

Framework for Risk Assessment and Response for Incursion of Exotic Mosquitoes into a New Location in Queensland



TITLE

This framework shall be titled and known as the:

Framework for Risk Assessment and Response for Incursion of Exotic Mosquitoes into a New Location in Queensland

AUTHORISATION

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Authority and Planning Responsibility

The development, implementation and revision of this framework are the responsibility of the Executive Director, Communicable Diseases Branch.

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This framework will be updated and available electronically on the Queensland Health Website.

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- Queensland Health
- Local Governments

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List of abbreviations

AIP	Approved Inspection Program
APCP	Authorised Prevention and Control Program
BG	BioGents™ Sentinel Trap
CDB	Communicable Diseases Branch (Queensland Health)
CHIKV	Chikungunya virus
DoH	Queensland Department of Health
DB	Detection Block
DENV	Dengue virus(es)
EZ	Eradication Zone
FSS	Forensic and Scientific Services
GAT	BioGents™ Gravid <i>Aedes</i> Trap
HHS	Hospital and Health Service
IMT	Incident Management Team
IRB	Inner Ring Block
IRS	Interior Residual Spray
LG	Local Government
ME	Queensland Health Medical Entomologist
ORB	Outer Ring Block
PCA	Pest Control Advice
PMT	Pest Management Technician
PHU	Public Health Unit
QH	Queensland Health
SEQ	Southeast Queensland
ZIKV	Zika virus

Introduction

This framework aims to support public health units (PHUs) within Hospital and Health Services (HHS's), the Department of Health (DoH) and local governments (LGs) to determine the risk associated with the detection of exotic mosquitoes in novel locations across Queensland and plan an appropriate response. The primary components of the framework are (a) the decision tool which supports decision-making and overall planning, and (b) the exotic mosquito incursion response guide which offers further detail of operational considerations and actions to formulate a response.

The decision tool outlines the process for assessing the risk posed by the incursion of an exotic mosquito (particularly those belonging to the subgroup *Stegomyia*, including *Aedes aegypti* and *Aedes albopictus*) into locations where they are not known to currently exist in Queensland, and outside of International First Points of Entry and Approved Arrangement sites, i.e. Commonwealth jurisdiction or other locations outside Queensland state jurisdiction. The decision tool is intended to be applied by local, regional and state authorities in mosquito management to provide advice to decision makers about the level of risk of incursions and an appropriate response. It may inform governance processes.

In the event of a detection of *Aedes aegypti* or *Aedes albopictus* in a novel location, a local stakeholder/expert group will provide advice to the Executive Director, Communicable Diseases Branch and relevant local government representatives to formulate an appropriate response and enact local plans.

The decision tool is comprised of the following components:

- Decision tree
- Decision tool – definitions and epidemiological data considerations
- Incursion event response guide

The exotic mosquito incursion response guide outlines the general principles, response options and legislative context that shape operational responses to exotic incursions. Further, operational actions which may be appropriate for responses where the event is considered high concern are presented for consideration.

Scope

This framework does not apply to an event of local transmission of dengue (DENVs), chikungunya (CHIKV) or Zika (ZIKV) viruses. Guidance on the management of these can be found in the Queensland Dengue Management Plan, the Queensland Chikungunya Management Plan and the Queensland interim plan for the prevention and control of Zika virus.

Purpose

The incursion of exotic mosquitoes capable of transmitting serious mosquito-borne viruses into highly populated areas in Queensland poses a significant public health risk. The species of greatest concern are currently:

- *Aedes albopictus* (detected anywhere on mainland Queensland)
- *Aedes aegypti* (detected in new locations in Queensland).

An immediate and coordinated response to an incursion notification can minimise this risk.

The purpose of this framework is to assist each Hospital and Health Service (HHS) and LG to develop local operational plans for the management of exotic mosquito incursions that pose a risk for disease transmission. **Note that guidance for responses to detections of exotic mosquitoes within International First Points of Entry is addressed in the [Response Guide for Exotic Mosquito Detections at Australian First Points of Entry](#).**

The framework is based on five key elements:

1. Standard procedures for obtaining rapid confirmation of an exotic mosquito incursion.
2. Governance framework for a rapid response.
3. Effective communication pathways and processes, including initial notification processes.
4. Good practice operational procedures for vector elimination or eradication.
5. Transparent systems and procedures for accessing human and other resources to implement the response.

Mosquito management legislation

The legislation (Acts and Regulations) applicable to mosquito management in Queensland includes:

- Public Health Act 2005
- Public Health Regulation 2005
- Pest Management Act 2001
- Pest Management Regulation 2003.

There are two avenues available for addressing local government public health risks as defined in Chapter 2 Part 1 of the Public Health Act 2005. These are either an Approved Inspection Program (AIP) or an Authorised Prevention and Control Program (APCP).

