Manly Hydraulics Laboratory

NSW COASTAL RAINFALL ANNUAL SUMMARY
2016–2017

Report MHL2575
October 2017

Prepared for:

NSW Office of Environment and Heritage

Cover Photograph: Kooroowi rainfall station, Bellinger River Region

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Foreword

Manly Hydraulics Laboratory is a business group within the Department of Finance, Services and Innovation. The NSW rainfall database has been developed to support a number of NSW Office of Environment and Heritage (OEH) programs associated with coastal, floodplain and estuary management. The monitoring service is available to local government and other organisations, both in Australia and overseas.

This annual summary presents the results of rainfall monitoring obtained by the automatic rainfall recording stations along the coastal estuaries and rivers of New South Wales over the period 1 July 2016 to 30 June 2017, and catalogues data collected in NSW by Manly Hydraulics Laboratory.

This summary has been prepared to provide ready access to Manly Hydraulics Laboratory's rainfall database and its data analysis capabilities.

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Executive summary

This report contains:

- a brief description of the coastal rainfall monitoring program
- guidelines on how to use this report
- information on how to access the database
- a review of significant program developments and rainfall events in 2016–2017
- a list of all stations for which Manly Hydraulics Laboratory collected rainfall data in 2016–2017 (Table 5.1)
- the annual data summaries for each station
- Appendix A, which details the rainfall data available
- Appendix B, outlining some of the data analysis suites and presentation formats available
- Appendix C, a list of publications which may be of interest.

Contents

1. Rainfall monitoring program

This report presents the thirty-second year of rainfall data collected by Manly Hydraulics Laboratory (MHL). The network of automatic recorders and the associated analysis routines enable efficient delivery of near real time rainfall data from stations across NSW. Extracts from the historical database of rainfall data can also be made available on request (refer to Appendix A).

The present program is based on a network of automatic rainfall recording stations installed at various coastal sites (see Section 5 Station Location Maps). The network consists of 73 permanent stations funded by OEH and this network supplements the coverage provided by the Bureau of Meteorology's rainfall network. The system utilises 0.2 mm and 0.5 mm tipping buckets and data loggers, as shown in Figure 1.

Rainfall data is transferred to MHL's databases, located in the NSW Government Data Centre, using a variety of telemetry techniques including internet protocols (IP), landline telephone, cellular networks and event-reporting radio telemetry system (ERTS). The incoming raw data is then made available in near real time to external users to view online as schematised in Figure 2.

Data is stored in a database and subject to a quality assurance process which involves several control steps to maintain data quality. Computer programs are used to further format and analyse data.

Data is backed up daily and archived to magnetic tape as a security measure at regular intervals, and copies are stored off site.

2. How to use this report

This report aims to streamline access to MHL's services and to the rainfall database.

The NSW coastline has been divided into geographic regions based on river systems. Location maps display the station locations and the annual plots confirm the availability and suitability of data for the particular period of interest. A list of rainfall station data collected and stored online is included in Appendix A.

Once a choice has been made of the period for which information is required, data and services can be obtained in a variety of formats, according to their intended use.

Appendix B provides examples of data analysis and presentation formats available from MHL. Available rainfall products include:

Tabulated output

- daily totals
- intensity/duration tables
- time of tips of rain gauge or short period fixed time step data
- intensity-frequency-duration tables.

Graphical plots

- hourly, daily, monthly and yearly hyetographs (a graphical representation of rainfall distribution over a period of time)
- intensity-frequency-duration curves.

3. How to access the data

MHL provides a full online data access service via the internet for its clients, and a restricted service for the general public at http://www.mhl.nsw.gov.au/.

Typically the last seven days of data are available online in a non-quality controlled form to aid the fastest possible access to data records. The online service for clients can provide access to all data catalogued in Appendix A.

Quality controlled data may be ordered via the MHL web page (http://www.mhl.nsw.gov.au), by emailing data-request@mhl.nsw.gov.au, or via customised decision support tools that can be provided on request.

4. Significant events and developments

This section outlines events and developments which have influenced rainfall data monitoring during the 2016–2017 reporting period.

The following stations were upgraded during the fiscal year:

- Whitemans Ridge – full station rebuild due to outdated instrumentation
- Hamlyn Terrace – rain gauge replacement
- Koolewong 2 – rain gauge replacement
- Lake Conjola Downstream – rain gauge installed at the new water level station.

In the 2016–2017 fiscal year, the maximum recorded rainfall intensities for 11 durations between 5 minutes and 72 hours occurred at three different stations across the OEH rainfall network (Table 4.1). To determine the significance of a rainfall event, the intensities are compared against the Annual Exceedance Probability (AEP), where the AEP is the probability of an event occurring in any one year at a particular duration. An event with a 1% AEP (or the 100-year rainfall) is an event that has a 1% chance of being equalled or exceeded in any one year.

A summary of rainfall events for each month during 2016–2017 on the NSW east coast is provided in Table 4.2. 100 mm of rain falling in a 24-hour period has been deemed a suitably significant rain event by OEH.

The maximum recorded rainfall for durations of 5 minutes to 72 hours at each station for 2016–2017 is presented in Table 4.3.

Table 4.1 Maximum recorded intensities for all stations

Duration	Station	Date	Rainfall (mm)	Rainfall (mm/hr)	AEP (%)
5min	Kulnura	19/02/2017	17.5	210.0	~10
10min	Kulnura	19/02/2017	27.5	165.0	~10
20min	Huonbrook	01/02/2017	43.5	130.5	~5
30min	Huonbrook	01/02/2017	62.0	124.0	~2
60min	Huonbrook	01/02/2017	93.0	93.0	~2
3hrs	Cudgera	30/03/2017	164.5	54.8	~2
6hrs	Cudgera	31/03/2017	248.0	41.3	~2
12hrs	Cudgera	31/03/2017	288.5	24.0	~5
24hrs	Huonbrook	31/03/2017	483.6	20.2	~2
48hrs	Huonbrook	31/03/2017	511.2	10.7	~5
72hrs	Huonbrook	31/03/2017	511.2	7.1	~10

Table 4.2 2016–2017 Summary of rainfall events

Month	Summary of rainfall events
July 2016	No events exceeding 100 mm in 24 hours have occurred this month.
August 2016	Daily rainfall exceeding 100 mm in 24 hours has occurred at seven stations in the Bellinger River region, two stations in the Nambucca River region, one station in the Macleay River region, two stations in the Hastings River region, one station in the Camden Haven River region and one station in the Hawkesbury River region.
September 2016	No events exceeding 100 mm in 24 hours have occurred this month.
October 2016	No events exceeding 100 mm in 24 hours have occurred this month.
November 2016	No events exceeding 100 mm in 24 hours have occurred this month.
December 2016	No events exceeding 100 mm in 24 hours have occurred this month.
January 2017	Daily rainfall exceeding 100 mm in 24 hours has occurred at two stations in the Brunswick River region and at six stations in the Bellinger River region.
February 2017	Daily rainfall exceeding 100 mm in 24 hours has occurred at six stations in the Wollongong Coastal region.
March 2017	Daily rainfall exceeding 100 mm in 24 hours has occurred at one station in the Tweed River region, three stations in the Brunswick River region, eight stations in the Bellinger River region, two stations in the Nambucca River region, one station in the Macleay River region, one station in the Hastings River region, one station in the Camden Haven River region, one station in the Macquarie-Tuggerah Lakes region, one station in the Hawkesbury River region and 15 stations in the Wollongong Coastal region.
April 2017	No events exceeding 100 mm in 24 hours have occurred this month.
May 2017	No events exceeding 100 mm in 24 hours have occurred this month.
June 2017	Daily rainfall exceeding 100 mm in 24 hours has occurred at one station in the Tweed River region, three stations in the Brunswick River region, two stations in the Bellinger River region, three stations in the Macquarie-Tuggerah Lakes region and two stations in the Hawkesbury River region

4.1 Southern Oscillation Index

The Southern Oscillation Index (SOI) is a calculation of monthly or seasonal shifts in the air pressure between Darwin and Tahiti (source: Bureau of Meteorology). As well as being linked to the temperature of the Pacific Ocean and the strength of Pacific trade winds, the SOI is also associated with rainfall and can be used to predict whether higher or lower than average rainfall may occur in northern and eastern Australia.

A La Niña episode occurs when there are ongoing positive SOI values, and increases the probability of higher than average rainfall in northern and eastern Australia. Sustained negative SOI values have been coined El Niño events, and are associated with a reduction in rainfall over northern and eastern Australia. Even low to moderate El Niño events can lead to severe droughts in Australia. The SOI for the period July 1997 to June 2017 is graphically represented in Figure 3.

4.2 Data provision

Rainfall data is provided to the public on behalf of OEH via the following:

- MHL's public internet home pages, providing near real time access to a limited sample of data. Other methods of disseminating data include email correspondence and File Transfer Protocol (FTP)
- the NSW Government Water Information website at http://waterinfo.nsw.gov.au/ which provides a link to MHL's webpage for access to near real time rainfall data
- MHL provides OEH and NSW State Emergency Service officers access to near real time environmental data and our 'quality assured' historical database through the OEH information portal, which is password protected
- NSW SES officers also receive automated notifications from flood warning systems in NSW
- a web-based data request system is available where electronic requests can be submitted via MHL's homepage at http://www.mhl.nsw.gov.au under the data request menu.

During 2016-2017:

- MHL received in excess of 90,000 visitors per month to its website
- MHL served in excess of 166,000 webpage hits per month to customers and to the public
- approximately 1,500,000 webpage hits were recorded from the public (excluding customers) in 2016–2017.

Data access also continues to assist the Bureau of Meteorology, local government authorities, State Emergency Service, NSW Police, WaterNSW, NSW Surf Life Saving Association, universities, the NSW court system, private consultancies, NSW Roads and Maritime Services and the Natural Resources Commission.

Table 4.3 2016–2017 Maximum recorded rainfall (mm)

Station	Duration											Total yearly rainfall
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Cudgera	13/06/2017 9.5	13/06/2017 13.5	30/03/2017 25.5	30/03/2017 36.0	30/03/2017 66.0	30/03/2017 164.5	31/03/2017 248.0	31/03/2017 288.5	31/03/2017 367.4	31/03/2017 395.5	31/03/2017 395.3	1577.0
Main Arm	2/01/2017 11.0	2/01/2017 21.0	2/01/2017 37.0	2/01/2017 51.0	2/01/2017 81.5	31/03/2017 156.0	31/03/2017 233.5	31/03/2017 282.0	31/03/2017 461.0	31/03/2017 493.4	31/03/2017 493.2	2116.0
Huonbrook[1]	2/01/2017 14.0	2/01/2017 24.0	2/01/2017 43.5	2/01/2017 62.0	2/01/2017 93.0	2/01/2017 123.0	31/03/2017 172.5	30/03/2017 264.5	31/03/2017 483.6	31/03/2017 511.2	31/03/2017 511.2	2182.0
Myocum	9/11/2016 12.0	9/11/2016 17.5	9/11/2016 22.0	18/03/2017 27.0	18/03/2017 42.5	31/03/2017 100.0	31/03/2017 144.5	31/03/2017 173.5	31/03/2017 256.1	31/03/2017 265.4	1/04/2017 265.7	1799.0
Lake Ainsworth	6/12/2016 13.5	6/12/2016 25.0	6/12/2016 33.5	6/12/2016 34.5	6/12/2016 43.5	15/03/2017 73.0	31/03/2017 114.5	31/03/2017 135.5	31/03/2017 197.0	31/03/2017 202.1	31/03/2017 202.3	1825.5
Wooli Caravan Park	5/12/2016 11.5	5/12/2016 20.5	5/12/2016 30.0	5/12/2016 35.5	5/12/2016 37.5	3/08/2016 40.5	3/08/2016 54.5	4/08/2016 83.5	4/08/2016 91.0	5/08/2016 104.6	5/08/2016 113.8	1715.0
Perry Drive	14/11/2016 6.5	9/11/2016 11.0	9/11/2016 20.0	9/11/2016 22.0	9/11/2016 24.5	3/08/2016 42.0	3/08/2016 73.5	4/08/2016 118.6	4/08/2016 139.4	4/08/2016 152.2	5/08/2016 155.5	1726.0
Shephards Lane	9/11/2016 8.5	9/11/2016 15.5	9/11/2016 24.5	9/11/2016 27.0	9/11/2016 28.0	3/08/2016 50.0	3/08/2016 85.0	4/08/2016 135.5	4/08/2016 166.6	4/08/2016 180.0	5/08/2016 182.2	1845.0
Red Hill	9/11/2016 10.0	9/11/2016 17.5	9/11/2016 29.0	9/11/2016 30.5	9/11/2016 31.0	3/08/2016 53.5	3/08/2016 94.0	3/08/2016 151.6	4/08/2016 192.5	4/08/2016 203.5	5/08/2016 205.9	1934.5
Newports Creek[1]	31/10/2016 9.0	31/10/2016 15.5	9/11/2016 24.0	9/11/2016 29.0	9/11/2016 31.5	3/08/2016 59.0	3/08/2016 94.5	3/08/2016 157.6	4/08/2016 205.0	4/08/2016 216.0	5/08/2016 217.4	1982.5
Middle Boambee	31/10/2016 11.5	31/10/2016 19.0	1/11/2016 27.5	1/11/2016 32.5	1/11/2016 38.0	1/11/2016 40.0	3/08/2016 73.0	4/08/2016 132.0	4/08/2016 135.1	4/08/2016 142.6	5/08/2016 144.0	1977.5
North Bonville	5/12/2016 5.5	3/08/2016 10.0	3/08/2016 18.5	3/08/2016 24.0	3/08/2016 30.0	3/08/2016 52.0	3/08/2016 79.0	3/08/2016 132.0	4/08/2016 166.6	4/08/2016 181.9	4/08/2016 182.2	1793.5
Kooroowi	5/12/2016 5.5	5/12/2016 7.5	5/12/2016 10.0	5/12/2016 16.0	5/12/2016 24.5	3/08/2016 40.5	3/08/2016 63.5	4/08/2016 89.0	3/08/2016 105.6	4/08/2016 111.4	5/08/2016 113.8	1270.5

Station	Duration											Total yearly rainfall
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Stuarts Island Downstream	28/10/2016 8.0	28/10/2016 12.0	28/10/2016 18.0	28/10/2016 20.5	3/08/2016 22.0	3/08/2016 49.5	3/08/2016 69.5	3/08/2016 118.0	3/08/2016 143.5	4/08/2016 147.4	5/08/2016 148.3	1410.0
Utungun[1]	1/11/2016 7.5	1/11/2016 11.5	1/11/2016 15.0	28/10/2016 21.5	28/10/2016 26.0	3/08/2016 43.0	3/08/2016 74.5	3/08/2016 110.5	4/08/2016 128.4	4/08/2016 132.0	5/08/2016 133.9	1224.0
Aldavilla Downstream[1]	1/11/2016 12.0	1/11/2016 21.0	1/11/2016 24.0	1/11/2016 24.0	1/11/2016 24.0	3/08/2016 33.0	3/08/2016 60.0	3/08/2016 95.0	3/08/2016 127.0	4/08/2016 138.2	4/08/2016 139.0	1079.0
Green Valley	5/12/2016 5.0	5/12/2016 9.0	1/11/2016 11.0	1/11/2016 15.0	1/11/2016 19.5	3/08/2016 37.5	3/08/2016 59.0	3/08/2016 97.6	4/08/2016 119.5	4/08/2016 138.2	5/08/2016 141.8	1243.5
Telegraph Point[1]	3/08/2016 5.0	17/10/2016 9.5	3/08/2016 13.0	3/08/2016 17.0	3/08/2016 23.0	3/08/2016 45.0	3/08/2016 75.5	3/08/2016 113.5	4/08/2016 142.1	4/08/2016 156.5	5/08/2016 158.4	807.0
Logans Crossing	5/12/2016 6.0	5/12/2016 11.5	5/12/2016 17.5	5/12/2016 19.5	3/08/2016 32.0	3/08/2016 53.5	3/08/2016 77.5	3/08/2016 114.5	3/08/2016 132.0	4/08/2016 139.2	5/08/2016 141.1	1247.5
Mount George[2]												
Nabiac	19/02/2017 11.5	19/02/2017 15.0	19/02/2017 17.5	19/02/2017 21.5	19/02/2017 27.0	19/03/2017 40.0	19/03/2017 45.5	15/03/2017 54.0	16/03/2017 95.0	16/03/2017 115.2	18/03/2017 128.2	935.5
Tuncurry Downstream	17/12/2016 5.5	17/12/2016 11.0	17/12/2016 15.5	17/12/2016 16.0	14/03/2017 24.0	19/02/2017 31.5	3/08/2016 38.5	3/08/2016 65.0	3/08/2016 77.5	16/03/2017 121.9	16/03/2017 126.7	1103.5
Pacific Palms Wharf	5/12/2016 7.0	18/02/2017 12.0	22/03/2017 20.0	22/03/2017 24.5	22/03/2017 33.5	22/03/2017 35.5	22/03/2017 45.0	15/03/2017 50.5	15/03/2017 55.9	16/03/2017 79.2	17/03/2017 82.8	1142.0
Tarbuck Bay	19/02/2017 13.0	19/02/2017 21.5	19/02/2017 25.5	19/02/2017 28.5	19/02/2017 34.5	19/02/2017 44.0	19/02/2017 47.0	15/03/2017 57.5	15/03/2017 66.0	16/03/2017 93.6	16/03/2017 95.0	1265.5
Bulahdelah	19/03/2017 7.5	19/03/2017 14.0	19/03/2017 20.0	19/03/2017 24.0	19/03/2017 28.0	19/03/2017 34.5	22/03/2017 42.0	19/03/2017 47.0	19/03/2017 58.6	19/03/2017 110.9	19/03/2017 112.3	1053.0
Gostwyck	17/02/2017 8.0	17/02/2017 14.5	17/02/2017 23.5	17/02/2017 23.5	17/02/2017 24.5	17/02/2017 34.0	17/02/2017 34.5	17/02/2017 34.6	18/03/2017 51.6	19/03/2017 61.4	10/06/2017 83.5	853.0
Seaham	17/02/2017 15.0	17/02/2017 21.0	17/02/2017 27.0	17/02/2017 28.5	17/02/2017 29.5	4/03/2017 33.5	2/01/2017 36.5	2/01/2017 46.0	4/03/2017 67.9	5/03/2017 81.6	10/06/2017 95.8	988.0
Belmore Bridge	24/12/2016 6.0	24/12/2016 11.0	24/12/2016 21.5	24/12/2016 30.5	24/12/2016 37.0	4/03/2017 58.0	4/03/2017 60.5	4/03/2017 62.0	4/03/2017 76.1	5/03/2017 80.2	10/06/2017 103.7	896.5

Station	Duration											Total yearly rainfall
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Hexham Bridge	16/02/2017 9.0	16/02/2017 17.5	16/02/2017 20.5	17/02/2017 21.0	17/02/2017 24.0	30/03/2017 25.0	30/03/2017 32.5	30/03/2017 37.0	10/06/2017 42.5	9/06/2017 73.4	10/06/2017 103.7	819.5
Barnsley	24/01/2017 6.5	24/01/2017 11.5	24/01/2017 16.0	24/01/2017 21.0	24/01/2017 26.0	24/01/2017 29.0	18/03/2017 33.0	18/03/2017 43.6	18/03/2017 65.0	19/03/2017 77.3	19/03/2017 87.8	898.5
Martinsville	14/03/2017 11.5	14/03/2017 20.0	14/03/2017 33.0	14/03/2017 35.0	14/03/2017 37.0	14/03/2017 37.5	30/03/2017 40.0	30/03/2017 50.5	7/06/2017 56.4	16/03/2017 85.9	18/03/2017 90.7	1028.5
Mandalong	30/03/2017 8.0	30/03/2017 12.0	30/03/2017 16.0	30/03/2017 17.0	30/03/2017 19.0	7/06/2017 27.0	30/03/2017 44.0	30/03/2017 56.5	31/03/2017 57.1	18/03/2017 68.6	18/03/2017 89.3	1019.5
Wyee	14/03/2017 6.0	14/03/2017 10.5	14/03/2017 16.0	14/03/2017 18.5	14/03/2017 29.5	14/03/2017 40.0	14/03/2017 43.5	7/06/2017 46.0	8/06/2017 67.9	16/03/2017 89.3	10/06/2017 110.2	1156.5
Whitemans Ridge	28/02/2017 5.0	24/01/2017 9.0	7/06/2017 14.5	7/06/2017 19.5	7/06/2017 25.0	7/06/2017 30.5	7/06/2017 39.0	7/06/2017 57.5	7/06/2017 73.0	8/06/2017 83.0	10/06/2017 110.9	1104.5
Yarramalong[1]	1/03/2017 7.5	30/03/2017 10.5	24/01/2017 17.5	24/01/2017 22.0	9/11/2016 25.5	3/03/2017 31.0	3/03/2017 37.0	30/03/2017 47.0	16/03/2017 55.0	19/03/2017 83.0	18/03/2017 109.4	821.0
Kulnura	19/02/2017 17.5	19/02/2017 27.5	19/02/2017 35.5	19/02/2017 40.0	30/03/2017 47.0	30/03/2017 64.5	30/03/2017 82.5	30/03/2017 119.5	30/03/2017 119.5	19/03/2017 153.1	18/03/2017 198.7	2301.5
Toukley	7/06/2017 9.0	7/06/2017 14.0	3/03/2017 23.5	3/03/2017 27.0	3/03/2017 28.0	30/03/2017 40.0	14/03/2017 47.5	14/03/2017 49.6	8/06/2017 71.0	16/03/2017 81.6	9/06/2017 119.5	909.5
Hamlyn Terrace	9/11/2016 7.0	26/02/2017 13.0	7/06/2017 20.5	7/06/2017 25.5	7/06/2017 34.0	7/06/2017 47.5	30/03/2017 52.5	7/06/2017 79.0	8/06/2017 111.6	8/06/2017 123.8	9/06/2017 172.8	1246.5
Mardi Dam	17/02/2017 7.5	17/02/2017 13.5	17/02/2017 22.0	17/02/2017 28.0	7/06/2017 30.5	7/06/2017 49.5	7/06/2017 61.0	7/06/2017 95.5	7/06/2017 100.6	8/06/2017 115.7	10/06/2017 140.4	1223.5
Sterland	14/03/2017 8.0	14/03/2017 14.0	14/03/2017 17.5	24/01/2017 20.5	24/01/2017 25.0	18/03/2017 31.5	18/03/2017 47.0	18/03/2017 60.5	18/03/2017 70.6	19/03/2017 108.0	19/03/2017 131.8	1324.5
Kangy Angy	17/02/2017 11.0	17/02/2017 17.5	17/02/2017 29.5	17/02/2017 35.5	17/02/2017 36.5	7/06/2017 44.5	7/06/2017 56.5	7/06/2017 86.5	15/03/2017 91.0	16/03/2017 111.8	16/03/2017 135.4	1260.0
Berkeley Vale	16/06/2017 8.0	17/02/2017 13.5	17/02/2017 26.5	17/02/2017 33.5	17/02/2017 34.5	7/06/2017 53.5	7/06/2017 65.0	7/06/2017 102.0	7/06/2017 105.6	8/06/2017 118.1	10/06/2017 135.4	1200.3
Bateau Bay	17/02/2017 9.0	17/02/2017 13.0	17/02/2017 20.5	17/02/2017 24.5	17/02/2017 25.5	7/06/2017 36.0	7/06/2017 42.5	7/06/2017 66.0	8/06/2017 69.6	8/06/2017 81.1	9/06/2017 94.3	1149.5

Station	Duration											Total yearly rainfall
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Lisarow[2]												
Strickland	17/02/2017 8.5	22/03/2017 13.0	24/01/2017 17.0	17/02/2017 23.5	7/06/2017 26.5	7/06/2017 40.0	7/06/2017 46.5	7/06/2017 60.5	8/06/2017 73.9	8/06/2017 101.3	16/03/2017 135.4	1357.0
Narara	22/03/2017 10.5	22/03/2017 19.5	22/03/2017 30.5	22/03/2017 37.0	22/03/2017 45.5	22/03/2017 46.0	22/03/2017 46.5	30/03/2017 59.0	22/03/2017 77.0	15/03/2017 109.0	16/03/2017 141.1	1409.5
Mount Elliot	17/02/2017 10.0	7/06/2017 14.0	7/06/2017 21.5	7/06/2017 27.0	30/03/2017 35.5	7/06/2017 50.0	7/06/2017 75.5	7/06/2017 107.5	7/06/2017 114.5	8/06/2017 139.7	9/06/2017 161.3	1473.0
Wyoming	17/02/2017 8.0	19/02/2017 12.5	19/02/2017 18.5	19/02/2017 22.5	30/03/2017 29.0	30/03/2017 35.5	30/03/2017 45.5	30/03/2017 64.6	8/06/2017 73.9	8/06/2017 99.8	10/06/2017 129.6	1373.5
Kincumber	19/02/2017 13.0	19/02/2017 25.0	19/02/2017 36.5	26/02/2017 41.0	30/03/2017 62.0	30/03/2017 72.5	30/03/2017 87.5	30/03/2017 129.0	15/03/2017 135.6	8/06/2017 182.9	9/06/2017 226.1	2602.0
Webbs Creek	19/02/2017 8.2	19/02/2017 15.2	19/02/2017 22.0	19/02/2017 22.8	9/11/2016 24.4	18/03/2017 30.8	18/03/2017 37.6	30/03/2017 44.8	18/03/2017 53.5	19/03/2017 72.0	19/03/2017 78.5	852.8
Colo Junction	21/11/2016 6.4	21/11/2016 12.4	21/11/2016 21.4	21/11/2016 24.8	21/11/2016 25.8	21/11/2016 26.4	18/03/2017 30.2	30/03/2017 42.0	30/03/2017 42.2	18/03/2017 51.4	18/03/2017 74.9	795.2
Sackville D/S[1]	24/12/2016 5.8	24/12/2016 11.2	24/12/2016 15.0	24/12/2016 17.4	24/12/2016 20.2	24/12/2016 27.6	24/12/2016 29.6	30/03/2017 30.6	20/07/2016 33.6	18/03/2017 46.1	18/03/2017 57.6	573.2
Curl Curl	14/02/2017 12.0	14/02/2017 22.0	14/02/2017 38.5	14/02/2017 44.0	14/02/2017 51.5	14/02/2017 54.0	14/02/2017 54.0	30/03/2017 59.5	7/06/2017 64.6	8/06/2017 88.3	9/06/2017 107.3	1235.5
Kelso Creek	18/03/2017 6.5	18/03/2017 8.5	1/03/2017 15.5	1/03/2017 22.0	26/02/2017 24.5	26/02/2017 38.0	26/02/2017 42.0	24/08/2016 43.0	7/06/2017 51.1	8/06/2017 58.6	4/03/2017 88.6	825.5
Rixons Pass	15/01/2017 10.0	22/03/2017 17.0	25/02/2017 24.5	25/02/2017 32.5	26/02/2017 45.0	26/02/2017 61.5	26/02/2017 83.5	16/03/2017 88.6	17/03/2017 108.5	18/03/2017 143.5	18/03/2017 175.7	1319.5
Russell Vale	16/03/2017 7.5	22/03/2017 15.0	25/02/2017 21.0	16/03/2017 26.0	26/02/2017 32.5	16/03/2017 48.0	26/02/2017 69.5	16/03/2017 71.5	17/03/2017 89.5	18/03/2017 114.2	18/03/2017 138.2	1104.5
Mount Pleasant	25/02/2017 7.0	25/02/2017 14.0	25/02/2017 22.0	26/02/2017 27.5	25/02/2017 37.5	16/03/2017 67.0	16/03/2017 89.5	16/03/2017 110.0	17/03/2017 129.6	18/03/2017 163.2	19/03/2017 198.7	1425.0
Mount Kembla[1]	18/02/2017 11.0	18/02/2017 17.5	3/03/2017 23.0	3/03/2017 30.5	18/02/2017 49.0	16/03/2017 66.0	16/03/2017 103.0	16/03/2017 122.0	17/03/2017 133.4	16/03/2017 155.0	19/03/2017 187.2	1115.0
Dombarton Loop	18/02/2017 11.5	22/03/2017 18.0	16/03/2017 27.0	16/03/2017 36.0	16/03/2017 50.0	16/03/2017 86.0	16/03/2017 159.0	16/03/2017 178.0	16/03/2017 191.0	16/03/2017 225.1	19/03/2017 269.3	1427.0

Station	Duration											Total yearly rainfall
	5 min	10 min	20 min	30 min	60 min	3 hrs	6 hrs	12 hrs	24 hrs	48 hrs	72 hrs	
Wongawilli	18/02/2017 9.0	18/02/2017 17.0	16/03/2017 24.0	16/03/2017 32.0	16/03/2017 46.0	16/03/2017 81.5	16/03/2017 144.5	16/03/2017 156.0	16/03/2017 162.5	16/03/2017 187.7	19/03/2017 213.8	1041.0
Port Kembla	18/02/2017 8.5	18/02/2017 13.5	16/03/2017 18.5	16/03/2017 24.0	16/03/2017 44.5	16/03/2017 68.0	16/03/2017 83.5	16/03/2017 97.6	17/03/2017 113.5	18/03/2017 127.2	19/03/2017 134.6	1069.0
Darkes Road	16/03/2017 8.5	22/03/2017 17.0	16/03/2017 26.0	16/03/2017 30.5	16/03/2017 48.5	16/03/2017 82.5	16/03/2017 117.0	16/03/2017 134.0	17/03/2017 143.5	16/03/2017 171.8	18/03/2017 180.7	997.5
Cleveland Road	22/03/2017 10.0	22/03/2017 17.0	1/03/2017 23.5	1/03/2017 29.0	16/03/2017 36.0	16/03/2017 78.0	16/03/2017 117.5	16/03/2017 124.6	17/03/2017 131.0	16/03/2017 153.1	19/03/2017 161.3	1020.5
Huntley Colliery	18/02/2017 10.0	18/02/2017 14.5	16/03/2017 27.5	16/03/2017 39.5	16/03/2017 58.5	16/03/2017 106.5	16/03/2017 165.5	16/03/2017 181.0	16/03/2017 189.1	16/03/2017 231.4	16/03/2017 239.8	1139.5
Upper Calderwood	16/03/2017 10.0	16/03/2017 18.5	16/03/2017 29.5	16/03/2017 40.0	16/03/2017 60.0	16/03/2017 140.0	16/03/2017 187.5	16/03/2017 206.5	16/03/2017 212.4	16/03/2017 258.2	16/03/2017 265.7	1059.5
Little Lake Entrance	6/04/2017 16.5	6/04/2017 21.0	6/04/2017 21.0	7/02/2017 22.0	7/02/2017 40.0	7/02/2017 81.5	16/03/2017 90.0	16/03/2017 96.0	17/03/2017 104.4	18/03/2017 115.2	19/03/2017 120.2	1003.0
North Macquarie	16/03/2017 9.0	16/03/2017 16.5	16/03/2017 28.5	16/03/2017 41.0	16/03/2017 67.5	16/03/2017 146.0	16/03/2017 187.5	16/03/2017 211.0	16/03/2017 219.1	16/03/2017 277.4	19/03/2017 302.4	1414.5
Clover Hill	16/03/2017 8.0	16/03/2017 15.0	16/03/2017 28.5	16/03/2017 39.0	16/03/2017 64.0	16/03/2017 141.0	16/03/2017 179.5	16/03/2017 205.6	17/03/2017 215.5	16/03/2017 280.8	17/03/2017 313.2	1448.0
Nurrewin	16/03/2017 7.5	16/03/2017 12.0	16/03/2017 23.0	16/03/2017 30.0	16/03/2017 54.5	16/03/2017 117.5	16/03/2017 157.0	16/03/2017 171.5	16/03/2017 174.0	16/03/2017 205.0	16/03/2017 221.8	932.5
Yellow Rock Road	16/03/2017 9.0	16/03/2017 16.0	16/03/2017 30.5	16/03/2017 42.0	16/03/2017 65.5	16/03/2017 135.5	16/03/2017 167.0	16/03/2017 189.5	17/03/2017 198.5	18/03/2017 213.1	19/03/2017 247.7	1196.0
Lake Conjola Downstream	30/12/2016 9.5	13/07/2016 16.0	13/07/2016 20.5	16/03/2017 28.5	16/03/2017 51.0	16/03/2017 73.0	16/03/2017 83.5	16/03/2017 92.5	17/03/2017 97.0	8/07/2016 142.6	4/03/2017 148.3	1122.5
Barlows Bay	4/03/2017 7.5	4/03/2017 13.5	4/03/2017 19.5	4/03/2017 21.0	3/04/2017 26.5	3/04/2017 46.5	3/04/2017 66.0	20/05/2017 103.6	20/05/2017 145.4	21/05/2017 145.9	21/05/2017 146.2	873.0
Regatta Point	3/03/2017 6.5	3/03/2017 11.0	3/03/2017 14.0	3/03/2017 20.0	3/03/2017 24.0	23/03/2017 30.5	3/03/2017 41.0	20/05/2017 69.5	20/05/2017 94.6	21/05/2017 95.0	21/05/2017 95.0	673.0

[1] Some measure of data loss occurred at these stations. See individual plots for further details.
[2] Storm analysis was not undertaken at these stations due to the extended periods of *very poor* or *missing* data.
NB: The date listed refers to the time that the recorded total rainfall ends.

5. Rainfall monitoring summary

This section documents locality maps and quality assured rainfall monitoring summaries for each station. Table 5.1 and Table 5.2 provide indexes to the figures presented. The rainfall plots shown in Figure 5 to Figure 92 are presented as daily rainfall totals from midnight to midnight.

Table 5.1 Index of figures

	Figure
Typical pluviometer station	1
Data transfer schematic	2
Southern Oscillation Index, June 1997–June 2017	3

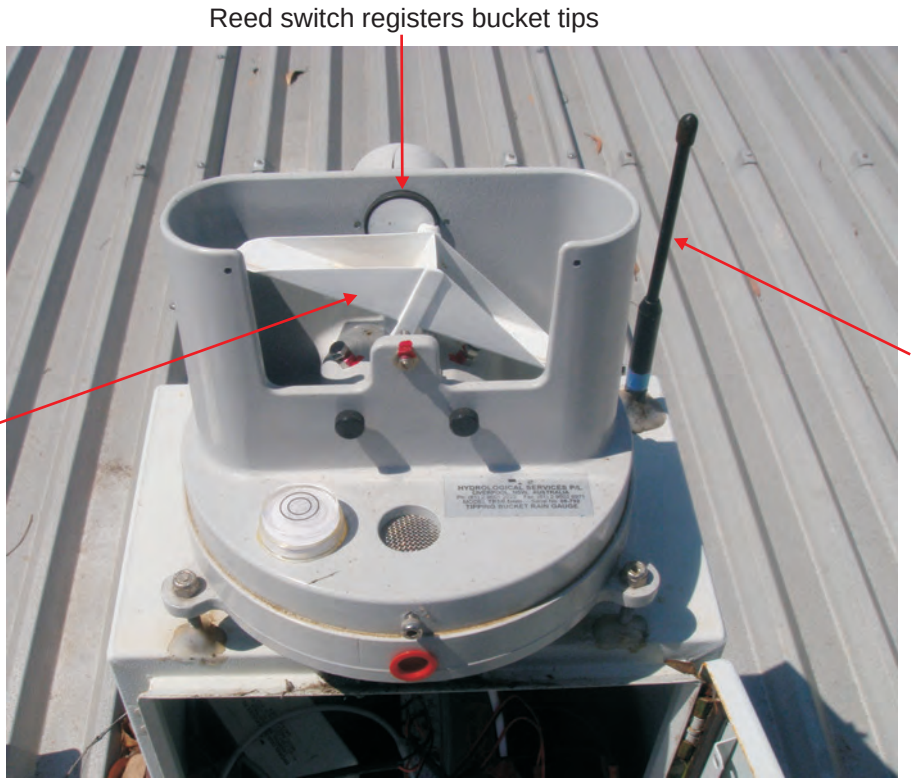
Region	Short name	Station no.	MGA	Easting	Northing	Figure
Station Locality Map	Tweed River and Brunswick River Regions					4
Tweed	Cudgera	558046	56	549668	6859164	5
Brunswick	Main Arm	558053	56	542469	6847276	6
Brunswick	Huonbrook	558049	56	537723	6841573	7
Brunswick	Myocum	558036	56	550528	6837390	8
Station Locality Map	Richmond River Region					9
Richmond	Lake Ainsworth	203455	56	557863	6816160	10
Station Locality Map	Bellinger River Region (North)					11
Bellinger	Wooli Caravan Park	205463	56	524551	6697797	12
Station Locality Map	Bellinger River Region (South)					13
Bellinger	Perry Drive	559019	56	510142	6650416	14
Bellinger	Shephards Lane	559017	56	508196	6650884	15
Bellinger	Red Hill	559016	56	506635	6649672	16
Bellinger	Newports Creek	559051	56	505893	6646680	17
Bellinger	Middle Boambee	559048	56	504720	6645291	18
Bellinger	North Bonville	559050	56	500593	6641143	19
Bellinger	Kooroowi	205440	56	482967	6629647	20
Station Locality Map	Nambucca River Region					21
Nambucca	Stuarts Island Downstream	205466	56	499519	6608564	22
Nambucca	Utungun	205414	56	485800	6600344	23
Station Locality Map	Macleay River and Hastings River Regions					24
Macleay	Aldavilla Downstream	206459	56	479318	6561231	25
Hastings	Green Valley	207406	56	486416	6540068	26
Hastings	Telegraph Point	207415	56	481082	6534512	27

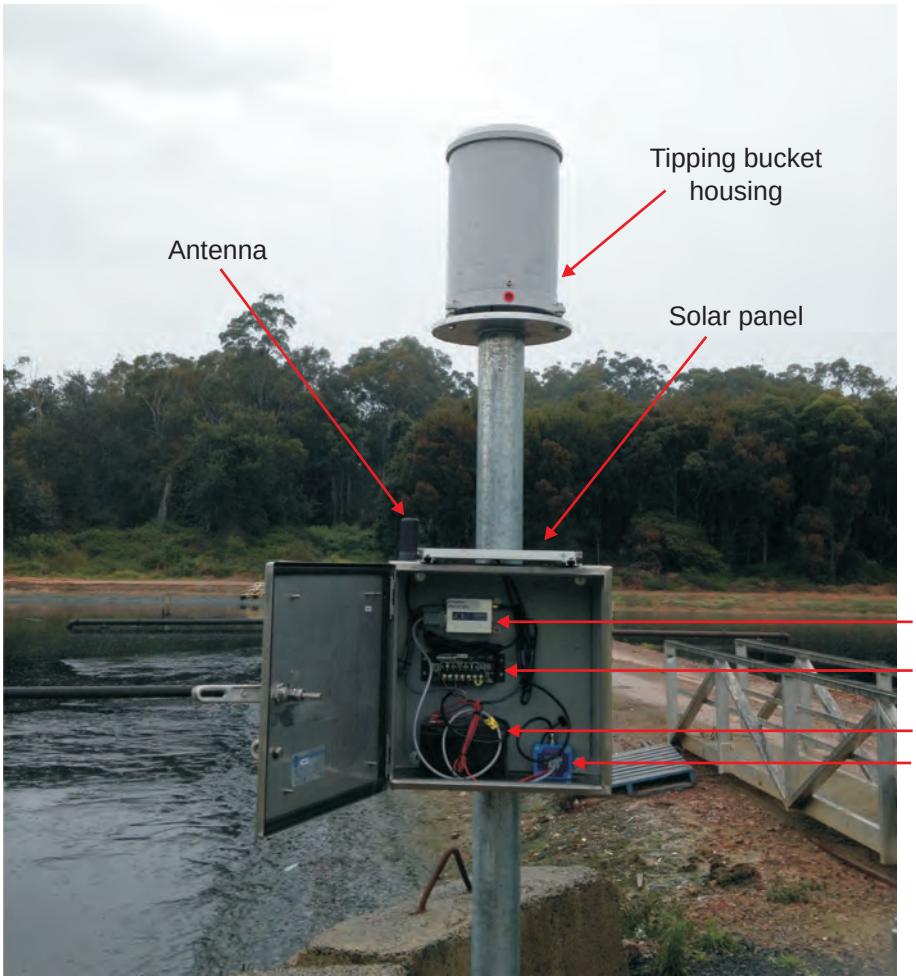
Region	Short name	Station no.	MGA	Easting	Northing	Figure
Station Locality Map	Camden Haven Region					28
Camden Haven	Logans Crossing	207428	56	470913	6502295	29
Manning	Mount George	208440	56	419229	6472262	30
Station Locality Map	Karuah River Region					31
Karuah	Nabiac	209404	56	436831	6446432	32
Karuah	Tuncurry Downstream	209401D	56	450368	6441819	33
Karuah	Pacific Palms Wharf	209406	56	455401	6422551	34
Karuah	Tarbuck Bay	209465	56	451548	6417906	35
Karuah	Bulahdelah	209460	56	425442	6413407	36
Station Locality Map	Hunter River Region					37
Hunter	Gostwyck	210402	56	369088	6396074	38
Hunter	Seaham	210462	56	381105	6385316	39
Hunter	Belmore Bridge	210458	56	364492	6377780	40
Hunter	Hexham Bridge	210448	56	376568	6368156	41
Station Locality Map	Macquarie-Tuggerah Lakes (North) Region					42
Macquarie-Tuggerah Lakes	Barnsley	561067	56	367906	6355834	43
Macquarie-Tuggerah Lakes	Martinsville	561083	56	351239	6341583	44
Macquarie-Tuggerah Lakes	Mandalong	561081	56	355224	6335165	45
Macquarie-Tuggerah Lakes	Wyee	561097	56	358608	6328268	46
Station Locality Map	Macquarie-Tuggerah Lakes (South), Brisbane Water and Hawkesbury River Regions					47
Macquarie-Tuggerah Lakes	Whitemans Ridge	561026	56	343653	6324899	48
Macquarie-Tuggerah Lakes	Yarramalong	561137	56	338869	6322377	49
Macquarie-Tuggerah Lakes	Kulnura	561078	56	333796	6321517	50
Macquarie-Tuggerah Lakes	Toukley	211401	56	362599	6318531	51
Macquarie-Tuggerah Lakes	Hamlyn Terrace	561133	56	357399	6319854	52
Macquarie-Tuggerah Lakes	Mardi Dam	561082	56	351038	6314555	53
Macquarie-Tuggerah Lakes	Sterland	567138	56	342433	6315335	54
Macquarie-Tuggerah Lakes	Kangy Angy	561132	56	350168	6310609	55
Macquarie-Tuggerah Lakes	Berkeley Vale	561134	56	353191	6309376	56
Macquarie-Tuggerah Lakes	Bateau Bay	561069	56	358098	6305653	57
Macquarie-Tuggerah Lakes	Lisarow	561079	56	348900	6305317	58
Hawkesbury	Strickland	561136	56	345377	6305541	59
Hawkesbury	Narara	561085	56	344310	6304220	60
Hawkesbury	Mount Elliot	561084	56	350646	6302980	61
Hawkesbury	Wyoming	561098	56	346415	6302026	62
Hawkesbury	Kincumber	561077	56	350387	6294461	63
Station Locality Map	Hawkesbury River (Mid) Region					64
Hawkesbury	Webbs Creek	212408	56	312331	6303939	65
Hawkesbury	Colo Junction	212407	56	303223	6298183	66
Hawkesbury	Sackville Downstream	212438	56	302769	6291566	67

Region	Short name	Station no.	MGA	Easting	Northing	Figure
Station Locality Map	Sydney Coastal Region					68
Sydney Coastal	Curl Curl	213426	56	342094	6262459	69
Sydney Coastal	Kelso Creek	213430	56	313782	6241020	70
Station Locality Map	Wollongong Coastal Region					71
Wollongong Coastal	Rixons Pass	568317	56	305281	6196889	72
Wollongong Coastal	Russell Vale	568318	56	306377	6196135	73
Wollongong Coastal	Mount Pleasant	568229	56	303026	6191630	74
Wollongong Coastal	Mount Kembla	568314	56	299550	6186441	75
Wollongong Coastal	Dombarton Loop	568307	56	294719	6185605	76
Wollongong Coastal	Wongawilli	568320	56	293261	6182388	77
Wollongong Coastal	Port Kembla	568316	56	306636	6182719	78
Wollongong Coastal	Darkes Road	568309	56	297450	6182477	79
Wollongong Coastal	Cleveland Road	568308	56	295800	6179726	80
Wollongong Coastal	Huntley Colliery	568311	56	290648	6178905	81
Wollongong Coastal	Upper Calderwood	568319	56	288750	6175160	82
Wollongong Coastal	Little Lake Entrance	214467	56	304250	6173571	83
Wollongong Coastal	Nurrewin	568228	56	284567	6173437	84
Wollongong Coastal	Clover Hill	568310	56	284233	6172392	85
Wollongong Coastal	North Macquarie	568315	56	291440	6171492	86
Wollongong Coastal	Yellow Rock Road	568321	56	292886	6167649	87
Station Locality Map	South Coast (North) Region					88
South Coast	Lake Conjola Downstream	216420	56	272446	6094316	89
Station Locality Map	South Coast (Mid) Region					90
South Coast	Barlows Bay	218415	56	239464	5988955	91
South Coast	Regatta Point	219405	56	236881	5971060	92

Table 5.2 Index of Appendix B figures

Sample rainfall data outputs	Figure
Sample daily and monthly rainfall plots	B1
Sample Intensity-Frequency-Duration formulated in 1987	B2
Sample Intensity-Frequency-Duration formulated in 2016	B3
Sample rain gauge tip times	B4
Quality code description	B5





