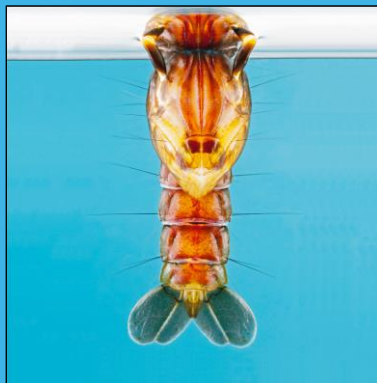


# NSW Arbovirus Surveillance & Mosquito Monitoring Program, 2017-2018

Weekly Update: 22/Dec/2017



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## Summary

- **Climate:** over the last week, there was light rainfall along the Murray, the ranges and the coast.
- **Three Month Forecast:** for January to March 2018, rainfall predictions for NSW are for an increased chance of above average precipitation for most of the state, with an increased probability towards the coast. Maximum and minimum temperatures are expected to be below average, particularly along the coast. According to the BOM as of 19/Dec/17, the La Niña continues, suggesting that rainfall patterns are likely to be above average for the upcoming months until autumn and that summer will be humid.
- **Tidal:** a small set of high tides occurred over 19-20/Dec and did surpass the predicted height, which may trigger some *Aedes vigilax* hatching along the coast. The next larger set of tides are due over 31/Dec to 6/Jan with tides up to 2.07m forecasted.
- **MVEV models:** the data relevant to both the Forbes' and Nichols' hypotheses have been updated to the end of Nov 2017. Both theories have aligned towards conditions associated with past MVEV outbreaks, but the models are not suggestive of an epidemic.
- **Mosquito Numbers Inland:** mosquito numbers have increased this week, with 'high' or greater numbers from several locations.
- **Mosquito Numbers Coast:** mosquito numbers continue to be 'high' at the north coast sites and Gosford, although densities of *Aedes vigilax* remain 'low'.
- **Mosquito Numbers Sydney:** mosquito numbers tended to be higher this week with some 'medium collections'.
- **Arboviral Isolates:** there have been no isolates to date.
- **Chicken Sentinel Flocks:** there were no seroconversions.
- **Human Notifications:** for the current fiscal year, there have been 226 RRV and 39 BFV notifications, this is around average for recent years.

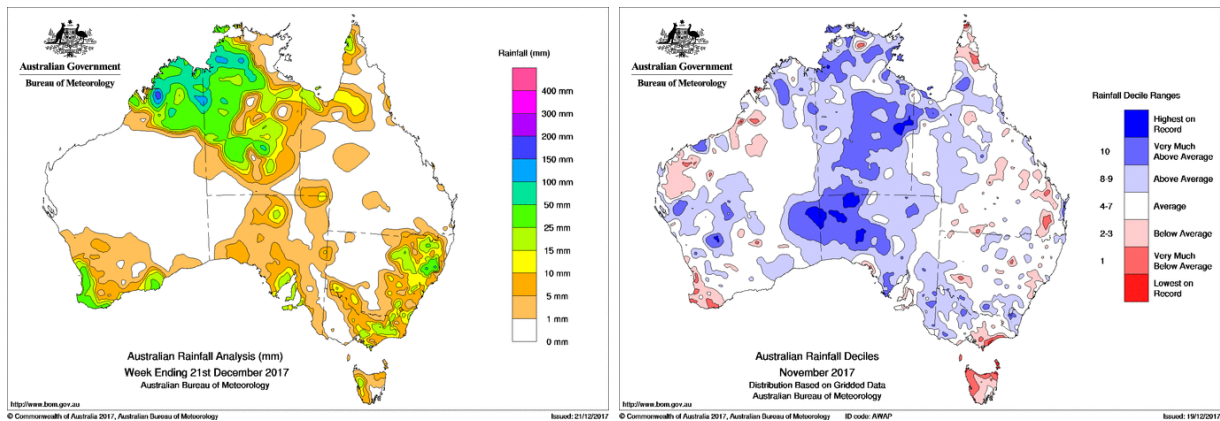
**Comment:** the recent heavy rains in the south of the inland during early December has given a boost to local mosquito numbers, with a notable increase in floodwater *Aedes* species and *Culex annulirostris* (just in time for Christmas!). For the coast, 'high' mosquito numbers continue to be trapped from the north coast and Gosford, but remain mostly 'low' elsewhere.

