

**INDUSTRY BIOSECURITY PLAN
FOR THE NURSERY & GARDEN INDUSTRY**

Threat Specific Contingency Plan

Glassy winged sharpshooter

Homalodisca vitripennis

(formally *H. coagulata*)

Plant Health Australia

June 2009



Disclaimer

The scientific and technical content of this document is current to the date published and all efforts were made to obtain relevant and published information on the pest. New information will be included as it becomes available, or when the document is reviewed. The material contained in this publication is produced for general information only. It is not intended as professional advice on any particular matter. No person should act or fail to act on the basis of any material contained in this publication without first obtaining specific, independent professional advice. Plant Health Australia and all persons acting for Plant Health Australia in preparing this publication, expressly disclaim all and any liability to any persons in respect of anything done by any such person in reliance, whether in whole or in part, on this publication. The views expressed in this publication are not necessarily those of Plant Health Australia.

Further information

For further information regarding this contingency plan, contact Plant Health Australia through the details below.



Address: Suite 5, FECCA House
4 Phipps Close
DEAKIN ACT 2600

Phone: +61 2 6215 7700

Fax: +61 2 6260 4321

Email: admin@phau.com.au

Website: www.planthealthaustralia.com.au

1	Purpose and background of this contingency plan	5
2	Australian nursery industry.....	5
3	Pest information/status.....	6
3.1	Pest details.....	6
3.1.1	Background	6
3.1.2	Life cycle	9
3.1.3	Dispersal	10
3.2	Affected hosts.....	10
3.2.1	Host range.....	10
3.2.2	Current geographic distribution	10
3.2.3	Symptoms	10
3.3	Diagnostic information.....	11
3.4	Pest risk ratings and potential impacts	12
3.4.1	Phytosanitary risk	13
3.4.2	Entry potential	13
3.4.3	Establishment potential.....	13
3.4.4	Spread potential	14
3.4.5	Economic impact	14
3.4.6	Overall risk	15
4	Pest management	15
4.1	Response checklist.....	15
4.2	Surveys and epidemiology studies	16
4.2.1	Technical information for planning surveys.....	16
4.2.2	Surveys for early detection of an incursion in a nursery.....	16
4.2.3	Delimiting surveys in the event of an incursion	17
4.2.4	Collection and treatment of samples	18
4.2.5	Epidemiological study	19
4.2.6	Models of spread potential.....	19
4.2.7	Pest Free Area guidelines.....	19
4.3	Availability of control methods.....	21
4.3.1	General procedures for control.....	21
4.3.2	Chemical control.....	21
4.3.3	Biological control	25
5	Course of action.....	25
5.1	Destruction strategy	25

5.1.1	Destruction protocols	25
5.1.2	Decontamination protocols.....	26
5.1.3	Priorities	26
5.1.4	Plants, by-products and waste processing	27
5.1.5	Disposal issues.....	27
5.2	Containment strategies	27
5.3	Quarantine and movement controls.....	27
5.3.1	Quarantine priorities	27
5.3.2	Movement controls	27
5.4	Zoning	28
5.4.1	Destruction Zone	29
5.4.2	Restricted Area.....	29
5.4.3	Quarantine Zone.....	30
5.4.4	Buffer Zone	30
5.4.5	Control Area	30
5.5	Decontamination and property clean up	30
5.5.1	Decontamination procedures	30
5.5.2	General safety precautions	31
5.6	Surveillance and tracing.....	31
5.6.1	Surveillance.....	31
5.6.2	Survey regions	31
5.6.3	Post-eradication surveillance	32
6	Technical debrief and analysis for stand down	33
7	References	33
7.1	Related Websites.....	34
8	Appendices.....	35
8.1	Appendix 1: Extended host list	35
8.2	Appendix 1: Standard diagnostic protocols.....	38
8.3	Appendix 2: Resources and facilities	38
8.4	Appendix 3: Communications strategy	39
8.5	Appendix 4: Market access impacts	39

1 Purpose and background of this contingency plan

This contingency plan provides background information on the pest biology and available control measures to assist with preparedness for an incursion into Australia of Glassy winged sharpshooter (GWSS; *Homalodisca vitripennis*). While the greatest biosecurity risk from the GWSS is as the vector for *Xylella fastidiosa* (Pierce's disease), the scope of this contingency plan is for an incursion of the GWSS only. *X. fastidiosa* is not recorded as present in Australia and this pest will require the development of a separate contingency plan. For risk analysis and background information on this pest, refer to the Nursery and Garden Industry Biosecurity Plan (Plant Health Australia, 2008b) and the *X. fastidiosa* pest risk review¹.

Any Response Plan developed for GWSS using information in whole or in part from this contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

This contingency plan was developed for the Nursery and Garden Industry Australia (NGIA), and therefore is focussed on production nurseries covered by this association. In the event of an incursion, operations not covered by the NGIA (e.g. retail nurseries) will not be eligible for Owner Reimbursement Costs, as defined in the Emergency Plant Pest Response Deed (EPPRD), if affected by actions carried out under the Response Plan.

2 Australian nursery industry

The Australian nursery industry is a significant horticultural sector with a combined supply chain (production to retail/grower) valued at more than \$6 billion dollars annually. The industry employs approximately 45,000 people spread over more than 20,000 small to medium sized businesses including production nurseries and retail outlets. The industry is located predominantly along the Australian coastline and in major inland regions servicing urban and production horticulture.

Nursery production adds value to Australia's primary industry's sector and in 2008/2009 is forecast to contribute more than \$2 billion to the national economy. Nursery production is a highly diverse primary industry servicing the broader \$14 billion horticultural sector within Australia (Table 1).

¹ Both documents can be downloaded from www.planthealthaustralia.com.au/biosecurity

Table 1. Nursery production supply sectors within Australian horticulture

Production Nursery	Horticultural markets	Economic value
Container stock ²	Ornamental/urban horticulture	\$2 billion retail value
Foliage plants ²	Interior-scapes	\$87 million industry
Seedling stock ³	Vegetable growers	\$3.3 billion industry
Forestry stock ⁴	Plantation timber	\$1.7 billion industry
Fruit and nut tree stock ³	Orchardists (citrus, mango, etc)	\$5.2 billion industry
Landscape stock ²	Domestic & commercial projects	\$2 billion industry
Plug and tube stock ⁵	Cut flower	\$319 million industry
Revegetation stock ²	Farmers, government, landcare	\$109 million industry
Mine revegetation	Mine site rehabilitation	Value unknown
Total horticultural market value		\$14.5 billion

3 Pest information/status

3.1 Pest details

Common names:	Glassy winged sharpshooter; sharpshooter, glassy winged
Scientific name:	<i>Homalodisca vitripennis</i>
Synonyms:	<i>Homalodisca coagulata</i> ; <i>Homalodisca triquetra</i> Turner; <i>Phera bitripennis</i> (Germar); <i>Phera coagulata</i> Stal; <i>Tettigonia coagulata</i> Say
Taxonomic position:	Kingdom, Animalia; Phylum, Arthropoda; Class, Insecta; Order, Hemiptera; Family, Cicadellidae

3.1.1 Background

The Glassy winged sharpshooter (GWSS) is an insect native to the south-eastern United States and is now considered a serious threat to California’s crops and ornamental plants. GWSS is a large leafhopper that obtains its nutrients by feeding on fluids from the water conducting plant xylem tissue. It was first found in the southern regions of California in 1990 and has continued to move northwards.

The GWSS feeding activity rarely causes significant damage by itself, even though the insect excretes copious amounts of liquid that can make leaves and fruit appear white washed (Figure 1) when dry. The biosecurity risk associated with the GWSS comes as it is the vector of the pathogenic bacterium *Xylella fastidiosa*. This bacterium is the causal agent of many devastating plant diseases, including Pierce’s disease of grape, oleander leaf scorch, almond leaf scorch, mulberry leaf scorch, phony peach disease, plum leaf scald, leaf scorches in sycamore, elm, maple, oak and variegated

² Data sourced from Market Monitor

³ Data sourced from Horticultural Handbook 2004

⁴ Data sourced from ABARE 2005

⁵ Data sourced from industry

citrus chlorosis. It also infects landscape plants in California causing sweet gum dieback and cherry plum leaf scorch. For this reason, the GWSS is of enormous concern to California agriculture, threatening their wine and table grape industry. GWSS flies further than native sharpshooters in the US, increasing bacterial spread and seriously threatens agricultural production.

GWSS attacks a wide variety of ornamental and crop plants, and in most cases it feeds on the stems of plants rather than leaves. Among the hosts are grapes, citrus, almond, stone fruit and oleanders. Because of the large number of hosts, GWSS populations can flourish in both agricultural and urban areas. When feeding, it produces copious amounts of watery excrement in a steady stream of small droplets.

GWSS are large insects about 12 mm in length with a dark brown to black colouring with a lighter underside. The upper parts of the head and back are stippled with ivory or yellowish spots, with wings that are partly transparent with reddish veins (Figure 2). Watery excrement often collects on either side of the insect, appearing as large white spots. GWSS eggs are laid together on the underside of leaves (Figure 3), usually in groups of 10-12. The eggs are easier to observe following hatching, when they change in appearance from green water blisters to leave tan to brown scars on the leaves. The immature nymphs are wingless. After several moultings the nymphs become adults.