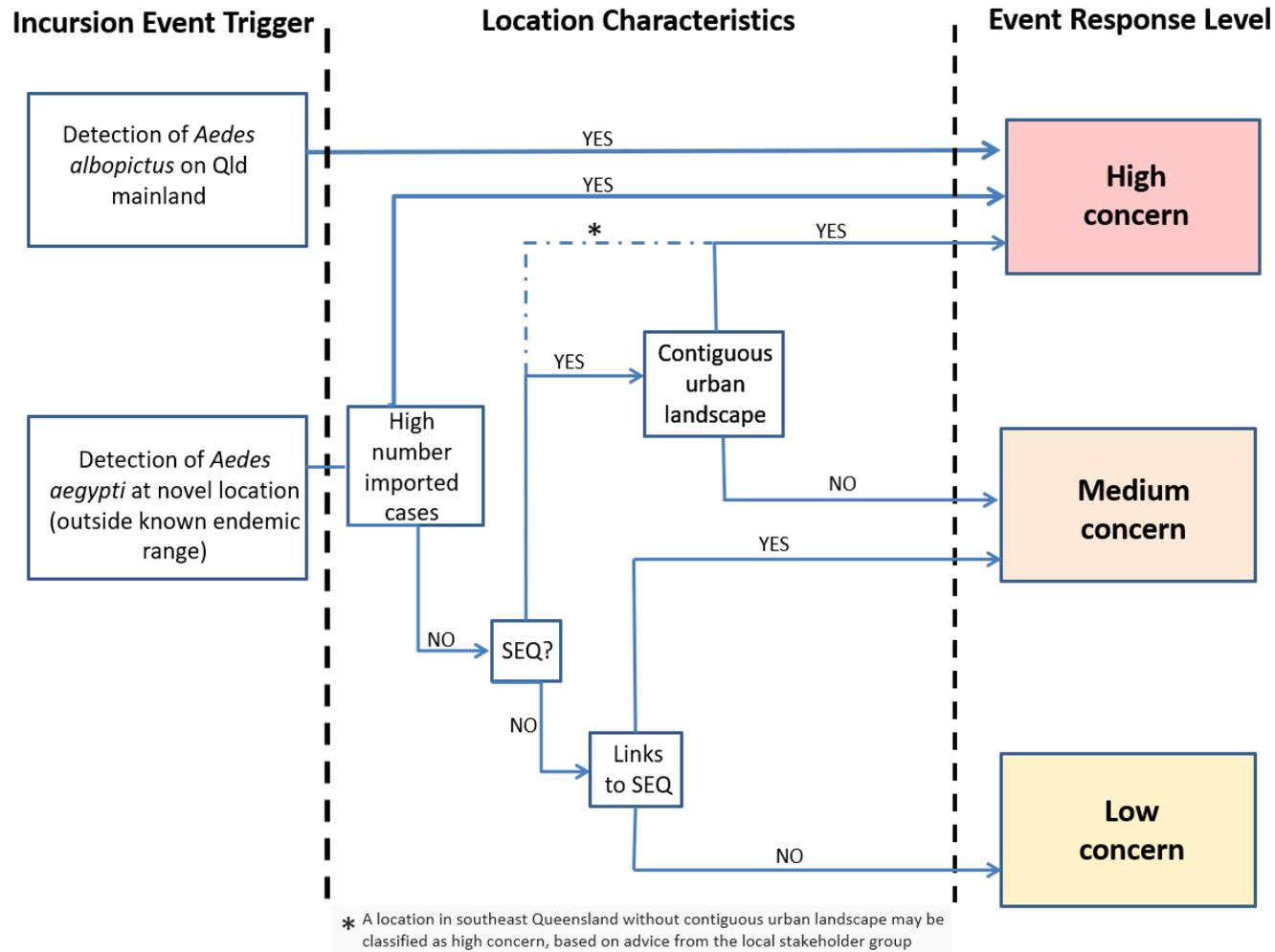
The Director-General of Queensland Health or the Chief Executive Officer of a LG can approve an AIP under which authorised persons may enter places to monitor compliance with a regulation referring to public health risks. An APCP can be approved by the Director General of Queensland Health (QH) or Chief Executive of a local HHS or the Director-General of QH if there is, or is likely to be, an outbreak of a disease capable of transmission to humans by a designated pest, or a plague or infestation of a designated pest including mosquitoes.

The provisions for an AIP are contained in Chapter 9 Part 4 of the Public Health Act 2005 and those relevant to an APCP are contained in Chapter 2 Part 4 of that Act.

Under the Public Health Regulation 2005 local governments require residents and occupiers of commercial premises to control mosquito breeding on their properties and maintain compliance of water tanks.

The Pest Management Act 2001 requires all mosquito control activities involving the application of pesticides to be conducted by a licensed pest management technician with some exceptions for relevant authorised officers (e.g. (S)-methoprene formulations and lethal ovitraps).

Decision Tree



Incursion event response guide

Event Response Level	Public Health Concern	In the event of a detection of <i>Aedes aegypti</i> or <i>Aedes albopictus</i> in a novel location, a local stakeholder/expert group will be consulted to formulate an appropriate response.	Response Action- General Guide
<p>High concern</p>	<ul style="list-style-type: none"> • High potential for vector establishment &/or • If established, likely difficult/impractical/impossible option for eradication &/or • High potential for disease transmission, if established &/or • Distinct links/connections to locations with high potential for disease transmission (e.g. SEQ) 		<ul style="list-style-type: none"> • Always demands an Incident Management Framework (with IMT) • Incident likely led by QH in collaboration with Local Government • The response may be led by the Department of Health or HHS depending on the level of response required • Response will reflect the exotic incursion framework
<p>Medium concern</p>	<ul style="list-style-type: none"> • Moderate- high potential for establishment &/or • Potential difficult control/eradication, if established • Moderate-high potential for vector spread to (other) areas of SEQ or • Distinct links/connections to locations with high potential for disease transmission (e.g. SEQ) 		<ul style="list-style-type: none"> • Local Management (PHU/LG) • Likely Local Government-led IMT with QH support/advice • QH may or may not have own IMT • Recommendation that response should reflect best practice response described in exotic incursion framework
<p>Low concern</p>	<ul style="list-style-type: none"> • Low potential for local disease transmission, if established • unlikely risk of movement to other locations that have high potential for disease transmission (if vector was present; e.g. SEQ) 	<ul style="list-style-type: none"> • Local Management • Local Government lead (with or without PHU involvement) • Specialist technical advice available from QH if requested 	