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TYPICAL PLUVIOMETER STATION

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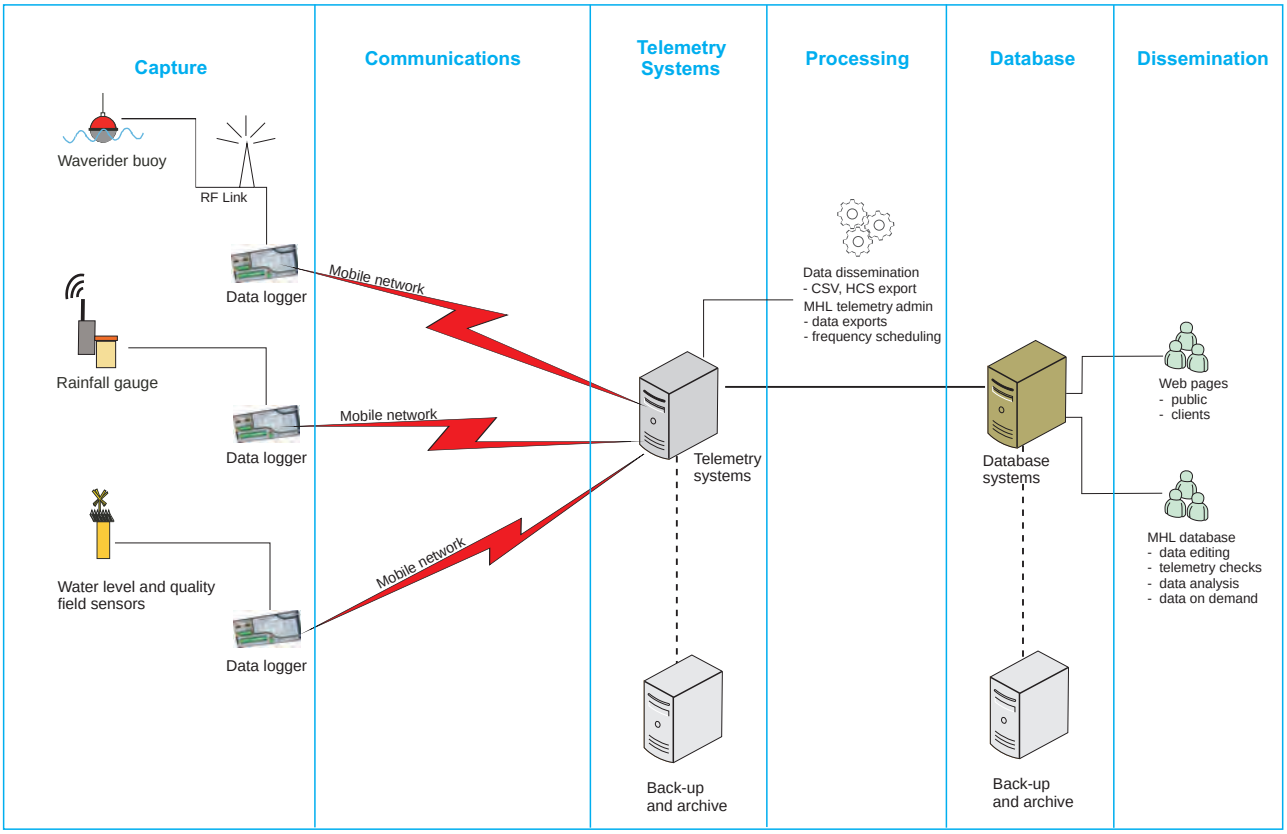
Figure 1

DRAWING 2575-1-3.cdr



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DATA TRANSFER SCHEMATIC

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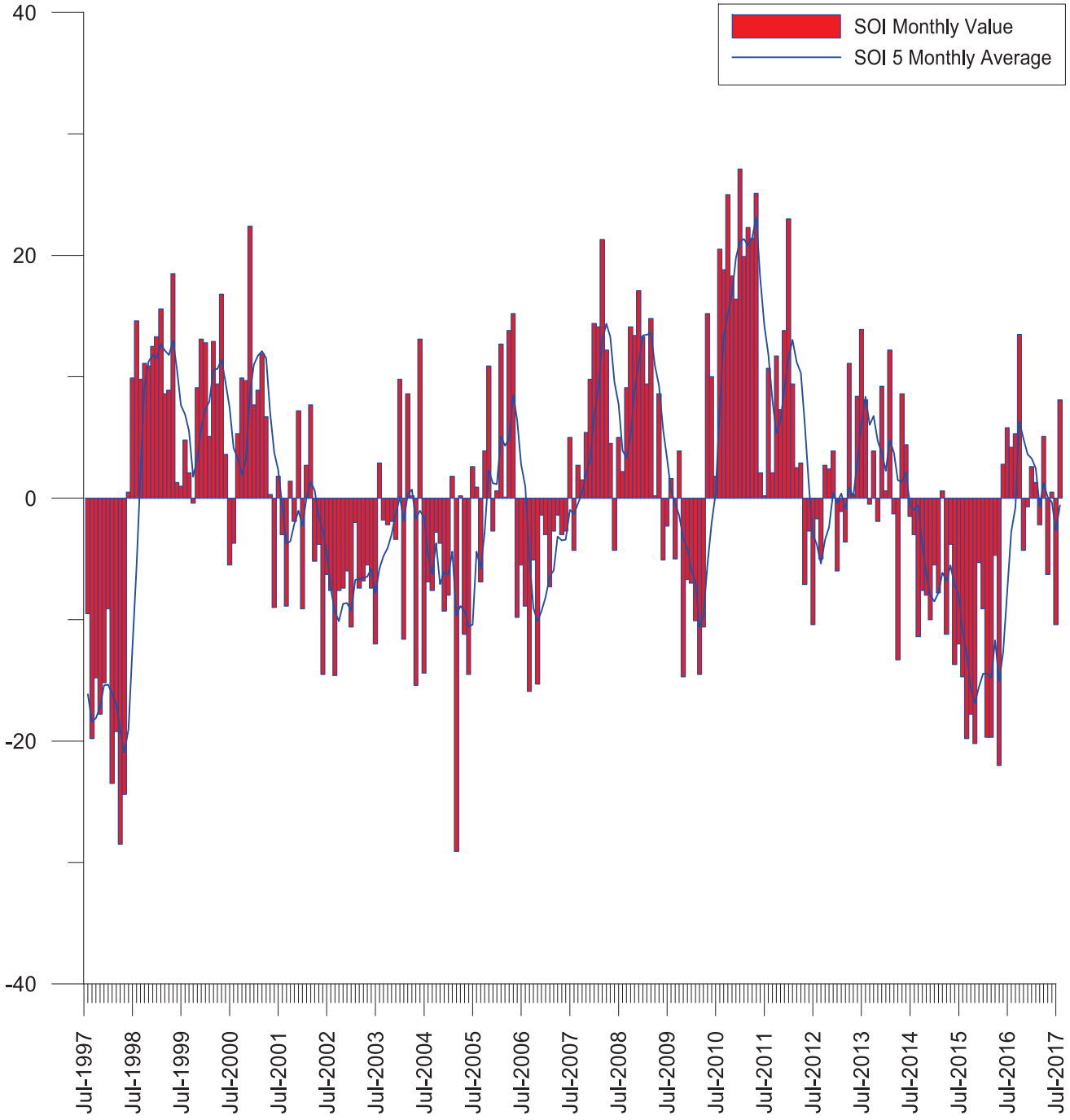
Figure 2

DRAWING 2575-1-3.cdr



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SOUTHERN OSCILLATION INDEX
JULY 1997–JUNE 2017

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Figure 3

DRAWING 2575-1-3.cdr

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RAINFALL STATION LOCATIONS
TWEED RIVER AND BRUNSWICK RIVER REGIONS

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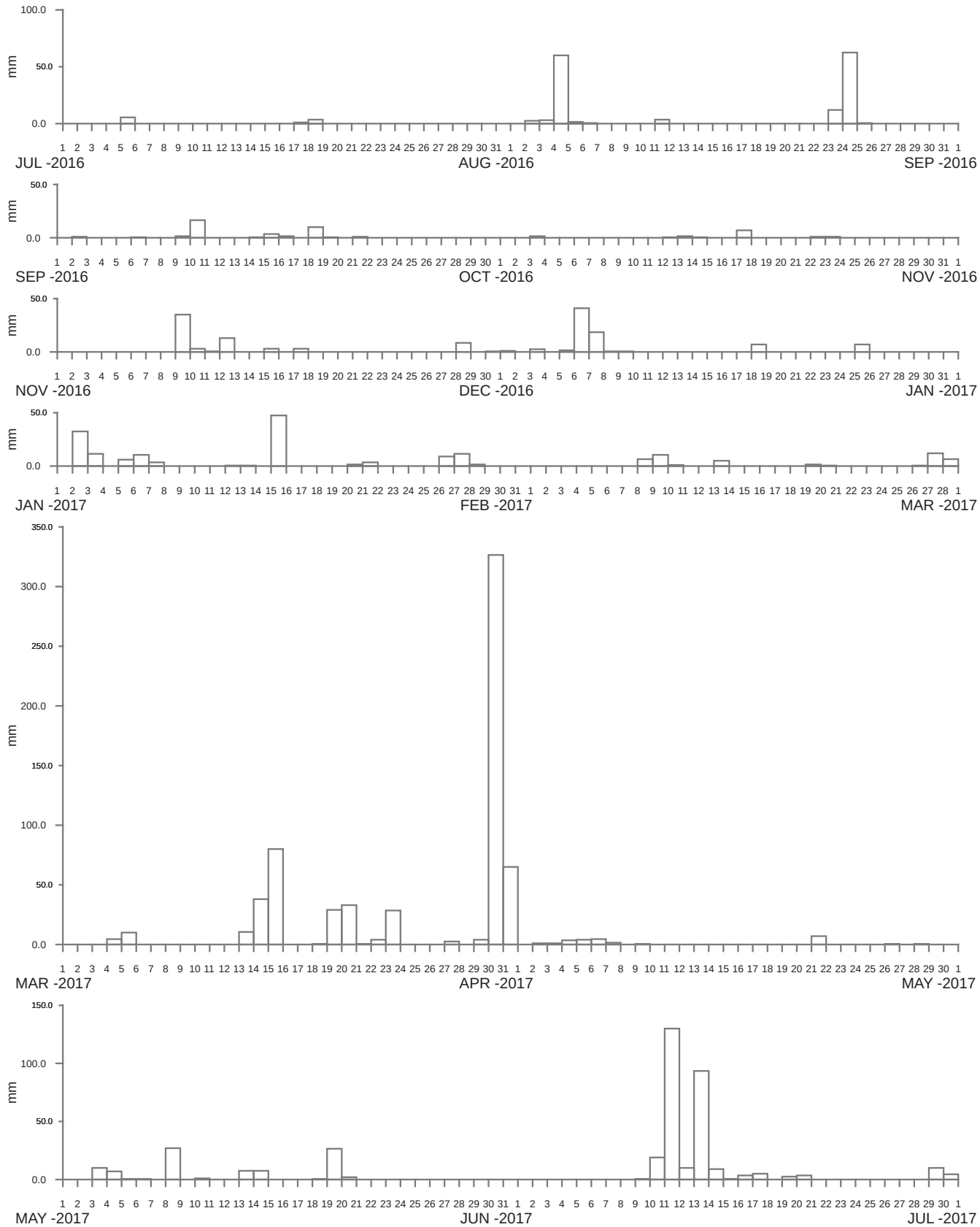
Figure 4

DRAWING 2575-4.cdr



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CUDGERA AT CABBAGE GUM ROAD
2016–2017

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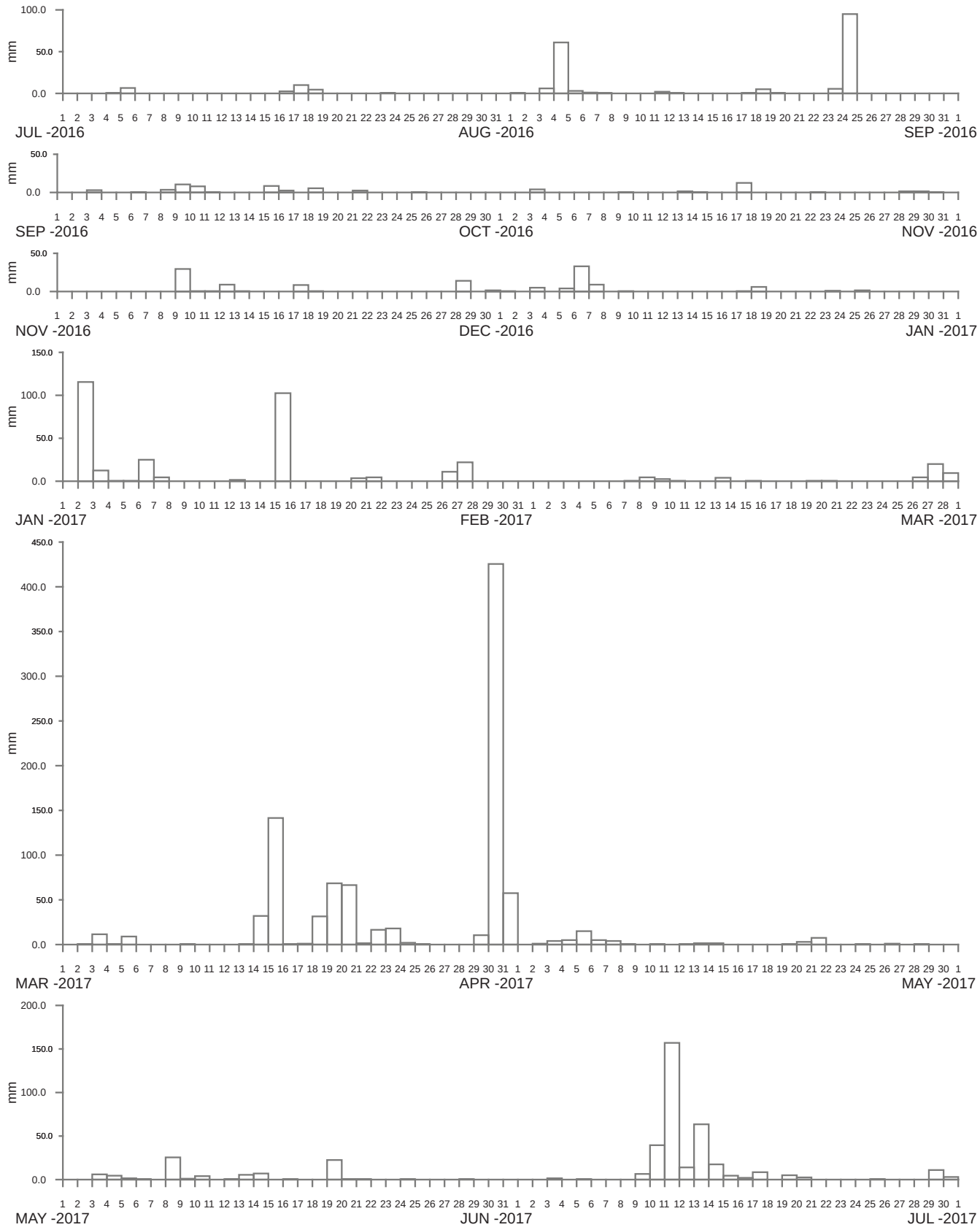
Figure 5

DRAWING 2575-05-08.cdr



---------- DATA LOSS

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MAIN ARM AT MAIN ARM ROAD
2016–2017

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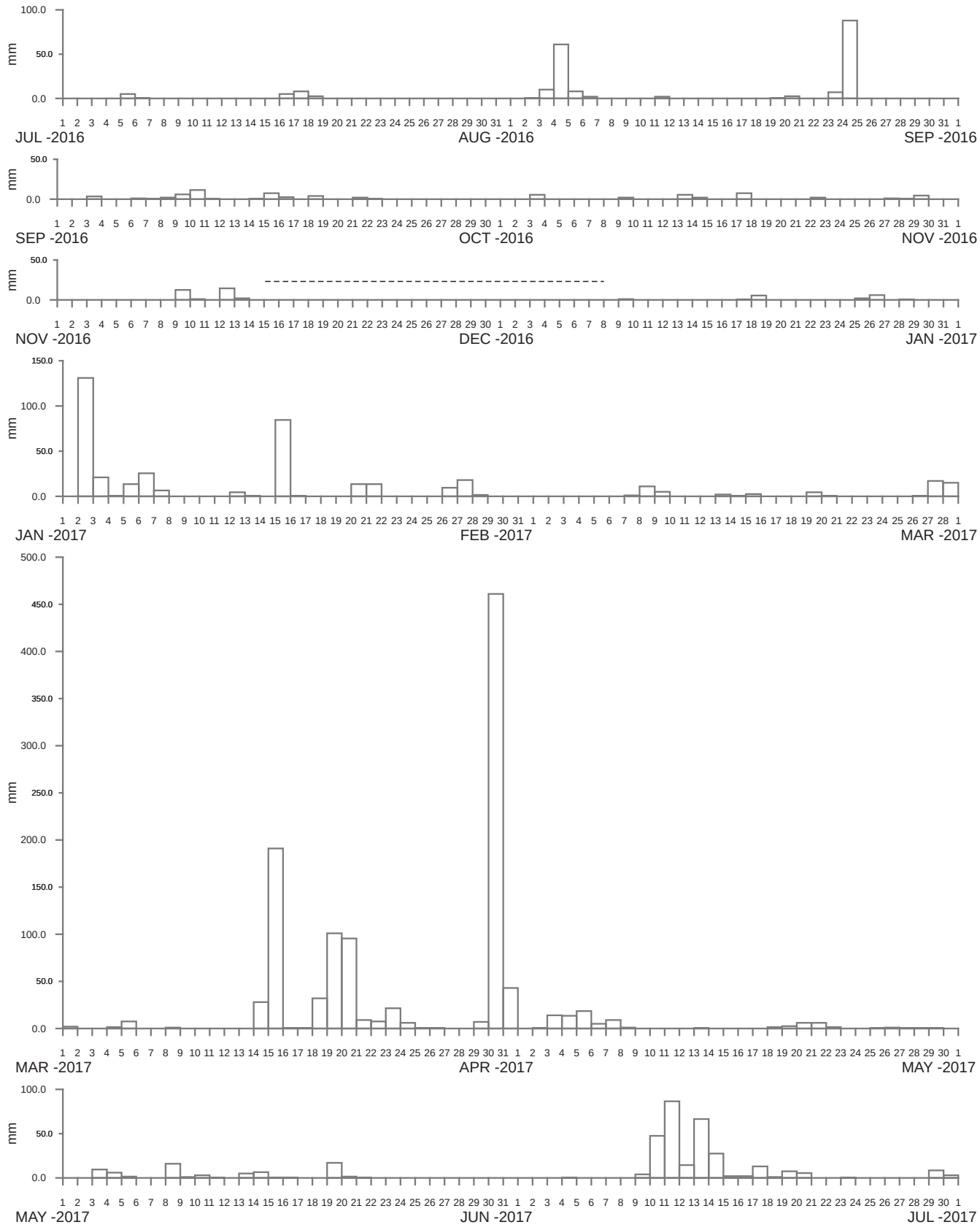
Figure 6

DRAWING 2575-05-08.cdr



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NSW GOVERNMENT

HUONBROOK AT WILSONS CREEK ROAD
2016–2017

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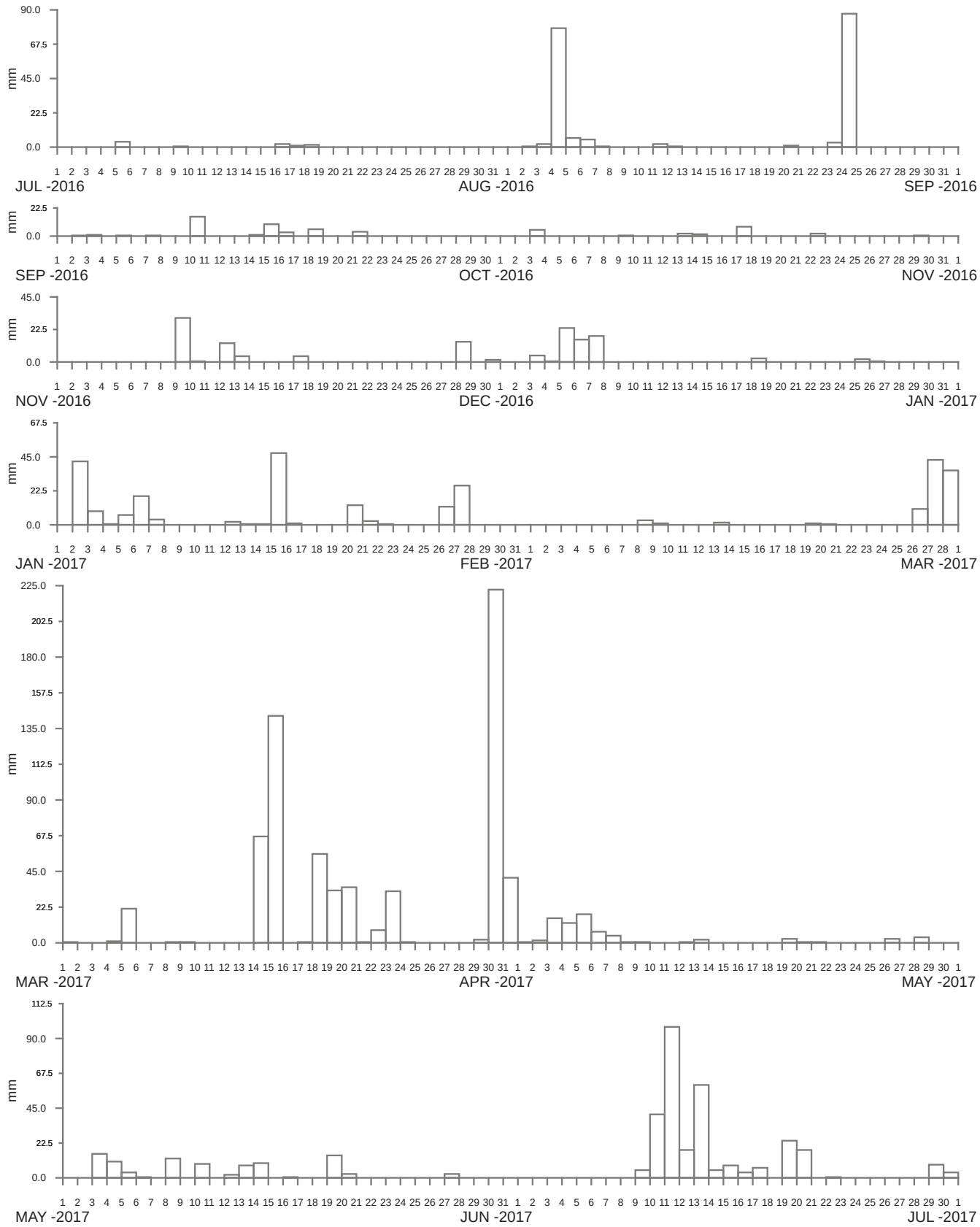
Figure 7

DRAWING 2575-05-08.cdr



DATA LOSS

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MYOCUM AT KINGSVALE ROAD
2016–2017

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Figure 8

DRAWING 2575-05-08.cdr

RAINFALL STATION LOCATIONS
RICHMOND RIVER REGION

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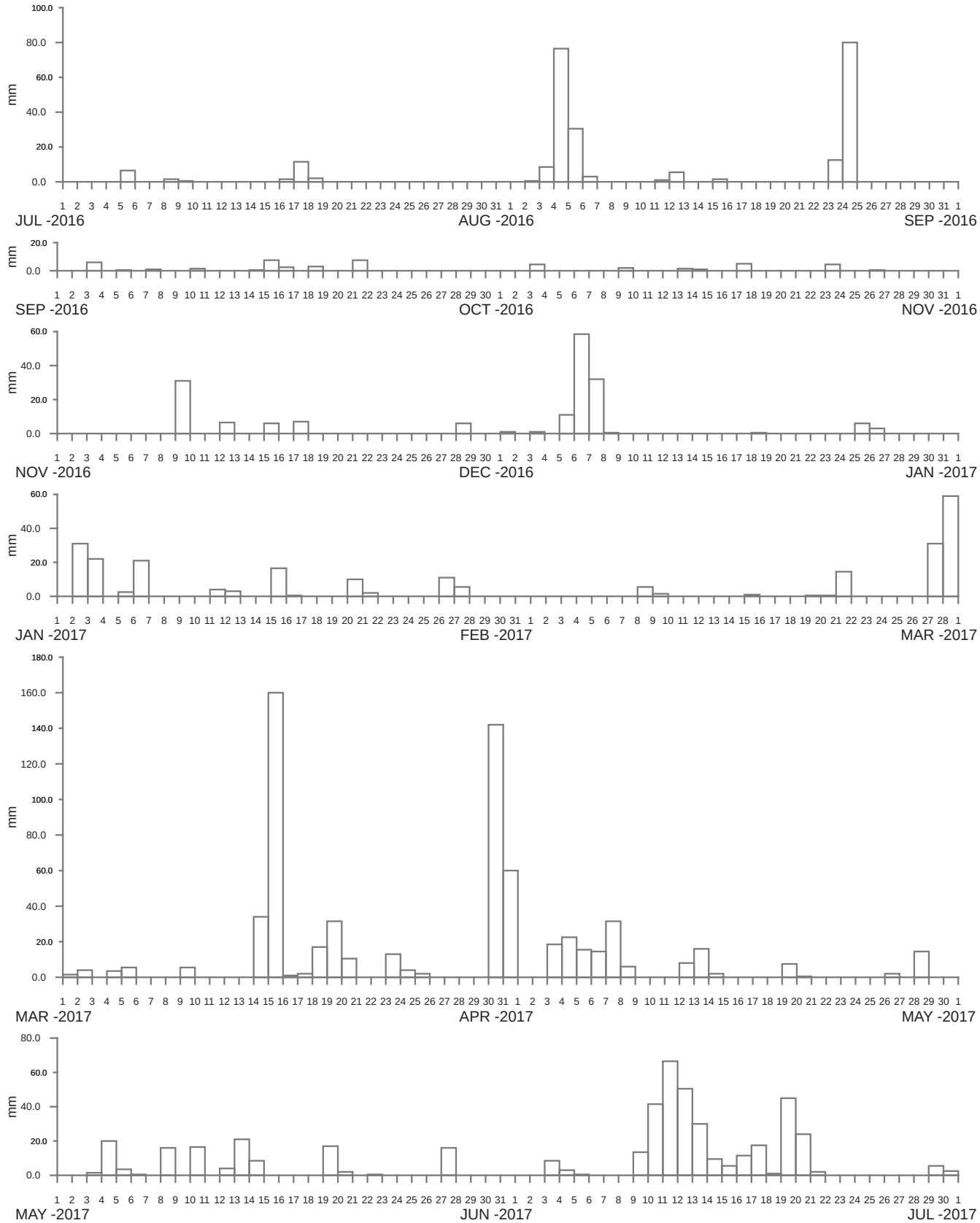
Figure 9

DRAWING 2575-09.cdr



DATA LOSS

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NSW GOVERNMENT

LAKE AINSWORTH AT LENNOX HEAD
2016–2017

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Figure 10

DRAWING 2575-10.cdr

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RAINFALL STATION LOCATIONS
BELLINGER RIVER REGION (NORTH)

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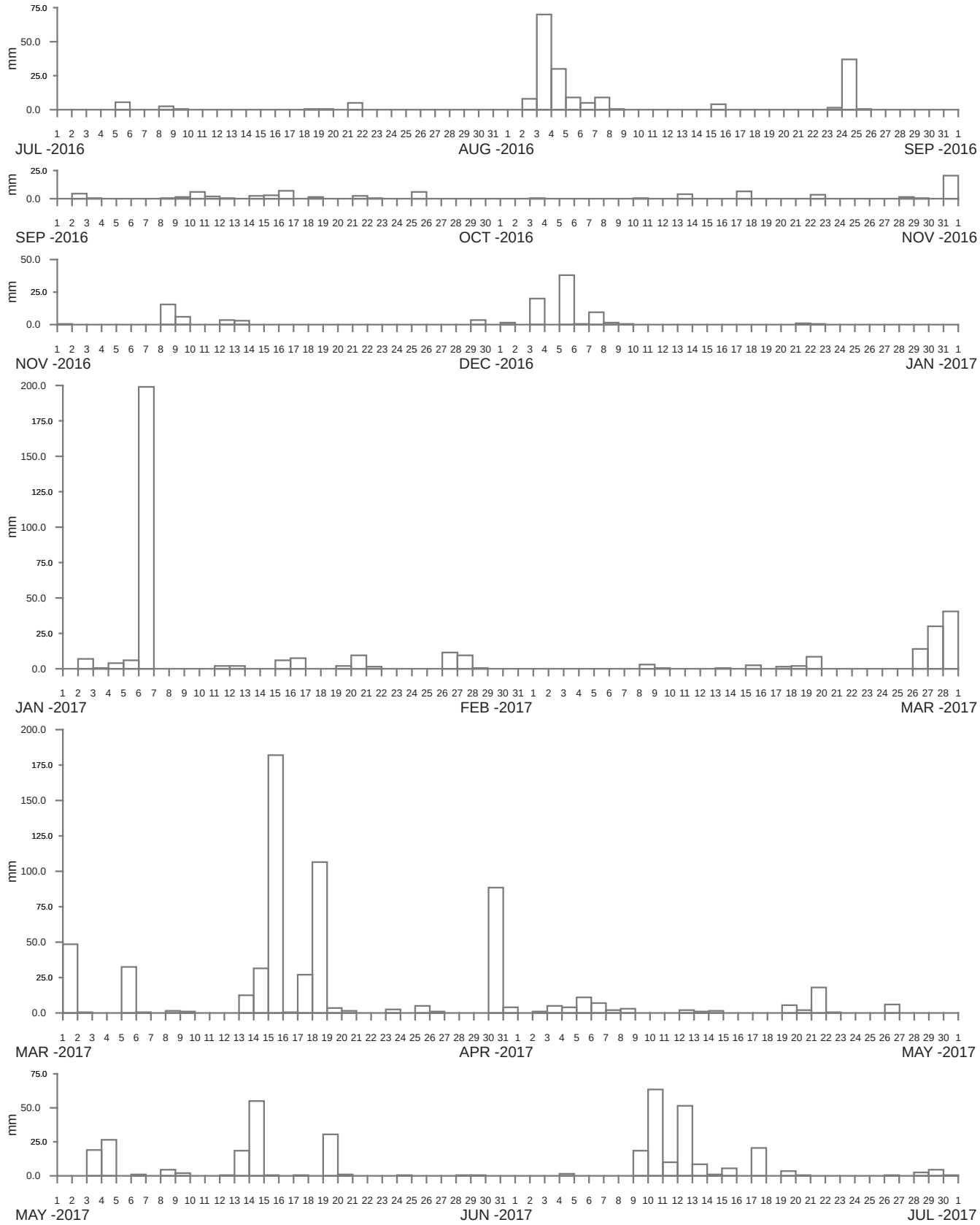
Figure 11

DRAWING 2575-11.cdr



DATA LOSS

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WOOLI CARAVAN PARK AT WOOLI RIVER
2016–2017

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Figure 12

DRAWING 2575-12.cdr

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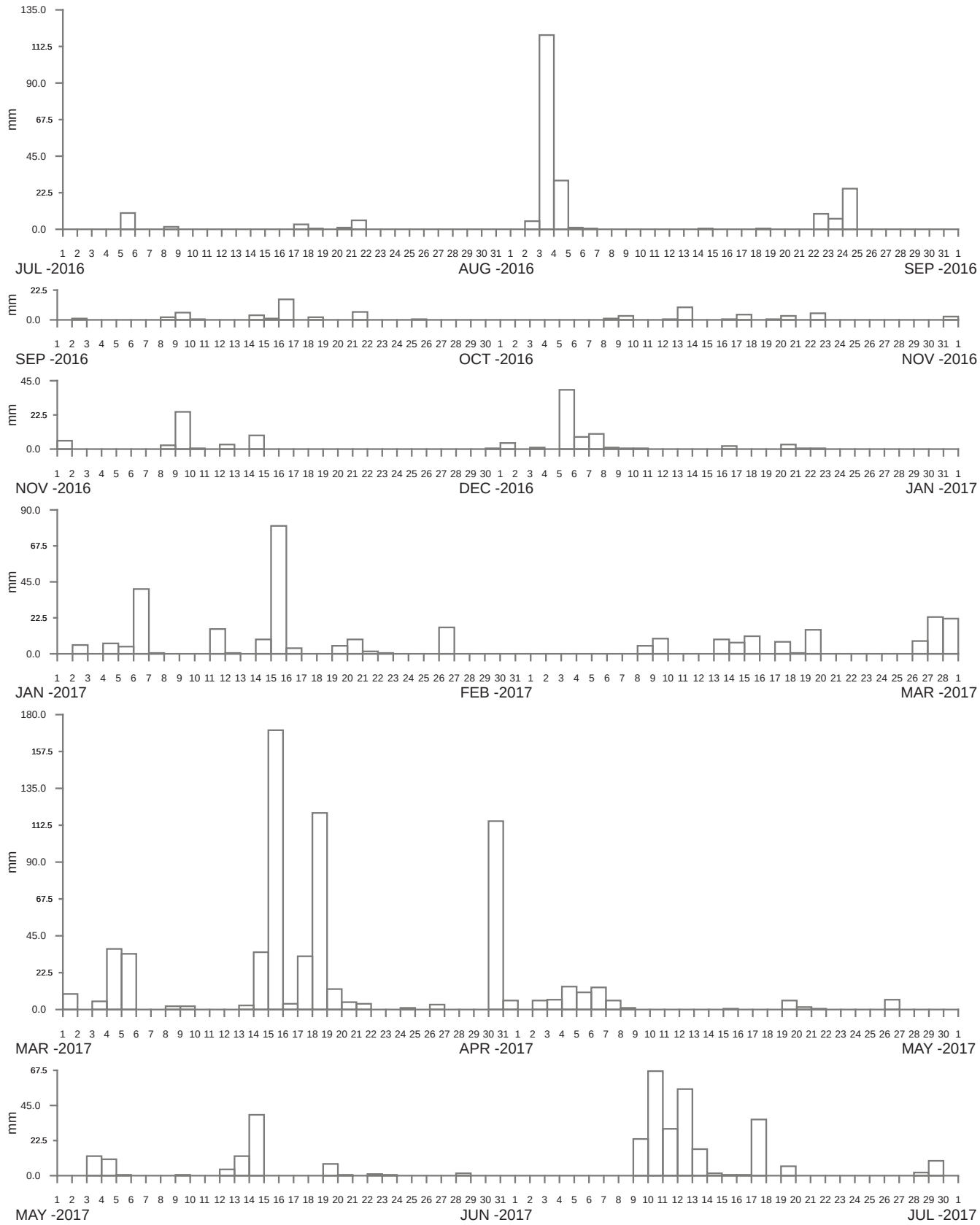
RAINFALL STATION LOCATIONS
BELLINGER RIVER REGION (SOUTH)

MHL Report 2575

Figure 13

DRAWING 2575-13.cdr



DATA LOSS

Manly Hydraulics Laboratory

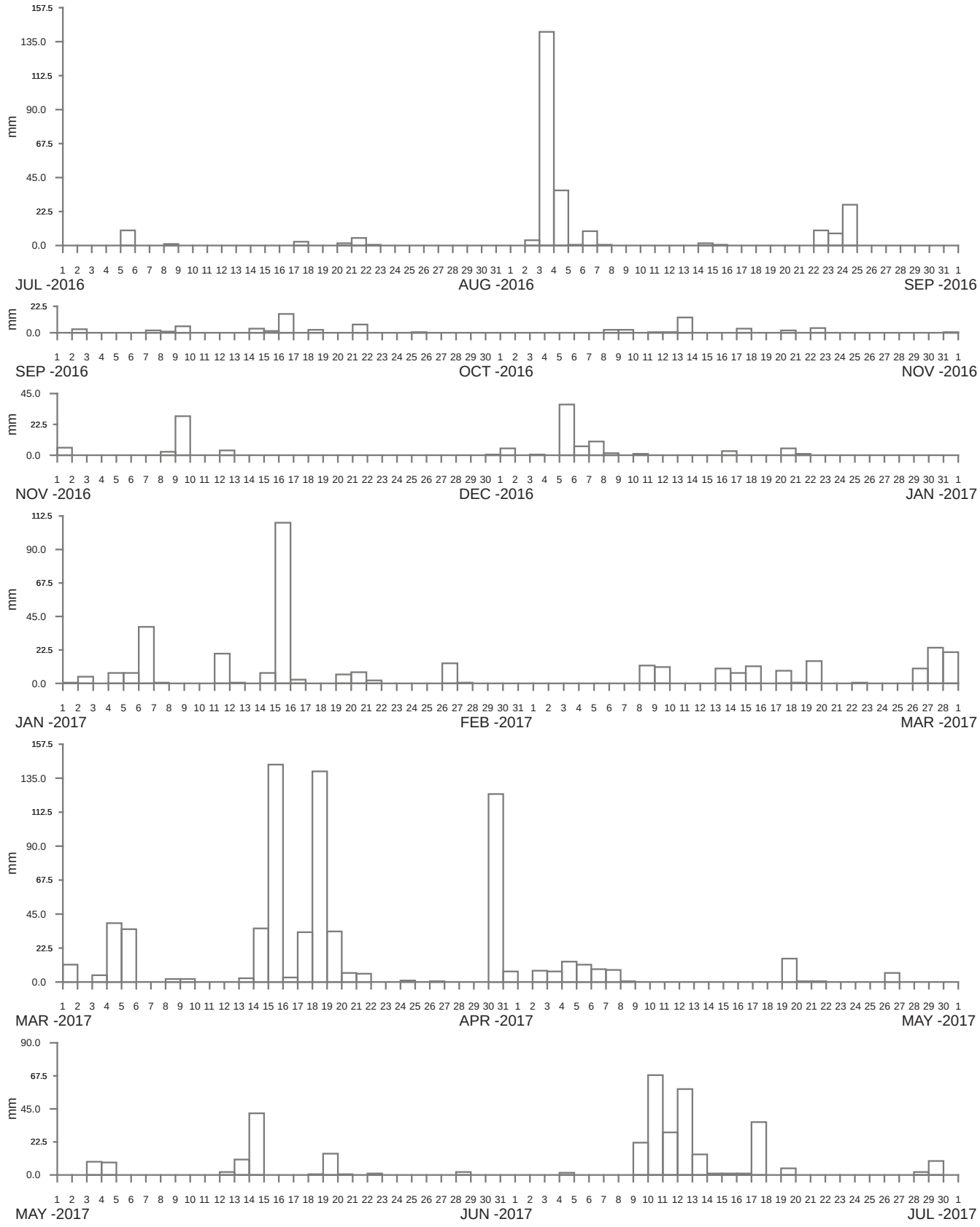
NSW GOVERNMENT

PERRY DRIVE AT COFFS HARBOUR
2016–2017

MHL Report 2575

Figure 14

DRAWING 2575-14-20.cdr



DATA LOSS

Manly Hydraulics Laboratory

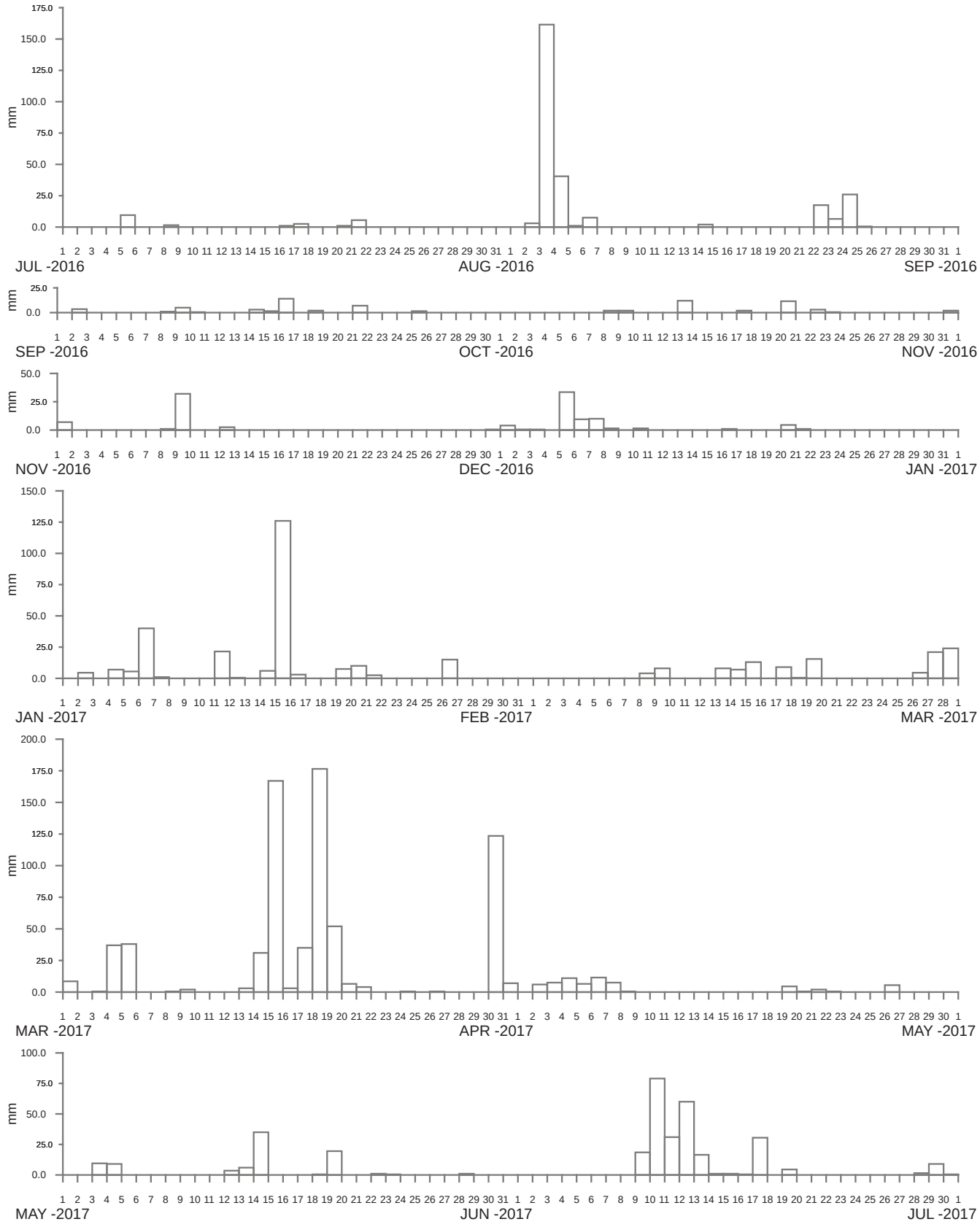
NSW GOVERNMENT

SHEPHARDS LANE AT COFFS HARBOUR
2016–2017

MHL Report 2575

Figure 15

DRAWING 2575-14-20.cdr



DATA LOSS

Manly Hydraulics Laboratory

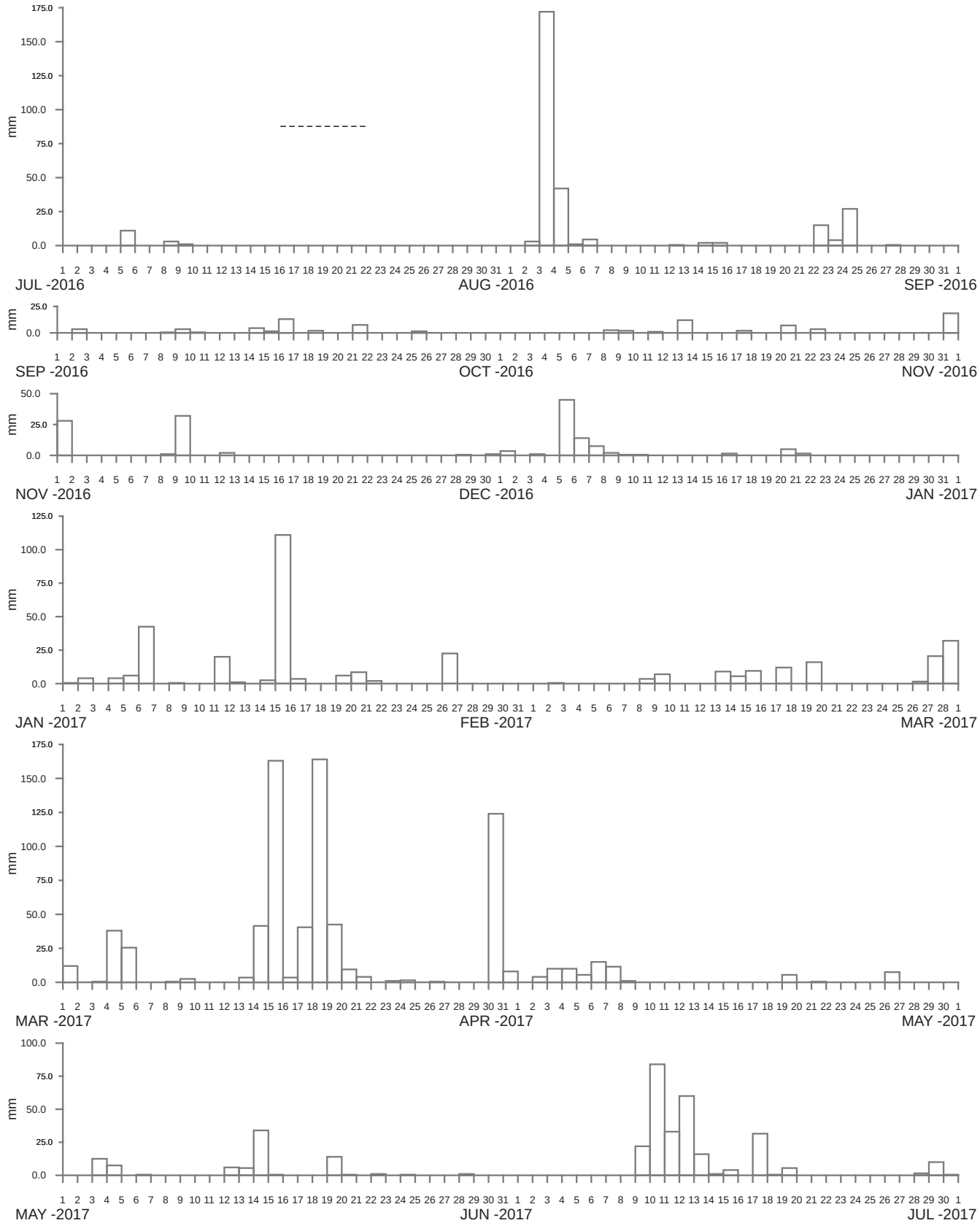
NSW GOVERNMENT

RED HILL AT COFFS HARBOUR
2016–2017

MHL Report 2575

Figure 16

DRAWING 2575-14-20.cdr



DATA LOSS

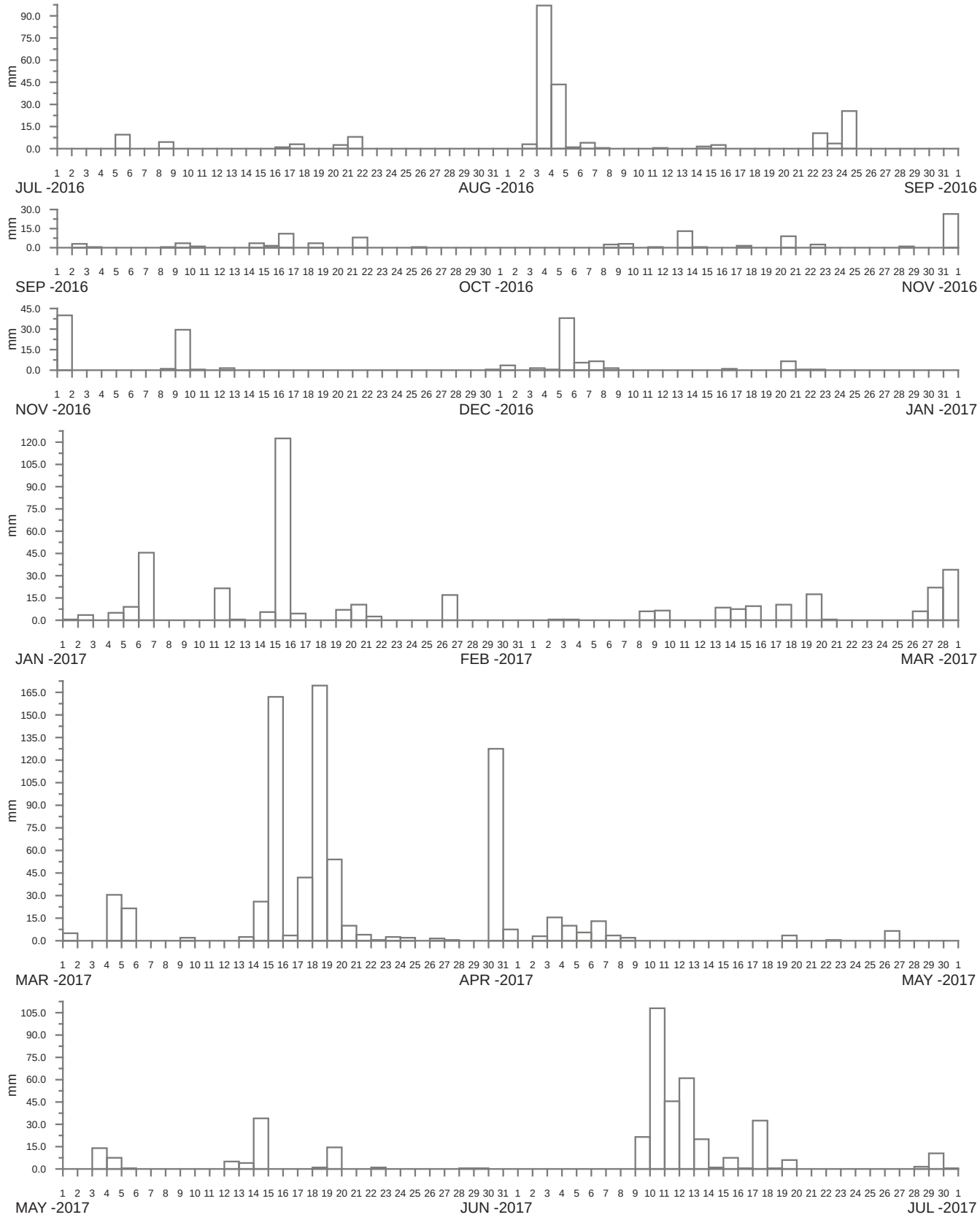
NSW GOVERNMENT Manly Hydraulics Laboratory