To date there have been no arboviral isolates nor any seroconversions in the sentinel chicken flocks, and human arboviral cases are presently around one third below the average. However, with the recent and upcoming high tides, the increased rainfall expected with the La Niña, all this may change soon.

## Environmental Conditions

### Rainfall

Rainfall across Australia for the week ending 21/Dec/2017 is depicted on the left and monthly rainfall deciles for November 2017 are on the right. Over the last week, there was light rainfall along the Murray, the ranges and the coast. For November, rainfall was around average for much of the state. Maximum and minimum temperatures for November were 2-3 degrees above normal and warmer to the south.



### Three Month Rainfall & Temperature Forecast

For January to March 2018, rainfall predictions for NSW are for an increased chance of above average precipitation for most of the state, with an increased probability towards the coast. Maximum and minimum temperatures are expected to be below average, particularly along the coast. The following pages contain graphics of the seasonal outlook:

[www.bom.gov.au/climate/outlooks/#/rainfall/median](http://www.bom.gov.au/climate/outlooks/#/rainfall/median) (Rainfall outlook).

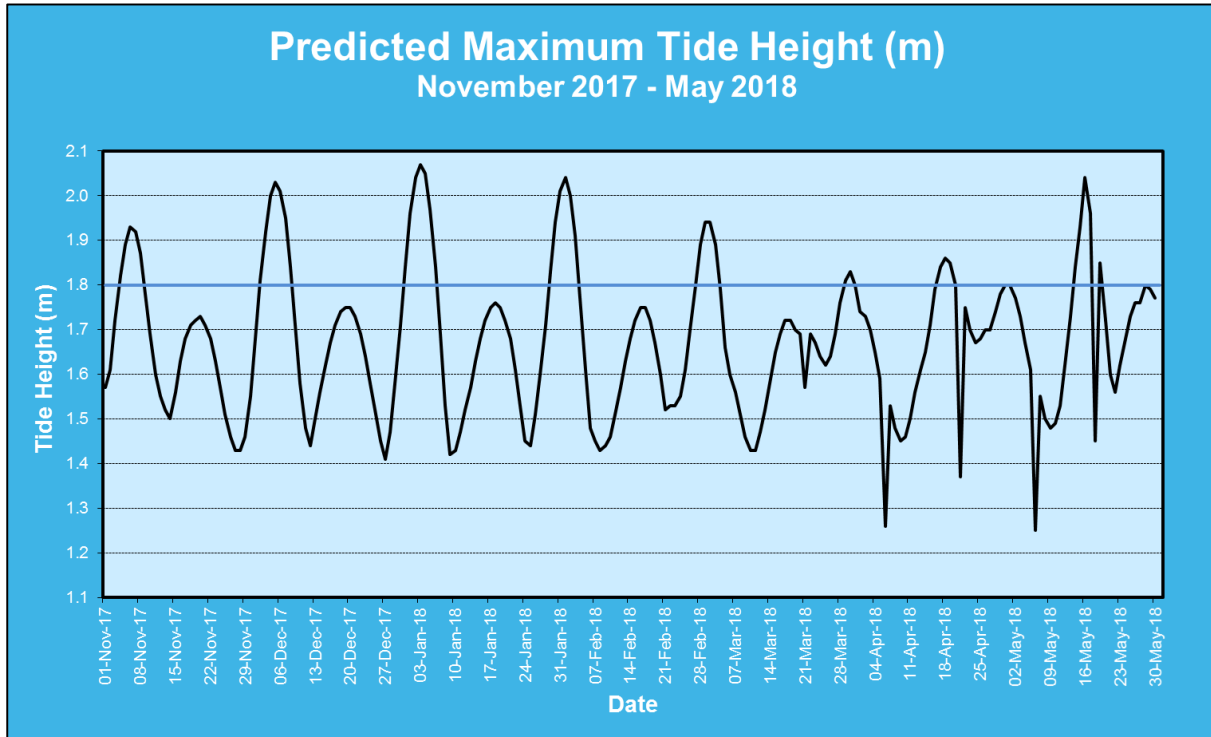
[www.bom.gov.au/climate/outlooks/#/temperature/summary](http://www.bom.gov.au/climate/outlooks/#/temperature/summary) (Max & min temperature outlook).

