A guide to developing a mosquito management plan for Local Government

Part B –
Case study examples
Foreword

This document should be used in conjunction with “Part A: Template and Guidance Notes”.

Included within these pages are examples of text, some of which other Local Governments (LGs) have used in Mosquito Management Plans (MMPs), which may be helpful to use as a guide when producing information for your own MMP.

The issue of mosquito management is complex. It may be useful to refer to the WA Department of Health’s most current Mosquito Management Manual for more detailed information when preparing a MMP.
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Case study examples

1. Introduction/executive summary

Example 1:
“The Shire of xx covers a vast area of 50,000 square kilometres and is located more than 1,000 kilometres north of Perth. The Shire comprises several small communities with one major town site (xx). Along the boundaries of the Shire are the Shires of xx and xx.

The town site of xx has a population of approximately 5,000 people according to the 2011 Census. xx is surrounded by vast expanses of flat inter-tidal salt marshes and native bush land. xx has experienced significant growth since 2010 due to the newly developed industrial area, bringing more workers and resulting in the construction of new housing estates at the southern end of the residential area. The new subdivisions are in close proximity to bushland (natural adult mosquito harbourage areas) and salt marshes (natural mosquito breeding habitat) therefore increasing the likelihood of an impact from mosquitoes. Furthermore, these housing developments provide for high density living, placing a greater number of residents in close proximity to high mosquito nuisance areas.

xx experiences temperatures consistently high in the summer months along with a relatively high rainfall, mostly experienced from November to March. The mean annual rainfall for xx is 500mm. It is generally during these months, due to the favorable weather conditions and the significant amount of pooling water in surrounding natural breeding habitat, we are subjected to an increase in adult mosquito populations.

xx also experiences extreme high tides, with peak tides reaching 8.5 metres. Mosquitoes breed naturally on the salt marsh habitat when the land becomes inundated with water, following a tidal event. Each high tide can trigger another breeding cycle of mosquitoes.

The varied natural environment in the xx region provides for a wide range of temporary, seasonal and permanent mosquito breeding sites. Some of the environmental variances that can greatly impact the mosquito numbers are:

- Tidal variations
- Rainfall & flood events during the wet season
- Temperature
- Humidity

All of these weather factors play an important role in mosquito management and need to be considered during the implementation of the program. Even with a MMP in place, there will be occasions when mosquito management is not effective due to factors such as unfavourable environmental conditions. Ineffective control, combined with the close proximity of the xx town site to these natural breeding areas mean, despite best efforts, there will be times when a significant mosquito nuisance will result.”
Example 2:

“The Shire of xx is geographically part of the Swan Coastal Plain and incorporates the expanse of wetlands that run from xx to xx. The Shire is experiencing significant population growth and with this growth comes the pressures of expanding urbanisation. One of these pressures is the availability of land for development resulting in some development occurring within close proximity to known mosquito breeding areas. When this occurs, the risk of new residents becoming infected by a mosquito-borne disease increases.

Mosquitoes are a concern for the community not only due to their potential to carry debilitating diseases but also due to their nuisance value which can impact on the ability of residents to enjoy the amenities and natural beauty of the area. In contradiction to this, while they may be pests, mosquitoes are an important component of the local ecosystem, providing food for birds, bats, amphibians, fish and insects. The challenge is creating a balance between these factors and implementing a program that has little impact on the environment but reduces the risk of the community being exposed to mosquito borne diseases.

This challenge can be met through an integrated mosquito management program incorporating physical, chemical, cultural and biological control options. Such an approach needs to consider the statutory obligations, policies, guidelines, current practices, the community and the environment. By having such an approach to mosquito management, it creates an effective and environmentally sensitive solution that is sustainable. It also provides for avenues that are sometimes less allocated for, being health promotion and chemical resistance management.”
Example 3:

“Mosquitoes are a fact of life within many areas of the state and greater metropolitan area. Mosquitoes are one of the most significant groups of insects with the potential to cause nuisance and transmit diseases to humans and other warm-blooded animals. The continued development of residential areas in close proximity to natural mosquito habitats allows for easy access for mosquitoes to enter the urban environment. Residential backyard breeding in gutters, storm water systems, roadside drains and constructed wetlands can be attributed to continued urban development. Such development has allowed for the creation of more breeding habitats for different species of mosquitoes.

