
TAMARICACEAE											
Tamarix ramosissima	Tamarisk	-	-	-	-	-	-	-	-	-	-
TYPHACEAE											
Typha orientalis*	Cumbungi / Typha*	-	X	-	-	X	X	X	X	X	-
ULMACEAE											
Celtis sinensis	Chinese Elm	3	X	-	-	-	-	-	-	-	-
VERBENACEAE											
Lantana camara	Lantana	3	X	X	X	X	-	-	-	-	X
Lantana montevidensis	Creeping Lantana	3	-	-	-	-	-	-	-	-	-
Verbena aristigera	Mayne's Pest	-	-	X	-	-		X	X	X	-
Verbena bonariensis	Purple Top	-	X	X	-	-	X	X	X	X	X
Vitex trifolia var. trifolia*	Coastal Vitex*	-	X	X	-	-	-	-	-	-	-

Appendix 4

GPS Location of Declared Species

Scientific Name	Common Name	Location	Lat	Long
Schinus terebinthifolius	Broad-leaf pepper tree	Car Park Precinct	153.166347	-27.386282
Senecio madagascariensis	Fireweed	Car Park Precinct	153.166646	-27.387403
Lantana camara	Lantana	Lucinda Drain	153.177818	-27.383205
Opuntia stricta	Prickly Pear	Lucinda Drain	153.174971	-27.388514
Opuntia stricta	Prickly Pear	Lucinda Drain	153.17285	-27.390845
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.180161	-27.38027
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.180516	-27.380092
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.180599	-27.380063
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.18065	-27.380047
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.181006	-27.379525
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.181333	-27.378927
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.180879	-27.379433
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.180989	-27.379359
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.179573	-27.380547
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.178705	-27.381537
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.178522	-27.381785
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.177297	-27.383414
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.17705	-27.383677
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.174167	-27.388989
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.174072	-27.389136
Schinus terebinthifolius	Broad-leaf pepper tree	Lucinda Drain	153.168957	-27.392113
Baccharis halimifolia	Groundsel	Port Gate	153.161686	-27.40892
Baccharis halimifolia	Groundsel	Port Gate	153.16171	-27.409197
Baccharis halimifolia	Groundsel	Port Gate	153.161706	-27.409286
Baccharis halimifolia	Groundsel	Port Gate	153.161846	-27.409633
Baccharis halimifolia	Groundsel	Port Gate	153.162393	-27.409865
Baccharis halimifolia	Groundsel and pepper trees	Port Gate	153.162447	-27.409899
Baccharis halimifolia	Groundsel	Port Gate	153.163157	-27.410569
Baccharis halimifolia	Groundsel	Port Gate	153.163166	-27.410425
Baccharis halimifolia	Groundsel	Port Gate	153.162097	-27.409671
Baccharis halimifolia	Groundsel	Port Gate	153.161962	-27.409653
Baccharis halimifolia	Groundsel	Port Gate	153.161707	-27.408182
Baccharis halimifolia	Groundsel	Port Gate	153.161701	-27.408069
Baccharis halimifolia	Groundsel	Port Gate	153.1617	-27.407712
Baccharis halimifolia	Groundsel	Port Gate	153.16163	-27.407189
Baccharis halimifolia	Groundsel	Port Gate	153.161494	-27.405536
Cinnamomum camphora	Camphor laurel	Port Gate	153.161671	-27.409013
Lantana camara	Lantana	Port Gate	153.161672	-27.409012
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.168925	-27.392197
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161335	-27.404581
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161588	-27.40797
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161686	-27.40892

Scientific Name	Common Name	Location	Lat	Long
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161671	-27.409012
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161717	-27.409406
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.16279	-27.410187
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.16294	-27.410327
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.163119	-27.410515
Schinus terebinthifolius	Broad-leaf pepper tree	Port Gate	153.161753	-27.408634
Baccharis halimifolia	Groundsel	Port West	153.139987	-27.432247
Baccharis halimifolia	Groundsel	Port West	153.13887	-27.430026
Baccharis halimifolia	Groundsel	Port West	153.138804	-27.429809
Baccharis halimifolia	Groundsel	Port West	153.13874	-27.429693
Baccharis halimifolia	Groundsel	Port West	153.138698	-27.429609
Baccharis halimifolia	Groundsel	Port West	153.138632	-27.429444
Baccharis halimifolia	Groundsel	Port West	153.138571	-27.429271
Baccharis halimifolia	Groundsel	Port West	153.13854	-27.429193
Baccharis halimifolia	Groundsel	Port West	153.138473	-27.429026
Baccharis halimifolia	Groundsel	Port West	153.137894	-27.427712
Baccharis halimifolia	Groundsel	Port West	153.138699	-27.430787
Lantana camara	Lantana	Port West	153.139976	-27.43229
Lantana camara	Lantana	Port West	153.139868	-27.432385
Lantana camara	Lantana	Port West	153.139785	-27.432397
Lantana camara	Lantana	Port West	153.138788	-27.429774
Lantana camara	Lantana	Port West	153.138507	-27.429121
Lantana camara	Lantana	Port West	153.138482	-27.429052
Lantana camara	Lantana	Port West	153.138303	-27.428646
Lantana camara	Lantana	Port West	153.138146	-27.428297
Lantana camara	Lantana	Port West	153.138107	-27.428211
Lantana camara	Lantana	Port West	153.137893	-27.427714
Lantana camara	Lantana	Port West	153.137752	-27.42738
Lantana camara	Lantana	Port West	153.137188	-27.426138
Lantana camara	Lantana	Port West	153.137082	-27.42592
Lantana camara	Lantana	Port West	153.137001	-27.425721
Lantana camara	Lantana	Port West	153.139262	-27.432008
Lantana camara	Lantana	Port West	153.139868	-27.432664
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139987	-27.432247
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139841	-27.432376
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139786	-27.432398
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139399	-27.431692
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139073	-27.430526
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138871	-27.430025
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138846	-27.42993
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.13872	-27.429803
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138497	-27.429101

Scientific Name	Common Name	Location	Lat	Long
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.13847	-27.429027
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138399	-27.428804
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.13828	-27.428592
Schinus terebinthifolius	Broad-leaf pepper tree and Lantana	Port West	153.138107	-27.428216
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137974	-27.427956
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137894	-27.427714
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137508	-27.426841
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137103	-27.425986
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137083	-27.425919
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.137034	-27.425817
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138946	-27.430385
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.138515	-27.430895
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139302	-27.432032
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139352	-27.432085
Schinus terebinthifolius	Broad-leaf pepper tree and Lantana	Port West	153.139391	-27.432137
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139419	-27.432242
Schinus terebinthifolius	Broad-leaf pepper tree and Lantana	Port West	153.139469	-27.432421
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139807	-27.432614
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139892	-27.432613
Schinus terebinthifolius	Broad-leaf pepper tree	Port West	153.139927	-27.432748
Baccharis halimifolia	Groundsel	T1 - 3	153.165571	-27.39077
Baccharis halimifolia	Groundsel	T1 - 3	153.165274	-27.391765
Baccharis halimifolia	Groundsel	T1 - 3	153.165316	-27.391762
Baccharis halimifolia	Groundsel	T1 - 3	153.165512	-27.39155
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165498	-27.390721
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.169901	-27.390619
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.169304	-27.390383
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.169242	-27.390423
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165839	-27.390678
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.167599	-27.392017
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.167158	-27.392084
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165776	-27.392261
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165302	-27.392371
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.164848	-27.392085
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165316	-27.391762
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165558	-27.391483
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165742	-27.390959
Schinus terebinthifolius	Broad-leaf pepper tree	T1 - 3	153.165678	-27.390863
Senecio madagascariensis	Fireweed	T1 - 3	153.166246	-27.389314
Senecio madagascariensis	Fireweed	T1 - 3	153.166196	-27.389396

Scientific Name	Common Name	Location	Lat	Long
Senecio madagascariensis	Fireweed	T1 - 3	153.166178	-27.389416
Senecio madagascariensis	Fireweed	T1 - 3	153.165979	-27.389713
Senecio madagascariensis	Fireweed	T1 - 3	153.165801	-27.389973
Senecio madagascariensis	Fireweed	T1 - 3	153.165755	-27.390051
Senecio madagascariensis	Fireweed	T1 - 3	153.165677	-27.390155
Senecio madagascariensis	Fireweed	T1 - 3	153.16622	-27.389481
Senecio madagascariensis	Fireweed	T1 - 3	153.16653	-27.391159
Senecio madagascariensis	Fireweed	T1 - 3	153.166218	-27.39097
Senecio madagascariensis	Fireweed	T1 - 3	153.1687	-27.391708
Senecio madagascariensis	Fireweed	T1 - 3	153.16541	-27.391532

Appendix 5

Maps of Declared Species Locations

Client: Port of Brisbane Pty Ltd	**Lucinda Drain Declared Weed Species Locations**
Compiled by: CO — Date: 20/05/2013	
Approved by: LF — Date: 20/05/2013	**Appendix 5** — Project: Port of Brisbane Annual Plant Assessment

0 0.1 0.2 0.4 Kilometers

Datum: GDA94

RPS

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013

Client:	Port of Brisbane Pty Ltd
Compiled by:	CO
Date:	20/05/2013
Approved by:	LF
Date:	20/05/2013