According to the BOM as of 19/Dec/2017, the La Niña conditions continue. The climatic models suggest this is likely to be short lived ending in autumn 2018. The Indian Ocean Dipole (IOD) remains neutral. This all suggests that rainfall patterns are likely to be above average for the upcoming months, with higher levels of humidity that will aid adult mosquito survival.

For more information: [www.bom.gov.au/climate/enso/](http://www.bom.gov.au/climate/enso/) and, <http://www.bom.gov.au/climate/iod/>

## 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, as measured at Sydney, 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. Note this height varies between region, thus at Batemans Bay, a tide height over 0.8m can trigger egg hatching.



A small set of high tides were due over 19-20/Dec that may induce some *Aedes vigilax* hatching. These tides were forecast to be only a maximum of 1.75m in height but they did surpass predicted, reaching around 1.9m in Sydney. This may trigger hatching in some parts of the coast. The next, and much larger, set of tides are due over 31/Dec to 6/Jan/2018 with tides up to 2.07m forecasted.

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.

## 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 localized 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 2016 or for the first quarter of 2017 (Table 1). For the last quarter of 2017 (October data only), rainfall was above Decile 7 in all but one catchment basin.

**Table 1.** Rainfall indices for the main catchment basins of eastern Australia as per Forbes' hypothesis, relevant to the 2017-2018 season. Note that a value of 1 equals Decile 7 rainfall.

| Catchment Basin                    | Oct-Dec 2016 | Jan-Mar 2017 | Oct-Dec 2017* | Jan-Mar 2018 |
|------------------------------------|--------------|--------------|---------------|--------------|
| Darling River                      | 0.58         | 0.81         | 1.05          |              |
| Lachlan/Murrumbidgee/Murray Rivers | 0.92         | 1.01         | 1.01          |              |
| Northern Rivers                    | 0.98         | 1.03         | 1.28          |              |
| North Lake Eyre system             | 1.09         | 0.73         | 0.82          |              |

\*Data for October and November only.

### ii. Nichol's Hypothesis

**Table 2.** The seasonal atmospheric pressures (in mm) according to Nichol's hypothesis, relevant to the 2017-2018 season.

|                              | Autumn 2017 | Winter 2017 | Spring 2017 |
|------------------------------|-------------|-------------|-------------|
| <b>2017 Value</b>            | 1009.60     | 1013.23     | 1009.70     |
| <b>Pre past MVEV seasons</b> | <1009.74    | <1012.99    | <1009.99    |

Only the Winter period pertaining to the Nichol's hypothesis is not in line with past MVEV active years.

## Arboviral Isolates

| LOCATION - Site | Date Trapped | Mosquito Species | Virus |
|-----------------|--------------|------------------|-------|
| Nil to date     |              |                  |       |
|                 |              |                  |       |
|                 |              |                  |       |
|                 |              |                  |       |

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

## Human Notifications

Weekly notifications of human mosquito-borne diseases infections are available from the NSW Ministry of Health, Communicable Disease Weekly Report and summarized in the Table below\* ([www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx](http://www.health.nsw.gov.au/Infectious/reports/Pages/CDWR.aspx)).