Figure 1. White washed appearance of citrus fruit covered in GWSS excrement



Figure 2. GWSS dorsal (top) and lateral (bottom) views. Images taken from PaDIL (www.padil.gov.au)



Figure 3. Egg masses of the GWSS positions just under the lower leaf epidermis

3.1.2 Life cycle

The GWSS produces two generations a year in southern California. After a peak in adult activity during the winter months, oviposition begins in late winter and early spring (February/March) peaking in May. Adults live for about two months. Before laying eggs, the female secretes a chalky white substance that is held on its wings. They lay small sausage shaped eggs side by side in masses of 10-12 eggs, on average. The eggs are laid just under the lower leaf epidermis of host plants. After laying the eggs, they are covered with the chalky material held on her wings, which provides a level of protection from parasitoids. Thus, the white spots on the wings are only visible on females shortly before laying a batch of eggs. Egg masses appear as greenish water blisters beneath the leaf. The nymphs hatch after about two weeks and proceed to feed on leaf petioles or small stems, while progressing through 5 moults before becoming winged adults.

A second peak in adult activity occurs in the summer during July and August. Peak oviposition in these first generation adults occurs in August. After the eggs have hatched, the old egg mass blister then appears as a tan to brown scar. In the US, oviposition is greater in laurel sumac, macadamia, lemon and the ornamental *Pittosporum* species than in most other oviposition hosts (Phillips, 1999b).

In Tahiti, GWSS is multivoltine (i.e. has more than two generations each year and these generations can overlap). At night, large numbers of adult insects are attracted to lights around shops, houses and airport hangers. The insect has been reported to „bite“ people when adults land on skin and probe sweat glands with mouth parts. „Sharpshooter rain“ (excessive fluid excretion from large populations feeding in trees) is a major nuisance in Tahiti and has led to the decline and partial defoliation of ornamental street trees.

3.1.3 Dispersal

Adult GWSS are strong fliers and can move rapidly from plant to plant. Nymphs are wingless but can distribute themselves by walking and jumping through the canopy or dropping from plants and walking to new hosts. Most rapid and long distant movement is as viable egg masses in nursery stock of either crop or ornamental plants.

3.2 Affected hosts

3.2.1 Host range

GWSS has a host range of over 200 plant species (see Table 10 in Appendix 1).

As GWSS continues to expand its range within California following its introduction in 1990, both the ovipositional and feeding host lists continue to expand, primarily within ornamental plant species grown in nurseries or landscape gardens. As it is a xylem feeder, it circumvents secondary plant defence chemistry found in phloem sap and, as a result, appears to be able to feed on most plant species. The high volume of xylem fluid intake required limits its survival to situations in which continued contact with a living host is possible. Only the egg stage is capable of survival for 2 or 3 weeks on excised fresh and moist plant foliage.

GWSS is native to the subtropical gulf states of south-eastern USA, in areas with a high water table where wild hosts produce the luxuriant growth necessary to sustain the xylem feeder. GWSS can also be found in the more arid regions of southern Texas and north-eastern Mexico, especially irrigated habitats, landscape gardens and citrus orchards.

Plants at all stages of development can be attacked by the GWSS.

3.2.2 Current geographic distribution

GWSS is found only in northern America, with restricted distribution in Mexico and French Polynesia (Tahiti).

GWSS is primarily a south-eastern US species and is abundant from eastern Texas to northern Florida, including the states of Louisiana, Alabama, Mississippi, Georgia, South Carolina and the southern parts of North Carolina and Arkansas (Turner and Pollard 1959). Populations of the pest are considerably smaller in central and southern Florida (Hoddle et al 2003) and central Texas. It has recently become a problem pest of ornamentals and native plants in French Polynesia and crops and ornamentals in southern, central and northern California (Blua et al 1999).

3.2.3 Symptoms

GWSS feeds on the nutrient poor liquid in the plants xylem and therefore must consume copious amounts of fluid in order to gain enough nutrients to grow and reproduce. Consequently, the adults and nymphs excrete large amounts of liquid while feeding, resulting in the fruit and foliage having a white washed appearance (Figure 1).

Extremely high populations of GWSS have been shown to reduce fruit quality and yield of coastal lemons and Valencias in southern California.

Feeding causes no visible signs of damage, even though the insect consumes hundreds of times its body weight per day in xylem fluid. Most non xylem feeding leafhoppers produce a sugary or particulate excrement but the excrement of xylem feeders is very watery, high in ammonia and dries to a fine, whitish powder which can cover the stems, foliage and fruit when the insects are abundant (Phillips 1998). High densities of feeding sharpshooters excrete enough waste products to cause a „rain“, which falls from the trees. This rain can be seen easily on sunny days and can be felt on the skin. This phenomenon is highly evident in Tahiti where puddles form on roads and sidewalks as result of sharpshooter rain.

Egg masses are usually laid into recently expanded foliage. Older foliage will contain the distinctive scars left after the eggs have hatched. When populations are more abundant, egg masses can be laid into the rind of immature fruits of crops such as citrus and melon. Old hatched egg masses appear as grey or tan scars on surface of the rind (Blua et al 1999).

If *X. fastidiosa* entered Australia with the GWSS, the resulting symptoms of this pathogen could also be used for detection of spread and establishment. The most characteristic symptom of *X. fastidiosa* pathogen is the development of leaf scorch, where parts of apparently healthy leaves suddenly dry, turning brown. Drying spreads and the whole leaf may shrivel and drop. For a more detailed explanation of *X. fastidiosa* symptoms, refer to the Pierce's disease pest risk review and leaf scorch factsheets on the Plant Health Australia website (www.planthealthaustralia.com.au/biosecurity). Further information can also be found on the Pest and Disease Image Library website⁶.

3.3 Diagnostic information

An expert with a good knowledge and understanding of Australian sharpshooters would be required to identify the pest. A diagnostic protocol has been prepared for GWSS (Fletcher 2002⁷). Care must be taken in distinguishing Australian leafhoppers from GWSS as some Australian species share some features with GWSS (Table 2; and refer to Fletcher (2002) for comparative images).

⁶ www.padil.gov.au/viewPestDiagnosticImages.aspx?id=499

⁷ Available at www.planthealthaustralia.com.au/biosecurity

Table 2. Australian Auchenorrhyncha species that share characteristics with GWSS (Fletcher 2002)

Cicadellidae: Ledrinae: Thymbrini. Species of this tribe sometimes have an expanded head with prominent eyes although the face is not swollen as in GWSS. Also, the tegmina (leathery front part of the wing) are opaque and cover the sides of the abdomen laterally.

Cicadellidae: Ledrinae: Ledrini. The ledrines have the head expanded, sometimes quite markedly, but the face is always flattened or even concave to enable the leafhoppers to fit against the stems on which they feed.

Cicadellidae: Ledrinae: Stenocotini. Stenocotini often have the tegmina glassy transparent between the veins although, in those species, the anterior expansion of the head is due to an expanded pronotum rather than an expanded head (see Figure 6 in Fletcher 2002). In *Ledracotis gunnensis* Evans (Figure 7 in Fletcher 2002), it is the head that is expanded and this species can also have the face medially bulging, although not swollen. *L. gunnensis* can easily be differentiated from GWSS by having tegmina which are opaque and cover the sides of the abdomen laterally.

Cicadellidae: Euacanthellinae: Euacanthellini. *Euacanthella palustris* Evans is normally brachypterous (i.e. have non-functional wings) but occasionally occurs in a macropterous form which has certain similarities to GWSS. However, the tegmina are opaque and cover the sides of the abdomen laterally.

Cicadellidae: Tartessinae. Some Tartessinae are brown and large but do not have the head expanded and swollen like GWSS.

Cercopoidea. Spittlebugs and their relatives are xylem feeders and therefore have the frons expanded to enclose the muscles of the feeding pump. However, the general structure of spittlebugs is quite different from GWSS. The head is not triangularly expanded, the tegmina are coloured, often quite brightly, and cover the abdomen laterally and the pronotum is often convex giving the insects a humped appearance quite different to the generally flattened and elongate appearance of GWSS.

The Australian Cicadellinae all belong to the Tribe Cicadellini and differ from GWSS in lacking the broadly triangular vertex (upper most surface of the head) and in coloration. Species of *Ishidaella* Matsumura have blue-black tegmina and yellow bodies with black markings while Australian species in other genera are whitish or pale yellow, usually with dark markings.

3.4 Pest risk ratings and potential impacts

A pest risk analysis has been carried out on this insect, taking into account the entry, establishment and spread potentials, together with the economic and environmental impact of establishment. A summary of these ratings are shown in Table 3. Based on this information, GWSS is considered a **medium** overall risk to Australia.

Table 3. Pest risk ratings for GWSS as determined in the IBP for the Nursery and Garden Industry

Potential or impact	Rating
Entry potential	Medium
Establishment potential	Medium
Spread potential	High
Economic impact	High
Overall risk	Medium

3.4.1 Phytosanitary risk

GWSS has been found in the mild winter regions of southeast United States. The greatest threats to Australia for the GWSS are to regions with mild winters where one or more of the following crops are grown: grapes, citrus, almond, stone fruits (*Prunus* spp), coffee, oleander, or where tree species potentially affected by leaf scorch diseases occur.