NEWPORTS CREEK AT ENGLANDS ROAD 2016–2017

MHL Report 2575

Figure 17

DRAWING 2575-14-20.cdr



DATA LOSS

Manly Hydraulics Laboratory

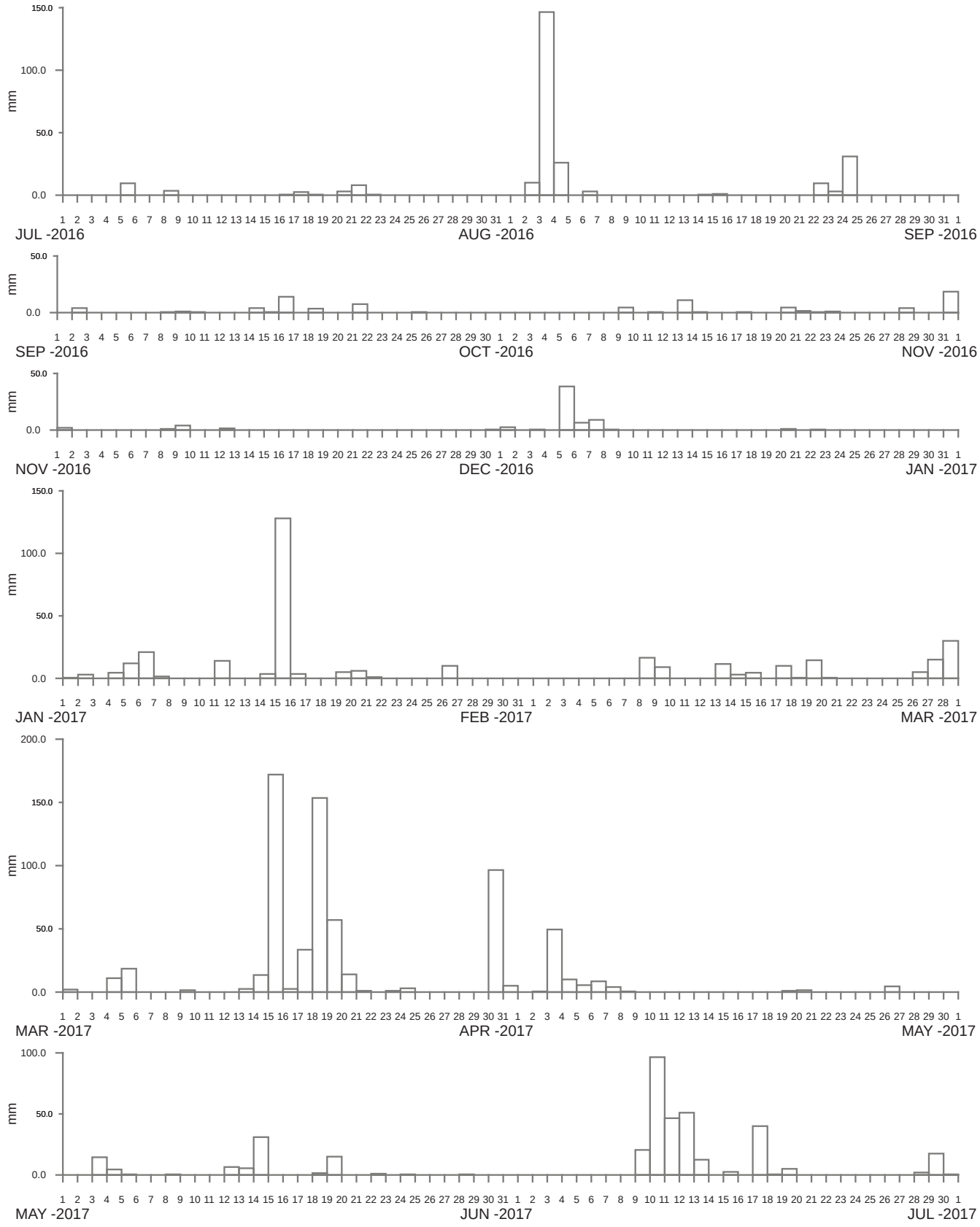
NSW GOVERNMENT

MIDDLE BOAMBEE AT CEDARVALE ROAD 2016–2017

MHL Report 2575

Figure 18

DRAWING 2575-14-20.cdr



---------- DATA LOSS

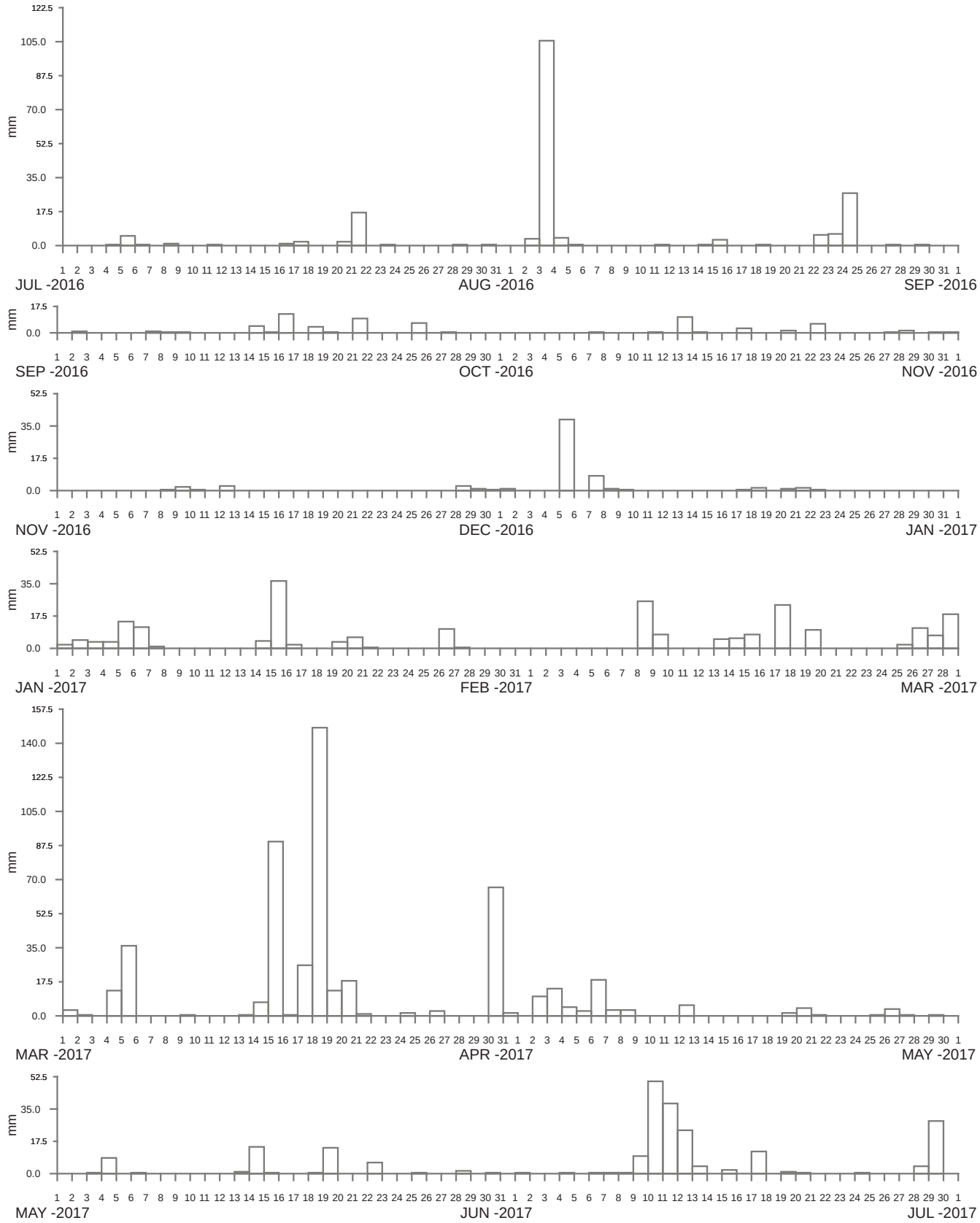
NSW GOVERNMENT Manly Hydraulics Laboratory

NORTH BONVILLE AT NORTH BONVILLE ROAD 2016–2017

MHL Report 2575

Figure 19

DRAWING 2575-14-20.cdr



DATA LOSS

NSW GOVERNMENT Manly Hydraulics Laboratory

KOOROOWI AT KALANG RIVER
2016–2017

MHL Report 2575

Figure 20

DRAWING 2575-14-20.cdr

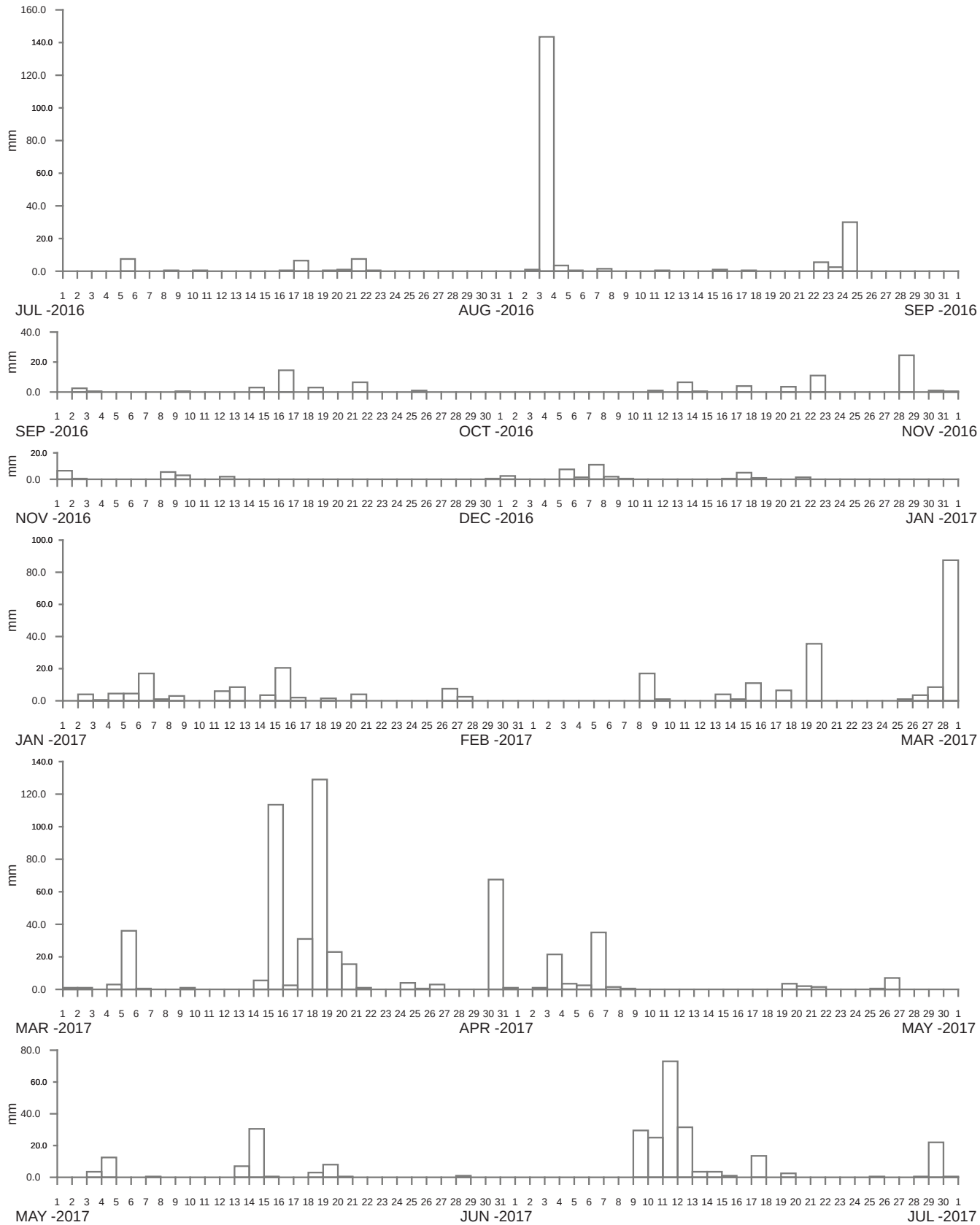
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
NAMBUCCA RIVER REGION

MHL Report 2575

Figure 21

DRAWING 2575-21.cdr



DATA LOSS

Manly Hydraulics Laboratory

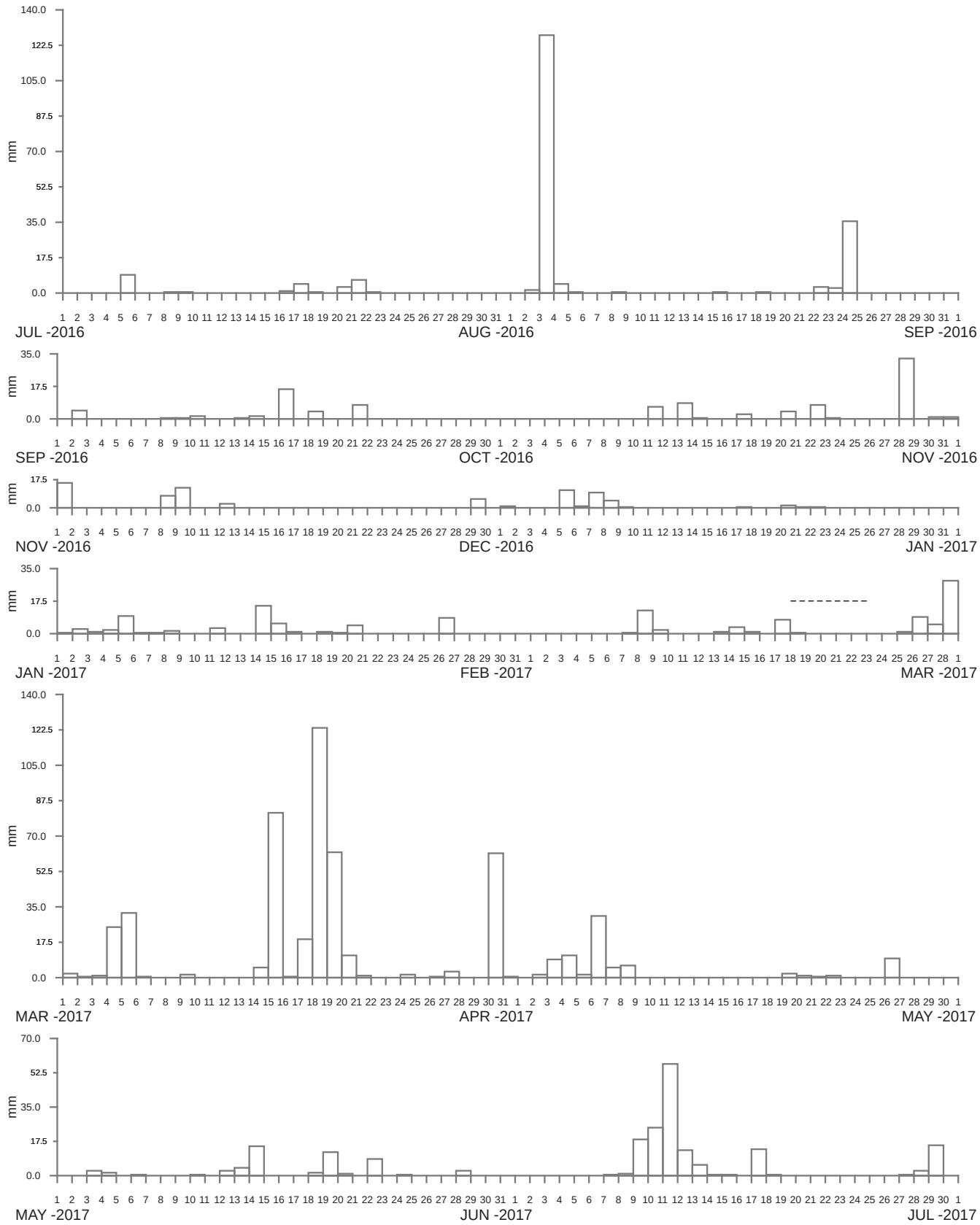
NSW GOVERNMENT

STUARTS ISLAND DOWNSTREAM AT NAMBUCCA RIVER 2016–2017

MHL Report 2575

Figure 22

DRAWING 2575-22-23.cdr



---------- DATA LOSS

NSW GOVERNMENT Manly Hydraulics Laboratory

UTUNGUN AT TAYLORS ARM
2016–2017

MHL Report 2575

Figure 23

DRAWING 2575-22-23.cdr

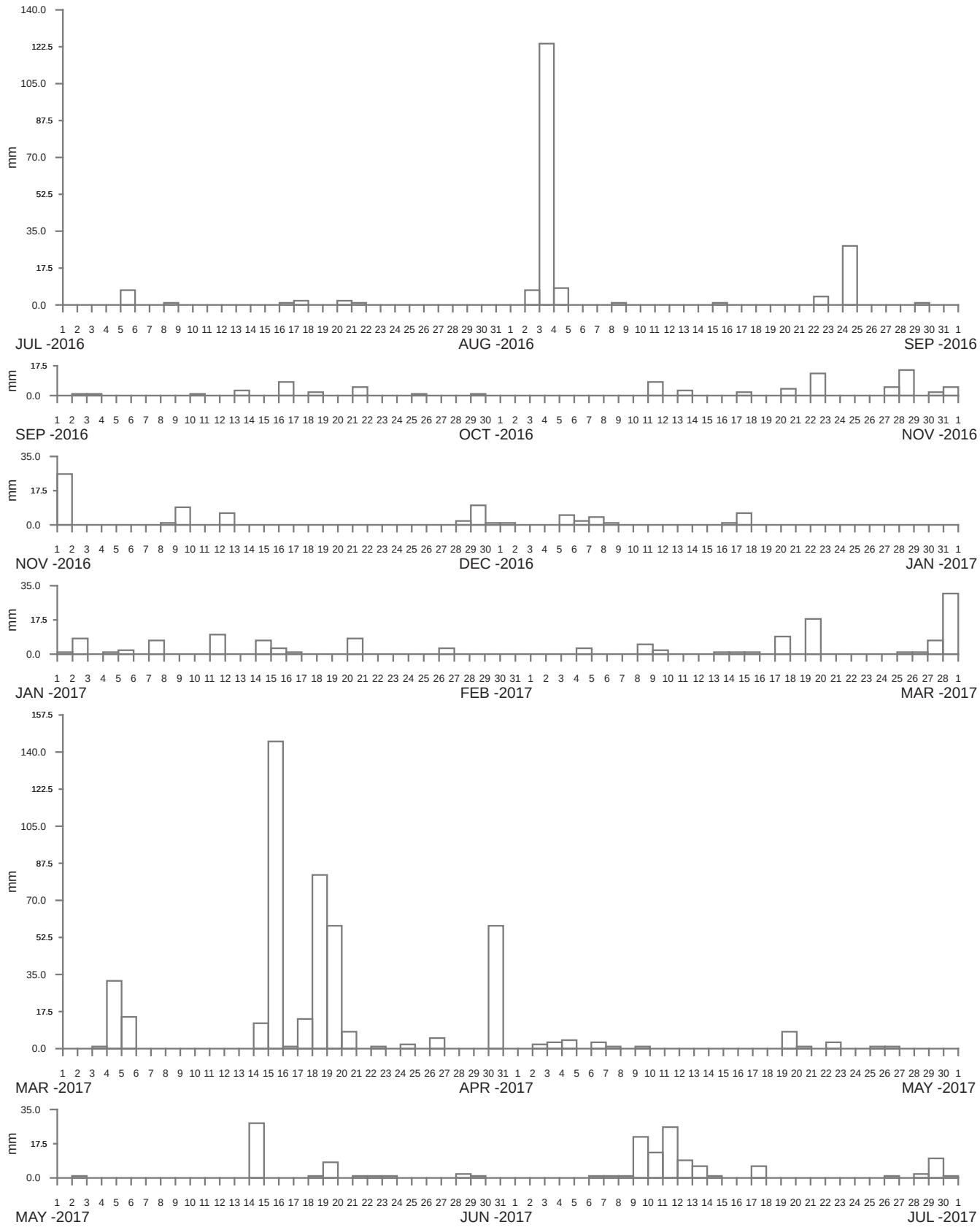
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
MACLEAY RIVER AND HASTINGS RIVER REGIONS

MHL Report 2575

Figure 24

DRAWING 2575-24.cdr



DATA LOSS

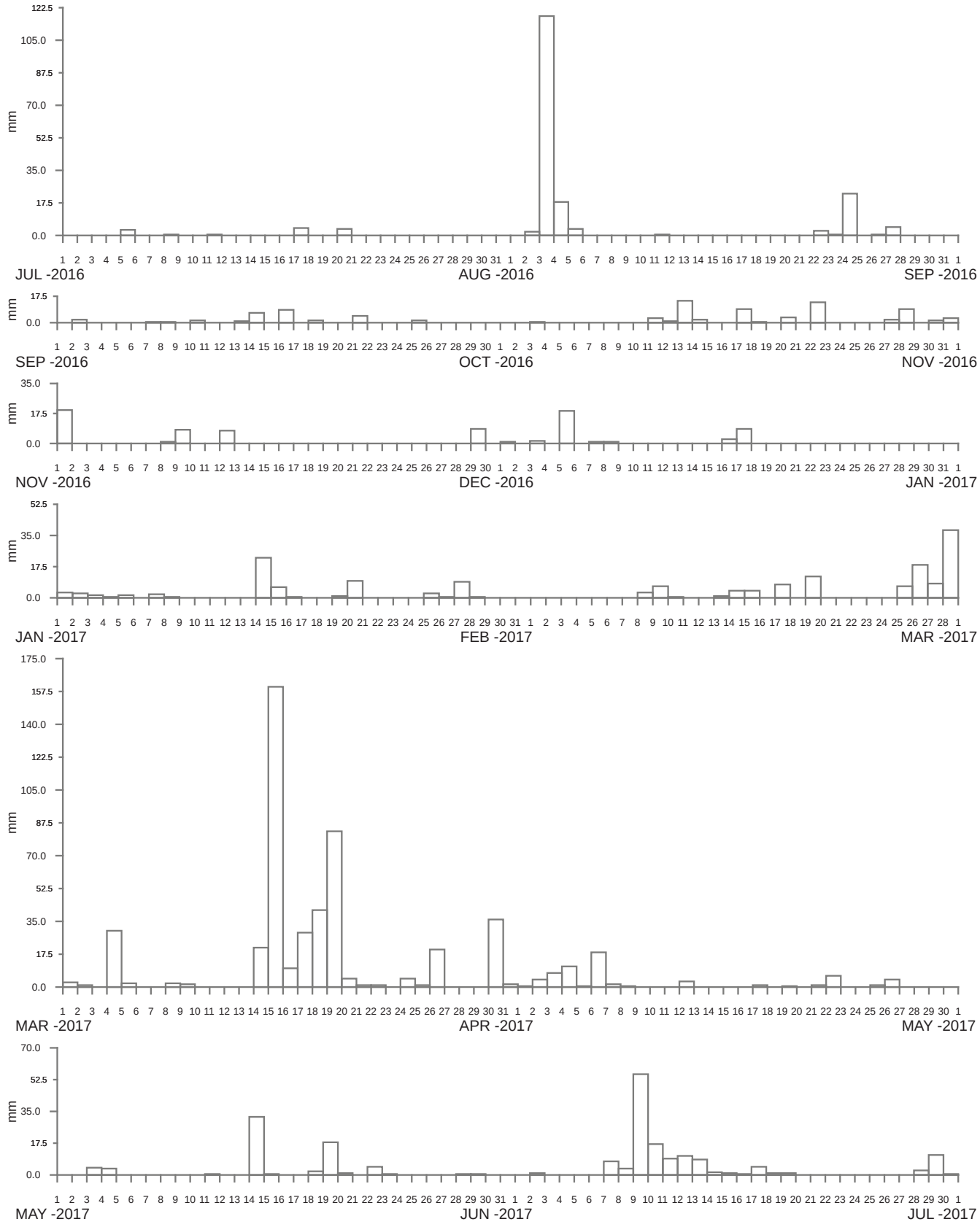
NSW GOVERNMENT Manly Hydraulics Laboratory

ALDAVILLA DOWNSTREAM AT MACLEAY RIVER 2016–2017

MHL Report 2575

Figure 25

DRAWING 2575-25-27.cdr



DATA LOSS

Manly Hydraulics Laboratory

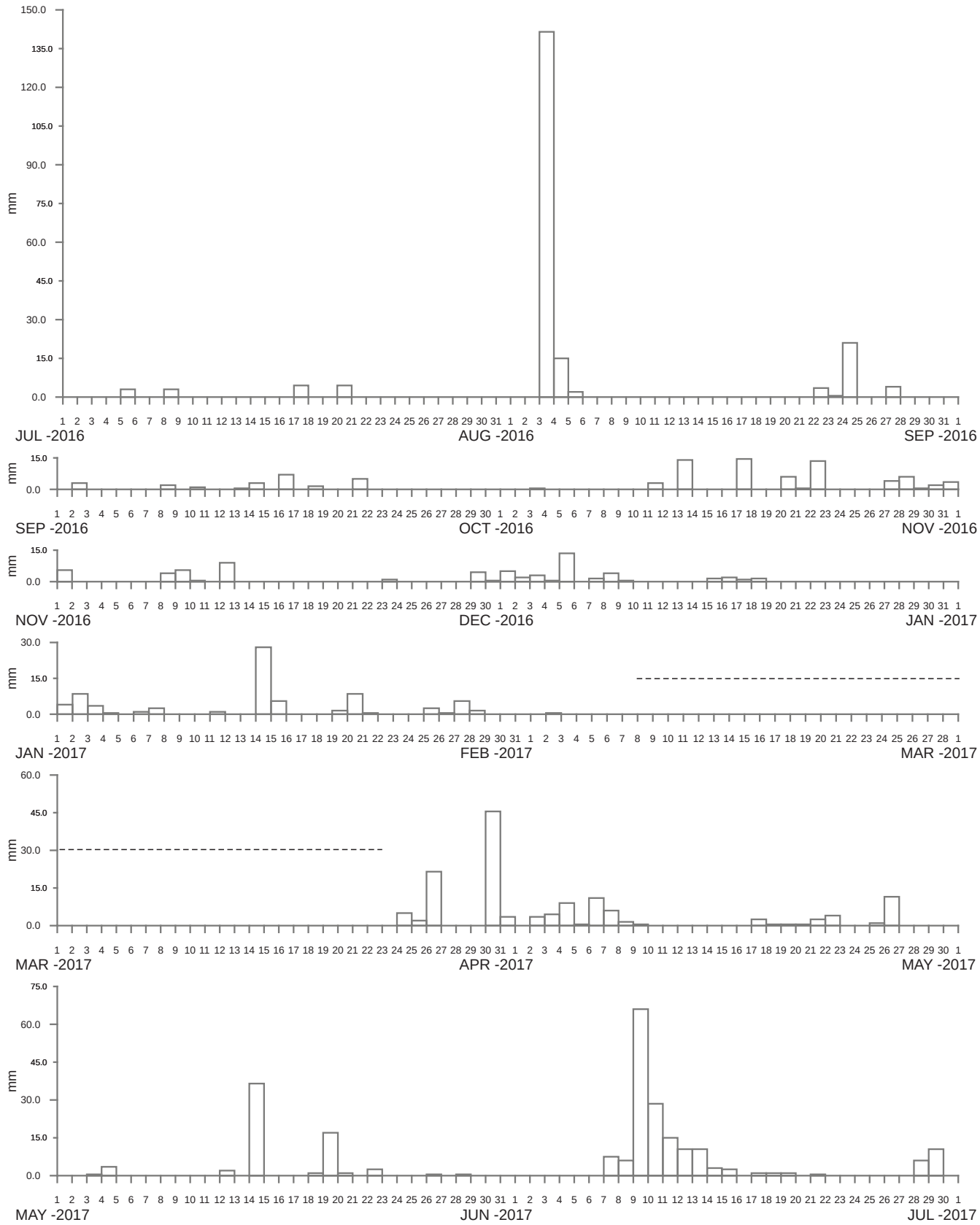
NSW GOVERNMENT

GREEN VALLEY AT MARIA RIVER
2016–2017

MHL Report 2575

Figure 26

DRAWING 2575-25-27.cdr



NSW GOVERNMENT Manly Hydraulics Laboratory

TELEGRAPH POINT AT WILSONS RIVER 2016–2017

MHL Report 2575

Figure 27

DRAWING 2575-25-27.cdr

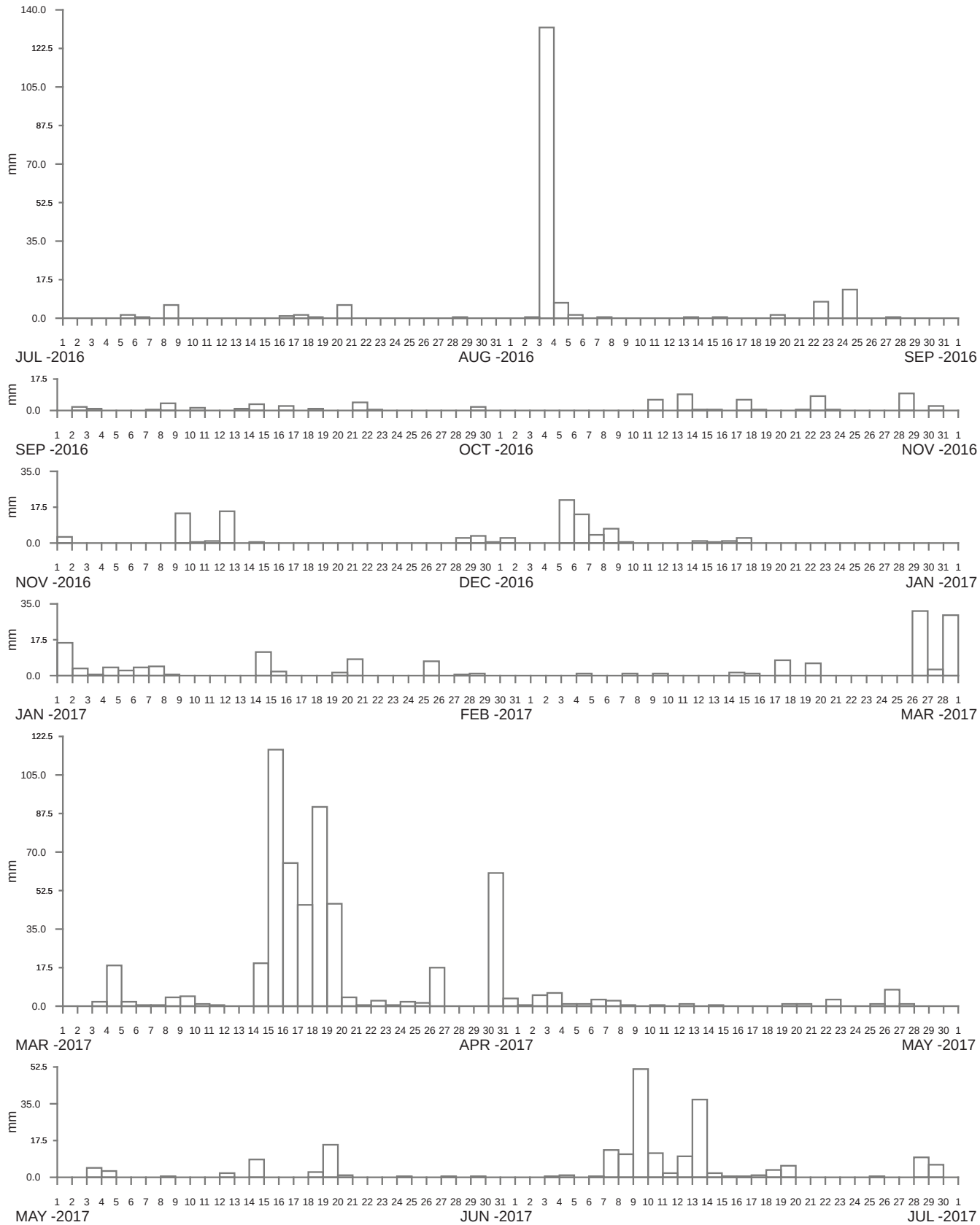
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
CAMDEN HAVEN REGION

MHL Report 2575

Figure 28

DRAWING 2575-28.cdr



---------- DATA LOSS

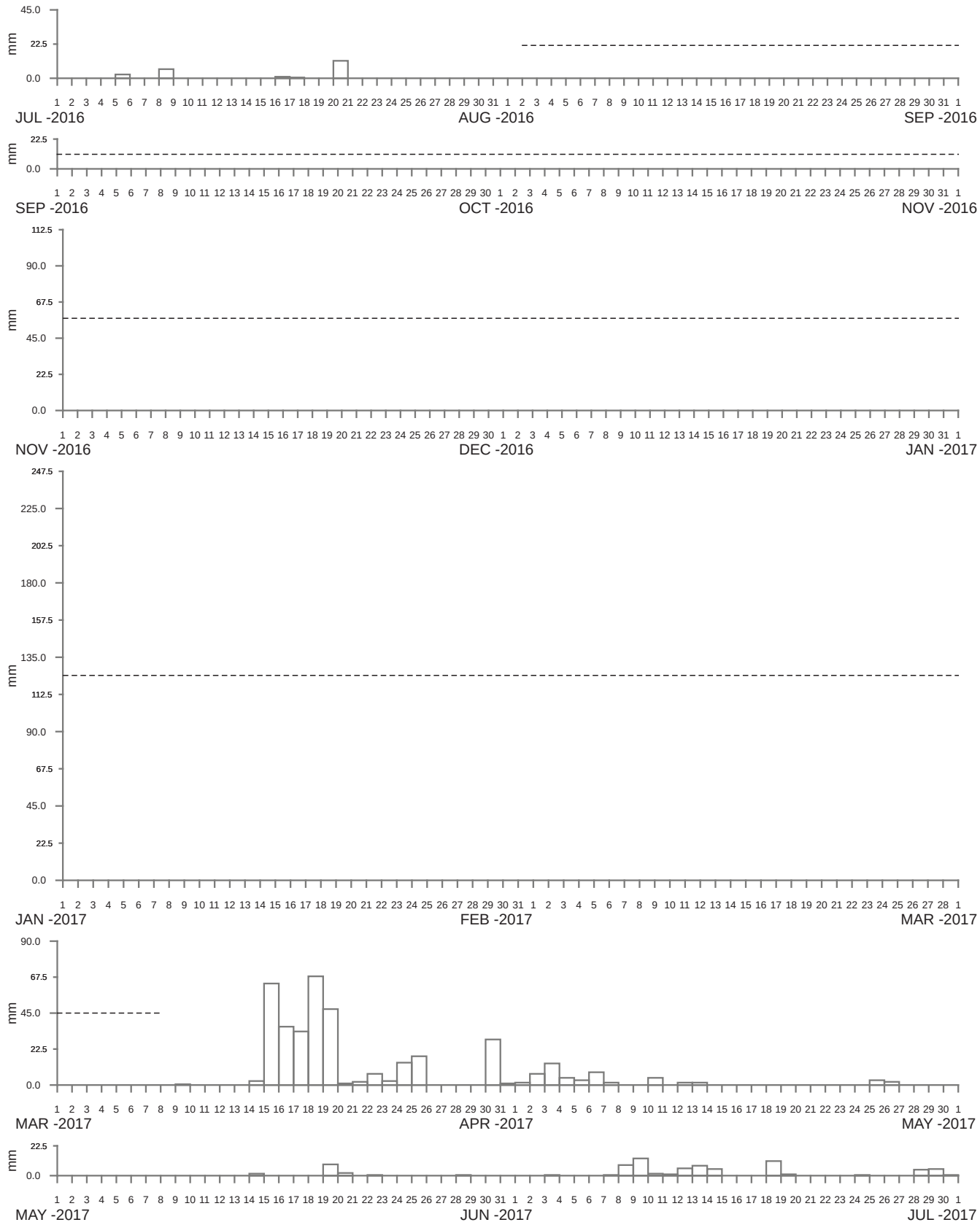
NSW GOVERNMENT Manly Hydraulics Laboratory

LOGANS CROSSING AT CAMDEN HAVEN RIVER 2016–2017

MHL Report 2575

Figure 29

DRAWING 2575-29-30.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

MOUNT GEORGE AT MANNING RIVER
2016–2017

MHL Report 2575

Figure 30

DRAWING 2575-29-30.cdr

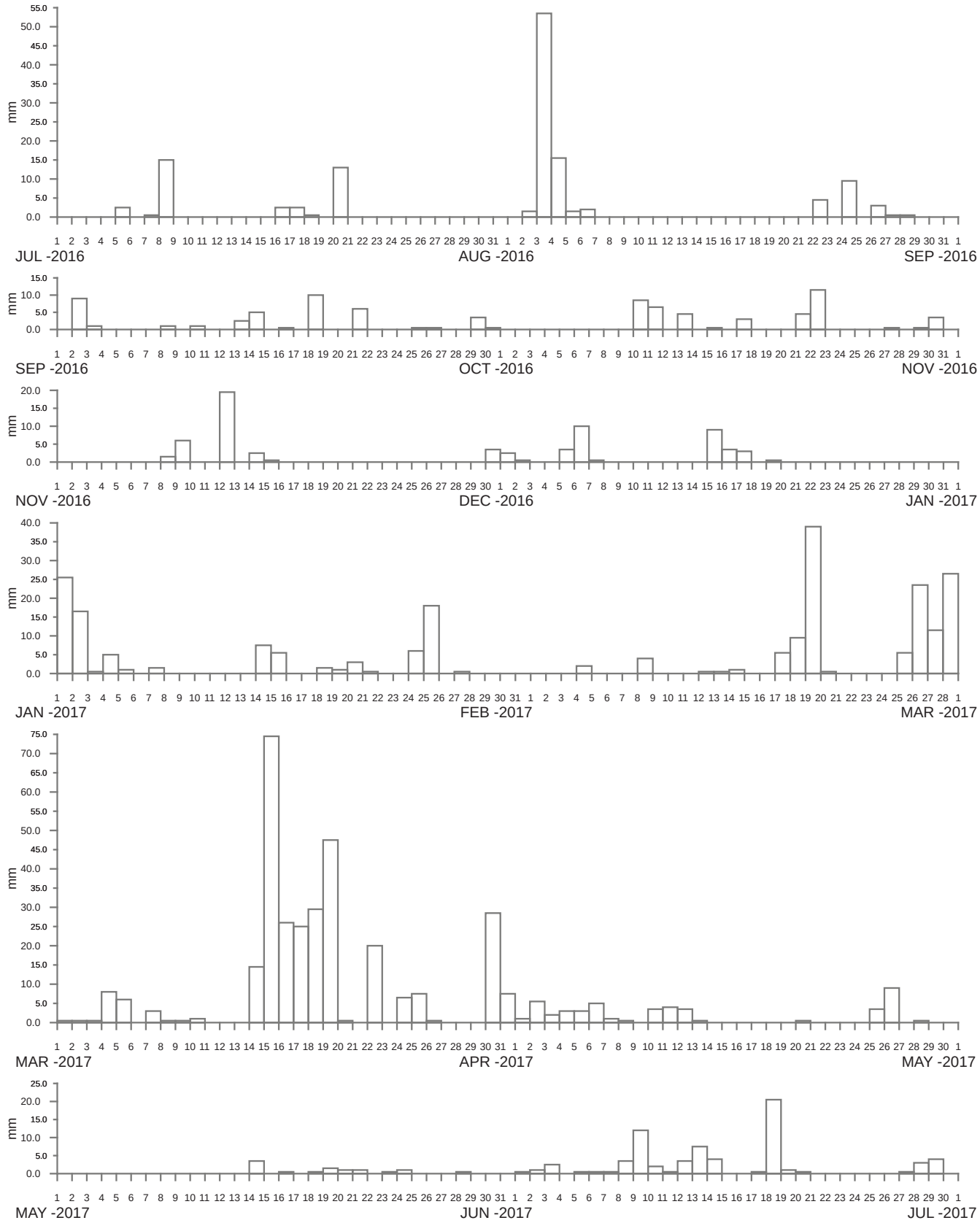
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
KARUAH RIVER REGION

MHL Report 2575

Figure 31

DRAWING 2575-31.cdr



DATA LOSS

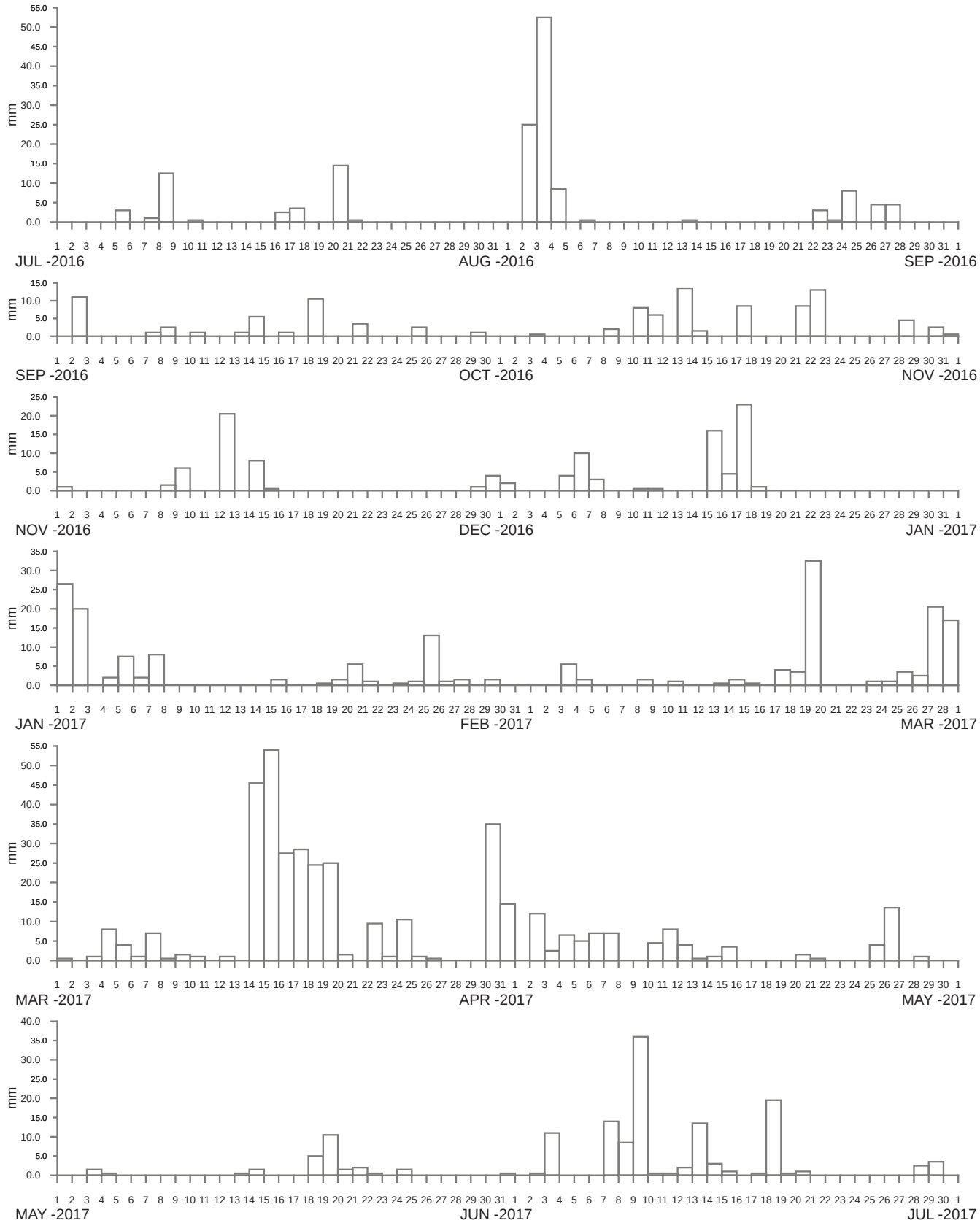
Manly Hydraulics Laboratory

NABIAC AT WALLAMBA RIVER
2016–2017

MHL Report 2575

Figure 32

DRAWING 2575-32-36.cdr



DATA LOSS

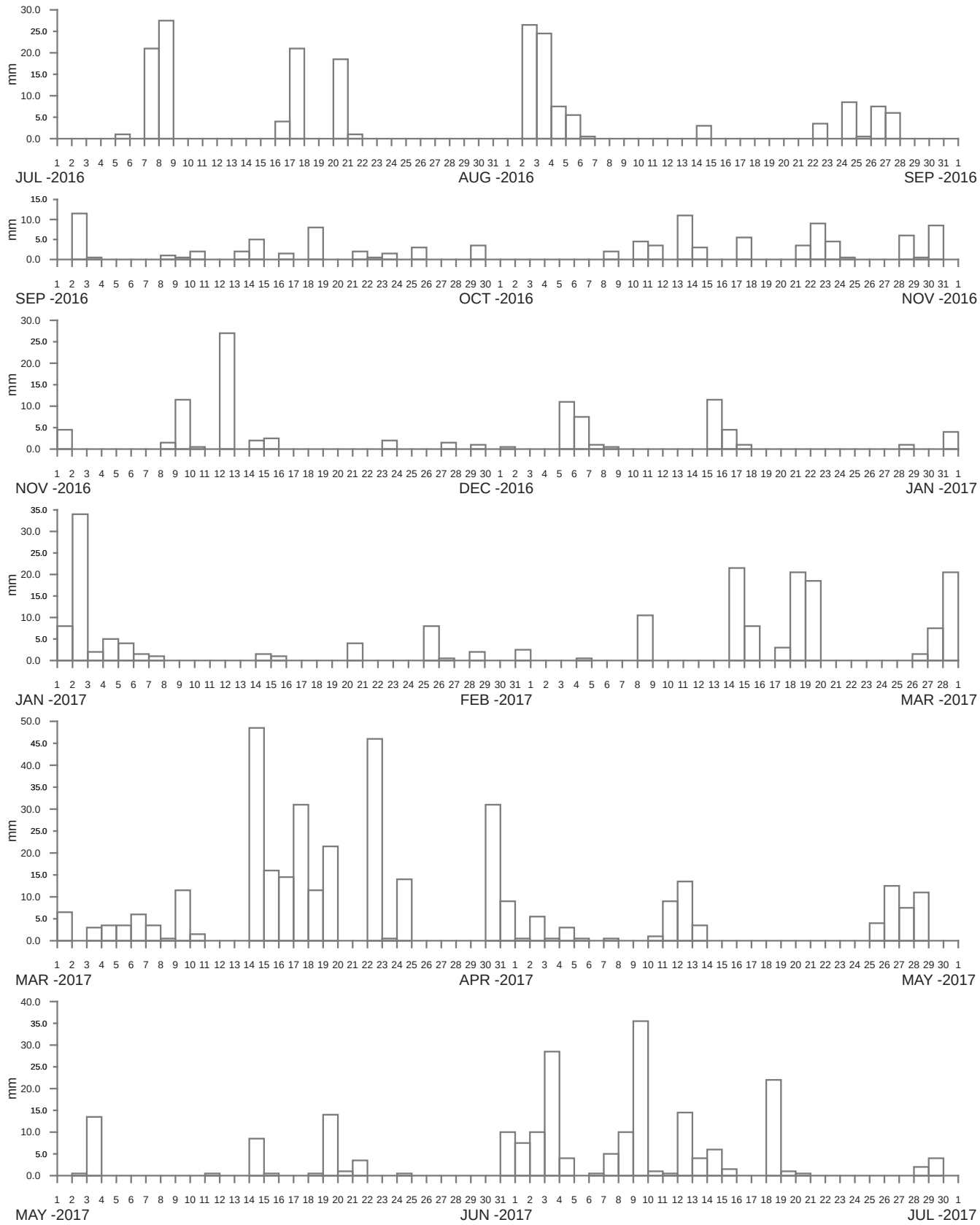
NSW GOVERNMENT Manly Hydraulics Laboratory