Decisions tool- Definitions and epidemiological data considerations

Decision tree term/node	Definition	How does this influence transmission risk?	How does this influence the level of concern
<p>High number of imported cases</p>	<p>The number (and frequency) of DENV/CHIKV/ZIKV notifications recorded in the location (including surrounding suburbs) of interest. It includes both overseas acquired cases and cases that may have been acquired elsewhere in Australia.</p>	<p>Frequent DENV/CHIKV/ZIKV importations (from either overseas or elsewhere in Queensland) represent opportunities for local transmission events, where an appropriate vector is present. Thus, local transmission risk increases with increasing number of notifications in high human population density areas.</p> <p>Notifications of cases acquired elsewhere may also indicate a mobile human population (which may increase risk of movement of virus to different locations).</p>	<p>Introduction of virus is a prerequisite for local transmission risk.</p> <p>If a high number of imported cases are notified in a location of interest (or in the surrounding locations) it suggests that there is a high risk of local transmission between humans if a suitable vector is present/abundant and humans are present.</p> <p>*Note: additional epidemiological considerations must be applied when 'high number of imported cases' is determined (see below).</p>

Decision tree term/node	Definition	How does this influence transmission risk?	How does this influence the level of concern
SEQ (South-East Queensland)	<p>South-East Queensland (SEQ). This describes the population centre of Queensland, including Brisbane and surrounding LG areas.</p> <p>Consider SEQ definition provided by Department of State Development, Infrastructure and Planning: http://www.dilgp.qld.gov.au/resources/map/regional-plan-areas.pdf</p> <p>Note: This area may be extended to include adjacent/contiguous urban locations at the periphery of this geographic designation.</p>	<p>In general terms, SEQ is particularly vulnerable to potential virus transmission due to a high human population density (relative to the rest of Queensland) and the reception of a disproportionate number of imported cases of DENV/CHIKV/ZIKV.</p> <p>Further, extensive urban landscape in SEQ provides operational challenges for effective urban mosquito control/eradication efforts.</p>	<p>SEQ is a priority for exclusion of DENV/CHIKV/ZIKV vectors due to a high potential for local transmission (due to high numbers of imported cases) and vector establishment (contiguous urban landscapes).</p>
Contiguous urban landscape	<p>This refers to the distribution of human residences/business premises in a town/location and includes a comparison of rural vs. urban (and suburban) landscape. It also considers the proximity of other urban landscapes (e.g. adjoining suburbs within or across LG areas). Consider: http://www.dilgp.qld.gov.au/resources/map/south-east/draft-seqrp-2016-map-6.pdf</p>	<p>Domestic mosquitoes (<i>Ae. aegypti</i> in particular) thrive in urban environments.</p> <p>DENV/CHIKV/ZIKV transmission is more likely if humans are in close proximity to each other (and exposed mosquitoes). In rural or semi-rural environments, the distribution of domestic mosquitoes is more likely to be highly focal, and vectors are less likely to encounter numerous human hosts from different premises.</p>	<p>If <i>Ae. aegypti</i> and/or <i>Ae. albopictus</i> become established in an urban environment, there is the possibility of proliferation and/or spread to other (contiguous/neighbouring) urban environments. Once a population is established (and/or widespread over a large area) control is difficult and eradication may be impossible.</p> <p>Combined with imported cases, an urban landscape is highly susceptible to DENV/ZIKV/CHIKV transmission if a vector is abundant and widespread.</p>

<p>Links to SEQ</p>	<p>The potential for a town/location to provide a conduit for mosquito introduction into SEQ. This may describe the proximity (defined by distance and/or location as a 'last stop' before reaching an urban centre along a major transport route).</p> <p>A town or location can be considered a conduit to SEQ if there is plentiful industrial, tourist, or other 'traffic' that frequently moves (directly or indirectly) between the location and SEQ.</p>	<p>Transport and other 'links' provide opportunities for mosquito spread to urban areas of high concern (i.e. SEQ). Mosquito eggs, other immatures and/or adults can be introduced by human-mediated transport to vulnerable locations (SEQ) from other locations that are well connected via transport.</p>	<p>SEQ is a priority for exclusion of DENV/CHIKV/ZIKV vectors due to high potential for local transmission (due to high imported cases) and vector establishment (contiguous urban landscapes). Therefore, potential sources of vector incursion into SEQ are also prioritised.</p>
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***Epidemiological considerations: notes on the process of extracting and considering epidemiological data for assessment of 'high numbers of imported cases' as part of the determination of event response level**

- Extract data for the entire LG area for the past 10 years and consider the regularity and scale of dengue notifications in the locality.
- The most recent patterns of imported cases can imply current risk. Consider if there have been any years of higher number of imports in the previous 5 years.
- To the locality specific dengue cases, add cases in all surrounding suburbs and in smaller urban and rural areas include all contiguous suburbs. Consider again the regularity and scale of dengue notifications. This is important as populations are not static and movement across suburbs and within towns occurs regularly.
- Consider the year to date count of state-wide dengue notifications and determine if it is above average or not, and to what degree. In years when Queensland has an above average number of dengue imports, it is often due to large outbreaks overseas, most often in South East Asia and the Pacific region. An above average number of notifications could indicate a higher likelihood of an import during the current year/season.
- In addition to the above, consider if there are any large outbreaks in the region. Consider locations that account for a high number of imported cases into Queensland, including Indonesia, Thailand, Papua New Guinea, Pacific Island nations.
- Using the above data, provide a summary of the regularity and scale of dengue notifications in the area under risk assessment given the historical and current trends.

Managing exotic mosquito incursions – general principles

Key elements	Recommended actions
<p>Standard procedures for obtaining rapid confirmation of an exotic mosquito incursion</p>	<p>HHSs should have a protocol for urgent (within 24hr where possible) verification of the identity of suspected exotic species.</p> <p>Specimens should be urgently reviewed by a QH Medical Entomologist; specimens or digital microscope images may be sent to a QH Medical Entomologist for verification.</p> <p>If additional molecular diagnostic services are required (such as when the specimen is in poor condition or unable to be morphologically identified), secondary options include QH Forensic and Scientific Services (FSS) or an external taxonomist (e.g. Department of Medical Entomology, New South Wales Health Pathology).</p> <p>‘Specimen preservation’ (Section 10 p 36) provides instruction regarding the preservation and labelling of specimens to be transported for identification. A Specimen Identification Request form (e.g. Appendix 1) is recommended for tracking specimens.</p> <p>Information required to assist verification of specimens includes:</p> <ul style="list-style-type: none"> • detection location • date of collection • collection context (e.g. trap type or description of container, or other habitat source) • contact details of the sender and collector.
<p>Governance framework for a rapid response</p>	<p>Local area arrangements for the governance of a response to the incursion of an exotic mosquito should be agreed upon and documented in local plans that are ratified by the HHS and LG.</p> <p>Arrangements should include the immediate notification to the Consultant Medical Entomologist, Communicable Diseases Branch (CDB) when an exotic mosquito identity is confirmed.</p> <p>Local area arrangements should be periodically reviewed according to an agreed schedule.</p>

