Plant Assessment Report

Lucinda & Port Gate Drains

Draft Report

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Report No: PR102522
Version/Date: April 2010

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Quality Assurance Statement				
Revision No.	Author	Reviewer	Approved for Issue	
			Signature	Date
0	S Stone	L Fisher		09 April 2010
1	S Stone	L Fisher		13 April 2010

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Executive Summary

RPS (formerly trading as Conics) has been commissioned by Port of Brisbane Corporation (PBC) to participate in a bi-annual weed monitoring program by undertaking a survey of weeds listed by the Australian Quarantine and Inspection Service (AQIS) along Lucinda Drain and Port Gate Drain, within the Port of Brisbane.

The monitoring program aims to monitor weed species listed by AQIS, the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), and Brisbane City Council (BCC). Furthermore, the bi-annual report produced provides recommendations with respect to the ongoing management of weeds along Lucinda and Port Gate Drains.

The weed monitoring program is currently conducted at six monthly intervals, during post-summer months (February/March) and post-winter months (October/November). A total of 19 weed surveys along Lucinda Drain, and six weed surveys along Port Gate Drain have been conducted to date.

Summary of Findings

The following points summarise the findings of the March 2010 plant survey of Lucinda Drain:

- Seventy-four plant species were recorded. This consisted of 19 native / planted species and 55 exotic species;
- Out of the 55 exotic species none were AQIS listed weed species;
- Five exotic species were recorded for the first time during the current survey (none of which are declared under the LPA). These are Easter Cassia *(Senna pendula var. glabrata)*, Green Panic (*Megathyrsus* var *pubiglumis*), Wild Gooseberry (*Physalis minima*), Cypress Vine (*Ipomoea quamoclit*), and *Cyperus aggregatus*, which are common weeds to most disturbed areas;
- Occurrences of Broad-leaf Pepper (*Schinus terebinthifolia*), Lantana (*Lantana camara*), Creeping Lantana (*Lantana montevidensis*), and Prickly Pear (*Opuntia* sp.) - all declared under the LPA - were recorded again during the current March 2010 survey. Although, a decrease in occurrence of Broad-leaf Pepper and Lantana were recorded along the eastern side of the drain;
- A new occurrences of immature Prickly Pear was detected along the western side of the drain, suggesting that this declared species may be spreading;
- In comparison with previous surveys, no occurrences of Class 2 Groundsel Bush (*Baccharis halimifolia*) and Class 3 Singapore Daisy (*Sphagneticola trilobata*), were identified during the current survey;
- A variety of exotic grasses including Red Natal Grass (*Melinis repens*), Guinea Grass (*Megathyrsus maximus* var. *maximus*), and Rhodes Grass (*Chloris gayana*) were the dominant groups of exotic species along Lucinda Drain with periodic dominance of Siratro (*Macroptilium atropurpureum*), and Glycine (*Neonotonia wightii*) occurring in sections of the transect. Common Reed (*Phragmites australis*) dominates the western side of the drain; and
- Exotic species diversity, abundance, and coverage have increased in comparison to the survey results of November 2009.

The following points summarise the findings of the March 2010 plant survey of Port Gate Drain:

- Fifty-two plant species were recorded. This consisted of 23 native / planted species and 29 exotic species;
- Out of the 29 exotic species none were AQIS listed weeds;
- One new species was recorded during the current survey, namely *Sporobolus coromandelianus*;
- Species declared under the LPA (i.e. Broad-leaf Pepper, Groundsel Bush, Lantana, Creeping Lantana, and Camphor Laurel [*Cinnamomum camphora]*) that have been recorded in previous surveys, were recorded again in the current survey (March 2010);
- In comparison to previous surveys, no occurrences of Class 2 Fireweed (*Senecio Madagascariensis*) were identified during the current survey;
- Exotic and native invasive species, in particular Common Reed, Nut Grass (*Cyperus rotundus*) and Rhodes Grass dominated the Port Gate Drain. Stands of immature Sesbania Pea (*Sesbania cannabina*) were identified along sections of the transect;
- The drain was again dominated by exotic species. However, the number of exotic species present along the drain has slightly decreased in comparison to the previous November 2009 survey. The number of native species recorded was slightly higher in comparison; and
- Whilst exotic species diversity has slightly decreased in comparison to the previous November 2009 survey, the abundance and coverage has largely remained constant. However, an increase in abundance and coverage was recorded at the entrance to the southern drain.

Summary of Recommendations

Recommendations regarding the short and long-term management of exotic species within the Lucinda and Port Gate Drain areas are provided in this report. All maintenance activities are to continue as scheduled and should be extended to include exotic species removal, particularly those declared under the LPA. It is noted that some of the declared species may be located along banks and the method of removal should be sensitive to bank stability (e.g. stem injection or cut and paint).

1.0 Introduction

RPS (formerly trading as Conics) has been commissioned by Port of Brisbane Corporation (PBC) to undertake a bi-annual weed monitoring program along Lucinda Drain and Port Gate Drain, within the Port of Brisbane, and produce associated reporting that details the findings of the surveys. Lucinda Drain and Port Gate Drain are located on land formally described as Lot 83 on SP108337 and Lot 732 on SP142208, respectively. The drains are located within the Wynnum-Manly Ward of Brisbane City Council (BCC).

This is the 19th report that has been prepared for the Lucinda Drain, and the sixth report for the Port Gate Drain.

1.1 Scope of Works/Objectives

This report has been prepared in response to a request from Australian Quarantine and Inspection Service (AQIS) to increase surveillance relating to potential AQIS listed weed incursions along the drains. The primary objective of the weed survey conducted is to contribute to a long-term bi-annual monitoring program at the Port of Brisbane through identification of AQIS listed weed species, which may enter the country via containers and other materials shipped and unloaded at the Port of Brisbane facility. Additionally, the program aims to monitor species considered to be exotic/invasive, including species declared under the *Land Protection (Pest and Stock Route Management) Act 2002* (LPA), listed by BCC, and locally occurring weed species (from hereafter collectively referred to as exotic species as well as invasive natives).

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

- Identification of species declared or listed by the AQIS, LPA, or BCC;
- Monitor the occurrence and abundance of exotic/invasive species;
- Assess the extent of exotic flora species;
- Report the findings of the current survey;
- Undertake a comparative analysis of the current and previous survey results; and
- Provide recommendations for the on-going weed management along the drains.

1.2 Site Description

The weed monitoring focuses on the Lucinda and Port Gate Drain areas at the Port of Brisbane. Lucinda Drain is located along the eastern side of the Port of Brisbane and provides drainage for stormwater run-off from the hardstand areas adjacent to the drain (**Figure 1.1**). This drain also experiences tidal influence from the Boat Passage, where it discharges through the Lucinda Weir.

Lucinda Drain is a constructed drainage channel using concrete filled geo-textile sandwich construction some 2.5 kilometres in length. The berms of the channel consist of sand above the geo-textile sandwich. The channel currently has a regular maintenance schedule that provides for the western bank of the drain (adjacent to Lucinda Drive) to be mowed and sprayed for noxious weeds. The eastern bank of the drain has an irregular maintenance program with some time between maintenance events.

Port Gate Drain is located in the south-west portion of the Port of Brisbane at Port Gate. The drain also provides drainage for stormwater run-off from the hardstand areas adjacent to the drain as well as partially receiving tidal waters from the mouth of the Brisbane River (**Figure 1.2**). The drain is separated into two portions by Howard Smith Drive and tidal flow is prevented from entering the part of the drain to the south of this road. Unlike Lucinda Drain, the area either side 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 with the majority of vegetation located in the southern portion of the drain.

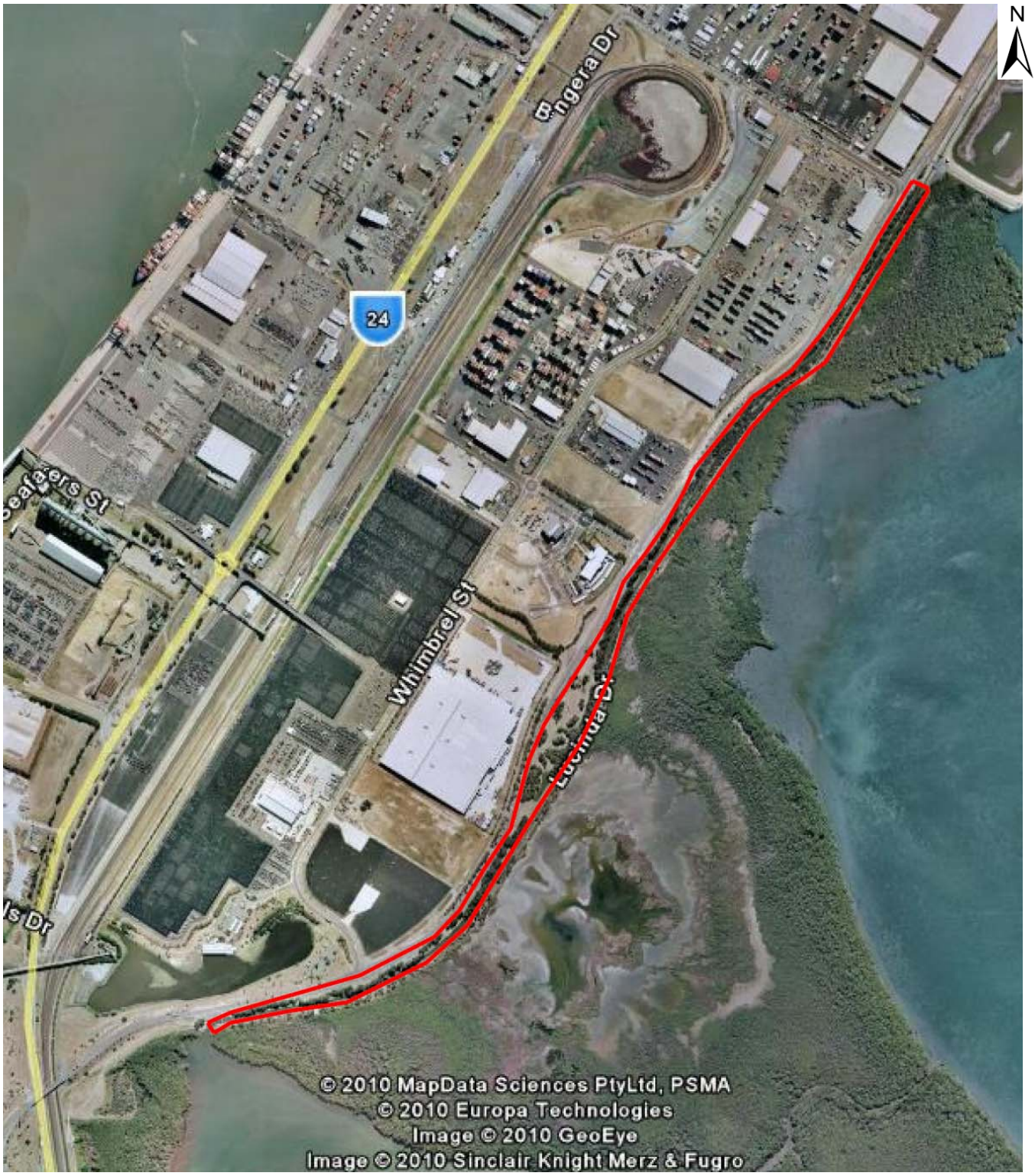


Figure 1.1 – Lucinda Drain Study Area

Client: Port of Brisbane Corporation

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR102522

RPS

Source: Google 2008

Legend:
Site Boundary

Figure 1.2 – Port Gate Drain Study Area

Client: Port of Brisbane Corporation

Date: 09-04-2010	Compiled by: SS	Project Manager: LF	Scale: Not to scale	Reference: PR102522