The City of xx has approximately xx kilometres of xx River foreshore situated xx and xx. Much of this land is owned by the State of Western Australia and consists of wetlands and areas which are potential breeding sites for mosquitoes.

The incidence of Ross River virus and Barmah Forest virus throughout the State of Western Australia presents a serious risk to public health. Whilst not all mosquito species are transmitters of disease many are aggressive biters and can have a significant impact on quality of life.

Without the appropriate controls, precautions and treatment of mosquitoes, outdoor recreation areas, gardens, and other similar areas are rendered potentially useless. The nuisance and annoyance caused by mosquitoes is not easily translated into economic values.

The City of xx mosquito management strategy is designed to reduce the impact of mosquitoes on both the population and visitors to the City.

An effective Mosquito Management Plan (MMP) provides a clear definition of the mosquito problem, determination of practical objectives, the selection of appropriate control measures, procedures for measuring the effectiveness of the mosquito control operations and the establishment of a process for evaluating the management strategy.

It is not realistically possible or environmentally desirable to eradicate mosquitoes as they are an important part of the ecosystem. However, it is possible to achieve a reduction in mosquito populations, in an effort to minimise the risk of mosquito borne disease such as Ross River and Barmah Forrest virus, with an effective integrated Management Plan.”
2. **Aim/objectives**

Example 1:

“The principles governing this MMP are:

- mosquito management incorporates the health, environmental and socio-economic values across the LG;
- while disease control is the primary focus, reduction of nuisance mosquitoes is a legitimate aspect of improved community well being;
- mosquitoes are an important part of the ecosystem and their treatment may have both positive and negative impacts on the environment; so management options will try to minimise negative impacts;
- effective mosquito management requires the cooperation and coordination of all stakeholders.
- treatment of mosquito larvae and/or adults is an on-going activity that requires continual surveillance and review.

The objectives governing this MMP are:

- to identify breeding areas and potential breeding locations;
- to provide an easy access document to convey information to future staff;
- to inform, guide and assist developers, consultants, land owners, residents, council staff and the general public of Councils mosquito management actions and guidelines;
- to work with other local governments in the region to ensure mosquito management is carried out in a cooperative manner and to ensure complimentary mosquito management across LG borders; and,
- to strategically guide the financial direction of mosquito management.”

3. **Strategic implications**

Example 1:

“In accordance with the Shire’s Strategic Plan – ‘Our MISSION is to make the Shire of xx the most attractive place to live, work and visit in Western Australia’. The MMP strives to address the following strategic directions....”

4. **Statutory Management/Legislation**

Example 1:

“As the Town’s lake systems are protected under the Environmental Protection Swan Coastal Plain Lakes Policy 1992 and the Ramsar Convention (xx Lake), approvals have been obtained from the xx, allowing the Town to carry out mosquito management in the Lakes according to the MMP. If, under review, changes are made to the MMP, new approvals will need to be obtained...”
5. Mosquitoes

Example 1:
“Mosquitoes go through four development stages - egg, wriggler (larva), tumbler (pupa) and finally adult. This whole cycle from hatching egg to flying adult can take as little as 5-7 days in summer. During colder months the life cycle may take several weeks. Mosquitoes can breed in any type of standing water. Different species of mosquitoes will breed in different environments, from natural and man-made water bodies to a variety of water-holding containers, and from fresh to brackish or even saltwater.

Some species of adult mosquitoes are known to travel 3km or more from a breeding site in search of a blood meal. As a result, residents living at a distance from the breeding sites (as well as those close by) may be affected.