Key elements	Recommended actions
	<p>In the event of a detection of <i>Ae. aegypti</i> or <i>Ae. albopictus</i> in a novel location, a local stakeholder/expert group will be consulted to provide advice to decision makers and formulate an appropriate response, based on local plans.</p> <p>Complex responses to detections of <i>Ae. aegypti</i> and/or <i>Ae. albopictus</i> in high risk novel locations should be managed using a formal Incident Management Framework (see Queensland Health Public Health Sub-Plan 2018, https://www.health.qld.gov.au/_data/assets/pdf_file/0029/706376/public-health-sub-plan.pdf).</p> <p>Where the Chief Health Officer determines an incident of public health significance has occurred Prevention Division will provide overall governance and oversight, however HHS and LG will continue to be responsible for local area management of the incident.</p>
<p>Established communication pathways and processes, including initial notification processes</p>	<p>Local plans should clearly document the communication pathways to be implemented during a response, which should include:</p> <ul style="list-style-type: none"> • Initial notification - advice provided to the relevant HHS, LG and Consultant Medical Entomologist, CDB at NDPC@health.qld.gov.au on confirmation of identification of an exotic vector incursion. • Notifications to CDB should be by telephone to 07 3328 9782 and accompanied by an email to NDPC@health.qld.gov.au • CDB should be included as a liaison during the incident response. • Provision for incident situational reports - including distribution lists for incident team minutes and situation reports. • Executive briefing process, as required. • Include communications with Department of Agriculture if appropriate (e.g. presence of <i>Ae. albopictus</i>). • Targeted communication strategy to health services, other government departments, the public and industry.

Key elements	Recommended actions
	<ul style="list-style-type: none"> • Templates for media releases should be considered. LG, HHS and CDB should communicate to ensure consistent messaging. • Generic templates will be required for community engagement: <ul style="list-style-type: none"> – prevention, control and trap explanation materials for residents – specific advisories describing types / schedules of activities e.g. – trap formats – rainwater tank repair – property access requests – “Do It Yourself” spraying (if appropriate) – rubbish removal – pest control advices/chemical information etc.
Local planning	<p>Local plans should clearly articulate the aim and objectives of a response, with consideration of:</p> <ul style="list-style-type: none"> • Risk of disease transmission • Whether the mosquito is likely to be able to be eliminated or just controlled (based on current distribution and environmental factors). <p>In the event of a confirmed detection of an exotic mosquito in a novel location, the local stakeholder/expert group will review the local plan and formulate an appropriate response for the event.</p> <p>Objectives should be measurable, and the evaluation process should be clearly documented in the plan.</p> <p>Relevant mosquito surveillance and control activities should be informed by and reflect: <i>Operational guide for emergency response to detection of ‘exotic’ mosquito species Aedes (Stegomyia) on mainland Queensland:</i></p>

Key elements	Recommended actions
	<p><i>outside International First Points of Entry and Approved Arrangement sites – and where the event is considered high concern.</i></p> <p>Depending on level of local risk and capacity, alternative response options may be considered (see p35) for options suggest for <i>Aedes (Stegomyia)</i> detections). Not all responses will require all activities described in the Operational Guide (p 36). Alternative responses should be clearly documented in the local plan.</p> <p>Responses to events that are considered medium or low concern may not require all activities described in p 36.</p> <p>The local plans should nominate the agencies responsible for implementing specific activities in local plan. Local plans should articulate the process for implementing and authorising an APCP, if required.</p>
<p>Transparent systems and procedures for accessing resources to implement a response</p>	<p>A comprehensive list of human resources required to support the local response should be collated and documented in the local plan. The plan should describe current human resources and list existing staff that can be accessed to assist an incursion response. Chief Executives (HHS or LG) should be briefed of any additional resources likely to be needed.</p> <p>Note: If resource requirements to mount a timely response are greater than local capacity, the Chief Executive may escalate according to existing emergency management plans. If the risk from an incursion is considered very high, based on a formal risk assessment process, the response will be managed using an incident management process.</p> <p>Local plans should include a list of equipment required during a response and identify:</p> <ul style="list-style-type: none"> • Equipment currently available and accessibility details. • Additional equipment that would need to be sourced at short notice and process for accessing. • Local plans should identify the data management system(s) to be used to collect and report: • Mosquito surveillance activities and results. • Mosquito control activities. • Human and other resource logistics data.

Key elements	Recommended actions
	<p>Data collection templates should be included in the local plan and the process for training staff in their use identified.</p> <p>Local plans should also include a process for ensuring staff maintain knowledge and skills in mosquito surveillance and control. A pre-emptive “just-in-time” training resource may be considered.</p>

Response options to detection of exotic mosquitoes *Aedes (Stegomyia)* on mainland Queensland: outside International First Points of Entry and Approved Arrangement sites

All response actions will be determined by the event response level, as determined using the decision tool and subsequent advice from the local stakeholder/expert group. Note that if elimination is sought, immediate response action is required; a delayed response may compromise elimination efforts. Note also that any objective other than elimination may require ongoing mosquito management effort to minimise public health risk and nuisance biting.