In the USA there is an internal quarantine against movement within the state of California from areas of known infestation to central and southern California. Australia has also imposed quarantine against this pest as no vectors of *X. fastidiosa* are known to exist in this country. Tahiti poses a major infestation epicentre for the south Pacific and a risk to Australia. Large numbers are attracted to hangar lights at night and yellow colour on sides of planes may attract flying sharpshooter, which can enter open plane doors. Dead sharpshooters have been found in cargo bins and to restrict spread, planes and cargo bins should be disinfested before leaving the country.

In relation to import conditions for GWSS, Australia has recently (June 2009) revised import conditions for *X. fastidiosa*. Import of germplasm from countries where *X. fastidiosa* is known to occur is limited to budwood and cuttings, which have been PCR tested or treated for pathogen presence. A phytosanitary statement must accompany germplasm imports from countries where *X. fastidiosa* is not known to occur.

3.4.2 Entry potential

Rating: MEDIUM

GWSS are strong fliers and can move rapidly from one plant to another and also have a wide known host range (that may continue to increase to include new species given further research). However, the most likely pathway of entry is as a hitchhiker on plant material and transport machinery (for details see Table 4). From this information, the entry potential has been rated as **medium**.

A possible method of entry of GWSS into Australia would be the importation of nursery plant stock. Evidence suggests that the leafhopper entered California in nursery stock as eggs, which are difficult to detect. Since then agricultural quarantine inspections have frequently intercepted leafhopper specimens.

Table grape exports into Australia could also be a potential entry pathway for sharpshooter. The risk of GWSS arriving in Australia would in some part be related to the number of insects present in the source areas from which the table grape exports originate. In the early part of the table grape season when the insect is extremely active and all forms of the insect can be found in vineyards and in other orchards the risk of the insect entering Australia would be higher.

3.4.3 Establishment potential

Rating: MEDIUM

The wide host range of GWSS together with suitable environmental conditions, would allow for the establishment of GWSS in many regions of Australia. Therefore, the likelihood of GWSS establishment in Australia following entry is considered **medium**.

Table 4. Potential entry pathways for GWSS into Australia⁸

Parameter	Details
Plant parts that can carry GWSS in transport/trade	<ul style="list-style-type: none"> • Fruits (including pods) can carry eggs internally – visible to the naked eye • Leaves can carry eggs and nymphs both internally and externally – visible to the naked eye • Stems, shoots, trunks and branches can carry nymphs and adults externally – visible to the naked eye
Plant parts not known to carry GWSS in transport/trade	<ul style="list-style-type: none"> • Bark • Bulbs, tubers, corms and rhizomes • Growing medium accompanying plants • Flowers, inflorescences, cones and calyx • Seedlings and micropropagated plants • Roots • True seeds (include grain) • Wood
Transport pathways for long distance transport	<ul style="list-style-type: none"> • Adults can be carried within transport vehicles • Adults and nymphs can be moved in storage and transport bins
Main pathways for the likely entry of GWSS into Australia	<ul style="list-style-type: none"> • Nursery stock for planting (excluding seeds and fruit) of known susceptible hosts • Foliage of cut branches (for ornamental purposes) of susceptible foliar hosts • Fruit of susceptible hosts

3.4.4 Spread potential

Rating: HIGH

GWSS adults are strong flyers allowing rapid movement of the insect. In addition, all life stages can move on machinery, equipment and plant material. These factors combined with the wide distribution of suitable host species results in a **high** spread potential for GWSS.

In America, GWSS has been spread through transportation of commercial nursery products. As a consequence of this pathway, state authorities have imposed agricultural quarantine restrictions on the movement of all nursery material headed for areas that do not have GWSS.

3.4.5 Economic impact

Rating: HIGH

The economic impact of GWSS would be dependent on the presence of the damaging *X. fastidiosa* pathogen. The impact of direct feeding damage on host plants from GWSS is low. However, GWSS acts as a vector for *X. fastidiosa*, which is not currently present in Australia. There is a chance that GWSS could carry *X. fastidiosa* if it were to arrive in Australia. If *X. fastidiosa* was also present, the economic impact of GWSS would be considered **high**.

⁸ Information taken from CABI (2007)

GWSS and Pierce’s disease (*X. fastidiosa*) represent a major threat to agricultural industries in California. Losses of \$33 billion to the grape industry alone, potential losses of commercial agriculture and nursery crops would also be high (USDA Environmental Assessment 2002).

3.4.6 Overall risk

Rating: MEDIUM

Based on the individual ratings above, the combined overall risk is considered **medium**.

4 Pest management

Pest management guidelines described in this contingency plan relate only to the GWSS. Pathogens that may be carried by the GWSS, such as *X. fastidiosa*, may require alternative management strategies which are not covered in this document. For information regarding these pests, a separate contingency plan may be developed at a later time.

4.1 Response checklist

The following checklist (Table 5) provides a summary of generic requirements to be identified and implemented within a Response Plan.

Table 5. Checklist of requirements to be identified in a Response Plan

Checklist item	Further information
Destruction methods for plant material, soil and disposable items	Sections 5.1.1 and 5.1.2
Disposal procedures	Section 5.1.5
Quarantine restrictions and movement controls	Section 5.3
Decontamination and property cleanup procedures	Section 5.5
Diagnostic protocols and laboratories	Sections 3.3 and 8.2
Trace back and trace forward procedures	Section 5.6
Protocols for delimiting, intensive and ongoing surveillance	Section 4.2
Zoning	Section 5.4
Reporting and communication strategy	Section 8.4

Additional information is provided by Merriman and McKirdy (2005)⁹ in the Technical Guidelines for Development of Pest Specific Response Plans.

⁹ Available on the Plant Health Australia website (www.planthealthaustralia.com.au/biosecurity)

4.2 Surveys and epidemiology studies

Information provided in Section 4.2.1 to 4.2.3 provides a framework for the development of early detection and delimiting surveys for GWSS in Australia.

Where GWSS is found in a production nursery that is in close proximity to potential host trees and shrubs, periodically inspect nearby hosts for signs of GWSS infestation. Infested sources within the nursery may provide an opportunity for GWSS to spread to trees and shrubs outside the nursery.

Agricultural inspectors and other nursery visitors should avoid moving contaminated plant material between nurseries. Shoes, tools and vehicle tyres should be thoroughly washed of soil and then sanitised with a registered disinfectant. Extra precaution should be taken when working in areas known to be infested, including disposable overboots that may be used and disposed of on-site.

4.2.1 Technical information for planning surveys

When developing surveys for GWSS presence and/or distribution, the following characteristics of the pest provide the basic biological knowledge that informs the survey strategy:

- GWSS is similar to a number of endemic sap-sucking insects (see Fletcher 2002) which need to be considered in diagnosing samples
- Endemic host species in Australia are likely to be numerous and widely dispersed
- The risk of pest movement on machinery, equipment and personal effects is high
- Significant proportions of Australia have favourable climatic conditions for GWSS spread and establishment

4.2.2 Surveys for early detection of an incursion in a nursery

If an incursion of GWSS is to be eradicated in a nursery, it must be detected early, before the insect has had the opportunity to disperse to a large extent. It is therefore necessary to consider pathways and plan surveys accordingly. Important points to consider when developing early detection surveys are:

- The greatest entry risk currently comes from importations of host plants or other goods. Therefore surveys at importing nurseries and ports are required.
- Awareness information should be targeted at people who are in regular close contact with potential hosts in high risk areas or movement vectors (e.g. production nursery operators).
- Systematic and careful inspection of nursery crops and propagative plant material is essential to prevent introduction of GWSS and limit its spread within and from infested nurseries. Early detection of the pest, while at very low levels, will provide the best chance of eradication.
- An inspector must be trained to recognize the basic identification of all stages of GWSS, including egg masses, nymphs and adults as well as other similar insects for comparison (see Section 3.3). A nursery layout map that includes approximate locations of known host species will be required to develop a strategy for surveys. A survey map should include species and cultivar names, locations, approximate quantity and sources of targeted plants within the area. During the survey walkthrough, record the date, observations, and sampling information directly onto the survey map. The recorded information should be reviewed and used to develop an efficient survey strategy each time the nursery is inspected.

- Begin the inspection with an overview of the area from the crop perimeter or with a quick walk-through. If suspicious symptoms or stages of GWSS are apparent, immediately examine them more closely and collect samples if required. If no symptoms are apparent from the overview inspection, start the complete inspection by walking a systematic path through the crop. A common survey technique is to move relatively quickly down a walkway and scan both sides of adjacent production beds, back and forth. If suspicious symptoms are seen, inspect plants more closely. A good-quality 10x magnification hand lens can help identify many pest symptoms. If plants are found with suspicious symptoms or stages of GWSS are apparent, a sample should be taken and the plant marked with plastic tape or a flag with the location noted on the survey map. Also, a few plants can be selected at random to closely inspect for GWSS. Surveys can be prioritised to highest risk stock.
- Stock or cuttings of hosts from outside sources should be monitored closely. Note outside sourced plants on survey maps for weekly examination.