There are almost 100 species of mosquitoes in WA and many of them can be serious pests. In addition to being a nuisance, mosquitoes can also pass on viruses when they bite. The main viruses transmitted by mosquitoes in WA are:

- **Ross River virus (RRV)** - this is the most common virus transmitted by mosquitoes in WA. Symptoms of RRV disease include joint pain and swelling, sore muscles, rash, fever and fatigue. Symptoms may persist for several weeks to months.

- **Barmah Forest virus (BFV)** – BFV disease has similar symptoms to RRV disease but is not as common.

- **Murray Valley encephalitis (MVE) virus** – MVE is a rare but potentially fatal disease that occurs mainly in the northern two thirds of WA. Symptoms include fever, drowsiness, confusion, headaches and stiff neck, nausea and vomiting, muscle tremors and dizziness. In severe cases brain damage, paralysis or death may result.

- **Kunjin virus** - while the symptoms of this rare but serious disease can be similar to MVE, illness is generally milder and not life threatening.

There are no specific cures or registered vaccines for any of these diseases, so managing mosquitoes and reducing human – mosquito interaction via an integrated mosquito management plan is the only way to reduce the risk of the community being exposed to a mosquito-borne disease.

Viruses and parasites transmitted by mosquitoes can also cause illness and death in animals. Dog heartworm is caused by a parasitic worm passed on by mosquitoes which, in large numbers, can clog the dog’s heart/vessels and severely affect blood flow.”

Example 2:
“Under provisions within the WA Local Government Act 1995, the City has adopted measures specific to the prevention and control of mosquito-borne diseases which are contained in the City of xx Health Local Laws 1997...”
6. Breeding sites – land ownership/responsibility

Example 1:
“The responsibility for the maintenance and governance of the subdivision (including mosquito management) will remain with the proponent during the development phase of the subdivision. At the completion of the development stage (in five years time) the responsibility for the continued management of mosquitoes will fall to the Shire of xx.”

Example 2:
“Of the 600Ha of natural mosquito breeding habitat identified within this MMP, more than half of this land is located on private property, with the remainder being vested in the City of xx. For this reason, the health section has been involved in extensive community consultation with the above mentioned land owners over the management strategies being proposed in this MMP. As a result of this consultation the land owners have agreed to allow access to their land for the purpose of mosquito surveillance and for larvicides to be applied on their land via an aerial treatment program.”
7. Nuisance/disease risk

Example 1:

“Within the Shire of xx, mosquito management is necessary for two reasons:

i. Mosquito-borne disease risk (vectors, disease and human cases)

It has been well documented that known vectors of mosquito-borne diseases, such as Ross River virus (RRV), Barmah Forest virus (BFV), Murray Valley encephalitis virus (MVEV) and Kunjin virus (KUNV), are present within the Shire. This has been confirmed through adult mosquito trapping carried out by the Shire and through opportunistic mosquito surveillance carried out by the University of Western Australia’s Arbovirus Surveillance and Research Laboratory (UWA-ASRL) and the WA Department of Health (DoH). The UWA/DoH surveillance work has also isolated mosquito-borne viruses in mosquitoes trapped within the Shire, indicating the viruses are active at various times.

Another mosquito-borne surveillance program run by UWA/DoH, that the Shire participates in, involves monitoring of sentinel chickens (discussed further in Section xx). This program regularly detects annual wet season activity of MVEV and KUNV in the xx region.

During the last mosquito season the xx region, along with many other areas of the State, experienced a large RRV outbreak with 45 notifications, 15 of which were likely to have been acquired within the Shire. Based on the Shire’s population size this is a significant number of cases within one season.