Response option	Considerations
Response focussed on community education and engagement only	<ul style="list-style-type: none"> • Establishment of exotic mosquito is likely. • Not recommended for events in locations considered medium or high concern (as determined by the <i>decision tool</i> and stakeholder/expert group). • Potential need for ongoing surveillance and mosquito management (likely resource intensive).

	<ul style="list-style-type: none"> • Community engagement to reduce domestic larval habitats recommended. • May or may not include community clean up campaigns (e.g. tyre amnesty, rubbish pick up). • Routine monitoring and risk assessment required for dengue/chikungunya/Zika notifications where relevant.
Ongoing management plan	<ul style="list-style-type: none"> • Establishment of exotic mosquito is likely. • Not recommended as priority option for locations where incursions are considered high concern (as determined by the <i>decision tool</i> and stakeholder/expert group). • Requirement for resource-intensive ongoing surveillance and mosquito control. • Community engagement strategy and clean-up campaigns recommended. • Ongoing monitoring and risk assessment required for dengue/chikungunya/Zika notifications.
Elimination/eradication attempt	<ul style="list-style-type: none"> • Recommended response for event response level of 'high concern' as outlined in the <i>decision tool</i>. • Timely deployment of elimination response plan is a priority. • Complex and sustained surveillance and control resources required. • Community awareness and engagement plan required. • Ongoing monitoring post-elimination required (short/medium/long term depending on complexity of scenario). • If elimination is demonstrated, ongoing surveillance may be required.

Operational guide for emergency response to detection of exotic mosquito species *Aedes (Stegomyia)* on mainland Queensland: outside International First Points of Entry and Approved Arrangement sites – and where the event is considered high concern

This guide provides a general example of surveillance and control actions that may comprise a response to exotic mosquitoes. It is provided for application in locations where an exotic incursion is considered ‘high concern’ by the local stakeholder/expert group (and as described in the decision tool). This guide reflects ‘current good practice’ and will require periodic review to accommodate novel chemicals, application methods, traps and processes.

Urgent confirmation of identification must be sought whenever an exotic species is suspected (noting that exotic refers to any *Aedes albopictus* incursion onto the mainland and *Ae. aegypti* incursions into high risk regions including SEQ).

Both early detection and timeliness of the emergency response are critical for containing an incursion, minimising the risk of establishment, and will determine the success of containment and/or eradication efforts.

The recommended actions in Tables 1 and 2 may be modified for incursions that are of low or medium concern (as described in the *Decision Tool*). In these circumstances, a scalable response can be considered.

Note: All insecticides must be used according to the label instructions and applied by licensed Pest Management Technician unless the activity is conducted by an Authorised Officer acting under Australian Pesticides and Veterinary Medicines Authority permit permissions.

Confirmation of identification of sample

Process	Day	Item	Recommended action
1. Specimen collection and/or submission	-	1	<p>Collect and transfer specimens into labelled containers with date, address/location, breeding site/trap description and collector details. Exotic specimens may be detected as:</p> <ul style="list-style-type: none"> • Larvae or other immatures collected by QH or LG officers during premise inspections or surveillance programs, response to a case notification (e.g. dengue), a complaint investigation etc. • Adult(s) collected from a mosquito trap or otherwise (e.g. aspirator, knockdown spray, sweep net). • Adults or larvae submitted by the public or other third party. Note these may be submitted in a variety of formats (e.g. squashed on sticky tape) and may not be morphologically identifiable. Seek advice from a medical entomologist to determine if additional specimens are required or if the specimen is suitable for molecular diagnostics.
Specimen preservation	-	2	<p>Preserve specimens whenever possible as IV instar larvae or adults to facilitate morphological identification:</p> <ul style="list-style-type: none"> • Larvae (I-IV already dead) – immediately transfer into a labelled vial with 80% ethanol. • Larvae (live) I-III instar – rear to IV instar or adult (in escape-proof container(s)). If a rapid response is required, place in >80% ethanol and submit to QHFSS for molecular identification. • Larvae (IV live) – immediately transfer into a labelled vial filled with >80% ethanol. • Pupae (live) – rear to adult in escape-proof container or place in >80% ethanol or may be sent for molecular identification. • Adults (dead or alive) – transfer to freezer in resealable labelled container (e.g. vial, plastic container, zip-lock bag). If a freezer is not available, >80% ethanol preservation of adults is acceptable, particularly if molecular identification is being pursued. • Eggs collected in ovitraps that are suspected to be of exotic origin may be reared or submitted to QH FSS for molecular identification or Rapid Surveillance of Vector Presence (RSVP).

Process	Day	Item	Recommended action
Preliminary identification	-	3	<ul style="list-style-type: none"> Identify any specimens (adults and/or larvae IV) as soon as possible following collection from the field (i.e. don't store for weeks without identification): Use microscopy, diagnostic keys and other reference guides for preliminary morphological identification. If an exotic species is suspected, consult PHU and/or LG urgently to discuss diagnostics and escalate to the next process (submission to medical entomologist, QH FSS or other secondary diagnostic facility).
2.Specimen submission to QH	+1	4	<ul style="list-style-type: none"> Send any microscope images (via email) and exotic specimens urgently (delivered or express courier post) to QH medical entomologist for identification confirmation. Alert relevant medical entomologist to receive sample and discuss detail of detection site, collection date, collection context (container source/trap type), and contact details for future discussions. Refrain from broadcasting a potentially false alarm until identification is confirmed.
Document specimen receipt	1-2	5	<ul style="list-style-type: none"> Medical Entomologist to complete a '<i>Specimen ID Request Form</i>' upon receipt to ensure specimen tracking (Appendix 3). QH medical entomologist may refer to specialist taxonomist and/or QH FSS.
Specimen analysis	1-2	6	<ul style="list-style-type: none"> Medical Entomologist to examine adults and larval specimen to attempt species identification. Submit for urgent molecular identification/confirmation if uncertain due to novelty of species, or damaged/small condition (e.g. QH FSS). Confirmed exotic specimens should also be submitted for population genetic analysis to attempt to determine possible origin of incursion (refer to advice from medical entomologist regarding appropriate laboratory submission). The submitter will be advised of outcome.
3.Confirmation	1	7	Confirmation of the identity of an exotic species will trigger different responses, dependent on species, geographical context and advice from the local stakeholder/expert advisory group, as outlined in the <i>Decision Tool</i> .