TUNCURRY DOWNSTREAM AT WALLAMBA RIVER 2016–2017

MHL Report 2575

Figure 33

DRAWING 2575-32-36.cdr



DATA LOSS

Manly Hydraulics Laboratory

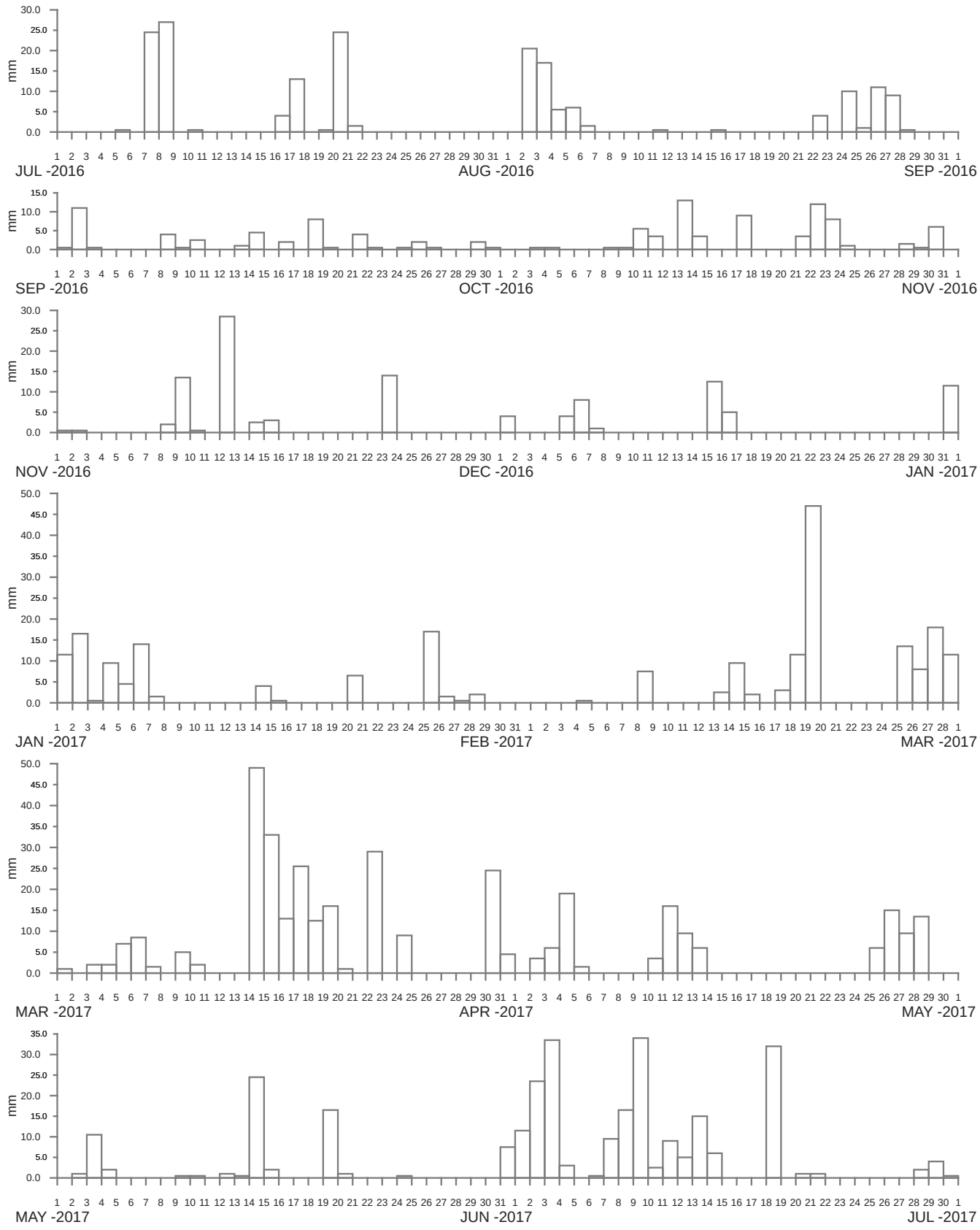
NSW GOVERNMENT

PACIFIC PALMS WHARF AT WALLIS LAKE
2016–2017

MHL Report 2575

Figure 34

DRAWING 2575-32-36.cdr



DATA LOSS

Manly Hydraulics Laboratory

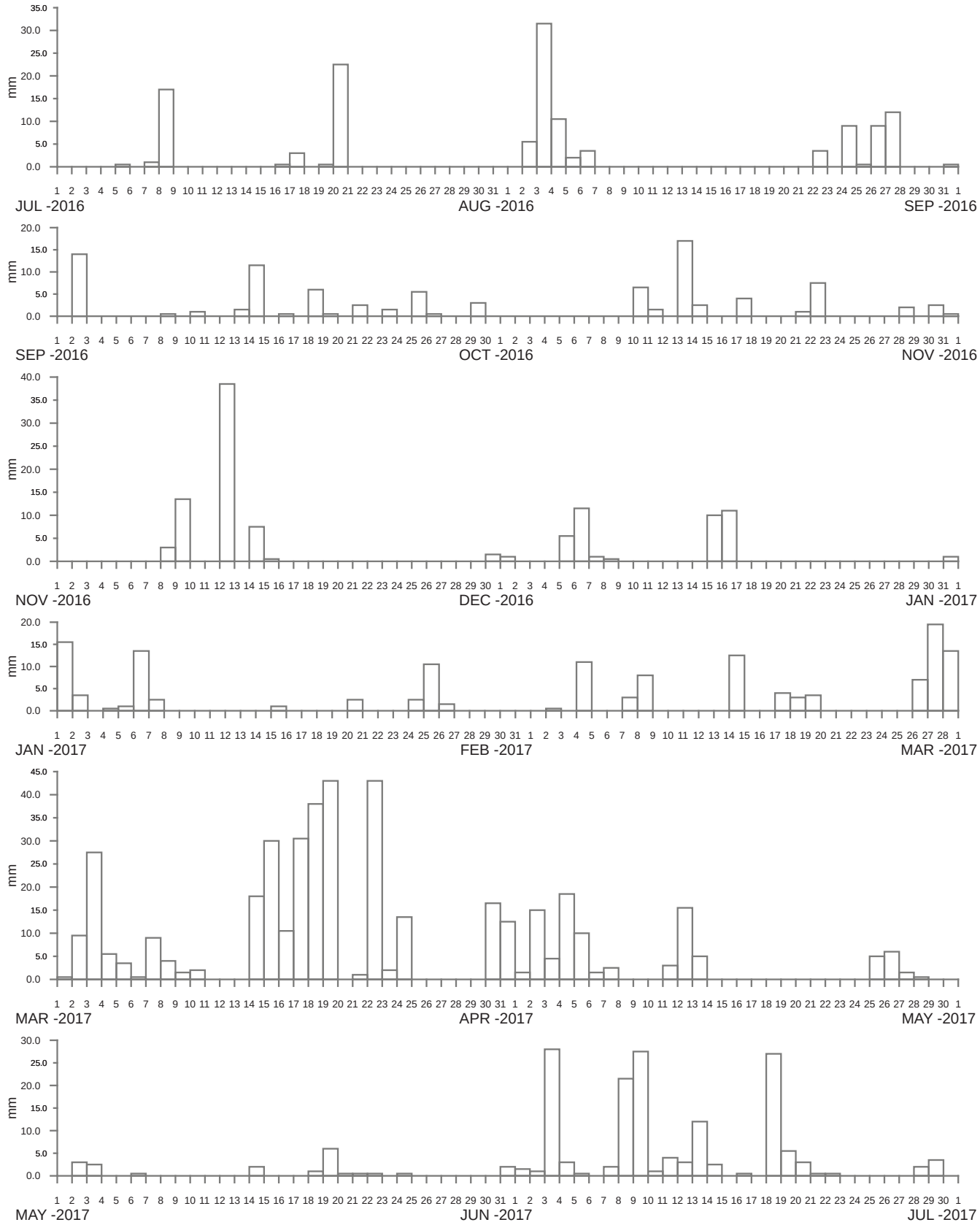
NSW GOVERNMENT

TARBUCK BAY AT SMITHS LAKE
2016–2017

MHL Report 2575

Figure 35

DRAWING 2575-32-36.cdr



DATA LOSS

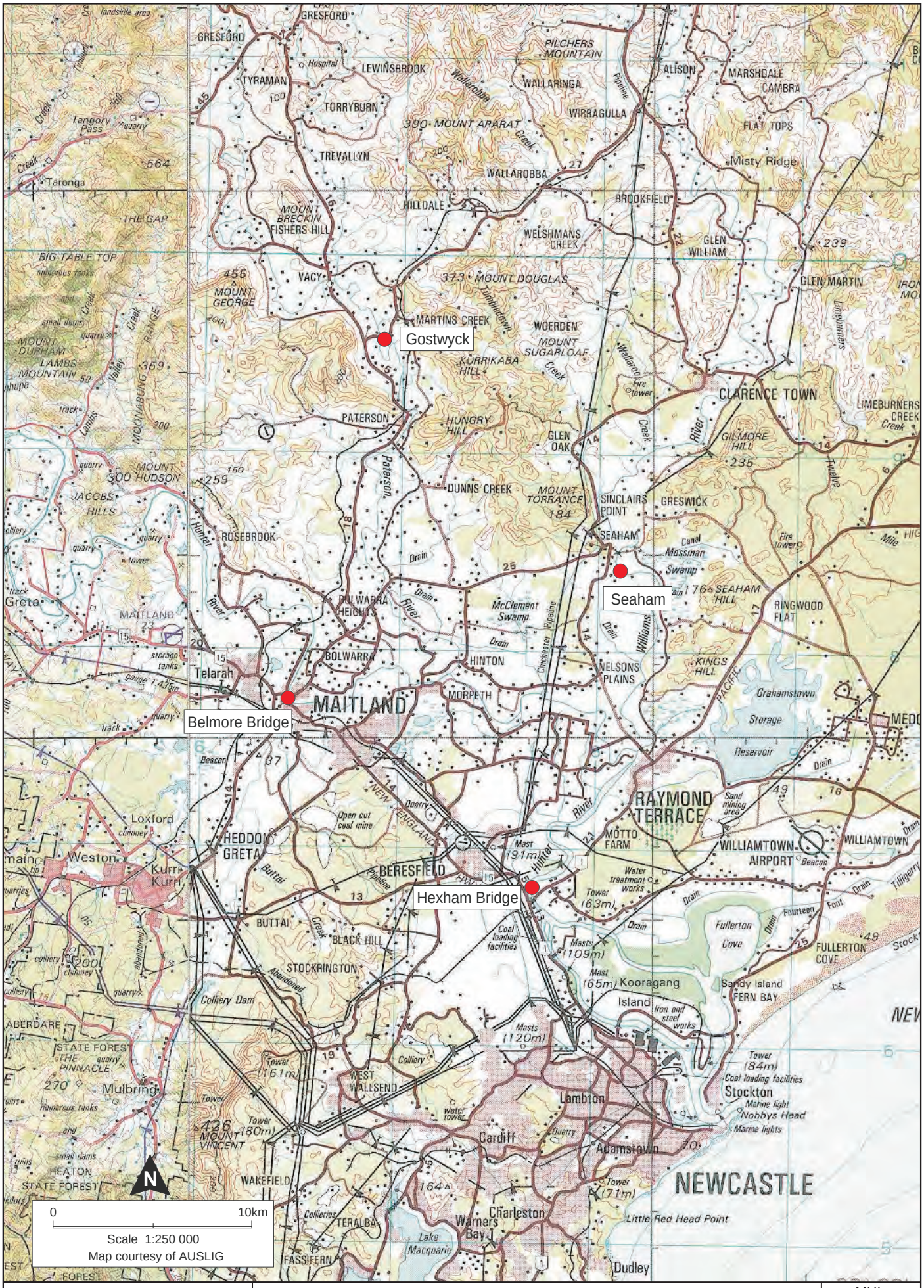
NSW GOVERNMENT Manly Hydraulics Laboratory

BULAHDELAH AT MYALL RIVER
2016–2017

MHL Report 2575

Figure 36

DRAWING 2575-32-36.cdr



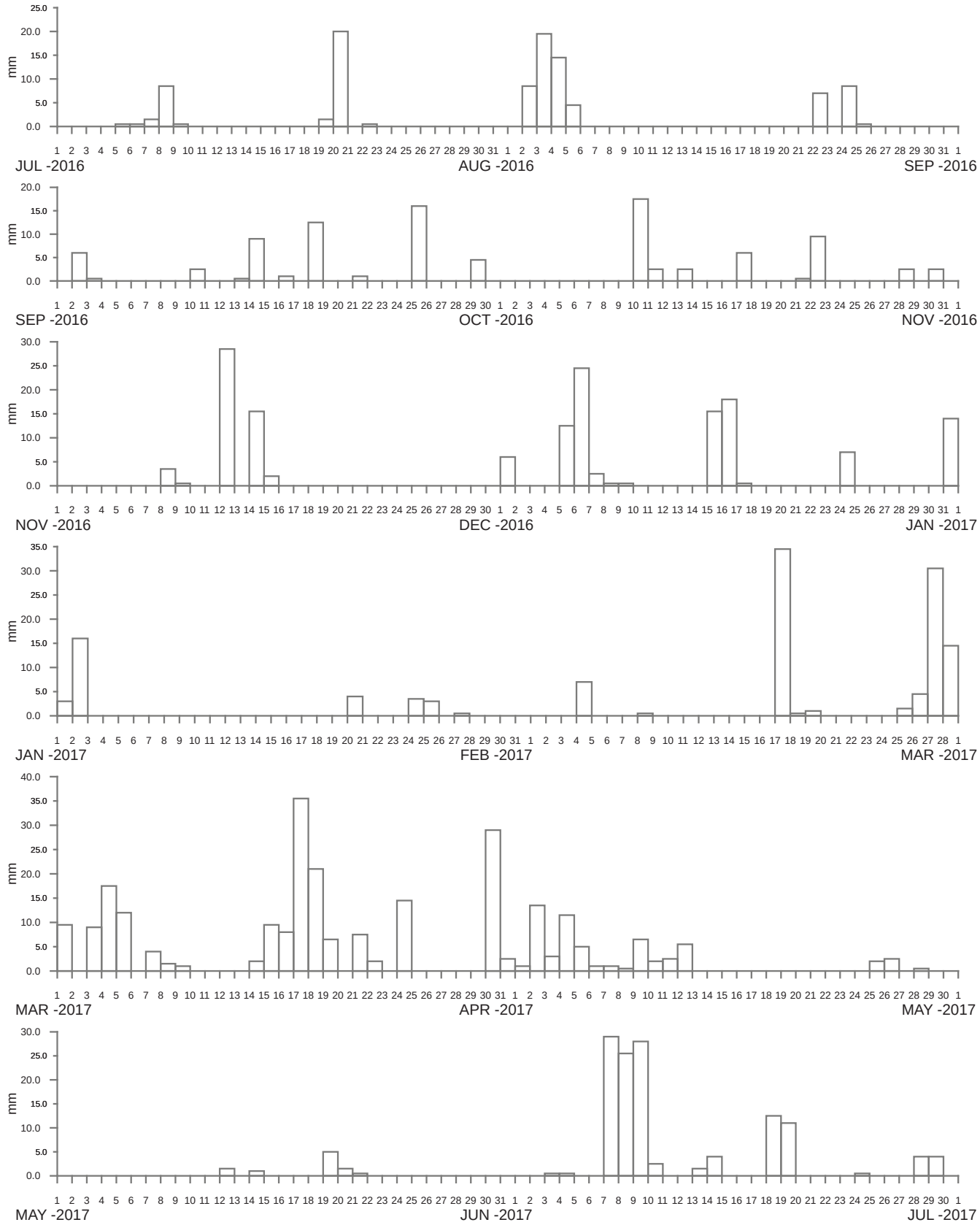
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS HUNTER RIVER REGION

MHL Report 2575

Figure 37

DRAWING 2575-37.cdr



DATA LOSS

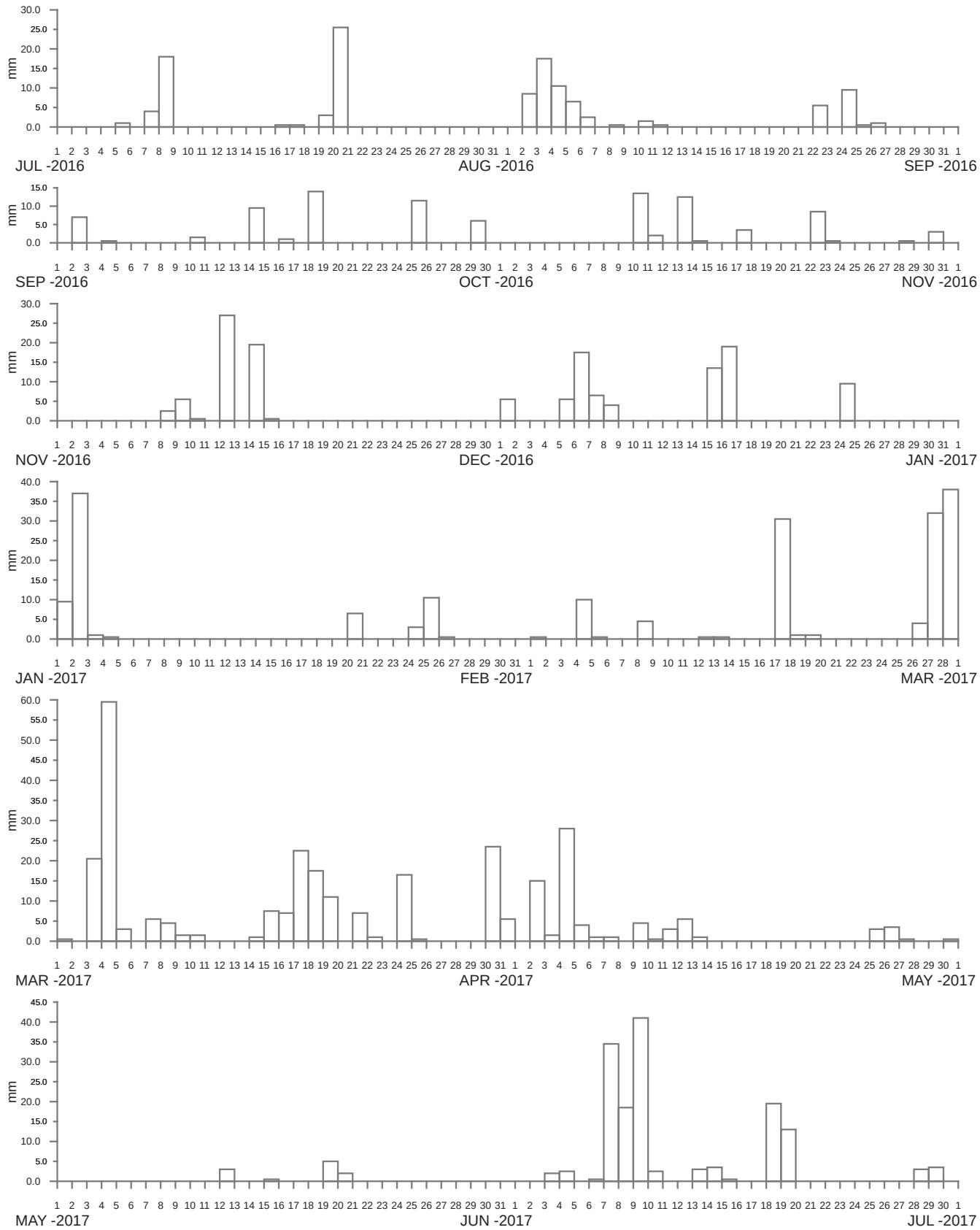
NSW GOVERNMENT Manly Hydraulics Laboratory

GOSTWYCK AT PATERSON RIVER
2016–2017

MHL Report 2575

Figure 38

DRAWING 2575-38-41.cdr



DATA LOSS

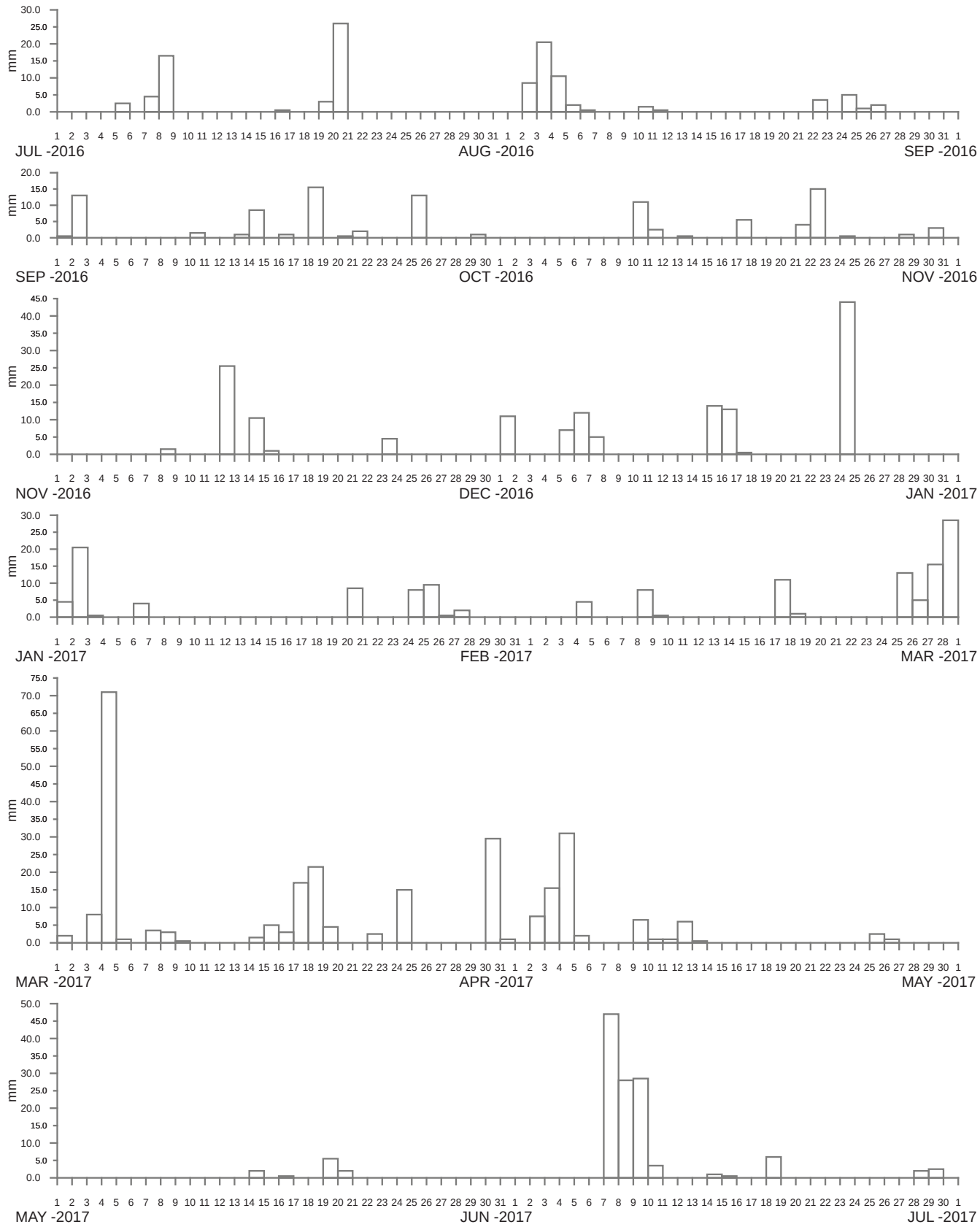
NSW GOVERNMENT Manly Hydraulics Laboratory

SEAHAM AT WILLIAMS RIVER
2016–2017

MHL Report 2575

Figure 39

DRAWING 2575-38-41.cdr



DATA LOSS

Manly Hydraulics Laboratory

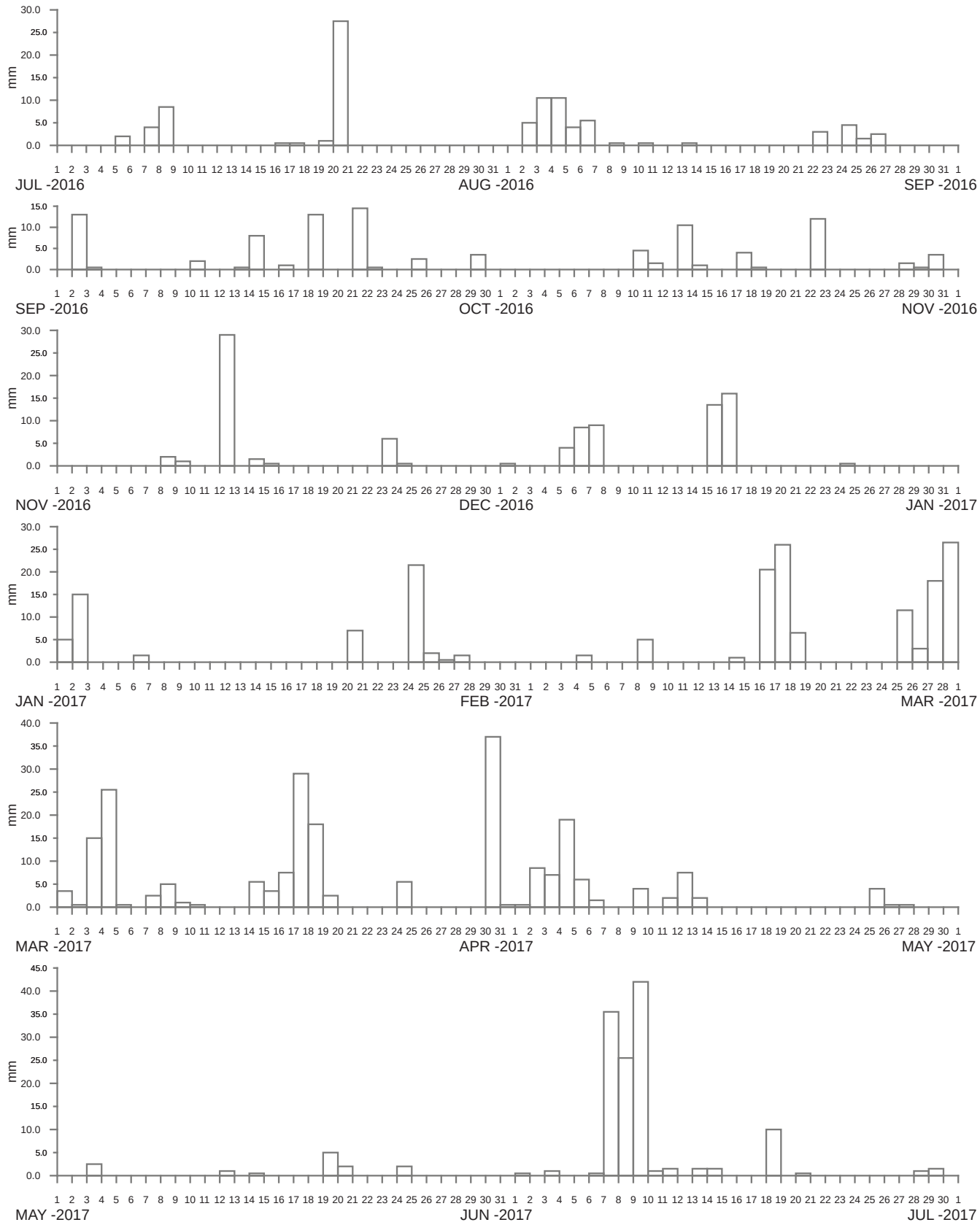
NSW GOVERNMENT

BELMORE BRIDGE AT HUNTER RIVER
2016–2017

MHL Report 2575

Figure 40

DRAWING 2575-38-41.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

HEXHAM BRIDGE AT HUNTER RIVER
2016–2017

MHL Report 2575

Figure 41

DRAWING 2575-38-41.cdr

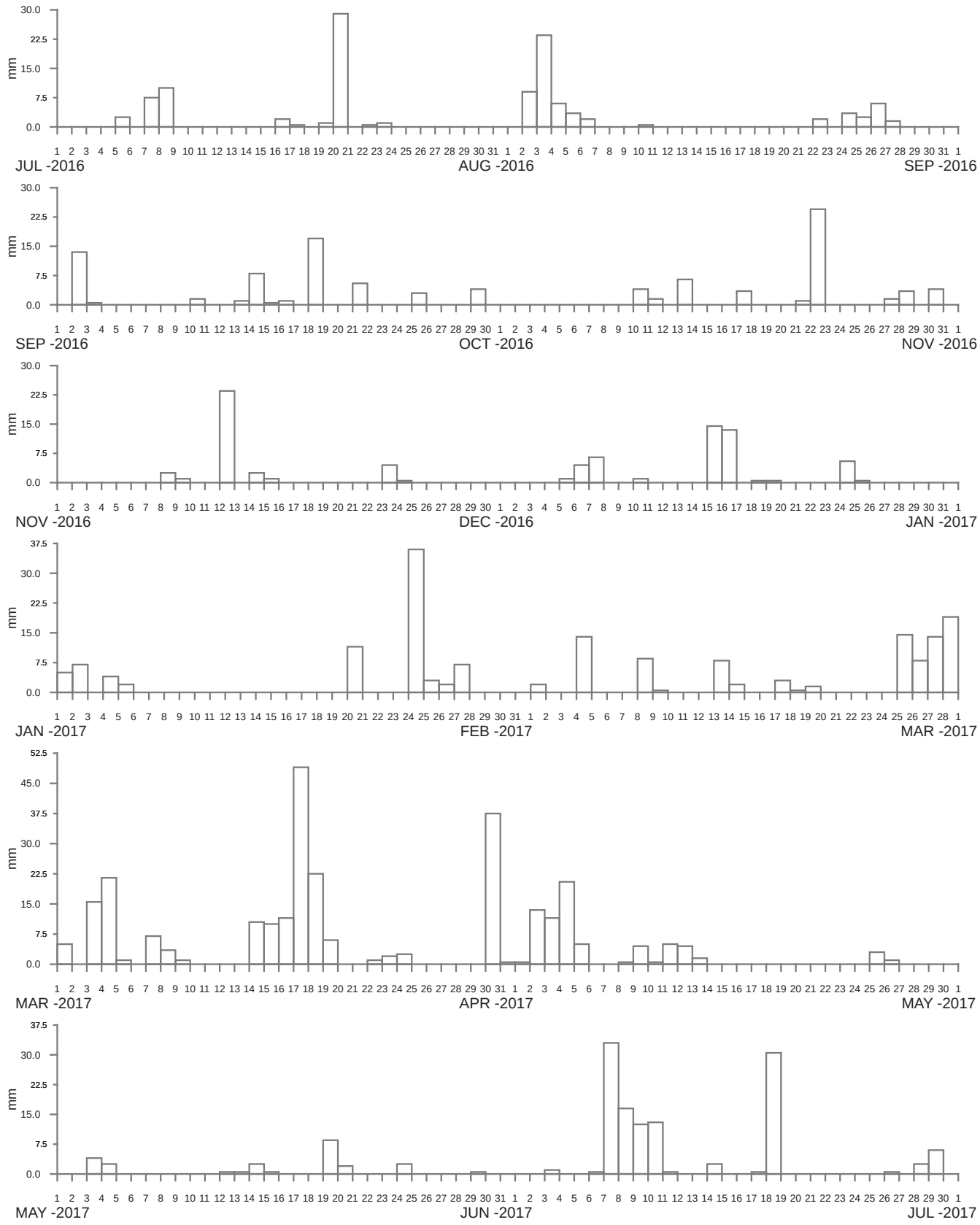
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
MACQUARIE-TUGGERAH LAKES (NORTH) REGION

MHL Report 2575

Figure 42

DRAWING 2575-42.cdr



DATA LOSS

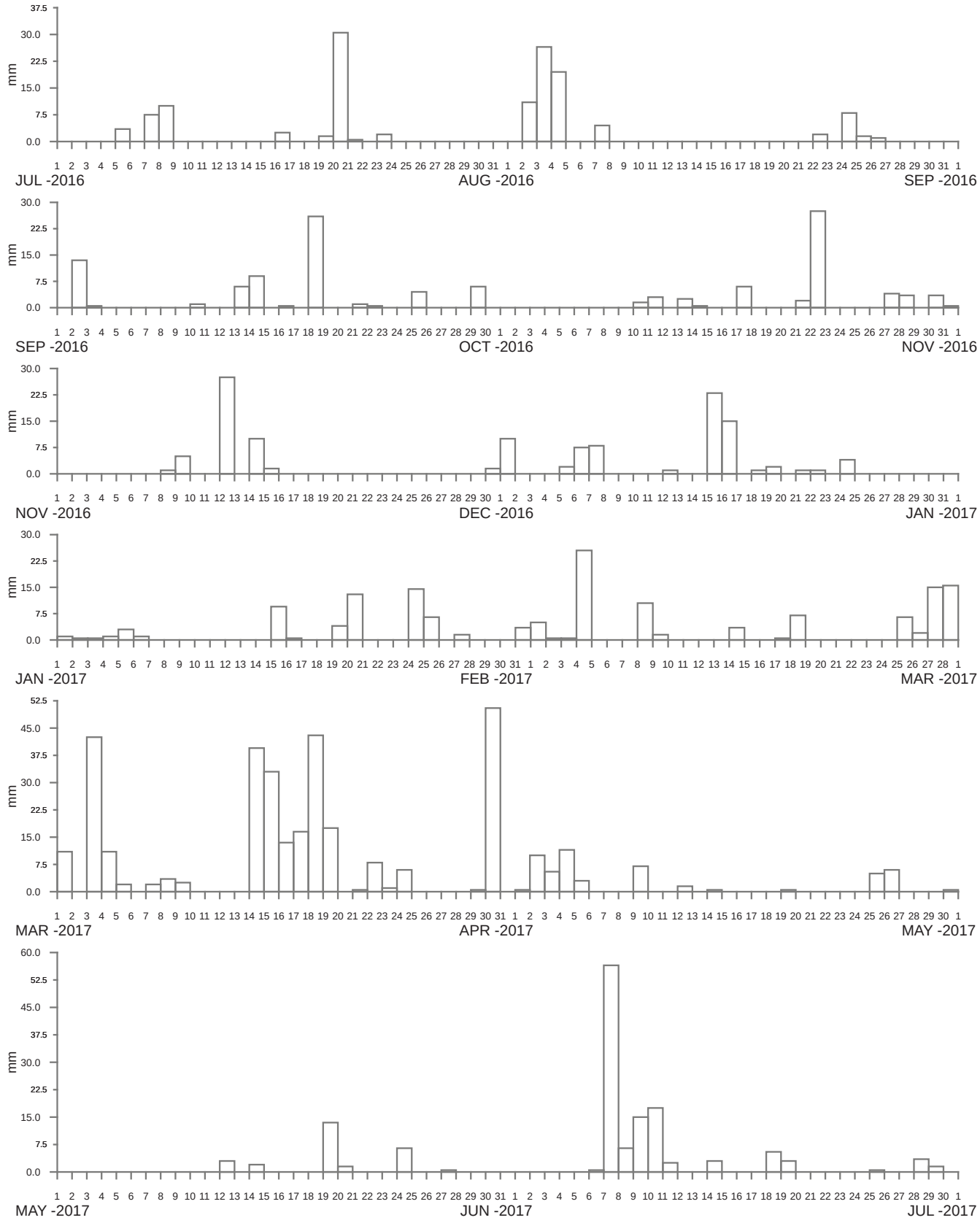
NSW GOVERNMENT Manly Hydraulics Laboratory

BARNSLEY AT JOHNSON AVENUE
2016–2017

MHL Report 2575

Figure 43

DRAWING 2575-43-46.cdr



DATA LOSS

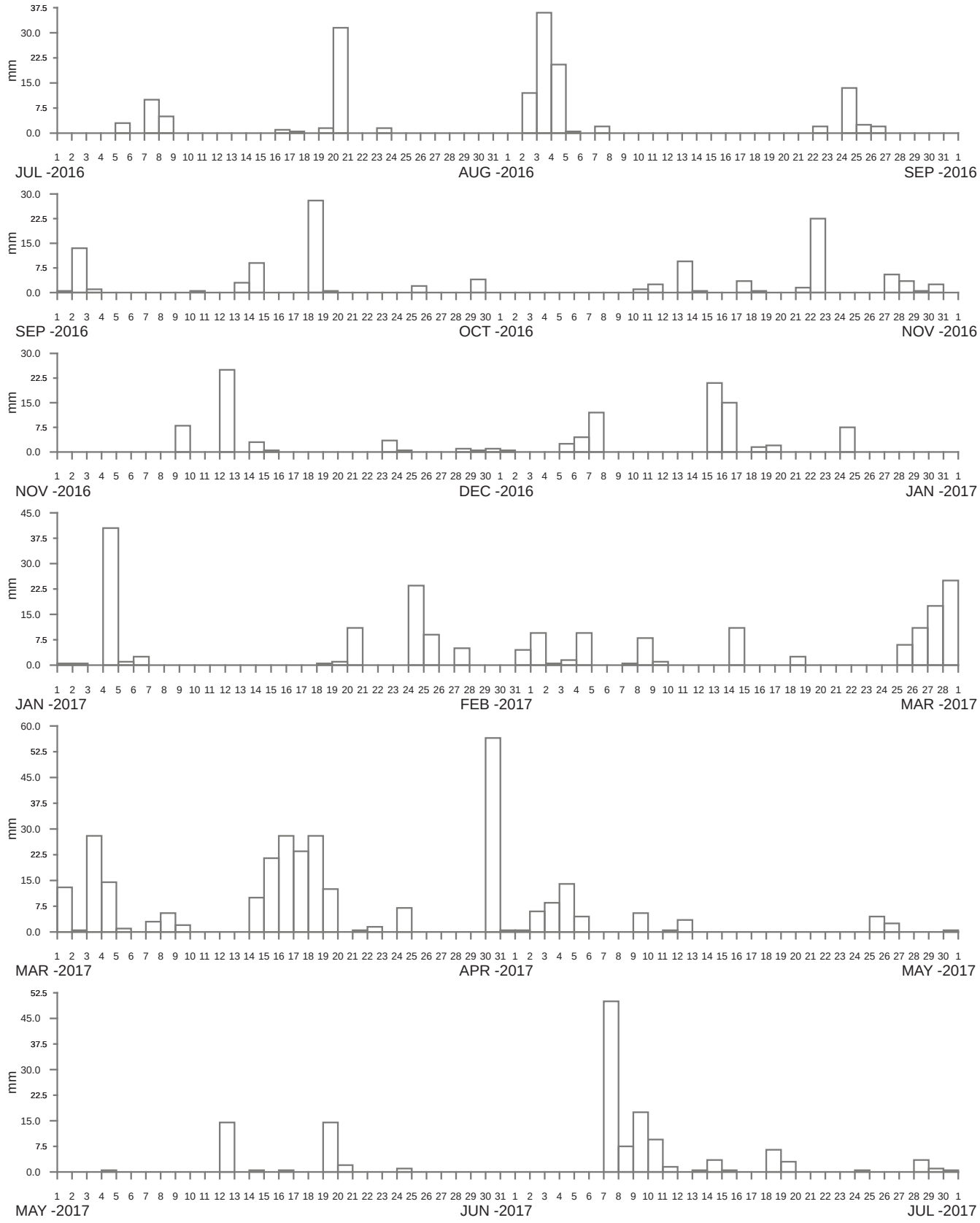
NSW GOVERNMENT Manly Hydraulics Laboratory

MARTINSVILLE AT MARTINSVILLE ROAD
2016–2017

MHL Report 2575

Figure 44

DRAWING 2575-43-46.cdr



DATA LOSS

Manly Hydraulics Laboratory

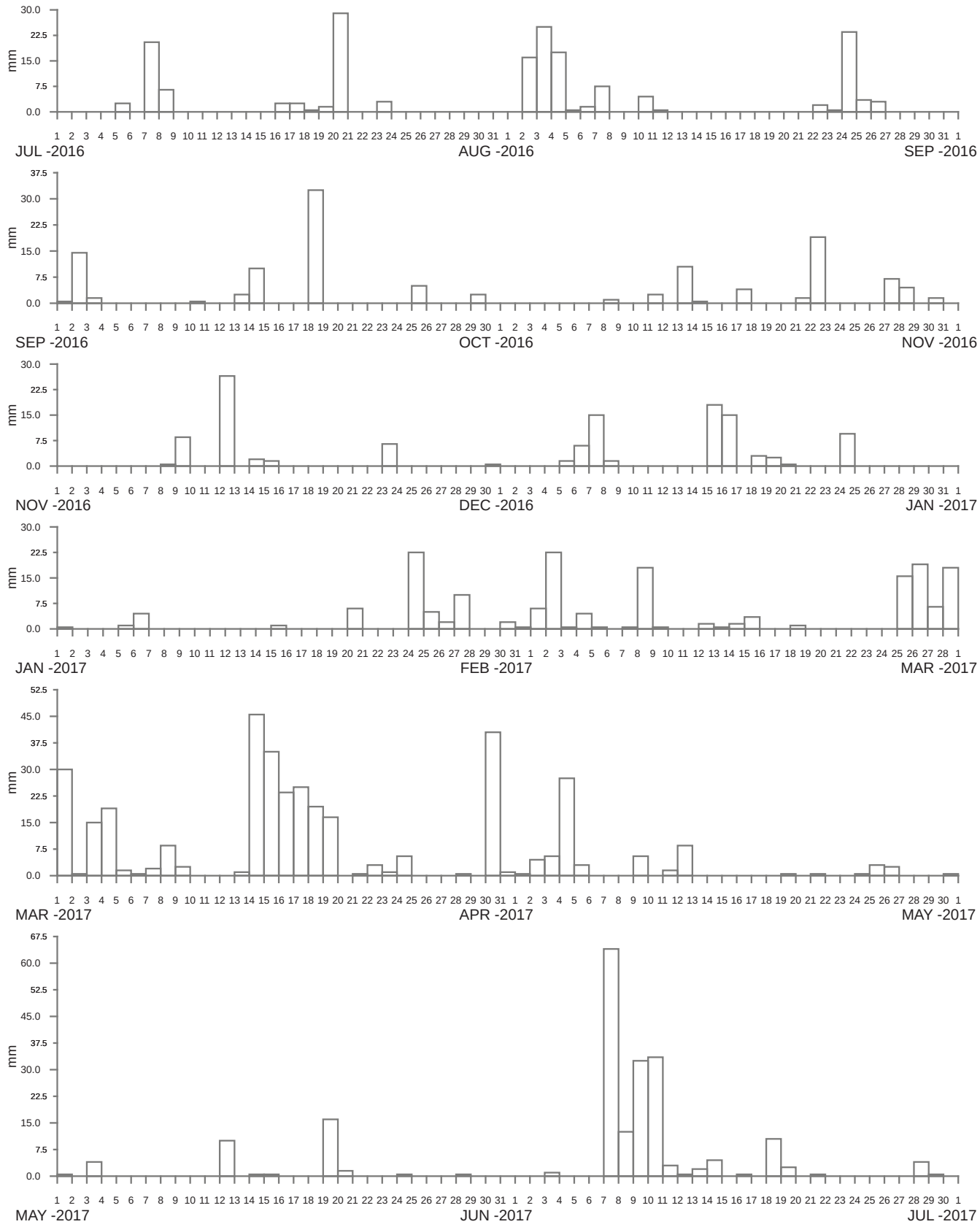
NSW GOVERNMENT

MANDALONG AT DEAVES ROAD
2016–2017

MHL Report 2575

Figure 45

DRAWING 2575-43-46.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

WYEE AT COLLUNGRA STREET
2016–2017

MHL Report 2575

Figure 46

DRAWING 2575-43-46.cdr

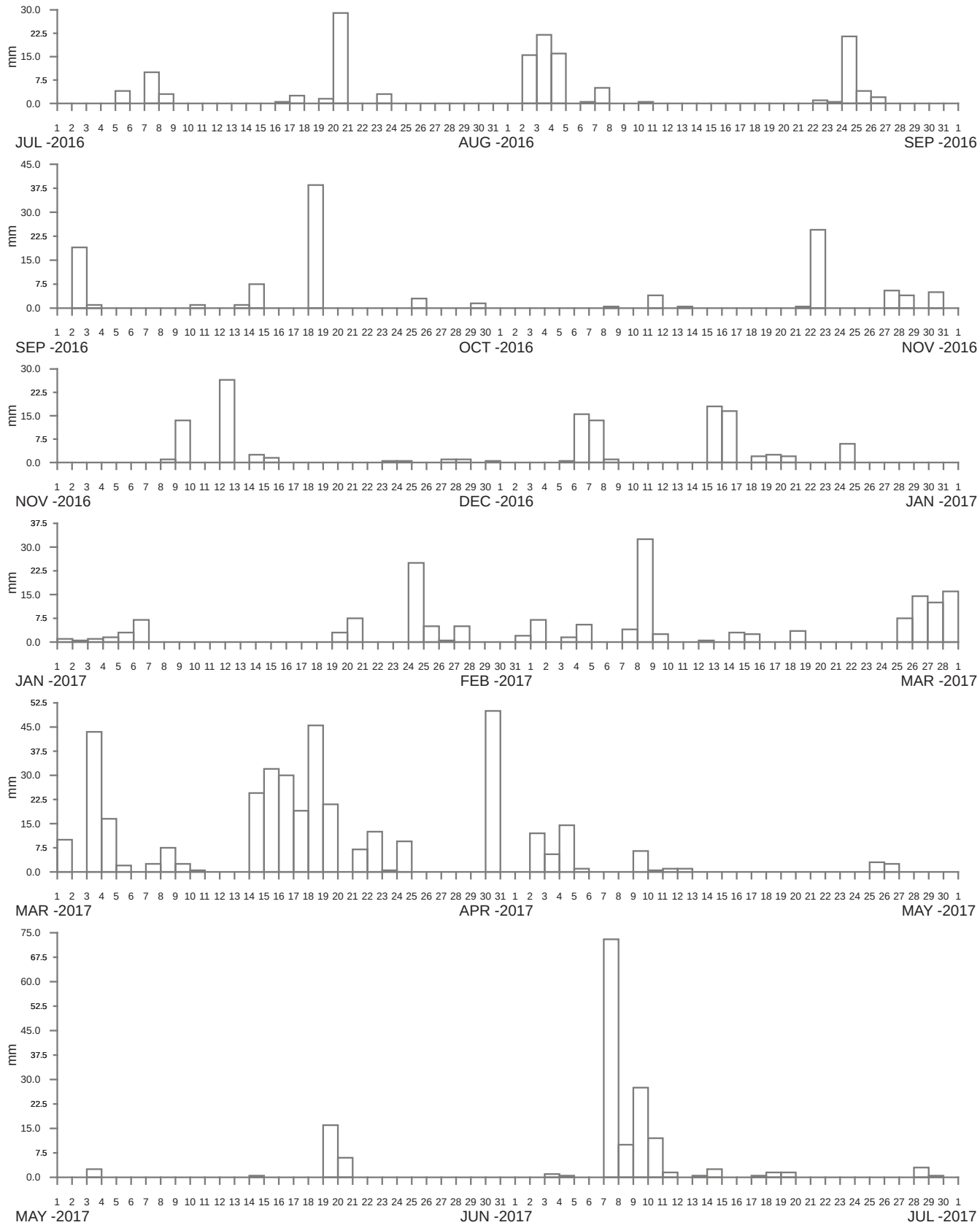
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
MACQUARIE-TUGGERAH LAKES (SOUTH),
BRISBANE WATER AND HAWKESBURY RIVER REGIONS