To further assess the risk of mosquito-borne disease in the State, the DoH has analysed 10 years worth of human case data, which has ascertained the Shire’s average attack rate (the number of cases per 100,000 population) for RRV is significantly higher than the average attack rate for the rest of the State. This data places the Shire at a ranking of xx out of 140 Local Governments in terms of risk rating for RRV (where one is the highest risk and 140 is the lowest risk).

These mosquito-borne diseases all have a significant impact on the health, social and financial well-being of residents and visitors to the region. They will be discussed in further detail in section xx.

ii. Nuisance mosquitoes

As well as being a disease risk, mosquitoes can also be a considerable nuisance. Some mosquito species in the Shire are known to be aggressive biters, causing discomfort and pain to affected residents and can impact significantly on lifestyle. One species in particular, Aedes vigilax, is not only a vicious biter, but will attack at any time during the day or night and can travel tens of kilometres from their breeding sites. This can cause a significant nuisance to residents and visitors, severely impacting their outdoor amenity.

As well as monitoring natural breeding sites, the Shire monitors adult mosquito populations in response to local nuisance concerns throughout the residential and urban areas around the town. Although the Shire only receives an average of 6 direct complaints per season, there is a community expectation for the Shire to manage mosquitoes at an acceptable level to reduce their impact whilst recreating in public open spaces and/or their own properties.”
8. Mosquito management – baseline survey/existing data

Example 1:
“A baseline investigation has been carried out across the development site over the last 12 months. As part of this investigation, an adult trapping program has been established, with three EVS CO\textsubscript{2} traps being set on a fortnightly basis through the spring, summer and early autumn months. Monthly trapping continued over the cooler months to develop knowledge of species composition changes in the mosquito fauna throughout the entire year. Figure A shows the location of the three established EVS CO\textsubscript{2} traps across the development site.

(Insert figure A here)

The initial results from the first 12 months of adult trapping can be seen in Figure B. Trap 1 collected the largest number of adult mosquitoes for most months of the year, being substantially higher than the other sampling locations. Trap 3 collected the lowest number of adult mosquitoes compared to the other sampling locations. All three traps consistently caught fewer mosquitoes in the winter months. Mosquito numbers increased in all traps from September before beginning to decline in February/March. The composition of all adult traps was similar with a dominance of *Aedes camptorhynchus* between September and December, after which, *Aedes vigilax* became the dominant species across the trapping sites until the end of March.

(Insert Figure B here)

Larval monitoring has also been carried out across the proposed development since January 2011 to gather baseline data on the density and species present. The frequency of larval monitoring has been based on weather conditions/breeding triggers (discussed further in section xx), but generally occurred on a weekly to fortnightly basis throughout spring, summer and early autumn. Larval monitoring was reduced to monthly sampling over late autumn and winter. Figure C shows the larval dipping sites that have been established across the development site.

(Insert Figure C here)

At each sampling location, several dips were taken and the number of mosquito larvae within each dip estimated. An average was calculated, based on the number of dips taken and then converted to obtain an overall estimate of the number of mosquito larvae at each site (larvae per m\textsuperscript{2}). These results from the first year are shown in Figure D. Larval specimens were also collected for identification to determine the mosquito genus at each site.

(Insert Figure D here)

Dip site 2 regularly collected more mosquito larvae than the other dip sites, possibly due to the shelter provided within Lake xx and the constant high tides leading to hatching of mosquito eggs on a regular basis. Monitoring sites further north had fewer mosquito larvae, possibly due to the tides having less impact and lower levels of flooding leading to a reduction in hatching of mosquito eggs. Dip site 3 had the lowest number of mosquito larvae, possibly due to the tidal action removing larvae from the site at low tides when the water is drawn to the ocean.