Effective ways to monitor GWSS in commercial nurseries are:

- Standard yellow sticky card monitoring traps – yellow sticky cards can be used for surveillance and early detection of GWSS in a nursery. Standard yellow sticky cards placed at a minimum of one every 2000 m² and checked at least weekly. Colour preference for GWSS is not known, but yellow traps are known to attract GWSS. This method will only detect adult GWSS when at relatively high population densities. GWSS are also attracted to black and incandescent lights.
- Beat sheets, beat trays or sweep nets – when the ambient temperature is cool (below 15°C), GWSS can be detected by placing a white sheet underneath the canopy, then striking or shaking the canopy vegetation and examining the debris. Sweeping an insect net through the foliage is also suitable (Phillips 1999a; Varela et al 2001).
- Visual inspections – visual inspection is the best method for detecting all stages of the sharpshooter. GWSS is a stem feeder and leaves very little visible symptoms of its feeding other than white, powdery dried excrement on plant surfaces (Figure 1). Examine leaf petioles, twigs and small branches for the presence of nymph and adult sharpshooters and the underside of leaves to detect egg masses.

4.2.3 Delimiting surveys in the event of an incursion

- In the event of an incursion, delimiting surveys will be required to inform the decision-making process
- The size of the survey area will depend on the size of the infested area and the insect population size, as well as prevailing winds and movement of plant material during the period prior to detection
- All potential host species (refer to Section 3.2 and 8.1) should be surveyed, with particular attention paid to the species in which the pest was initially detected
- If the incursion is in a populated area, publication and distribution of information sheets and appeals for public assistance may assist

4.2.4 Collection and treatment of samples

Protocols for the collection, transport and diagnosis of suspect Emergency Plant Pests (EPPs) must follow PLANTPLAN (Plant Health Australia, 2008a). Any personnel collecting samples for assessment should notify the diagnostic laboratory prior to submitting samples to ensure expertise is available to undertake the diagnosis. Sampling techniques for GWSS as described in Fletcher (2002) is shown below.

4.2.4.1 COLLECTION OF SPECIMENS

Sampling procedures

Samples can be collected by hand or collected using vacuum sampler or pooter then placed in glass vials. Adults and nymphs are normally found on the trunk and stems of the host plant. Eggs are laid on the underside of leaf in an ovoid or quadrate arrangement (Figure 3).

Number of specimens to be collected

Where possible, collect multiple specimens representative of all life stages of the population available. It is important for at least one of the specimens to be an adult male. Adult females are identifiable as belonging to Tribe Proconiini but males are necessary to confirm identification to the species level.

Record the identity of the host plant. Record the location, preferably as GPS co-ordinates, or alternatively, a map reference or distance and direction from a suitable landmark. If the land is privately owned, record the owner's details including contact telephone numbers.

How to preserve GWSS

Adults and nymphs can be placed in 70% ethanol and stored indefinitely. Adults can also be stored dried but will become brittle which can result in damage in transit.

How to transport GWSS

Vials of ethanol should be sealed to avoid leakage and packed with cushioning material in a strong box. Dried specimens can be packed in tissue in an uncrushable vial, which is then packed with cushioning material in a strong box.

How to collect and send plant samples with eggs attached

Winged adults are the preferred stage for identification. However, if adult GWSS specimens are not available, egg masses and nymphs should be collected but would need to be reared to the adult stage for species identification.

Leaves with suspect egg masses should be picked and refrigerated (not frozen). Leaves should be removed and placed in a sealed plastic bag between moist sheets of newspaper. Each sealed bag should be placed in a second bag along with additional paper to absorb excess moisture. Bagged samples should then be placed in a non-crushable container with paper/bubble/foam to fill the remaining space and protect samples during transit.

All sample containers should be clearly labelled with the name, address and contact phone number of both the sending and receiving officers. In addition containers should be clearly labelled in accordance with the requirements of PLANTPLAN (Plant Health Australia, 2008a). Containers should be carefully sealed to prevent loss, contamination or tampering of samples. The Chief Plant Health

Manager will select the preferred laboratory. Additional labelling includes the identification of plant species/parts affected, location of affected plant (where available include GPS reading) as well as symptoms and an image if available.

Refer to PLANTPLAN for packing instructions under IATA 650.

Precaution

Overheating or desiccation of samples prior to despatch should be prevented. Samples may be stored in a fridge (4-10°C) for a few days if necessary.

Receipt

On receipt of the samples the diagnostic laboratory should follow strict quarantine and processing guidelines. In keeping with ISO 17025 refer to PLANTPLAN (Plant Health Australia, 2008a).

4.2.5 Epidemiological study

The extent of infestation in a nursery, on a property or within a region will depend on the initial population size and whether conditions have been favourable for the pest to spread from the initial location. Sampling should be based upon the origins of the initial suspect sample(s). Factors to consider will be:

- The proximity of other susceptible plants to the initial infestation source, including both current and previous crops. This will include crops in the nursery or on the property with the initial detection and those on neighbouring properties
- Machinery or vehicles that have been into the infested area or in close proximity to the infestation source
- The extent of human movements into and around the infested area. A possible link to the recent importation of plant material from other regions should also be considered
- The source of any nursery stock propagation material
- If any other crops have been propagated from the same source and/or distributed from the affected nurseries

4.2.6 Models of spread potential

No models of spread potential have been developed for GWSS.

4.2.7 Pest Free Area guidelines

Determination of Pest Free Areas (PFAs) should be completed in accordance with the International Standards for Phytosanitary Measures (ISPMs) 8 and 10 (IPPC 1998a, 1999).

General points to consider are:

- Design of a statistical delimiting field survey for the presence of the insect on host plants (see Section 4.2 for points to consider in the design)

- Surveys should be completed as described in the BioSecure HACCP manual (Nursery and Garden Industry Australia, 2008), including monitoring processes (summarised in Table 6 and Table 7), indicator plants and weed monitoring
- Surveys should also consider alternative hosts (see Section 3.2.1) and not be limited to the primary infested host
- Information (including absence of the pest) should be recorded

Table 6. Summary of monitoring processes for protected production areas as described in BioSecure HACCP Guidelines

Wear protective clothing when handling suspect samples
Walk at random through the area in a zigzag pattern
Take at least 10 minutes to inspect 10-20 plants or plug trays per 100 m ² of production area
Inspect the tops and bottoms or leaves, looking for any direct evidence of insects
Inspect the entire plant if it has less than 6 leaves, or from larger plants select six leaves from all parts of the plant (upper, lower, middle) and examine them individually
Inspect the length of all stems and branches for insects and symptoms
During individual plant inspection, strike the foliage over a white sheet of paper or a paper plate to dislodge small insects for easier viewing
If any plants show suspect symptoms or evidence of eggs or nymphs (refer to Section 3.2.3) take a sample (refer to Section 4.2.4) to be formally diagnosed (refer to Section 3.3)
Check for a problem that have occurred regularly in the past, until you are certain it is not present
Record on the „Crop Monitoring Record“ sheet the presence or absence of the pest
Routinely inspect growing areas and remove alternate hosts and reservoirs of the pest, including weeds, crop residues and old plants that will not be marketed

Additional information is provided by the IPPC (1995) in Requirements for the Establishment of Pest Free Areas. This standard describes the requirements for the establishment and use of PFAs as a risk management option for phytosanitary certification of plants and plant products. Establishment and maintenance of a PFA can vary according to the biology of the pest, pest survival potential, means of dispersal, availability of host plants, restrictions on movement of produce, as well as PFA characteristics (size, degree of isolation and ecological conditions).

Table 7. Summary of monitoring processes for field production areas as described in BioSecure HACCP Guidelines

Wear protective clothing when handling suspect samples
Pay particular attention to areas on the windward side, the sides bordering ditches, canals or other uncultivated areas and growing block centres
Place a flag or other marker at the entrance to the block or sampling area at the beginning of each inspection
Vary the entrance point in the sampling area (1m to 3m) for each subsequent sampling so that the same plants are not inspected each time
Walk at random through the area in a zigzag pattern
The scout should follow the same general pattern at each sampling
Make an effort to select those plants that appear less healthy for visual inspection
Take at least 10 minutes to inspect 10-20 plants or plug trays per 100 m ² of production area
Inspect the tops and bottoms or leaves, looking for any direct evidence of insects
Inspect the entire plant if it has less than 6 leaves, or from larger plants select six leaves from all parts of the plant (upper, lower, middle) and examine them individually
Inspect the length of all stems and branches for insects and symptoms
During individual plant inspection, strike the foliage over a white sheet of paper or a paper plate to dislodge small insects for easier viewing
If any plants show suspect symptoms or evidence of eggs or nymphs (refer to Section 3.2.3) take a sample (refer to Section 4.2.4) to be formally diagnosed (refer to Section 3.3)
Check for a problem that have occurred regularly in the past, until you are certain it is not present
Record on the „Crop Monitoring Record“ sheet the presence or absence of the pest
Routinely inspect growing areas and remove alternate hosts and reservoirs of the pest, including weeds, crop residues and old plants that will not be marketed

4.3 Availability of control methods

4.3.1 General procedures for control

- Keep traffic out of affected areas and minimize movement in adjacent areas
- Adopt best-practice property hygiene procedures to retard the spread of the pest between fields and adjacent properties
- After surveys are completed, destruction of the infested plant material is an effective control
- On-going surveillance of infested areas to ensure the pest is eradicated
- Do not use any material from infested plants for propagation

4.3.2 Chemical control

Chemical control of GWSS is not commonly employed in countries where it is endemic, as suppression of the insects rarely lead to a significant reduction in the incidence of any pathogens it

may vector (CABI 2007). However, chemical control may be implemented where the aim is the eradication or containment of the insect pest following an incursion.

