Resilient Valley, Resilient Communities

Hawkesbury–Nepean Valley Flood Risk Management Strategy

Flood probabilities Frequently asked questions

What does a '1 in 100 flood' mean?

With the recent widespread flooding in NSW, there has been confusion in the community and in the media regarding flood probabilities. People have been using the term '1 in 100 flood'. A better term is a 1 in 100 chance per year flood.

A 1 in 100 chance per year flood means that there is a 1% chance of this sized flood or larger happening every single year. It does not mean that such a flood will happen only once every 100 years, which is a common misunderstanding. For example, there is a 1% chance every year of a flood reaching 17.3 metres at Windsor.

Another way to think about the chance of a particular sized flood is the likelihood of it happening in an average lifetime. For example, there is a 55% likelihood that an 80-year-old person would have experienced a 1 in 100 chance per year flood.

What is the relationship between the chance of a flood occurring and the size of a flood?

On average, small floods happen more often and big floods happen less frequently. This is demonstrated in Figure 1 below, which also shows the seasonality of flood events.

What was the likelihood (chance per year) of the recent floods in the Hawkesbury-Nepean Valley?

As devastating as the recent floods have been to many households and businesses in the Hawkesbury-Nepean Valley, they were not 1 in 100 chance per year floods.

The March 2022 and July 2022 floods were around 1 in 20 chance per year events at Windsor. This means they have a 5% chance of occurring in any year, and are smaller and lower than a 1 in 100 chance per year flood would be.

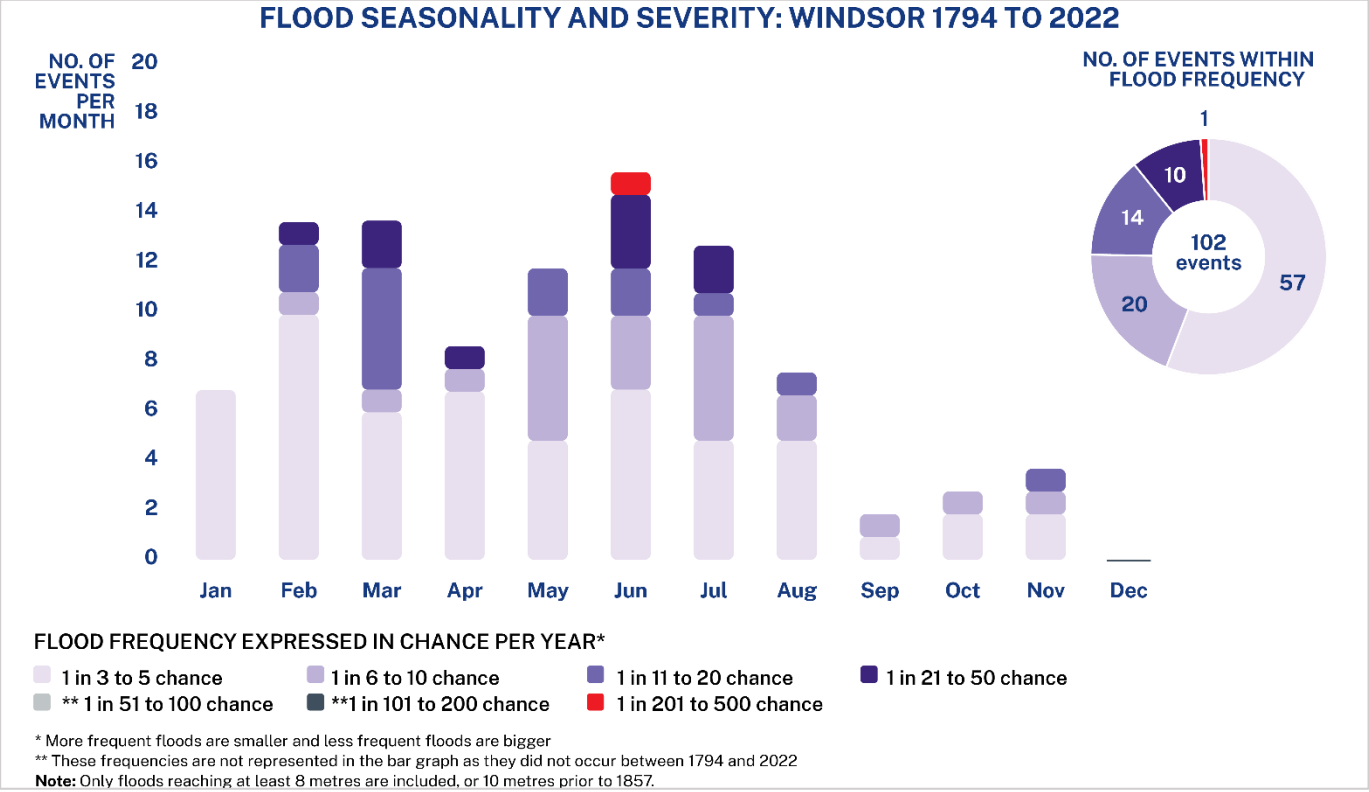

Figure 1: Frequency of different sized floods at Windsor (1794 - 2022)

What pattern of flood probabilities has occurred in the Hawkesbury-Nepean Valley?