Activation of emergency response for incursion of *Ae. albopictus* or *Ae. aegypti* into locations considered of high concern

Process	Day	Item	Recommended action
4. Detection of exotic species: Notification of stakeholders a. Resident	1-2	8	<ul style="list-style-type: none"> Request interview with resident/occupier (if relevant) to establish timelines, potential pathways, alternative addresses relevant for additional surveillance and control. Verify if any high-risk premises/businesses (e.g. removalist/logistics depots, plant nurseries, tyre yards) are proximal to detection site, or have any connections to positive address. Notify resident of identity of specimen.
b. Partners	1-2	9	<ul style="list-style-type: none"> Notify local PHU (Director/Public Health Physicians and/or Manager Environmental Health (MEH) and Consultant Medical Entomologist, CDB at NDPC@health.qld.gov.au using agreed communication channels. Relevant incident management structures to be activated by QH and/or LG. Convene local stakeholder/expert group to consider level of concern and general guide to response actions as outlined in the <i>Decision Tool</i>. Note that incursion events in locations considered 'high concern' should trigger response as outlined herein and which emulates actions outlined in Table 1. Convene meeting by Incident Controller of key stakeholders (QH PHU and CDB, LG, port authorities) to consider event oversight and confirm the activation of response plan. Where required, coordinate/consider: <ol style="list-style-type: none"> Brief to relevant executive. Declaration of an APCP by delegated officers under the <i>Public Health Act 2005</i> enabling access by authorised officers to all yards of premises. Determination whether specific methods (e.g. 'fogging' in residential areas) require community and/or executive endorsement. Media and communications management.

Process	Day	Item	Recommended action
			<ul style="list-style-type: none"> e. Financial governance arrangements. f. Resources – requirements for staff, work rosters, vehicles and consumables to be outlined and endorsed (Table 2 below provides a preliminary guide for consideration).
c. Interstate stakeholders	1-2	10	<ul style="list-style-type: none"> • If <i>Ae. albopictus</i> is detected - Consultant Medical Entomologist, CDB to notify relevant local, State and Commonwealth partners (e.g. National Arbovirus and Malaria Advisory Committee). • If <i>Ae. aegypti</i> is detected in a low - medium risk location notify State and local partners. Notification of interstate and Commonwealth partners not likely required • If <i>Ae. aegypti</i> is detected in high concern location (e.g. South East Queensland) – notify State, Commonwealth and New South Wales authorities.
5. Media and communications	2	11	<p>Establish communication networks to interact with public (phone number, etc.) to enable rapid response to mosquito complaints/enquiries within affected area and prioritisation to those nearest to the detection block (DB).</p> <p>Review existing templates for:</p> <ul style="list-style-type: none"> • Prevention, control and trap explanation material to residents • Specific advisories describing type/schedule of activities: <ul style="list-style-type: none"> – trap formats – rainwater tank repair – dog restraint requests – urgent requests to revisit property – trap collection (with thanks) – barrier spray information – DIY spraying

Process	Day	Item	Recommended action
			<ul style="list-style-type: none"> – kerb-side pick-ups etc.) • Pest Control Advice (PCA) and Material Safety Data Sheet (MSDS) or relevant chemical notifications.
6. Operational response: Planning and management	1-2	12	<p>Key operational stakeholders meet to define perimeter of an Eradication Zone (EZ). Scope of EZ for <i>Ae. aegypti</i> should minimally encompass blocks 250m from detection blocks (DB), and 500m from DB for <i>Ae. albopictus</i>, and both consider landscape features that will inform response zone planning.</p> <p>Within the EZ, city blocks can be subdivided into three sectors (see Figure 1.):</p> <ul style="list-style-type: none"> • Detection block(s) (DB). • Inner ring blocks (IRB; those that surround the DB) and • Outer ring blocks (ORB; those that surround the IRBs). <p>The number of blocks included in each sector each day will be specific to the details of the incursion and dynamic, as new detections are reported. Review EZ sectors daily to accommodate further detections/emerging information.</p> <p>Review the response plan and coordinate concurrent key activities:</p> <ul style="list-style-type: none"> • Survey teams: prioritise definition of extent of incursion/infestation within EZ. • Determine if initial EZ is sufficient or if additional EZs are required for other addresses that may be connected to the incursion address(es). • Control teams: Conduct comprehensive chemical applications within a declared EZ (starting at DB) with priority. <p>Review individual stakeholder responsibilities and resource capability.</p> <p>Confirm data recording requirements (templates and platforms) and data sharing arrangements.</p> <p>Generate map(s) of EZs showing surveillance and control responsibilities and distribute to stakeholders (note: consider restriction of receptacle movement from infested or port areas, where applicable).</p>

Process	Day	Item	Recommended action
7. Surveillance team(s) actions	1-2,1-8, 15,23,30	13	<p>Survey teams scope</p> <p>At least 1 month consisting of:</p> <ul style="list-style-type: none"> • <i>Ae. aegypti</i> – IRB and ORB: Deployment of adult traps (BioGents Sentinel (BGS) and/or Gravid <i>Aedes</i> Traps (GAT)) and sweep netting. Use observation of key houses/satellite imagery to identify candidate addresses (e.g. heavily shaded areas) if appropriate; refer to Table 1 below. • <i>Ae. albopictus</i> – IRB and ORB: consider use of sweep net in shaded areas; deploy adult traps (BGS and/or GAT and CO₂-baited traps in parkland). In absence of key premises deploy network of traps (Table 1). Consider adding CO₂ and/or lures to BG traps to increase sensitivity. • Deploy adult traps at mosquito complaint addresses within 2-5 km of EZ. • Collect larvae opportunistically at premises that are visited or where traps are set.
8. Control team(s) actions	1-8	14	<p>Control teams scope</p> <p>A. Sample collection</p> <ul style="list-style-type: none"> • DB: Check all containers in every premise for larvae and/or pupae. Collect samples from as many containers as possible and preserve in >80% ethanol. Collect harbouring/biting adults (using sweep nets/aspirators). • IRB and ORB: Collect representative sample of larvae from containers; preserve in >80% ethanol. <p>B. Source reduction</p> <ul style="list-style-type: none"> • Determine if key containers (rubbish, tyres) will be removed during inspection. Consider strategies to minimise movement of potentially infested containers. <p>C. Chemical application</p> <ul style="list-style-type: none"> • Provide a PCA (where relevant) and/or communication whenever an inspection is conducted and/or chemical has been applied. <p>Larvicide – (all properties within the EZ):</p>