In summary, *Aedes vigilax* and *Aedes camptorhynchus* were the two most dominant species trapped throughout the site over the first 12 months of adult monitoring. Similarly, they were also the dominant species collected during larval monitoring. Significantly, both of these species are capable of transmitting Ross River and Barmah Forest viruses. Appendix xx shows a full list (in descending order of dominance) of adult mosquitoes collected across the site for the first year of the study and their associated disease risks.”
9. Mosquito management – control options/strategies

Example 1:
“There are four approaches to mosquito management that should be considered in the development of an integrated mosquito management plan. These include Cultural, Physical, Biological and Chemical control of mosquitoes and their breeding habitats. All are important to develop a successful approach to manage mosquitoes. An integrated Mosquito Management Action Plan has been developed which incorporates all of the information detailed below. The Action Plan along with necessary equipment and budget requirements is shown in Appendix X.”

1. Physical Control – Physical control methods are used to reduce the potential for mosquito breeding and harbourage by modifying the natural or built environment. Breeding sites can be reduced by decreasing the amount of vegetation within drains, marsh or other known breeding sites or by filling in low lying land to reduce the impact of flooding/tides.

2. Chemical control (Larvicides) – Where chemical control is required it is more ideal to treat the mosquitoes as larvae while they are contained within an aquatic environment rather than as flying adults. Larvicides kill mosquito larvae and/or prevent the larvae developing into adult mosquitoes.

The following larvicides are currently used as part of the Shire’s mosquito management program –

- S-methoprene: S-methoprene is an insect growth regulator that is absorbed by the larvae and prevents the larvae from emerging from the pupal stage. The Shire will apply this product in accordance with the required application rates throughout the mosquito season. This product is available in several different formulations, including slow-release briquets, which can provide ongoing control for up to 150 days under certain environmental conditions.

- Bacillus thuringiensis israelensis (Bti) - contains spores and endotoxins of naturally occurring bacterium. These spores and endotoxins are ingested by mosquito larvae, resulting in death within 24 hours. Bti is toxic only to the larvae of certain dipteran (true flies). It does not harm other aquatic, marine or terrestrial fauna.
3. **Chemical control (Adulticides)** – Adulticiding refers to the killing of adult mosquitoes, and is the only form of chemical control once the mosquitoes reach adulthood. Adulticiding is not target specific and works like a large scale insect spray, killing other insects, including predators and beneficial insects. Fogging (a form of adulticide application) can only be utilised when weather conditions are fine and there is little wind and no rain. It should be noted that the environmental impact, particularly on natural wetland/marsh areas can be significant and is undesirable. Fogging is short lived and will only knock down mosquitoes it comes in contact with at the time it is applied.

Fogging can, however, be useful during times of flood (where larval control is not feasible) or during times where there is an outbreak of mosquito-borne disease, by decreasing the adult mosquito population.

Residual surface treatment chemicals are now available. They have a similar mode of action to traditional adulticides; however they can be applied to internal and external surface areas at or around known breeding sites/harbourage areas, and kill mosquitoes that land on the surface. These treatments can last up to six weeks, but like fogging they will also have a significant impact on non-target organisms.

The following adulticides are currently used as part of the Shire’s mosquito management program:

- **Pyrethroids** – this chemical is used in the thermal fogger and is used as a space-spray for the control of adult mosquitoes and flies.
- **Bifenthrin** – this is an insecticide that is used as a barrier treatment. The chemical is sprayed on surfaces such as dense vegetation and walls/fences to kill mosquitoes that land on the surface.

4. **Public Education & Awareness** – The public are a vital stakeholder for this MMP and have a responsibility in any integrated program to manage mosquitoes on their own properties. Due to the highly transient residential population in the region, it is important that educational programs are ongoing to ensure information is received by all residents. It is also essential to consider the large number of tourists that visit the region in the dry season months and convey public health messages to these people wherever possible. Pamphlet drops on backyard breeding and personal protective measures should be considered on a regular basis to inform and protect
10. Mosquito management – ongoing monitoring and surveillance

Example 1:

“As mosquitoes breeding on the xx flats are known to travel at least 3km from their breeding sites, the Shire’s Planning Department will ensure all development proposals within this 3km flight range will be referred to Health for comment and assessment prior to any decision being made about the appropriateness of the proposed land use.