The Hawkesbury River at Windsor has the longest flood record in Australia, going back to the 1790s.

Over the historical record we have seen periods with clusters of floods. A flood in one year or series of years does not reduce the chance of a similar sized or larger flood in the following years.

For example, between June 1949 and June 1956 there were 13 floods similar in size to the 5 floods experienced between February 2020 and July 2022. 1870 and 1950 experienced 4 floods, and 1860,1952, 1963 and 1974 experienced 3 floods in one year.

There have been over 130 moderate and major floods at Windsor from 1794 – 2022. Figure 2 below demonstrates the **102 moderate and major floods** that have occurred above 10 metres or 8 metres since 1857.

There have been:

- 57 floods at a 1 in 3 to 5 chance per year probability
- 22 floods at a 1 in 6 to 10 chance per year probability
- 12 floods at a 1 in 11 to 20 chance per year probability
- 10 floods at a 1 in 21 to 50 chance per year probability
- 0 floods at a 1 in 51 to 200 chance per year probability
- 1 flood at a 1 in 201 to 500 chance per year probability

These floods have occurred even during periods of drought dominated cycles - however these are less common.

RECORD OF MODERATE AND MAJOR FLOODS – WINDSOR 1794 TO PRESENT DAY

Flood Dominated Regime (FDR)

Date	Flood size (m AHD)[2]	Chance per year
1794-1820 FDR – 5 major[3] floods in 26 years		
1799 Mar	10.5	1:6 to 1:10
1806 Mar	12.9	1:11 to 1:20
1809 May	14.7	1:21 to 1:50
1816 Jun	14.1	1:21 to 1:50
1817 Feb	14.4	1:21 to 1:50
1819 Mar	12.9	1:11 to 1:20
1821-1856 DDR – 0 major[3] floods in 35 years		
1857-1910 FDR – 9 major[3] floods in 54 years		
1857 Jul	10.4	1:6 to 1:10
1857 Aug	11.9	1:6 to 1:10
1860 Feb	8.8	1:3 to 1:5
1860 Apr	11.8	1:6 to 1:10
1860 Jul	11.1	1:6 to 1:10
1860 Nov	11.4	1:6 to 1:10
1861 Apr	8.8	1:3 to 1:5
1864 Jun	15.1	1:21 to 1:50
1864 Jul	11.4	1:6 to 1:10
1866 Jun	8.3	1:3 to 1:5
1866 Jul	8.8	1:3 to 1:5
1867 Apr	8.5	1:3 to 1:5
1867 Jun	19.7	1:201 to 1:500
1868 Feb	9.5	1:3 to 1:5
1869 May	11.6	1:6 to 1:10
1870 Mar	9.0	1:3 to 1:5
1870 Apr	14.1	1:21 to 1:50
1870 May	11.2	1:6 to 1:10

Drought Dominated Regime (DDR)

Date	Flood size (m AHD)[2]	Chance per year
1870 Nov	8.5	1:3 to 1:5
1871 May	11.7	1:6 to 1:10
1871 May	8.5	1:3 to 1:5
1873 Feb	13.1	1:11 to 1:20
1873 Jun	9.0	1:3 to 1:5
1874 Feb	8.7	1:3 to 1:5
1875 Jun	12.3	1:11 to 1:20
1877 May	9.6	1:3 to 1:5
1877 Jul	8.6	1:3 to 1:5
1878 Feb	8.5	1:3 to 1:5
1879 Sep	13.6	1:11 to 1:20
1889 May	12.2	1:6 to 1:10
1890 Mar	12.3	1:11 to 1:20
1891 Jun	11.2	1:6 to 1:10
1892 Sep	8.5	1:3 to 1:5
1893 Mar	9.1	1:3 to 1:5
1894 Mar	10.1	1:3 to 1:5
1895 Jan	9.7	1:3 to 1:5
1898 Feb	10.1	1:3 to 1:5
1899 Aug	8.6	1:3 to 1:5
1900 Jul	14.5	1:21 to 1:50
1901-1948 DDR – 1 major[3] floods in 47 years		
1904 Jul	12.6	1:11 to 1:20
1911 Jan	8.3	1:3 to 1:5
1913 May	8.5	1:3 to 1:5
1915 Jan	8.0	1:3 to 1:5
1916 Oct	11.0	1:6 to 1:10
1922 Jul	9.6	1:3 to 1:5
1925 May	8.6	1:3 to 1:5