0 60 120 240 Meters

Datum: GDA94

RPS

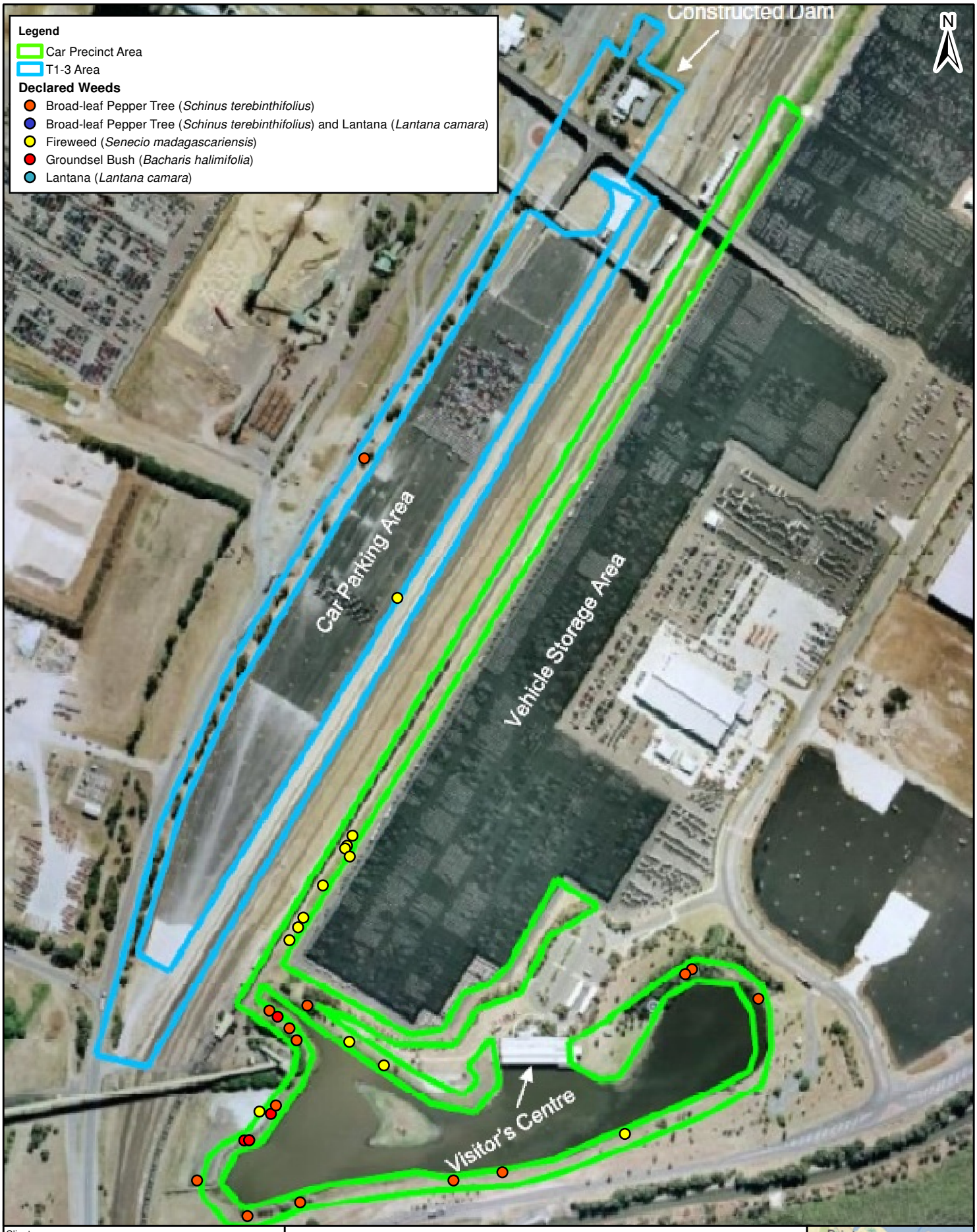
Port Gate Declared Weed Species Locations

Appendix 5

Project: Port of Brisbane Annual Plant Assessment

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013



Client: Port of Brisbane Pty Ltd	**T1-3 and Car Precinct Area Declared Weed Species Locations**
Compiled by: CO — Date: 20/05/2013	
Approved by: LF — Date: 20/05/2013	**Appendix 5** — Project: Port of Brisbane Annual Plant Assessment

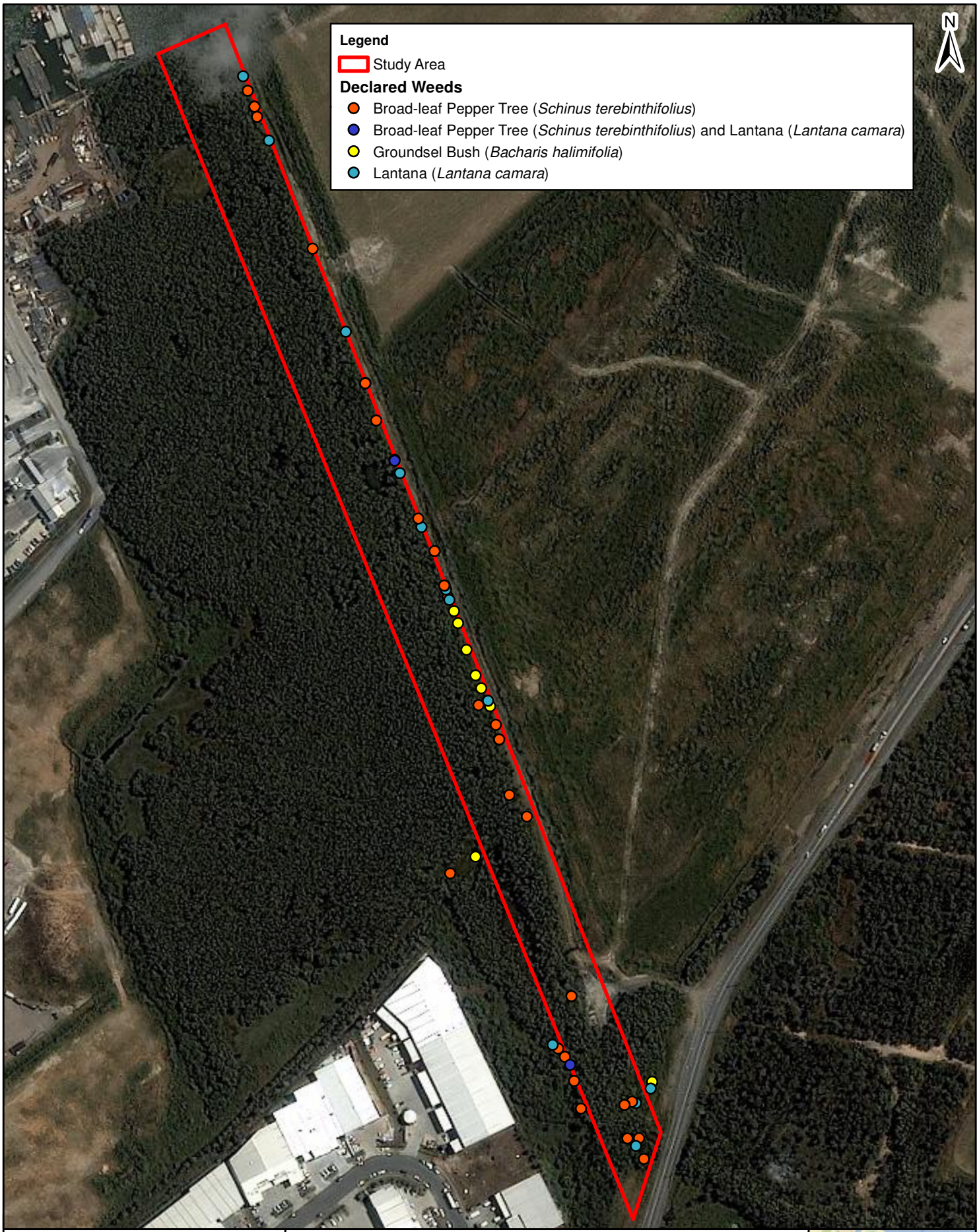
0 50 100 200 Meters

Datum: GDA94

RPS

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013



Client: Port of Brisbane Pty Ltd	**Port West Declared Weed Species Locations**
Compiled by: CO — Date: 20/05/2013	
Approved by: LF — Date: 20/05/2013	**Appendix 5** — Project: Port of Brisbane Annual Plant Assessment

0 45 90 180 Meters

Datum: GDA94

RPS

Source: Aerial Imagery: Google 2008

Tracking number: PR117445-1 20/05/2013

Appendix 6

LP Act Declared Species Fact Sheets

Broadleaved pepper tree

Schinus terebinthifolius

DECLARED CLASS 3

The problem

The broadleaved pepper tree is invading coastal dune areas, wetlands and along stream banks. It harbours a disease which can kill mangroves. The tree is choking out native plants and is becoming a serious problem. Broadleaved pepper tree is a garden escapee and native to Brazil.

The broadleaved pepper tree can also affect human and animal health as it contains toxic resins. Contact with the sap can cause persistent swelling, rashes, welts, running sores, swollen faces, colic and haemorrhages in the eyes. The pollen can cause respiratory difficulty.

Description

Broadleaved pepper trees can grow into a large spreading tree, up to 10 m high and broad. The leaves consist of 5–9 dark green leaflets and at the ends of the branches are small whitish flowers, followed by bunches of glossy, round red fruits 6 mm across. There are male and female trees, so not all bear fruit.

Management

Birds are attracted to the trees bright red berries and are the main method of spread of this tree. Removal should be done in winter. Revegetation of the cleared area should be pre-planned to ensure that other weeds do not gain a foothold in the disturbed area, and should include mulching to keep weeds down.

Hand pull or chip out young plants.

If the tree is chopped down be prepared for it to regrow and the roots to sucker, sometimes for up to six months. Treat these as they occur. Try cutting 2 inches below the soil, chip away all the bark and nail a tin plate down over the stump. Sometimes the plant won't start to regrow until 18 months after initial chopping.

Broadleaved pepper tree can be put through a wood chipper to make mulch.

Declaration details

Broadleaved pepper tree is a declared Class 3 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. The Act prohibits the supply or sale of Class 3 plants and may require their removal from environmentally significant areas.

Further information

Further information is available from the vegetation management/weed control/environmental staff at your local government.

TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF BROADLEAVED PEPPER TREE

Method	Herbicide	Rate	Registration status	Comments
Basal bark spray	fluroxypyr (200 g/L)	35 mL per 1 L diesel or kerosene	PERMIT 7485	Spray or paint the chemical on the full circumference of each stem.
Cut stump	glyphosate (360 g/L)	1 L per 1 L water	PERMIT 7485	Paint within 15 seconds of cutting
Foliar spray	fluroxypyr (200 g/L)	500 mL per 100 L water	Registered	Winter application or while the tree is in berry, providing that no replanting of desirable broadleaf plants is intended for 6 months.

Read the label carefully before use and always use the herbicide in accordance with label directions.