RPS

Source: Google 2008

Legend:
Site Boundary

2.0 Methodology

2.1 Weed Monitoring Schedule for Lucinda & Port Gate Drain

The weed monitoring program is conducted on a biannual basis, during post-summer months (February/March) and post-winter months (October/November). RPS has conducted a total of 19 weed surveys along Lucinda Drain (**Table 2.1**)

TABLE 2.1 LUCINDA DRAIN WEED MONITORING SURVEYS

Year	Month	Season
2001	February	Summer
	October – December	Spring
2002	February	Summer
	November	Spring
2003	March	Autumn
	November	Spring
2004	March	Autumn
	October	Spring
2005	April	Autumn
	November	Spring
2006	March	Autumn
	October	Spring
2007	March	Autumn
	November	Spring
2008	March	Autumn
	November	Spring
2009	March	Autumn
	November	Spring
2010	March	Autumn

This report also represents the sixth weed survey for the Port Gate Drain. The initial Port Gate Drain survey was conducted in November 2007, and has since been conducted every March and November to date.

The latest weed monitoring survey along Lucinda and Port Gate drains was conducted by two ecologists on the 9th and 10th of March 2010, which consisted of verifying the occurrence and abundance of exotic and invasive species.

2.2 Target Species

Whilst common weed species are generally monitored during the bi-annual weed monitoring program, the survey specifically targets those species identified by AQIS as presenting a threat to natural and agriculture

systems (**Appendix A**). Exotic species declared under the LPA, and BCC listed environmental weeds are also targeted.

2.3 Weed Survey

The weed survey conducted along the Lucinda and Port Gate Drains consisted of establishing survey transects, and use of the random meander methodology for sampling of exotic and invasive species encountered. The survey was conducted on-foot to ensure that extensive coverage of the drain was achieved (which included the bed, bank and top of bank areas).

The weed survey along the Lucinda Drain consisted sampling of exotic and invasive species encountered along a two-metre-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 resulting from dense vegetation and narrow banks. However, a visual inspection of the western bank was performed intermittently, where access to the drain was possible. Two complete two-metre-wide transects traversing the entire length of the eastern and western banks of Port Gate Drain were established and surveyed successfully.

Weed identifications were carried out utilising available flora and botanical reference material. Samples of weed species unable to be identified *in situ*, or with the assistance of appropriate field guides, were pressed and sent to the Queensland Herbarium for identification. The presence and abundance of any declared AQIS, LPA, and BCC listed weeds, in addition to locally occurring exotic and invasive species that occurred along the Lucinda and Port Gate drains were recorded on data sheets (**Appendix B**). Approximate locations of LPA declared weed species (e.g. Broad-leaf Pepper [*Schinus terebinthifolius*], Lantana [*Lantana camara*] etc) were documented by a recording a GPS co-ordinate, where possible.

2.4 Survey Limitations

It should be noted that the detectability of plants and the ability to accurately identify plants to species level may vary 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 for the site should not be regarded as conclusive evidence that certain declared plants do not occur along the drains; however every effort has been made to detect theses species in habitat / areas considered suitable.

3.0 Results

3.1 Lucinda Drain

Appendix C contains a list of flora species recorded during each Lucinda Drain survey from November 2005 to date. The following points summarise the findings of the March 2010 survey:

- Seventy-four plant species were recorded. This consisted of 19 native / planted species and 55 exotic species;
- Out of the 55 exotic species none were AQIS listed weed species;
- Five exotic species were recorded for the first time during the current survey (none of which are declared under the LPA). These are Easter Cassia *(Senna pendula var. glabrata)*, Green Panic (*Megathyrsus* var *pubiglumis*), Wild Gooseberry (*Physalis minima*), Cypress Vine (*Ipomoea quamoclit*), and *Cyperus aggregatus*, which are common weeds to most disturbed areas;
- Occurrences of Broad-leaf Pepper (*Schinus terebinthifolia*), Lantana (*Lantana camara*), Creeping Lantana (*Lantana montevidensis*), and Prickly Pear (*Opuntia* sp.) - all declared under the LPA - were recorded again during the current March 2010 survey. Although, a decrease in occurrence of Broad-leaf Pepper and Lantana were recorded along the eastern side of the drain;
- A new occurrences of immature Prickly Pear was detected along the western side of the drain, suggesting that this declared species may be spreading;
- In comparison with previous surveys, no occurrences of Class 2 Groundsel Bush (*Baccharis halimifolia*) and Class 3 Singapore Daisy (*Sphagneticola trilobata*), were identified during the current survey;
- A variety of exotic grasses including Red Natal Grass (*Melinis repens*), Guinea Grass (*Megathyrsus maximus* var. *maximus*), and Rhodes Grass (*Chloris gayana*) were the dominant groups of exotic species along Lucinda Drain with periodic dominance of Siratro (*Macroptilium atropurpureum*), and Glycine (*Neonotonia wightii*) occurring in sections of the transect. Common Reed (*Phragmites australis*) dominates the western side of the drain; and
- Exotic species diversity, abundance, and coverage have increased in comparison to the survey results of November 2009.

3.2 Port Gate Drain

Appendix D contains a list of flora species recorded during each Port Gate Drain survey from November 2007 to date. The following points summarise the findings of the March 2010 survey:

- Fifty-two plant species were recorded. This consisted of 23 native / planted species and 29 exotic species;
- Out of the 29 exotic species none were AQIS listed weeds;
- One new species was recorded during the current survey, namely *Sporobolus coromandelianus*;
- Species declared under the LPA (i.e. Broad-leaf Pepper, Groundsel Bush, Lantana, Creeping Lantana, and Camphor Laurel [*Cinnamomum camphora]*) that have been recorded in previous surveys, were recorded again in the current survey (March 2010);
- In comparison to previous surveys, no occurrences of Class 2 Fireweed (*Senecio Madagascariensis*) were identified during the current survey;
- Exotic and native invasive species, in particular Common Reed, Nut Grass (*Cyperus rotundus*) and Rhodes Grass dominated the Port Gate Drain. Stands of immature Sesbania Pea (*Sesbania cannabina*) were identified along sections of the transect;
- The drain was again dominated by exotic species. However, the number of exotic species present along the drain has slightly decreased in comparison to the previous November 2009 survey. The number of native species recorded was slightly higher in comparison; and
- Whilst exotic species diversity has slightly decreased in comparison to the previous November 2009 survey, the abundance and coverage has largely remained constant. However, an increase in abundance and coverage was recorded at the entrance to the southern drain.

4.0 Discussion

4.1 Lucinda Drain

4.1.1 Weed Species Observed

The 19th weed monitoring survey along Lucinda Drain has identified a total number of 74 flora species, of which 55 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the March 2010 plant survey, however, four LPA declared species were recorded (**Table 4.1**). **Appendix E** provides GPS co-ordinates of the location of the above-mentioned declared species along Lucinda Drain.

TABLE 4.1 CLASS & ABUNDANCE OF WEED SPECIES (UNDER LPA) RECORDED DURING LUCINDA DRAIN SURVEY

LPA Class	Botanical Name	Common Name	Abundance & Location
2	*Opuntia sp.*	Prickly Pear	Low abundance along the eastern bank. Immature individual detected along the western bank.
3	*Schinus terebinthifolia*	Broad-leaf Pepper	Low abundance mainly along the eastern bank.
	Lantana camara	Lantana	Low abundance along the eastern bank.
	Lantana montevidensis	Creeping Lantana	Low abundance along the eastern bank.

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

- **Class 1** – landholders are required by law to keep their land free of these species;
- **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.

One individual LPA declared (Class 2) Prickly Pear, and three individual occurrences of LPA Class 3 species (Broad-leaf Pepper, Lantana, and Creeping Lantana) identified during the previous surveys, were again noted in the most recent March 2010 survey. However, fewer Broad-leaf Pepper and Lantana individuals were observed in the current survey. Active treatment to control the identified LPA declared Class 2 and 3 species was evident during the March 2010 survey. It is important to note that where Broad-leaf Pepper have been treated (i.e. lopped or frilled), regeneration is occurring and secondary treatment is likely to be required.

In comparison to the November 2009 survey, the latest survey did not result in the detection of the LPA Class 2 Groundsel Bush or Class 3 Singapore Daisy. The recruitment of Prickly Pear along the western bank of the drain was also apparent in the current March 2010 survey, which had not been observed in the previous November 2009 survey. In comparison to the previous survey, the overall abundance and diversity of LPA declared species has decreased.

Under the LPA, 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). 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 F**.

Several species that are not listed under LPA, but are listed as environmental / noxious weeds by BCC, were identified during the current 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 CATEGORY1	BCC CLASSIFICATION2
Cenchrus echinatus	Mossman River Grass	Environmental Weed	R
Chloris gayana	Rhodes Grass	Environmental Weed	R
Ficus elastica	Indian Rubber Tree	Environmental Weed	R
Ipomoea cairica	Coastal Morning Glory	Environmental Weed	R
Ipomoea indica	Purple Morning Glory	Environmental Weed	C
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	-
Neonotonia wightii	Glycine	Environmental Weed	C
Schinus terebinthifolius	Broad-leaf Pepper	Environmental Weed	C
Senna pendula var *glabrifolia*	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:

- **Class 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 Comparisons Between Lucinda Drain Surveys

The absence of AQIS listed species is consistent with the findings from previous survey results. However, variations in exotic species abundance and diversity levels have been evident in previous survey results.