Process	Day	Item	Recommended action
			<p>Inside yards</p> <ul style="list-style-type: none"> • Surface containers: Treat all receptacles containing water OR that can contain water with S-methoprene (sand, pellets, or briquets) or appropriate outdoor residual surface spray (e.g. lambda-cyhalothrin, alpha-cypermethrin or handheld pneumatic sprayers). Do not treat containers used for pet drinking water, fish habitat or children’s swimming pools. These items will require cleaning or alternative treatment to remove or kill mosquito eggs. • All receptacles with mosquito immatures should be treated and cleaned to remove or destroy unhatched eggs. Where appropriate, such receptacles should be removed from premises after treatment. • Covert sites: Dose roof gutters (≤3 m height) and drain sumps with S-methoprene pellets. • Rainwater tanks: treat non-compliant tanks (damaged/missing screens) with S-methoprene briquets, (obtaining permission before treatment and providing resident with the opportunity to conduct urgent compliance repairs). <p>Outside yards</p> <ul style="list-style-type: none"> • As above, but also check communication pits, gully traps, kerbside stormwater discharge points and tyres. <p><u>Adulticide</u></p> <p><i>Ae. aegypti</i>:</p> <ul style="list-style-type: none"> • Conduct interior residual spray (IRS) of affected address(es) and offer IRS to all premises in DB with priority. Provide IRS to any address in EZ that request a spray and/or present as ‘key’ premises. • Deploy lethal ovitraps to an agreed schedule (e.g. 1–2 per property, in all premises within DB and IRB), as per Table 1. Egg strips to be collected weekly for 4 weeks, then fortnightly for 4 weeks, then redeploy for 4 weeks (total 3 months). Note: this schedule will require review if further detections are confirmed. • Consider harbourage spraying of fence lines and surrounding vegetation to contain dispersal – only if infestation appears to be contained.

Process	Day	Item	Recommended action
			<p><i>Ae. albopictus:</i></p> <ul style="list-style-type: none"> • Conduct barrier/harbourage spraying (weather permitting), in suitable outdoor areas of premise and harbourage areas ≤1 km from DB. Barrier spray any shrubs, parks with harbourage vegetation or fences to contain dispersal (Note. Potential public concern should be addressed prior to spraying using agreed communication strategy). • Consider if ULV or thermal fogging may be appropriate. Additional ULV/fogging for 1–2 days may be considered if adults remain active (or consider relying on barrier sprays). • Deploy lethal ovitraps: DBs (2 per premises) at all addresses; IRB (1 per premises) at all premises; ORB as per guide (Table 1) with focus on key premises. • (Note IRS is generally not required as adults do not readily enter buildings to same extent as <i>Ae. aegypti</i>).
9. Revisit properties		15	<ul style="list-style-type: none"> • Premises that are locked or inaccessible (e.g. due to the presence of dogs) should receive documentation (based on prepared template) requesting urgent access and/or for dogs to be restrained. • Properties where access is not possible (locked) or control is incomplete (e.g. inaccessible rainwater tank) need to be re-visited the following day. • Note that inability to access or lack of compliance may require issue of Public Health Orders.
10. Sample collection frequencies from EZ	2-8, 16, 23, 30, 60 90	16	<ul style="list-style-type: none"> • All samples must be accurately labelled. • DB: Collect adult samples from adult traps (BGS traps and GATs) each week for 4 weeks. (note: These monitor efficacy of control, so less frequency required than IRB traps which are used to detect spread from DB). • IRB & ORB: Collect adults daily for first week, then weekly for additional 3 weeks (provided no exotic mosquitoes detected). • Refresh lethal ovitraps after 30 days from deployment. • All adult and larval samples/results to be submitted to diagnostic team at the end of each day for urgent identification (within 24 hrs). • Revise EZ perimeter each day in response to sample identifications from IRB and ORBs. Adjust treatment and trapping regimes whenever detections occur in new/additional blocks.

Process	Day	Item	Recommended action
11. Specimen diagnostics	8-30	17	<ul style="list-style-type: none"> • ME and/or proficient officer to count, sex, and identify specimens. • Submit specimens for urgent molecular identification (QH FSS) if large sample sizes, or if specimens are too damaged or too small to permit morphological identification.
12. Quality assurance	1-30	18	<ul style="list-style-type: none"> • Exchange maps between relevant stakeholders at end of each day, showing updated treatment responsibilities, inspection progress and outcomes. • Daily updates for 1 week with relevant stakeholders then weekly updates to follow; any ongoing media informed if necessary, through an agreed media strategy. • Deploy Quality Assurance teams into DB one week after initial control and other areas as needed (e.g. around persistent breeding sites) to ensure control activities are effective. Duties include checking for evidence of treatment, larvae, new breeding sites, etc.
13. Re-assessment	8-30+	19	<ul style="list-style-type: none"> • Reassess EZ perimeter following each new detection outside the DB (e.g. daily within the first week, then as each trap run is completed or following <i>ad hoc</i> detections within or beyond EZ). Reconvene stakeholder meeting to discuss options, particularly if there is a proposal to expand the control area. • If the exotic species continues to be detected and/or appears to be well established over large and/or multiple eradication zones, alternative strategies may require consideration. At this stage, there is a need to be certain that vector persistence is not due to inadequate treatment, treatment failure or low trapping sensitivity (i.e., failure to detect presence during delimiting surveys).
14. Staged stand down and validation of eradication	60-90+	20	<ul style="list-style-type: none"> • Pending agreement of all stakeholders and expert group, stand down control activities one month after completion of work associated with last positive detection. • Continue surveillance to 'validate zero exotics' (when no target mosquitoes are detected after completion of primary EZ operations), consisting of adult traps and ovitraps for 2–3 months after completion of emergency response, and preferably two weeks after a rain event that may trigger hatching. • All results and actions to be documented and provided to executive.