It is a requirement of a permit that all persons using the products covered by this off-label permit comply with the details and conditions listed in the permit. In addition read the herbicide label carefully before use and always use the herbicide in accordance with label directions. The above permit can be used by pest control operations, members of environmental groups such as Bushcare, Catchment Care, Coast Care and people employed as or working under supervision of local and state government officers.

Fact sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our website <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact should be used in accordance with the restrictions (federal and state legislation and local government laws) directly or indirectly related to each control method. These restrictions may prevent the utilisation of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.
© The State of Queensland (Department of Primary Industries and Fisheries) 2008

Invasive plants and animals

Groundsel bush

Baccharis halimifolia

DECLARED CLASS 2





Description

Groundsel bush is a densely-branched shrub usually no more than 3 m high. Stems are green maturing to brown and woody. Bark of mature plants is deeply fissured. Leaves are dull green, alternate, wedge-shaped, 2.5–5 cm long, 1–2.5 cm broad, with a few lobes in the upper part. Has a deep branching taproot with numerous fibrous laterals in the upper soil.

Male and female flowers are borne on separate plants. Male flowers are pale yellow and open around mid to late March, slightly earlier than the female flowers. Female flowers are white and inconspicuous at the end of branches until seeds are fully developed. Then the plant has a fluffy appearance with tufts of white hair (around late March to early April) that begin to blow the fluffy seeds in the breeze from mid to late April.

Problem

Economic

Groundsel bush rapidly colonises disturbed areas, especially overgrazed pastures. It competes with pasture species for water and nutrients. It spreads rapidly from windbourne seed making clearing groundsel bush from paddocks a very time consuming and expensive task.

Environmental

In native *Melaleuca* wetlands, groundsel bush can form a dense understorey, suppressing growth of native sedges and interfering with the natural ecosystem. Fire management may play an important role in controlling groundsel bush in this environment although no formal research has yet been conducted.

Groundsel bush can become abundant in the vegetation along watercourses and in coastal woodlands and forest areas if not controlled.

Social

The wind dispersed seed can be a nuisance in urban areas where it sticks to insect screens and germinates in home gardens. Urban problems include potential allergies caused by air-borne pollen and the air-borne seed 'fluff'.

Habitat and distribution

Groundsel bush is a native of Florida and coastal areas adjacent to the eastern side of the Gulf of Mexico.

It was introduced into the Brisbane region as an ornamental plant in the year 1900 and has spread along the coastal areas of south-east Queensland (north to Miriam Vale Shire) and down the New South Wales coast. Scattered plants have occurred as far west as the Chinchilla region.

Groundsel bush is a rapid coloniser of cleared, unused land and is particularly suited to moist gullies, salt marsh areas and wetlands. It also does well on high, cleared slopes.

Most germination occurs in the autumn/winter period. Plants normally do not flower in the first year of growth. Two metre tall plants can produce half up to a million seeds.

Seeds from mature plants drift in the breeze like thistle seeds, most falling within a few metres of the parent bush. Wind updraughts can carry seeds many kilometres.

Seeds germinate readily with rainfall, however, if they become buried they can remain dormant for several years.

Seeds are readily transported by wind, running water, vehicles and machinery. Soil disturbance in infested areas usually leads to substantial germination. Further infestation occurs unless the ground is sown to pasture or other competitive ground cover.

Declaration details

Groundsel bush is a declared Class 2 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. A **Class 2** pest is one that has already spread over substantial areas of Queensland, but its impact is so serious that we need to try and **control** it and avoid further spread onto properties that are still free of the pest. By law, all landholders must try to keep their land free of Class 2 pests and it is an offence to keep or sell these pests without a permit. A Local Government may serve a notice upon a landholder requiring control of declared pests.

Prevention

The spread of groundsel bush threatens the sustainability of agriculture and other land uses. Groundsel bush can replace plants and destroy habitat for native wildlife.

The best form of weed control is prevention. Always treat weed infestations when small, do not allow weeds to establish. Weed control is not cheap, but it is cheaper now than next year, or the year after. Proper management planning ensures you get value for each dollar spent.

Look at your weed problem carefully. Can you realistically eradicate it? Or should you contain the weed to stop new infestations developing while you reduce existing ones? What are you required to do by legislation? How does weed control fit into your property management plan? What can you do to restore areas and prevent re-establishment?

The best approach is usually to combine different methods. Control may include chemical, mechanical, fire and biological methods combined with land management changes. The control methods you choose should suit your particular situation.

Management strategies

In grazing situations good pasture management will greatly reduce groundsel bush invasions. Slashing, timely use of fertiliser and management of stocking rates can assist in control by maintaining a healthy pasture. Good pastures provide competition to limit re-invasion of groundsel bushes. Consult the Department of Primary Industries Pasture Agronomists on the best options for your property.

For tall, dense infestations burning can reduce the amount of above-ground material (and even kill the odd plant) making it a lot easier to spray regrowth. Annual burning does not reduce existing plant numbers, but allows grasses to establish more quickly and outcompete groundsel bush seedlings.

Regular slashing over a period of several years will result in a decreased level of infestation. In non-grazing situations re-forestation will eventually assist in control of groundsel bush. However, it is important to ensure that seed production is prevented while trees are establishing.

Mechanical control

Hand pull out small plants. Larger plants dig plants out or cut them off more than 10 cm below ground level.

As groundsel bush is a perennial woody plant with underground growing buds, **slashing or burning will rarely kill plants** and such action will generally result in regrowth occurring. Therefore the regrowth will need to be promptly controlled.

Biological control

Biological control in the process of introducing the natural enemies of the weed to reduce their growth and seed production, or kill them. Biological control agents are specific to that weed, they will not harm native or economically important plants. Biological control agents are released at specific locations from which they will naturally start seeking out more areas of the targeted weed.

Since the biological control program began for Groundsel bush in 1967 over thirty-five different insects have been tested but only six have become permanently established in the field.

The six insects established are:

1. Stem borer *(Megacyllene mellyi).* This beetle is restricted to areas adjacent to salt marshes where the sap flow in the host plant is lower. Newly hatched larvae are drowned by the heavier sap flow in plants growing in non-saline soils. Dense populations of this insect can reduce groundsel bush infestations in suitable habitats.
2. Plume moth *(Oidaematophorus balanotes).* This insect is present in all areas. Damage is caused by larvae tunnelling in the stems and varies from severe dieback to death of individual branches. Populations of the moth appear to be restricted by ant predation on the eggs and young larvae. This in turn restricts plant damage.
3. Gall-fly *(Rhopalomyia californica*). The larvae of this mosquito-like fly feed within development shoots and buds. Initially this insect caused heavy damage when it was released. However, soon after its release it was attacked by a small native wasp that drastically reduced gall numbers. Galls can always be found in low numbers, but occasionally higher numbers are found in patches. Overall damage to the plant is minimal.
4. Groundsel bush leaf beetle *(Trirhabda baccharidis*). This beetle is restricted to similar habitats as the stem borer where the larvae can form suitable cocoons and pupate in the soil. Plants will be totally defoliated in autumn but can recover and are in full leaf next spring. In some years larvae severely damage the buds and flowers.
5. Leaf skeletoniser *(Aristotelia ivae).* The larvae of this moth eat the soft leaf tissue leaving the skeletal woody veins. Though widespread, populations do not become large enough to cause significant damage. It is most commonly found in the spring on new leaves.
6. Leaf miner *(Buccalatrix iveila*). The larvae of this small moth mine in the leaf blades and later skeletonise the leaves in a manner similar to *Aristotelia*. This insect is widespread within the range of groundsel bush and causes minor damage.

Recent research has seen the move away from insect to plant disease biological control agents. Two diseases have been studied in Florida, USA. Experimental field releases of a rust fungus Puccinia evaders from Florida were commenced in 1998 and this pathogen is now established at several sites.

7. Groundsel bush rust (*Puccinia evadens*). This pathogen acts as both a leaf and a stem parasite causing defoliation during summer and winter and stem dieback over summer. The infection process requires a moisture film on the leaf or stem surface. The dry spores are spread by wind.

The presence of these biocontrol agents does not relieve landholders from their responsibility under Queensland legislation to control declared plants.

Herbicide control

Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Table 1 details the herbicides registered for groundsel bush control.

Further information

Further information is available from the vegetation management/weed control/environmental staff at your local government.