Chlorpyrifos can be used to kill active stages of the pest with limited residual activity (CABI 2007). The application of imidicloprid as a systemic insecticide can suppress the population by 95% for up to 5 months. Evidence suggests that pyrethroids and synthetic neonicotinoids may be suitable for integrated pest management programs and combinations and rotations of products may be needed to minimize resistance development (Akey et al 2001; Bethke et al 2001).

A summary of insecticides effective of GWSS and current in use in the USA is shown in Table 8. The use of these chemicals may be considered as a response to a GWSS incursion into Australia. However, any chemicals used for the eradication or control of GWSS in Australia must be registered for use through the Australian Pesticides and Veterinary Medicines Authority (APVMA). For information regarding this process visit the APVMA website (www.apvma.gov.au).

Table 8. Insecticides currently used in citrus nurseries in the USA and their impact on GWSS

Trade name	Chemical name	Citrus uses	Restrictions (nonbearing and bearing)	Effect of GWSS emergence	Effect on GWSS nymphs	Effect of GWSS adults
Organophosphates						
Orthene	Acephate	Worms, aphids, thrips whiteflies, grasshoppers, mealybugs	NB	Poor	-	Moderate to good
Naled	Dibrom	Worms, aphids, thrips whiteflies, grasshoppers	NB & B	-	-	-
Cygon	Dimethoate	Worms, thrips whiteflies, grasshoppers	NB & B	-	-	-
Lorsban or Dursban	Chlorpyrifos	Worms, aphids, whiteflies, grasshoppers, ants, mealybugs	NB & B	Poor	Moderate to good	Moderate to good
Malathion	Malathion	Worms, aphids, thrips whiteflies, grasshoppers, scale, ants	NB & B	-	-	-
Diazinon		Worms, aphids, scale, mealybugs	NB & B	-	-	-
Carbamates						
Sevin	Carbaryl	Worms, aphids, thrips grasshoppers, scale	NB & B	Very Good	-	Moderate to very good
Carzol	Formetanate	Thrips, leafhoppers, snails	NB & B	-	Good	Good
Lannate	Methomyl	Worms, aphids, leafhoppers	NB & B	-	Very good	Very good
Mesurool	Methiocarb	Thrips	NB	Moderate to good	Excellent	Excellent
Pyrethroids						
Talstar	Bifenthrin	Worms, mites, aphids, thrips, whiteflies, scales	NB	Good	Excellent	Excellent
Tame	Fenpropathrin	Thrips, mites, aphids, worms, whiteflies, and mealy bugs	GH (Gloves in GH)	Good	Very good	Excellent

Trade name	Chemical name	Citrus uses	Restrictions (nonbearing and bearing)	Effect of GWSS emergence	Effect on GWSS nymphs	Effect of GWSS adults
Astro	Permethrin	Thrips, aphids, worms	NB	Poor	Excellent	Very Good
Neonicotinoids						
Admire	Imidacloprid (soil)	Aphids, whitefly, scale	NB & B	Poor	Good to very good	Moderate
Marathon II	Imidacloprid	Aphids, whitefly, scale	NB	Excellent	Good to very good	Moderate
Provado	Imidacloprid	Aphids, whitefly, scale	NB	Excellent	Good to very good	Moderate
Assail	Acetamiprid	Scale, thrips, GWSS	NB & B	Excellent	Excellent	Excellent
Miscellaneous classes of pesticides						
Pyrellin	Pyrethrin + rotenone	Aphids, thrips, worms and white flies	B	-	Poor	Poor
Cinnamite	Cinnamaldehyde	Mites, aphids	NB	-	-	-
Endeavor	Pymetrazine	Aphids, whiteflies	NB	Poor		Poor
Distance	Pyriproxyfen	Red scale, aphids, whiteflies	NB & B	Poor	Excellent	Poor
Applaud	Buprofezin	Scale, whiteflies	NB & B	Poor	Excellent	Poor
Neemix	Azadirachtin	Aphids, thrips, worms mealybugs, leafhoppers	NB & B	-	-	-
Azatin	Azadirachtin	Aphids, thrips, worms, whiteflies	NB	-	-	-
Saf-T-Side	Unsulfonated oil	scale, mites, whiteflies	NB & B	Poor	Poor	Poor
Ultra-FineOil	Paraffinic oil	Scale, mites, whiteflies	NB & B	Poor	Poor	Poor
Hexygon	Hexythiazox	Mites [ovicide]	NB	Poor	-	-
Nexter	Pyridaben	Mites	NB & B (enclosed Cab)	Poor	Moderate	Poor
Aramite	Bifenazate	Mites	NB	-	-	-

4.3.3 Biological control

It has been shown that indigenous mymarid egg parasitoids can account for 20-40% of mortality in the spring generations in California. The second generation of egg masses in summer with >95% parasitism. The mass production and release of parasites is being considered as a control mechanism. The difficulty is the enormous number of parasitoids needed year round to have a significant impact on the sharpshooter.

Other biological controls being considered are the mymarid wasps: *Gonatocerus ashmeadi*, *G. triguttatus*, *G. morrilli* and *G. fascisatus* (Triapitsyn and Phillips 2000). *G. Ashmeadi*, a tiny stingerless parasitic wasp, destroys the eggs of GWSS and has been shown to be effective in suppressing GWSS egg hatch during late summer and autumn (Grafton-Cardwell et al 2003). Parasitized can be identified by tiny pinholes on the surface of the egg mass.

Biological control mechanisms would not be expected to provide a mechanism for eradication of GWSS, but would help lower populations and reduce the risk of spreading and vectored pathogens, such as *X. fastidiosa*.

The effects of these potential biological control organisms have not been tested on Australian flora and fauna. Before any of these organisms are used as part of a control program for CLHB, the impact of these organisms in Australia should be fully investigated.

5 Course of action

Additional information is provided by the IPPC (1998b) in Guidelines for Pest Eradication Programmes. This standard describes the components of a pest eradication programme which can lead to the establishment or re-establishment of pest absence in an area. A pest eradication programme may be developed as an emergency measure to prevent establishment and/or spread of a pest following its recent entry (re-establish a PFA) or a measure to eliminate an established pest (establish a PFA). The eradication process involves three main activities: surveillance, containment, and treatment and/or control measures.

The course of action to a GWSS incursion outlined in this document relates only to the GWSS. Pathogens that may be carried by the GWSS, such as *X. fastidiosa*, may require alternative response strategies which are not covered in this document. For information regarding these pests, a separate contingency plan may be developed at a later time.

5.1 Destruction strategy

5.1.1 Destruction protocols

- Disposable equipment, infested plant material or growing media/soil should be disposed of by autoclaving, high temperature incineration or deep burial
- Any equipment removed from the site for disposal should be double-bagged
- Machinery used in destruction processes need to be thoroughly washed, preferably using a detergent or farm degreaser
- Insecticides are effective against GWSS, including imidacloprid

- Infested plants should be destroyed

5.1.2 Decontamination protocols

Machinery, equipment and vehicles in contact with infested plant material or growing media/soil, or present within the Quarantine Area, should be washed to remove plant material and growing media/soil using high pressure water or scrubbing with products such as a degreaser or a bleach solution (1% available chlorine) in a designated wash down area. When using high pressure water, care should be taken not to spread plant material. High pressure water should be used in wash down areas which meet the following guidelines:

- Located away from crops or sensitive vegetation
- Readily accessible with clear signage
- Access to fresh water and power
- Mud free, including entry and exit points (e.g. gravel, concrete or rubber matting)
- Gently sloped to drain effluent away
- Effluent must not enter water courses or water bodies
- Allow adequate space to move larger vehicles
- Away from hazards such as power lines
- Waste water, growing media/soil or plant residues should be contained (see Appendix 18 in PLANTPLAN (Plant Health Australia, 2008a))
- Disposable overalls and rubber boots should be worn when handling infested plant material or growing media/soil in the field. Boots, clothes and shoes in contact with infested plant material or growing media/soil should be disinfected at the site or double-bagged to remove for cleaning
- Skin and hair in contact with infested plant material or growing media/soil should be washed

Procedures for the sterilisation of plant containers and growing media are provided within the BioSecure *HACCP* Guidelines, however, in the event of a GWSS incursion, procedures outlined in the BioSecure *HACCP* Guidelines may not be effective for the destruction of the pest. Any sterilisation procedure must be approved for use in the endorsed Response Plan.