Table 4.3 and **Figure 4.1** highlight 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 THE LUCINDA DRAIN

SURVEY	NUMBER OF EXOTIC SPECIES RECORDED
February 2001	37
October 2001	35
February 2002	27
November 2002	35
May 2003	27
November 2003	36
March 2004	27
October 2004	29
April 2005	33
November 2005	37
March 2006	35
October 2006	41
March 2007	24
November 2007	33
March 2008	46
November 2008	45
March 2009	40
November 2009	43
March 2010	**55**

Figure 4.1 illustrates a trend occurring with regard to the number of post-summer and post-winter exotic species recorded over the entire survey period for Lucinda Drain.

FIGURE 4.1 NUMBER OF EXOTIC SPECIES RECORDED PER SURVEY ALONG THE LUCINDA DRAIN

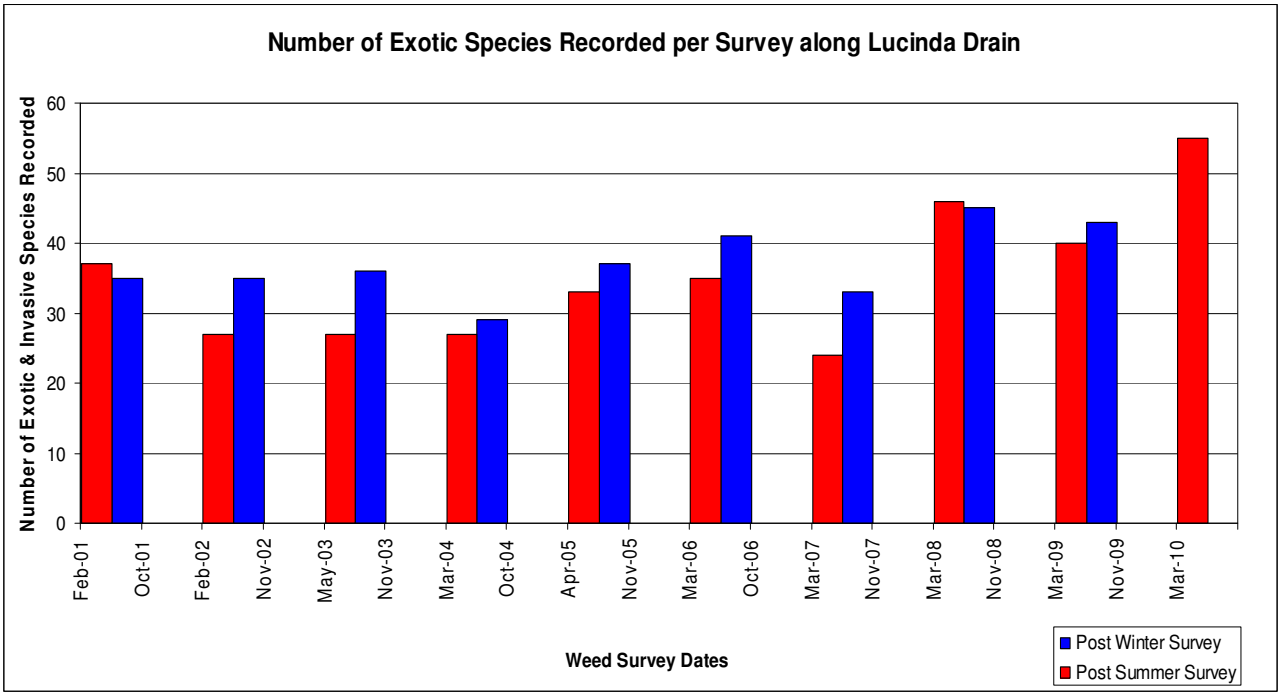


Table 4.4 outlines the numbers of exotic species within each family that were recorded in the current March 2010 survey, and previous surveys.

TABLE 4.4 NUMBER OF EXOTIC SPECIES BY FAMILY FOR LUCINDA DRAIN

FAMILY	MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
	NUMBER OF EXOTIC SPECIES PRESENT					
AGAVACEAE	0	0	0	1	1	0
AMARANTHACEAE	1	0	1	1	2	0
ANACARDIACEAE	1	1	1	1	1	1
ASCLEPIADACEAE	0	0	0	0	0	0
ASPARAGACEAE	0	0	1	0	1	0
ASTERACEAE	10	13	9	10	9	8
BORAGINACEAE	1	0	0	0	0	0
BRASSICACEAE	1	1	0	1	1	0
CACTACEAE	1	1	1	1	0	1
CAESALPINIACEAE	1	0	0	0	0	0
COMMELINACEAE	2	1	0	0	2	1
CONVOLVULACEAE	3	1	1	2	1	1
CYPERACEAE	3	0	0	0	1	0
EUPHORBIACEAE	3	1	1	0	1	0

FAMILY	MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
	NUMBER OF EXOTIC SPECIES PRESENT					
FABACEAE	5	6	6	8	6	5
LAURACEAE	0	0	0	0	0	0
LORANTHACEAE	0	0	1	0	0	0
MALVACEAE	2	1	1	1	2	2
MORACEAE	1	1	0	0	0	0
ONAGRACEAE	1	2	1	2	1	0
OXALIDACEAE	1	0	1	1	1	1
PASSIFLORACEAE	0	0	0	0	0	0
PLANTAGINACEAE	1	1	0	1	1	1
POACEAE	8	6	7	7	8	5
PORTULACACEAE	2	2	2	2	1	1
PRIMULACEAE	0	1	1	1	1	1
RUBIACEAE	1	0	0	0	1	0
SAPINDACEAE	0	0	0	0	0	0
SOLANACEAE	2	1	2	1	1	1
ULMACEAE	0	0	0	0	0	0
VERBENACEAE	4	3	3	4	3	4

Note: Shading indicates dominant family group

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

- There has been a relatively consistent trend of the number of exotic species along Lucinda Drain in the post summer and post winter surveys. Generally, surveys undertaken early in the calendar year (post summer) detect less exotic species (i.e. species diversity) than those conducted in the later half of the calendar year (post winter). However, current survey results are not consistent with this trend as the number of exotic species recorded in the March 2010 post summer survey (55 exotic species) are more than the number of exotic species recorded in the November 2009 post winter survey (43 exotic species);
- The number of exotic species detected along Lucinda Drain during the current March 2010 (55) survey is greater than the number detected during any other survey (summer and winter) to date. Furthermore, the species diversity, abundance, and coverage have increased since the last survey (November 2009).This may be a result of the scheduling of maintenance activities and the recent high levels of rainfall (**Section 4.3**).
- Weather conditions conducive to plant growth were noted in the previous November 2009 survey. Similarly, appropriate weather conditions (i.e. high rainfall) preceded the current March 2010 survey. However, unlike the previous November 2009 survey, maintenance activities did not occur within a close timeframe to the March 2010 survey;
- Weed maintenance occurred three weeks prior to the recent March 2010 survey, with spot spraying on the western banks occurring on the day of the survey. As a consequence of this in addition to high

rainfall, weeds along Lucinda Drain were mature, and reproductive material (i.e. fruit, flowers, and seed capsules) was present. Such features aid in identification of species, and thus may have contributed to the high species diversity recorded. This may have also attributed to a higher recording of density and coverage in the March 2010 survey; and

- The dominant Family type recorded in the March 2010 survey remained consistent with all other previous surveys, with the greatest number of exotic species originating from the Asteraceae family.

4.2 Port Gate Drain

4.2.1 Weed Species Observed

The sixth weed monitoring survey along Port Gate Drain has identified a total number of 52 flora species, of which 29 are considered exotic. No AQIS listed weed species (**Appendix A**) were recorded during the March 2010 plant survey, however, five LPA declared species were recorded (**Table 4.5**).

TABLE 4.5 CLASS & ABUNDANCE OF WEED SPECIES (UNDER LPA) RECORDED DURING PORT GATE DRAIN SURVEY

LPA CLASS	BOTANICAL NAME	COMMON NAME	ABUNDANCE & LOCATION
2	*Baccharis halimifolia*	Groundsel Bush	Medium abundance recorded along the drain
3	*Cinnamomum camphora*	Camphor Laurel	Low abundance along the southern drain
	Lantana camara	Lantana	Low abundance recorded along the southern drain
	Lantana montevidensis	Creeping Lantana	Low abundance recorded along the southern drain
	Schinus terebinthifolia	Broad-leaf Pepper	Medium abundance recorded along the drain

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

- **Class 1** – landholders are required by law to keep their land free of these species;
- **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 E provides GPS co-ordinates of the location of the above-mentioned declared species along Port Gate Drain. Previously recorded incidences of Groundsel Bush (Class 2), and Broad-leaf Pepper, Camphor Laurel and Lantana (Class 3), were again identified during the March 2010 survey. Creeping Lantana (Class 3) which was recorded last in November 2008, was recorded again along the southern drain during the recent survey. Nonetheless, the diversity and abundance of LPA declared species recorded during the March 2010 survey is similar to that of the previous November 2009 survey.

Under the LPA, landholders are obliged to attempt to remove Class 2 species and encouraged to remove Class 3 species. Therefore, consideration should be given to remove these declared species and control further establishment. Fact sheets for declared pests identified on the site are provided in **Appendix F**.

Several species that are not listed under LPA, but are listed as environmental / noxious weeds by BCC, were identified during the current 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 CATEGORY1	BCC CLASSIFICATION2
Chloris gayana	Rhodes Grass	Environmental Weed	R
Chloris virgata	Feather-top Rhodes Grass	Environmental Weed	R
Cinnamomum camphora	Camphor Laurel	Environmental Weed	C
Ipomoea cairica	Coastal Morning Glory	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	-
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:

- **Class E** (early detection and eradication) – Landholders are encouraged to rregularly 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 Comparisons Between Port Gate Drain Surveys

No AQIS listed species have ever been recorded during a Port Gate Drain plant survey. However, an analysis of the diversity and abundance of exotic vegetation recorded during the current survey, compared to the previous surveys, indicates that there is a variation between both exotic species type and the number of exotic species recorded.

Table 4.7 and **Figure 4.2** highlight the number of exotic species identified in the previous and current weed 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	29
March 2008	36
November 2008	39
March 2009	28
November 2009	31
March 2010	**28**

Figure 4.2 illustrates a trend occurring with regard to the number of post summer and post winter exotic species recorded over the entire survey period for Port Gate Drain.