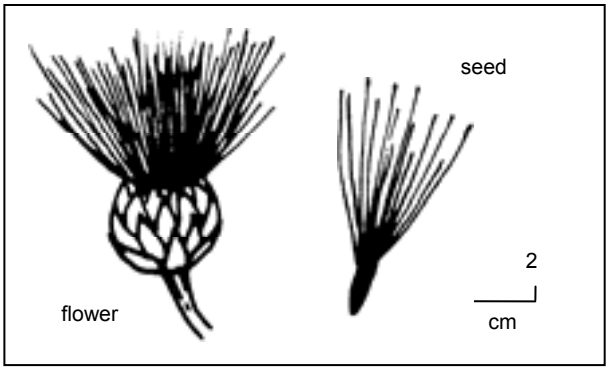


TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF GROUNDSEL BUSH

Situation	Herbicide	Rate	Comments[1,2,3]
pastures; non-agricultural, commercial, industrial land; rights-of-way	2,4-D amine (500 g/L)	3.6-5.5 L/ha 0.4 L/100 L 300 mL/15 L 1.2 L/15 L	air - higher rate for bushes high volume foliar spray cut stump misting
pastures; non-agricultural land	2,4-D acid	10 L/ha 33 mL/ 1 L kero or turps 100 mL/10 L 1 L/10 L	helicopter spraying basal bark or cut stump knapsack foliar spray sprinkler spray - 1 L/100 m^2
pastures	2,4-D ester 800 g/L 600 g/L e.g. AF rubbervine spray	0.25 L/ha 0.37 L/ha 1 L/40 L diesel	Do not spray in "hazardous areas" - consult local DPI office for further information Basal bark or cut stump
Commercial industrial land, pastures, rights-of-way	2,4-D sodium e.g. Tornado DF	0.275 kg/100 L	Spot spray
irrigation channels/banks; non-agricultural commercial industrial land; home gardens, pastures; rights of way; forests	glyphosate[5] - IPA 360 g/L	0.7-1 L/100 L 100 - 150 mL/15 L 1:9 (2x2 mL dose/0.5 m bush height)	handgun - high rate in winter knapsack foliar spray splatter gun foliage
commercial industrial land; pastures; rights-of-way	picloram + 2,4-D 75 g + 300 g e.g. Tordon 75-D®	0.65 L/100 L	spot spray foliage
commercial industrial land; pastures; rights-of-way; forests	picloram + triclopyr (premix) e.g. Grazon DS®* *Cannot be use in hazardous areas without a Department of Primary Industries Permit. Access	0.25-0.35 L/100 L 2.5 L/100 L 30 mL/15 L 1 L/60 L diesel	handgun foliage misting foliage knapsack foliage basal bark or cut stump
recreation commercial industrial land; pastures; rights-of-way; forests	Triclopyr 600g/L e.g. Garlon 600® home garden packs e.g. Defender Chemspray (Garden King)	0.16-0.32 L/100 L water 1 L/120 L diesel 25-50 mL/15 L 50 g/L 120 g/L 0.1-0.2 L/5 L water 0.1 L/0.5 L kerosene	overall spray foliage basal bark or cut stump knapsack foliage overall spray foliage basal bark or cut stump knapsack foliage basal bark or cut stump
grass pasture	dicamba + MCPA (premix) (e.g. Banuel M®)	2.8-4 L/ha 0.19-0.27 L/100 L 60 mL/15 L	 knapsack foliage
pastures; forests; rights-of-way	Clopyralid e.g. Lontrel®	0.33-0.5 L/100 L	handgun foliage
pastures	Tebuthiuron 200g/kg e.g. Graslan®	1 gm/m^2	hand application (use restrictions apply)

Notes:
1. Pasture legumes are susceptible to these herbicides.
2. Cut stump treatments – cut as close to ground as possible and apply mixture immediately (within 15 seconds).
3. Basal bark treatments – paint/spray 25 cm band around base of each stem.
4. Do not apply during summer or winter drought.
5. Glyphosate will kill pasture species.

Fact sheets are available from DPI&F service centres and the DPI&F Information Centre phone (13 25 23). Check our web site <www.dpi.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact should be used in accordance with the restrictions (federal and state legislation and local government laws) directly or indirectly related to each control method. These restrictions may prevent the utilisation of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, the Department of Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.
© The State of Queensland (Department of Primary Industries and Fisheries) 2007

Fact sheet

DECLARED CLASS 3 PEST PLANT

Lantana

Lantana camara

Currently, lantana covers more than 5 million ha of the east coast from southern New South Wales to Far North Queensland. Small infestations of lantana have also been found in central west Queensland, the Northern Territory, Western Australia, South Australia and Victoria. Efforts are under way to control these.

Lantana is mainly spread by people (as ornamental plants) and fruit-eating birds. It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles.

Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires.

Declaration details

All lantana species are declared Class 3 plants under the *Land Protection (Pest and Stock Route Management) Act 2002*. Lantana species cannot be sold or distributed and landholders may be required to control these plants if they pose a threat to an environmentally significant area.

Description and general information

Lantana is a heavily branched shrub that can grow in compact clumps, dense thickets or as a climbing vine.

The stems are square in cross section, with small, recurved prickles. Most leaves are about 6 cm long and are covered in fine hairs. They are bright green above, paler beneath and have round-toothed edges. Leaves grow opposite one another along the stem. When crushed the leaves produce a distinctive odour.

Flowers appear throughout most of the year in clustered, compact heads about 2.5 cm in diameter. Flower colours vary from pale cream to yellow, white, pink, orange and red. Lantana produces round, berry-like fruit that turn from glossy green to purplish-black when ripe.

For rural producers, lantana poses problems of stock poisoning and invasion of desirable pasture. An economic impact assessment indicated lantana costs the Queensland grazing sector in excess of $70 million (2005–06 values) per year.

PP34 March 2010

Queensland Government

It is now illegal to sell or distribute any variety of lantana in Queensland. However, garden plantings are still common in many areas and have the potential to cause problems of their own.

Despite being sold and marketed as 'sterile' plants, research indicates some ornamental lantana varieties have the ability to set seed and can spread vegetatively. They also produce some viable pollen and have the potential to cross-pollinate with wild forms, creating new varieties that could naturalise in the environment.

If the number of naturalised varieties increases due to genetic drift from ornamental varieties it will make finding effective biological control agents even more difficult, and potentially extend the climatic tolerances and range of the weed's spread.

Habitat and distribution

Lantana is native to the tropical and subtropical regions of Central and South America.

It is found throughout most coastal and subcoastal areas of eastern Australia, from Far North Queensland to southern New South Wales. It grows in a wide variety of habitats, from exposed dry hillsides to wet, heavily shaded gullies.

Toxicity

Many lantana varieties are poisonous to stock. It is difficult to tell which varieties are toxic so it is better to treat all forms as potentially poisonous. The toxins in lantana include the triterpene acids, lantadene A (rehmannic acid), lantadene B, and their reduced forms.

Most cases of lantana poisoning occur when new stock are introduced into lantana-infested areas. Stock bred on lantana-infested country avoid lantana unless forced to eat it due to lack of other fodder. Young animals introduced to lantana areas are most at risk.

Symptoms of lantana poisoning depend on the quantity and type of lantana consumed and, under some circumstances, the intensity of light to which the animals are exposed.

Early symptoms of depression are noticeable, with head swaying, loss of appetite, constipation and frequent urination. After a day or two the eyes and the skin of the nose and mouth start yellowing with jaundice, and the muzzle becomes dry and warm. The eyes may become inflamed and have a slight discharge. The animal also becomes increasingly sensitive to light. Finally, the muzzle becomes inflamed, moist and very painful ('pink nose'). Areas of skin may peel and slough off. Death commonly occurs 1–4 weeks after symptoms occur. Death from acute poisoning can occur 3–4 days after eating the plant.

If animals show any of the early symptoms, they should be moved to lantana-free areas, kept in the shade and monitored. Veterinary treatment should be sought immediately. Some remedies may include intravenous fluids, treating skin damage with antibiotics, or drenching with an activated charcoal slurry.

Care should be taken when introducing new or young animals into a paddock if lantana is present. Ensure they have enough fodder to stop them eating lantana in quantities sufficient to result in poisoning. During drought, animals should not be placed in lantana-infested areas without alternative food.

Control

Using a mix (integration) of control methods gives the best results. Size, density and geographic location of infestations are important considerations for choosing which control methods to use. A general principle is to commence control programs in areas of light infestations and work towards the denser infestations.

For large lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire, dozing/stick raking, slashing/cutting, aerial helicopter spraying can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable.

Lantana seed banks remain viable for at *least* four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted.

Appropriate fire regimes may become part of a management program to ensure lantana invasiveness is reduced and pasture is maintained.

Removal of lantana within areas of remnant vegetation may require a permit under the *Vegetation Management Act 1999*. Further information should be sought from the Department of Environment and Resource Management before works commence.

Mechanical control

Stick raking or ploughing can be effective in removing standing plants. However, regrowth from stumps and/or increased seedling germination in disturbed soil is common and the site will require follow-up treatment.

Grubbing of small infestations—for example, along fence lines—can be a useful and effective method of removing plants, though this is time consuming.

Repeated slashing can also reduce the vigour of lantana, exhausting its stored resources and reducing its likelihood of re-shooting.

Some locations—for example, very steep inclines or gullies—are not suitable for mechanical control options because of the danger of overturning machinery and soil erosion.

Fire

Regular burning will reduce the capacity of plants to survive; however, initial kill rates are variable.

The effectiveness of this method will depend on the suitability of available fuel loads, fire intensity, temperature, relative humidity, soil moisture and season. Pasture re-establishment can then provide competition to inhibit lantana seed germination.

Fire is not recommended in non–fire tolerant vegetated areas such as rainforest, or wooded or plantation areas.

A typical control program for fire may include:

- exclude stock to establish a pasture fuel load
- burning (may require a permit)
- sow improved pastures—consult your local Biosecurity Queensland officer for advice
- continue to exclude stock until pasture has established and seeded
- burn again in summer before rain and spot spray lantana regrowth when › 0.5 m high and when it is actively growing (see Table 1).

Herbicide control

Herbicide recommendations for lantana are shown in Table 1. Users of herbicides have a legal obligation to read herbicide labels and use only the registered rates. Always use herbicides responsibly; adhere to legislation and safety requirements.

Variation in results can be a result of inconsistent application methods, mix rates or seasonal variation. Red-flowered and pink-edged red-flowered lantana are often considered the most difficult to control because their leaves are often smaller and tougher. However, herbicides can kill these varieties if you carefully follow application procedures.

For single-stemmed lantana, basal bark spraying and cut stump methods also give good results at any time of year (but best when the plant is actively growing). On multi-stemmed varieties, you will obtain best results by carefully applying herbicide to each stem.

When treating actively growing plants less than 2 m high, overall spraying of foliage to the point of run-off is recommended. Splatter gun techniques are also effective and particularly useful in hard-to-access areas. This is best done in autumn—when sap flows draw the poison down into the root stock, but before night temperatures get too cold.

Remove grazing animals from spray areas during and soon after treatment. Stress can cause increased sugar levels in the leaves of lantana plants, making them more palatable.

Landholders and contractors should check if the property is situated in a hazardous area. This prevents the use of some chemicals, as defined in the *Agricultural Chemicals Distribution Control Act 1966*.

Biological control

Since 1914, 31 biological control agents have been introduced into Australia in an attempt to control lantana. Seventeen have established, of which several insect species cause seasonal damage, reducing the vigour and competitiveness of lantana in some areas.

Biosecurity Queensland research programs continue to investigate agents suitable for release in Australia, and test the viability of these agents in an effort to identify more effective biological control agents.

It is important to remember that biological control alone should not be relied upon for managing lantana infestations. Consideration should be given to other available control techniques.