Table 1 Operational guide for a minimum eradication zone based on a single positive property (i.e. one detection block).

Note that each additional detection will require an urgent review of scope of eradication zone and associated workplan.

A. Number of premises to process in minimum eradication zone	Estimate of operational requirement (*this is a guide only)
Detection block (DB; one city block)	20–50 premises
Inner Ring blocks (IRB; usually 8 city blocks around detection block)	160–400 premises
Outer ring blocks (ORB; usually 16 city blocks around inner ring)	320–800 premises
TOTAL	500–1250 premises
B. Chemical	
Yards	
Residual chemical	TBA
(S)-methoprene for 1,250 premises (30 g per premises)	37.5 kg (assuming one treatment per premise required)
(S)-methoprene briquets for Rainwater tanks (2 per tank)	1,000 briquets
Commercial/parkland	
Residual surface spray (synthetic pyrethroid)	TBA
ULV misting (e.g. Reslin, malathion or alternative)	TBA
C. Application equipment	
Domestic	
Pneumatic sprayers (2 per control team)	8+ sprayers
Commercial/open space	
Barrier sprayers (motorised backpack mister)	4+ sprayers
ULV foggers	2 foggers
D. Mosquito traps	
Adult traps	

BGSs DB	3 BGs
BGs in IRBs (one per block, battery or mains power)	8 BGs
BGs in ORBs (one per block)	16 BGs
Complaint responses (one per property)	11 BGs (depends on number of complaints received)
TOTAL	50 BGs minimum
Gravid adult traps	
DB (1 per property, checked weekly)	20–50 GATs
IRB (minimum 5 per block plus key premises, check daily, then weekly – unless further detections)	40 GATs
ORB (min 3 per block and any key premises – check weekly)	50 GATs
TOTAL	150 GATs minimum
Lethal ovitraps (1.2 or 9L)	
Detection block DB – 2 per premises	40–100 LOs
IRB (8 city blocks) – 1 per premises	160–400 LOs
ORB (16 city block) – 1 per 2 premises, OR at 1 per key premises 200	160–400 LOs
SUBTOTAL	360–900 LOs
Deployment regime	
Round 1. Deploy day 1–8	400–900
Round 2. Refresh on day 30	400–900 (swap with new lethal traps)
Round 3. Refresh on day 60	400–900 (swap with Round 1 traps)
Collect day 90	
TOTAL	800–2,000 LOs
CO ₂ -baited traps (for <i>Ae. albopictus</i> incursions)	
Parkland within 500 m	10 light traps
Complaints within 5 km	10 light traps
Total	20 light traps

Table 2 Operational staff: tentative requirements (week one – assuming no additional detections)

Staff type	Recommended number of staff
Coordinator	1
Surveillance Teams – DB & IRB (2x teams of 2)	4
Surveillance Team – ORB (1x team of 2)	2
Control Teams – Yard Inspections (4 x teams of 3)	12
Control Teams – barrier spraying/fogging (2 x teams of 2)	4
Quality Assurance team (1x team of 2)	2
Scouting/complaints teams within 5 km – (2 teams of 2)	4
Specimen ID (2 teams of 2)	4
TOTAL	33
Support staff	
Mapping and reporting	TBA
Data entry (depends on IT platform available)	TBA
Communications	TBA
QHFSS molecular diagnostic capability	TBA

Figure 1 Schematic of an eradication zone around a detection block (DB), representing a minimum response around a single property where a target exotic species was detected.

Numbers of blocks in inner ring block (IRB) and outer ring block (ORB) must be assessed on a case-by-case basis. IRB and ORB need daily re-assessment in early phase of response as daily surveillance data becomes available. Each square represents a typical neighbourhood 'block' of houses, typically bounded by streets.

ORB 1	ORB 2	ORB 3	ORB 4	ORB 5
ORB 16	IRB 1	IRB 2	IRB 3	ORB 6
ORB 15	IRB 8	DB	IRB 4	ORB 7
ORB 14	IRB 7	IRB 6	IRB 5	ORB 8
ORB 13	ORB 12	ORB 11	ORB 10	ORB 9

Appendix 1 Specimen identification request form (template)

Specimen identification request form (template) to be filled out by QH Medical Entomologist or QHFSS Diagnostic Services upon receipt of a specimen or photograph of a suspect exotic mosquito.

Contact details for submission

Name of Submitter	
Agency of Submitter	
Address	
Contact No.	
E-mail	
Date Submitted	
Date Received	
Received By	Signature:

Details of sample

Total number of samples:	Sample number(s):
Sample description: <i>collection details (e.g. trap type, date of collection), preservation details and additional description, as required</i>	
Other Individuals Who Have Reviewed Sample:	
Comment:	
Activity requested: <i>Confirm ID – potential exotic mosquito</i>	
Action: Label sample(s) with archive identifier and storage location; note person(s) notified of sample arrival	

Result

Sample number	Result	Comments	Sample fate <i>(e.g. disposed of, kept by external agency, kept by PHU, returned to submitter)</i>
Comments:			
Name of Provider of Final Confirmation of Species:			
Designation and Agency:			
Signature:			