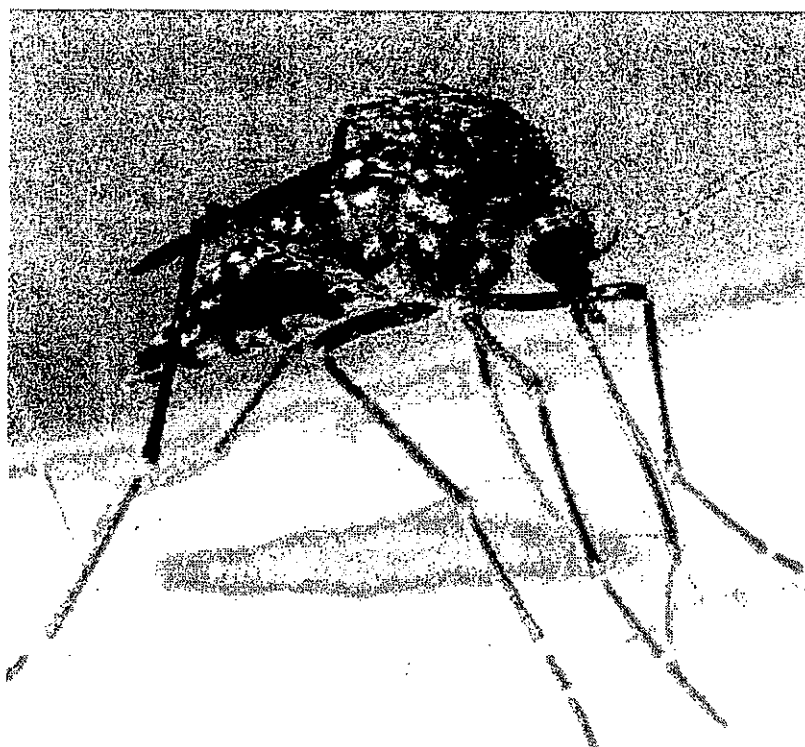


Mosquito Risk Assessment: Cronulla Sutherland Leagues Club Development, Woollooware Bay, NSW.



Prepared for Cronulla Sutherland Leagues Club

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Introduction

Mosquito risk assessments are designed to provide information on actual and/or potential mosquito populations and provide comments on the significance of nuisance biting and/or public health impacts.

Mosquitoes associated with estuarine wetlands, in particular the saltmarsh mosquito, *Ochlerotatus vigilax*, are major nuisance biting pests and vectors of human disease pathogens (e.g. Ross River virus and Barmah Forest virus). These mosquitoes can have wide ranging impacts on the local community with mosquitoes dispersing long distances from breeding habitats. However, there are also mosquito species associated with freshwater and urban habitats that may potentially cause pest impacts.

The impact of mosquitoes on residential and/or recreational areas is highly dependent on the proximity of productive mosquito habitats and on-site mosquito mitigation strategies. While in some locations off-site mosquito abatement may be required to have a significant impact on overall pest populations, the risks of severe pest impacts can be minimised through the implementation of site-specific mitigation strategies.

In the absence of mosquito population sampling, information on local mosquito fauna must be based on previously published studies, mosquito habitats identified through site visits and the inspection of aerial photographs, vegetation studies and topographic maps. Plans of proposed developments, their impact on current habitats and potential to create additional habitats are also considered.

The development and surrounding habitats

The proposed residential development is adjacent to the Cronulla Sutherland Leagues Club on Captain Cook Drive at Woollooware Bay (Figure 1). While no wetlands are proposed to be constructed in conjunction with this project, potential mosquito impacts may result from populations produced from existing nearby habitats.

The concepts plans for the proposed development (Appendix 1) indicate that there will be a combination of residential and tourist (hotel) dwellings as well as small passive recreation areas and a proposed 30m buffer between the development and mangroves.

The shoreline is heavily vegetated with mangroves (*Avicennia marina*) that stretch along the southern shoreline of Woollooware Bay and east towards Towra Point. The mangroves in this section of Woollooware Bay appear well flushed and do not represent significant mosquito breeding habitats. Generally, in mangrove habitats

where there is frequent inundation (at least once per week) the 'flushing' action of the tides, as well as the movement of predatory fish into the area, create unfavourable conditions for mosquito breeding.

