Mosquito breeding survey Vesteys Lake 15th January 2008

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February 2008
Updated February 2009

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1.0 Introduction

Vesteys Lake is one of the most significant and productive mosquito breeding sites in Darwin Urban for the northern salt marsh mosquito *Aedes vigilax*. Historically the area was a disturbed salt marsh/mud flat habitat with numerous tidal pools and drainage lines, which were breeding sites for *Ae. vigilax* and other mosquito species (PER 1988). *Aedes vigilax* is the principal pest mosquito in areas of Darwin Urban near the coast, and is a potential vector of Ross River virus (RRV) and Barmah Forest virus (BFV).

The Conservation Commission of the NT commenced construction of the lake in 1988, and Darwin City Council assumed responsibility of the lake some time after construction was completed. The construction of the lake and surrounds resulted in the creation of new and extensive *Aedes vigilax* breeding sites. The lake itself has never become a mosquito breeding site, but the surrounding landscape has been a significant breeding site for *Aedes vigilax* from the inception of the lake to the present, 20 years later. The mosquito breeding sites were the result of suitable grades not being applied to many areas. There has been some works over the years by Medical Entomology and DCC (under the combined Mosquito Engineering Program) to remove mosquito breeding sites, which have been successful in reducing the extent of various mosquito breeding sites, but there are still further works required to prevent mosquito breeding.

Medical Entomology and DCC Technical Officers are required to control mosquito breeding at Vesteys Lake on an annual basis, mainly during the wet season. Mosquito control at Vesteys Lake can take 2 officers up to 4 hours to control during heavy rainfall periods, and results from routine weekly mosquito trapping by Medical Entomology indicate control efforts sometimes cannot prevent mosquito problems (Figure 3). The physical nature of some sites, with tall and dense grass and sedges sometimes makes it difficult to locate ponding or get the insecticide into the water. Potential mosquito breeding sites require inspection after >25mm rainfall usually from November to the end of January, sometimes February and March also.

The following document highlights the major mosquito breeding sites at Vesteys Lake that routinely require control. There are other minor areas of ponding that are known to breed mosquitoes, these are not covered in the report as they can be dealt with once the major breeding sites have been rectified.

2.0 Methods

A survey was conducted at Vesteys Lake on the 15th of January 2008, 3 days after significant rainfall of over 100mm in all areas of Darwin. The aim of the survey was to locate long lasting pools (3 days or longer) that would act as breeding sites for mosquitoes. The timing of the survey was not ideal, as maximum flooding at Vesteys Lake usually occurs after sustained monsoon rainfall, when frequent squalls create significant and sustained ponding, and cooler temperatures reduce evaporation.

All sites ponding water or known to pond water and breed mosquitoes were marked using a hand held GPS unit, with site accuracies according to the GPS from 3m – 6m. All sites are displayed in Figures 1 and 2. Photos were taken of all sites that were ponding water and of some sites that have been known to pond water but were damp at the time of the survey. A
ruler was placed in the deepest point of each pool, to obtain an idea of actual water ponding depth at the time of the survey.

3.0 Results

Site locations shown in Figures 1 and 2, while photos are shown in Appendix 1. The maximum extent of flooding at individual sites is marked as red shaded polygons in Figures 1 and 2. Minimal mosquito larvae were found, due to previous control efforts minimising the population of egg laying adult mosquitoes, and previous extended flooding from monsoon rains minimising egg laying.

Sites 1-4 were located in a *Sporobolus sp.* grassy area near (south) the Atkins Dve tidal inlet/outlet drain (Figure 1). Water ponding at this site was previously very significant (over 400m$^2$), before two small drains were constructed 3 years ago under the Medical Entomology-DCC mosquito engineering program. At present, maximum water ponding is in the order of 100-150m$^2$ after sustained monsoon rainfall. Water ponding occurs in 4 distinct areas, two either side of the lateral drains (Sites 1 & 2), one on the south side of the small flat (Site 3), and one area near the palm trees (Site 4). The depth of ponding at Sites 1 and 3 was 20mm, with no mosquito larvae found. Sites 2 & 4 were damp. After sustained rainfall, maximum ponding depth at these sites is generally around 40-50mm. *Aedes vigilax* productivity in this area is usually very high.