MHL Report 2575

Figure 47

DRAWING 2575-47.cdr



DATA LOSS

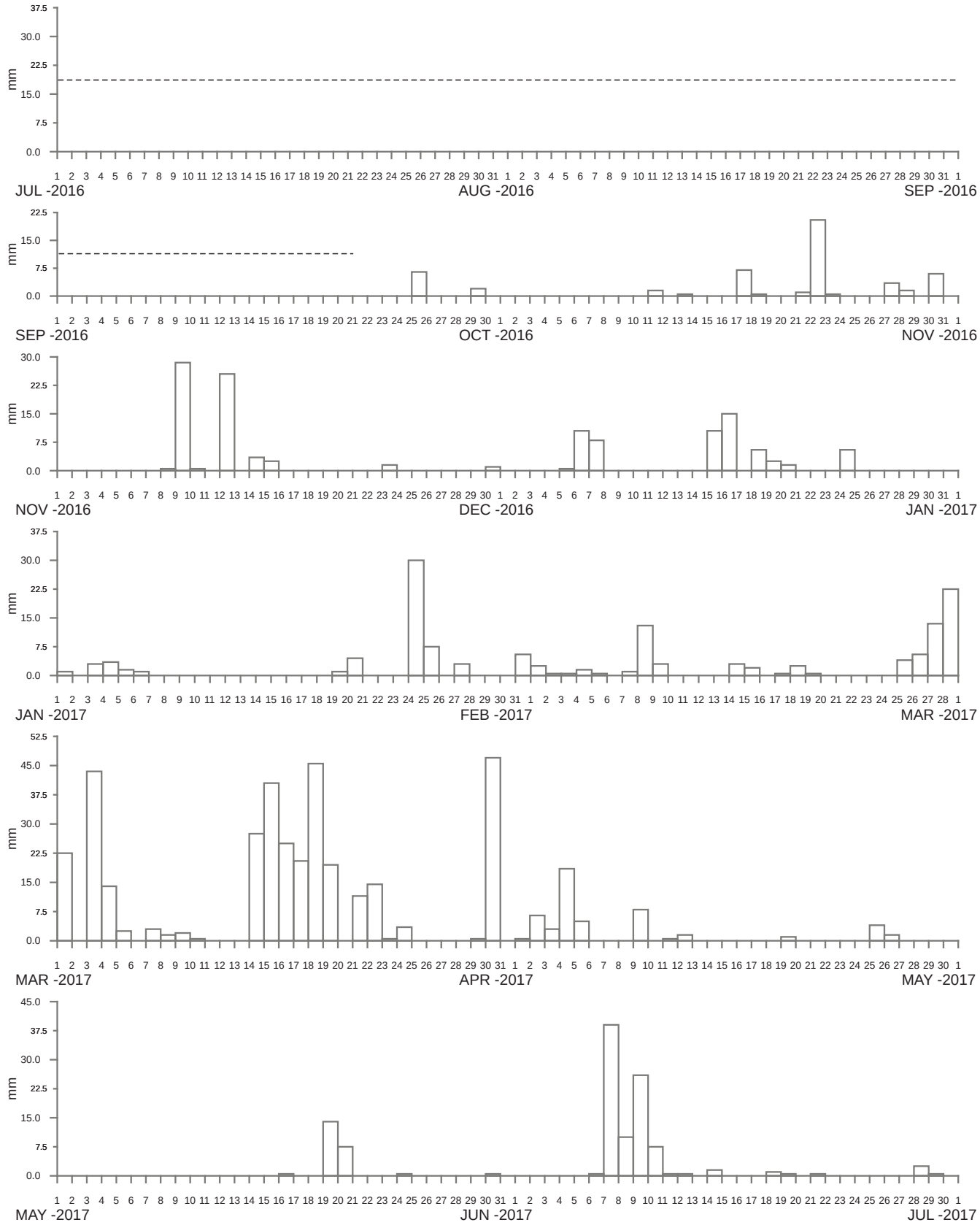
NSW GOVERNMENT Manly Hydraulics Laboratory

WHITEMANS RIDGE AT WATAGANS FOREST DRIVE 2016–2017

MHL Report 2575

Figure 48

DRAWING 2575-48-63.cdr



DATA LOSS

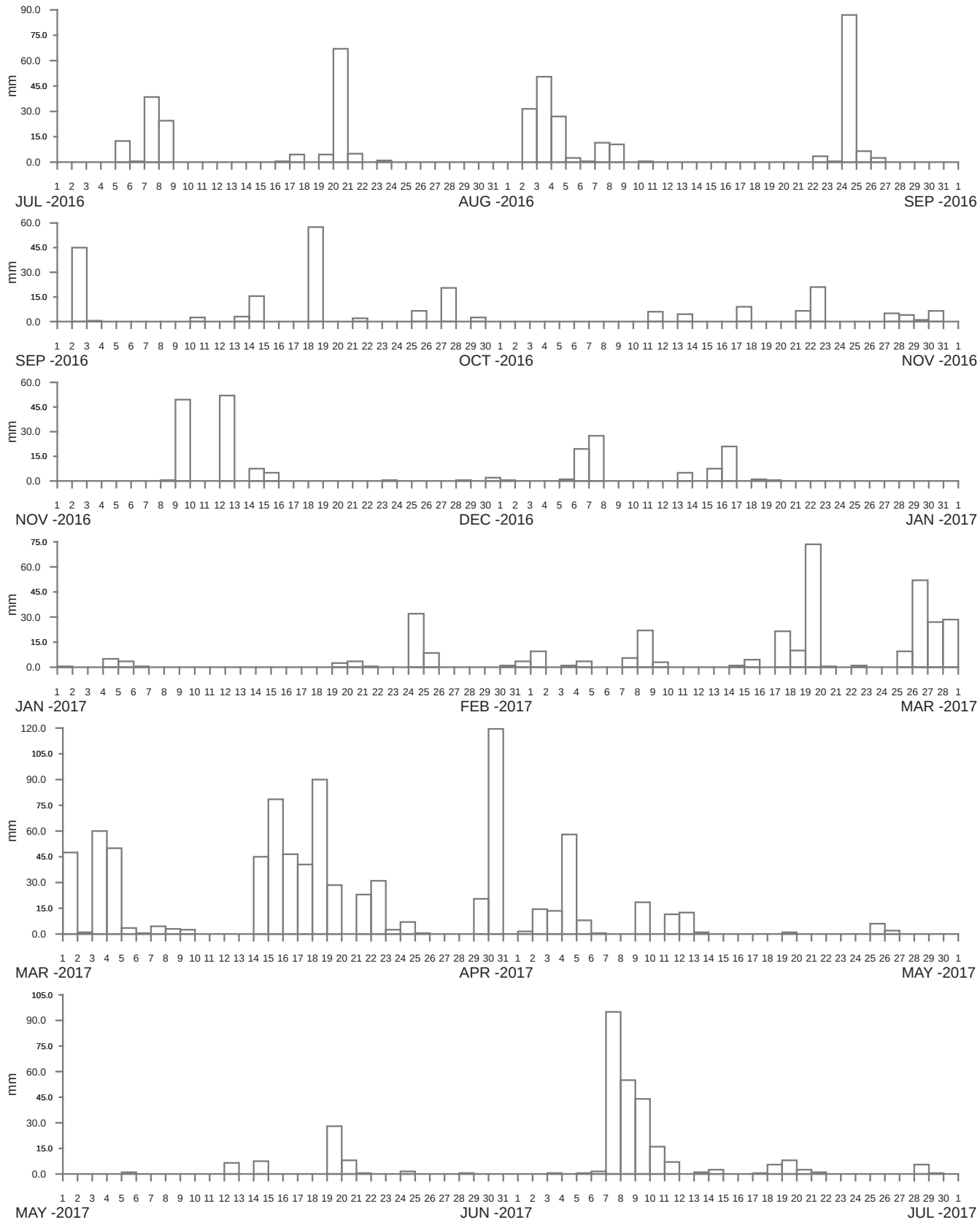
NSW GOVERNMENT Manly Hydraulics Laboratory

YARRAMALONG AT BUMBLE HILL ROAD
2016–2017

MHL Report 2575

Figure 49

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

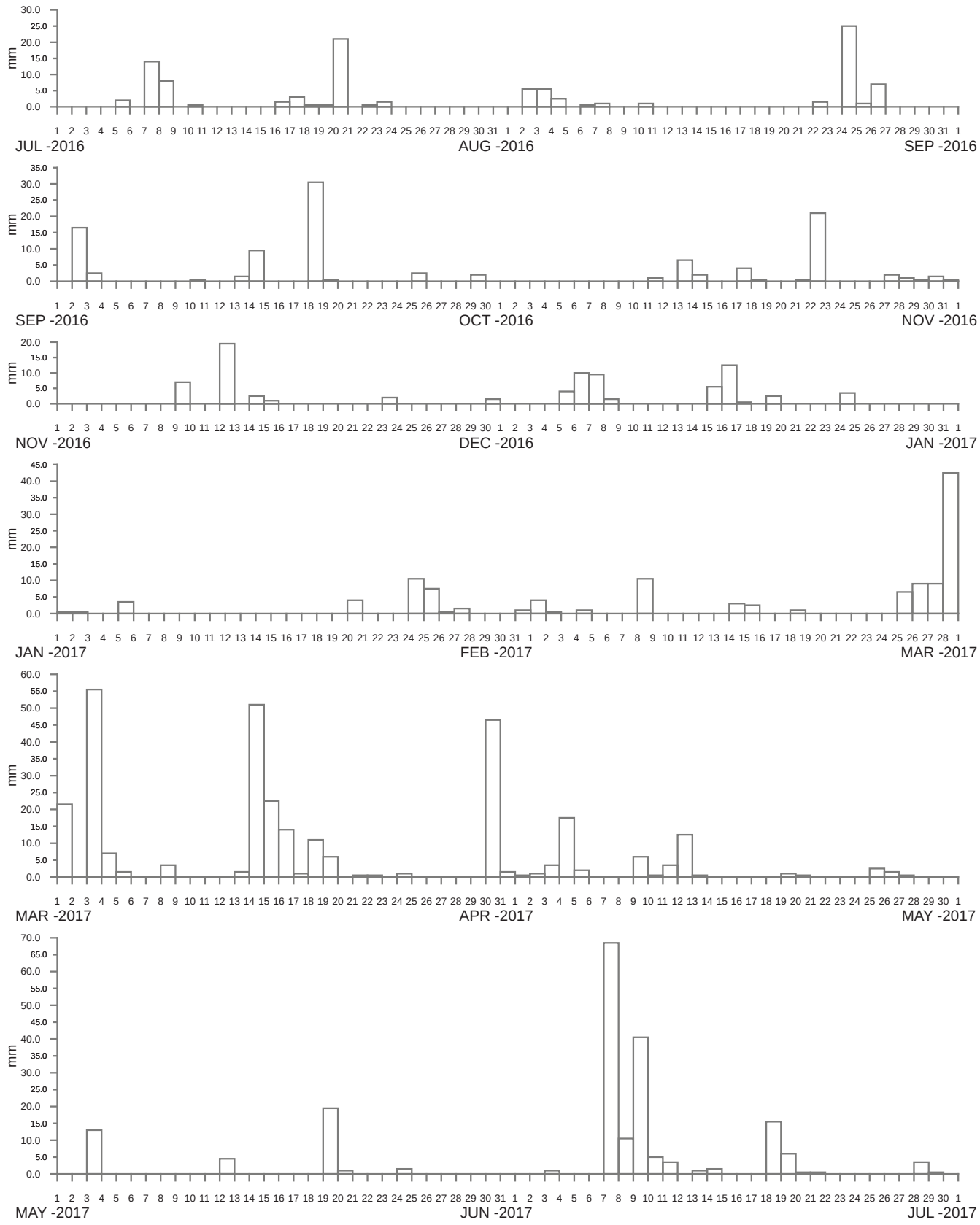
NSW GOVERNMENT

KULNURA AT GEORGE DOWNS DRIVE
2016–2017

MHL Report 2575

Figure 50

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

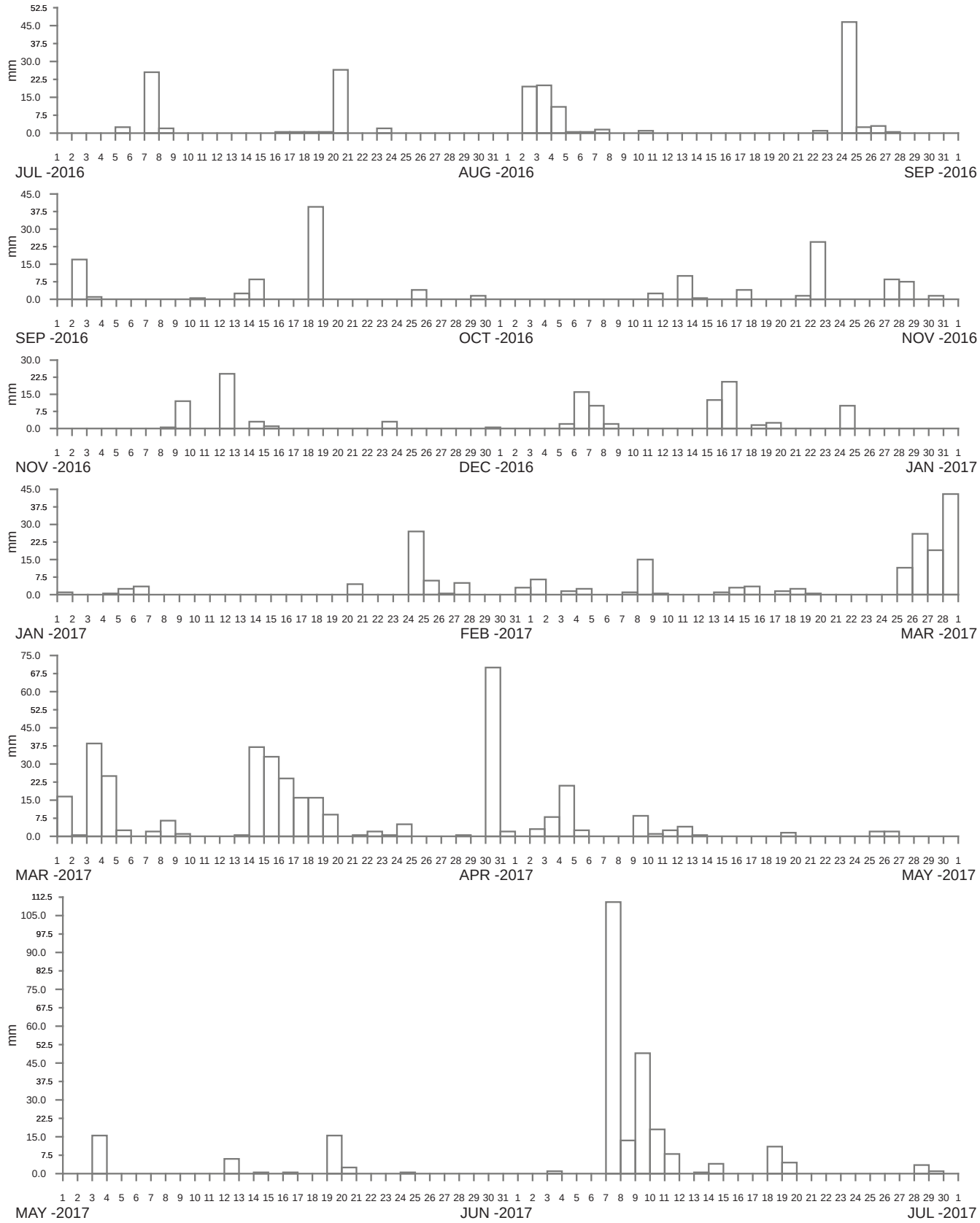
NSW GOVERNMENT

TOUKLEY AT TUGGERAH LAKE
2016–2017

MHL Report 2575

Figure 51

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

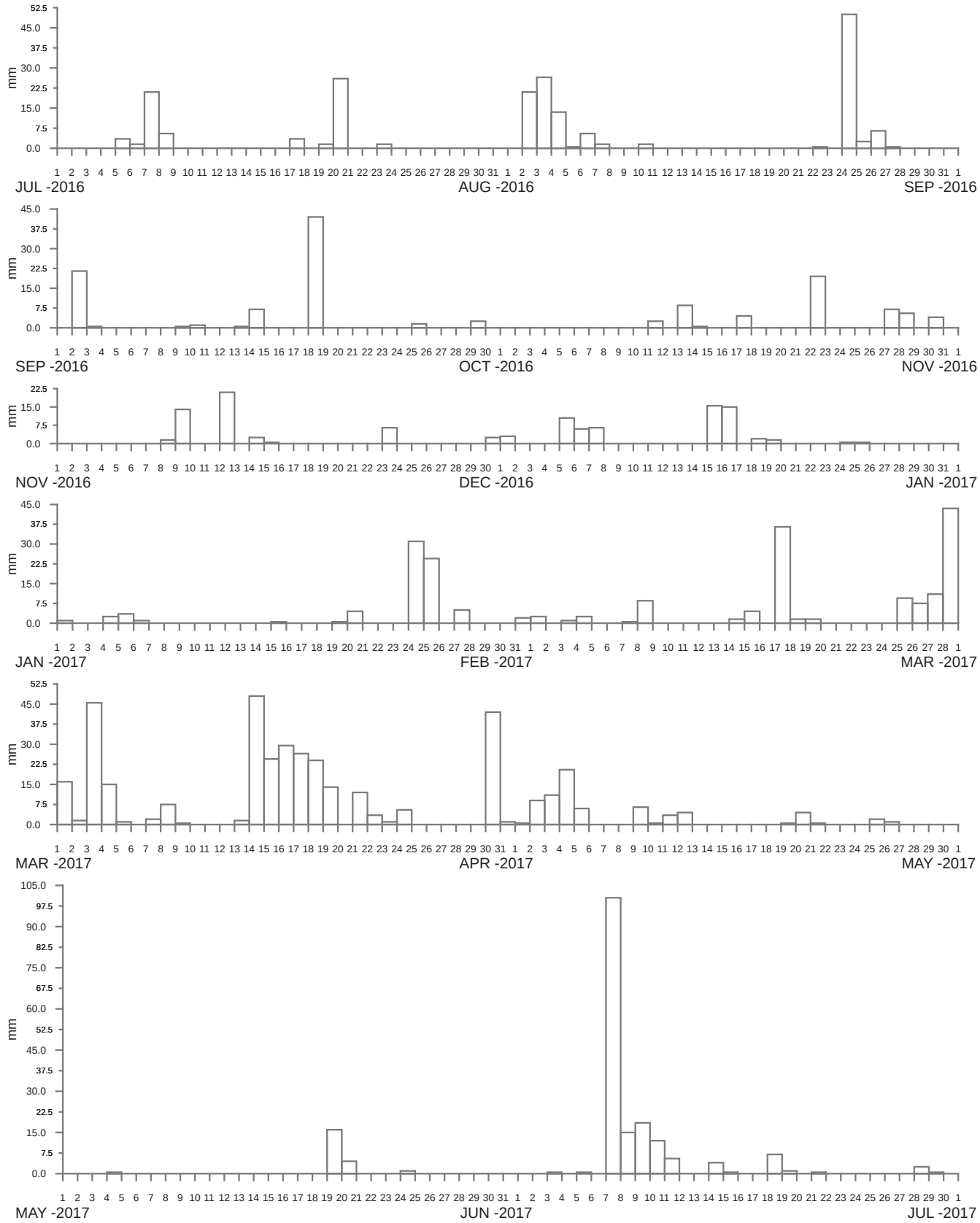
NSW GOVERNMENT

HAMLYN TERRACE AT WARNERVALE ROAD
2016–2017

MHL Report 2575

Figure 52

DRAWING 2575-48-63.cdr



DATA LOSS

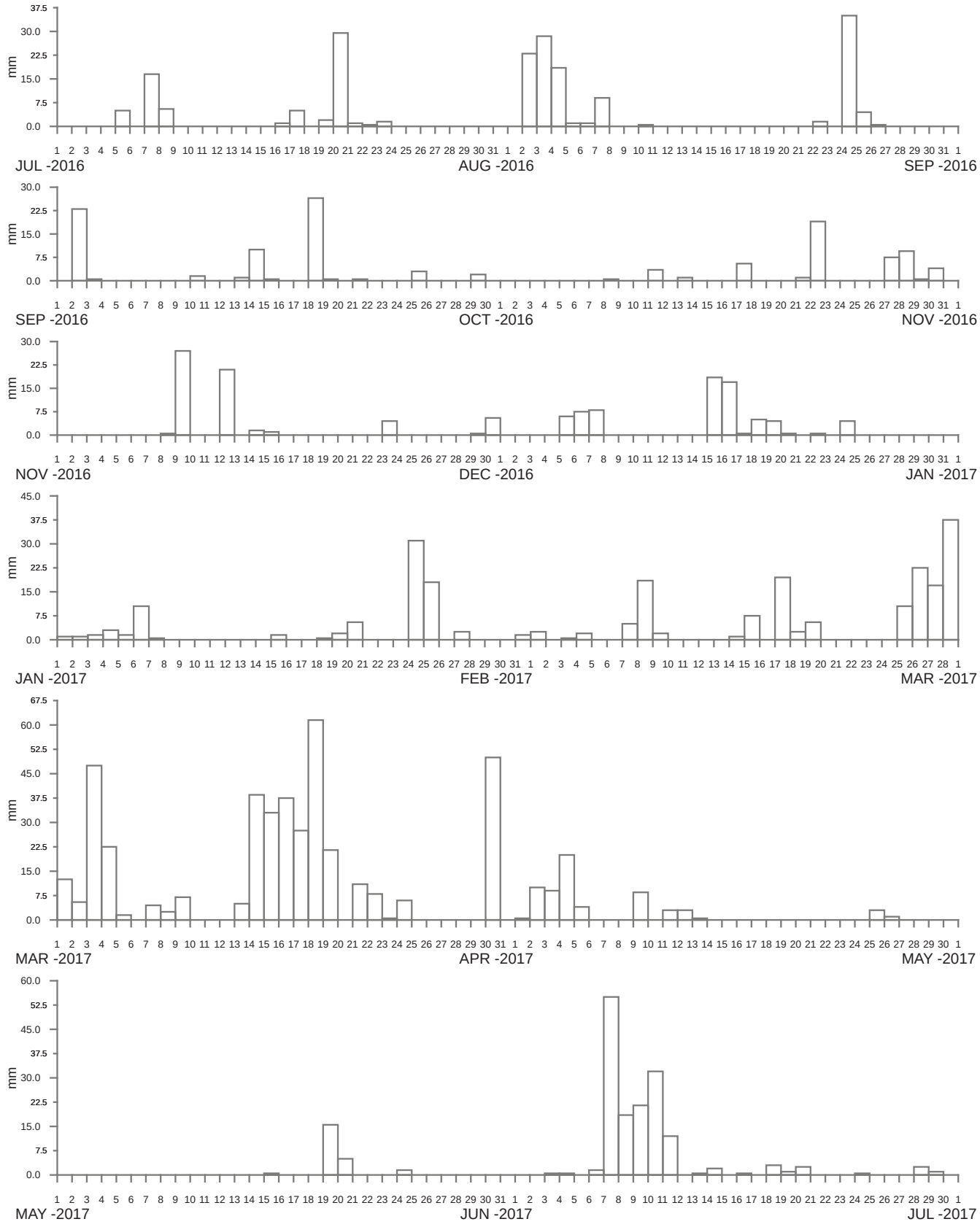
NSW GOVERNMENT Manly Hydraulics Laboratory

MARDI DAM AT OLD MAITLAND ROAD
2016–2017

MHL Report 2575

Figure 53

DRAWING 2575-48-63.cdr



DATA LOSS

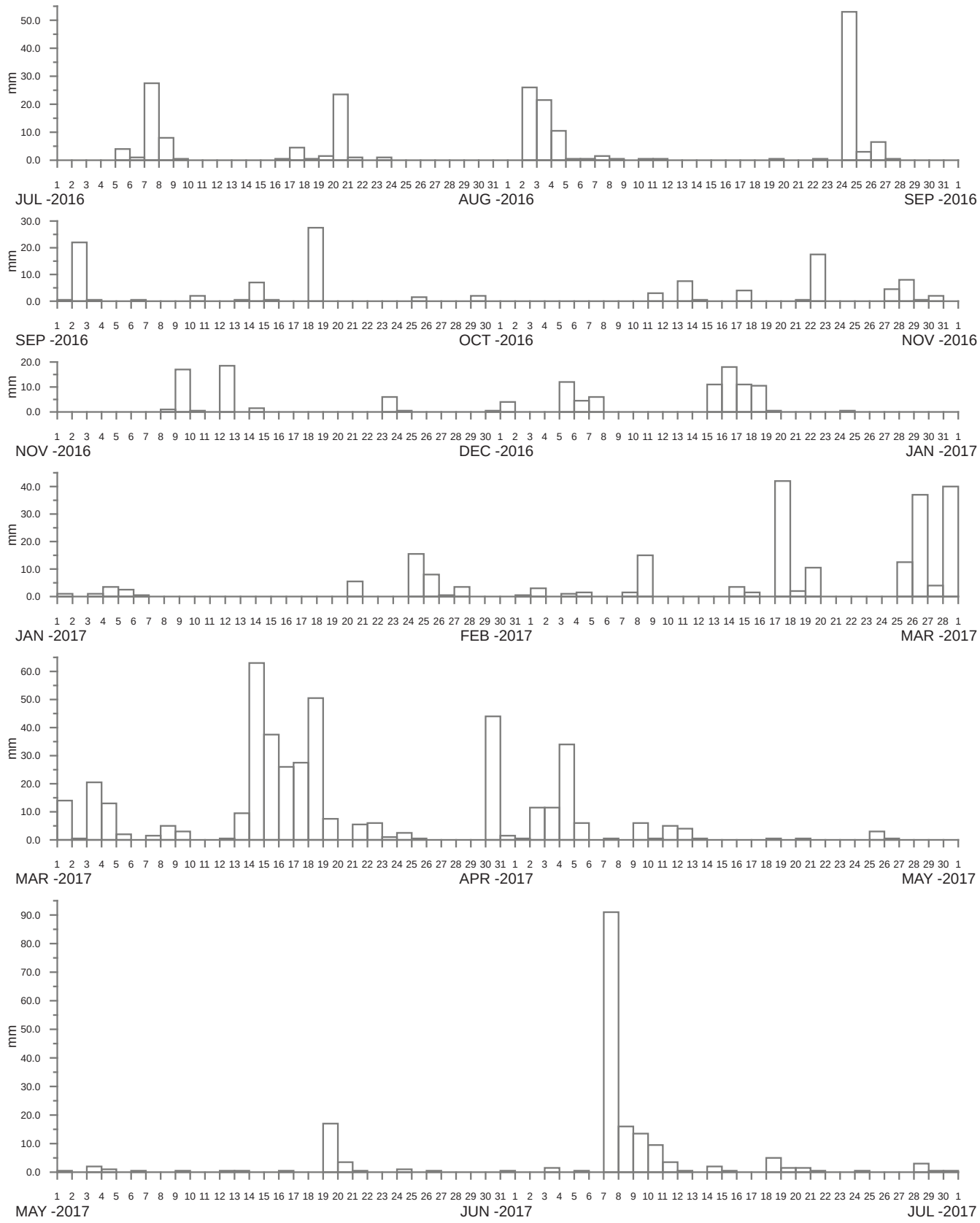
NSW GOVERNMENT Manly Hydraulics Laboratory

STERLAND AT RED HILL FOREST ROAD
2016–2017

MHL Report 2575

Figure 54

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

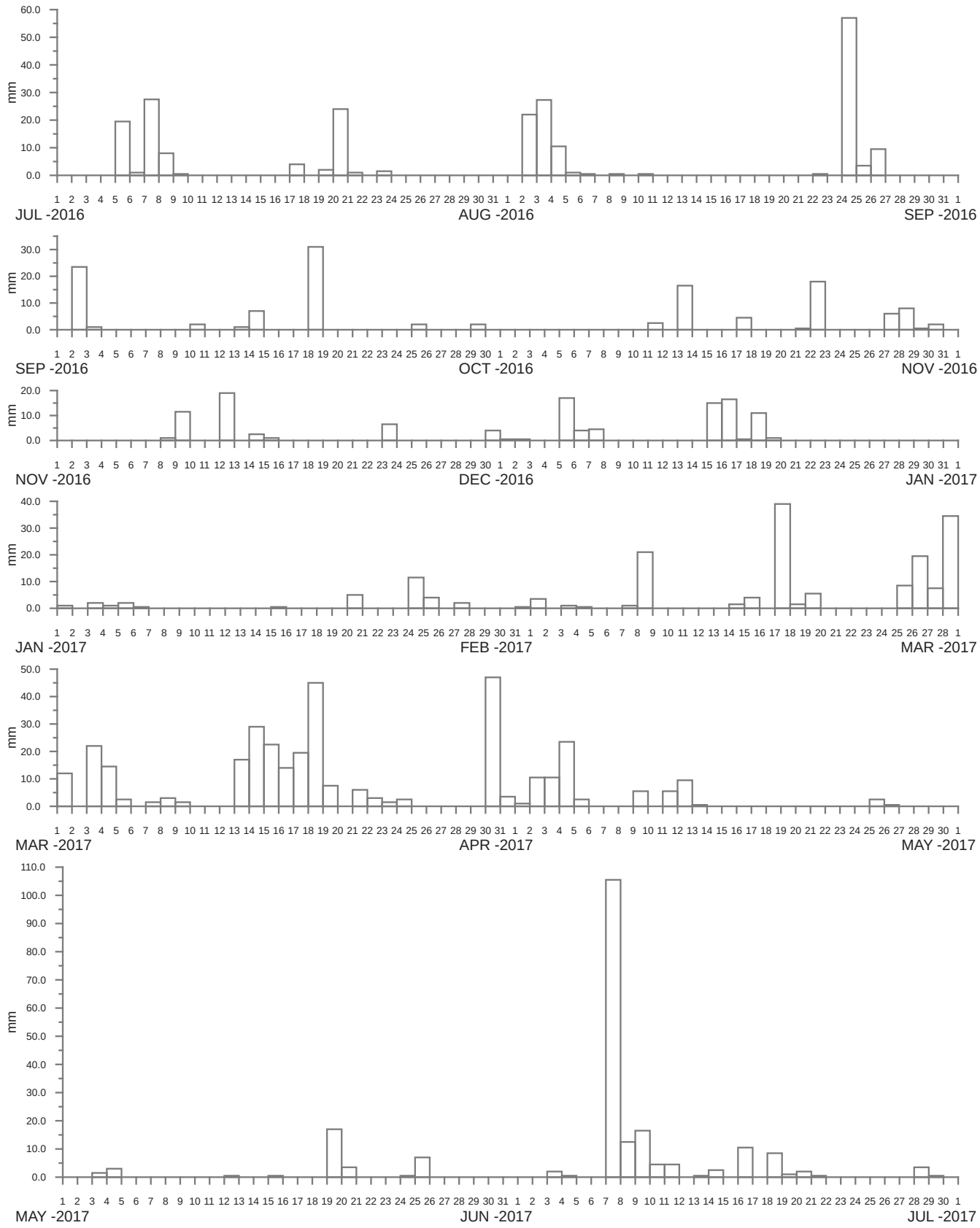
NSW GOVERNMENT

KANGY ANGY AT ORCHARD ROAD
2016–2017

MHL Report 2575

Figure 55

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

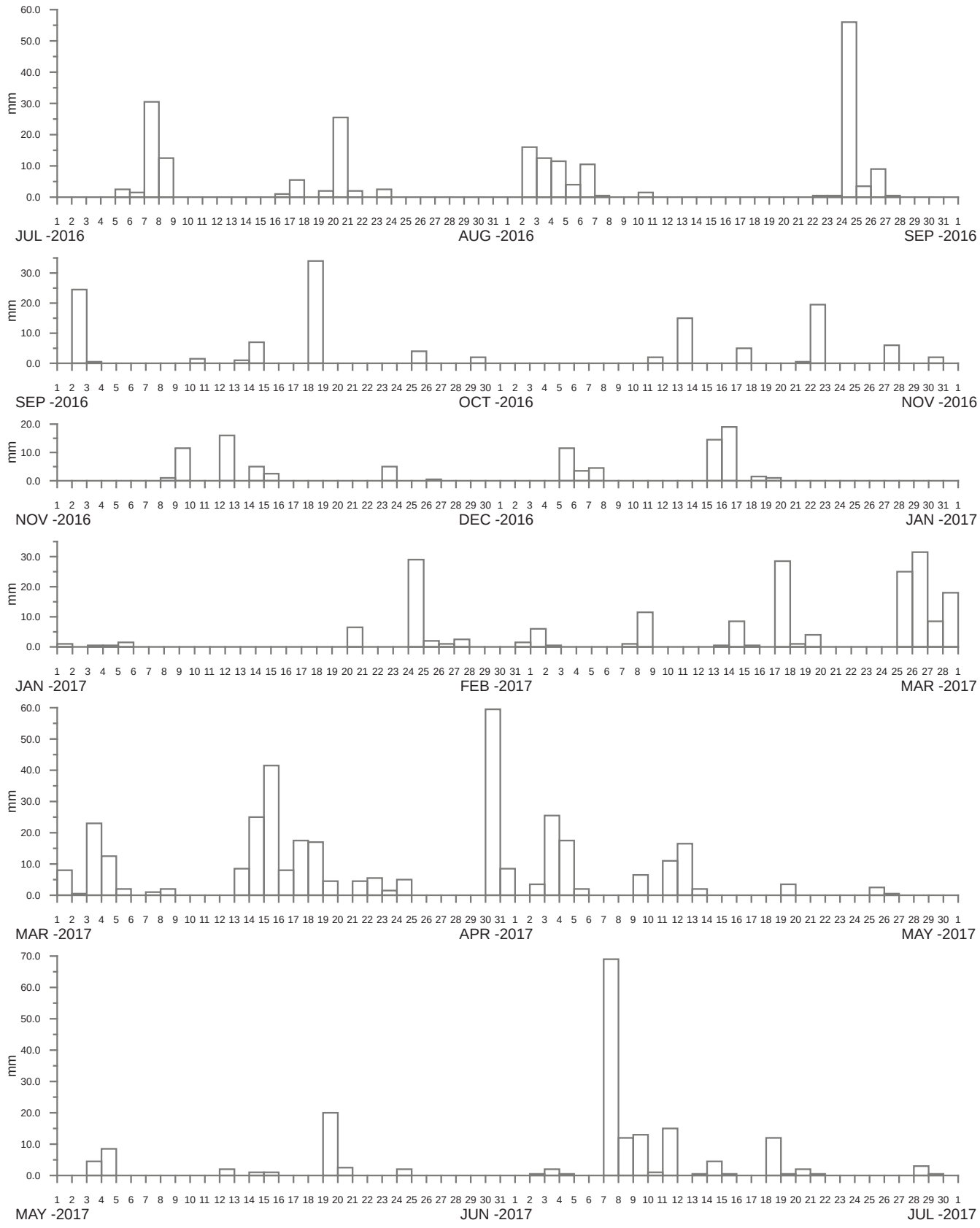
NSW GOVERNMENT

BERKELEY VALE AT BERKELEY VALE ROAD
2016–2017

MHL Report 2575

Figure 56

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

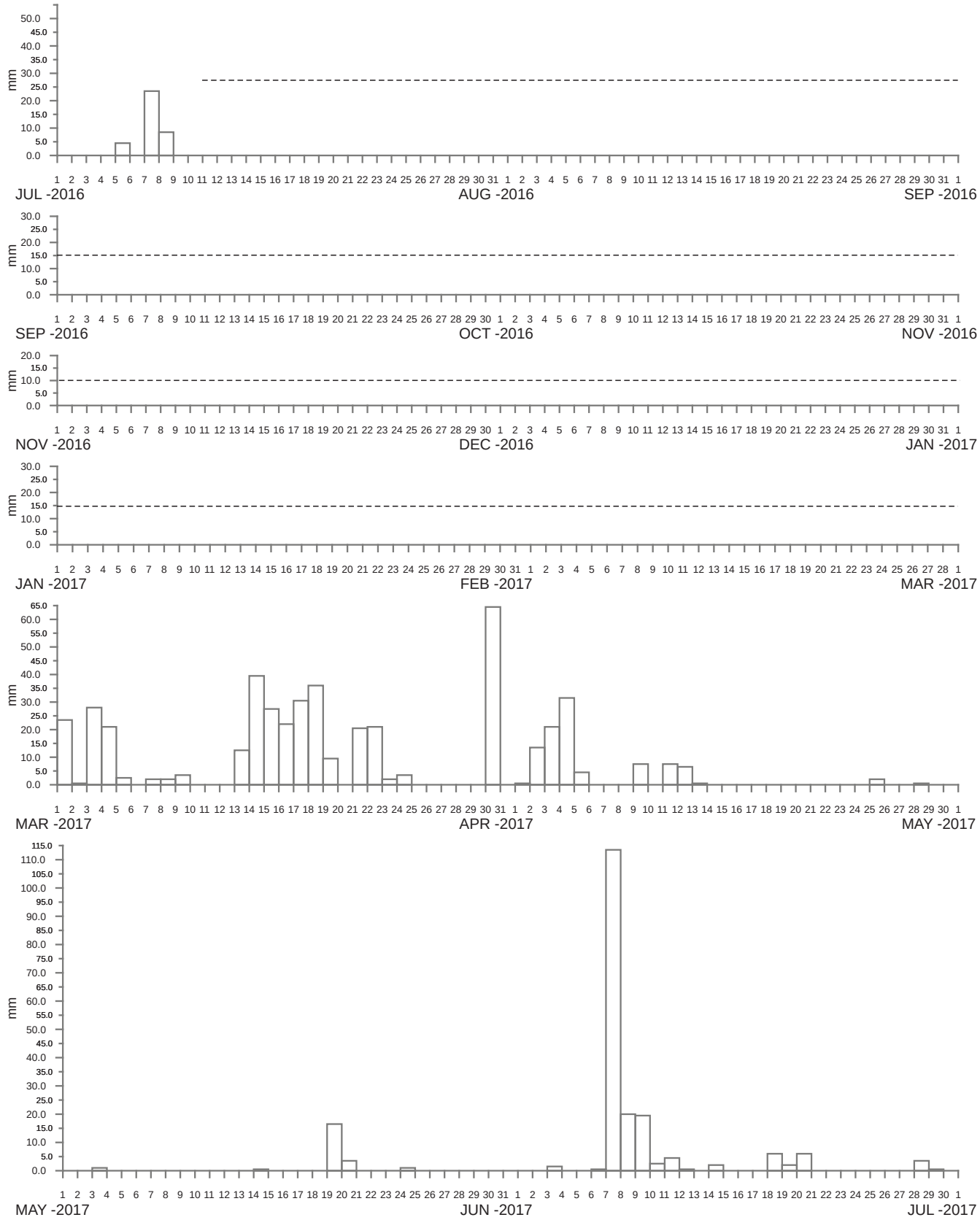
NSW GOVERNMENT

BATEAU BAY AT SEWAGE TREATMENT WORKS 2016–2017

MHL Report 2575

Figure 57

DRAWING 2575-48-63.cdr



DATA LOSS

Station calibration greater than +/- 10% between 11 August 2016 and 29 March 2017