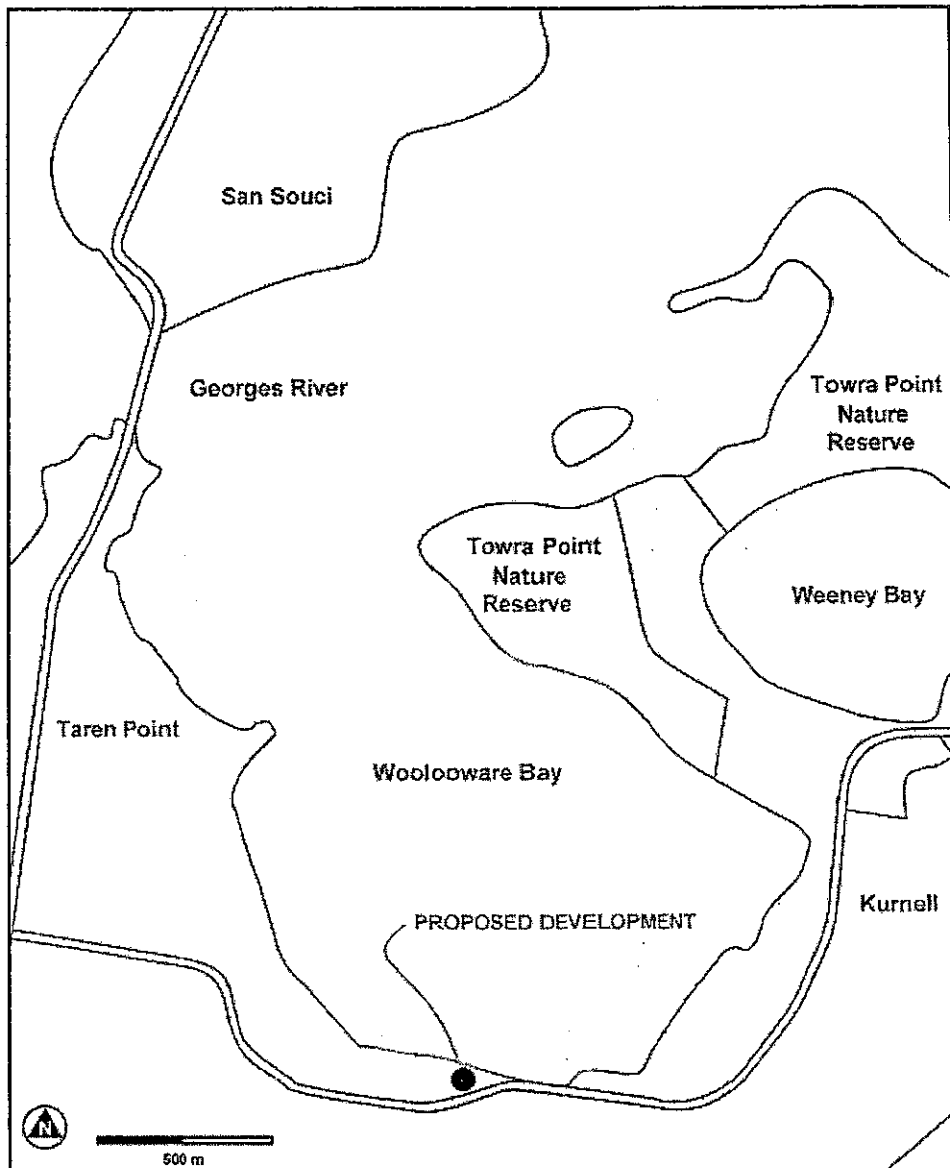


FIGURE 1. The location of the proposed development adjacent to the Cronulla Sutherland Leagues Club at Woollooware Bay.

On the south-eastern side of Botany Bay, east of Woollooware Bay (approximately 1.5km) is the largest expanse of estuarine wetland in the Sydney region. In and around the Towra Point Nature Reserve are saltmarsh and mangroves, and brackish and freshwater habitats. This mosaic of habitats provides actual and potential breeding opportunities for a wide range of pest mosquitoes.

In addition to the estuarine wetlands, the urban areas to the south and west of the proposed development contain abundant habitats for domestic mosquitoes, such as small water holding containers in residential backyards, stormwater drains, grass pollutant traps and other water retaining structures.

Pest mosquitoes

Over 50 mosquito species have been identified from the Sydney basin region of NSW with the most abundant pest mosquitoes in the Georges River/Botany Bay region being *Culex annulirostris*, *Culex quinquefasciatus*, *Ochlerotatus notoscriptus* and *Ochlerotatus vigilax*.

The species of greatest concern is *Ochlerotatus vigilax* and this mosquito is likely to cause major pest impacts in the local area during the summer months. The species is closely associated with saltmarsh habitats, is known to disperse widely (>10 km) from breeding habitats, and is a vicious biting pest and major vector of arboviruses. The major breeding habitats for this species in the local area are the estuarine wetlands of Towra Point.