Site 5 was a revegetated seepage area near the base of the Bowls Club fill area. The water ponding observed was the maximum ponding that occurs in this area, due to continual seepage from the base of the bowls club area. The deepest point was around 65mm, although water ponding depth at this site was variable and mostly very shallow, and was mostly a result of vehicle disturbance. In general this site is not as productive for *Ae. vigilax* as other seasonally flooded areas at Vestey's Lake, but is an important breeding site for *Verrallina funerea*, also a significant pest mosquito and potential vector of RRV. The maximum area of ponding in this area is around 80 m$^2$.

Site 6 was a poorly draining area under *Paperbark* and black wattle trees, south of the footpath to the bridge. Water ponding in the deepest depression was around 70mm. Ponding in this area is a result of a flat surface with numerous small depressions. *Aedes vigilax* productivity is usually high in this area. The maximum area of ponding is usually around 20m$^2$.

Site 7 was the interface of the mown grass area and the flat *Paperbark* black wattle area. The area was damp during the survey, although water usually ponds in this area after sustained rainfall, at a depth of no more than around 30-40mm. The maximum area of ponding is around 30m$^2$, and *Ae. vigilax* productivity is usually high.

Site 8 was a small area of ponding south of the footpath to the bridge (around 6 m$^2$). Maximum water depth was around 40mm. *Aedes vigilax* breeding in this area is usually high.

Site 9 was a relatively large area of ponding on both sides of the new footpath, and has been caused by the level of the footpath being higher than the surface level either side of the footpath, as well as due to the area being very flat. The total area of ponding on both sides of the footpath was around 25m$^2$. *Aedes vigilax* productivity was high in the surveys prior to this one. Ponding depth was around 45mm at the deepest point.
Site 10 was a depression under *Paperbark* trees north of the footpath. The area of water ponding during the survey was around 25m$^2$, and the deepest point was 40mm. *Aedes vigilax* productivity at this site is usually moderate to high. The flooding observed during the survey is the maximum flooding that usually occurs at this site.

Site 11 was a poorly draining grassy area north of the footpath to the lake. Water was ponding in an area of around 10m$^2$, although maximum ponding likely to occur at this site is around 30 square metres. The maximum water depth at the time of the survey was 30mm. This site is usually a low-moderately productive *Ae. vigilax* breeding site.

Site 12 is the largest mosquito breeding site at Vesteys Lake. The construction of a drain several years ago has reduced the size of the flooded area and reduced the ponding depth, although significant ponding still occurs. The site was mostly dry during the survey, although a small area of around 10 square metres was ponding water, at a depth of 20mm. The actual area of ponding water after sustained rainfall is usually over 200 m$^2$, at a depth of around 30-40mm at the deepest. *Aedes vigilax* productivity is usually moderate.

Site 13 was a shallow depression located in a sedge and grass vegetated area. The site was damp during the survey, although previous water ponding was evident. The area of ponding is usually around 20 square metres, with a depth of around 30-40mm. Sites 14 & 16 were similar shallow depressions that have been known to pond water and breed mosquitoes. Productivity is usually high at these sites.

Site 17 was a low lying area north of the Atkins Dve tidal inlet/outlet culvert. Water was ponding at a depth of around 30mm, in a small area of around 5m$^2$. Water ponding extends under the beach hibiscus trees after sustained rainfall, and the maximum area of ponding is usually around 15m$^2$, and maximum ponding depth is around 40mm.

4.0 Discussion

Rectification of mosquito breeding sites at Vesteys Lake is required to prevent the on-going seasonal pest problems and potential disease risk to nearby residents of Fannie Bay and users of nearby public clubs. Figure 3 shows a graph of *Ae. vigilax* numbers at Vesteys Lake in comparison with Longwood Ave at the edge of the extensive Leanyer Swamp, from July 2004 to June 2007. *Aedes vigilax* numbers at Longwood Ave reaches seasonally high numbers, as the adjacent Leanyer Swamp contains hundreds of hectares of known breeding habitat. The annual peak at Vesteys Lake is sometimes around one half to two thirds of that experienced in Leanyer, despite breeding sites at Vesteys Lake being very small and localised in comparison to Leanyer Swamp. This indicates control programs at Vesteys Lake are not entirely effective in preventing mosquito problems to adjacent areas, therefore the most effective option is rectification.