Manly Hydraulics Laboratory

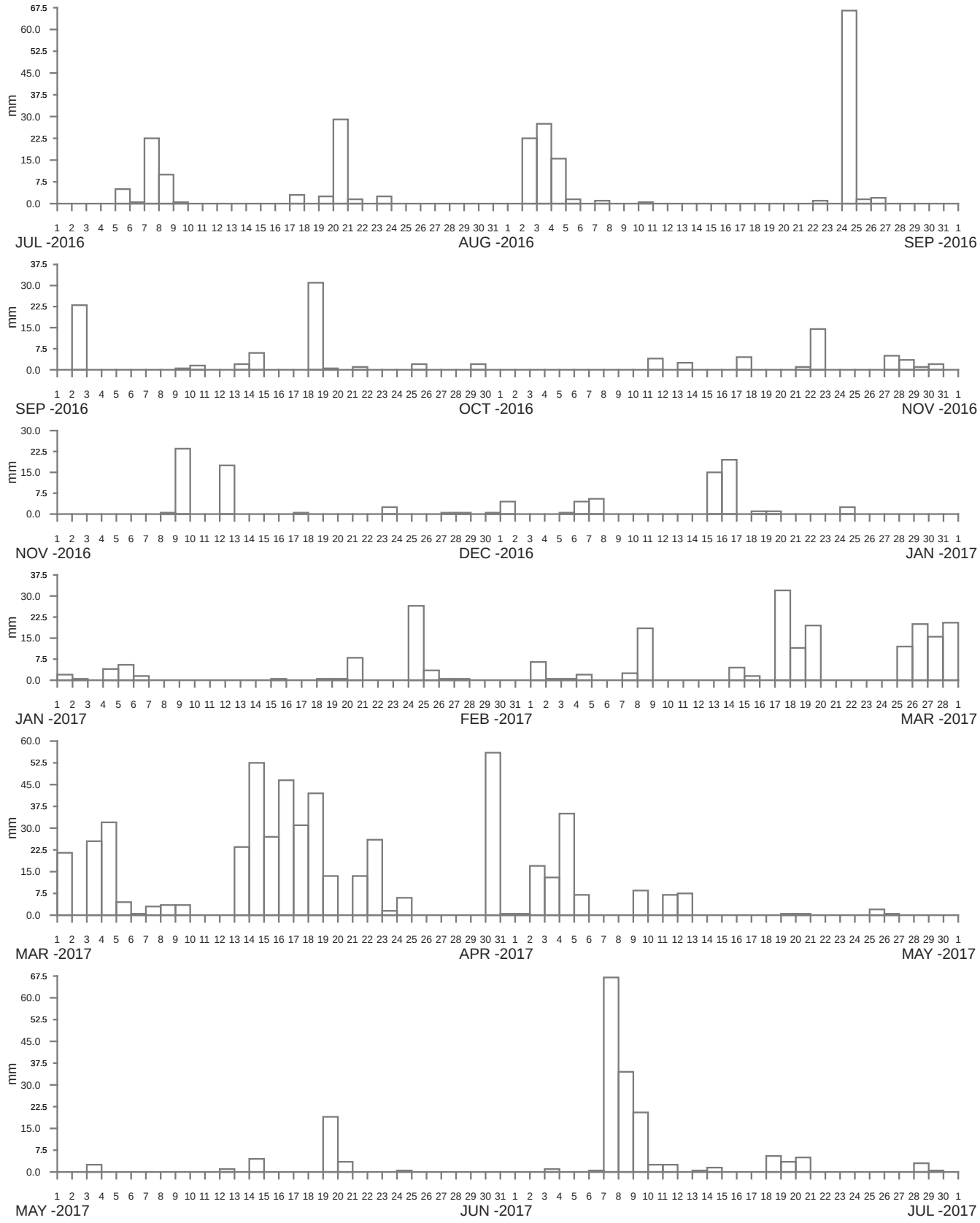
NSW GOVERNMENT

LISAROW AT FAGANS ROAD
2016–2017

MHL Report 2575

Figure 58

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

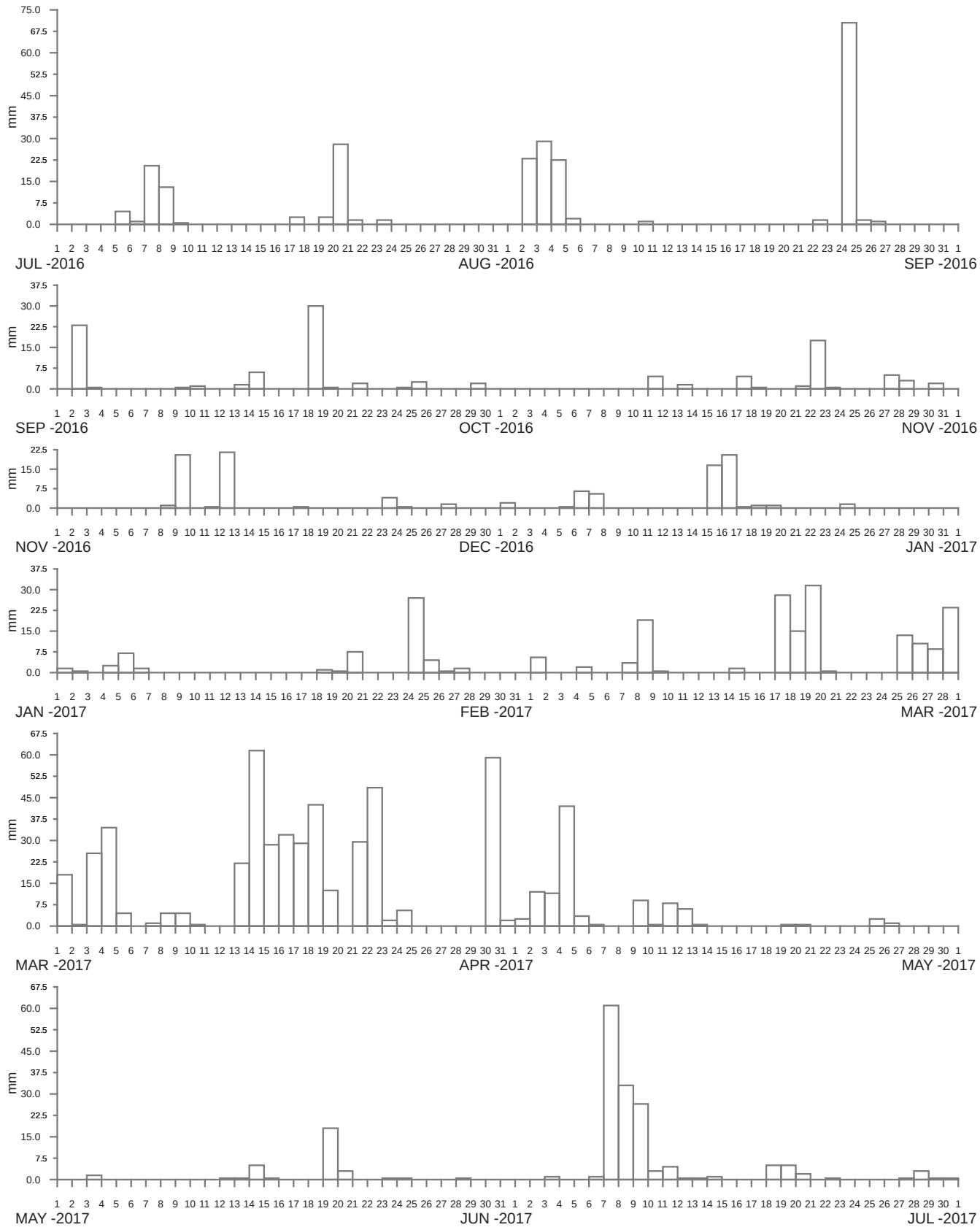
NSW GOVERNMENT

STRICKLAND AT MANGROVE ROAD
2016–2017

MHL Report 2575

Figure 59

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

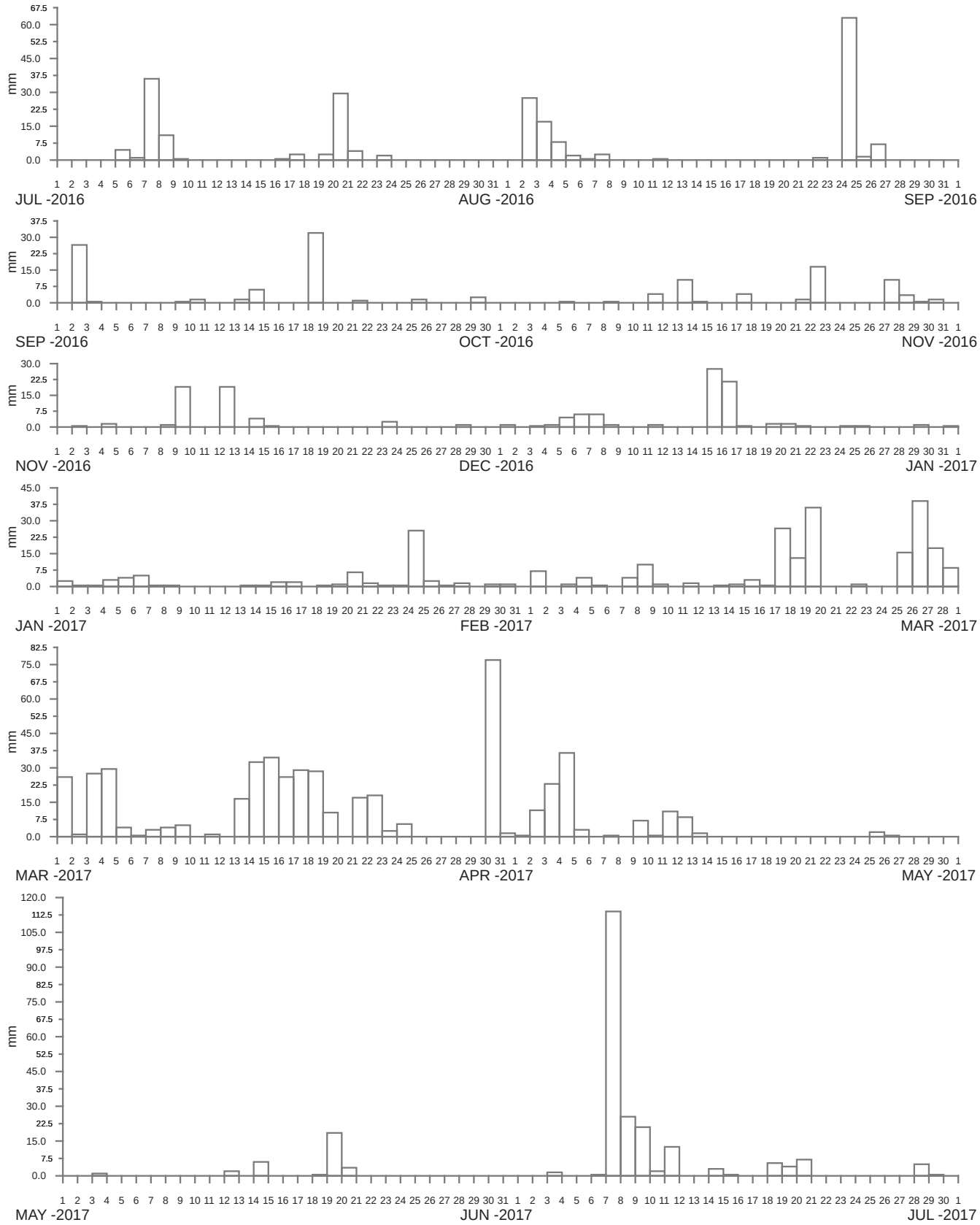
NSW GOVERNMENT

NARARA AT RESEARCH ROAD
2016–2017

MHL Report 2575

Figure 60

DRAWING 2575-48-63.cdr



DATA LOSS

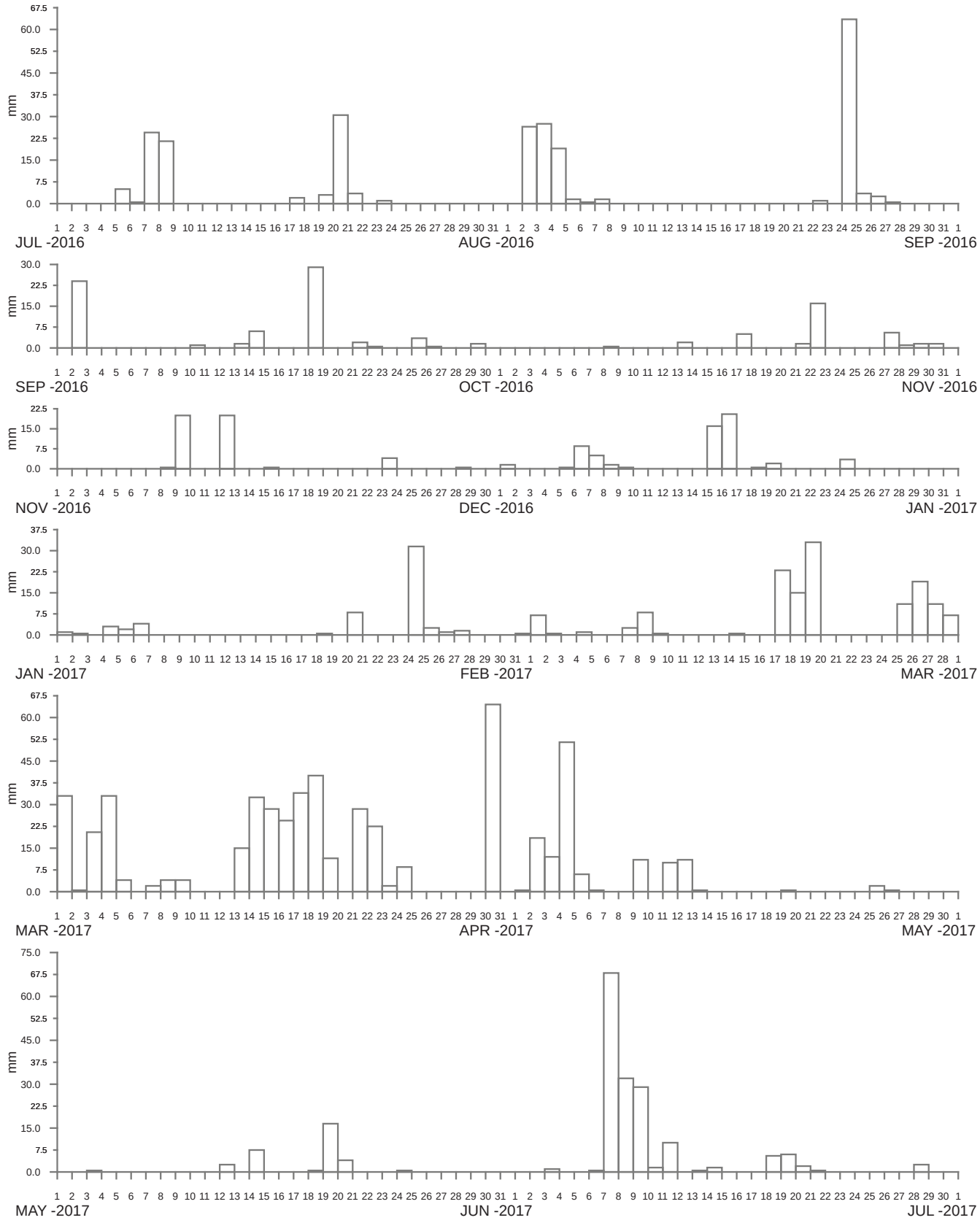
NSW GOVERNMENT Manly Hydraulics Laboratory

MOUNT ELLIOT AT TOOMEYS ROAD
2016–2017

MHL Report 2575

Figure 61

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

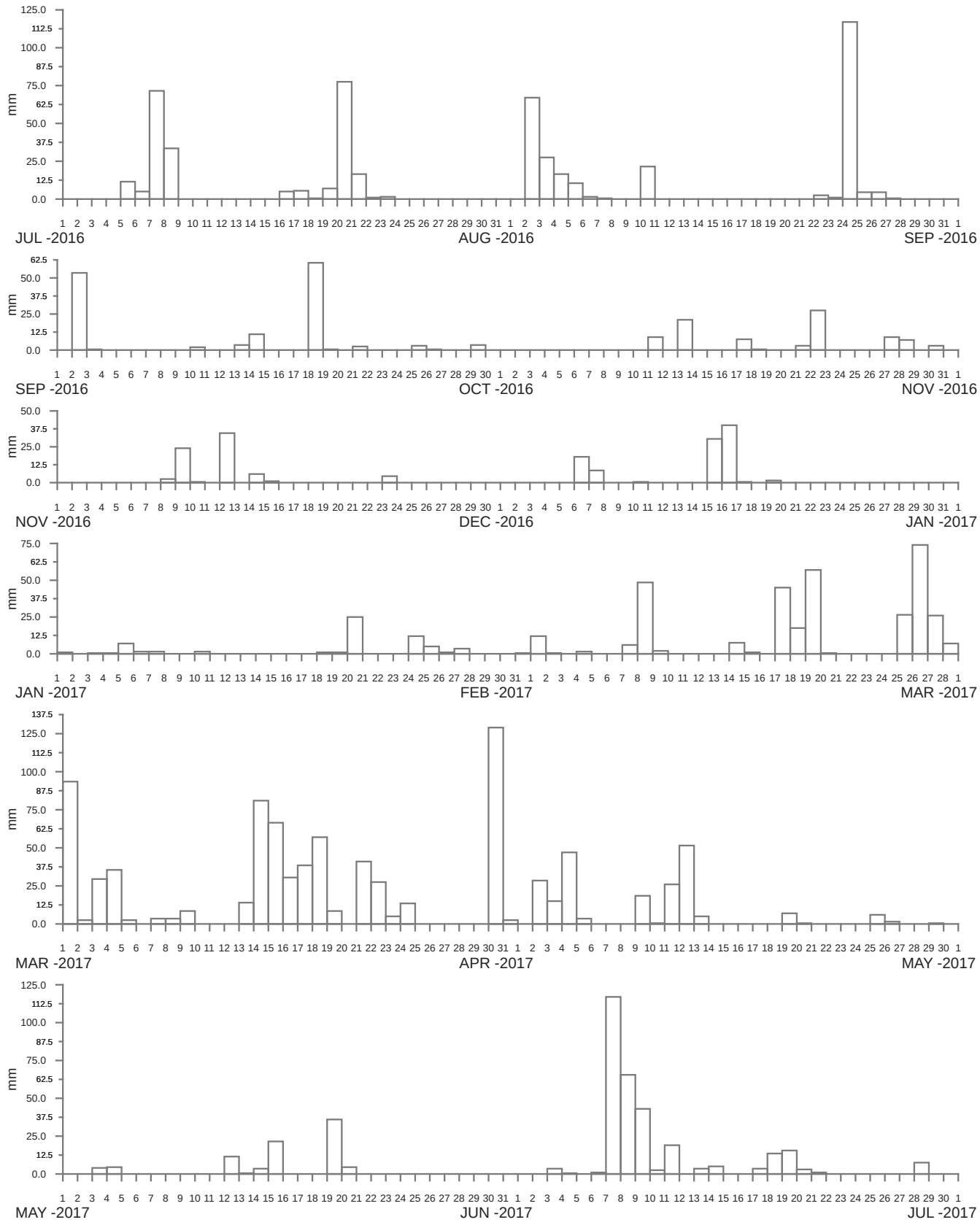
NSW GOVERNMENT

WYOMING AT LAYCOCK STREET
2016–2017

MHL Report 2575

Figure 62

DRAWING 2575-48-63.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

KINCUMBER AT DOYLE STREET
2016–2017

MHL Report 2575

Figure 63

DRAWING 2575-48-63.cdr

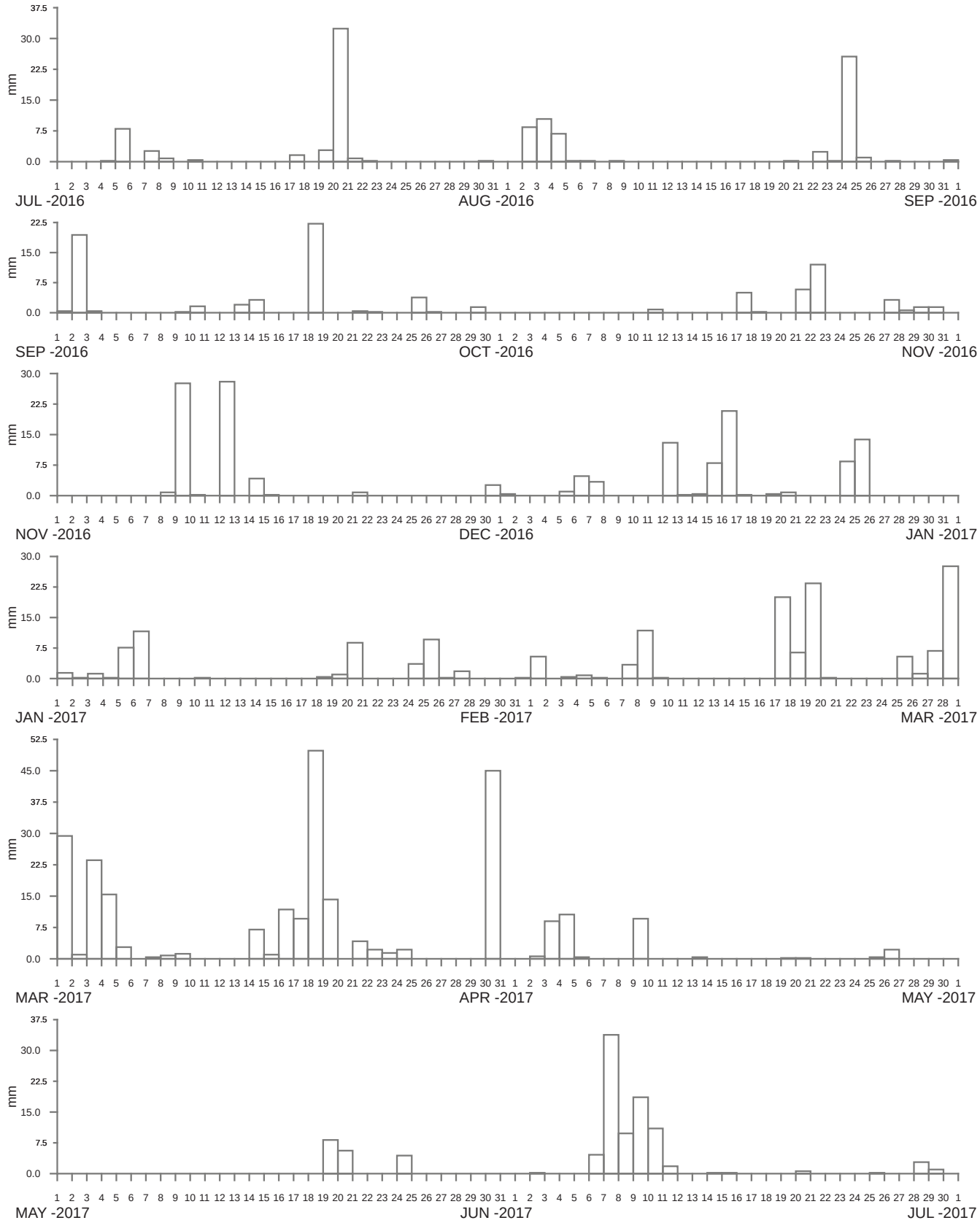
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
HAWKESBURY RIVER (MID) REGION

MHL Report 2575

Figure 64

DRAWING 2575-64.cdr



DATA LOSS

Manly Hydraulics Laboratory

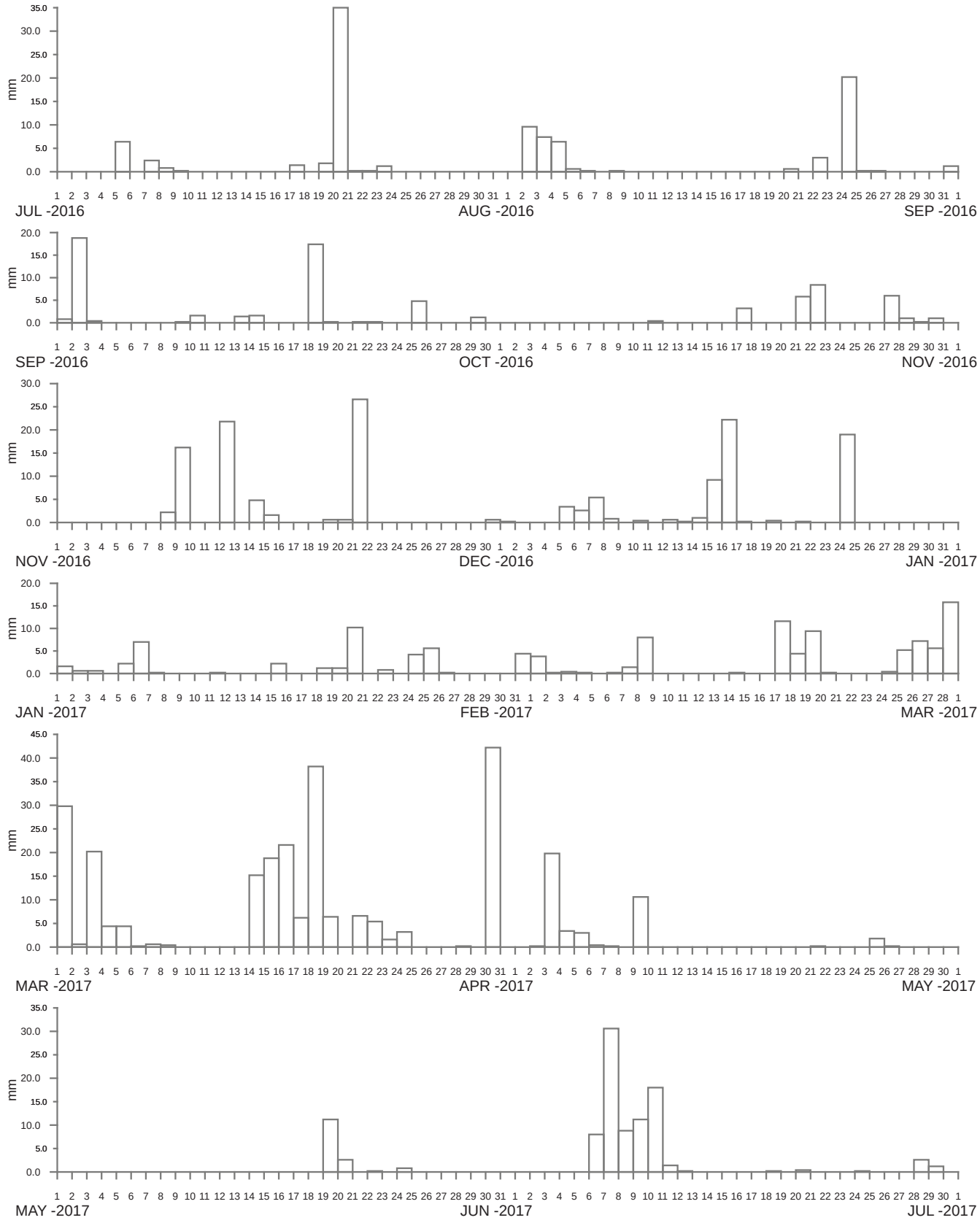
NSW GOVERNMENT

WEBBS CREEK AT HAWKESBURY RIVER
2016–2017

MHL Report 2575

Figure 65

DRAWING 2575-65-67.cdr



DATA LOSS

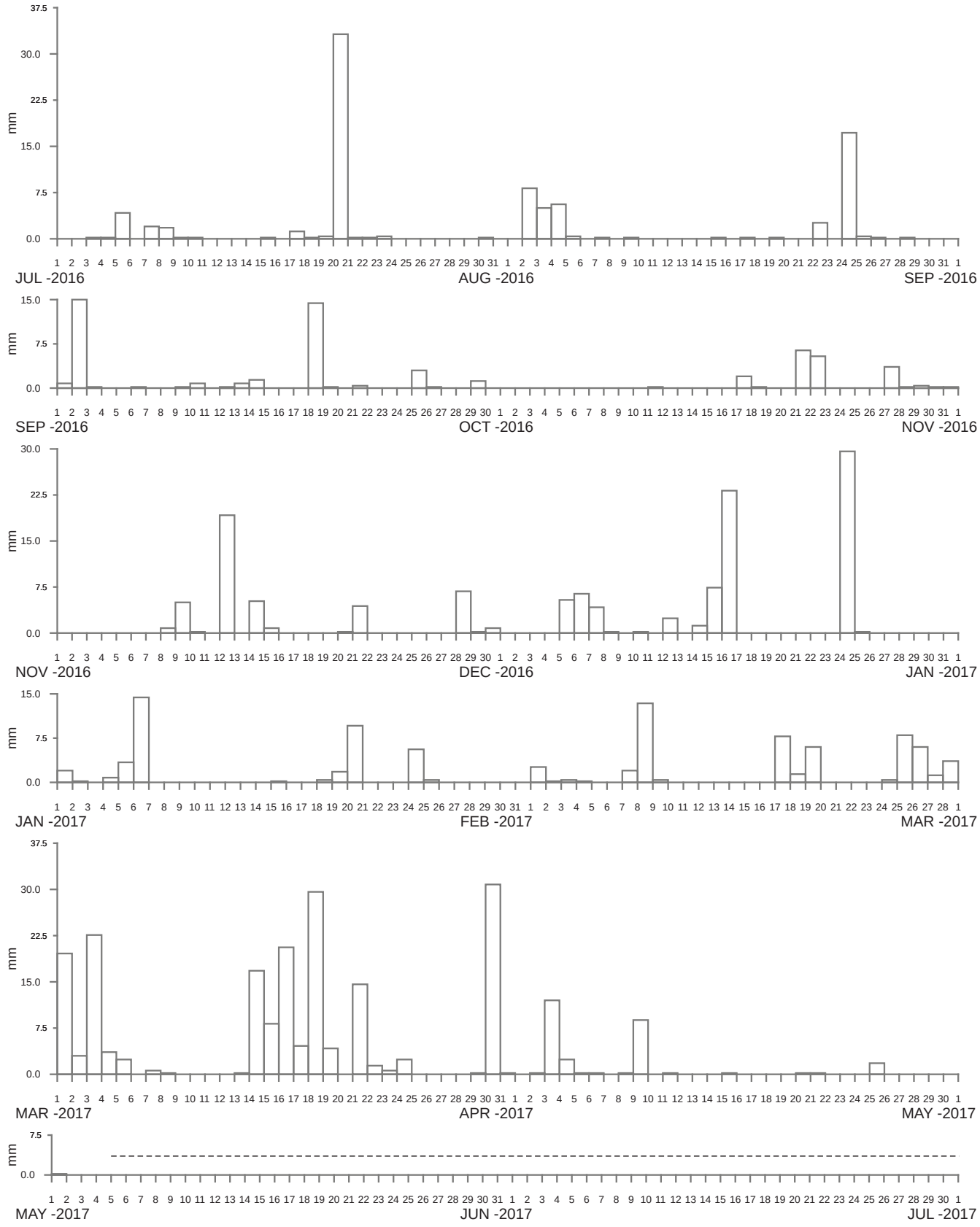
NSW GOVERNMENT Manly Hydraulics Laboratory

COLO JUNCTION AT HAWKESBURY RIVER 2016–2017

MHL Report 2575

Figure 66

DRAWING 2575-65-67.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

SACKVILLE DOWNSTREAM AT HAWKESBURY RIVER 2016–2017

MHL Report 2575

Figure 67

DRAWING 2575-65-67.cdr

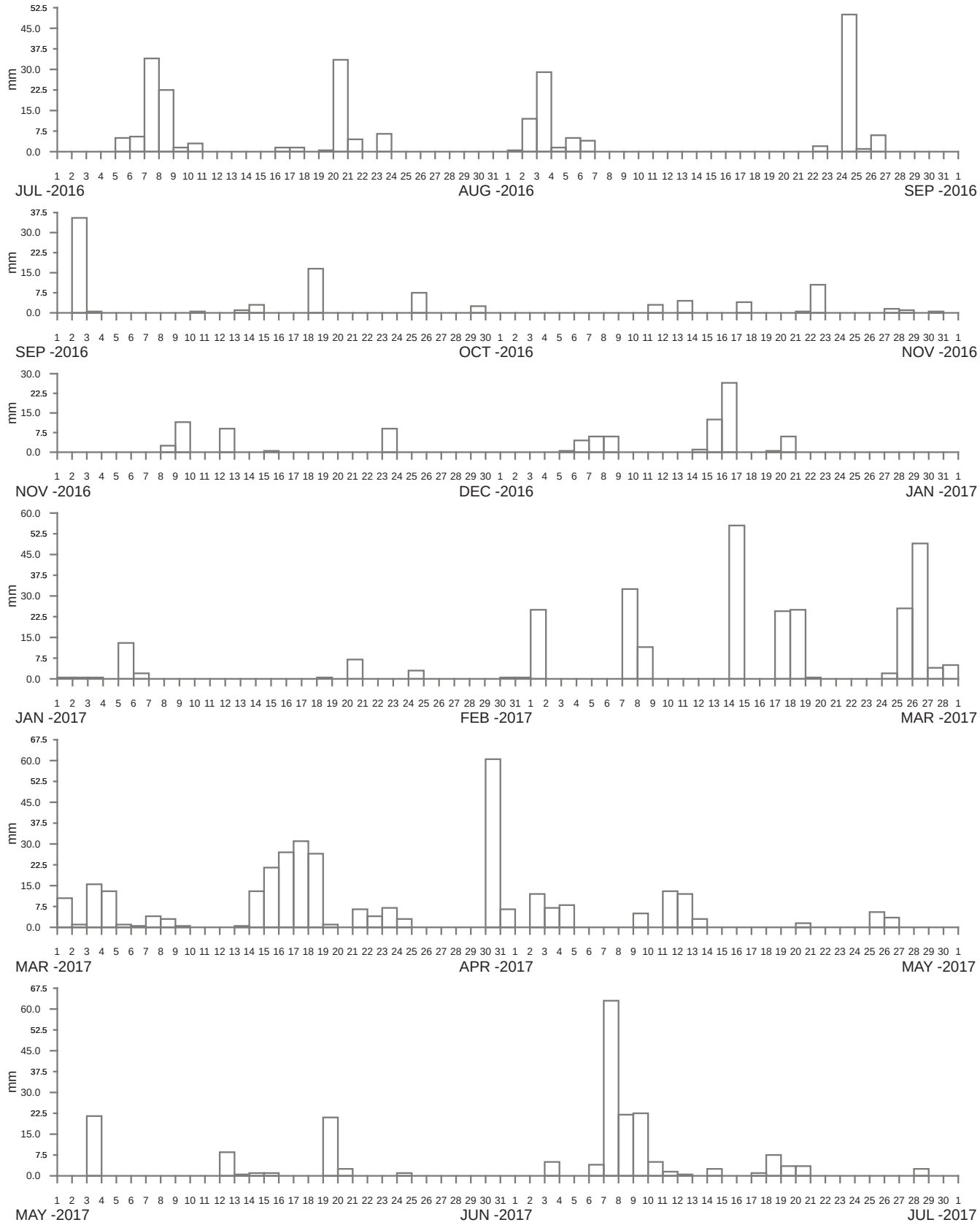
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
SYDNEY COASTAL REGION

MHL Report 2575

Figure 68

DRAWING 2575-68.cdr



DATA LOSS

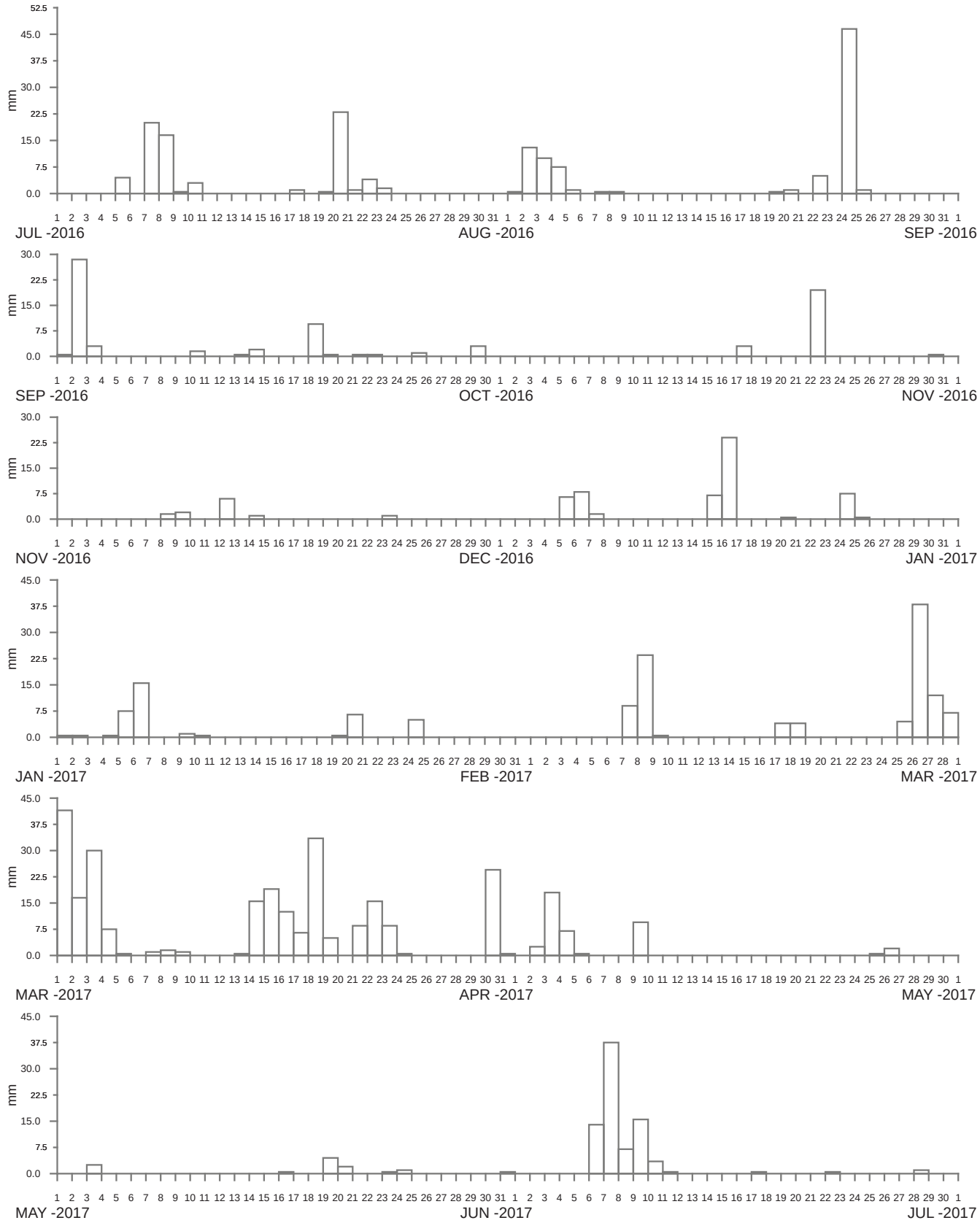
NSW GOVERNMENT Manly Hydraulics Laboratory

CURL CURL AT CURL CURL LAGOON
2016–2017

MHL Report 2575

Figure 69

DRAWING 2575-69-70.cdr



DATA LOSS

NSW GOVERNMENT Manly Hydraulics Laboratory

KELSO CREEK AT KELSO CREEK
2016–2017

MHL Report 2575

Figure 70

DRAWING 2575-69-70.cdr

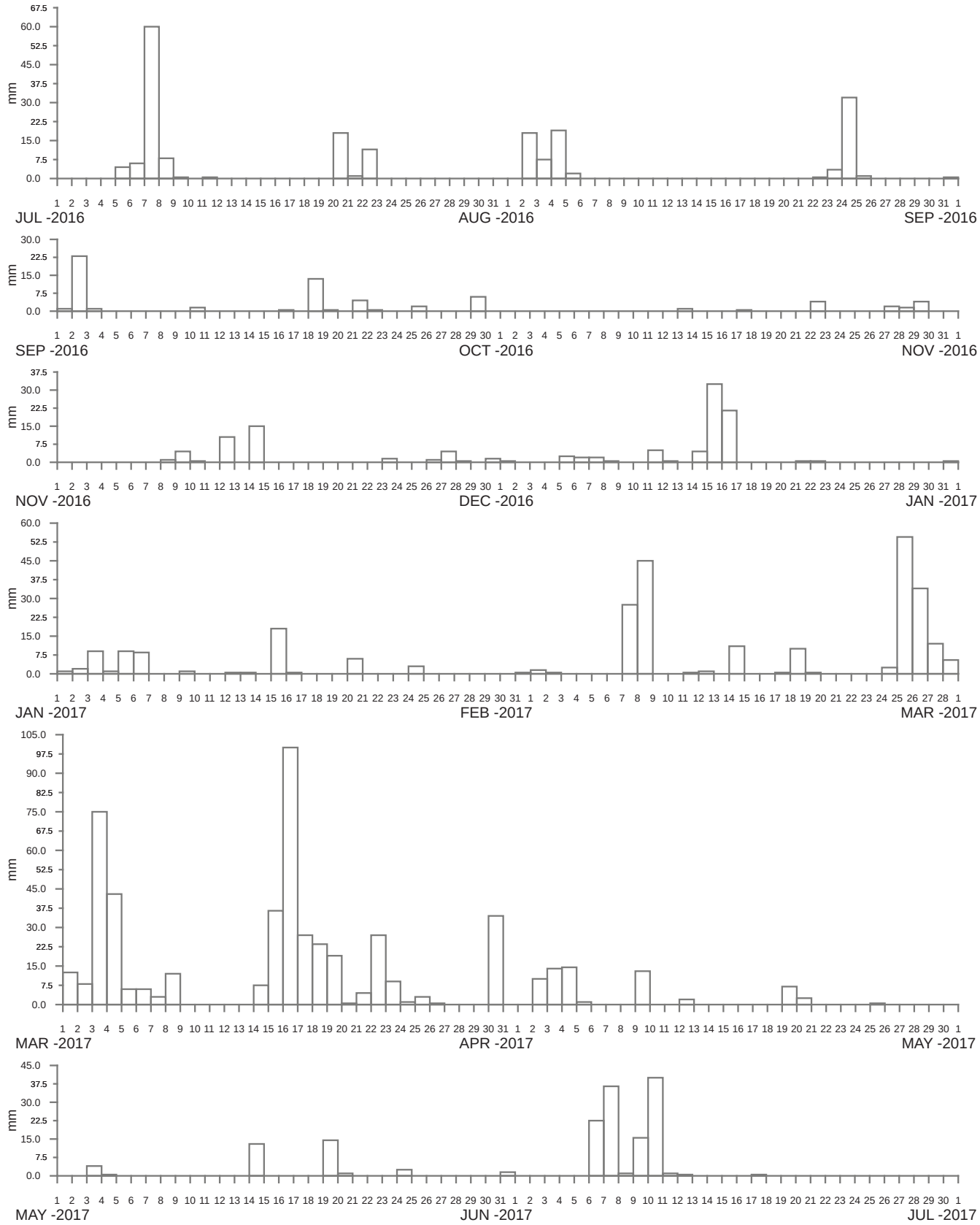
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
WOLLONGONG COASTAL REGION