The Shire’s engineering section has agreed to include regular monitoring for and maintenance of invasive vegetation at all compensation basins and storm water ponds within the Shire. In addition, there will be no newly created constructed water bodies without consultation with Health over appropriate design and ongoing maintenance of the water body.”

11. Internal stakeholders

Example 1:

“As mosquitoes breeding on the xx flats are known to travel at least 3km from their breeding sites, the Shire’s Planning Department will ensure all development proposals within this 3km flight range will be referred to Health for comment and assessment prior to any decision being made about the appropriateness of the proposed land use.

The Shire’s engineering section has agreed to include regular monitoring for and maintenance of invasive vegetation at all compensation basins and storm water ponds within the Shire. In addition, there will be no newly created constructed water bodies without consultation with Health over appropriate design and ongoing maintenance of the water body.”
12. External stakeholders/CLAGs

Example 1:
“Within the Shire, mosquito management is facilitated through monitoring and the treatment of breeding areas within the Shire’s boundaries. Unfortunately mosquitoes don’t recognise these boundaries and coordinated efforts with neighbouring local government areas is needed to effectively manage mosquito-borne diseases.

Regional cooperation is supported and instigated by the Shire and has occurred through various avenues. The Shire has formally joined the City of xx to form the xx CLAG. This partnership entitles the two areas to financial support from the WA DoH for 50% of larvicide costs for hand treatments. Another avenue where regional cooperation has occurred is working with the Cities of xx, xx and xx to develop a health promotion campaign to create awareness about mosquito-borne disease.”

13. New developments

Example 1:
“Ideally, residential developments should be located well away from mosquito breeding sites to minimise contact between mosquitoes and residents. This is however not usually practical or achievable in the xx region due to the magnitude of the natural environment in comparison to the size of the town sites. To assist with informing residents of the potential risks of mosquito nuisance and mosquito-borne disease, any new developments will have a notification placed on the property title informing new residents of this risk.”
Example 2:

"With the City’s growth expected to increase by an estimated 40,000 by 2031, land use, subdivisions and rezoning could play a role in increasing the risk presented to future residents/visitors. At a strategic level, allowing development of land in close proximity to known mosquito breeding habitat should be given due consideration. It has been demonstrated that an increase in risk of acquisition of RRV/BFV (where vector species are present) and/or nuisance can be directly correlated with proximity to breeding habitat.

The Western Australian Planning Commission (WAPC) Statement of Planning Policy No. 1: State Planning Framework provides a number of ‘General Principles for Land Use Planning and Development’. Environmental principle IV states: ‘The protection of environmental assets and the wise use and management of resources are essential to encourage more ecologically sustainable land use and development Planning should contribute to a more sustainable future by adopting a risk-management approach which aims to avoid or minimise environmental degradation and hazards’. This principle is most relevant when considering appropriate planning for mosquito management.

The WAPC has the power to impose a memorial on land titles that are newly created through the process of subdivision and are potentially affected by a relatively permanent hazard. Similar to midge memorials, nuisance and disease risk associated with mosquitoes could be captured through use of a Section 12A (Town Planning Act and Development Act 1928) memorial notifying prospective purchasers of the hazard. This option will be considered by the City’s Development Services Division.

The City has in place a policy which addresses development and associated midge nuisance around wetlands and lakes (APD6). Similar policy recognising mosquito risk could be adopted and either amalgamated into APD6 or a new policy specific to mosquitoes developed and adopted. Buffer zones may be based on midge constraints or field work conducted to establish flight distance into sensitive land use areas. This option will be considered by the City’s Development Services Division.

There is also an avenue for the WAPC to impose Conditions of approval on any subdivision proposal in high risk locations. Conditions dealing with risk associated with mosquitoes can be requirements such as the proponent being required to prepare a mosquito management plan and/or make contribution to local government mosquito management plan. Proposal may not be supported where it can be demonstrated that management of the risk cannot be achieved through environmentally sensitive methods. This option will be considered by the City’s Development Services Division.