Notifications of Mosquito-Borne Disease in NSW, 2017-2018\*

| Week Ending  | RRV        | BFV       | DENV <sup>†</sup> | Malaria <sup>†</sup> | CHIKV <sup>†</sup> | ZIKV <sup>†</sup> | Total      |
|--------------|------------|-----------|-------------------|----------------------|--------------------|-------------------|------------|
| 1-Jul-17     | 14         | 6         | 3                 | 2                    | 0                  | 0                 | 25         |
| 8-Jul-17     | 6          | 4         | 0                 | 4                    | 1                  | 0                 | 15         |
| 15-Jul-17    | 8          | 0         | 2                 | 1                    | 0                  | 0                 | 11         |
| 22-Jul-17    | 10         | 3         | 7                 | 2                    | 0                  | 0                 | 22         |
| 29-Jul-17    | 6          | 0         | 2                 | 2                    | 0                  | 0                 | 10         |
| 5-Aug-17     | 8          | 0         | 4                 | 0                    | 0                  | 0                 | 12         |
| 12-Aug-17    | 11         | 1         | 3                 | 2                    | 5                  | 0                 | 22         |
| 19-Aug-17    | 5          | 2         | 1                 | 2                    | 2                  | 0                 | 12         |
| 26-Aug-17    | 6          | 3         | 3                 | 2                    | 0                  | 1                 | 15         |
| 2-Sep-17     | 6          | 0         | 1                 | 0                    | 1                  | 0                 | 8          |
| 9-Sep-17     | 14         | 0         | 1                 | 2                    | 1                  | 0                 | 18         |
| 16-Sep-17    | 9          | 1         | 5                 | 0                    | 0                  | 0                 | 15         |
| 23-Sep-17    | 9          | 1         | 3                 | 1                    | 0                  | 0                 | 14         |
| 30-Sep-17    | 7          | 0         | 1                 | 1                    | 1                  | 0                 | 10         |
| 7-Oct-17     | 7          | 0         | 3                 | 2                    | 0                  | 0                 | 12         |
| 14-Oct-17    | 10         | 1         | 2                 | 1                    | 0                  | 0                 | 14         |
| 21-Oct-17    | 11         | 2         | 8                 | 2                    | 1                  | 0                 | 24         |
| 28-Oct-17    | 16         | 1         | 6                 | 1                    | 1                  | 0                 | 25         |
| 4-Nov-17     | 14         | 3         | 7                 | 3                    | 1                  | 0                 | 28         |
| 11-Nov-17    | 5          | 2         | 7                 | 0                    | 0                  | 0                 | 14         |
| 18-Nov-17    | 3          | 2         | 10                | 0                    | 0                  | 0                 | 15         |
| 25-Nov-17    | 9          | 2         | 6                 | 1                    | 1                  | 0                 | 19         |
| 2-Dec-17     | 14         | 1         | 8                 | 0                    | 0                  | 0                 | 23         |
| 9-Dec-17     | 9          | 0         | 3                 | 1                    | 0                  | 0                 | 13         |
| 16-Dec-17    | 9          | 4         | 2                 | 1                    | 2                  | 0                 | 18         |
|              |            |           |                   |                      |                    |                   |            |
| <b>Total</b> | <b>226</b> | <b>39</b> | <b>98</b>         | <b>33</b>            | <b>17</b>          | <b>1</b>          | <b>414</b> |

<sup>†</sup>All of these viruses are acquired overseas, although some DENV cases may be from North Queensland.

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

**Comment:** It should also be noted that notifications are for NSW residents and that infection may have been acquired elsewhere and that winter notifications of RRV are likely to be false positives.



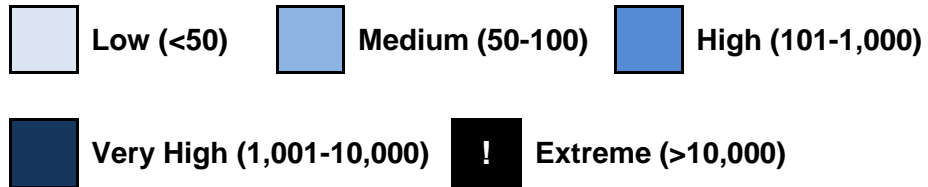
**Table 6.** Ross River virus infection notifications in NSW residents, by month of disease onset per fiscal year, July 2013 to November 2017\*.

| Year      | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Total        |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------------|
| 2013-2014 | 36  | 23  | 27  | 36  | 30  | 30  | 33  | 35  | 44  | 72  | 86  | 57  | <b>509</b>   |
| 2014-2015 | 38  | 50  | 46  | 67  | 59  | 90  | 117 | 305 | 431 | 264 | 102 | 50  | <b>1,619</b> |
| 2015-2016 | 54  | 61  | 53  | 61  | 70  | 54  | 42  | 60  | 78  | 79  | 52  | 16  | <b>680</b>   |
| 2016-2017 | 12  | 11  | 20  | 17  | 38  | 216 | 429 | 274 | 200 | 142 | 174 | 89  | <b>1,622</b> |
| 2017-2018 | 29  | 40  | 52  | 55  | 34  | 16  |     |     |     |     |     |     | <b>226</b>   |

\*updated 22/Nov/2017 (this table is updated more regularly than Table 5 above, hence there maybe differences in the numbers). Table modified from: <http://www1.health.nsw.gov.au/IDD/#/ROSS>