It is highly likely that the proposed development will be impacted by *Oc. vigilax* dispersing from Towra Point with the pest impacts greatest during the period from December through until March. Population increases of *Oc. vigilax* are closely associated with the inundation of wetlands by high tides (usually the highest tides of each month) or rainfall that flood the habitats and result in hatching of larvae. During the warmer months (December – March), they can hatch and the larvae will complete their development in 7-10 days. The resulting implication for pest impacts is that there will, generally, be a substantial increase in the adult mosquito populations approximately 10-14 days following a series of high tides and populations are likely to be significantly greater if there is a major rainfall event (eg. over 60mm within one week) or rainfall and tides occur at the same time, inundating large areas of wetland.

There are two additional mosquito species associated with the estuarine wetlands, *Ochlerotatus alternans* and *Culex sitiens*. The larvae *Oc. alternans* is associated with both saline marshes and freshwater temporary ground pools and this species is predatory on other mosquito larvae (and other small invertebrates). The adults are large mosquitoes that can be major pests but are generally considered not important as disease vectors. *Culex sitiens* is usually associated with permanently inundated brackish or saline pools and does not travel far from breeding habitats. These two

species, although potential pests, are unlikely to pose significant risks to the proposed development.

There are no significant non-estuarine mosquito habitats adjacent to the proposed development but there may be a number of mosquitoes that may cause localised pest impacts. Two pest mosquitoes commonly associated with urban developments are *Culex quinquefasciatus*, usually associated with but not limited to, habitats with a high organic content such as drains, sullage pits, septic tanks and other water holding and water storage areas, and *Ochlerotatus notoscriptus*, usually associated with small water holding containers around dwellings such as tins, pots, ornamental ponds, blocked guttering and tyres, as well as water holding plants (eg. bromeliads) and tree holes. These two species are common in Sydney and populations are usually greatest following major rainfall events.

Many of the mosquitoes found in the Botany Bay region, including *Oc. vigilax*, are known to be associated with the transmission of disease causing pathogens such as Ross River virus and Barmah Forest virus. The health risks associated with the local mosquito population are, however, considered relatively low as the absence of suitable animal reservoir hosts (i.e. native macropods that carry the virus) minimises the opportunity for the mosquitoes to acquire the virus.

Mosquito monitoring

Monitoring is the only reliable method to identify the source of nuisance biting mosquito populations. As well as the impact of *Oc. vigilax* dispersing into the site from Towara Point, other mosquitoes, particularly *Oc. notoscriptus* may cause pest problems within the Woollooware Bay area.

While routine monitoring specific to the proposed development is not recommended, if there is a noticeable increase in mosquito activity, or complaints by residents of mosquitoes increase, a series of trapping nights will provide a measure of current mosquito activity and identify the species, and their respective breeding habitats, responsible for the pest impacts. It is important that such monitoring, if required, is conducted by a trained entomologist experienced in mosquito biology, ecology and taxonomy as the correct identification of pest species is crucial to the implementation of a suitable mitigation strategy.

Mitigation strategies

There are only limited onsite mosquito mitigation strategies available. As the development is relatively close to the extensive estuarine wetlands of Towra Point, it is expected that there will be population increases of *Oc. vigilax* following the inundation of the wetlands by the highest monthly high tides and/or major rainfall events between December and March. The magnitude of population increases is

difficult to predict due to fluctuations between monthly tides and irregularity of rainfall but nuisance biting impacts would be greatest approximately 10 days following major tidal, or rainfall, events that inundate the nearby wetlands and persist for up to two weeks.

Control strategies – adulticides

The application of adulticides has often been undertaken in areas of high disease risk with the insecticide applied from vehicle mounted ultra low volume spray units. Although there are products available that may be useful against adult mosquitoes (e.g. Maldison, Chlorpyrifos and Permethrin), these products are not effective for the control of mosquitoes over a large area, can be expensive and may have greater non-target impacts. This strategy is not considered appropriate as a routine mosquito mitigation strategy for the proposed development.

Mosquito Control – Buffer zones/vegetation

The use of buffer zones, vegetated or non-vegetation areas between mosquito breeding and/or harborage sites and residential/recreational areas has been proposed as a potential strategy to reduce mosquito impacts. However, there is ongoing debate as to the design of such buffer zones and their relative effectiveness.

On the north coast of NSW, there is anecdotal evidence that vegetation free buffer zones can minimise the dispersal of mosquitoes associated with flooded *Casuarina* and *Melaleuca* forests. When the major pest mosquito is *Oc. vigilax*, a species that disperses many kilometers, buffer zones are not considered a practical strategy.

It is important to note that the “buffer zone” included in the proposed development plans is unlikely to achieve a major reduction in on-site pest impacts but may be designed in such a way to offer, at least, some protection. The mangroves, while not a site of significant mosquito breeding, do represent a suitable harborage site. Mosquitoes that rest in these shaded and humid areas during the day will then disperse at dusk. If the buffer zone is planted with dense vegetations (e.g. Shrubs and small trees), it will extend the harbourage sites closer to the development. To reduce pest impacts as much as possible, the buffer zone should be free of extensive vegetation.

