

NSW ARBOVIRUS SURVEILLANCE & MOSQUITO MONITORING PROGRAM 2015-2016

Weekly Update

Date: 24/Mar/2016

SUMMARY

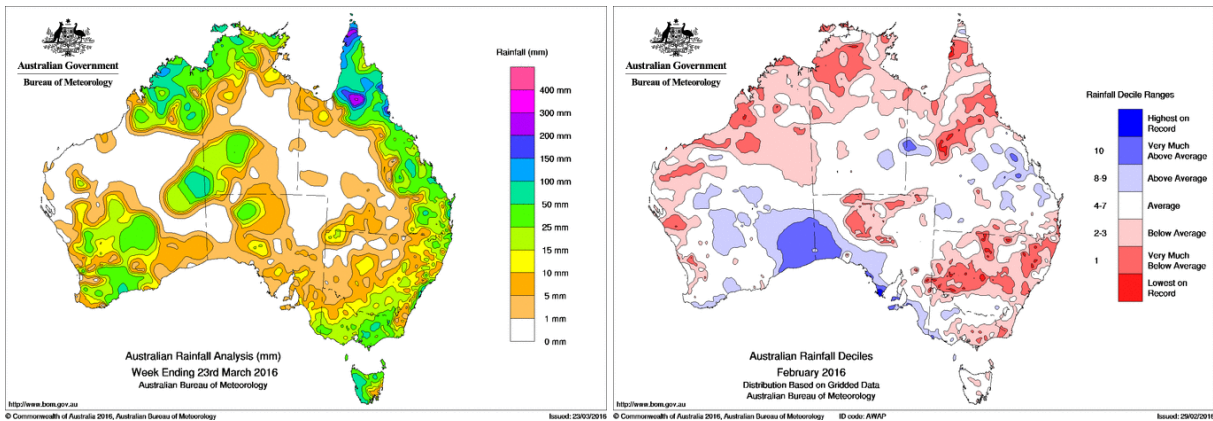
- **Climate:** the last week, light to moderate rainfall fell across the entire state, being heavier towards the coast. For February, rainfall was below to very much below average for most of the state. Maximum and minimum temperatures for February were 2-3 degrees above average.
- **Three Month Forecast:** April to June 2016, rainfall predictions for NSW are for slightly above average rainfall for the west of the state and average for the coast. Maximum and minimum temperatures are expected to be above average, although around average maximum temperatures are forecasted in the west of the state. According to the BOM as of 15/Mar/16, the current El Niño continues its gradual and steady decline, and should return to neutral levels by mid-2016.
- **Tidal:** the next series of high tides that may result in *Aedes vigilax* hatching are due to occur over 5-11/Apr/2016, although this may be too late in the season to produce any productive hatching.
- **MVEV models:** the data relevant to both the Forbes' and Nichols' hypotheses have been updated to February 2016 and both theories remain inconsistent with past MVEV outbreaks.
- **Mosquito Numbers Inland:** mosquito numbers continue decline further and are only just 'medium' from the Riverina and 'low' elsewhere.
- **Mosquito Numbers Coast:** Ballina and Tweed continue with the 'high' collections, albeit with few *Aedes vigilax*. Elsewhere mosquito numbers were mainly 'low'.
- **Mosquito Numbers Sydney:** mosquito numbers continue to remain 'low' at all sites barring Sydney Olympic Park, which had a 'high' collection.
- **Arboviral Isolates:** there was one isolate of RRV from Leeton.
- **Chicken Sentinel Seroconversions:** there were no seroconversions.
- **Human Notifications:** for the current fiscal year, there have been 583 RRV and 53 BFV notifications. The notifications for 2016 are lower than the comparable period for 2015 and similar to 2014.

Comment: Other than some large collections from the north coast, mosquito numbers continue to decline across the state with the onset of Autumn. There have been only the one additional arboviral isolate from the mosquitoes and no seroconversions in the sentinel chickens, with an overall very quiet arboviral season.

ENVIRONMENTAL CONDITIONS

Rainfall

Rainfall across Australia for the week ending 23/Mar/2016 is depicted on the left and monthly rainfall deciles for February 2016 are on the right. Over the last week, light to moderate rainfall fell across the entire state, being heavier towards the coast. For February, rainfall was below to very much below average for most of the state. Maximum and minimum temperatures for February were 2-3 degrees above average.