MHL Report 2575

Figure 71

DRAWING 2575-71.cdr



DATA LOSS

Manly Hydraulics Laboratory

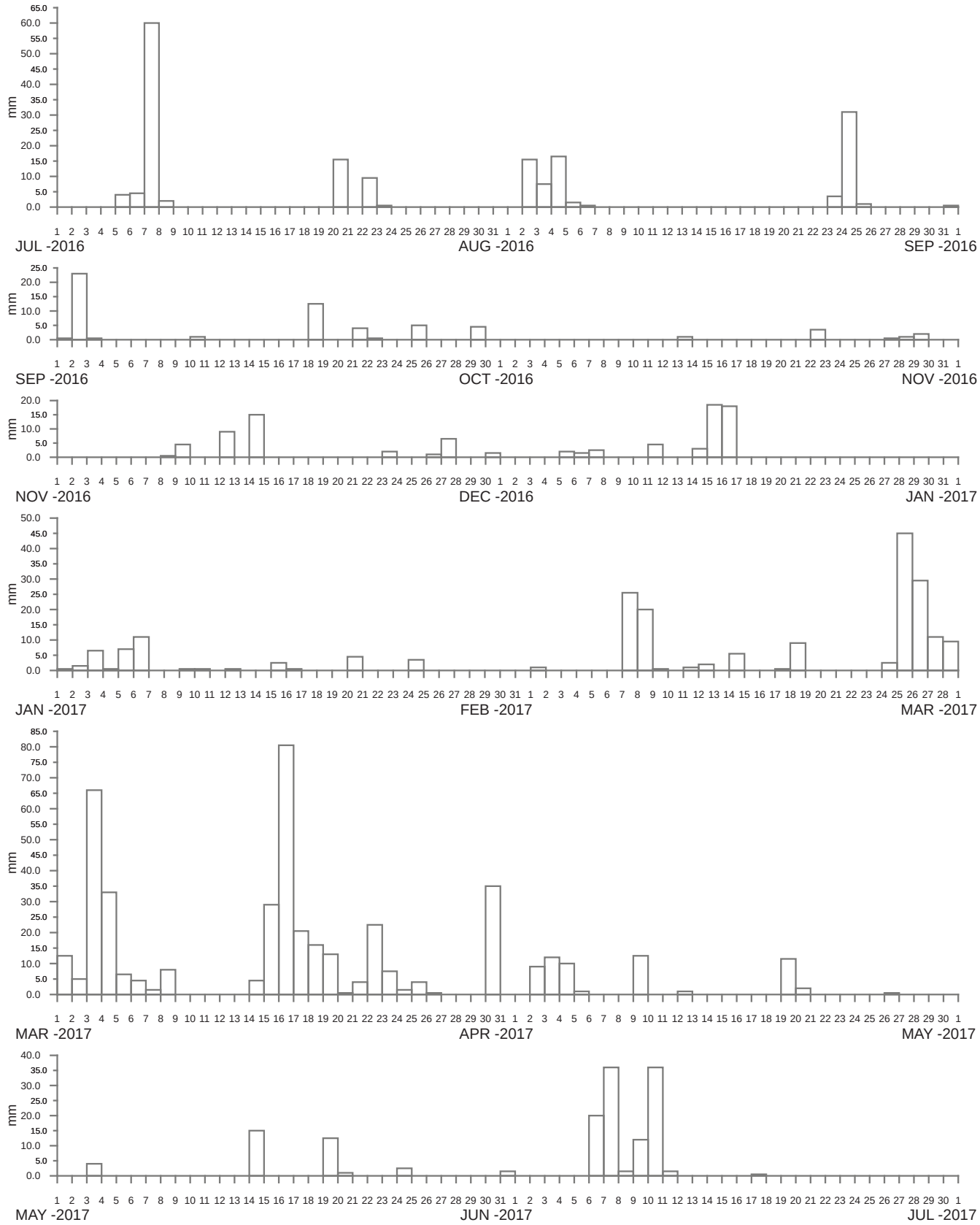
NSW GOVERNMENT

RIXONS PASS AT RIXONS PASS ROAD
2016–2017

MHL Report 2575

Figure 72

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

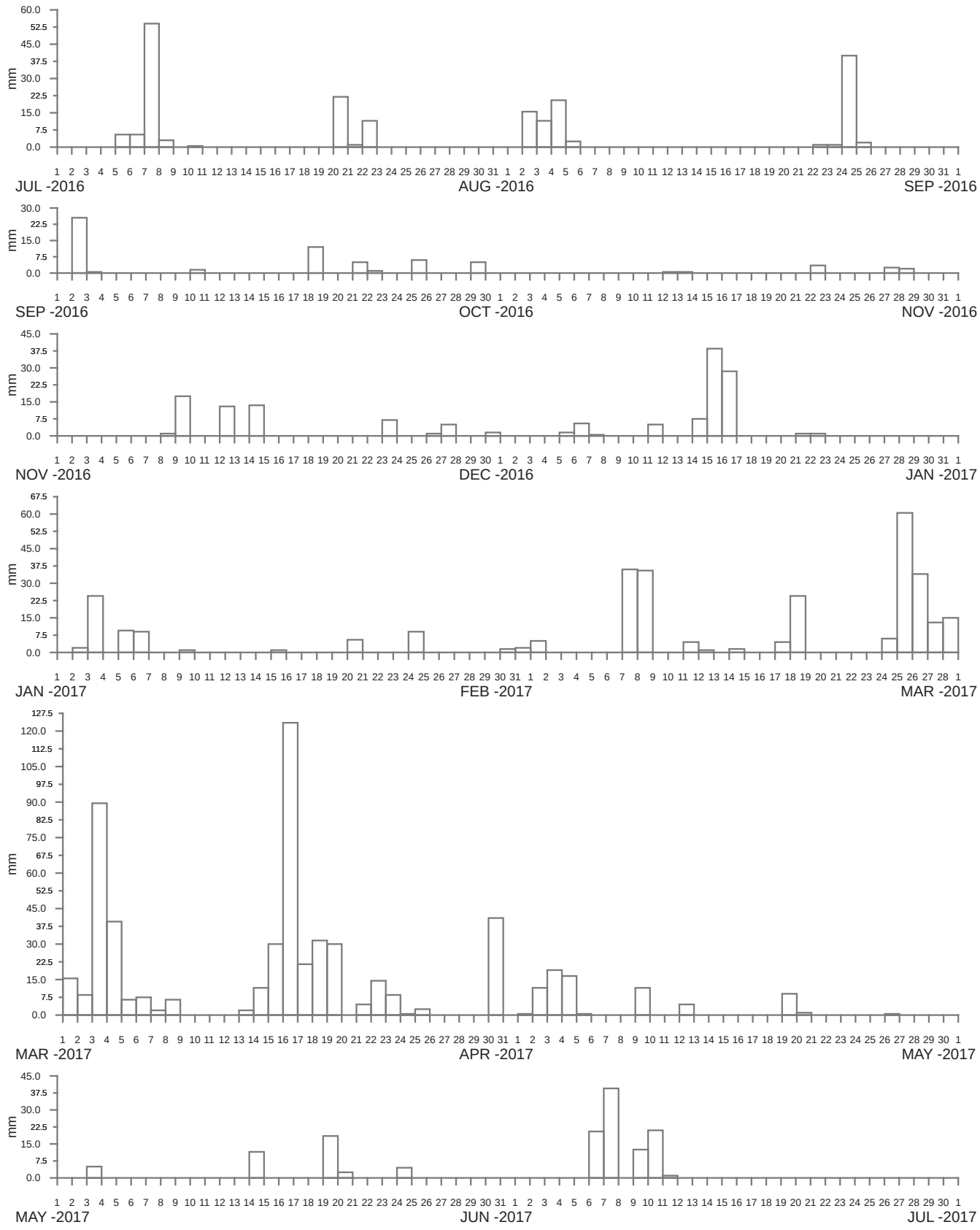
NSW GOVERNMENT

RUSSELL VALE AT WHITING CRESCENT
2016–2017

MHL Report 2575

Figure 73

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

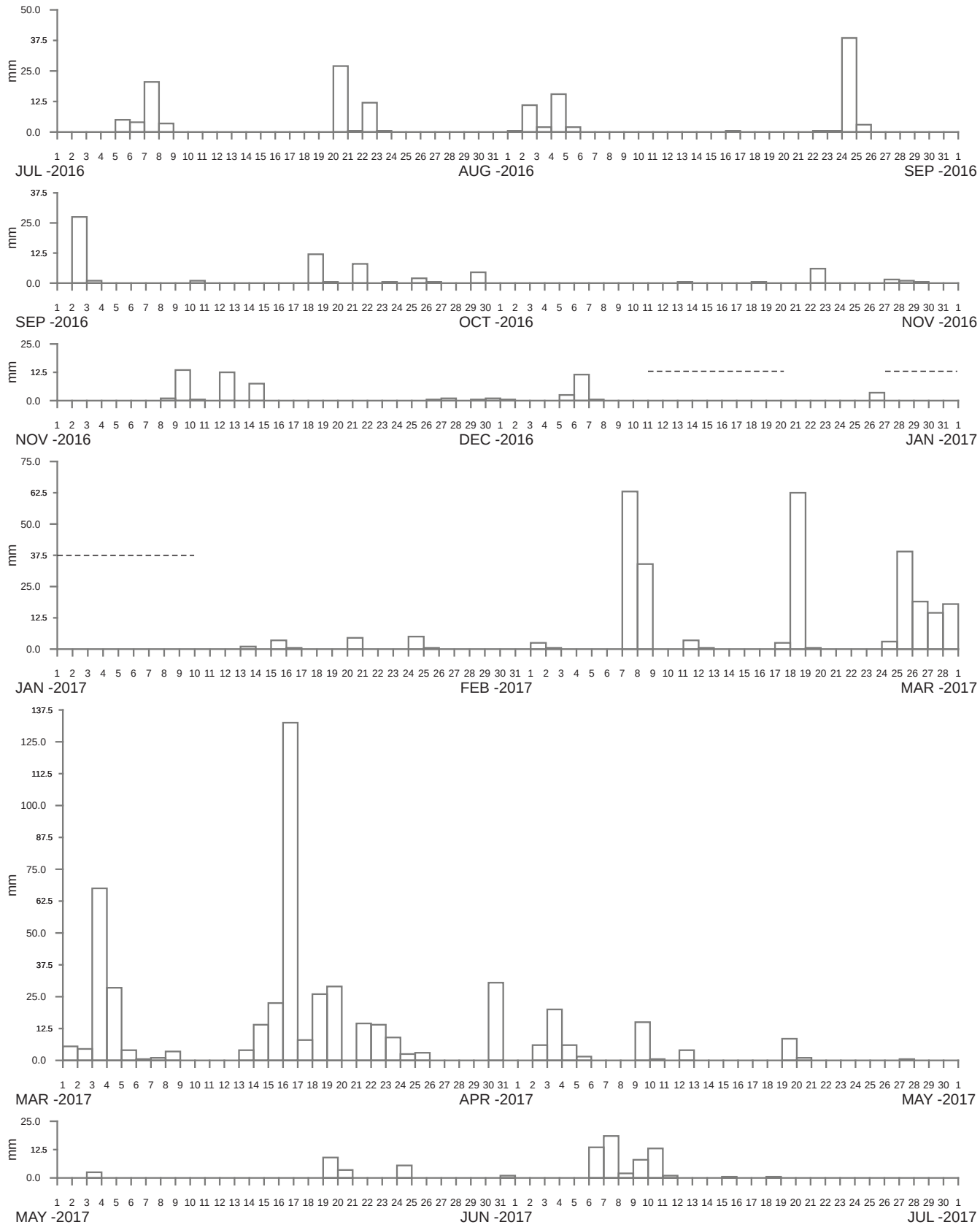
NSW GOVERNMENT

MOUNT PLEASANT AT PARRISH AVENUE
2016–2017

MHL Report 2575

Figure 74

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

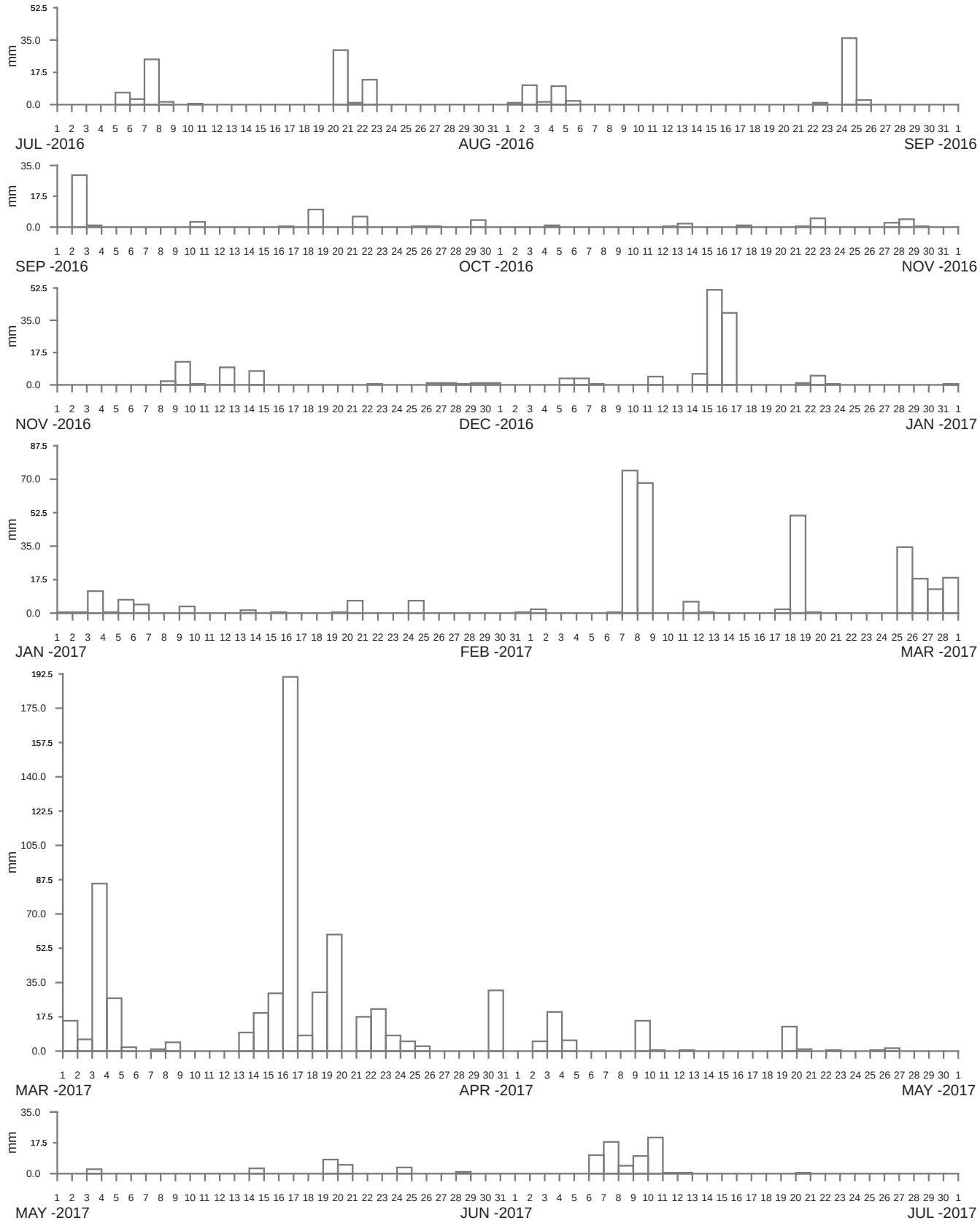
NSW GOVERNMENT

MOUNT KEMBLA AT STAFF ROAD
2016–2017

MHL Report 2575

Figure 75

DRAWING 2575-72-87.cdr



DATA LOSS

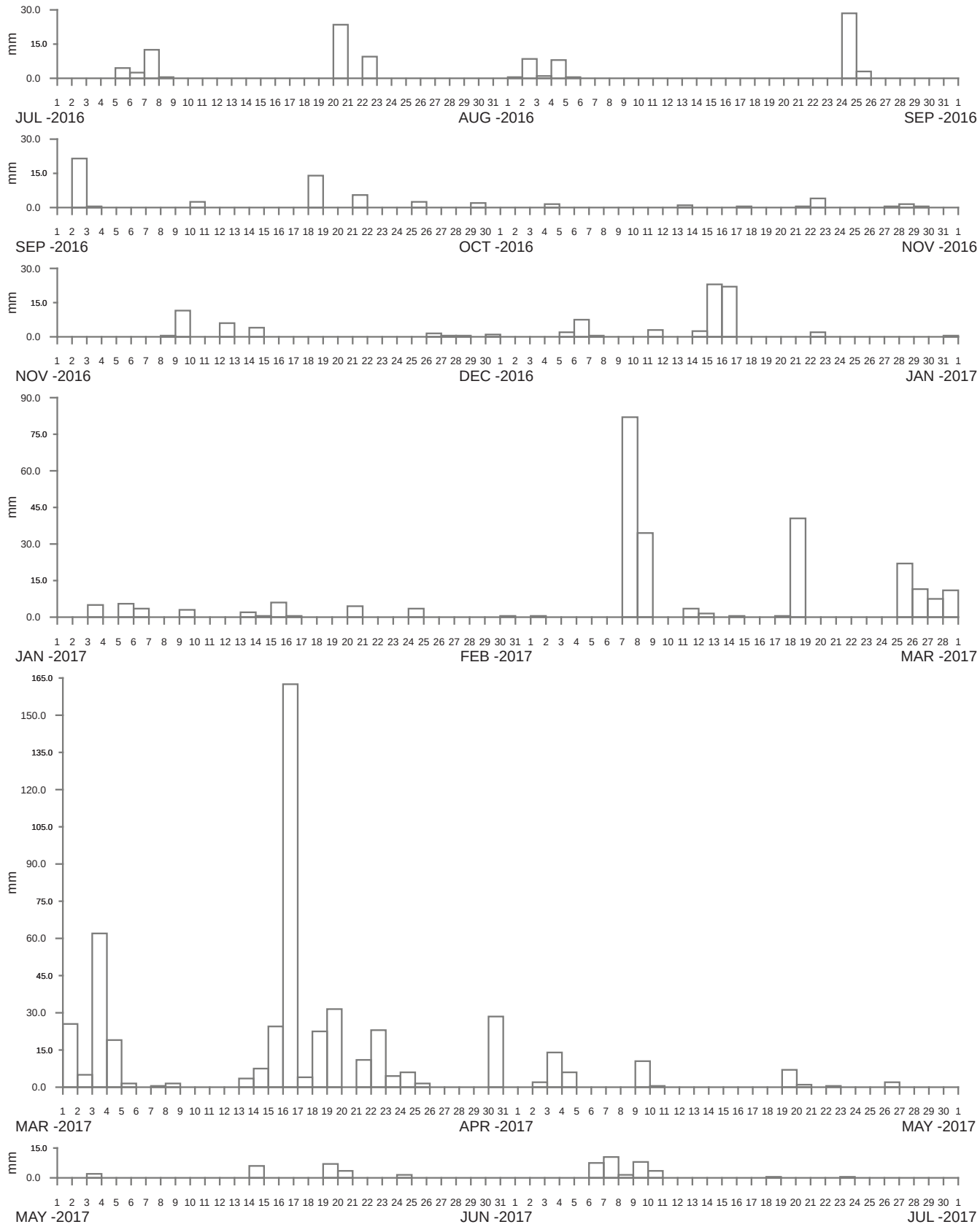
NSW GOVERNMENT Manly Hydraulics Laboratory

DOMBARTON LOOP AT PAYNES ROAD
2016–2017

MHL Report 2575

Figure 76

DRAWING 2575-72-87.cdr



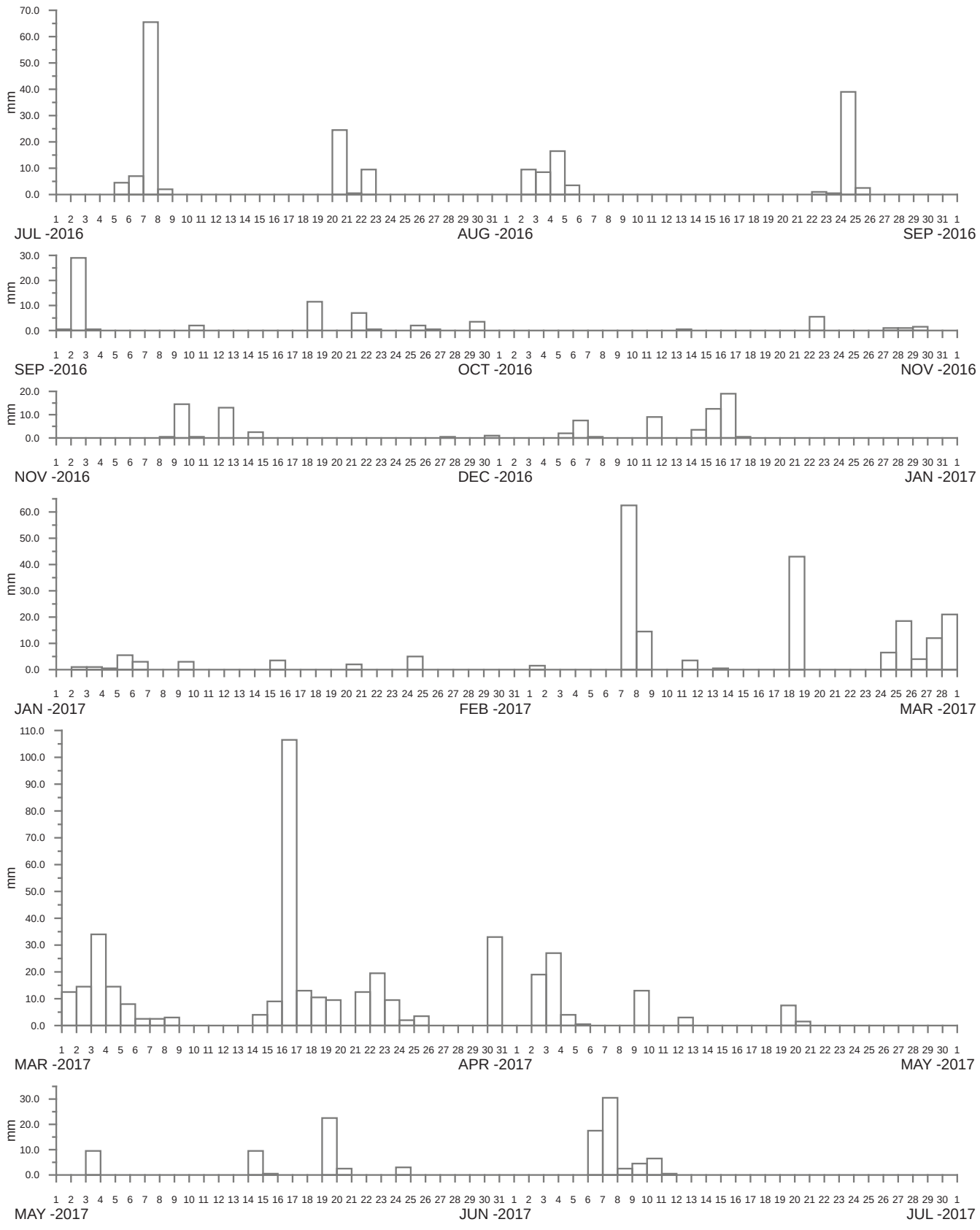
NSW GOVERNMENT Manly Hydraulics Laboratory

WONGAWILLI AT JERSEY FARM ROAD
2016–2017

MHL Report 2575

Figure 77

DRAWING 2575-72-87.cdr



---------- DATA LOSS

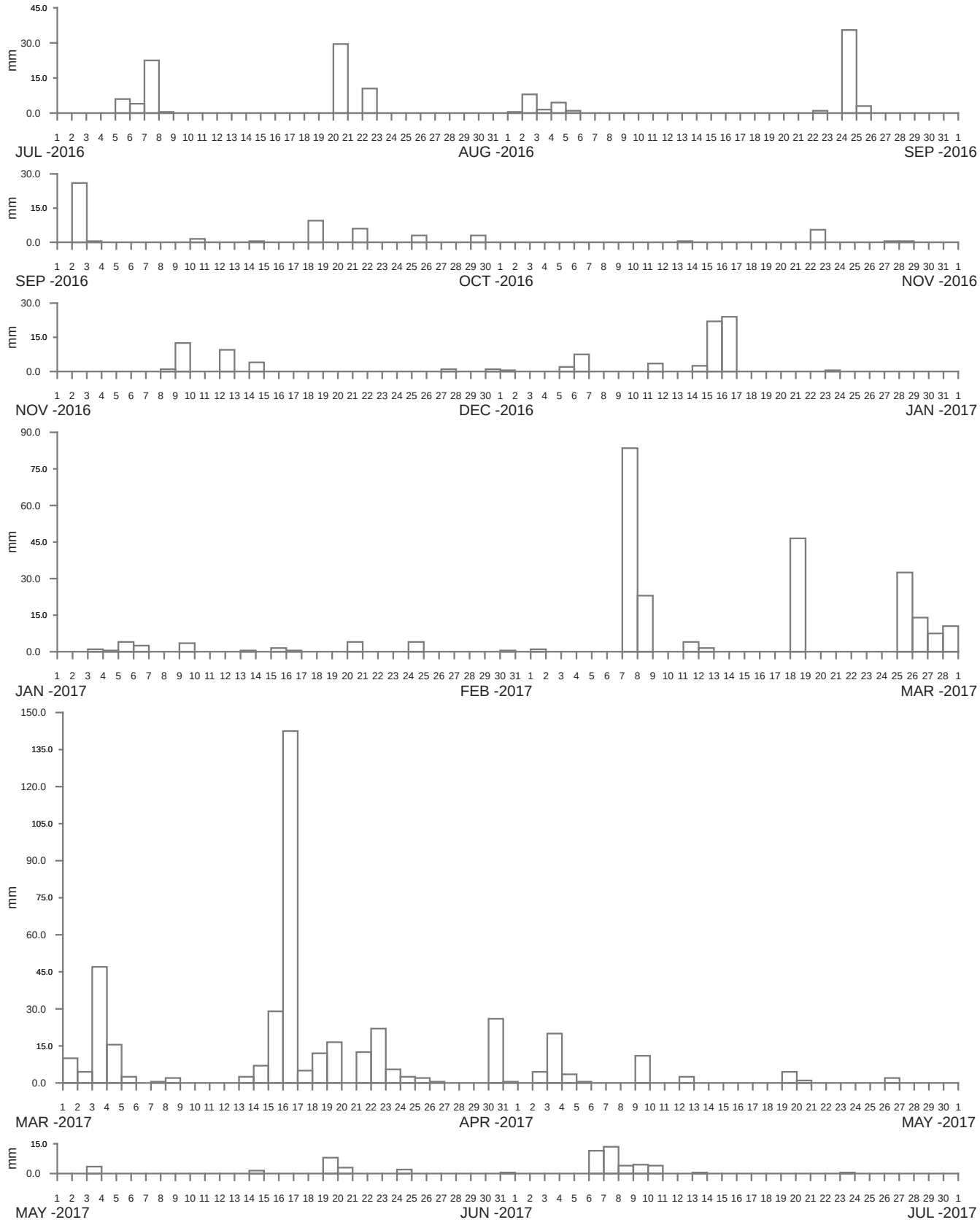
NSW GOVERNMENT Manly Hydraulics Laboratory

PORT KEMBLA AT FIVE ISLANDS ROAD
2016–2017

MHL Report 2575

Figure 78

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

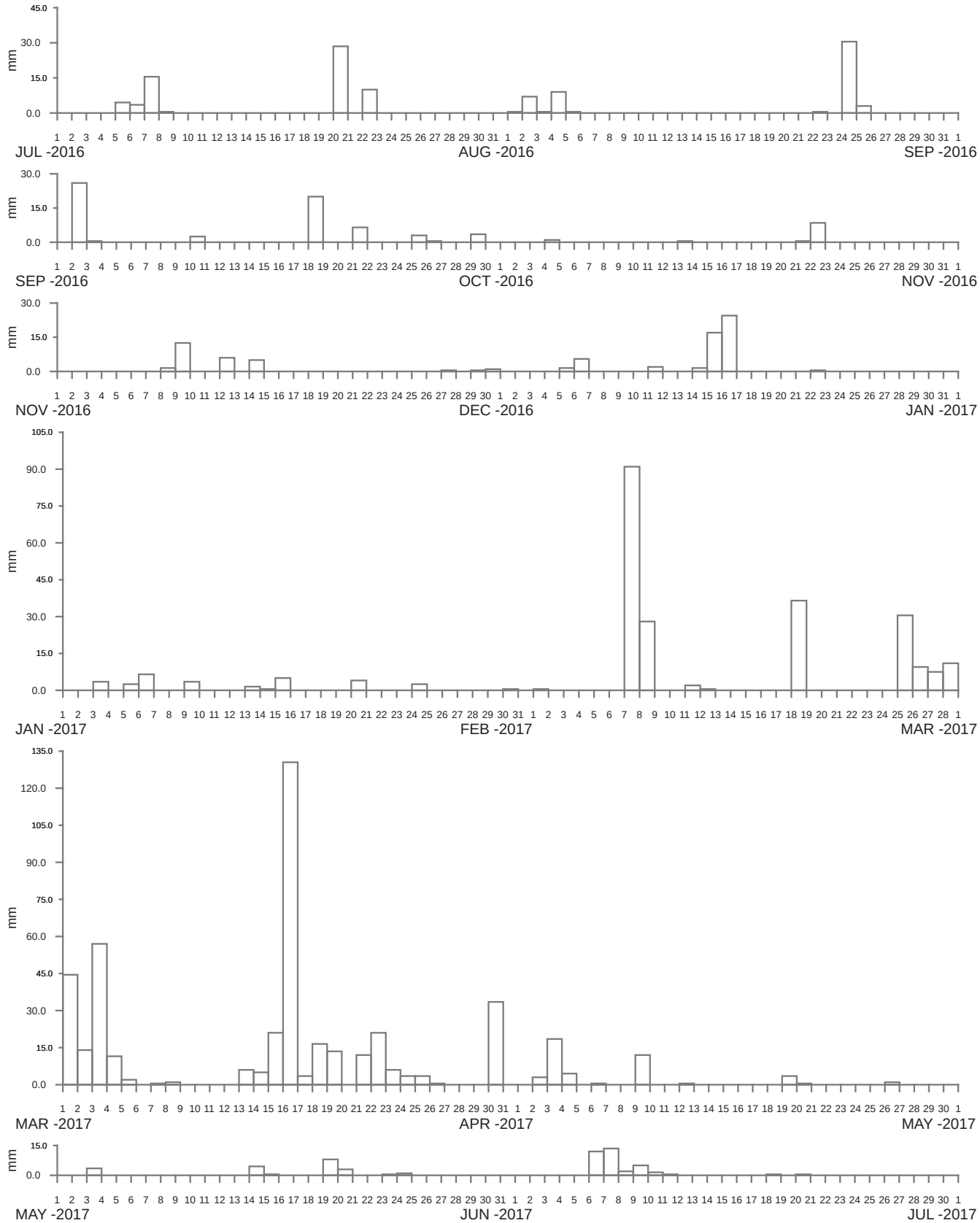
NSW GOVERNMENT

DARKES ROAD AT DAPTO
2016–2017

MHL Report 2575

Figure 79

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

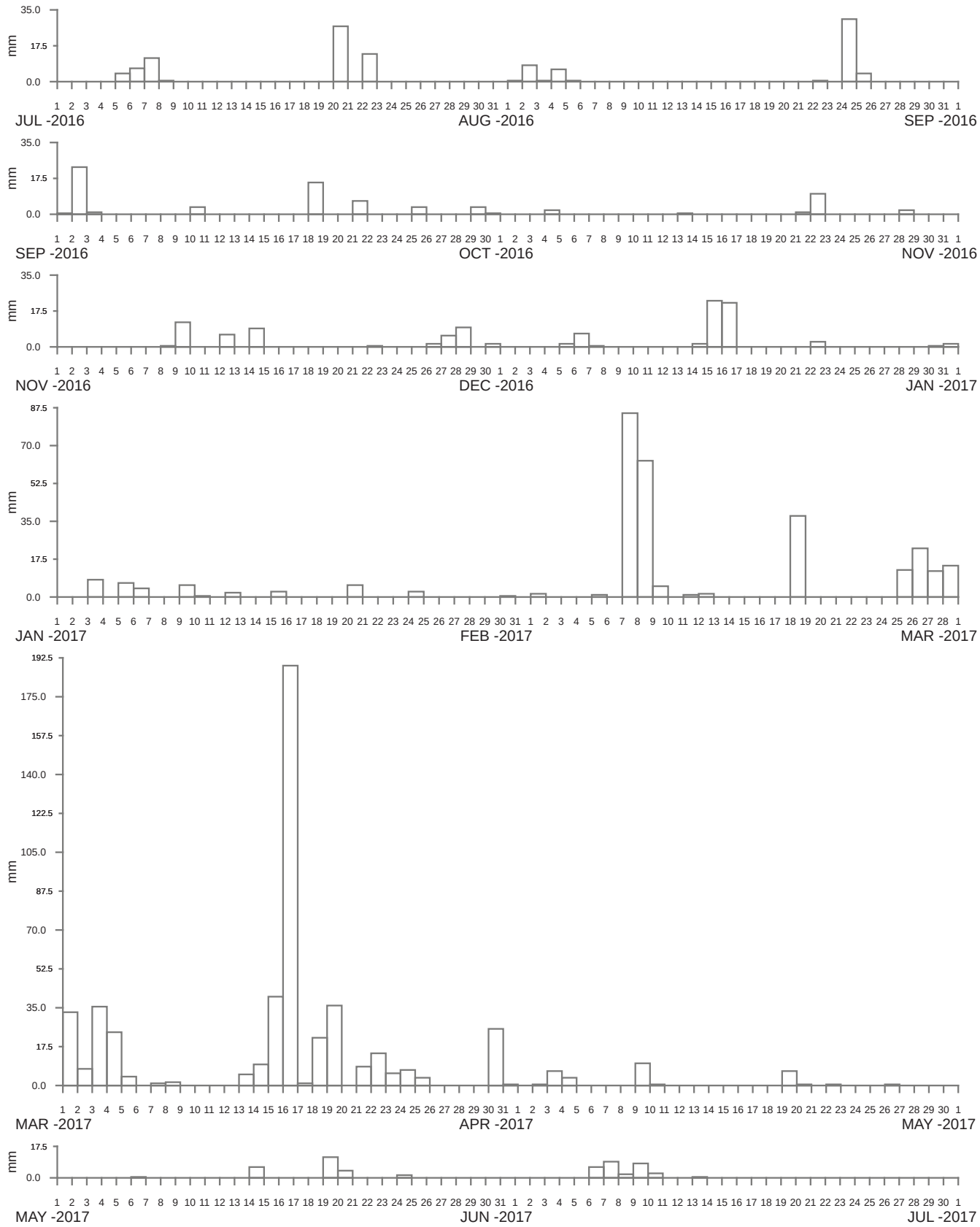
NSW GOVERNMENT

CLEVELAND ROAD AT CLEVELAND ROAD
2016–2017

MHL Report 2575

Figure 80

DRAWING 2575-72-87.cdr



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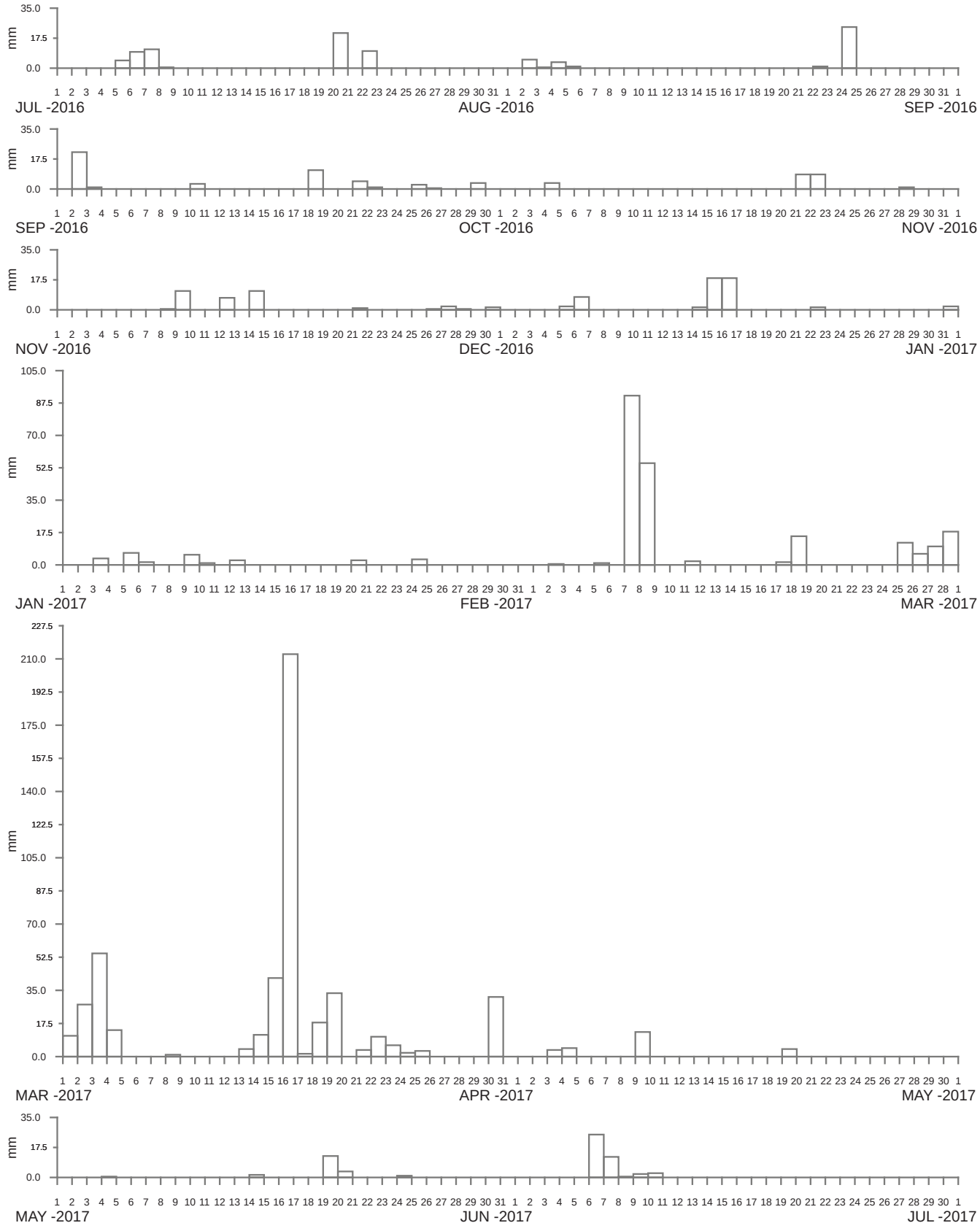
NSW GOVERNMENT

HUNTLEY COLLIERY AT AVONDALE ROAD
2016–2017

MHL Report 2575

Figure 81

DRAWING 2575-72-87.cdr



DATA LOSS

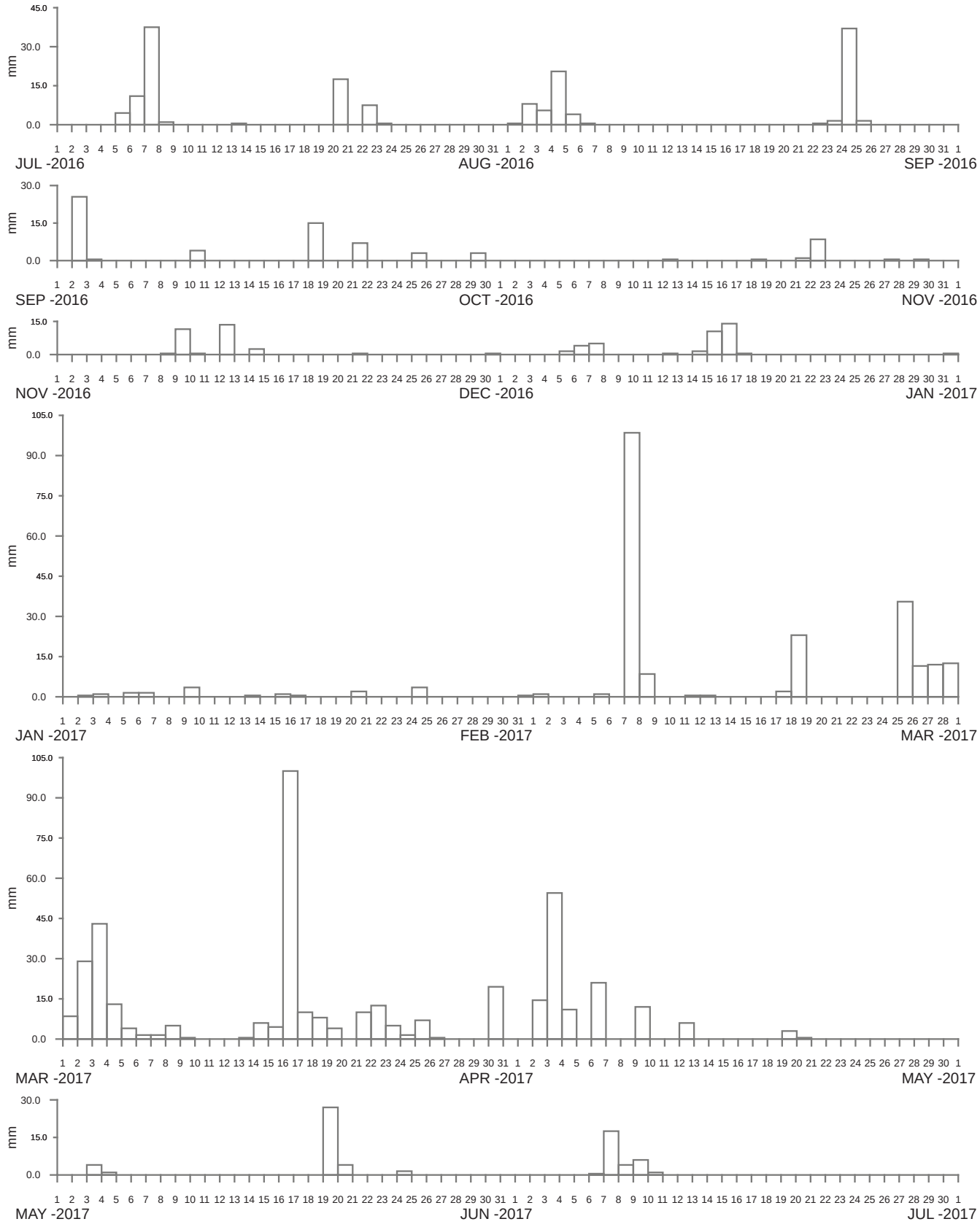
NSW GOVERNMENT Manly Hydraulics Laboratory

UPPER CALDERWOOD AT CALDERWOOD ROAD 2016–2017

MHL Report 2575

Figure 82

DRAWING 2575-72-87.cdr



DATA LOSS

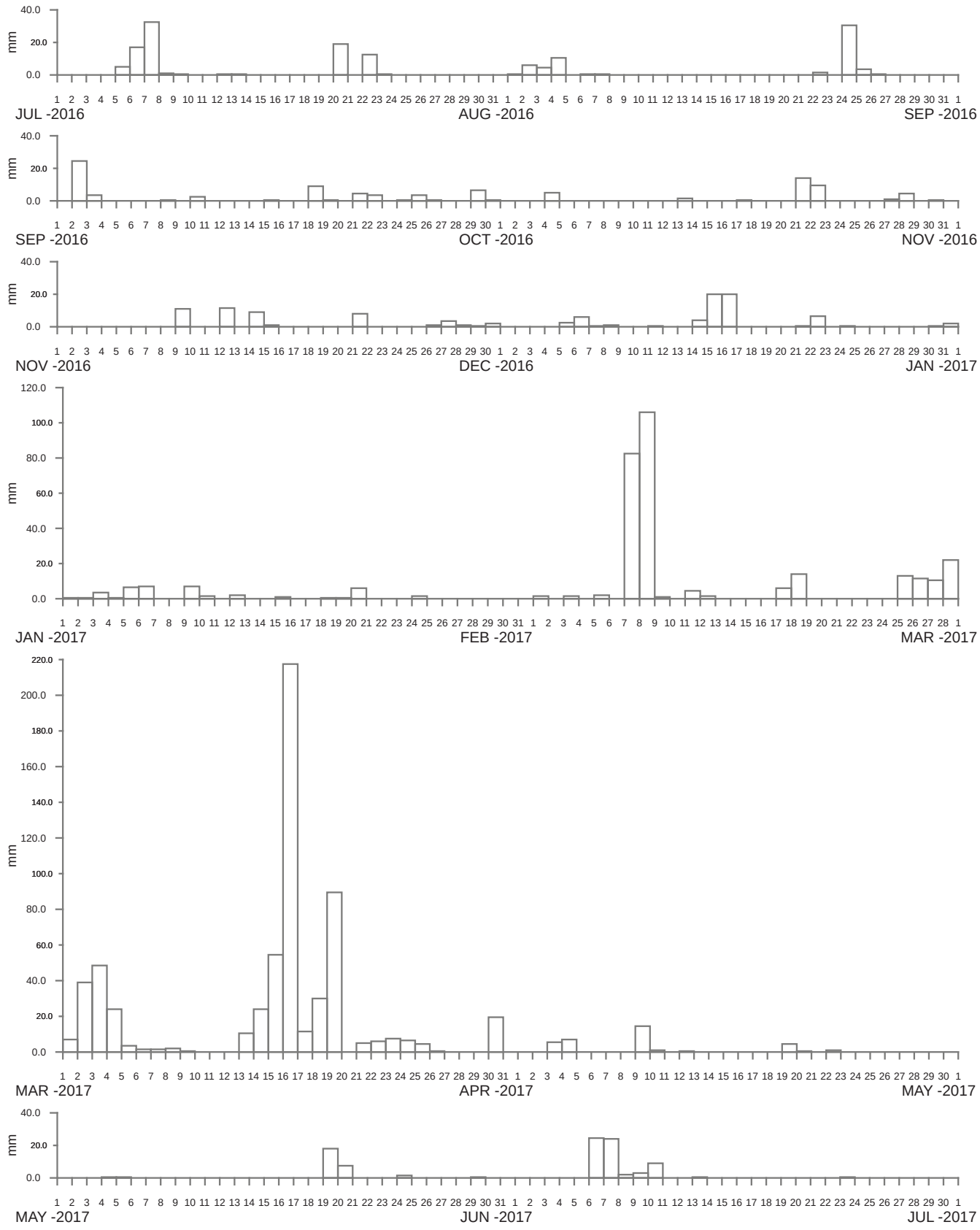
Manly Hydraulics Laboratory

LITTLE LAKE ENTRANCE AT LITTLE LAKE 2016–2017

MHL Report 2575

Figure 83

DRAWING 2575-72-87.cdr



DATA LOSS

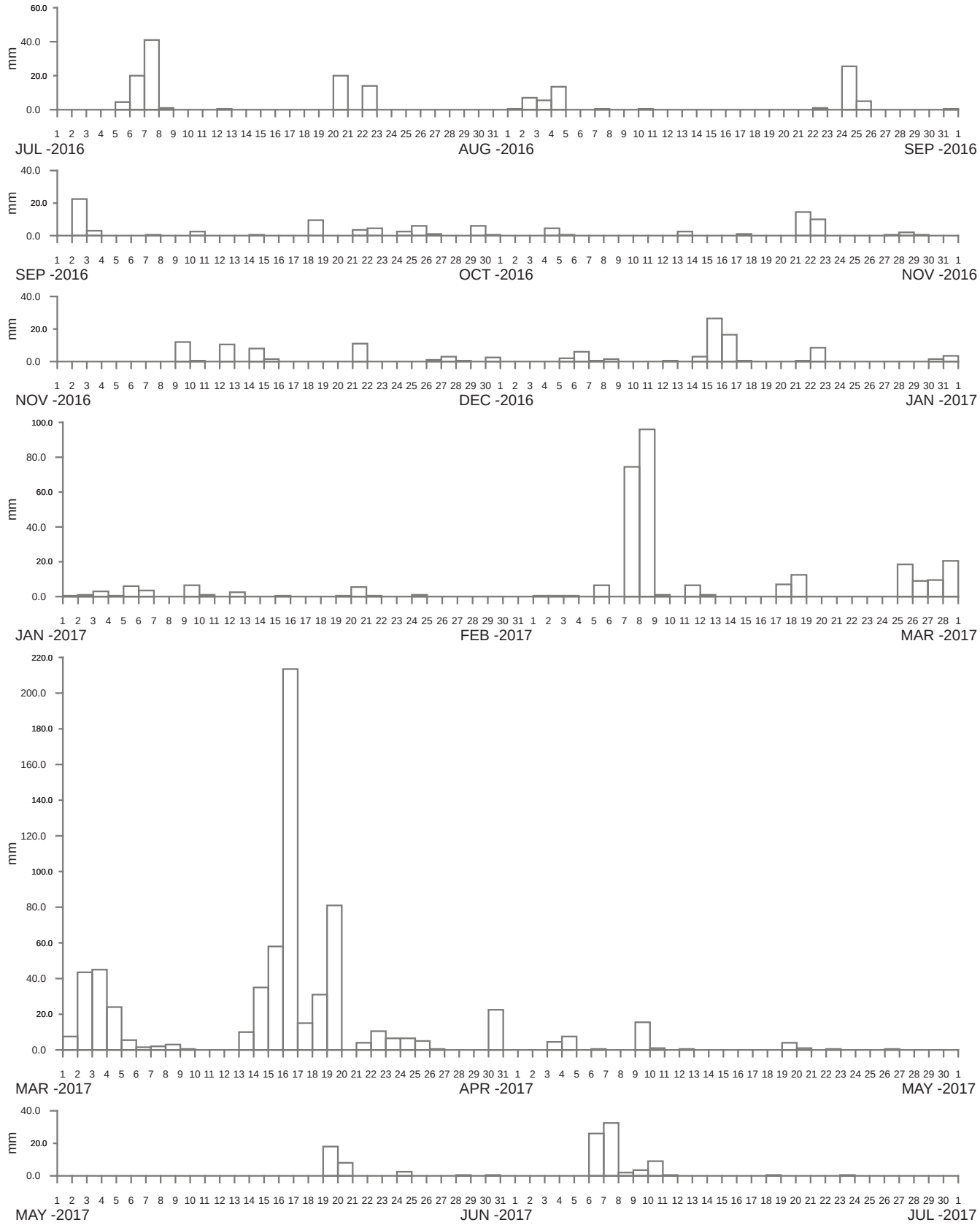
NSW GOVERNMENT Manly Hydraulics Laboratory