In cases where the development is proposed to be near existing natural wetlands or an artificial water body created, the proponent may be required to submit to the Environmental Protection Authority (EPA) for assessment. At the minimum, proponents should adopt the principles and standards within EPA Guidance Statement No. 40 – Guidance Statement for Management of Mosquitoes by Land Developers.

Increased stormwater catchment, treatment and final disposal/containment methods associated with development should be given due consideration by developers and the City. Implementing principles of water sensitive urban design with best practice/latest technologies may assist in reducing potential mosquito breeding sites and minimise the risk to the public."
14. **Record keeping/annual report**

Example 1:
“It is critical that good record keeping practices are carried out. The following records (but not limited to) should be kept on the Shire’s system -

- annual complaint register;
- RRV/BFV/MVE notifications and interview documentation;
- adult and complaint based trapping results;
- larval sampling surveys;
- chemical/bio-larvicide treatments;
- reports;
- product labelling/MSDS; and
- media releases.

A centralised recording system should ensure current staff and any future employee/s involved with delivering the MMP have access to background knowledge.

An annual report will also be prepared in July each year to summarise the mosquito management actions that have taken place throughout the previous mosquito season.”

15. **Budget/resource requirements**

Example 1:
“Operating and implementing an effective mosquito management program is a costly exercise requiring large amounts of human and operational resources. The Department of Health cover 50% of the larvicide used to reduce mosquito numbers which goes some way to reduce the cost to local government. To ensure the continued improvement and implementation of the program, a source of sustainable financing needs to be secured. Without this, areas of the program will start to deteriorate and due to the nature of integrated mosquito management, once one component is lost, the program starts to lose its effectiveness. Due to the nature of mosquito management and the large variations that can occur from one season to the next, there is also a need for funding to reflect this and be able to be adjusted accordingly. Currently the program requires a minimum of two officers at 0.6 FTE between September and January and one officer at 0.2 FTE during the remainder of the year. A dedicated 4WD vehicle is also required to be used for all mosquito management work.”
16. Training/staff development

Example 1:
“It is essential that personnel involved in the operational aspects of the MMP are suitably qualified, trained and/or supervised. Skills/knowledge required include -
1. basic mosquito ecology;
2. principles of integrated mosquito management;
3. surveillance/monitoring techniques;
4. collection and recording of mosquito samples;
5. standard operating procedures for equipment;
6. safe storage, handling and application of chemicals/larvicides in accordance with product labelling and MSDS;
7. use of appropriate PPE in accordance with product labelling, MSDS and environmental conditions;
8. calibration techniques;
9. information technologies/geographical information systems;
10. budget management; and
11. first aid.

The Department of Health offers an in depth mosquito management course approximately every two years which teaches most skills and competencies required. All staff working in the area of mosquito management should undertake this training when available. The Department of Health is also available to offer advice and assistance regarding the MMP and its execution.”

17. Procedure manual

Example 1:
“A Procedure Manual has been produced which outlines the mosquito management actions to be completed at the various times of the mosquito season and throughout the year. It also contains site by site descriptions and assessments. Like this MMP, the Procedure Manual is also a working document and will be reviewed and updated on a regular basis due to the constant changes in mosquito seasons and the associated environmental conditions. This document can be found in Appendix xx.”

18. Review

Example 1:
“Due to the nature of mosquito management, there will be an ongoing need to review and refine this document and the related Procedure Manual. This will allow both documents to accommodate new and/or changing mosquito breeding sites which may be identified from year to year depending on rainfall, tidal influence and human activity.

Furthermore alternative approaches and new innovations to mosquito management may become available or desirable for the region. It is also necessary to periodically review achievements and results from consecutive seasons to identify emerging trends or risks.”