Uncertain Period[1]

Date	Flood size (m AHD)[2]	Chance per year
1925 Jun	11.5	1:6 to 1:10
1929 Feb	8.1	1:3 to 1:5
1929 Oct	8.6	1:3 to 1:5
1934 Feb	9.3	1:3 to 1:5
1943 May	10.3	1:3 to 1:5
1945 Jun	8.5	1:3 to 1:5
1949-1990 – 7 major[3] floods in 41 years		
1949 Jun	12.1	1:6 to 1:10
1950 Jan	9.1	1:3 to 1:5
1950 Mar	9.4	1:3 to 1:5
1950 Jun	9.6	1:3 to 1:5
1950 Jul	8.4	1:3 to 1:5
1950 Oct	9.8	1:3 to 1:5
1951 Jan	9.3	1:3 to 1:5
1952 Jun	9.5	1:3 to 1:5
1952 Jul	11.8	1:6 to 1:10
1952 Aug	9.6	1:3 to 1:5
1954 Feb	8.8	1:3 to 1:5
1955 May	9.9	1:3 to 1:5
1956 Feb	13.8	1:11 to 1:20
1956 Jun	9.7	1:3 to 1:5
1960 Warragamba Dam built		
1961 Nov	15.0	1:21 to 1:50
1962 Jan	8.6	1:3 to 1:5
1963 Apr	8.7	1:3 to 1:5
1963 Jun	8.9	1:3 to 1:5
1963 Aug	9.6	1:3 to 1:5
1964 Jun	14.6	1:21 to 1:50
1967 Aug	8.9	1:3 to 1:5
1969 Nov	10.2	1:6 to 1:10
1974 Apr	8.7	1:3 to 1:5
1974 May	10.4	1:6 to 1:10
1974 Aug	9.6	1:3 to 1:5
1975 Jun	11.2	1:6 to 1:10
1976 Jan	9.4	1:3 to 1:5
1976 Mar	8.0	1:3 to 1:5
1977 Mar	8.9	1:3 to 1:5
1978 Mar	14.5	1:21 to 1:50
1978 Jun	9.7	1:3 to 1:5
1984 Jul	8.3	1:3 to 1:5
1986 Aug	11.4	1:6 to 1:10
1988 May	12.8	1:11 to 1:20
1988 Jul	10.9	1:6 to 1:10
1989 Apr	9.2	1:3 to 1:5
1990 Apr	8.7	1:3 to 1:5
1990 Aug	13.5	1:11 to 1:20
1991-2019 – 0 major[3] floods in 28 years		
1992 Feb	11.1	1:6 to 1:10
2020-2022 – 3 major[3] floods in 3 years		
2020 Feb	9.3	1:3 to 1:5
2021 Mar	12.9	1:11 to 1:20
2022 Mar	13.8	1:11 to 1:20
2022 Apr	9.1	1:3 to 1:5
2022 Jul	13.9	1:21 to 1:50

1 It is too early to determine if we have moved from a drought dominated regime into a flood dominated regime.
2 m AHD – Australian Height Datum – A common national surface level datum approximately corresponding to mean sea level.
3 Major flood is defined as 12.2 metres and higher. Moderate flood is defined as 7.0 to 12.2 metres.
Note: Only floods reaching at least 8 metres are included. Only floods reaching at least 10 metres are included prior to 1857.
Sources: Warragamba Dam Auxiliary Spillway EIS Flood Study (Webb, McKeown & Associates, 1996); 1992 flood level from former Office of Environment and Heritage; 2020 – 2022 flood level from Manly Hydraulics Laboratory (MHL); Drought and flood dominated periods sourced from Warner, RF, 2009 'Secular regime shifts, global warming and Sydney's water supply', *Geographical Research*, 47(3), 227-241.

Figure 2: Record of moderate and major floods at Windsor – 1794 - 2022

Will climate change have an impact on flood probabilities?

Climate change will increase the probability of floods reaching certain levels in any given year. In future, for example, the current 1 in 100 chance per year level might have a 1.5% chance of occurring in any year (rather than the 1% chance).

For more information about flooding in the Hawkesbury-Nepean Valley, visit www.myfloodrisk.nsw.gov.au

For more information about the Flood Strategy, visit www.insw.com/flood-strategy