The four most important biological control agents are:

- **sap-sucking bug (*Teleonemia scrupulosa*)**
  Found in dry areas from Cooktown to Wollongong, this small, mottled, bug feeds on the underside of leaves, growing tips and flower buds, causing the leaves to drop early and stopping the plant from flowering.
- **leaf-mining beetle (*Uroplata girardi*)**
  Found in most lantana infestations from Cape Tribulation to Sydney as well as around Darwin, except in very dry or high altitude areas. The adult beetles are dark brown. They shelter in curled leaves and feed on the upper leaf surfaces. Larvae feed in leaves causing blotches to spread across the leaf. This beetle reduces plant vigour and can suppress flowering.
- **leaf-mining beetle (*Octotoma scabripennis*)**
  Found in most lantana infestations from Atherton to Wollongong. Adults of this species feed on the upper leaf surface, while larvae feed and mine the centre of the leaf and cause blotches. This activity reduces plant vigour and can suppress flowering.
- **seed-feeding fly (*Ophiomyia lantanae*)**
  Found from Cape Tribulation to Eden in New South Wales and also around Darwin and Perth. *Ophiomyia* is a small black fly that feeds on flowers and lays eggs on the green fruits. The maggots of the fly eat the seed and make the fruit unattractive to birds, reducing seed spread.

Other agents such as *Aconophora compressa* (a stem-sucking bug) and *Leptobyrsa decora* (a sap-sucking bug) have caused some damage in specific geographic areas.

Note: Landholders are advised not to consume their time collecting established insects for distribution. Due to their own ability to disperse, these insects will be periodically/seasonally present in areas that are climatically suitable for them.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.deedi.qld.gov.au).

Table 1. Herbicides for control of lantana

Method of application: active ingredient (trade name)[a]	Rate	Optimum time[b]	Remarks
Foliar (overall) spray			
Fluroxypyr (Starane® 200)	0.5 L to 1 L/100 L water	December to April	Thorough wetting of plants is required, higher rate should be used for larger plants
Glyphosate (Roundup® 360, Glyphosate 360®)	1 L/100 L water	October to April	Wet plant thoroughly. Glyphosate affects any green plant it comes into contact with. Glyphosate is available in a range of strengths
Picloram + 2,4-D (Tordon® 75-D)	0.65 L/100 L water	February to April	Wet plant thoroughly. Legumes are affected if sprayed
Dichlorprop (Lantana® 600)	0.5 L/100 L water	December to April	Must thoroughly wet all leaves. Please refer to product label for situation details
Picloram + triclopyr + aminopyralid (Grazon Extra®)	0.35 L to 0.5 L/100 L water	February to April	Wet plant thoroughly. Use the higher rate on larger plants. Legumes may be affected if sprayed
2,4-D amine (Amicide® 625)	0.32 L/100 L water	March to May	Red-flowered lantanas are more resistant to 2,4-D. Will kill young legumes
Metsulfuron methyl, (Brush-off®, Brushkiller® 600,Lynx® 600)	10 g/100 L water[b]	March to May	Results variable. Not found effective in tropics. Follow-up sprays are necessary
Metsulfuron methyl + glyphosate (Cutout®)	95 g/100 L water	March to May	Apply to bushes up to 2 m tall. Spray to thoroughly wet all foliage and stems. Spray to penetrate throughout the bush
Metsulfuron methyl + glyphosate (Trounce®)	173 g/100 L water	March to May	Apply when actively growing. Do not apply during periods of stress
Aminopyralid + fluroxypyr (Hotshot®)	0.5 L to 0.7 L/100 L water	October to April	Spray all foliage, including stems, to the point of run-off
(i) Basal bark (ii) Cut stump			
Triclopyr (Garlon 600®)	1 L/60 L diesel	Any time. Best results when actively growing	(i) Apply to lower 40 cm of every stem. Must ensure complete coverage around stem (ii) Cut close to ground level. Immediately apply herbicide
2,4-D ester (AF Rubber Vine Spray®)	2.5 L/100 L diesel	Any time. Best results when actively growing	As above
Picloram + Triclopyr (Access®)	1 L/60 L diesel	Any time. Best results when actively growing	As above
Picloram (Vigilant® Herbicide Gel)	3 mm to 5 mm gel	Any time. Best results when actively growing	(ii) If diameter of stump is › 20 mm, use a minimum of 5 mm gel thickness
Glyphosate (Roundup®, Weedmaster Duo®)	Neat	Any time. Best results when actively growing	Off-label permit
Splatter gun			
Glyphosate (Roundup® 360)	1:9 glyphosate +water	October to April	2 x 2 ml dose per 0.5 m height of lantana
Metsulfuron methyl (Brushkiller® 600, Lynx® 600)	2 g/L water	March to May	As above
Aerial			
Picloram + triclopyr + 2,4-D (Grazon® DS + 2,4-D amine 625 g/L)	1.5 L + 6 L/ha or 10 L/ha (Grazon®)	When plant actively growing	Helicopter only. Minimum of 200 L water per hectare. Follow-up re-spray will be required. Do not burn within six months of treatment
Dichlorprop(Lantana® 600)	6 L to 8 L L/ha	When plant actively growing	As above

a Only some common trade names provided.
b Optimum times are only a guide. Lantana must be actively growing for the herbicide to work.
® = Registered trade name.
Labels often recommend the additional use of a wetting agent or surfactant within the mix. Herbicides types vary in their selectivity against other species and soil residual.

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Business Information Centre (telephone 13 25 23). Check our website at www.deedi.qld.gov.au ‹file://www.deedi.qld.gov.au› to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

© The State of Queensland, Department of Employment, Economic Development and Innovation, 2010

Prickly pear

Opuntia, Nopalea and Acanthocereus spp.

The introduction and spread of prickly pears into Queensland and New South Wales is one of the greatest environmental invasions of modern times.

Prickly pears were introduced into pastoral districts in the 1840s. By 1900, over 4 million hectares in Queensland and New South Wales was infested by prickly pear. By 1925, the pest had invaded over 24 million hectares. Control costs were prohibitive and the only effective herbicide at the time was hazardous. This resulted in landholders abandoning large tracts of land.

Research for biological control agents commenced in 1912, and in 1914 cochineal insects were released to control one of the minor prickly pear species. Control of this minor prickly pear species by these introduced insects occurred within a few years.

The success of the cochineal insects led to renewed efforts against other types of prickly pear in the 1920s. These efforts resulted in the control of the major pest prickly pear by the moth *Cactoblastis cactorum*; by the mid-1930s, prickly pear was no longer a major problem.

Several prickly pear species have since remained as minor weeds.

PP29 September 2009

Queensland Government

Declaration details

Prickly pear (*Opuntia* spp.) is a declared Class 1 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. *O. ficus-indica* is not declared. *O. Stricta, O. aurantiaca, O. monacantha, O. tomentosa* and *O. streptacantha* species are Class 2 declared pest plants and all other species are declared Class 1.

Description and general information

'Prickly pear' is a general term used to describe some plants of the Cactaceae family. The term includes species of *Opuntia, Nopalea* and *Acanthocereus*. All of these plants originate in the Americas. The term 'prickly pear' relates to the fruit that is often spiny and pear-shaped. Plants are normally leafless succulent shrubs. Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves.

Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures.

Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species. Prickly pear fruits vary between species and can be red, purple, orange, yellow or green.

Areoles (spots with clusters of spines) are found on both the pads (joints, segments) and fruit. In addition to spines, areoles often have clusters of sharp bristles (glochids) and tufts of fibre ('wool'). Each areole contains a growing point that can produce roots or shoots.

Life cycle

Prickly pears have several features that enable them to compete and become pests.

Prickly pears are drought resistant because of their succulent nature, their lack of leaves and their thick, tough skins. These features result in plants that use the majority of their internal tissues for water storage and their outer parts to reduce water loss and damage by grazing and browsing animals. They can remain vigorous in hot, dry conditions that cause most other plants to lose vigour or even die. Some species develop underground bulbs that enable the plant to resist fire and mechanical damage.

Prickly pears reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings. Seeds have hard seed coats that allow them to survive heat and lack of water. Asexual reproduction (cloning) of prickly pears occurs when pads (joints, segments) or fruits located on the ground take root and produce shoots. Animals and floods move broken pads long distances. These pads can survive long periods of drought before weather conditions allow them to set roots.

Habitat and distribution

Prickly pears considered pests in Queensland are:

- Common pest pear — *Opuntia stricta* var. *stricta* (= *O. inermis*)
- Spiny pest pear — *Opuntia stricta* var. *dillenii* (= *O. stricta*)
- Tiger pear — *Opuntia aurantiaca*
- Drooping tree pear — *Opuntia vulgaris* (= *O. monacantha*)
- Velvety tree pear — *Opuntia tomentosa*
- Westwood pear — *Opuntia streptacantha*
- Devil's rope pear — *Opuntia imbricata*
- Coral cactus — *Opuntia cylindrica*
- Snake cactus — *Opuntia fulgida* X *O. imbricate*
- Sword pear — *Acanthocereus pentagonus*

Common pest pear (*Opuntia stricta* var. *stricta*)

This bushy, spreading plant grows up to 1.5 m high and forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Common pest pear produces flowers that are 7.5 cm wide, bright lemon yellow and green at the base. The fruit is oval-shaped, has a deep cavity on one end and tapers at the other. Fruit is purple, 6 cm long and 3 cm wide, with carmine-coloured (dark red) seeds and a fleshy pulp.

Common pest pear is found as small to large clumps of varying density. The clumps are usually broken up by the action of *Cactoblastis cactorum*. Common pest pear occurs throughout most of central and southern Queensland and is still spreading westwards. It is often found along beaches and on offshore islands.

Spiny pest pear (*Opuntia stricta* var. *dillenii*)

This succulent shrub grows 1–2 m high. The stems are hairless and bluish-green or dull green. The stems are divided into pads up to 30 cm long, 15 cm wide and 1–2 cm thick. The areoles have tufts of short and finely barbed bristles accompanied by one or two yellow spines between 2 cm and 4 cm long. Small scale-like leaves are found on areoles of immature pads.

Spiny pest pear produces 6–8 cm wide flowers that are lemon yellow with green or pink markings on the back. The fruit is pear-shaped and about 4–6 cm long with a red-purple skin. The areoles located on fruits have fine, barbed bristles. The red flesh of fruits contains rounded seeds that are yellow or pale brown.