Three Month Rainfall & Temperature Forecast

For April to June 2016, rainfall predictions for NSW are for slightly above average rainfall for the west of the state and average for the coast. Maximum and minimum temperatures are expected to be above average, although around average maximum temperatures are forecasted in the west of the state. The following pages contain graphics of the seasonal outlook:

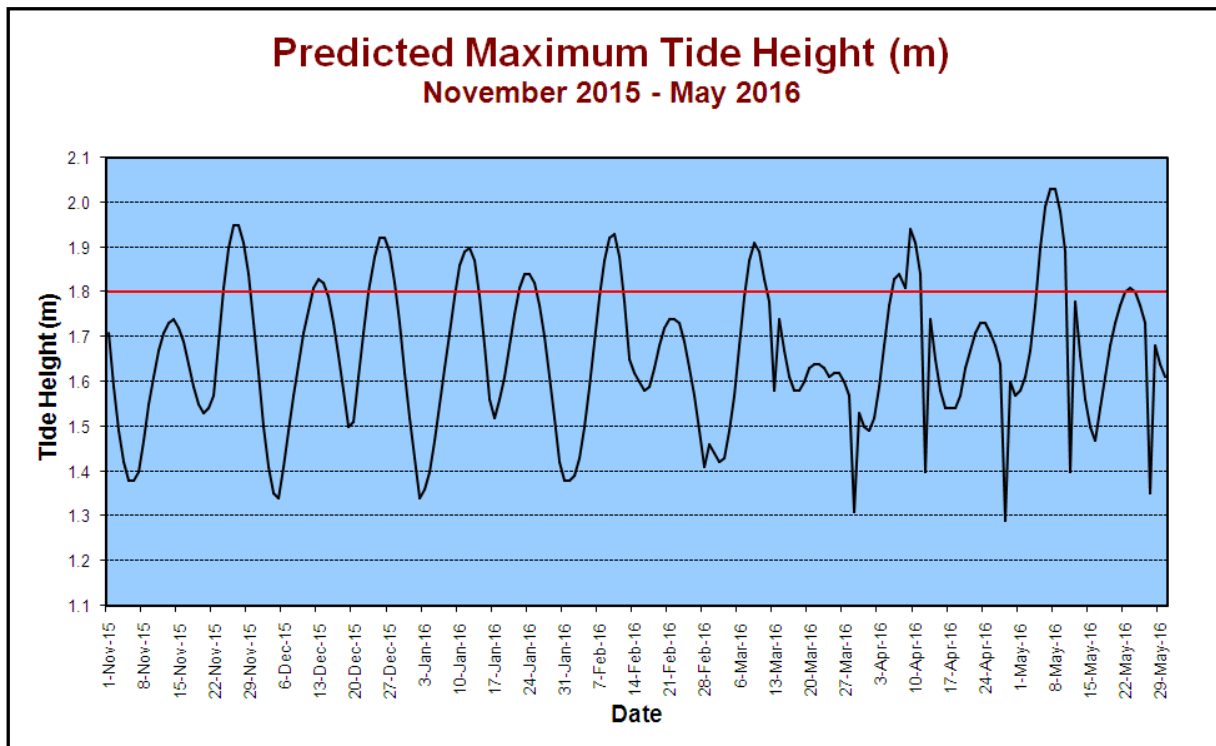
www.bom.gov.au/climate/outlooks/#/rainfall/median (Rainfall outlook).

www.bom.gov.au/climate/outlooks/#/temperature/summary (Max & min temperature outlook).

According to the BOM as of 15/Mar/16, the current El Niño continues its gradual and steady decline, and should return to neutral levels by mid-2016 (note: an El Niño is associated with decreased rainfall eastern Australia, whereas a La Niña is associated with increased rainfall). For more information: www.bom.gov.au/climate/enso/

On 17/Mar/16, the BOM released a special climate statement on the prolonged March heatwave. From 1-9 March, NSW had temperatures 7.35°C above average, and records temperatures for March were recorded during this period. For Victoria, temperature were even higher; 9.23°C above average.

Tidal



Tidal information is relevant for the prediction of the activity of the salt marsh mosquito, *Aedes vigilax*. Typically for NSW, tides of over 1.8m can induce hatching of *Aedes vigilax* larvae and the graph below of predicted tide heights can provide some indication of when this is likely to occur.

The next series of high tides that may result in *Aedes vigilax* hatching are due to occur over 5-11/Apr/2016, although this is late in the season and these tides may not influence vector numbers for most of the state.

Note that actual tide heights can vary by 0.3m (or more in unusual circumstances) due to variations in atmospheric pressure, rainfall, wind and other climatic phenomena. Thus predicted tide height should be used as a gauge only for potential *Aedes vigilax* activity. The larvae of the saltmarsh mosquito relies on a inundation/drying cycle for the mudflats in which it lives; continual wet weather prevents the drying cycles thereby reducing larval production.

