Public Works
Manly Hydraulics Laboratory

NSW COASTAL RAINFALL ANNUAL SUMMARY
2015–2016

Report MHL2476
October 2016

prepared for:
NSW Office of Environment and Heritage

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Cover photograph: Lake Conjola water level and rainfall station, South Coast

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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 2015 to 30 June 2016, 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.

Requests for further information should be directed to:

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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 2015–2016
- a list of all stations for which Manly Hydraulics Laboratory collected rainfall data in 2015–2016 (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-first year of rainfall data collected by Manly Hydraulics Laboratory (MHL). The network of automatic recorders and the associated analysis routines enable efficient delivery of rainfall data. As well as near real time rainfall information at over 80 stations in NSW, extracts from the historical database of rainfall data can 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 72 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 the NSW Data Collection Warehouse, Data Centre 1 and to MHL's data server using a variety of telemetry techniques including internet protocol (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 data archived to magnetic tape as a security measure at regular intervals. A backup database is also kept at Data Centre 1.

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
- 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://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 2015–2016

This section outlines events and developments which have influenced rainfall data monitoring during this reporting period.

The following stations were upgraded during the fiscal year:

- Main Arm – station relocation to nearby land as private land ownership had changed
- North Bonville – full station rebuild due to outdated instrumentation
- Tuncurry – water level and rainfall station relocated nearby to a downstream jetty to improve safe access and remove the need to access through private land
- Mandalong – full station rebuild due to outdated instrumentation
- Martinsville – full station rebuild due to outdated instrumentation
- Koolewong – water level and rain gauge station relocated to the bank to improve safe access to the station
- Lake Conjola – water level and rain gauge station relocated to the bank to improve safe access to the station.

In the 2015–2016 fiscal year, the maximum recorded rainfall intensities for 11 durations between 5 minutes and 72 hours occurred at five 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 during 2015–2016 on the NSW east coast is provided in Table 4.2.

The maximum recorded rainfall for durations of 5 minutes to 72 hours at each station for 2015–2016 is presented in Table 4.3.

Table 4.1 Maximum recorded intensities for all stations 2015–2016

Duration	Station	Date	Rainfall (mm)	Rainfall (mm/hr)	AEP (%)
5min	Lake Ainsworth	26/03/2016	15.5	186.0	~2
10min	Lake Ainsworth	26/03/2016	26.5	159.0	~10
20min	Russell Vale	26/03/2016	46.5	139.5	~5
30min	Russell Vale	26/03/2016	65.0	130.0	~5
60min	Russell Vale	26/03/2016	110.5	110.5	~1
3hrs	Newports Creek	4/06/2016	168.0	56.0	~1
6hrs	Wooli Caravan Park	4/06/2016	256.0	42.7	~1
12hrs	Wooli Caravan Park	5/06/2016	338.0	28.2	~1
24hrs	Nurrewin	5/06/2016	512.5	21.4	~5
48hrs	Nurrewin	6/06/2016	575.0	12.0	~2
72hrs	Nurrewin	6/06/2016	580.5	8.1	~5

Table 4.2 lists significant rainfall events that occurred in the 2015–2016 fiscal year. 100 mm of rain falling in a 24-hour period has been deemed a suitably significant rain event by OEH.