Constructed saltmarsh

If a constructed saltmarsh is proposed for the buffer zone, a specific risk assessment on the design will need to be undertaken. There is a range of factors, including sediment composition, slope, tidal flows (frequency, volume and duration) and vegetation composition that all need to be considered to ensure the habitat does not

produce mosquitoes and cause a significant increase in the overall mosquito populations within the development.

For mosquitoes to colonise a constructed saltmarsh, there must be free-standing water retained in channels, pools and/or depressions following inundation of the saltmarsh by high tides and/or rainfall. Mosquito larvae cannot survive in damp soil.

The most important design consideration when constructing a saltmarsh is that any opportunities for pooling water are minimised. If the design of the saltmarsh requires the incorporation of pools or the intentional retention of water on the marsh, mosquito populations can be reduced by ensuring easy access of fish to the site.

Mosquito Control – Barrier treatments

A recently proposed mosquito mitigation strategy is the use of barriers treated with a residual insecticide, bifenthrin (trade name BISTAR), to increase the mortality rate of adult mosquitoes onsite. Bifenthrin is a contact poison with high insect toxicity but low mammalian toxicity and provides a residual layer of pesticide that kills landing and/or resting mosquitoes. It is currently registered for the control of mosquitoes and biting flies around dwellings as a control agent for treating mosquito resting places (internal & external areas of domestic, commercial, public and industrial buildings).

Initial field trials have shown positive results with a reduction in mosquito abundance observed where the product has been applied (note these trials have not been published in peer reviewed scientific publications). However, there are some environmental concerns, in particular non-target insects and aquatic organisms. There are warnings on the label that the product is toxic to bees, fish & aquatic organisms and that mud, sand, mangroves, dams, rivers should not be directly treated or exposed to spray drift. For this reason, it is strongly recommended that only a qualified pest control officer undertake the application of the product. To our knowledge, there are no published reports available on the impact to non-biting insects such as butterflies, moths, beetles, other organisms (inc. snails etc). However, as this product is a contact poison, it is likely that many of these non-target insects may be killed if exposed to the product; consequently, bifenthrin may not be suitable for use in an environmentally sensitive habitat.

Mosquito Control – Trapping

A number of commercial trapping units are available that utilise attractants (e.g. light, heat, carbon dioxide, odour) to draw in and catch or kill adult mosquitoes. There are many different types of units available and, while many will collect mosquitoes, there is no quantitative evidence that they can reduce nuisance biting impacts in areas close to productive breeding habitats. Units that use light alone to attract mosquitoes (e.g. Blue light electrocutors) have been shown to have little impact on nuisance biting rates and often kill many more harmless insects than mosquitoes.

The units that use carbon dioxide as the main attractant may offer some limited protection but a network of multiple traps would probably need to be employed to protect the parkland areas from exposure to mosquitoes and there is no information available in Australia regarding the design of effective trapping networks.

Building design

While some mosquito activity should be expected in outdoor areas, the entry of mosquitoes into buildings can often have significantly greater nuisance impacts. Fly screens should be fitted to windows and doors where possible. It should also be ensured that there are no entry points via air conditioning ducts, ventilation structures or other connections between indoor and outdoor areas.

Personal protection

With an urban development located close to estuarine wetlands, it should be expected that some mosquitoes will be active during the summer months and education of the local residents and visitors to undertaken personal protection measures is recommended. Avoidance of mangrove areas during the peak periods of mosquito activity (i.e. dusk and dawn) will minimise mosquito impacts as well as the use of personal insect repellents (formulations containing DEET or Picaridin or mosquito coils containing insecticide) are also highly recommended.

Summary

The proposed development adjacent to the Cronulla Sutherland Leagues Club at Woollooware Bay area is likely to be exposed to occasional high pest mosquito activity during the summer months, especially by *Oc. vigilax*. This species is primarily associated with the saltmarsh habitats of Towra Point and as it disperses widely from breeding habitats, the pest impacts on the proposed development are not considered significantly greater than those of other residential areas surrounding Woollooware Bay.

While there are only limited strategies available for reducing onsite mosquito impacts outdoors, but the use of fly screens on windows and doors will stop mosquitoes entering the buildings at night. If nuisance biting impacts outdoors are considered problematic, consideration should be given to alternative mitigation strategies.

If future modifications are planned to the site, in particular the construction of a saltmarsh in the proposed 'buffer zone', consideration should be given to a specific mosquito risk assessment so that designs can be reviewed an/or modified to ensure the newly created habitat does not contribute to an increase in the overall mosquito population.

APPENDIX 1: Draft development control drawings for the proposed development at Woollooware Bay.