## Mosquito Results

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         | Oct-17 |   |    |    |    | Nov |    |    |    | Dec |    |    |    | Jan-18 |   |    |    | Feb |   |    |    | Mar |   |    |    |    |
|-------------------|------------------|--------|---|----|----|----|-----|----|----|----|-----|----|----|----|--------|---|----|----|-----|---|----|----|-----|---|----|----|----|
|                   |                  | 1      | 8 | 15 | 22 | 29 | 5   | 12 | 19 | 26 | 3   | 10 | 17 | 21 | 28     | 7 | 14 | 21 | 28  | 4 | 11 | 18 | 25  | 4 | 11 | 18 | 25 |
| 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 |    |    |    | Dec |    |    |    | Jan-18 |   |    |    | Feb |   |    |    | Mar |   |    |    | Apr |   |   |    |    |    |
|-----------------------|--------------------|-----|----|----|----|-----|----|----|----|--------|---|----|----|-----|---|----|----|-----|---|----|----|-----|---|---|----|----|----|
|                       |                    | 5   | 12 | 19 | 26 | 3   | 10 | 17 | 21 | 28     | 7 | 14 | 21 | 28  | 4 | 11 | 18 | 25  | 4 | 11 | 18 | 25  | 1 | 8 | 15 | 22 | 29 |
| <b>Ballina</b>        | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Coffs Harbour</b>  | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Gosford</b>        | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Lake Macquarie</b> | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Port Macquarie</b> | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Tweed</b>          | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
| <b>Wyong</b>          | <i>Ae. vigilax</i> |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |
|                       | Total Mosq.        |     |    |    |    |     |    |    |    |        |   |    |    |     |   |    |    |     |   |    |    |     |   |   |    |    |    |

# Sydney

| Location            | Mosquito           | Nov |    |    |    | Dec |    |    |    |    | Jan-18 |    |    |    | Feb |    |    |    | Mar |    |    |    | Apr |   |    |    |    |
|---------------------|--------------------|-----|----|----|----|-----|----|----|----|----|--------|----|----|----|-----|----|----|----|-----|----|----|----|-----|---|----|----|----|
|                     |                    | 5   | 12 | 19 | 26 | 3   | 10 | 17 | 21 | 28 | 7      | 14 | 21 | 28 | 4   | 11 | 18 | 25 | 4   | 11 | 18 | 25 | 1   | 8 | 15 | 22 | 29 |
| 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 Flocks

| Location             | Oct-17 |   |    |    |     | Nov |     |     |     | Dec |     |    |    |    | Jan-18 |    |    |    | Feb |    |    |    | Mar |    |    |    |  |
|----------------------|--------|---|----|----|-----|-----|-----|-----|-----|-----|-----|----|----|----|--------|----|----|----|-----|----|----|----|-----|----|----|----|--|
|                      | 1      | 8 | 15 | 22 | 29  | 5   | 12  | 19  | 26  | 3   | 10  | 17 | 21 | 28 | 7      | 14 | 21 | 28 | 4   | 11 | 18 | 25 | 4   | 11 | 18 | 25 |  |
| Bourke               |        |   |    |    |     |     |     |     |     |     |     |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Deniliquin           |        |   |    |    |     | 15N | 14N | 15N | 15N | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Dubbo                |        |   |    |    |     | 15N | 15N | 15N | 15N | 15N | 14N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Forbes               |        |   |    |    |     | 15N |     | 15N | 15N | 15N | 14N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Griffith             |        |   |    |    | 15N | 15N | 15N | 15N | 15N | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Hay                  |        |   |    |    | 15N | 15N | 15N | 15N | 15N | 15N |     |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Leeton               |        |   |    |    |     | 15N | 15N |     | 15N | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Macquarie<br>Marshes |        |   |    |    |     |     | 15N | 15N | 15N | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Menindee             |        |   |    |    |     |     |     |     |     | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Moama                |        |   |    |    |     |     |     |     |     |     |     |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Moree                |        |   |    |    |     |     |     |     |     | 15N | 15N |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |
| Wee Waa              |        |   |    |    |     |     |     |     |     |     |     |    |    |    |        |    |    |    |     |    |    |    |     |    |    |    |  |

N= Negative for MVEV & KUNV

Prepared by: Stephen Doggett, Manager, Department of Medical Entomology, NSW Health Pathology (ICPMR), Westmead Hospital NSW 2145. Email: [Stephen.Doggett@health.nsw.gov.au](mailto:Stephen.Doggett@health.nsw.gov.au)

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