5.1.3 Priorities

- Confirm the presence of the pest
- Prevent movement of vehicles and equipment through affected areas
- Stop the movement of any plant material that may be infested with the pest
- Determine the strategy for the eradication/decontamination of the pest and infested host material
- Determine the extent of infestation through survey and plant material trace back

5.1.4 Plants, by-products and waste processing

- Any growing media/soil or infested plant material removed from the site should be destroyed by (enclosed) high temperature incineration, autoclaving or deep burial
- As the pest can be mechanically transmitted, plant debris from the destruction zone must be carefully handled and transported for destruction
- Infested areas or nursery yards should remain free of susceptible host plants until the area has been shown to be free from the pest

5.1.5 Disposal issues

- Particular care must be taken to minimize the transfer of infested plant material or insects from the area
- Host material, including leaf litter, should be collected and incinerated or double bagged and deep buried in an approved site

5.2 Containment strategies

For some exotic pest incursions where eradication is considered impractical, containment of the pest may be attempted to prevent or slow its spread and to limit its impact on other parts of the state or country. Containment is currently being considered for inclusion within the EPPRD. The decision on whether to eradicate or contain the pest will be made by the National Management Group, based on scientific and economic advice.

5.3 Quarantine and movement controls

Consult PLANTPLAN (Plant Health Australia, 2008a) for administrative details and procedures.

5.3.1 Quarantine priorities

- Plant material and growing media/soil at the site of infestation to be subject to movement restrictions
- Machinery, equipment, vehicles and disposable equipment in contact with infested plant material or growing media/soil, or present in close proximity to the site of infestation to be subject to movement restrictions

5.3.2 Movement controls

Movement controls need to be put in place to minimise the potential for translocation of the pest as a contaminant of plant material, growing media of other articles.

Movement of people, vehicles, equipment and plant material, from and to affected properties or areas, must be controlled to ensure that the pest is not moved off-property. Movement controls can be achieved through the following, however specific measures must be endorsed in the Response Plan:

- Signage to indicate quarantine area and restricted movement into and within these zones
- Fenced, barricaded or locked entry to quarantine areas
- Movement of equipment, machinery, plant material or growing media/soil by permit only. Therefore, all non-essential operations in the area or on the property should cease
- Where no dwellings are located within these areas, strong movement controls should be enforced
- Where dwellings and places of business are included within the Restricted and Control Areas movement restrictions are more difficult to enforce, however limitation of contact with infested plants should be enforced
- If a production nursery is situated within the Restricted Area, all nursery operations must cease and no material may be removed without permission, due to the high likelihood of pest spread. Movement restrictions would be imposed on both host and non-host material
- Residents should be advised on measures to minimise the inadvertent transport of GWSS from the infested area to unaffected areas
- Clothing and footwear worn at the infested site should either be double-bagged prior to removal for decontamination or should not leave the site until thoroughly disinfected, washed and cleaned
- Plant material or plant products must not be removed from the site
- All machinery and equipment should be thoroughly cleaned down with a high pressure cleaner (see Section 5.1.2) or scrubbing with products such as a farm degreaser or a 1% bleach (available chlorine) solution, prior to leaving the affected area. Machinery should be inspected for the presence of insects and if found treatment with insecticide may be required. The clean down procedure should be carried out on a hard surface, preferably a designated wash-down area, to avoid mud being re-collected from the affected site onto the machine. When using high pressure water, care should be taken to contain all plant material and mud dislodged during the cleaning process

5.4 Zoning

The size of each quarantine area will be determined by a number of factors, including the location of the incursion, biology of the pest, climatic conditions and the proximity of the infested property to other infested properties. This will be determined by the National Management Group during the production of the Response Plan. Further information on quarantine zones in an EPP incursion can be found in PLANTPLAN, Appendix 10 (Plant Health Australia, 2009). These zones are outlined below and in Figure 4.

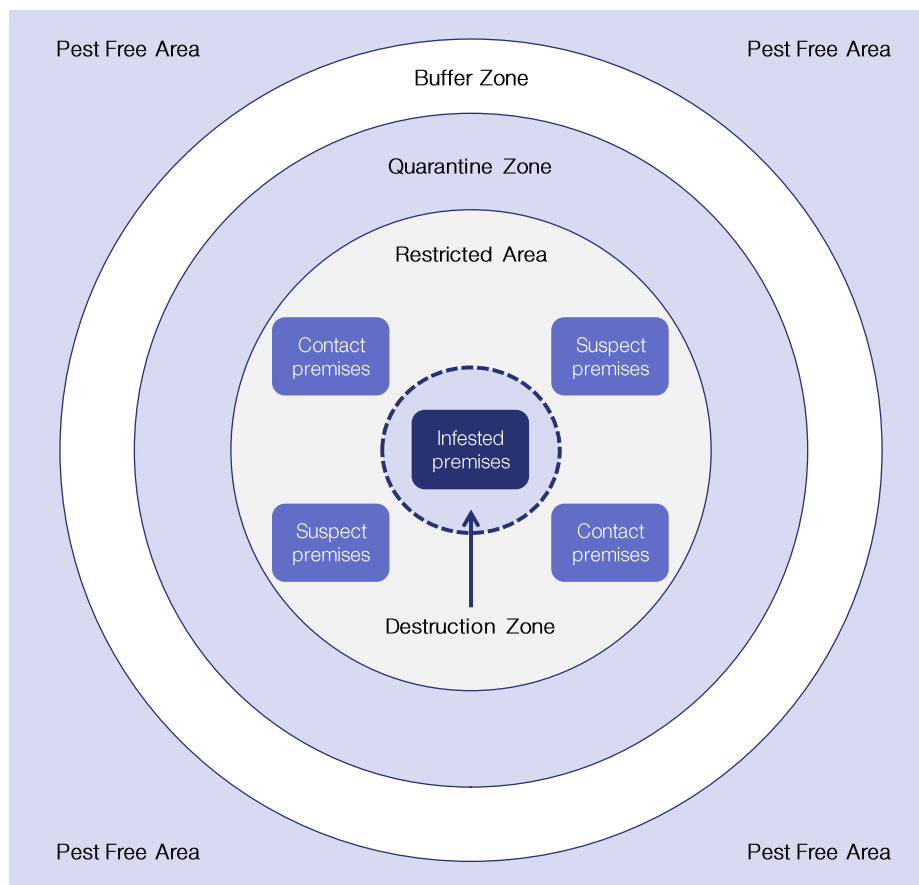


Figure 4. Schematic diagram of quarantine zones used during an EPP incursion

5.4.1 Destruction Zone

The size of the destruction zone (i.e. zone in which the pest and all host material is destroyed) will depend on the ability of the pest to spread, distribution of the pest (as determined by delimiting surveys), time of season (and part of the pest life cycle being targeted) and factors which may contribute to the pest spreading.

All host plants should be destroyed after the level of infestation has been established. The delimiting survey will determine whether or not neighbouring plants are infested and need to be destroyed. Non-host plant material within this zone may be destroyed, based on recommendations in the Response Plan. The Destruction Zone may be defined as contiguous areas associated with the same management practices as the infested area (i.e. the entire nursery, property or forest area if spread could have occurred prior to the infection being identified).

Particular care needs to be taken to ensure that plant material (including non-hosts) is not moved into surrounding areas.

5.4.2 Restricted Area

The Restricted Area is defined as the zone immediately around the infested premises and suspected infested premises. The Restricted Area is established following initial surveys that confirm the presence of the pest. The Restricted Area will be subject to intense surveillance and movement

control with movement out of the Restricted Area to be prohibited and movement into the Restricted Area to occur by permit only. Multiple Restricted Areas may be required within a Control Area.

5.4.3 Quarantine Zone

The Quarantine Zone is defined as the area where voluntary or compulsory restraints are in place for the affected property or properties. These restraints may include restrictions or movement control for removal of plants, people, growing media/soil or contaminated equipment from an infested property.

5.4.4 Buffer Zone

A Buffer Zone may or may not be required depending on the incident. It is defined as the area in which the pest does not occur but where movement controls or restrictions for removal of plants, people, soil or equipment from this area are still deemed necessary. The Buffer Zone may enclose an infested area (and is therefore part of the Control Area) or may be adjacent to an infested area.

5.4.5 Control Area

The Control Area is defined as all areas affected within the incursion. The Control Area comprises the Restricted Area, all infested premises and all suspected infested premises and will be defined as the minimum area necessary to prevent spread of the pest from the Quarantine Zone. The Control Area will also be used to regulate movement of all susceptible plant species to allow trace back, trace forward and epidemiological studies to be completed.

5.5 Decontamination and property clean up

Decontaminant practices are aimed at eliminating the pest thus preventing its spread to other areas.

5.5.1 Decontamination procedures

General guidelines for decontamination and clean up:

- Refer to PLANTPLAN (Plant Health Australia, 2008a) for further information
- Keep traffic out of affected area and minimize it in adjacent areas
- Adopt best-practice property hygiene procedures to retard the spread of the pest between growing areas/fields and adjacent properties
- Machinery, equipment, vehicles in contact with infested plant material or growing media/soil present within the Quarantine Zone, should be washed to remove growing media/soil and plant material using high pressure water or scrubbing with products such as a degreaser or a bleach solution in a designated wash down area as described in Section 5.1.2
- Only recommended materials are to be used when conducting decontamination procedures, and should be applied according to the product label
- Infested plant material should be disposed of by autoclaving, high temperature (enclosed) incineration or deep burial

5.5.2 General safety precautions

For any chemicals used in the decontamination, follow all safety procedures listed within each MSDS.