While this prickly pear once formed large-scale dense infestations, it is now found as small clumps or as scattered plants. These clumps are usually broken by the action of *Cactoblastis cactorum*. It is found in eastern central Queensland, the Burnett district, the Darling Downs and south-eastern Queensland.

Tiger pear (*Opuntia aurantiaca*)

This succulent low shrub with underground tubers usually grows 30–60 cm high. The stems are divided into very spiny, slightly flattened pads that are 1–30 cm long and 1–5 cm wide. The stems are dark green to purple and red in colour. The areoles have 3–7 brown barbed spines up to 4 cm long surrounded by tufts of short, fine bristles. The pads detach easily and are transported on the skins of animals. Small and scale-like leaves are found on areoles of immature pads.

Tiger pear produces 6 cm wide yellow flowers. The rarely formed fruits are pear-shaped and about 2.5 cm long. When ripe, they are red with purple markings.

Dense tiger pear forms an impenetrable spiny groundcover and is prevalent in southern Queensland but extends into central Queensland.

Drooping tree pear (*Opuntia vulgaris*)

This erect succulent shrub with fibrous roots grows up to 5 m high but is usually 2–3 m high. The branches are divided into glossy light green pads up to 45 cm long, 15 cm wide and 1.5 cm thick. The dark grey trunk grows up to 25 cm in diameter. Drooping tree pear gets its name because the upper segments tend to droop. The areoles on the older pads have 1–5 sharp spines about 5 cm long.

Small, scale-like leaves are found on areoles of very young pads that are quickly shed as the pad grows. Drooping tree pear produces yellow flowers that are 6 cm wide and have red markings on the back. The fruit is pear-shaped and 4–7 cm long with a green skin. The flesh of the fruit is red, pulpy and contains round seeds that are yellow or pale brown. The fruits have areoles with tufts of fine, barbed bristles.

Dense thickets result when drooping tree pear is allowed to grow freely. Small scattered infestations occur in the south-east corner of Queensland and in coastal northern Queensland.

Velvety tree pear (*Opuntia tomentosa*)

This tree-like plant forms a central woody trunk over 40 cm wide and grows up to 5 m high. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15–35 cm long, 8–12 cm wide and 1.5–2 cm thick.

Young plants have 2–4 white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange. The fruit is egg-shaped, about 5 cm long and 3 cm wide, and dull red. The top of the fruit is saucer-shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds within a reddish pulp.

Velvety tree pear is found predominantly throughout the brigalow belt of Queensland and is still extending its range. It is occasionally found as dense shrubs, but more usually as small clumps of trees or as trees scattered over the landscape.

Westwood pear, Cardona (*Opuntia streptacantha*)

Westwood pears are shrub-like or tree-like plants that form clumps by branching from the base. They are usually 2–4 m high. The stems are divided into almost circular dull green pads, 25–30 cm long and 15–20 cm wide. The areoles have white spines that vary in number and size when the plant matures.

Young pads have 2–5 white spines 1–2 cm long, accompanied by two hair-like spines 0.5 cm long in the lower part of the areole. Spines increase in number (up to 20) and size (5 cm long) in areoles along the trunk of the plant.

The flowers are yellow and fruits are barrel-shaped, 6 cm long and 5 cm wide with a flat top. The fruit has a purple skin and a rind that is 1 cm thick. Fruits contain red seeds buried in a dark red (carmine) pulp.

Westwood pear is found in eastern central Queensland as small clumps or as plants scattered over the landscape.

Devil's rope pear (*Opuntia imbricata*)

This open branching shrub grows 1.5–3 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 37 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined, rope-like appearance. The areoles are found on these ridges and produce 3–11 pale yellow or white spines, with the longest being 2.5 cm long. Papery sheaths cover these spines.

The flowers are a dull, red-purple colour and found at the ends of pads. The yellow fruit resembles a small, 5 cm wide custard apple and has a spineless areole at the top.

Devil's rope pear occurs in Queensland as a small infestation at Gladfield.

Coral cactus (*Opuntia cylindrica*)

Coral cactus grows as a branching shrub 1–1.5 m in high. The stems of coral cactus are divided into green cylinder-like pads that are fist-like and obtuse at their apex. Mature coral cactus pads widen, become distorted and wavy, and resemble a piece of coral. Areoles along the pads have a number of short white spines.

Coral cactus produces small (1–2 mm wide) scarlet flowers. The fruit is yellow-green and 2–5 cm wide.

Coral cactus has been located near Mount Isa, Longreach, Wyandra, Eulo and Hungerford but its potential spread includes all of far western Queensland.

Snake cactus (*Opuntia fulgida* X *O. imbricata*)

This open branching shrub grows 1–2 m high. The stems are divided into hairless, dull green, cylindrical pads that vary up to 20 cm in length and are 3.5–5 cm thick. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on the bottom of these ridges and produce 5–10 pale yellow to brown spines, with the longest being 3 cm long.

The flowers are light red to dark rose and commonly 5–7 cm wide. Snake cactus produces fruit that is yellow and 2–5 cm wide.

Snake cactus has been located near Longreach but its potential spread includes all of north-western Queensland.

Sword pear (*Acanthocereus pentagonus*)

This elongated branching shrub grows in clumps up to 4 m high. The stems are erect, up to 1.5 m long, 3–8 cm wide and divided into many joints. Sword pear stems are three-, four- or five-angled and resemble star-picket posts. The areoles are found on the edges of the joints and produce many white spines 1–4 cm long.

The flowers are white, funnel-shaped and 14–20 cm long. The flowers open at night between spring and summer. Sword pear produces bright red sphere-shaped fruits that are 5 cm in diameter. The fruit has a red pulp and black seeds.

Sword pear occurs in the Gogango area west of Rockhampton.

Control

Biological control

Investigations into biological control agents against prickly pears began in 1912. Over 150 insect species were studied throughout the world, with 52 species selected for transport to Queensland. Following intensive host specificity testing, 18 insects and one mite were released in Queensland. Nine insects and the mite remain established in Queensland. These species are:

- *Cactoblastis cactorum*, a stem-boring moth
- *Dactylopius ceylonicus*, a cochineal mealybug
- *Dactylopius opuntiae*, a cochineal mealybug
- *Dactylopius confusus*, a cochineal mealybug
- *Dactylopius tomentosus*, a cochineal mealybug
- *Dactylopius austrinus*, a cochineal mealybug
- *Chelinidea tabulata*, a cell-sucking bug
- *Tucumania tapiacola*, a stem-boring moth
- *Archlagocheirus funestus*, a stem-boring beetle
- *Tetranychus opuntiae*, prickly pear red spider mite.

These biological control agents continue to keep several prickly pears under control. It is important to remember not all the agents attack all prickly pears.

The most successful of these species were the moth *Cactoblastis cactorum* and five cochineal mealybugs—*Dactylopius ceylonicus, D. opuntiae, D. confusus, D. tomentosus* and *D. austrinus*. The other agents are still around but not in sufficient numbers to provide control.

Cactoblastis cactorum (cactoblastis moth)

Larvae of this moth were introduced from Argentina in 1925. Cactoblastis proved to be the most effective agent against the common and spiny pest pears, destroying massive infestations in Australia. Larvae keeps these two pest pears controlled to an acceptable level most of the time, although it is less effective in some coastal and far western areas.

The larvae collectively eat out the contents of the pads leaving empty pad skins and piles of mushy droppings. The orange and black larvae are occasionally observed on the outsides of pads. Cactoblastis also attacks most types of prickly pear but is not effective against them.

Dactylopius spp. (cochineal insects)

All female cochineal insects are small, sessile mealy bugs that spend their adult lives permanently attached to their host plants sucking plant juices. They are covered by a fine, white, waxy secretion and when crushed yield a carmine colouring. The adult males are small, free-flying insects that do not feed.

Dactylopius ceylonicus (monacantha cochineal, Argentine cochineal)

This South American mealy bug was released in 1914 and 1915 to control drooping tree pear. It destroyed the dense infestations existing at that time. It is specific to drooping tree pear and today remains the only effective biological control agent for drooping tree pear. This insect needs to be distributed manually.

Dactylopius opuntiae (prickly pear cochineal)

This mealy bug was introduced from Mexico and southern United States between 1920 and 1922. It is effective against common pest pear, spiny pest pear, velvety tree pear and Westwood pear and remains the main biological control agent against velvety tree pear and Westwood pear. This insect spreads slowly in nature and can be assisted manually.

Dactylopius confusus (prickly pear cochineal)

This mealy bug was introduced from Florida and released in 1933 against spiny pest pear. It remains effective against spiny pest pear in central Queensland but spreads slowly. This insect can be spread manually.

Dactylopius tomentosus (devil's rope pear cochineal)

This mealy bug was introduced from southern United States in 1925 and 1926. It is effective against devil's rope pear but works slowly.

Dactylopius austrinus (tiger pear cochineal)

This mealy bug was introduced from Argentina in 1932. It is specific to and effective against tiger pear. It rapidly reduces tiger pear populations but dies out in a paddock after the destruction of tiger pear. It needs to be reintroduced after tiger pear regrows.

Chelinidea tabulata (prickly pear bug)

This plant-sucking bug was introduced from Texas in 1921. It was effective against dense common pest pear before *Cactoblastis cactorum* was but is now relatively ineffective. This insect also attacks most other prickly pears. The adult is a pale brown bug up to 20 mm long that leaves characteristic round bleached spots on the surface of the cactus.

Tucumania tapiacola (prickly pear moth-borer)

This moth was introduced from Argentina in 1934 against tiger pear. Its solitary larvae feed internally and eat out tiger pear pads with limited effect. It has been observed attacking common pest pear and harrisia cactus.

Archlagocheirus funestus (tree pear beetle)

This stem-boring beetle was introduced from Mexico in 1935. It was effective against velvety tree pear and Westwood pear but has become rare since the dense stands of these prickly pears have gone.

Tetranychus opuntiae (prickly pear spider mite)

This mite was introduced from southern United States and Mexico in 1922. It was effective against common pest pear but is now rare and difficult to find. It causes distinctive scar tissue formation around areoles.

Distributing biological control agents

Cactoblastis

Cactoblastis can be spread manually by distributing eggs or larvae. Cactoblastis moths lay chains of eggs (eggsticks) on prickly pear pads from January–February and September–November. The eggsticks are distinguished from spines by their curved appearance.