FIGURE 4.2 NUMBER OF EXOTIC SPECIES RECORDED PER SURVEY ALONG THE PORT GATE DRAIN

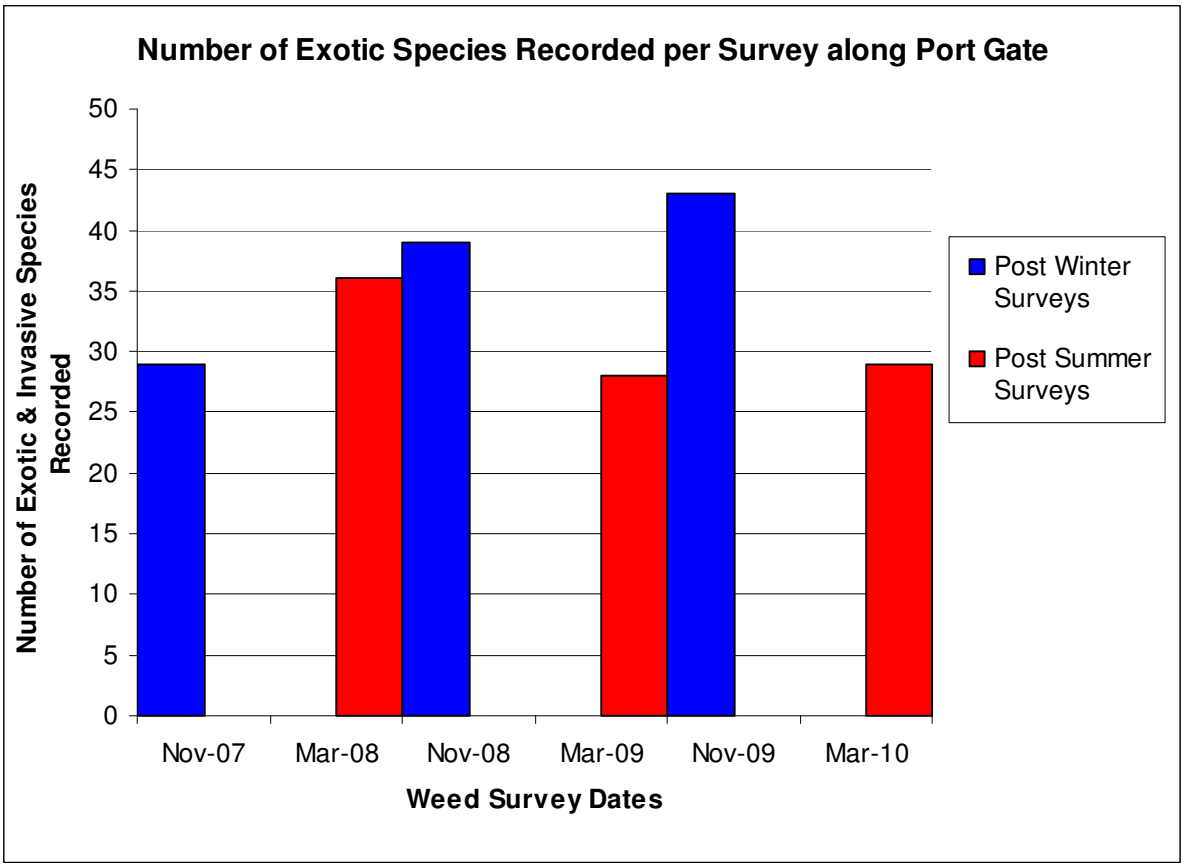


Table 4.8 outlines the numbers of exotic species within each Family that were recorded in the current March 2010 survey, and previous surveys.

TABLE 4.8 NUMBER OF EXOTIC SPECIES BY FAMILY FOR PORT GATE DRAIN

FAMILY	MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
	NUMBER OF EXOTIC SPECIES PRESENT					
AMARANTHACEAE	0	0	0	0	1	0
ANACARDIACEAE	1	1	1	1	0	0
ASCLEPIADACEAE	0	0	1	1	1	1
ASTERACEAE	7	8	4	9	5	5
BORAGINACEAE	0	0	1	1	0	0
BRASSICACEAE	0	1	1	0	0	0
CONVOLVULACEAE	1	1	1	1	1	1
CYPERACEAE	0	0	0	0	2	0
EUPHORBIACEAE	3	1	1	1	2	0
FABACEAE	6	6	8	8	7	6
LAURACEAE	1	1	0	1	0	0
MYRTACEAE	0	0	0	0	1	1
PAPAVERACEAE	0	0	0	0	0	1
PASSIFLORACEAE	0	0	0	0	1	1
PHYTOLACCACEAE	0	0	0	0	1	1
PLANTAGINACEAE	1	1	1	1	0	0
POACEAE	5	5	7	9	9	7
PORTULACACEAE	1	1	1	1	1	1
PRIMULACEAE	0	1	0	1	0	1
SOLANACEAE	1	2	0	0	1	1
VERBENACEAE	2	2	1	3	2	1

Note: Shading indicates dominant family group

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

- The number of exotic species recorded in the current Port Gate Drain post-summer (March 2010) survey is lower than the number of exotic species recorded in the previous post-winter survey (November 2009). The obvious trend occurring (as depicted in **Figure 4.2**) indicates that the post-summer surveys exhibit a lower species diversity than the post-winter surveys;
- Reduced exotic species diversity recorded during the current March 2010 survey may be attributed to the scheduling of maintenance activities occurring immediately prior to the survey across the majority of the drain;
- Unlike Lucinda Drain, the areas either side of Port Gate Drain (especially in the northern portion of the drain) consists of concrete, gravel, or compacted earth, which allows for only sparse vegetation growth. Therefore, the abundance and coverage remains typically constant between surveys. However, during the current March 2010 survey, a higher abundance and coverage of weed species

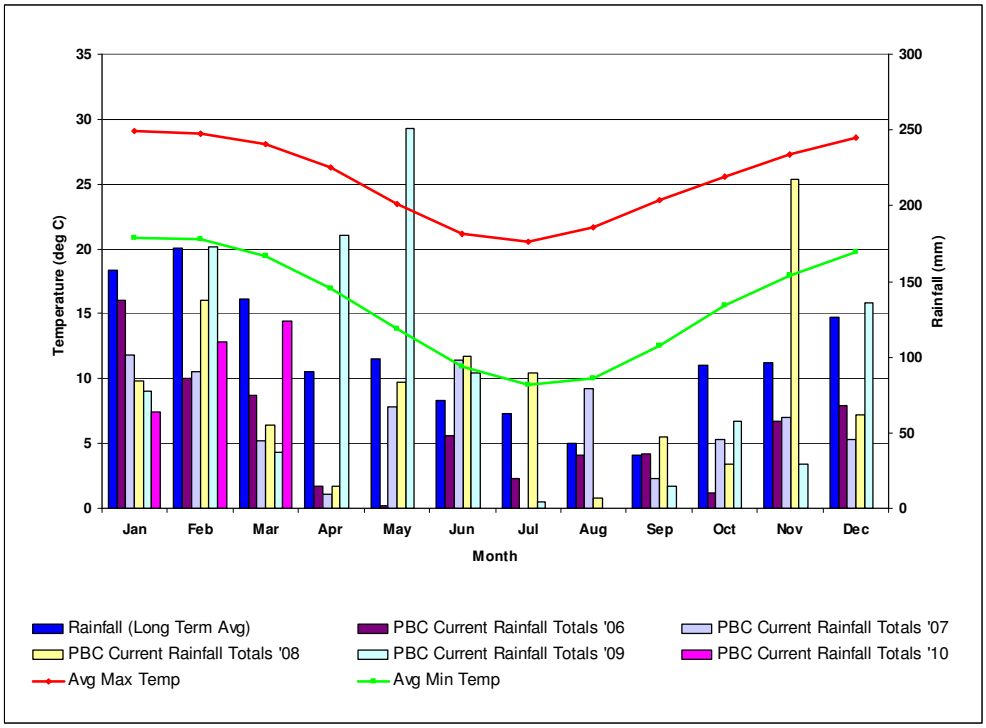
was recorded at the entrance to the southern portion of the drain. This area appeared to have not been included in recent maintenance activities, and with the recent high rainfall, had become overgrown;

- Akin to Lucinda Drain, the Asteraceae family is the dominant family for the current March 2010 weed survey. This dominance could be attributed to the overall harsh conditions that surround the drain and the ability of these resilient species to grow successfully in disturbed areas.

4.3 Weather Conditions

The following graph (**Figure 4.3**) portrays the rainfall recorded at the Port of Brisbane as well as the long term rainfall and temperature averages (taken from the Brisbane Airport).

FIGURE 4.3 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 and Port Gate Drains:

- Rainfall throughout the previous twelve month period (March 2009 – March 2010) has been highly variable (**Figure 4.3**). The months of November and December received large amounts of rainfall that well exceeded the long-term average rainfall. January and February have exhibited less than average rainfall. However, high levels of rainfall (123mm) were recorded in the first eight days of March (approx 47mm below the monthly average);
- As a potential result of the lack of recent scheduled maintenance activities, and unusually high levels of rainfall prior to the survey event, an unusual trend (i.e. a significant increase in the diversity, abundance, and coverage of exotic species) was detected for the Lucinda Drain in March 2010 survey; and

- Unlike Lucinda Drain, the areas either side of Port Gate Drain consists of concrete, gravel, or compacted earth, which allows for only sparse vegetation growth. Therefore, the abundance and coverage has remained typically constant. Whilst the region's rainfall is unusually high, the recorded lack of exotic species diversity may be a potential result of scheduled maintenance activities.

5.0 Recommendations

Early detection and intervention is a highly successful (and cost effective) method of preventing the establishment of new and emerging weeds, and should be given high priority in weed management program. The following recommendations pertain to the presence of exotic species occurring along both Lucinda and Port Gate 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:

- Ensure all existing maintenance programs occur along the eastern bank as well as the western bank of the Lucinda Drain. This should include regular mowing and spot spraying/hand pulling as well as other weed removal techniques along the eastern bank;
- Ensure attempts are made to remove **all** declared species under the LPA (see **Appendix E** for GPS 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 done in accordance with the relevant fact sheet provided by the Queensland Primary Industries and Fisheries (**Appendix F**); and
- Continue programmed monitoring of the diversity and status of plant species along the banks of the Lucinda Drain through twice-yearly 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 in regards to species from the Casuarinaceae family. Such canopy species provide shading, and dense matting from dropped needles produce conditions which potentially aid in decreasing the amount of understorey exotic vegetation. 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:

- Exotic species suppression through mulching and shading via the planting of a native canopy and understorey;
- Planting density of native species should be responsive to still allowing 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 facilitate out-competing of weed 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 under the LPA are to be removed (see **Appendix E** for GPS locations);
- Continue scheduled maintenance programs along the drain; and
- Continue to monitor of the drain's weed status at regular intervals.