5.6 Surveillance and tracing

5.6.1 Surveillance

Detection and delimiting surveys are required to delimit the extent of the outbreak, ensuring areas free of the pest retain market access and appropriate quarantine zones are established.

Initial surveillance priorities include the following:

- Surveying all host growing properties and businesses in the pest quarantine area
- Surveying all properties and businesses identified in trace-forward or trace-back analysis as being at risk
- Surveying all host growing properties and businesses that are reliant on trade with interstate or international markets which may be sensitive to GWSS presence
- Surveying production nurseries selling at risk host plants
- Surveying other host growing properties and backyards

5.6.2 Survey regions

Establish survey regions around the surveillance priorities identified above. These regions will be generated based on the zoning requirements (see Section 5.4), and prioritised based on their potential likelihood to currently have or receive an incursion of this pest. Surveillance activities within these regions will either allow for the area to be declared pest free and maintain market access requirements or establish the impact and spread of the incursion to allow for effective control and containment measures to be carried out. Detailed information regarding surveys for GWSS have been outlined elsewhere in this plan (refer to Section 4.2).

Steps outlined in Table 9 form a basis for a survey plan. Although categorised in stages, some stages may be undertaken concurrently based on available skill sets, resources and priorities.

Table 9. Phases to be covered in a survey plan

Phase 1	<ul style="list-style-type: none"> Identify properties that fall within the buffer zone around the infested premise Complete preliminary surveillance to determine ownership, property details, production dynamics and tracings information (this may be an ongoing action)
Phase 2	Preliminary survey of host crops in properties in buffer zone establishing points of pest detection
Phase 3	Surveillance of an intensive nature, to support control and containment activities around points of pest detection
Phase 4	<p>Surveillance of contact premises. A contact premise is a property containing susceptible host plants, which are known to have been in direct or indirect contact with an infested premises or the pest. Contact premises may be determined through tracking movement of materials from the property that may provide a viable pathway for spread of the pest. Pathways to be considered are:</p> <ul style="list-style-type: none"> Items of equipment and machinery which have been shared between properties including bins, containers, irrigation lines, vehicles and equipment The producer and retailer of infested material if this is suspected to be the source of the outbreak Labour and other personnel that have moved from infested, contact and suspect premises to unaffected properties (other growers, tradesmen, visitors, salesmen, crop scouts, harvesters and possibly beekeepers) Movement of plant material and growing media/soil from controlled and restricted areas
Phase 5	Surveillance of production and retail nurseries, gardens and public land where plants known to be hosts of the pest are being grown
Phase 6	Agreed area freedom maintenance, post control and containment

5.6.3 Post-eradication surveillance

The period of pest freedom sufficient to indicate that eradication of the pest has been achieved will be determined by a number of factors, including cropping conditions, the previous level of infestation, the control measures applied and the pest biology.

Specific methods to confirm eradication of GWSS may include:

- Monitoring of sentinel plants that have been grown at the affected sites. Plants are to be grown *in situ* under quarantine conditions and monitored for symptoms or other indications of GWSS presence
- If symptoms or suspect insects are detected, samples are to be collected and stored and plants destroyed
- Surveys for GWSS should be undertaken for a minimum of three years after eradication has been achieved
- Alternate non-host crops should be grown on the site and any self-sown plants sprayed out with a selective herbicide

6 Technical debrief and analysis for stand down

Refer to PLANTPLAN (Plant Health Australia, 2008a) for further details

The emergency response is considered to be ended when either:

- Eradication has been deemed successful by the lead agency, with agreement by the Consultative Committee on Emergency Plant Pests and the Domestic Quarantine and Market Access Working Group
- Eradication has been deemed impractical and procedures for long-term management of the pest risk have been implemented

A final report should be completed by the lead agency and the handling of the incident reviewed.

Eradication will be deemed impractical if, at any stage, the results of the delimiting surveys lead to a decision to move to containment/control.

7 References

Akey DH, Henneberry TJ, Toscano NC (2001) Insecticides sought to control adult glassy-winged sharpshooter. *California Agriculture*, 55:22-27.

Bethke JA, Blua MJ, Redak RA (2001) Effect of selected insecticides on *Homalodisca coagulata* (Homoptera: Cicadellidae) and transmission of oleander leaf scorch in a greenhouse study. *Journal of Economic Entomology*, 94:1031-1036.

Blua MJ, Phillips PA, Redak RA (1999) A new sharpshooter threatens both crops and ornamentals. *California Agriculture*, 53:22-25.

Fletcher MJ (2002) Diagnostic protocol for Glassy winged sharpshooter (*Homalodisca coagulata*) prepared for Plant Health Australia (www.planthealthaustralia.com.au).

Grafton-Cardwell B, Batkin T, Gorden J (2003) Glassy-winged sharpshooter population control measures - biological control program. In *California Citrus Industry Guide - Glassy winged sharpshooter and related bacterial diseases*, 2nd edition, Citrus Research Board.

Hoddle MS, Triapitsyn SV, Morgan DJW (2003) Distribution and plant association records for *Homalodisca coagulata* (Hemiptera: Cicadellidae) in Florida. *Florida Entomologist*, 86:89-91

IPPC (1995) Requirements for the Establishment of Pest Free Areas. *International Standards for Phytosanitary Measures (ISPM) No. 4*.

IPPC (1998a) Determination of pest free status in an area. *International Standards for Phytosanitary Measures (ISPM) No. 8*.

IPPC (1998b) Guidelines for Pest Eradication Programmes. *International Standards for Phytosanitary Measures (ISPM) No. 9*.

IPPC (1999) Requirements for the establishment of pest free places for production and pest free production sites (ISPM) No.10.

Merriman P, McKirdy S (2005) Technical guidelines for the development of pest specific response plans, Plant Health Australia.

Nursery and Garden Industry Australia (2008) *Biosecure HACPP: guidelines for managing biosecurity in nursery production*.

Phillips PA (1998) The glassy-winged sharpshooter - A potentially serious future threat to California citrus. *Citrograph*, 83:10-12.

Phillips PA (1999a) Vineyards, almond orchards threatened. *Fruit Grower*, 119:18F-18H.

Phillips PA (1999b) Glassy-winged sharpshooter - A serious new Pierce's Disease vector in California vineyards. *Grape Grower*, 31:16-34.

Plant Health Australia (2008a). PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 1. (www.planthealthaustralia.com.au/plantplan).

Plant Health Australia (2008b) Industry Biosecurity Plan for the Nursery and Garden Industry (Version 2). Plant Health Australia. Canberra, ACT.

USDA Environmental Assessment (2002) Glassy winged sharpshooter area wide management program Kerne County, California.

Triapitsyn SV, Phillips PA (2000) First record of *Gonatocerus triguttatus* (Hymenoptera: Mymaridae) from eggs of *Homalodisca coagulata* (Hymenoptera: Cicadellidae) with notes on the distribution of the host. *Florida Entomology* 83(2): 200-3.

Turner WF, Pollard HN (1959) Life histories and behaviour of five insect vectors of phoney peach disease. U.S. Dept. Agric. Tech. Bull., 1188.

Varela LG, Smith RJ, Phillips PA (2001) Pierce's Disease. Univ. of Calif. DANR Publication, #21600.

7.1 Related Websites

Australian Pesticide and Veterinary Medicine Authority (www.apvma.gov.au)

CAB Compendium (www.cabcompendium.org)

Pest and Disease Image Library (www.padil.gov.au)

University of California, Agriculture and Natural Resources (gwss.ucanr.org/faq.html)

University of California, California Agriculture (californiaagriculture.ucop.edu)

University of California, Davis, IPM Program (ipm.ucdavis.edu/PMG/r302301711.html)

University of Columbia (www.columbia.edu/itc/cerc/danoff-burg/invasion_bio/inv_spp_summ/Homalodisca_coagulata.html)

University of Florida – Featured Creatures (entnemdept.ufl.edu/creatures/fruit/glassywinged_sharpshooter.htm)

Wikipedia (en.wikipedia.org/wiki/Glassy-winged_sharpshooter)