1. Collect the fragile eggsticks carefully.
2. Glue single eggsticks to small pieces of paper using a starch-based adhesive.
3. Pin the egg papers to prickly pear pads. (Eggs take up to one month to hatch.)
4. Collect pads or plants in which larvae are obviously still active.
5. At a release site place all the collected plant material in a small part of the infestation.
6. Subsequent generations of moths will disperse through the infestation.
7. Follow up the biological control with either herbicide or mechanical treatment.

Cochineals

Because several cochineal insects affect some prickly pears and not others, it is essential to know what prickly pear you wish to control.

1. Identify your prickly pear type.
2. Find the same prickly pear type which is being attacked by a cochineal.
3. Collect pads of the prickly pear with the insects.
4. Place affected pads against unaffected prickly pears at the release site.
5. Follow up the biological control with either herbicide or mechanical treatment.

Tiger pear cochineal

Tiger pear cochineal is easy to multiply quickly after collection.

1. Carefully collect a reasonable quantity of unaffected tiger pear in a container (box or bucket).
2. Place a few pieces of cochineal-affected tiger pear into the same container.
3. Cover the container with a cloth and store under cover for a few weeks.
4. Check the cactus occasionally.
5. When most of the tiger pear in the container has cochineal, it is ready to distribute.
6. At the release site place affected pads against unaffected prickly pears.
7. Follow up the biological control with either herbicide or mechanical treatment.

Note: It is best to multiply tiger pear cochineal before release.

Mechanical control

Mechanical control using machinery is difficult because prickly pear pads can easily re-establish. A hot fire is an effective control method for dense prickly pear infestations. Before burning, consult Queensland Primary Industries and Fisheries to see if this practice is suitable for your pasture and land management practices.

Herbicide control

Herbicide options available for the control of prickly pears in Queensland are shown in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the *Agricultural Chemicals Distribution Control Act 1966* prior to spraying.

Further information

Further information is available from your local government office, or from your local primary industries and fisheries biosecurity officer: contact details are available through 13 25 23.

Table 1 Herbicides registered for the control of prickly pears

Herbicide	Situation	Rate	Method	Comments
Triclopyr	Forest—timber production; land—commercial/ industrial, non-agricultural, pastures, rights of way	0.8 L/60 L diesel	Overall spray	For use against common prickly pear, drooping prickly pear, tiger pear
Triclopyr	Forest—timber production; land—commercial/ industrial, non-agriculture, pastures, rights of way	3 L/100 L water	Overall spray	For use against common prickly pear, drooping prickly pear and tiger pear
Picloram + Triclopyr	Agricultural land—non-crop; forest—timber production; land—commercial and industrial, pastures, rights of way	1 L/60 L diesel	Basal bark/ cut stump	For use against velvet tree pear, tree pears, tiger pear, common prickly pear, snake cactus
Amitrole	Land—around buildings, commercial/industrial, non-agricultural, rights of way	1 ml/3 cm	Inject	
		1 L/25 L	Overall spray	Small plants or regrowth

Fact sheets are available from Queensland Primary Industries and Fisheries service centres and the Queensland Primary Industries and Fisheries Business Information Centre (telephone 13 25 23). Check our website at www.dpi.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this pest fact should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, Queensland Primary Industries and Fisheries does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

© The State of Queensland, Department of Employment, Economic Development and Innovation, 2009

PR09_4541N

Fact sheet

DECLARED CLASS 2 PEST PLANT

Fireweed

Senecio madagascariensis

Fireweed is an introduced weed that competes strongly with pasture species and is toxic to livestock. It is responsible for illness, slow growth and poor conditioning of cattle, and can result in death.

Heavy infestations of fireweed often result from neglect of steadily increasing fireweed infestations in previous years, and lack of good ground cover caused by overgrazing, drought, fire or slashing.

Declaration details

Fireweed is a declared Class 2 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. A Class 2 pest is one that has already spread over substantial areas of Queensland, but its impact is so serious that we need to try and control it and avoid further spread onto properties that are still free of the pest. By law, all landholders must try to keep their land free of Class 2 pests and it is an offence to keep or sell these pests without a permit. A local government may serve a notice upon a landholder requiring control of declared pests.

PP31 January 2011

Description and general information

Fireweed is an annual or a short-lived perennial. It is a daisy-like herb that can vary greatly in size and shape depending on environmental conditions. In dry, harsh conditions it may be less than 20 cm tall with narrow leaves, no branching and few flowers. In ideal conditions fireweed will grow to 50 cm tall with multiple branches, long wide leaves (6 cm × 2 cm) and about 100 flowers.

The leaves are alternate, dark green with serrated margins, and are usually 2–6 cm long. The flowers are bright yellow, daisy-like with a diameter of approximately 2 cm, and produce up to 100 seeds each. It is very similar to a range of native *Senecio* species.

Seeds are small, cylindrical in shape, and 2–3 mm long. Each seed has rows of very fine short hairs and a silky pappus (parachute). Flowers and seeds are produced continuously over the growing season. An average plant can produce over 10 000 seeds during this time.

Fireweed has a shallow branched taproot with many fibrous roots. The shallow roots often allow plants to fall over in windy conditions. When this happens the stem will sprout roots wherever it touches the ground.

Life cycle

Fireweed can be an annual but many plants do survive through the summer, so plants of all ages can be present at the same time.

Seeds germinate in mild, warm conditions (15–27 °C) in the presence of light and moisture. Most seedlings appear between March and June then grow quickly to produce their first flowers in 6–10 weeks.

Fireweed usually begins to die back in spring. The top growth dies, leaving the base and roots that can last through the summer and re-grow in the following autumn. Depending on rainfall, some plants continue to grow and produce flowers, and seed through summer.

A dry summer followed by autumn or winter rains leads to heavy fireweed infestations.

Poisoning

Unless fireweed poisoning is severe it can be difficult to detect, because the symptoms (such as reduced weight gain and/or low milk production) can have a variety of causes.

Symptoms of more severe poisoning are loss of appetite, aimless wandering, loss of coordination, sensitivity to sunlight, jaundice and abdominal straining with rectal eversion. Severe poisoning will result in death, and an autopsy will reveal chronic liver sclerosis.

All growth stages contain pyrrolizidine alkaloids that damage the liver. Fireweed is toxic when green or dry, therefore contaminated hay or silage may be toxic.

Fireweed is generally unpalatable to cattle, so poisoning is most likely to occur when fireweed plants are dense and stock can not feed selectively, or when there is a shortage of pasture and hungry stock are less selective about food.

Sheep and goats are less susceptible to fireweed poisoning and can graze in fireweed-infested paddocks for at least one season. Toxins found in fireweed are able to taint the milk of goats that graze this plant. Goats for milk production should not be allowed to graze in fireweed-infested paddocks.

Habitat and distribution

Fireweed is native to Madagascar and southern Africa, and was first recorded in Australia in the Hunter Valley in 1918. It is not known how it was introduced, but it could have been brought in privately as a garden plant. It spread slowly at first, but in the last 30 years it has rapidly increased its range, most likely aided by modern transport and rural practices.

Fireweed is a weed of beef and dairy pasture east of the Great Dividing Range, and is currently established along the entire New South Wales coast and north to Brisbane.

Isolated infestations have been found near Caboolture, Cooroy, Belli Park, Maleny, Yandina, Pelican Waters and as far north as Gympie.

Fireweed is spreading northward and has the potential to infest extensive areas of valuable pasture north of Brisbane. A prediction based on climate and land use suggests that fireweed has the potential to be a serious pest as far north as Rockhampton.

Even light infestations of fireweed can produce 1 million seeds per hectare. Seeds are light and have a pappus that enables them to be carried by the wind. The seeds also have rows of short hairs that can loosely cling to animals. Fireweed can be spread short distances by wind and stock. However, it is spread over greater distances in pasture seed, hay, turf, mulch and with stock transport. Fireweed seed can also be spread as a contaminant in transported materials such as hydromulch and grass seed.

Control

Management strategies

The best approach to fireweed control is to prevent it establishing by ensuring that there is a dense cover of pasture in autumn and winter. Waiting until autumn to begin pasture improvement will worsen the fireweed problem because fireweed (which germinates in autumn) will be promoted ahead of the pasture by fertilising and direct drilling of winter pasture species.

When small infestations of fireweed are identified, act immediately to prevent the situation from becoming worse and to increase the likelihood of eradication.

The best control for fireweed incorporates integrated management strategies, including herbicides and mechanical methods in addition to vigorous permanent pastures that can compete strongly with fireweed seedlings.

Biological control

A number of organisms can be found attacking fireweed, but any effect they have is temporary and isolated. An orange rust (*Puccinia lagenophorae*) is common and often affects fireweed, particularly in lower country. The blue stem borer moth (*Patagoniodes farinari*) is also common, but the larvae usually develop too slowly to have an impact. Two moths imported from Madagascar were host tested. In controlled tests they were found to feed on important non-target plants so no releases were made and all these insects were destroyed.

Other potential biological control agents have been identified, but rigorous testing is needed to ensure that they do not feed on closely related Australian native plants. No new agents are expected to be released in the near future.

Mechanical control

Chip out, bag and burn any isolated plants or dispose of them at council-approved landfill tips. You should not burn any toxic plants in household wood-burning stoves or heaters. Remove chipped-out plants from paddocks because they may still set seed and poison stock.

Slashing is usually not effective as it may lead to increased stock poisoning. Slashing tends to give a good visual effect because it removes the flowers, but at best it delays flowering and seeding and at worst damages the pasture, making conditions more favourable for fireweed.

Fireweed remains toxic after being cut and becomes more attractive to stock and thus more likely to cause poisoning.

Herbicide control

Herbicides are most effective if sprayed before plants reach maturity. However, application during flowering will be effective if higher recommended rates of herbicide are applied.

Research is ongoing at the Alan Fletcher Research Station for herbicide controls against fireweed, including residual control methods. Trials have shown herbicide application in the autumn period during April provides good control. Before undertaking such programs landholders are advised to determine the infestation levels.

An effective application method in an open pasture situation is a boom spray. Follow this up by spot spraying, or pulling and bagging any regrowth or missed plants.