Full tidal information and the implications of the tide heights relevant to the breeding of the salt marsh mosquito, *Aedes vigilax*, can be obtained from: <http://medent.usyd.edu.au/arbovirus/climate/tideheights201516.htm>

MVEV Climatic Models

Three predictive environmental based models for MVEV activity have been developed; the Forbes (which relies on rainfall in the river catchment basins of Eastern Australia), Nichols (based on the Southern Oscillation), and the Bennett theory (based on the Indian Ocean Dipole). The latter theory is poorly developed (and unreliable), and is not considered below. Note that all the predictive models have been developed on a limited data set and do not always forecast activity. There can also be unusual environmental conditions that may lead to the introduction of the virus to southeastern Australia, such as the movement of low pressure cells from the north to the south of the country during 2008 and 2011. Vertical transmission of the virus (from adult to the egg in *Aedes* species) can result in restricted activity following localised heavy precipitation (as per 2003 at Menindee).

i. Forbes' Hypothesis

Rainfall was not above Decile 7 in all of the river catchment basins in eastern Australia for the last quarter of 2014 or most of the catchments for the first quarter of 2015 (Table 1). For the Oct-Dec 2015 period, rainfall was not above Decile 7 in all catchment basins. For Jan-Mar 2016, based on the January data alone, rainfall was not above Decile 7 in all catchment basins.

Table 1. Rainfall indices for the main catchment basins of eastern Australia as per Forbes' hypothesis, relevant to the 2015-2016 season. Note that a value of 1 equals Deciles 7 rainfall.

| Catchment Basin | Oct-Dec 2014 | Jan-Mar 2015 | Oct-Dec 2015 | Jan-Mar 2016* |
|------------------------------------|--------------|--------------|--------------|---------------|
| Darling River | 0.80 | 0.65 | 0.72 | 0.78 |
| Lachlan/Murrumbidgee/Murray Rivers | 0.97 | 1.05 | 0.70 | 1.60 |
| Northern Rivers | 0.94 | 0.67 | 1.35 | 0.44 |
| North Lake Eyre system | 1.07 | 0.67 | 1.35 | 0.56 |

*Data for January & February 2016 only

ii. Nichol's Hypothesis

Table 2. The seasonal atmospheric pressures (in mm) according to Nichol's hypothesis, relevant to the 2015-2016 season.

| | Autumn 2015 | Winter 2015 | Spring 2015 |
|-----------------------|-------------|-------------|-------------|
| 2015 Value | 1010.83 | 1014.37 | 1014.57 |
| Pre past MVEV seasons | <1009.74 | <1012.99 | <1009.99 |

None of seasonal periods pertaining to the Nichol's hypothesis are in line with past MVEV active years.

ARBOVIRAL ISOLATES

| LOCATION - Site | Date Trapped | Mosquito Species | Virus |
|-----------------------------|--------------|----------------------------|-------|
| LEETON – Farm 347 | 1/Mar/16 | <i>Culex annulirostris</i> | RRV |
| PORT MACQUARIE – Stevens St | 8/Feb/16 | * | EHV |
| GRIFFITH – Hanwood | 1/Feb/16 | <i>Culex annulirostris</i> | BFV |

*Detection via Honey-Baited Cards, the mosquito species cannot be determined.

<http://medent.usyd.edu.au/arbovirus/results/virusisolates.htm>

HUMAN NOTIFICATIONS

Weekly notifications of human mosquito-borne diseases infections are available from the NSW Ministry of Health, Communicable Disease Weekly Report and summarised in the Table below*:

www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx

Notifications of Mosquito-Borne Disease in NSW, 2015-2016*

| Week Ending | RRV | BFV | DENV [†] | Malaria [†] | CHIKV [†] | ZIKV [†] | Total |
|--------------|------------|-----------|-------------------|----------------------|--------------------|-------------------|------------|
| 5-Jul-15 | 14 | 4 | 5 | 2 | 0 | 0 | 25 |
| 12-Jul-15 | 13 | 3 | 2 | 0 | 1 | 0 | 19 |
| 19-Jul-15 | 7 | 0 | 4 | 1 | 0 | 0 | 12 |
| 26-Jul-15 | 19 | 0 | 3 | 0 | 0 | 0 | 22 |
| 2-Aug-15 | 21 | 2 | 4 | 1 | 0 | 0 | 28 |
| 9-Aug-15 | 12 | 3 | 1 | 0 | 0 | 0 | 16 |
| 16-Aug-15 | 16 | 3 | 4 | 2 | 1 | 0 | 26 |
| 23-Aug-15 | 12 | 1 | 2 | 2 | 0 | 0 | 17 |
| 30-Aug-15 | 27 | 2 | 5 | 2 | 0 | 0 | 36 |
| 6-Sep-15 | 8 | 3 | 6 | 1 | 0 | 0 | 18 |
| 13-Sep-15 | 12 | 0 | 3 | 0 | 1 | 0 | 16 |
| 20-Sep-15 | 24 | 5 | 1 | 0 | 0 | 0 | 30 |
| 27-Sep-15 | 11 | 0 | 1 | 1 | 0 | 0 | 13 |
| 4-Oct-15 | 16 | 2 | 1 | 0 | 0 | 0 | 19 |
| 11-Oct-15 | 11 | 2 | 4 | 0 | 0 | 0 | 17 |
| 18-Oct-15 | 17 | 1 | 5 | 0 | 0 | 0 | 23 |
| 25-Oct-15 | 19 | 2 | 4 | 1 | 0 | 0 | 26 |
| 1-Nov-15 | 16 | 2 | 5 | 1 | 0 | 0 | 24 |
| 8-Nov-15 | 17 | 2 | 6 | 2 | 0 | 0 | 27 |
| 15-Nov-15 | 25 | 2 | 4 | 1 | 0 | 0 | 32 |
| 22-Nov-15 | 19 | 1 | 4 | 0 | 0 | 0 | 24 |
| 29-Nov-15 | 19 | 3 | 8 | 4 | 0 | 0 | 34 |
| 6-Dec-15 | 13 | 1 | 5 | 0 | 0 | 0 | 19 |
| 13-Dec-15 | 15 | 0 | 7 | 1 | 0 | 0 | 23 |
| 20-Dec-15 | 17 | 0 | 8 | 0 | 0 | 0 | 25 |
| 27-Dec-15 | 15 | 0 | 3 | 1 | 0 | 0 | 19 |
| Total | 415 | 44 | 105 | 23 | 3 | 0 | 590 |

[†]All of these viruses are acquired overseas, although some DENV cases may be from North Queensland.

| Week Ending | RRV | BFV | DENV [†] | Malaria [†] | CHIKV [†] | ZIKV [†] | Total |
|--------------|------------|-----------|-------------------|----------------------|--------------------|-------------------|------------|
| 3-Jan-16 | 7 | 1 | 7 | 1 | 0 | 1 | 17 |
| 10-Jan-16 | 12 | 1 | 5 | 0 | 0 | 0 | 18 |
| 17-Jan-16 | 3 | 2 | 3 | 2 | 0 | 0 | 10 |
| 24-Jan-16 | 8 | 0 | 8 | 0 | 2 | 1 | 19 |
| 31-Jan-16 | 8 | 0 | 3 | 0 | 2 | 0 | 13 |
| 7-Feb-16 | 15 | 1 | 15 | 2 | 0 | 0 | 33 |
| 14-Feb-16 | 17 | 0 | 2 | 1 | 0 | 0 | 20 |
| 21-Feb-16 | 19 | 2 | 7 | 1 | 0 | 0 | 29 |
| 28-Feb-16 | 26 | 1 | 3 | 2 | 0 | 0 | 32 |
| 6-Mar-16 | 21 | 1 | 14 | 0 | 0 | 0 | 36 |
| 13-Mar-16 | 32 | 0 | 4 | 0 | 0 | 1 | 37 |
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| | | | | | | | |
| Total | 583 | 53 | 176 | 32 | 8 | 2 | 850 |

[†]All of these viruses are acquired overseas, although some DENV cases may be from North Queensland.

Comment: the notifications for 2016 are lower than the comparable period for 2015 and similar to 2014.

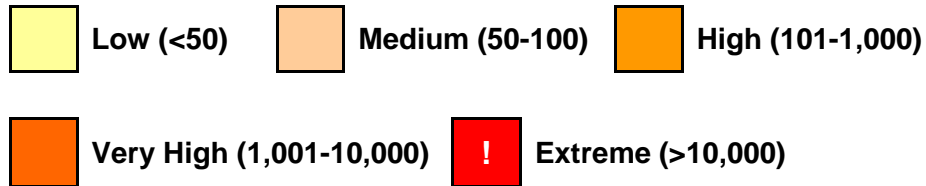
It should also be noted that notifications are for NSW residents and that infection may have been acquired elsewhere.