8 Appendices

8.1 Appendix 1: Extended host list

Table 10. List of taxa known to be hosts of GWSS^{10,11}

Agavaceae: <i>Cordyline, Phormium, Yucca*</i>
Aizoaceae: <i>Aptenia</i>
Amaranthaceae: <i>Amaranthus</i>
Amaryllidaceae: <i>Agapanthus, Tulbaghia</i>
Anacardiaceae: <i>Harpephyllum, Mangifera, Pistachia, Rhus, Schinus</i>
Annonaceae: <i>Annona</i>
Apocynaceae: <i>Mandevilla, Nerium, Trachelospermum, Vinca</i>
Aquifoliaceae: <i>Ilex</i>
Araceae: <i>Philodendron, Zantedeschia</i>
Araliaceae: <i>Fatshedera, Hedera, Schefflera, Tupidanthus</i>
Arecaceae: <i>Archontophoenix, Arecastrum, Cocos, Howea, Phoenix, Washingtonia</i>
Asclepiadaceae: <i>Asclepias</i>
Asteraceae: <i>Ambrosia*, Baccharis, Chrysanthemum, Erigeron, Eupatorium*, Euryops, Gazania, Helianthus, Lactuca*, Osteospermum,, Rudbeckia*, Solidago*, Sonchus*, Xanthium*</i>
Berberidaceae: <i>Berberis, Nandina</i>
Bignoniaceae: <i>Bignonia, Campsis, Catalpa, Chitalpa, Clytostoma, Jacaranda, Pandorea, Tabebuia, Tecomaria*</i>
Bombacaceae: <i>Chorisia</i>
Bromeliaceae: <i>Ananas</i>
Buxaceae: <i>Buxus, Pachysandra</i>
Cactaceae: <i>Opuntia</i>
Caesalpiniaceae: <i>Cassia</i>
Cannaceae: <i>Canna</i>
Caprifoliaceae: <i>Abelia, Lonicera, Sambucus, Viburnum</i>
Caricaceae: <i>Carica</i>
Caryophyllaceae: <i>Dianthus</i>
Celastraceae: <i>Euonymus, Maytenus</i>
Chenopodiaceae: <i>Chenopodium</i>
Cistaceae: <i>Cistus</i>
Commelinaceae: <i>Tradescantia</i>

¹⁰ Source: Californian Department of Food and Agriculture

¹¹ All taxa listed are regarded as oviposition hosts for GWSS, except for those marked with an asterisk*. The list includes ferns, gymnosperms, dicots and monocots.

Cornaceae: <i>Cornus</i>
Corylaceae: <i>Alnus, Betula</i>
Crassulaceae: <i>Crassula</i>
Cupressaceae: <i>Thuja*</i>
Cycadaceae: <i>Cycas</i>
Ebenaceae: <i>Diospyros</i>
Elaeagnaceae: <i>Elaeagnus*</i>
Elaeocarpaceae: <i>Elaeocarpus</i>
Ericaceae: <i>Arbutus, Arctostaphylos, Rhododendron</i>
Escalloniaceae: <i>Escallonia</i>
Euphorbiaceae: <i>Aleurites*, Sapium</i>
Fabaceae: <i>Acacia, Albizzia, Bauhinia, Calliandra, Castanospermum, Ceratonia, Cercis, Erythrina, Hardenbergia, Robinia, Tipuana, Vigna*, Wisteria</i>
Fagaceae: <i>Castanopsis, Quercus</i>
Flacourtiaceae: <i>Xylosma</i>
Geraniaceae: <i>Pelargonium</i>
Gesneriaceae: <i>Aeschynanthus</i>
Gingkoaceae: <i>Ginkgo</i>
Hamamelidaceae: <i>Liquidambar, Loropetalum</i>
Hypericaceae: <i>Hypericum</i>
Iridaceae: <i>Dietes, Gladiolus*</i>
Juglandaceae: <i>Juglans*</i>
Lamiaceae: <i>Ajuga, Monarda*</i>
Lauraceae: <i>Cinnamomum, Laurus, Persea, Sassafras*</i>
Liliaceae: <i>Asparagus*, Aspidistra, Chlorophytum, Hemerocallis</i>
Loganiaceae: <i>Gelsemium</i>
Lythraceae: <i>Lagerstroemia</i>
Magnoliaceae: <i>Liriodendron, Magnolia, Michelia</i>
Malvaceae: <i>Althaea, Gossypium*, Hibiscus, Malva*</i>
Meliaceae: <i>Melia*</i>
Menispermaceae: <i>Cocculus</i>
Moraceae: <i>Ficus, Morus</i>
Musaceae: <i>Ensete, Strelitzia</i>
Myoporaceae: <i>Myoporum</i>
Myrsinaceae: <i>Myrsine</i>
Myrtaceae: <i>Agonis, Callistemon, Eucalyptus, Eugenia, Feijoa, Melaleuca, Metrosideros, Myrtus, Psidium, Syzygium, Tristania</i>

Nyctaginaceae: *Bougainvillea*, *Mirabilis*

Nyssaceae: *Nyssa**

Oleaceae: *Forsythia*, *Fraxinus*, *Jasminum*, *Ligustrum*, *Olea*, *Osmanthus*, *Syringa*

Onagraceae: *Oenothera**

Passifloraceae: *Passiflora*

Phytolaccaceae: *Phytolacca**

Pinaceae: *Pinus**

Pittosporaceae: *Hymenosporum*, *Pittosporum*

Platanaceae: *Platanus*

Plumbaginaceae: *Ceratostigma*, *Limonium*, *Plumbago*

Poaceae: *Sorghum*, *Zea**

Podocarpaceae: *Podocarpus*

Polemoneaceae: *Phlox*

Polypodiaceae: *Nephrolepis*, *Platynerium*

Polygalaceae: *Polygala*

Polygonaceae: *Polygonum*

Portulacaceae: *Portulacaria*

Proteaceae: *Grevillea*, *Macadamia*, *Protea*

Punicaceae: *Punica*

Rhamnaceae: *Ceanothus*, *Rhamnus*

Rosaceae: *Amelanchier*, *Aronia*, *Cercocarpus*, *Cotoneaster*, *Eriobotrya*, *Heteromeles*, *Malus**, *Photinia*, *Prunus*, *Pyracantha*, *Pyrus*, *Raphiolepis*, *Rosa*, *Rubus**, *Sorbus*, *Vauquelinia*

Rubiaceae: *Coffea*, *Coprosma*, *Gardenia*

Rutaceae: *Calodendrum*, *Citrus*, *Fortunella*, *Geijera*, *Murraya*

Salicaceae: *Populus*, *Salix*

Sapindaceae: *Cupaniopsis*, *Dodonaea*, *Koelreuteria*, *Litchi*

Saxifragaceae: *Itea*, *Philadelphus*

Scrophulariaceae: *Antirrhinum*, *Penstemon*, *Veronica*

Simmondsiaceae: *Simmondsia*

Solanaceae: *Brunfelsia*, *Nicotiana*, *Solanum*, *Capsicum*

Sterculiaceae: *Brachychiton*

Theaceae: *Camellia*, *Ternstroemia*

Tiliaceae: *Grewia*

Ulmaceae: *Ulmus*

Verbenaceae: *Lantana*, *Lippia*, *Phyla*

Violaceae: *Viola*

Vitaceae: *Cissus*, *Parthenocissus*, *Vitis*

8.2 Appendix 1: Standard diagnostic protocols

For a range of specifically designed procedures for the emergency response to a pest incursion refer to Plant Health Australia’s PLANTPLAN (www.planthealthaustralia.com.au/plantplan).

8.3 Appendix 2: Resources and facilities

Table 11 provides a list of diagnostic facilities for use in professional diagnosis and advisory services in the case of an incursion.

Table 11. Diagnostic service facilities in Australia

Facility	State	Details
DPI Victoria – Knoxfield Centre	Vic	621 Burwood Highway Knoxfield VIC 3684 Ph: (03) 9210 9222; Fax: (03) 9800 3521
DPI Victoria – Horsham Centre	Vic	Natimuk Rd Horsham VIC 3400 Ph: (03) 5362 2111; Fax: (03) 5362 2187
DPI New South Wales – Elizabeth Macarthur Agricultural Institute	NSW	Woodbridge Road Menangle NSW 2568 PMB 8 Camden NSW 2570 Ph: (02) 4640 6327; Fax: (02) 4640 6428
DPI New South Wales – Tamworth Agricultural Institute	NSW	4 Marsden Park Road Calala NSW 2340 Ph: (02) 6763 1100; Fax: (02) 6763 1222
DPI New South Wales – Wagga Wagga Agricultural Institute	NSW	PMB Wagga Wagga NSW 2650 Ph: (02) 6938 1999; Fax: (02) 6938 1809
SARDI Plant Research Centre – Waite Main Building, Waite Research Precinct	SA	Hartley Grove Urrbrae SA 5064 Ph: (08) 8303 9400; Fax: (08) 8303 9403
Grow Help Australia	QLD	Entomology Building 80 Meiers Road Indooroopilly QLD 4068 Ph: (07) 3896 9668; Fax: (07) 3896 9446
Department of Agriculture and Food, Western Australia (AGWEST) Plant Laboratories	WA	3 Baron-Hay Court South Perth WA 6151 Ph: (08) 9368 3721; Fax: (08) 9474 2658

8.4 Appendix 3: Communications strategy

A general Communications Strategy is provided in Appendix 6 of PLANTPLAN (Plant Health Australia, 2009; www.planthealthaustralia.com.au/plantplan).

8.5 Appendix 4: Market access impacts

Within the AQIS PHYTO database (www.aqis.gov.au/phyto), export of grapevine material requires an additional declaration regarding freedom from GWSS (as at June 2009). Should GWSS be detected or become established in Australia, additional countries may require a specific declaration or supplementary measures upon export. Latest information can be found within PHYTO, using an Advanced search “Search all text” for *Homalodisca vitripennis*.