Boom spraying is also suitable for follow-up treatments, as it allows destruction of immature plants, which may otherwise grow to re-seed the area before they can be noticed.

Bromoxynil (trade names Bromicide 200, Brominil 200 and Buctril 200) is suitable for use in pastures containing clovers, medics and lucerne, and it will not affect grass.

Bromoxynil is effective if used on seedlings, which usually appear in autumn and early winter but may appear later following rain. Twice as much bromoxynil is needed if it is applied to plants that are just beginning to flower. Bromoxynil is less effective on mature plants, as it is a contact herbicide only. Mature plants will only be killed off where the bromoxynil comes into contact with the plant, allowing recovery of the plant from lower, untouched portions.

Unfortunately, fireweed control is often not considered until the highly visible flowers appear and it is too late for effective control with herbicide.

Table 1 (overleaf) lists herbicides registered for fireweed control. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for the control of fireweed

Situation	Herbicide	Rate	Registration status	Comments
Agricultural non-crop land, bushland, forests, wetlands, coastal and adjacent areas	2,4-D (625 g/L)	300 ml/100 L water or 3 L/ha	PERMIT 11463	Spot spray only.
Agricultural non-crop land, commercial and industrial land, forests, pastures and right-of-way areas	Aminopyralid (10 g/L) + fluroxypyr (333 g/L)	500 ml/100 L water	Registered	Apply as a high-volume or spot spray to flowering plants up to 30 cm tall.
Agricultural non-crop land, commercial and industrial land, forests, pastures and right-of-way areas	Triclopyr (300 g/L) + picloram (100 g/L) + aminopyralid (10 g/L)	350 ml/100 L water	Registered	Apply as a high-volume or spot spray when the plant is flowering.
Agricultural non-crop land and pastures	2,4-D (300 g/L)	700 ml/100 L water	Registered	Apply as a high-volume spray when the plant is actively growing.
Pastures and improved pastures (containing clover and/or lucerne)	Bromoxynil (200 g/L)	1.4 L/ha seedling control, 2.8 L/ha for early flowering plants	Registered	Apply during the autumn–winter period when plants are young and actively growing. Not effective on mature plants.
Improved pastures (containing clover and/or lucerne)	Bromoxynil (250 g/L) + diflufenican (25 g/L)	500 ml/ha	Registered	Seedling control up to the four leaf stage
Improved pastures (containing clover)	MCPA (250 g/L) + diflufenican (25 g/L)	1 L/ha	Registered	Seedling control up to the four leaf stage

It is a requirement of a permit that all persons using the products covered by the off-label permit PER11463 comply with the details and conditions listed in the permit. In addition, read the herbicide label carefully before use and always use the herbicide in accordance with label directions. The above permit can be used by pest control operators, members of environmental groups such as Bushcare, Catchment Care, Coast Care, and people employed as or working under supervision of local and state government officers.

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

© The State of Queensland, Department of Employment, Economic Development and Innovation, 2011.

PR11–5583

Fact sheet

DECLARED CLASS 3 PEST PLANT

Camphor laurel

Cinnamomum camphora

Camphor laurel was introduced into Australia from Asia in 1822. It has been promoted and planted as a garden ornamental throughout Queensland.

Camphor laurel is an attractive shade tree, but can be very destructive—it aggressively replaces native vegetation. The long-term consequences of its spread may result in the loss of native wildlife and agricultural productivity over large areas of south-east Queensland.

Camphor laurel invades pastures and disturbed riparian systems. It tends to germinate under fences and power lines (wherever birds rest and deposit the seed). As a result, it can push fences over and disrupt power facilities. It is a troublesome weed on dairy farms throughout south-east Queensland and northern New South Wales.

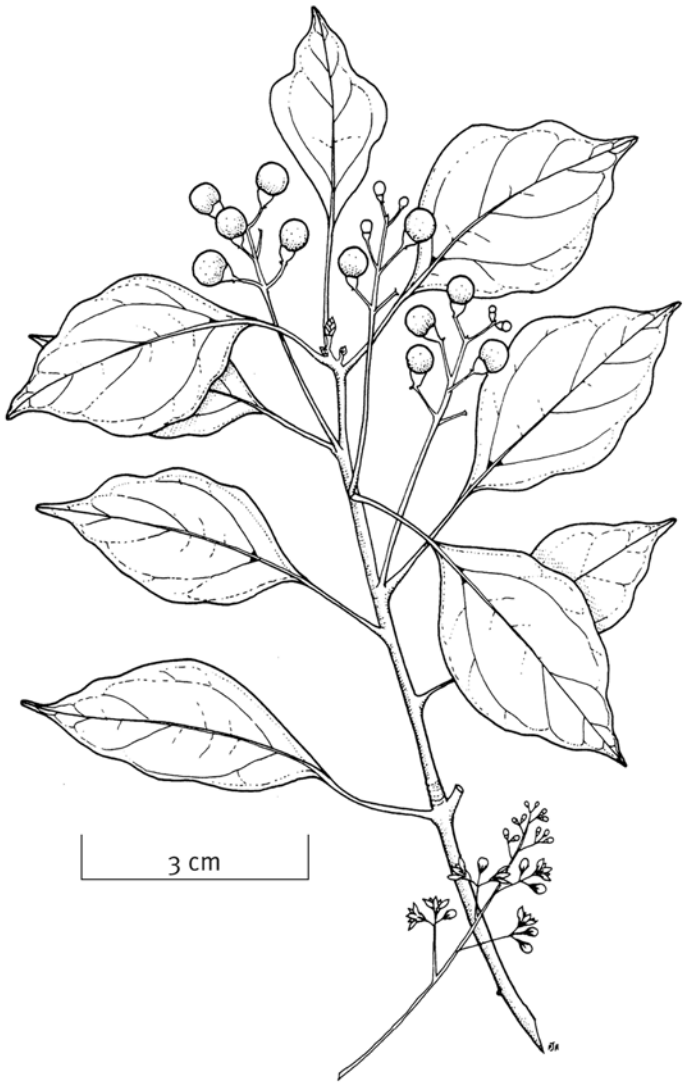
Along the waterways of south-east Queensland, camphor laurels are replacing the native blue gums threatening koala populations.

Old camphor laurel trees develop a massive root system that can block drains and crack concrete structures. The average suburban backyard is far too small to accommodate a mature camphor laurel without problems. Removal of a mature tree can cost hundreds of dollars.

WEEDBUSTERS

Queensland Government

PP46 January 2011



Declaration details

Camphor laurel is a declared Class 3 plant under the *Land Protection (Pest and Stock Route Management) Act 2002*. Class 3 plants cannot be sold in Queensland and their removal in Queensland is recommended. Landholders can be required to remove Class 3 plants if they live next to environmentally significant areas such as national parks or reserves.

Description and general information

Camphor laurel is a large evergreen tree, growing up to 20 m tall. The leaves have a glossy, waxy appearance and smell of camphor when crushed. In spring it produces lush, bright-green foliage and masses of small white flowers. The spherical fruits are green (changing to black when ripe) and 10 mm in diameter.

Habitat and distribution

Camphor laurel is native to Taiwan, Japan and some parts of China. Since it was introduced in 1822, it has spread along eastern Australia from the Atherton Tablelands down to Victoria. It is particularly common along watercourses and in soil types that once supported rainforest.

In south-east Queensland, it has the potential to develop dense infestations similar to older infestations that exist in northern New South Wales.

A large camphor laurel tree may produce over 100 000 seeds every year. The seeds are readily spread by a few species of birds.

Control

Mechanical control

Removal of newly established or isolated seedlings by hand pulling or grubbing is effective.

Bulldozing is only suitable for young trees that can be removed crowns and all. Failure to remove roots of mature trees will result in regrowth.

Fire kills plant tops but produces regrowth from the base.

Herbicide control

Selection of a suitable method depends on the size of the target tree and its situation. A standing tree that has been treated may be a serious hazard to human safety or other structures when it falls. Removal of the bulk of the tree before treating the stump is preferred in such situations.

Table 1 details the herbicides registered for camphor laurel control. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the label.

Foliar spray

Foliar sprays can be used for young trees up to 3 m tall.

Basal bark spray

Trees up to 6 m tall with a basal stem diameter up to 30 cm and no multi-stems can be treated using basal bark or cut stump methods, although basal bark is the preferred method.

When using the basal bark method, spray from ground level up to a height of 30 cm or higher than where multi-stems branch.

Stem injection

For trees taller than 6 m, stem injection using a modified axe is the most practical method—leave no more than 2 cm between cuts.

Axe cuts for stem injection of herbicides should be made at regular intervals all around the stem (or stems). Care should be taken to ensure the axe leaves a 'pocket' in the stem, into which the chemical is immediately injected. Cuts should penetrate the sapwood (just under the bark), but not the hard central wood. Cuts made too shallow into the bark or too deep into the stem will result in regrowth. The practice of drilling holes in the stem prior to herbicide application is not recommended.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for the control of camphor laurel

Situation	Herbicide	Rate	Comments
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	350–500 ml/100 L water	High-volume spray for trees up to 3 m tall; higher rate for › 2 m tall (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	2.5 L/100 L water	Air blast/mister; foliar spray (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl + picloram (e.g. Grazon DS®)	1:20 water	Gas gun or sprinkler sprayer; foliar spray (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Foliar spray	Triclopyr-butotyl (e.g. Garlon$^{600®}$)	170 ml/100 L water	High-volume foliar spray for trees up to 3 m tall (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Basal bark spray	Triclopyr-butotyl (e.g. Garlon$^{600®}$)	1 L in 60 L diesel	Basal bark for trees up to 6 m tall and 30 cm stem diameter or cut stump (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Stem injection	Glyphosate-IPA	2 ml of 1:1 mix with water	Stem injection for trees up to 25 cm in diameter (For pasture, non-crop, forestry, right-of-way and aquatic areas)
Stem injection	Glyphosate-IPA	2 ml undiluted	Stem injection for trees 25–60 cm in diameter (For pasture, non-crop, forestry, right-of-way and aquatic areas)

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

© The State of Queensland, Department of Employment, Economic Development and Innovation, 2011.

PR11–5582