*The data in this table is updated once available from the NSW Ministry of Health.

MOSQUITO RESULTS

All the full mosquito results can be obtained from:
<http://medent.usyd.edu.au/arbovirus/results/results.htm#site>

Mosquito abundances are best described in relative terms, and in keeping with the terminology from previous NSWASP Annual Reports, mosquito numbers are depicted on the tables below as:



Each location represents the average for all trapping sites at that location.

Inland

| Location | Mosquito | Nov-15 | | | | | Dec | | | | Jan-16 | | | | | Feb | | | | Mar | | | | Apr | | | |
|-----------------------------------|------------------|--------|---|----|----|----|-----|----|----|----|--------|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|
| | | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 |
| Albury | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bourke | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Griffith | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Leeton | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Macquarie Marshes | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mathoura | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wagga | <i>Cx. annul</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |

Coastal

| Location | Mosquito | Nov-15 | | | | | Dec | | | | Jan-16 | | | | | Feb | | | | Mar | | | | Apr | | | |
|--------------------------------|--------------------|--------|---|----|----|----|-----|----|----|----|--------|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|
| | | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 |
| Ballina | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coffs Harbour | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gosford | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lake Macquarie | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Port Macquarie | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tweed | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Wyong | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | | | | | | | | | | |

Sydney

| Location | Mosquito | Nov-15 | | | | | Dec | | | | Jan-16 | | | | | Feb | | | | Mar | | | | Apr | | | |
|-------------------------------------|--------------------|--------|---|----|----|----|-----|----|----|----|--------|----|----|----|----|-----|----|----|----|-----|----|----|----|-----|----|----|----|
| | | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 |
| Banks-town | <i>Ae. vigilax</i> | | | | | | ■ | ■ | ■ | | ■ | | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | ■ | ■ | ■ | | ■ | | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | |
| Blacktown | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Georges River | <i>Ae. vigilax</i> | | | | | | ■ | ■ | ■ | | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | ■ | ■ | ■ | | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | |
| Hawkes-bury | <i>Ae. vigilax</i> | | | | | | | | | | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | | | | | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Hills Shire | <i>Ae. vigilax</i> | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | | | | | |
| Penrith | <i>Ae. vigilax</i> | | | | | ■ | | ■ | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | ■ | | ■ | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Sydney Olympic Park | <i>Ae. vigilax</i> | | | | | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Ryde | <i>Ae. vigilax</i> | | | | | | ■ | ■ | | | ■ | ■ | ■ | | | ■ | | | | ■ | ■ | ■ | | | | | |
| | Total Mosq. | | | | | | ■ | ■ | | | ■ | ■ | ■ | | | ■ | | | | ■ | ■ | ■ | | | | | |

Sentinel Chicken Seroconversions

http://medent.usyd.edu.au/arbovirus/results/chicken_results_all_sites.htm

| Location | Nov-15 | | | | | Dec | | | | Jan-16 | | | | | Feb | | | | Mar | | | | Apr | | | |
|-----------------------------------|--------|-----|-----|-----|-----|-----|-----|-----|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|----|----|----|
| | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 |
| Bourke | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deniliquin | 15N | 15N | 15N | | 15N | 14N | 15N | 12N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 14N | 15N | | 15N | | | | | | |
| Forbes | | | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | | 13N | | | | | | | |
| Griffith | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 14N | | 14N | 14N | 14N | 15N | 14N | 14N | 14N | 14N | 14N | | | | | | | | |
| Hay | 15N | 15N | 13N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | | 15N | | | | | | |
| Leeton | 15N | 15N | 15N | | 15N | 15N | 15N | 14N | 14N | 14N | 14N | 13N | 13N | 13N | 13N | 13N | 13N | 13N | | | | | | | | |
| Macquarie Marshes | | 15N | 13N | 15N | 15N | | 15N | | 15N | 15N | | 15N | 15N | 15N | | 15N | | | | | | | | | | |
| Menindee | 6N | 15N | 15N | 15N | | 15N | 15N | 15N | 15N | | 15N | 15N | 15N | 15N | 15N | 15N | | | | | | | | | | |
| Moama | 15N | | | | | 15N | | | | | | | | | | | | | | | | | | | | |
| Moree | | | | | | | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | 15N | | | | | | |
| Wee Waa | | | 13N | 14N | 15N | | 15N | 15N | | 15N | 15N | | | 15N | 13N | 13N | 15N | | 15N | | | | | | | |

N= Negative for MVEV & KUNV

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