NURREWIN AT ILLAWARRA HIGHWAY
2016–2017

MHL Report 2575

Figure 84

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

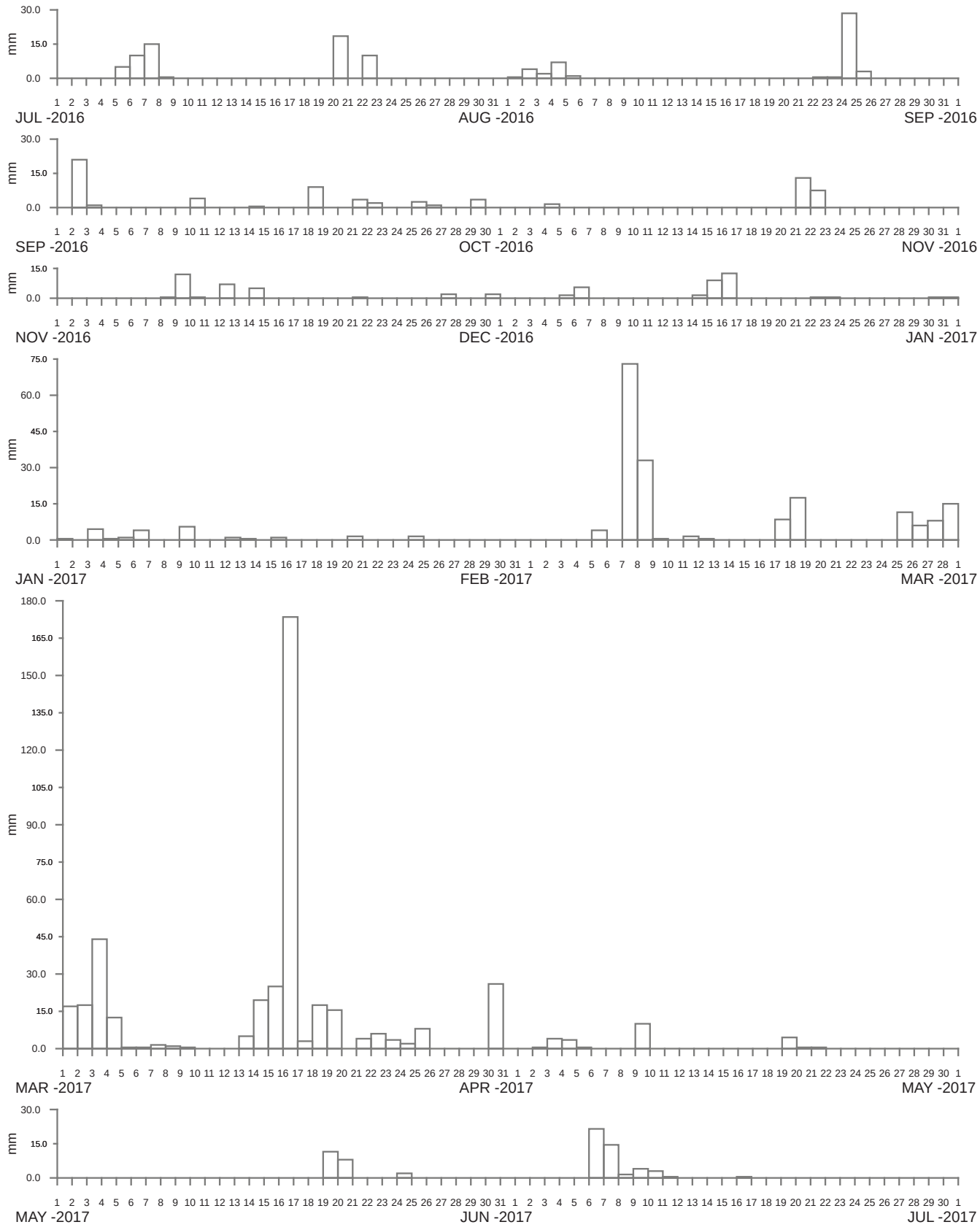
NSW GOVERNMENT

CLOVER HILL AT CLOVER HILL ROAD
2016–2017

MHL Report 2575

Figure 85

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

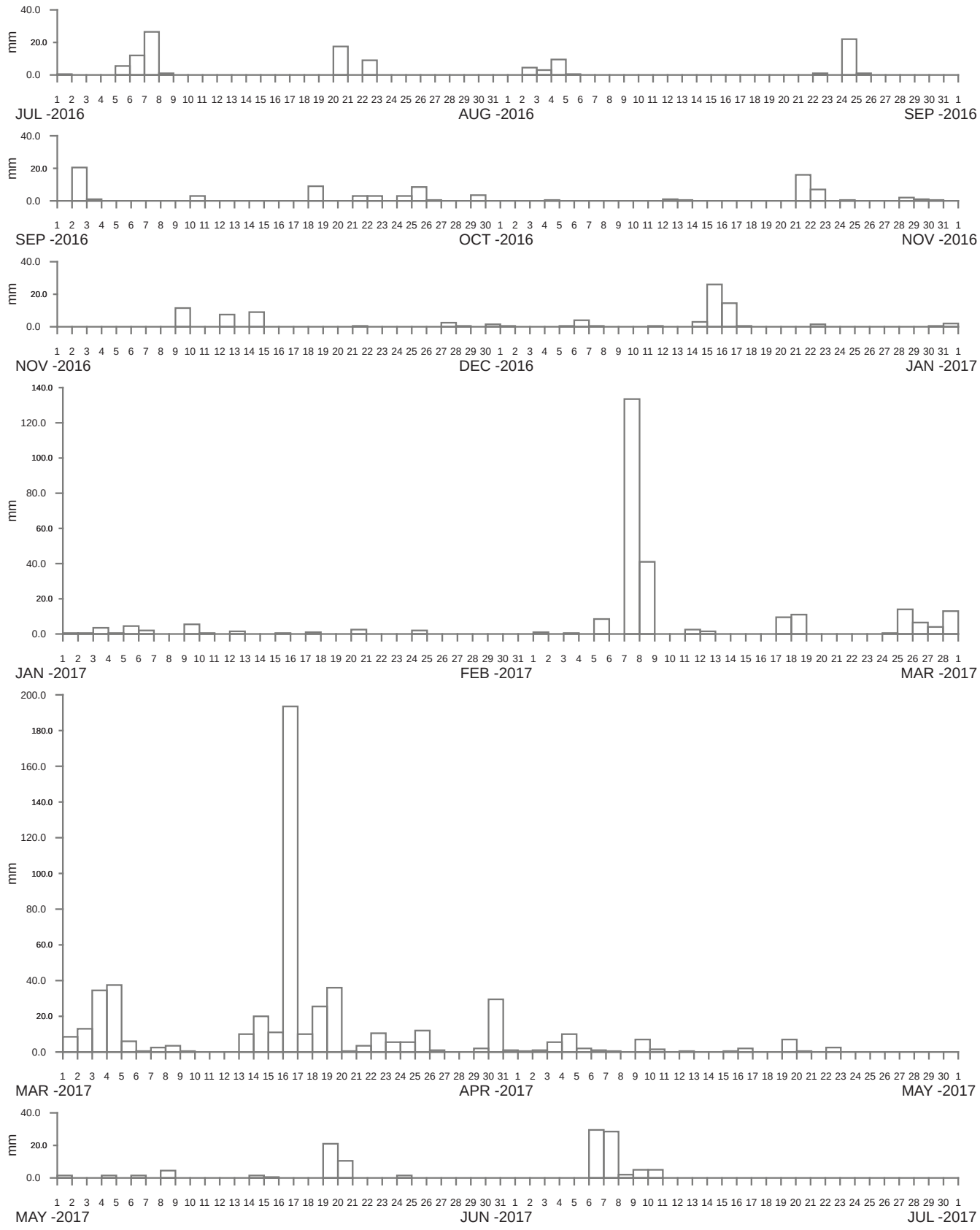
NSW GOVERNMENT

NORTH MACQUARIE AT NORTH MACQUARIE ROAD 2016–2017

MHL Report 2575

Figure 86

DRAWING 2575-72-87.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

YELLOW ROCK ROAD AT YELLOW ROCK ROAD
2016–2017

MHL Report 2575

Figure 87

DRAWING 2575-72-87.cdr

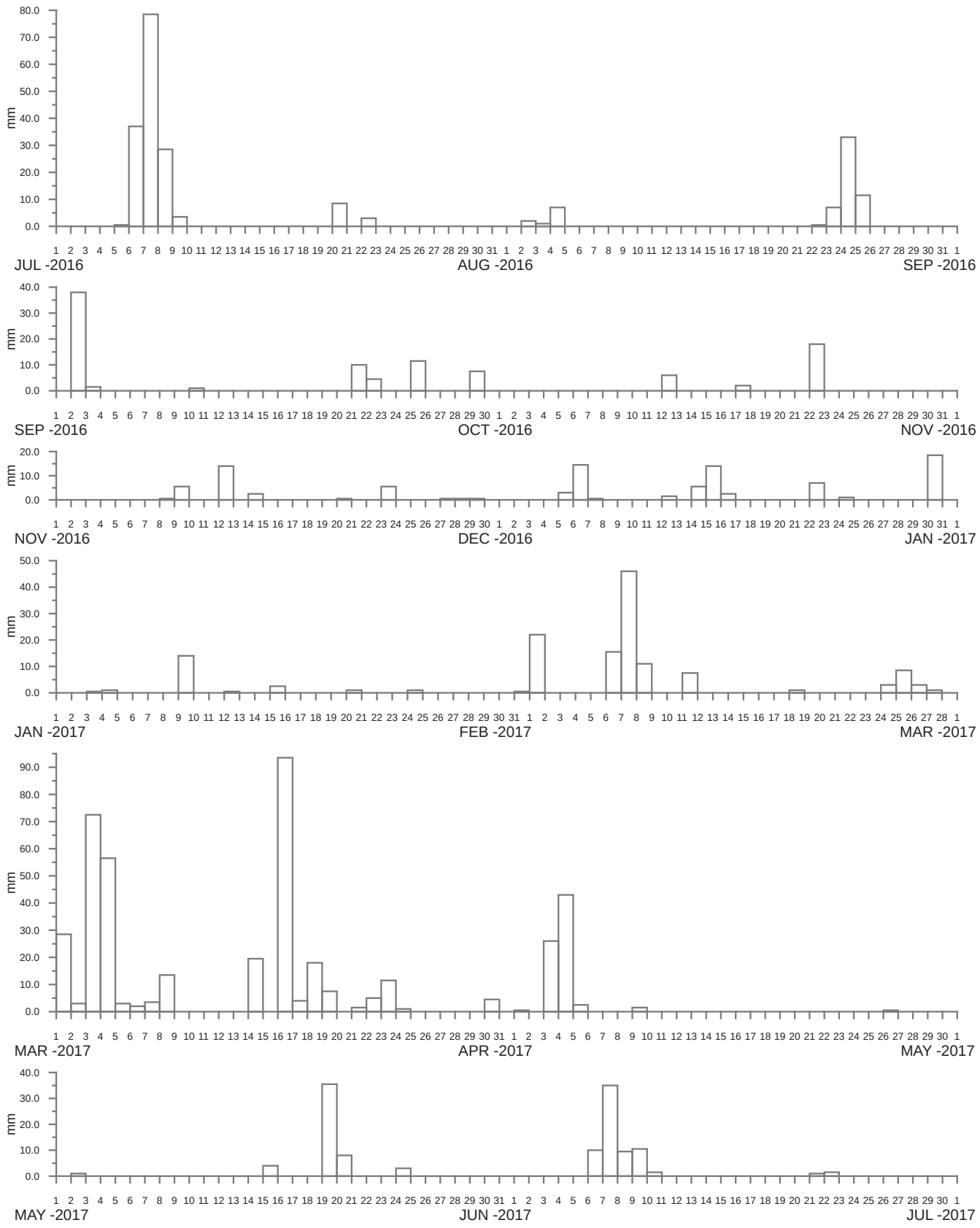
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATION
SOUTH COAST (NORTH) REGION

MHL Report 2575

Figure 88

DRAWING 2575-88.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

LAKE CONJOLA DOWNSTREAM AT CONJOLA LAKE 2016–2017

MHL Report 2575

Figure 89

DRAWING 2575-89.cdr

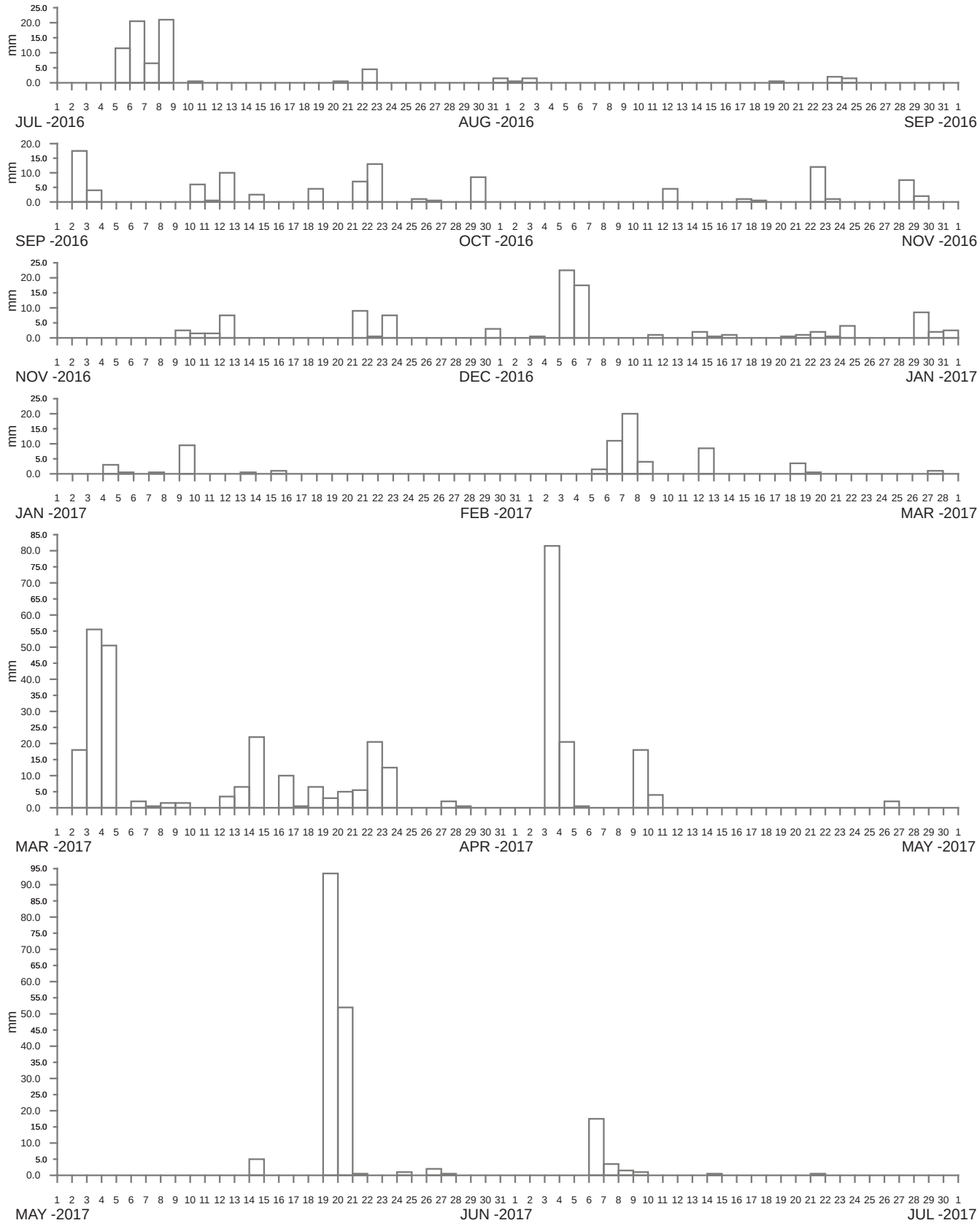
NSW GOVERNMENT Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
SOUTH COAST (MID) REGION

MHL Report 2575

Figure 90

DRAWING 2575-90.cdr



DATA LOSS

Manly Hydraulics Laboratory

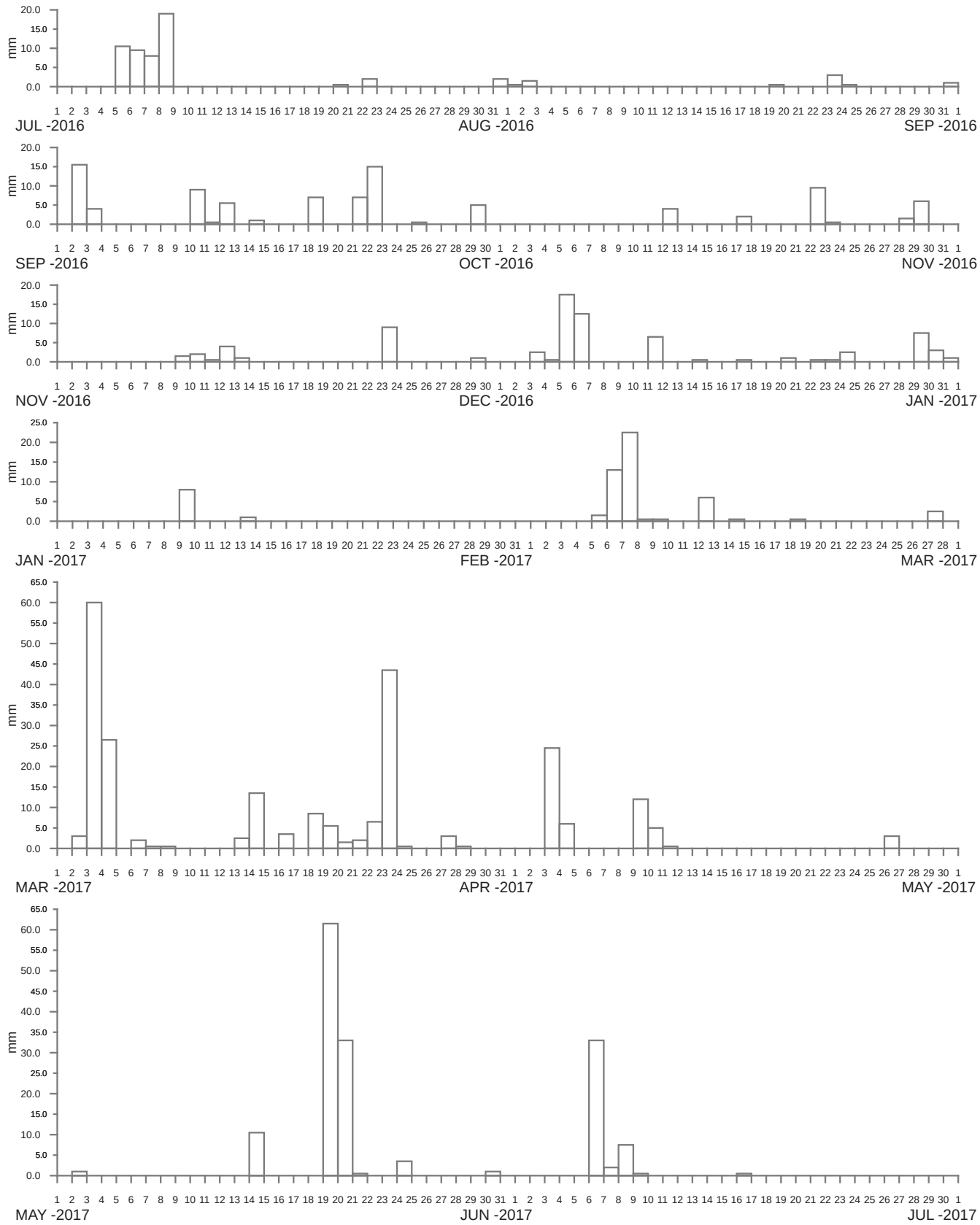
NSW GOVERNMENT

BARLOWS BAY AT WAGONGA INLET
2016–2017

MHL Report 2575

Figure 91

DRAWING 2575-91-92.cdr



DATA LOSS

Manly Hydraulics Laboratory

NSW GOVERNMENT

REGATTA POINT AT WALLAGA LAKE
2016–2017

MHL Report 2575

Figure 92

DRAWING 2575-91-92.cdr

Appendix A Station data online

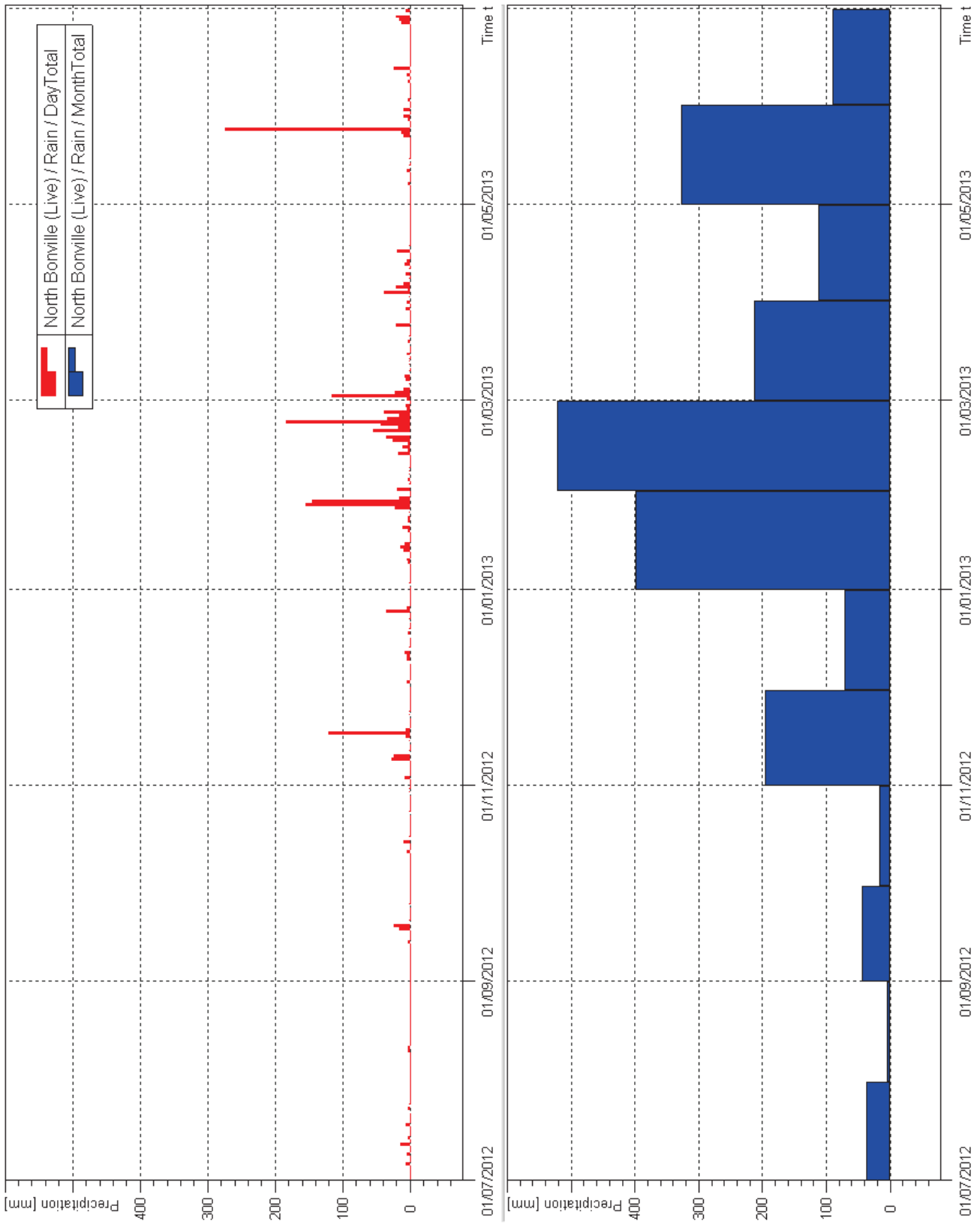
Table A1 Station data online

Region	Station	Period of data
Tweed	Cudgera	Aug 1983–ongoing
Brunswick	Main Arm	Sep 1983–ongoing
Brunswick	Huonbrook	May 1986–ongoing
Brunswick	Myocum	Feb 1986–ongoing
Richmond	Lake Ainsworth	Oct 1994–ongoing
Richmond	Empire Vale	May 1998–Jul 2000
Richmond	Wollongbar	Jul 1992–Jul 1994
Clarence	Yamba	Apr 2002–ongoing
Clarence	Wyndora	Jan 1990–Jun 1991
Clarence	Roberts Creek	May 1994–Jun 1996
Clarence	Shannon Creek	Nov 2000–May 2008
Bellinger	Wooli Caravan Park	Jun 1997–ongoing
Bellinger	Perry Drive	Dec 1998–ongoing
Bellinger	Shephards Lane	Dec 1998–ongoing
Bellinger	Red Hill	Nov 1998–ongoing
Bellinger	Newports Creek	Dec 1990–ongoing
Bellinger	Middle Boambee	Dec 1990–ongoing
Bellinger	South Boambee	Apr 1991–April 2015
Bellinger	North Bonville	Dec 1990–ongoing
Bellinger	Gleniffer	Aug 1993–Feb 2007
Bellinger	Bellinger Council	Apr 1993–Jun 2001
Bellinger	Kooroowi	May 1991–ongoing
Bellinger	Thora	Feb 1993–ongoing
Nambucca	Bowraville	Jun 1993–Oct 2001
Nambucca	Stuarts Island Downstream	Oct 1998–ongoing
Nambucca	Utungun	Dec 1991–ongoing
Macleay	Euroka Upstream	Jul 1990–June 2011
Macleay	Aldavilla Downstream	Dec 2011–ongoing
Maria	Green Valley	Sep 1994–ongoing
Hastings	Telegraph Point	Nov 1990–ongoing
Hastings	Lake Cathie	Aug 1993–Jun 2001
Hastings	Ellenborough	Jun 1991–Sep 1999
Camden Haven	Logans Crossing	Dec 1989–ongoing
Manning	Mount George	Mar 1991–ongoing
Karuah	Nabiac	Jun 1984–ongoing
Karuah	Tuncurry	Aug 2002– Oct 2016
Karuah	Tuncurry Downstream	Jun 2016-ongoing
Karuah	Tiona	Jun 2002–Sep 2015
Karuah	Pacific Palms Wharf	Oct 2013–ongoing
Karuah	Tarbuck Bay	May 1996–ongoing
Karuah	Bulahdelah	Aug 1996–ongoing
Hunter	Gostwyck	Oct 1999–ongoing
Hunter	Seaham	Sep 1999–ongoing
Hunter	Hexham Bridge	May 1998–ongoing
Hunter	Belmore Bridge	Sep 1995–ongoing

Region	Station	Period of data
Hunter	Cardiff	Mar 1991–Sept 1996
Macquarie-Tuggerah Lakes	Barnsley	Jan 1988–ongoing
Macquarie-Tuggerah Lakes	Fassifern	Jan 1992–Dec 1997
Macquarie-Tuggerah Lakes	Dora Creek	May 1992–Jul 1999
Macquarie-Tuggerah Lakes	Martinsville	Mar 1988–ongoing
Macquarie-Tuggerah Lakes	Mandalong	Dec 1988–ongoing
Macquarie-Tuggerah Lakes	Wyee	May 1992–ongoing
Macquarie-Tuggerah Lakes	Whitemans Ridge	Apr 1989–ongoing
Macquarie-Tuggerah Lakes	Yarramalong	Feb 1987–ongoing
Macquarie-Tuggerah Lakes	Kulnura	Mar 1989–ongoing
Macquarie-Tuggerah Lakes	Toukley	Dec 1985–ongoing
Macquarie-Tuggerah Lakes	Warnervale	Jan 1986–Apr 2010
Macquarie-Tuggerah lakes	Hamlyn Terrace	Mar 2010–ongoing
Macquarie-Tuggerah Lakes	Wyong Weir	Jan 1986–Apr 2008
Macquarie-Tuggerah Lakes	Wyong	Jan 1986–Apr 1991
Macquarie-Tuggerah Lakes	Kangy Angy	Aug 2010–ongoing
Macquarie-Tuggerah Lakes	Chittaway	May 1989–Aug 2010
Macquarie-Tuggerah Lakes	Berkeley Vale	Jun 1988–ongoing
Macquarie-Tuggerah Lakes	Mardi Dam	Jun 1988–ongoing
Macquarie-Tuggerah Lakes	Sterland	Apr 1989–ongoing
Macquarie-Tuggerah Lakes	Long Jetty	Sept 1992–Sept 1998
Macquarie-Tuggerah Lakes	Bateau Bay	Jan 1980–ongoing
Macquarie-Tuggerah Lakes	Lisarow	Mar 1989–ongoing
Hawkesbury	Strickland	Dec 1985–ongoing
Hawkesbury	Narara	Apr 1989–ongoing
Hawkesbury	Mount Elliot	Dec 1985–ongoing
Hawkesbury	Wyoming	Aug 1988–ongoing
Hawkesbury	Kincumber	May 1987–ongoing
Hawkesbury	Webbs Creek	Jul 1999–ongoing
Hawkesbury	Colo Junction	Jul 1999–ongoing
Hawkesbury	Sackville Downstream	Jun 1999–ongoing
Hawkesbury	Woy Woy	Jul 1991–Jul 1996
Hawkesbury	Brooklyn	Apr 1991–Jul 1996
Hawkesbury	Cowan	Jun 1991–Jul 1996
Hawkesbury	Penrith	Dec 1994–Jan 1995
Hawkesbury	Narellan Creek	Jan 1994–Sep 1996
Hawkesbury	Camden Life Centre	Mar 1994–Sep 1996
Hawkesbury	Mt Annan School	Feb 1994–Sep 1996
Blue Mountains	Mount Boyce	Nov 1992–Feb 1995
Blue Mountains	Clarence	Nov 1992–Feb 1995
Blue Mountains	Zig Zag	Nov 1992–Feb 1995
Sydney Coastal	Kuringai	Jan 1991–Sep 1996
Sydney Coastal	Wahroonga	Nov 1990–Jul 1996
Sydney Coastal	Beecroft	Sep 1992–Jul 1996
Sydney Coastal	Avalon	Jun 1994–ongoing
Sydney Coastal	Mona Vale	Jun 1994–ongoing
Sydney Coastal	Narrabeen Creek	May 1998–ongoing
Sydney Coastal	Middle Creek	Apr 1995–ongoing
Sydney Coastal	Cromer	Mar 1994–ongoing
Sydney Coastal	Belrose	May 1994–ongoing

Region	Station	Period of data
Sydney Coastal	Allambie	Jun 1999–ongoing
Sydney Coastal	Balgowlah	Aug 1999–May 2005
Sydney Coastal	Curl Curl	Feb 2014–ongoing
Sydney Coastal	North Manly	May 1995–ongoing
Sydney Coastal	Manly Dam	Nov 1995–ongoing
Sydney Coastal	Chatswood	Sep 1992–Jul 1996
Sydney Coastal	Denistone	Jan 1990–Jun 1996
Sydney Coastal	M4 Motorway	Jun 1993–Sep 1996
Sydney Coastal	Homebush Bay	Feb 1993–Mar 1994
Sydney Coastal	Kelso Creek	Nov 1996–ongoing
Wollongong Coastal	Bulli Pass	Sep 1982–Oct 1998
Wollongong Coastal	Rixons Pass	Jun 1985–ongoing
Wollongong Coastal	Russell Vale	Jul 1982–ongoing
Wollongong Coastal	Corrimal Colliery	Jun 1985–Dec 1993
Wollongong Coastal	Mount Pleasant	Jun 1997–ongoing
Wollongong Coastal	Mount Nebo	Sep 1982–Feb 1997
Wollongong Coastal	Mount Kembla	Jun 1985–ongoing
Wollongong Coastal	Dombarton Loop	Jun 1985–ongoing
Wollongong Coastal	Wongawilli	Sep 1982–ongoing
Wollongong Coastal	Port Kembla BHP	Jan 1993–ongoing
Wollongong Coastal	Port Kembla	Sep 1982–ongoing
Wollongong Coastal	Darkes Road	Feb 1994–ongoing
Wollongong Coastal	Cleveland Road	Jun 1985–ongoing
Wollongong Coastal	Huntley Colliery	Jun 1982–ongoing
Wollongong Coastal	Calderwood	Jan 1983–Jun 1985
Wollongong Coastal	Upper Calderwood	Jun 1985–ongoing
Wollongong Coastal	Little Lake	May 1991–Oct 2014
Wollongong Coastal	Little Lake Entrance	May 2014–ongoing
Wollongong Coastal	Airport	Jun 1991–Mar 1995
Wollongong Coastal	North Macquarie	Jul 1985–ongoing
Wollongong Coastal	Clover Hill	Aug 1985–ongoing
Wollongong Coastal	Nurrewin	May 2005–ongoing
Wollongong Coastal	Yellow Rock Road	Jun 1982–ongoing
Wollongong Coastal	Balgownie	Jul 1982–Jun 1987
Wollongong Coastal	Woonona	Jul 1982–Jun 1985
South Coast	Lake Wollumboola	Feb 1999–Oct 2000
South Coast	Lake Conjola Downstream	Jul 2016–ongoing
South Coast	Barlows Bay (Narooma)	Jul 1999–ongoing
South Coast	Regatta Point	Jan 1999–ongoing
South Coast	Merimbula Wharf	Aug 1997–Sep 2001
South Coast	Agnew Wharf	Aug 1997–Jun 2000

Appendix B Sample rainfall data outputs



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NSW GOVERNMENT

SAMPLE DAILY AND MONTHLY RAINFALL PLOTS

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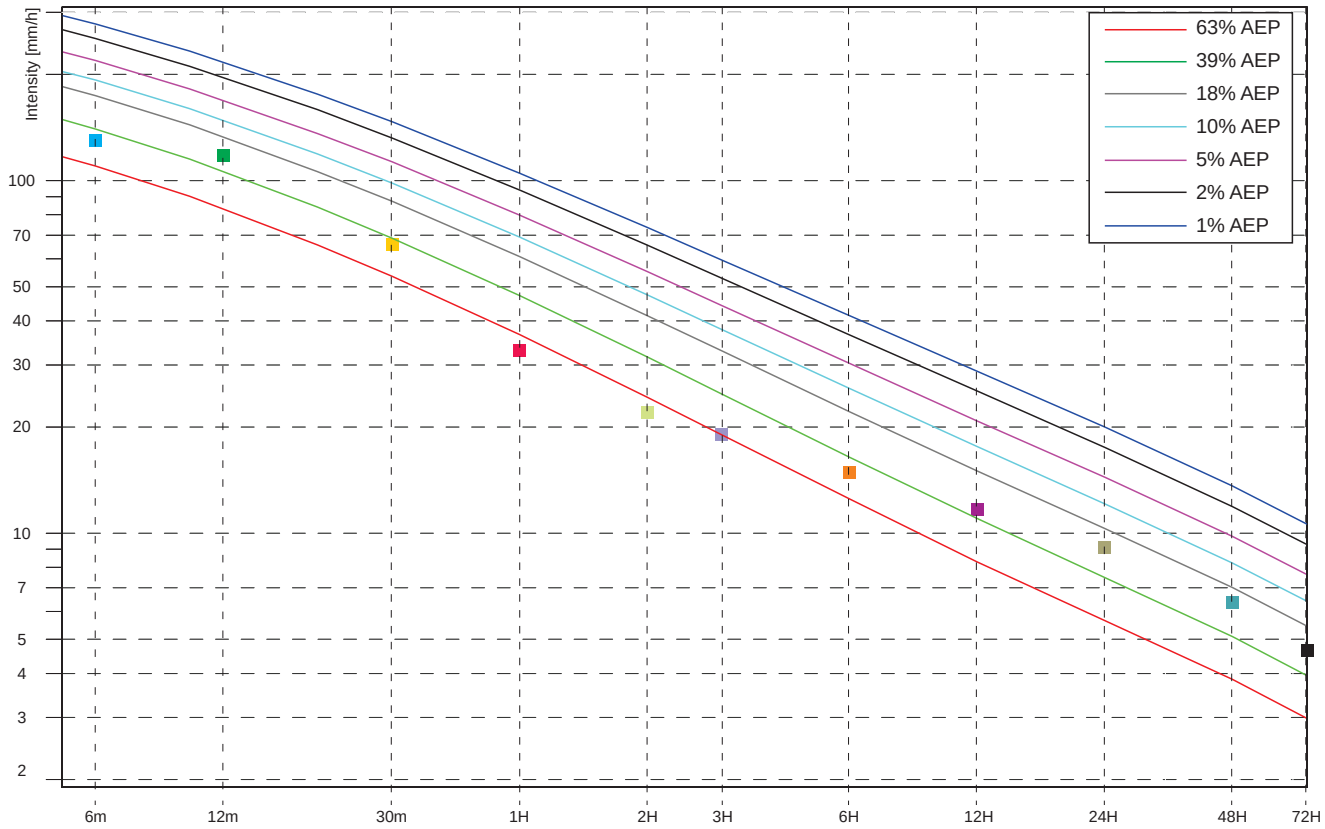
Figure B1

DRAWING 2575-B1-5.cdr



Duration
(minutes: m, hours: H)
Reference: Australian Rainfall and Runoff 1987

North Bonville Rainfall Intensity 21 January-21 March 2013		
Duration (minutes: m) (hours: H)	**Intensity (mm/hr)**	**Date/Time**
6m	130.00	17/02/2013 17:14
12m	117.50	17/02/2013 17:14
30m	66.00	17/02/2013 17:26
1H	33.00	17/02/2013 17:26
2H	22.00	22/02/2013 14:44
3H	19.00	22/02/2013 14:42
6H	14.83	22/02/2013 16:40
12H	11.67	22/02/2013 19:56
24H	9.08	28/01/2013 11:12
48H	6.35	28/01/2013 21:46
72H	4.64	29/01/2013 5:54

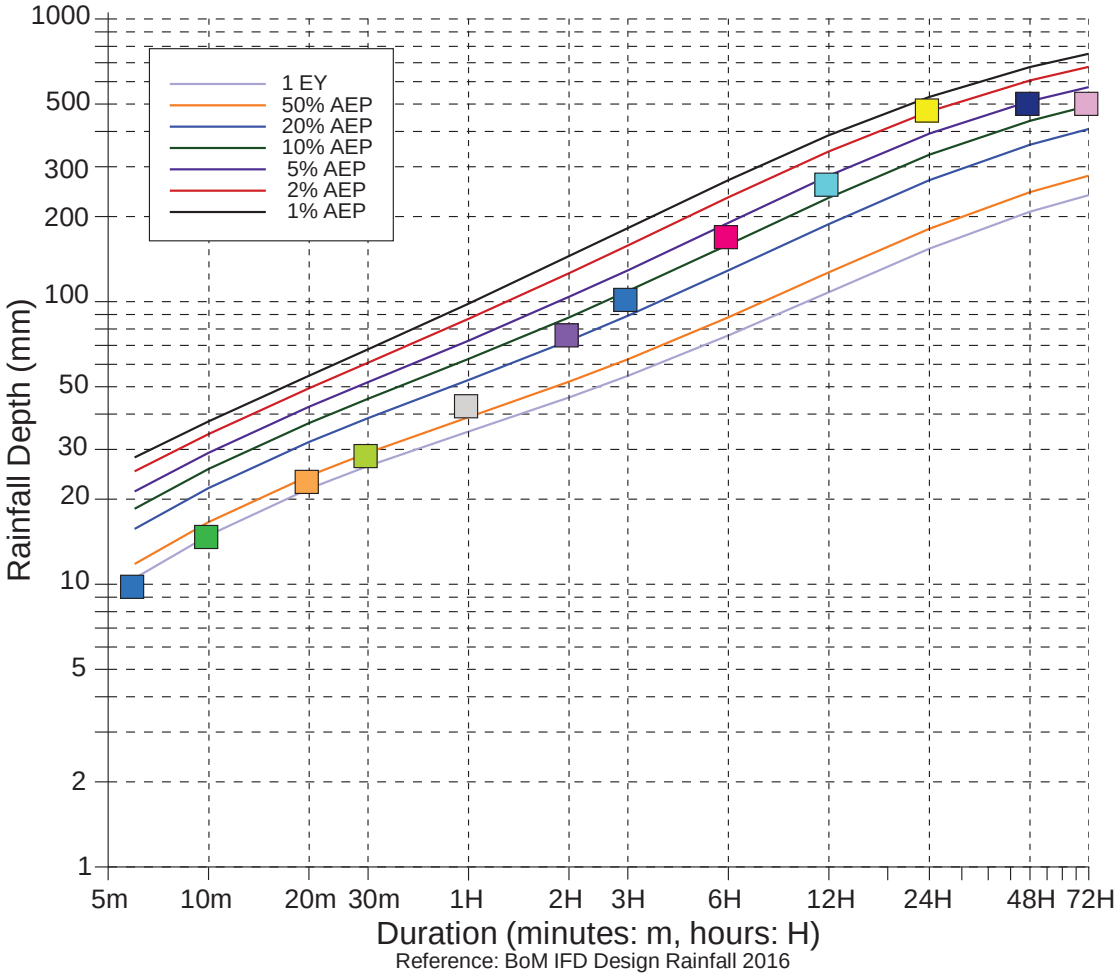
Australian Rainfall and Runoff (Institute of Engineers Australia 1987) states:
Use of the terms 'recurrence interval' and 'return period' has been criticised as leading to confusion in the minds of some decision-makers and members of the public. Although the terms are simple superficially, they are sometimes misinterpreted as implying that the associated magnitude is only exceeded at regular intervals, and that they are referring to the elapsed time to the next exceedance.

The use of the term 'Average Recurrence Interval' (ARI) can lead to confusion. It is preferable, therefore, to express the rarity of a rainfall event in terms of Annual Exceedance Probability (AEP). For example, 'a rainfall total of 60mm falling in 3 hours at Cudgera has a 0.010 (i.e. 1%) probability of being equalled or exceeded in any one year' can be easier to understand than the equivalent statement of 'rainfall total of 60mm in 3 hours has an ARI of 100 years'.

Adapted from: http://www.bom.gov.au/water/designRainfalls/ifd/glossary.shtml

Site Owner: OEH/MHL Latitude: -28.5521 Longitude: 153.3856

AEP = Annual Exceedance Probability
EY = Exceedance per Year



Reference: BoM IFD Design Rainfall 2016

Duration (minutes:m) (Hours: H)	Rainfall Depth (mm)	Time/Date
6m	10.0	05:12_15/03/2017
10m	15.0	05:12_15/03/2017
20m	23.5	05:10_15/03/2017
30m	29.0	03:14_30/03/2017
1H	43.5	23:04_30/03/2017
2H	77.5	22:32_30/03/2017
3H	103.5	21:32_30/03/2017
6H	172.5	18:50_30/03/2017
12H	264.5	01:22_30/03/2017
24H	484.0	01:18_30/03/2017
48H	511.0	18:00_29/03/2017
72H	511.0	18:00_29/03/2017

The probability terminology used for the 2016 design rainfalls is consistent with the probability terminology for the new edition of Australian Rainfall and Runoff (ARR2016). Further details on the new probability terminology can be found in Book 1; Chapter 2; Section 2.2 Terminology of ARR2016 http://arr.ga.gov.au/arr-guideline.The main terms used to describe design rainfalls are:
- *Exceedances per year (EY):* the number of times an event is likely to occur or be exceeded within any given year.
- *Annual exceedance probability (AEP):* the probability or likelihood of an event occurring or being exceeded within any given year, usually expressed as a percentage.
For further information refer to BoM frequently asked questions: http://www.bom.gov.au/water/designRainfalls/ifd/ifd-faq.shtml

NSW GOVERNMENT Manly Hydraulics Laboratory

SAMPLE INTENSITY-FREQUENCY-DURATION FORMULATED IN 2016

MHL Report 2575

Figure B3

DRAWING 2575-B1-5.cdr

Station Name	North Bonville (Live)
Station Number	559050
MGA Easting (m zone 56)	500592.91
MGA Northing (m zone 56)	6641143.16

Date	Time	Value [mm]	State of value
26/01/2013	2:35:17	0.5	5 (Very Good)
26/01/2013	2:40:12	0.5	5 (Very Good)
26/01/2013	4:04:04	0.5	5 (Very Good)
26/01/2013	4:04:53	0.5	5 (Very Good)
26/01/2013	4:07:48	0.5	5 (Very Good)
26/01/2013	5:56:18	0.5	5 (Very Good)
26/01/2013	5:57:42	0.5	5 (Very Good)
26/01/2013	5:59:16	0.5	5 (Very Good)
26/01/2013	6:00:32	0.5	5 (Very Good)
26/01/2013	6:01:22	0.5	5 (Very Good)
26/01/2013	6:02:22	0.5	5 (Very Good)
26/01/2013	12:20:33	0.5	5 (Very Good)
26/01/2013	12:20:51	0.5	5 (Very Good)
26/01/2013	12:21:32	0.5	5 (Very Good)
26/01/2013	12:22:02	0.5	5 (Very Good)
26/01/2013	12:22:42	0.5	5 (Very Good)
26/01/2013	12:23:49	0.5	5 (Very Good)
26/01/2013	12:24:37	0.5	5 (Very Good)
26/01/2013	12:25:42	0.5	5 (Very Good)
26/01/2013	12:35:17	0.5	5 (Very Good)
26/01/2013	19:16:58	0.5	5 (Very Good)
26/01/2013	19:49:01	0.5	5 (Very Good)
26/01/2013	19:51:13	0.5	5 (Very Good)
26/01/2013	21:12:07	0.5	5 (Very Good)
26/01/2013	21:55:36	0.5	5 (Very Good)
26/01/2013	22:01:34	0.5	5 (Very Good)
26/01/2013	22:05:28	0.5	5 (Very Good)
26/01/2013	22:10:31	0.5	5 (Very Good)
26/01/2013	22:12:16	0.5	5 (Very Good)
26/01/2013	22:13:47	0.5	5 (Very Good)
26/01/2013	22:15:34	0.5	5 (Very Good)
26/01/2013	22:17:57	0.5	5 (Very Good)

QUALITY CODE DESCRIPTIONS

Quality Code		Water Level*	Rainfall	Barometric Pressure*	Temperature*	Conductivity*
5 (Very Good)	Records processed to	±5mm	±3% of calibration	±0.5mbar	±0.5ºC	±2mS/m
6 (Good)	Records processed to	±10mm		±1mbar	±1.0ºC	±2mS/m
55 (Fair)	Records processed to	±20mm	±5% of calibration	±2mbar	±2.0ºC	±5mS/m
100 (Leost Code)	Data from previous MHL database, processed to	±20mm	±3% of calibration	±1mbar		
105 (Poor)	Records processed to	±50mm	±10% of calibration	±5mbar	±5.0ºC	±10mS/m
208 (Very Poor)	Records processed to greater than	±50mm	±10% of calibration	±5mbar	±5.0ºC	±10mS/m
41 (Fitted Data)	Fitted data					
150 UnCoded)	Uncoded – data not yet quality controlled	Raw data from the instrument with only preliminary quality checks performed				
1, 161, 204, 205, 206, 207, 250, 255 (Sensor is dry or data loss or missing data)	Data loss					

* A quality code is assigned under the conditions that at least 95% of the data meets the quality code requirements, based on single point calibration

Appendix C Publications of interest

Data Reports

MHL Annual Coastal Rainfall Summaries available:

MHL Report Nos. 610 (90–91), .624 (91–92), 660 (92–93), 699 (93–94), 730 (94–95), 776 (95–96), 874 (96–97), 946 (97–98), 1015 (98–99), 1071 (99–00), 1131 (00–01), 1207 (01–02), 1278 (02–03), 1348 (03–04), 1424 (04–05), 1513 (05–06), 1765 (06–07), 1849 (07–08), 1934 (08–09), 2011 (09–10), 2090 (10–11), 2159 (11–12), 2220 (12–13), 2293 (13–14), 2385 (14–15), 2476 (15–16).

MHL Annual Estuary and River Water Levels Summaries available:

MHL Report Nos. 555 (87–88), 564 (88–89), 582 (89–90), 601 (90–91), 625 (91–92), 659 (92–93), 698 (93–94), 731 (94–95), 778 (95–96), 875 (96–97), 947 (97–98), 1014 (98–99), 1070 (99–00), 1130 (00–01), 1206 (01–02), 1276 (02–03), 1346 (03–04), 1422 (04–05), 1511 (05–06), 1763 (06–07), 1847 (07–08), 1932 (08–09), 2009 (09–10), 2088 (10–11), 2157 (11–12), 2218 (12–13) 2291(13–14), 2383 (14–15), 2474 (15–16).

MHL Annual Ocean Tide Levels Summaries available:

MHL Report Nos. 515 (86–87), 544 (87–88), 563 (88–89), 585 (89–90), 602 (90–91), 628 (91–92), 658 (92–93), 697 (93–94), 732 (94–95), 777 (95–96), 876 (96–97), 947 (97–98), 1013 (98–99), 1069 (99–00, 1129 (00–01), 1205 (01–02), 1277 (02–03), 1347 (03–04), 1423 (04–05), 1512 (05–06), 1764 (06–07), 1848 (07–08), 1933 (08–09), 2010 (09–10), 2089 (10–11), 2158 (11–12), 2219 (12–13) 2292 (13–14), 2384 (14–15), 2475 (15–16).

MHL Annual Wave Climate and Coastal Air Pressure Summaries available:

MHL Report Nos. 547 (87–88), 560 (88–89), 581 (89–90), 600 (90–91), 627 (91–92), 655 (92–93), 695 (93–94), 733 (94–95), 779 (95–96), 877 (96–97), 948 (97–98), 1016 (98–99), 1072 (99–00), 1132 (00–01), 1208 (01–02), 1279 (02–03), 1349 (03–04), 1425 (04–05), 1514 (05–06),1766 (06–07), 1850 (07–08), 1935 (08–09), 2012 (09–10), 2091 (10–11), 2160 (11–12), 2221 (12–13) 2294 (13–14), 2386 (14–15), 2477 (15–16).

Flood Reports

MHL Flood Reports:

- *New South Wales North Coast Flood Summary June 2005*, MHL Report No. 1426
- *Marshalls Creek Flood Event 30 June 2005,* MHL Report No. 1435
- *New South Wales North Coast January 2006 Flood Summary*, MHL Report No. 1469
- *New South Wales North Coast March 2006 Flood Summary*, MHL Report No. 1482
- *New South Wales Central Coast June 2007 Flood Summary*, MHL Report No. 1754
- *New South Wales Hunter Valley, Wallamba River and Myall River June 2007 Flood Summary*, MHL Report No. 1755
- *New South Wales Hawkesbury and Nepean June 2007 Flood Summary*, MHL Report No. 1756
- *New South Wales Tweed River January 2008 Flood Summary*, MHL Report No. 1801

- *New South Wales Richmond River January 2008 Flood Summary*, MHL Report No. 1802
- *New South Wales Clarence River January 2008 Flood Summary*, MHL Report No. 1803
- *New South Wales Coffs Harbour and Bellinger River Region January 2008 Flood Summary*, MHL Report No. 1804
- *New South Wales Coffs Harbour, Bellinger River and Nambucca River Regions February 2009 Flood Summary*, MHL Report No. 1908
- *New South Wales Coffs Harbour and Bellinger River Regions April 2009 Flood Summary*, MHL Report No. 1913
- *NSW Northern Rivers May 2009 Flood Report*, MHL Report No. 1965
- *NSW North Coast Flood Summary January–March 2013*, MHL Report No. 2202
- *NSW Hunter and Central Coast Flood Summary April–May 2015,* MHL Report No. 2364
- *NSW South Coast Flood Summary August 2015,* MHL Report No. 2397
- *NSW North Coast Flood Summary March 2017*, MHL Report No. 2535

Other references

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) 2016, *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia,

Bureau of Meteorology, *Climate Glossary – Southern Oscillation Index*, retrieved on 04 October 2010 from http://www.bom.gov.au/climate/glossary/soi.shtml

The Institution of Engineers, Australia 1987, '*Australian Rainfall and Runoff: A Guide to Flood Estimation'*, Institute of Engineers, Australia

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