Table 4.2 2015–2016 Summary of rainfall events

Month	Summary of rainfall events
July 2015	No events exceeding 100 mm in 24 hours occurred this month.
August 2015	Daily rainfall exceeding 100 mm in 24 hours occurred for the entire Wollongong region and at Barlows Bay.
September 2015	Daily rainfall exceeding 100 mm in 24 hours occurred at Tarbuck Bay.
October 2015	No events exceeding 100 mm in 24 hours occurred this month.
November 2015	Daily rainfall exceeding 100 mm in 24 hours occurred at Utungun.
December 2015	No events exceeding 100 mm in 24 hours occurred this month.
January 2016	Daily rainfall exceeding 100 mm in 24 hours occurred for one station in the Hastings–Camden Haven region, the entire Hunter region, seven stations in the Macquarie–Tuggerah Lakes region, two Sydney stations and two South Coast stations.
February 2016	No events exceeding 100 mm in 24 hours occurred this month.
March 2016	Daily rainfall exceeding 100 mm in 24 hours occurred at two stations in the Tweed–Lismore region, one station in the Hunter region and two stations in the Wollongong region.
April 2016	No events exceeding 100 mm in 24 hours occurred this month.
May 2016	No events exceeding 100 mm in 24 hours occurred this month.
June 2016	All rainfall stations exceeded 100 mm in 24 hours during the June 2016 East Coast Low event with the exception of Sackville Downstream. The June 2016 East Coast Low event had an impact across the entire east coast of NSW and saw rainfall exceeding 300 mm in 24 hours in some locations, including two stations in the Tweed–Lismore region, six stations in the Bellinger region and four stations in the Wollongong 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 1996 to June 2016 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 SES officers access to near real time environmental data and our 'quality assured' historical database through the OEH Wiski Web 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://mhl.nsw.gov.au under the data request menu.

Statistics

- This year, in excess of 181,000 public and customer webpage hits per month were served by MHL.
- MHL has approximately 106,000 visits per month to its website.
- In excess of 2 million individual webpage hits have been recorded in 2015–2016.
- Data access also continues to assist the Bureau of Meteorology, local government authorities, State Emergency Service, NSW Police, Water NSW, NSW Surf Life Saving Association, universities, the NSW court system, private consultancies, NSW Roads and Maritime Services and the Natural Resources Commission.