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 SE Australia*. C H Jewrram, Victoria.

Conics (2009) *Plant Assessment Report - Lucinda & Port Gate Drains: November 2009*, Brisbane.

Department of Natural Resources (DNR) (2000). *Weed Pocket Guide*. DNR. Brisbane.

Johns, L. (2006). *Field Guide to Common Saltmarsh Plants of Queensland*. DPI&F, Brisbane.

Kleinschmidt H., Holland, A. & Simpson, P. (1996). *Suburban Weeds* 3rd ed. DPI. 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* – An Identification and Information – South-east Queensland CD. University of Queensland.

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

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.

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, Queensland*: Tropical Grassland Society of Aust Inc.

APPENDIX A AQIS WEED TARGET SPECIES LIST

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
AMARANTHACEAE	*Amaranthus dubius*	Chinese Spinach	Mart. ex Thell	Annual crops, rice, gardens, disturbed sites and secondary vegetation.
ASTERACEAE	*Austroeupatorium inulaefolium*	-	(H.B.K.) King & Robinson	Tea, rubber, rosella and other plantation crops; roadsides; environmental weed in secondary forests.
	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.
	Mikania cordata	-	(Burm. f.) B.L. Robinson	Rubber, coffee, banana, cocoa and oil palm plantations, pastures; potential environmental weed
	Mikania micrantha	Mile-a-Minute	H.B.K.	Cocoa, coconut, orchards, rubber, oil palm, sugarcane, vegetables, upland rice, pastures; serious environmental weed
CAPPARACEAE	*Cleome rutidosperma*	Spiderflower	DC.	Crops including vegetables, bananas, maize, tobacco, watermelons, cocoa, pineapples and coconuts; weed of disturbed ground and immature plantations.
CYPERACEAE	*Fimbristylis umbellaris*	Globular Fimbristylis	(Lam.) Vahl	Rice, pastures; swamps.
	Schoenoplectus juncoides	-	(Roxb.) Palla	Rice, freshwater and tidal swamps.
	Scirpus maritimus	-	L.	Rice, freshwater and tidal swamps.
EQUISETACEAE	*Equisetum ramosissimum*	Horsetail, Scouring Rush	Desf. subsp. debile (Vauch.) Hauke	Rice terraces and bunds, tea plantations.
ERIOCAULACEAE	*Eriocaulon truncatum*	-	Buch. - Ham. ex Mart	Rice, wetlands, river banks and floodplains
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 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.

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
HALORAGACEAE	*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
LAMIACEAE	*Hyptis brevipes*	Lesser Roundweed	Poit.	Plantation crops, orchards, vegetables rice; secondary forest, and disturbed sites in areas of high rainfall.
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.
MYRTACEAE	*Rhodomyrtus tomentosa*	Downy Rose Myrtle	(Ait.) Hassk.	Environmental weed; pastures, rangelands and untended areas.
NYCTAGINACEAE	*Boerhavia erecta*	-	L.	Peanuts, sorghum, rice and other annual crops; weed of cultivated land, pastures and coastal environments.
PIPERACEAE	*Piper aduncum*	-	L.	Weed of grazing lands and secondary forest, roadsides; environmental weed.
POACEAE	*Brachiaria paspaloides*	Common Brachiaria, Thurston Grass	(Presl.) C.E. Hubb	Orchards, tea, coffee, rice, lawns, roadsides, disturbed sites.
	Coix aquatica	Job's Tears	Roxb.	Serious weed of waterways, rice
	Digitaria fuscescens	Common Crabgrass	(Presl.) Henr.	Tobacco, vegetables, rubber, rice; pastures, disturbed sites, roadsides, coastal dunes, dry forests.
	Digitaria insularis	-	(L.) Mes ex Ekman	Pineapples; unpalatable weed of pastures, headlands,
	Echinochloa glabrescens	A barnyard grass	Munro ex Hook. f.	Rice, maize.
	Echinochloa stagnina	-	(Retz) Beauv.	Rice; lakes, rivers, wetlands; roadsides, open places. Potential major environmental weed.
	Eriochloa polystachya	Carib Grass	H.B.K.	Rice, riverbanks, swamps, drains and ditches; suppresses other vegetation.

FAMILY	BOTANICAL NAME	COMMON NAME	AUTHOR	COMMENTS
	Ischaemum timorense	Centipede Grass	Kunth.	Cloves, cocoa, rubber, coconut, oil palm, sugarcane and rice plantations; weed of roadsides, ditches, forest margins.
	Leptochloa chinensis	Red Sprangletop, Feathergrass	(L.) Nees.	Rice, cotton, soybean, maize, sugarcane, pineapple, sweet potato, vegetables, peanuts, tea, bananas.
	Leptochloa panicea	Sprangletop	(Retz.) Ohwi	Rice, cotton, soybeans, peas, sugarcane, maize, peanuts, pastures.
	Sacciolepis interrupta	-	(Willd.) Stapf.	Rice, irrigation channels, wetlands. Potential environmental weed.
RUBIACEAE	*Diodia sarmentosa*	-	Sw.	Coffee, tea, leucaena, stevia sp. Plantations.
	Paederia foetida	Lesser Malayan Stinkwort	L.	Sugarcane, secondary forest; climbs over shrubs and trees - potential environmental weed.
	Spermacoce assurgens	-	Ruiz & Pav.	Rice, maize, coconuts, sugarcane, bananas, pasture, gardens, forest clearings
	Spermacoce mauritiana	-	Gideon	Invades tracks in primary rainforest; rice, sugarcane, gardens, lawns.
SALVINIACEAE	*Salvinia cucullata*	Salvinia	Roxb.	Rice, waterways, wetlands.
	Salvinia natans	Salvinia	(L.) All.	Rice, waterways wetlands.
SCROPHULARIACEAE	*Striga angustifolia*	Witchweed	(D. Don.) C.J. Saldanha	Root parasite on rice, sorghum, sugarcane.
	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.
VIOLACEAE	*Hybanthus attenuatus*	-	(Humb. & Bonpl.) G.K. Schulze	Rice, a wide diversity of annual crops, pastures, waste places.

Source: http://www.affa.gov.au

APPENDIX B PLANT SURVEY DATA SHEET

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	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 (LPA)	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	-		
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	-		
CACTACEAE					
Opuntia sp.	Prickly Pear	s	2		
CAESALPINIACEAE					
Crotalaria paniculata	Poor Mans Gold	h	-		
Senna pendula var *glabrifolia*	Easter Cassia	s	-		
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	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
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	-		
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					

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
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					
Oenothera drummondii [n]	Beach 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	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
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	-		
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	-		

FAMILY / SPECIES	COMMON NAME	FORM	DECLARATION CATEGORY (LPA)	PRESENCE	ABUNDANCE
PROTEACEAE					
Banksia integrifolia [n]	Coastal Banksia	t	-		
SAPINDACEAE					
Cardiospermum halicacabum	Balloon Vine	v	-		
Cupaniopsis anacardioides [n]	Tuckeroo	t	-		
Dodonaea triquetra	Hop Bush	s	-		
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	-		

Form: t = tree, **s =** shrub, **h =** herb, **g =** grass, **c =** creeper, **v =** vine, **a =** aquatic