General discussions between Medical Entomology, DCC Parks and Technical Services regarding rectification at Vesteys Lake have concluded that a detailed contour survey the lake surrounds is required to identify areas that are likely to pond water, and features that impede drainage (ie footpaths). However, previous surveying in August 1997 (Figure 4) failed to specifically identify areas of ponding water, as contour intervals were taken at 100mm when all mosquito breeding depressions were less than 100mm deep, therefore important mosquito breeding depressions were missed, or labelled as irregular surface on the contour map. Any future contour survey would need to specifically include all sites identified in this report, so that they can be plotted on a map. The mosquito breeding areas should then be engineered to
have sufficient fall to enable suitable surface water drainage to the lake or to a concrete invert drain. It is possible that such a survey would be unnecessary to conduct considering all sites of major wet season ponding are already known.

Major works are required to remove mosquito breeding sites, such as filling and grading, extending the lake into low lying areas, creating new concrete drains or using subsoil drainage (where appropriate). These permanent engineering solutions may conflict with previous management requirements to have wetland areas, although works are only required to prevent surface ponding rather than lowering the water table, so there should be negligible effect on vegetation. The public health issues associated with mosquito breeding should also be a critical aspect to consider in the management of Vesteys Lake, particularly as all mosquito breeding sites at Vesteys Lake are man made.

To conclude, the Vesteys Lake surrounds contain significant breeding sites for pest and disease carrying mosquitoes, therefore breeding sites should be rectified as soon as possible to protect the public health and improve the amenity of neighbouring areas, and improve the amenity of the lake surrounds.
References
Figure 1 Vesteys Lake major mosquito breeding depressions southern half of Lake area
Figure 2 Vesteys Lake major mosquito breeding depressions northern half of lake
Darwin routine weekly carbon dioxide EVS trap results Vesteys Beach and Longwood Ave. Total number of female Aedes vigilax collected from July 2004 - June 2007

DM02 Longwood Ave (SW corner of 13 Longwood Ave (Lot 5085) - on hanging bracket attached to meter box at property entrance gate).
DM21 Vesteys Beach behind Bowls Club
Appendix 1 – Vesteys Lake mosquito breeding survey 15th January 2008

Vesteys Lake Site 1 – water ponding depth 20mm, area ponding 2 square metres. Potential ponding area 20 square metres.

Vesteys Lake Site 3 – ponding depth 20mm, ponding area 2 square metres. Potential ponding area 10 square metres.

Vesteys Lake Site 5 – ponding depth 70mm, area of ponding 30m².

Vesteys Lake Site 6 – ponding depth 70mm, area of ponding around 4m². Potential ponding area around 20m².

Vesteys Lake Site 7 – area damp, ponding potential around 20m².

Vesteys Lake Site 8 – ponding depth 40mm, ponding area around this site was around 6m².
Appendix 1 – Vesteys Lake mosquito breeding survey 15th January 2008

Vesteys Lake Site 9 – ponding depth 45mm, area of ponding on both side of the footpath around 25m²

Vesteys Lake Site 10 – ponding depth 40mm, area of ponding around 25m²

Vesteys Lake Site 11 – ponding depth 20mm, area of ponding 4m², potential ponding area over 30m²

Vesteys Lake Site 12 – ponding depth 20mm, area of ponding 10m², potential ponding area of over 200m²

Vesteys Lake Site 13 – damp, potential ponding of around 20m²

Vesteys Lake Site 14 – area damp, ponding potential around 20m²
Appendix 1 – Vesteys Lake mosquito breeding survey 15th January 2008

Vesteys Lake Site 15 – area damp, potential ponding area around 20m²

Vesteys Lake Site 17 – water ponding depth 30mm, area ponding 5m². Potential ponding area around 15m²