- A number of communities across Australia continue to receive environmental data from MHL.

Table 4.3 2015-2016 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	29/11/2015 9.0	29/11/2015 14.5	4/06/2016 22.5	4/06/2016 31.0	4/06/2016 51.0	4/06/2016 111.0	4/06/2016 188.0	4/06/2016 228.0	4/06/2016 297.5	5/06/2016 355.5	5/06/2016 356.0	1424.5
Main Arm	4/06/2016 11.5	4/06/2016 19.0	4/06/2016 33.5	4/06/2016 43.0	4/06/2016 69.5	4/06/2016 114.0	4/06/2016 159.0	4/06/2016 218.5	4/06/2016 368.5	5/06/2016 447.5	5/06/2016 450.0	1627.0
Huonbrook	4/06/2016 10.0	4/06/2016 17.5	4/06/2016 28.0	4/06/2016 38.0	4/06/2016 63.0	4/06/2016 95.5	4/06/2016 133.0	4/06/2016 202.5	4/06/2016 388.5	5/06/2016 435.0	5/06/2016 441.0	1769.5
Myocum	9/12/2015 9.5	9/12/2015 18.0	29/11/2015 25.0	29/11/2015 32.5	4/06/2016 43.5	4/06/2016 114.0	4/06/2016 149.5	5/06/2016 185.0	4/06/2016 244.0	5/06/2016 282.5	5/06/2016 285.0	1556.0
Lake Ainsworth	26/03/2016 15.5	26/03/2016 26.5	26/03/2016 44.0	26/03/2016 50.0	5/06/2016 56.5	5/06/2016 96.5	4/06/2016 121.0	5/06/2016 232.5	5/06/2016 261.5	5/06/2016 298.0	5/06/2016 301.5	1804.5
Wooli Caravan Park	4/06/2016 14.0	4/06/2016 24.5	4/06/2016 35.5	4/06/2016 47.0	4/06/2016 90.0	4/06/2016 145.5	4/06/2016 256.0	5/06/2016 338.0	5/06/2016 396.0	5/06/2016 429.5	5/06/2016 440.5	1342.0
Perry Drive	4/06/2016 11.0	4/06/2016 20.5	4/06/2016 36.0	4/06/2016 52.5	4/06/2016 81.5	4/06/2016 164.0	4/06/2016 214.0	4/06/2016 282.5	5/06/2016 343.5	5/06/2016 383.5	5/06/2016 384.0	1323.5
Shepards Lane	14/11/2015 9.0	4/06/2016 17.5	4/06/2016 30.5	4/06/2016 41.0	4/06/2016 81.0	4/06/2016 148.5	4/06/2016 225.5	4/06/2016 301.5	5/06/2016 375.0	5/06/2016 412.0	5/06/2016 412.0	1391.0
Red Hill	4/06/2016 9.5	4/06/2016 18.5	4/06/2016 32.0	4/06/2016 43.0	4/06/2016 85.5	4/06/2016 159.0	4/06/2016 238.5	4/06/2016 311.5	5/06/2016 384.5	5/06/2016 419.0	5/06/2016 419.0	1424.0
Newports Creek	4/06/2016 9.5	4/06/2016 19.0	4/06/2016 33.5	4/06/2016 48.5	4/06/2016 88.5	4/06/2016 168.0	4/06/2016 228.5	4/06/2016 315.0	5/06/2016 373.0	5/06/2016 422.0	5/06/2016 422.0	1436.5
Middle Boambee	4/06/2016 10.0	4/06/2016 19.5	4/06/2016 34.0	4/06/2016 46.5	4/06/2016 86.0	4/06/2016 165.5	4/06/2016 233.5	4/06/2016 313.5	5/06/2016 379.5	5/06/2016 422.0	5/06/2016 422.0	1445.0
North Bonville[1]	9/12/2015 15.0	9/12/2015 20.0	9/12/2015 24.0	8/11/2015 24.0	8/11/2015 36.5	8/11/2015 56.0	24/12/2015 68.0	24/12/2015 69.5	5/06/2016 113.0	5/06/2016 151.5	6/06/2016 164.5	1197.0
Kooroowi	29/11/2015 10.5	29/11/2015 17.0	29/11/2015 22.5	29/11/2015 23.0	5/06/2016 38.5	5/06/2016 75.0	5/06/2016 105.0	5/06/2016 177.0	5/06/2016 237.0	5/06/2016 254.0	5/06/2016 254.0	1207.5