[n] = native

APPENDIX C SURVEY RESULTS FOR LUCINDA DRAIN

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
AGAVACEAE												
Agave sp.	Agave	-	**-**	-	-	X	X	-	-	X	-	-
AIZOACEAE												
Carpobrotus glaucescens	Pigface*	-	**-**	X	X	X	X	X	X	X	X	X
Sesuvium portulacastrum	Sea Purslane*	-	**X**	X	X	X	X	X	X	X	X	X
Tetragonia tetragonioides	New Zealand Spinach*	-	**X**	X	X	X	X	X	-	-	-	-
AMARANTHACEAE												
Alternanthera pungens	Khaki Weed	-	**-**	-	-	-	-	-	-	-	-	-
Amaranthus quitensis	South American Amaranthus	-	**-**	-	-	-	-	-	-	-	-	X
Amaranthus viridis	Green Amaranths	-	**X**	-	X	-	X	-	-	-	-	-
ANACARDIACEAE												
Schinus terebinthifolius	Broad-leaf Pepper	3	**X**	X	X	X	X	X	X	X	X	X
APIACEAE												
Centella asiatica	Pennywort*	-	**X**	X	-	-	-	-	-	-	-	-
ASCLEPIADACEAE												
Gomphocarpus physocarpus	Balloon Cotton Bush	-	**-**	-	-	-	-	-	-	X	X	-
ASPARAGACEAE												
Asparagus aethiopicus cv. Sprengeri	Asparagus Fern	3	**-**	-	X	-	X	-	-	X	-	-
ASTERACEAE												
Ageratum houstonianum	Blue Billy-Goat	-	**-**	-	-	-	X	-	-	X	-	X
Ambrosia artemisiifolia	Annual Ragweed	2	**-**	-	-	-	-	X	X	X	-	X
Ambrosia tenuifolia	Lacy Ragweed	-	**-**	-	-	-	-	X	-	-	-	-
Baccharis halimifolia	Groundsel Bush	2	**-**	X	X	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
Bidens pilosa	Cobblers Pegs	-	**X**	X	X	X	X	X	X	X	X	X
Calyptocarpus vialis	Creeping Cinderella Weed	-	**X**	X	X	X	-	-	X	-	-	-
Cirsium vulgare	Spear Thistle	-	**-**	-	-	-	-	-	-	X	-	X
Conyza bonariensis	Flax-leaf Fleabane	-	**X**	X	X	X	X	-	-	-	X	X
Conyza pusilla	Canadian Fleabane	-	**-**	-	-	-	X	X	X	X	X	X
Conyza sumatrensis	Tall Fleabane	-	**X**	X	X	X	-	-	-	-	-	-
Crassocephalum crepidioides	Thickhead	-	**-**	-	-	-	-	-	-	-	-	X
Gamochaeta calviceps	Cudweed	-	**-**	X	-	X	-	X	-	-	-	-
Gomphrena celosioides	Gomphrena Weed	-	**X**	X	-	-	-	-	-	-	-	-
Emilia sonchifolia	Emilia	-	**X**	X	X	X	-	-	-	X	X	-
Hypochaeris radicata	Flatweed	-	**X**	X	X	X	X	X	X	X	X	-
Parthenium hysterophorus	Parthenium Weed	2	**-**	-	-	-	-	-	-	-	X	-
Senecio madagascariensis	Fireweed	2	**-**	-	-	X	-	-	-	-	-	-
Sonchus oleraceus	Rough Sow Thistle	-	**X**	X	X	X	X	X	-	-	-	X
Sphagneticola trilobata	Singapore Daisy	3	**-**	X	X	-	X	-	-	X	X	-
Tagetes minuta	Stinking Roger	-	**X**	X	-	-	X	X	-	X	X	-
Tridax procumbens	Tridax Daisy	-	**X**	X	-	-	X	-	-	-	-	-
AVICENNIACEAE												
Avicennia marina	Grey Mangrove*	-	**X**	X	X	X	X	X	X	X	X	X
BORAGINACEAE												
Heliotropium amplexicaule	Blue Heliotrope	-	**X**	-	-	-	-	-	-	X	X	X
BRASSICACEAE												
Lepidium africanum	Common Peppercress	-	**X**	X	-	X	X	-	-	-	-	-
CACTACEAE												
Opuntia sp	Prickly Pear	2	**X**	X	X	X	-	X	X	-	-	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
CAESALPINIACEAE												
Senna pendula var *glabrifolia*	Easter Cassia	-	**X**	-	-	-	-	-	-	-	-	-
CAMPANULACEAE												
Wahlenbergia graniticola	Granite Bluebell*	-	**-**	-	-	X	-	-	-	-	-	-
CASUARINACEAE												
Casuarina equisetifolia	Coastal Sheoak*	-	**X**	X	X	X	X	X	X	X	X	X
Casuarina littoralis	Black Sheoak*	-	**X**	X	X	X	X	X	X	X	X	X
CHENOPODIACEAE												
Enchylaena tomentose	Ruby saltbush*	-	**-**	-	X	-	-	-	-	-	-	-
Suaeda australis	Sea Blite*	-	**X**	X	X	X	-	-	-	-	-	-
COMMELINACEAE												
Commelina benghalensis	-	-	**X**	-	-	-	X	-	-	-	-	-
Commelina diffusa (C. cyanea)	Wandering Jew	-	**X**	X	-	-	X	X	-	-	X	-
CONVOLVULACEAE												
Cuscuta campestris	Dodder	-	**-**	-	-	-	-	-	-	X	-	-
Convolves arvensis	European Bindweed	-	**-**	-	-	-	-	-	-	-	-	-
Ipomoea so (alba)	White Ipomoea	-	**-**	-	-	-	-	-	-	-	-	X
Ipomoea cairica	Coastal Morning Glory	-	**X**	X	X	X	X	X	X	X	X	X
Ipomoea indica	Purple Morning Glory	-	**X**	-	-	X	-	-	-	-	-	-
Ipomoea pes-caprae	Goats Foot Convolvulus *	-	**-**	X	X	X	X	-	-	-	-	X
Ipomoea quamoclit	Cypress Vine	-	**X**		-	-	-	-	-	-	-	-
CYPERACEAE												
Carex appressa	Tall Sedge*	-	-	-	-	-	-	-	-	-	X	-
Cyperus aggregatus	-	-	**X**	-	-	-	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
Cyperus congestus	Clustered Flatsedge	-	-	-	-	-	-	-	-	-	-	X
Cyperus eragrostis	Umbrella Sedge	-	-	-	-	-	X	-	-	-	-	X
Cyperus rotundus	Nut Grass	-	X	-	-	-	-	-	-	-	X	-
Cyperus polystachyos	Bunchy Sedge	-	X	-	-	-	-	-	-	-	X	-
EUPHORBIACEAE												
Chamaesyce maculata	Caustic Weed	-	X	X	-	-	-	-	-	-	-	-
Euphorbia hirta	Asthma Plant	-	X	-	-	-	-	-	-	-	-	-
Euphorbia prostrata	Caustic Creeper	-	-	-	X	-	X	-	-	-	-	X
Euphorbia cyathophora.	Painted Spurge	-	X	-	-	-	-	-	-	-	-	-
Macaranga tanarius	Macaranga*	-	X	X	X	X	X	X	X	X	X	X
Phyllanthus virgatus	Creeping Phyllanthus	-	-	-	-	-	-	-	-	-	-	-
FABACEAE												
*Canavalia rosea**	Coastal Jack Bean*	-	X	-	X	-	X	-	-	-	-	-
Crotalaria incana	Woolly Rattle Pod	-	-	-	-	-	X	-	-	-	-	-
Crotalaria lanceolata	Lance-leaf Rattle Pod	-	X	-	X	X	-	-	-	-	-	-
Crotalaria pallida	Rattle Pod	-	-	-	-	-	-	X	X	X	X	X
Desmodium uncinatum	Silver Leafed Desmodium	-	-	-	-	-	-	-	-	X	-	-
Indigofera spicata	Creeping Indigo	-	X	X	X	-	-	-	-	-	-	-
Macroptilium atropurpureum	Siratro	-	X	X	X	X	X	X	X	X	X	X
Macroptilium lathyroides	Phasey Bean	-	-	-	X	-	-	-	-	X	-	-
Medicago lupulina	Black Medic	-	-	X	-	X	-	X	-	X	-	-
Medicago sativa	Lucerne	-	-	-	-	-	-	-	-	-	X	X
Melilotus albus	Bokhara	-	-	X	-	X	-	X	-	-	-	-
Melilotus indicus	Sweet Melilotus	-	-	-	-	X	-	-	-	X	-	X
Neonotonia wightii	Glycine	-	X	X	X	-	X	X	X	X	-	X

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
Sesbania cannabina	Sesbania Pea*	-	**X**	-	X	X	X	-	-	-	X	X
Stylosanthes hamata	Verano Stylo	-	**-**	-	X	X	X	-	-	-	-	-
Stylosanthes humilis	Townsville Stylo	-	**X**	X	-	-	-	-	-	-	-	-
Trifolium repens	Clover	-	**-**	-	-	X	X	-	X	X	X	-
*Vigna marina**	Yellow Beach Bean*	-	**-**	-	-	-	-	-	-	-	X	-
LAURACEAE												
Cinnamomum camphora	Camphor Laurel	3	**-**	-	-	-	-	-	-	X	-	-
LORANTHACEAE												
Amyema sp.	A Mistletoe	-	**-**	-	X	-	-	-	-	-	-	-
MALVACEAE												
Hibiscus tiliaceus	Cotton Tree*	-	**X**	X	X	X	X	X	X	-	X	X
Sida cornifolia	Flannel Weed	-	**X**	-	X	X	X	X	X	-	X	X
Sida rhombifolia	Common Sida	-	**X**	X	-	-	X	X	-	-	X	-
MIMOSACEAE												
Acacia disparrima	Hickory Wattle*	-	**-**	X	-	-	-	-	X	-	X	X
Acacia leiocalyx	Curracabah*	-	**-**	X	-	-	-	X	-	-	-	-
MORACEAE												
Ficus elastica	Rubber Tree	-	**X**	X	-	-	-	-	-	-	-	-
MYRTACEAE												
Eucalyptus robusta	Swamp Mahogany*	-	**-**	-	-	-	-	-	X	X	X	X
Lophostemon confertus	Brush Box*	-	**X**	X	X	X	X	X	X	X	X	X
Melaleuca linariifolia	Flax-leafed Paperbark*	-	**X**	X	X	X	X	X	X	X	X	X
Melaleuca quinquenervia	Broad-leaved Paperbark*	-	**X**	X	X	X	X	X	X	X	X	X
Callistemon viminalis	Weeping Bottlebrush*	-	**-**	-	-	-	-	X	-	X	-	X
ONAGRACEAE												
Oenothera drummondii	Beach Primrose	-	**X**	X	X	X	X	X	X	X	X	X