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	17/09/2015 10.5	17/09/2015 18.0	17/09/2015 23.5	17/09/2015 24.5	5/06/2016 33.5	5/06/2016 57.0	5/06/2016 70.5	5/06/2016 128.5	5/06/2016 162.0	5/06/2016 187.0	5/06/2016 187.5	932.5
Utungun	17/09/2015 11.0	8/11/2015 16.0	8/11/2015 29.0	8/11/2015 39.0	8/11/2015 64.5	8/11/2015 79.5	8/11/2015 90.5	5/06/2016 153.0	5/06/2016 200.5	5/06/2016 223.0	5/06/2016 223.0	1221.0
Aldavilla Downstream[1]	14/10/2015 7.0	14/10/2015 11.0	3/11/2015 17.0	3/11/2015 23.0	3/11/2015 30.0	5/06/2016 61.0	5/06/2016 89.0	5/06/2016 152.0	5/06/2016 195.0	5/06/2016 234.0	5/06/2016 234.0	859.0
Green Valley[1]	9/12/2015 8.0	29/03/2016 9.5	4/06/2016 14.5	4/06/2016 19.0	21/02/2016 24.0	4/06/2016 43.0	5/06/2016 64.5	5/06/2016 118.5	5/06/2016 155.0	5/06/2016 179.0	5/06/2016 180.0	1103.5
Telegraph Point	8/04/2016 10.0	8/04/2016 19.0	8/04/2016 27.5	8/04/2016 28.5	5/01/2016 31.0	5/06/2016 55.0	5/06/2016 87.5	5/06/2016 154.0	5/06/2016 213.0	5/06/2016 241.5	5/06/2016 242.0	1388.5
Logans Crossing	2/12/2015 8.0	16/12/2015 15.0	16/12/2015 27.0	16/12/2015 33.0	5/01/2016 54.5	5/01/2016 99.5	5/01/2016 142.5	5/01/2016 156.0	5/01/2016 157.5	5/01/2016 182.0	6/01/2016 187.0	1206.0
Mount George	23/01/2016 11.5	23/01/2016 22.0	23/01/2016 35.5	23/01/2016 39.0	23/01/2016 51.0	23/01/2016 54.5	16/12/2015 57.0	5/06/2016 72.5	23/01/2016 103.5	6/06/2016 125.0	6/06/2016 125.0	1392.5
Nabiac	26/12/2015 9.0	26/12/2015 16.0	26/12/2015 31.0	26/12/2015 34.0	26/12/2015 35.5	22/01/2016 41.0	5/06/2016 57.5	5/06/2016 85.0	5/06/2016 125.0	5/06/2016 150.0	6/06/2016 150.5	1094.0
Tuncurry	26/12/2015 7.5	26/12/2015 14.5	26/12/2015 26.5	26/12/2015 35.5	26/12/2015 40.0	5/06/2016 43.5	5/06/2016 68.0	5/06/2016 99.0	5/06/2016 139.0	5/01/2016 167.0	6/01/2016 181.0	1110.5
Pacific Palms Wharf	16/12/2015 14.0	16/12/2015 24.5	16/12/2015 29.0	16/12/2015 29.5	5/01/2016 43.0	5/01/2016 69.5	5/06/2016 96.5	16/03/2016 125.0	5/06/2016 165.0	5/01/2016 231.5	6/01/2016 282.5	1550.5
Tarbuck Bay	5/01/2016 8.5	5/01/2016 16.5	5/01/2016 30.5	5/01/2016 45.5	5/01/2016 73.5	5/01/2016 124.0	5/01/2016 152.0	5/01/2016 176.5	5/01/2016 271.5	5/01/2016 338.5	6/01/2016 379.5	1587.5
Bulahdelah	24/08/2015 12.5	13/11/2015 15.0	27/10/2015 21.0	27/10/2015 26.0	5/01/2016 35.5	5/01/2016 83.5	5/01/2016 139.5	5/01/2016 185.0	5/01/2016 268.0	5/01/2016 325.5	6/01/2016 341.5	1347.0
Gostwyck	26/12/2015 9.0	21/10/2015 12.5	21/10/2015 14.5	5/01/2016 18.0	5/01/2016 29.5	5/01/2016 61.0	6/01/2016 90.0	6/01/2016 130.5	6/01/2016 207.0	6/01/2016 270.5	6/01/2016 293.0	965.5
Seaham	29/03/2016 9.0	29/03/2016 17.0	5/01/2016 21.5	5/01/2016 29.5	5/01/2016 44.0	5/01/2016 59.0	5/01/2016 88.5	6/01/2016 165.0	6/01/2016 217.0	6/01/2016 269.5	6/01/2016 292.0	981.0
Belmore Bridge	10/12/2015 10.0	14/01/2016 17.5	14/01/2016 32.5	14/01/2016 36.5	14/01/2016 46.0	5/01/2016 66.0	5/01/2016 90.0	6/01/2016 145.5	6/01/2016 183.0	6/01/2016 225.5	6/01/2016 239.5	915.5