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
subsp. drummondii												
Oenothera laciniata	Cut-leaf Evening Primrose	-	-	X	-	X	-	-	-	-	-	-
OXALIDACEAE												
Oxalis corniculata	Creeping Oxalis	-	**X**	-	X	X	X	X	-	-	-	-
PANDANACEAE												
*Pandanus tectorius**	Screw Pine*	-	**X**	X	X	X	X	X	X	X	X	X
PASSIFLORACEAE												
Passiflora cairica	Stinking Passion Vine	-	-	-	-	-	-	-	-	X	-	-
Passiflora subpeltata	White Passion Flower	-	-	-	-	-	-	-	-	-	-	X
PLANTAGINACEAE												
Plantago lanceolata	Lamb's Tongue	-	**X**	X	-	X	X	X	-	-	-	-
POACEAE												
Brachiaria decumbens	Signal Grass	-	-	-	X	-	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	X
Chloris gayana	Rhodes Grass	-	**X**	X	X	X	X	X	X	X	X	X
Chloris truncata	Windmill Grass	-	-	-	-	-	-	X	-	-	X	-
Chloris virgata	Feather-top Rhodes Grass	-	-	-	-	-	-	-	-	-	X	X
Cynodon dactylon	Couch Grass	-	**x**	X	X	X	X	X	X	X	X	X
Dichanthium aristatum	Angleton Grass	-	-	-	-	-	-	-	-	-	-	-
Dichanthium sericeum	Queensland Blue Grass*	-	**X**	-	-	-	-	-	-	-	-	-
Digitaria ciliaris	Summer Grass	-	-	-	-	-	-	-	-	-	-	-
Echinochloa telmatophila	Swamp Barnyard Grass	-	-	-	-	-	X	-	-	-	-	-
Eleusine indica	Crowsfoot Grass	-	-	-	-	-	-	-	-	-	-	-
Eragrostis tenuifolia	Elastic Grass	-	-	-	-	X	-	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
Hemarthria uncinata	Mat Grass	-	**-**	-	-	-	-	-	-	-	-	-
*Imperata cylindrical**	Blady Grass*	-	**-**	-	-	-	X	X	X	X	X	-
Melinis repens	Red Natal Grass	-	**X**	X	X	X	X	X	X	X	X	X
Melinis minutiflora	Molasses Grass	-	**-**	-	-	-	-	-	-	X	-	-
Poa annua	Winter Grass	-	**-**	-	-	-	-	-	-	-	-	-
Panicum effusum	Hairy Panic	-	**-**	-	-	-	-	-	-	-	-	X
Panicum miliaceum	Millet Panic	-	**-**	-	X	-	-	-	-	-	-	-
Megathyrsus maximus var. *maximus*	Guinea Grass	-	**X**	X	X	X	X	X	X	X	X	X
Megathyrsus var. *pubiglumis*	Green Panic	-	**X**	-	-	-	-	-	-	-	-	-
Paspalum dilatatum	Paspalum	-	**X**	-	-	-	-	-	-	-	X	-
*Phragmites australis**	Common Reed*	-	**X**	X	X	X	X	X	X	X	-	X
Sorghum halepense	Johnson Grass	-	**-**	-	-	-	-	-	-	X	X	X
Sporobolus elongates	Slender Rat's Tail	-	**X**	X	-	X	-	-	-	-	-	-
*Typha orientalis**	Cumbungi / Typha*	-	**-**	-	-	-	-	-	-	X	X	X
Urochloa mosambicensis	Sabi Grass	-	**-**	-	-	-	-	-	-	-	-	X
PORTULACACEAE												
Portulaca oleracea	Pigweed	-	**X**	X	X	X	-	-	-	-	-	-
Portulaca pilosa	Hairy Pigweed	-	**X**	X	X	X	X	X	X	X	-	X
PRIMULACEAE												
Anagallis arvensis	Scarlet Pimpernel	-	**-**	X	X	X	X	X	-	X	-	X
PROTEACEAE												
*Banksia integrifolia**	Coastal Banksia*	-	**X**	X	X	X	X	X	X	X	X	X
RUBIACEAE												
Richardia brasiliensis	Mexican Clover	-	**X**	-	-	-	X	-	-	-	-	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007	MAR 2007	OCT 2006	MAR 2006	NOV 2005
SAPINDACEAE												
Cardiospermum halicacabum	Balloon Vine	-	**-**	-	-	-	-	-	-	-	-	-
*Cupaniopsis anacardioides**	Tuckeroo*	-	**X**	X	X	X	X	X	X	X	X	X
SOLANACEAE												
Physalis minima	Wild Gooseberry	-	**X**	-	-	-	-	-	-	-	-	-
Solanum seaforthianum	Brazilian Nightshade	-	**-**	-	X	-	-	-	-	X	-	X
Solanum nigrum	Blackberry Nightshade	-	**X**	X	X	X	X	X	X	-	-	-
ULMACEAE												
Celtis sinensis	Chinese Celtis	3	**-**	-	-	-	-	-	X	-	X	-
VERBENACEAE												
Lantana camara	Lantana	3	**X**	X	X	X	X	X	X	X	X	X
Lantana montevidensis	Creeping Lantana	3	**X**	X	-	X	-	X	-	X	X	-
Verbena bonariensis	Purple Top	-	**X**	X	X	X	X	X	X	X	-	X
Verbena aristigera	Mayne's Pest	-	**X**	-	X	X	X	X	-	X	-	-
Vitex trifolia var *trifolia**	Coastal Vitex*	-	**-**	-	-	-	-	-	-	-	-	X

Note:

* designates indigenous species

LPA Class – *Land Protection (pest and stock route management) Regulations* 2003, Schedule 2.

APPENDIX D SURVEY RESULTS FOR PORT GATE DRAIN

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007
AIZOACEAE								
*Carpobrotus glaucescens**	Pigface*	-	**X**	X	X	X	X	X
*Sesuvium portulacastrum**	Sea Purslane*	-	**X**	X	X	X	X	X
AMARANTHACEAE								
Amaranthus viridis	Green Amaranthus	-	-	-	-	**-**	X	-
ANACARDIACEAE								
Schinus terebinthifolia	Broad-leaf Pepper	3	**X**	X	X	X	-	-
APOCYNACEAE								
*Parsonsia straminea**	Monkey Rope Vine*	-	**X**	X	-	X	X	-
ASCLEPIADACEAE								
Gomphocarpus physocarpus	Balloon Cotton Bush	-	-	-	X	X	X	X
ASTERACEAE								
Ambrosia artemisiifolia	Annual Ragweed	2	-	-	-	-	-	X
Aster subulatus	Wild Aster	-	**X**	X	-	X	X	-
Baccharis halimifolia	Groundsel Bush	2	**X**	X	X	X	X	X
Bidens pilosa	Cobblers Pegs	-	**X**	X	X	X	-	X
Cirsium vulgare	Spear Thistle	-	-	-	-	X	-	-
Conyza bonariensis	Flaxleaf Fleabane	-	**X**	-	X	X	X	-
Conyza canadensis	Canadian Fleabane	-	-	-	-	-	X	X
Conyza sumatrensis	Tall Fleabane	-	**-**	X	-	X	-	-
Crassocephalum crepidioides	Thickhead	-	-	-	-	-	X	-
Emilia sonchifolia	Emilia	-	**X**	X	X	X	-	-
Gomphrena celosioides	Gomphrena Weed	-	**X**	-	-	X	-	-
Senecio madagascariensis	Fireweed	2	**-**	X	-	-	-	-
Sonchus oleraceus	Rough Sow Thistle	-	**-**	X	-	X	-	-
Tagetes minuta	Stinking Roger	-	-	-	-	-	-	X
Tridax procumbens	Tridax Daisy	-	**X**	X	-	-	-	-
BORAGINACEAE								

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007
Heliotropium amplexicaule	Blue Heliotrope	-	-	-	X	X	-	-
BRASSICACEAE								
Lepidium africanum	Common Peppercress	-	**-**	X	X	X	-	-
CASUARINACEAE								
*Casuarina equisetifolia**	Coastal Sheoak*	-	-	-	-	X	X	-
*Casuarina littoralis**	Black Sheoak*	-	**X**	-	-	X	X	-
CHENOPODIACEAE								
*Atriplex muelleri**	Annual Saltbush*	-	**X**	X	X	X	X	X
*Dysphania littoralis**	Red Crumbweed*	-	**X**	X	X	X	X	-
*Enchylaena tomentose**	Ruby saltbush*	-	**X**	-	X	-	X	-
*Sarcocornia quinqueflora**	Bead Weed*	-	**X**	X	X	X	X	-
Suaeda australis	Sea Blite*	-	-	-	X	X	X	-
CONVOLVULACEAE								
Ipomoea cairica	Coastal Morning Glory	-	**X**	X	X	X	-	-
CYPERACEAE								
Cyperus eragrostis	Umbrella Sedge	-	-	-	-	-	X	-
Cyperus involucratus	-	-	-	-	-	-	X	-
Cyperus polystachyos	Bunchy Sedge*	-	**X**	X	X	X	-	-
Fimbristylis dichotoma	Fringe Rush*	-	**X**	X	X	X	-	-
Fimbristylis ferruginea	-	-	**X**	-	-	-	-	-
Isolepis cernua	Nodding Club Rush*	-	**X**	X	X	X	X	-
EUPHORBIACEAE								
Chamaesyce maculata	Caustic Weed	-	**X**	-	-	-	-	-
Euphorbia hirta	Asthma Plant	-	**X**	-	-	-	X	-
Ricinus communis	Castor Oil Plant	-	**X**	X	X	X	X	-
FABACEAE								
Centaurium erythraea	Common Centaury	-	-	-	-	-	-	X
Crotalaria incana	Woolly Rattle Pod	-	-	-	-	-	X	-
Crotalaria lanceolata	Lance-leaf Rattle Pod	-	**X**	-	X	X	-	-
Crotalaria pallida	Rattle Pod	-	-	-	-	-	-	X

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007
Cullen *tenax*	Emu-foot*	-	**X**	X	X	-	-	-
Indigofera hirsute	Hairy Indigo	-	-	-	X	X	X	-
Indigofera spicata	Creeping Indigo	-	**X**	-	X	-	-	-
Macroptilium atropurpureum	Siratro	-	**X**	X	X	X	X	X
Macroptilium lathyroides	Phasey Bean	-	**X**	X	X	X	X	X
Melilotus indicus	Sweet Melilotus	-	-	-	-	X	-	-
Medicago polymorpha	Burr Medic	-	**-**	X	-	X	X	X
Medicago sativa subsp. Sativa	Lucerne	-	**-**	X	X	X	X	-
Neonotonia wightii	Glycine	-	**X**	X	X	-	-	X
Sesbania cannabina	Sesbania Pea*	-	**X**	X	X	X	X	-
Stylosanthes hamata	Verano Stylo	-	-	-	X	-	-	-
Stylosanthes humilis	Townsville Stylo	-	**X**	X	-	-	-	-
LAURACEAE								
Cinnamomum camphora	Camphor Laurel	3	**X**	X	-	X	-	-
MYRTACEAE								
Psidium guajava	Yellow Guava	-	-	-	-	**-**	X	X
PAPAVERACEAE								
Argemone ochroleuca	Mexican Poppy	-	-	-	-	-	-	X
PASSIFLORACEAE								
Passiflora foetida	Stinking Passion Flower	-	-	-	-	**-**	X	X
PHYTOLACCACEAE								
Phytolacca octandra	Ink Weed	-	-	-	-	**-**	X	X
PLANTAGINACEAE								
Plantago lanceolata	Lamb's Tongue	-	**X**	X	X	X	-	X
POACEAE								
Arundo donax	Giant Reed	-	-	-	-	-	X	-
Brachiaria decumbens	Signal Grass	-	**-**	-	-	X	-	-
Brachiaria mutica	Para Grass	-	-	-	-	-	X	X
Cenchrus echinatus	Mossman River Grass	-	**-**	X	X	X	X	-

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007
Chloris gayana	Rhodes Grass	-	**X**	X	X	X	X	X
Chloris truncata	Windmill Grass	-	-	-	-	-	-	X
Chloris virgata	Feather-top Rhodes Grass	-	**X**	-	X	X	X	X
*Cymbopogon refractus**	Barbed Wire Grass*	-	**X**	X	X	X	X	-
Cynodon dactylon	Couch Grass	-	-	-	X	-	X	X
Dichanthium sericeum	Queensland Bluegrass*	-	**X**	-	X	-	-	-
*Eriochloa crebra**	Cup Grass*	-	**-**	X	-	-	-	-
Eragrostis tenuifolia	Elastic Grass	-	-	-	-	X	-	-
Leptochloa fusca subsp. *fusca**	Brown Beetle Grass*	-	**X**	X	-	-	-	-
Melinis repens	Red Natal Grass	-	**X**	X	X	X	X	X
Megathyrsus maximus var. maximus	Guinea Grass	-	**X**	X	-	X	X	X
Panicum sp.*	-	-	**X**	-	-	-	-	-
Paspalum dilatatum	Paspalum	-	**-**	X	-	-	-	-
Paspalum urvillei	-	-	-	-	X	X	-	-
*Phragmites australis**	Common Reed*	-	**X**	X	X	X	X	-
*Setaria parviflora**	-	-	**X**	-	-	-	-	-
Setaria sphacelata	Pigeon Grass	-	-	-	-	-	X	-
Sorghum halepense	Johnson Grass	-	-	-	X	X	-	-
Sporobolus coromandelianus	-	-	**X**	-	-	-	-	-
*Sporobolus virginicus**	Salt Couch*	-	**X**	X	X	X	X	X
Typha orientalis	Cumbungi / Typha*	-	**X**	X	X	X	-	X
PORTULACACEAE								
Portulaca pilosa	Hairy Pigweed	-	**X**	X	X	X	X	X
PRIMULACEAE								
Anagallis arvensis	Scarlet Pimpernel	-	**-**	X	-	X	-	X
SOLANACEAE								
Cestrum parqui	Green Cestrum	-	**-**	X	-	**-**	-	-
Solanum nigrum	Blackberry Nightshade	-	**X**	X	-	**-**	X	X
VERBENACEAE								
Lantana camara	Lantana	3	**X**	X	X	X	X	X

SPECIES	COMMON NAME	LPA CLASS	MAR 2010	NOV 2009	MAR 2009	NOV 2008	MAR 2008	NOV 2007
Lantana montevidensis	Creeping Lantana	3	**X**	-	-	X	X	-
Verbena bonariensis	Purple Top	-	**-**	X	-	X	-	-

Notes: -

* designates indigenous species

LPA Class – Land Protection (pest and stock route management) Regulations 2003, Schedule 2.

APPENDIX E LOCATION OF DECLARED SPECIES

The following table lists the GPS location of the declared species listed in Schedule 2 of the *Land Protection (Pest and Stock Route Management) Regulations 2003* that were recorded during the previous and current survey for Lucinda and Port Gate Drains. GPS readings recorded during the previous survey that are similar to the current survey reading are in bold.

LOCATION OF DECLARED SPECIES ALONG LUCINDA DRAIN

BOTANICAL NAME	COMMON NAME	GPS LOCATION (LATITUDE AND LONGITUDE)					
		MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
LPA CLASS 1							
No species recorded	-	-	-	-	-	-	-
LPA CLASS 2							
Opuntia sp.	Prickly Pear	**27.3898,153.1741** 27.3908, 153.1728	**27.3898,153.1740**	**27.3898,153.1740**	**27.3898, 153.1741**	-	-
Baccharis halimifolia	Groundsel Bush	-	**27.3801,153.1800**	27.4025,153.1607	27.3814,153.1787	-	-
LPA CLASS 3							
Schinus terebinthifolia	Broad-leaf Pepper	**27.3920,153.1714** **27.3909,153.1731** **27.3832,153.1777** **27.3819,153.1787**	**27.3920,153.1713** **27.3918,153.1717** **27.3914,153.17231** **27.3911,153.1728** **27.3910,153.1730** **27.3833,153.1777** **27.3819,153.1787** **27.3801,153.1804** 27.3793,153.1809 27.3794,153.1810 27.3790,153.1815	**27.3922,153.1706** **27.3920,153.1713** **27.3918,153.1717** **27.3911,153.1729** **27.3833,153.1777** **27.3820,153.1786** **27.4028,153.1607**	**27.3922, 153.1706** **27.3919, 153.1714** **27.3917, 153.1719** **27.3912, 153.1729** **27.3833, 153.1778** **27.3802, 153.1803** **27.3925, 153.1688** **27.3914, 153.1724**	No points taken	**27.3922, 153.1706** **27.3921, 153.1714** **27.3918, 153.1718** **27.3910, 153.1729** **27.3833, 153.1778** **27.3801, 153.1804** 27.3921, 153.1710 27.3910, 153.1732
Lantana camara	Lantana	**27.3921,153.1710** **27.3819,153.1787** **27.3816,153.1789** **27.3796,153.1809**	**27.3831, 153.1778** **27.3819, 153.1787** **27.3818, 153.1788** **27.3816, 153.1789**	**27.3922, 153.1709** **27.3827, 153.1780** **27.3820, 153.1786** **27.3923, 153.1703**	**27.3919, 153.1711** **27.3818, 153.1788** **27.3923, 153.1703** 27.3797, 153.1809	**27.3921,153.171** **27.3827,153.1782**	**27.3921,153.1713** **27.3827,153.1782** **27.3819,153.1788** -

BOTANICAL NAME	COMMON NAME	GPS LOCATION (LATITUDE AND LONGITUDE)					
		MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
			27.3802, 153.1801	27.3816, 153.1789			27.3833, 153.1778
Lantana montevidensis	Creeping Lantana	**27.3906,153.1734**	27.3906, 153.1734	-	-	-	-
Sphagneticola trilobata	Singapore Daisy	-	No points taken	**27.3830,153.1779**	-	27.3811, 153.1794	-

Bold - GPS readings recorded during the previous surveys that are similar to the current survey reading.

LOCATION OF DECLARED SPECIES ALONG PORT GATE DRAIN

BOTANICAL NAME	COMMON NAME	GPS LOCATION (LATITUDE AND LONGITUDE)					
		MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
LPA CLASS 1							
No species recorded	-	-	No points taken	No points taken	-	-	-
LPA CLASS 2							
Baccharis halimifolia	Groundsel Bush	**27.4087, 153.1617** **27.4089, 153.1617**	No points taken	No points taken	27.4097, 153.1619 27.41, 153.1624	27.4099, 153.1623 27.4086, 153.1616	-
LPA CLASS 3							
Schinus terebinthifolia	Broad-leaf Pepper	**27.4046, 153.1613** **27.4046, 153.1613** **27.4061, 153.1614** **27.4079, 153.1616** **27.4089, 153.1616** **27.4092, 153.1616**	No points taken	No points taken	27.408, 153.1616 27.409, 153.1617 27.4094, 153.1617 27.4097, 153.1619 27.4098, 153.1621 27.410, 153.1624	-	-

BOTANICAL NAME	COMMON NAME	GPS LOCATION (LATITUDE AND LONGITUDE)					
		MARCH 2010	NOVEMBER 2009	MARCH 2009	NOVEMBER 2008	MARCH 2008	NOVEMBER 2007
		27.4093, 153.1617			27.410, 153.1629 27.4105, 153.163		
Cinnamomum camphora	Camphor Laurel	**27.4089, 153.1616**	No points taken	No points taken	27.409, 153.1617	-	**-**
Lantana camara	Lantana	**27.4089, 153.1616**	No points taken	No points taken	**27.409, 153.1617**	**27.409, 153.1617**	**27.4089, 53.1617**
Lantana montevidensis	Creeping Lantana	27.4055, 153.1613	-	-	**-**	**-**	**-**

Bold - GPS readings recorded during the previous surveys that are similar to the current survey reading.

APPENDIX F LPA DECLARED SPECIES FACT SHEETS

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.

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.

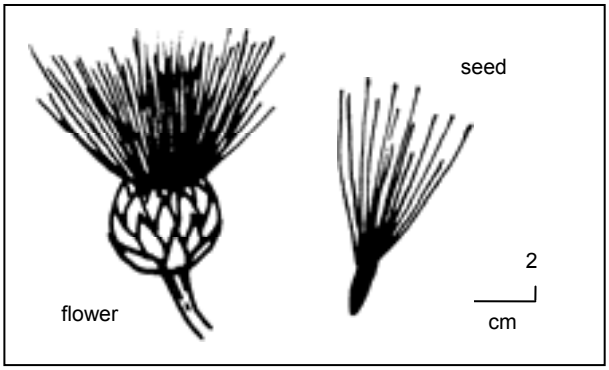


TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF GROUNDSEL BUSH

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 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.

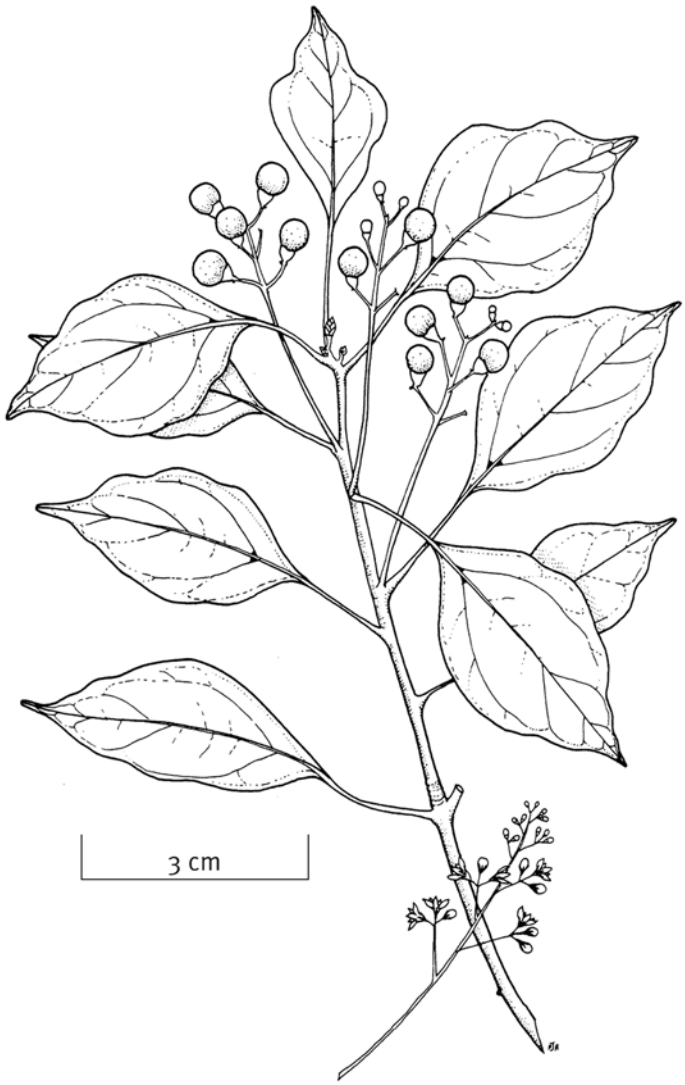
Along the waterways of south-east Queensland, camphor laurels are replacing the native blue gums threatening koala populations.

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 September 2009



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 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 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)

PR09_4282

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.

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

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

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