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	18/09/2015 10.0	14/01/2016 16.5	14/01/2016 24.5	14/01/2016 29.0	14/01/2016 33.5	5/01/2016 60.5	5/01/2016 83.5	6/01/2016 145.5	6/01/2016 199.0	6/01/2016 232.0	6/01/2016 257.0	1005.5
Barnsley	10/12/2015 8.0	14/01/2016 12.0	14/01/2016 21.5	14/01/2016 23.0	14/01/2016 26.5	5/01/2016 47.0	5/01/2016 78.0	6/01/2016 117.5	6/01/2016 169.0	6/01/2016 205.0	6/01/2016 236.0	954.0
Martinsville[1]	11/01/2016 11.0	11/01/2016 17.5	11/01/2016 20.5	11/01/2016 20.5	27/03/2016 30.0	27/03/2016 52.0	5/01/2016 57.5	6/01/2016 86.0	6/01/2016 135.0	6/01/2016 213.5	6/01/2016 248.5	967.5
Mandalong	6/11/2015 8.5	6/11/2015 12.0	6/11/2015 13.5	6/11/2015 13.5	22/01/2016 19.0	5/01/2016 30.0	5/01/2016 50.5	6/01/2016 78.0	6/01/2016 117.0	6/01/2016 177.0	6/01/2016 216.5	1070.0
Wyee	9/12/2015 14.0	9/12/2015 21.5	9/12/2015 33.5	9/12/2015 37.5	9/12/2015 40.0	9/12/2015 46.5	5/06/2016 56.5	5/06/2016 77.5	5/06/2016 149.5	5/06/2016 171.5	6/01/2016 197.0	1279.6
Whitemans Ridge	24/08/2015 8.0	16/12/2015 15.0	16/12/2015 22.0	16/12/2015 24.0	16/12/2015 26.0	16/12/2015 30.5	6/01/2016 44.5	6/01/2016 69.5	5/06/2016 119.5	6/01/2016 166.0	6/01/2016 197.5	1133.0
Yarramalong[1]	16/12/2015 11.0	16/12/2015 20.0	16/12/2015 26.5	16/12/2015 30.5	16/12/2015 32.5	16/12/2015 39.0	22/01/2016 48.5	5/06/2016 70.0	5/06/2016 123.0	6/01/2016 145.0	6/01/2016 177.0	1022.0
Kulnura[1]	6/11/2015 5.5	22/01/2016 6.5	23/01/2016 10.5	23/01/2016 12.5	23/01/2016 17.5	24/01/2016 33.5	22/01/2016 46.0	24/01/2016 67.0	5/06/2016 110.0	24/01/2016 131.5	24/01/2016 145.5	745.5
Toukley	24/08/2015 7.0	31/05/2016 10.5	31/05/2016 20.0	31/05/2016 23.0	16/03/2016 26.0	16/03/2016 40.5	5/06/2016 56.5	5/06/2016 88.5	5/06/2016 134.5	6/06/2016 157.5	5/06/2016 164.0	896.0
Hamlyn Terrace[1]	26/10/2015 11.0	26/10/2015 19.0	26/10/2015 31.5	26/10/2015 34.5	26/10/2015 38.5	16/03/2016 50.5	16/03/2016 57.0	6/01/2016 66.0	6/01/2016 101.0	7/01/2016 144.0	6/01/2016 163.5	1080.5
Mardi Dam	21/02/2016 9.5	21/02/2016 16.5	21/02/2016 23.0	21/02/2016 25.0	21/02/2016 39.0	21/02/2016 52.0	5/06/2016 53.0	5/06/2016 82.5	5/06/2016 131.5	5/06/2016 158.0	6/06/2016 160.0	1275.5
Sterland	27/03/2016 15.0	27/03/2016 26.0	27/03/2016 38.5	27/03/2016 45.5	27/03/2016 49.0	5/06/2016 57.5	5/06/2016 68.0	5/06/2016 85.5	5/06/2016 160.5	6/01/2016 180.0	6/01/2016 208.5	1334.5
Kangy Angy	6/11/2015 10.0	6/11/2015 15.5	6/11/2015 17.5	21/02/2016 20.0	21/02/2016 22.5	5/06/2016 31.5	5/06/2016 52.0	5/06/2016 81.5	5/06/2016 135.5	6/06/2016 160.5	6/06/2016 164.5	1250.5
Berkeley Vale[1]	6/11/2015 8.0	17/09/2015 13.0	17/09/2015 19.0	17/09/2015 22.0	17/09/2015 23.0	5/06/2016 34.5	5/06/2016 56.5	5/06/2016 86.0	5/06/2016 138.0	5/06/2016 163.5	6/06/2016 169.5	1213.0
Bateau Bay	17/09/2015 10.0	17/09/2015 20.0	17/09/2015 29.5	17/09/2015 34.0	17/09/2015 48.5	17/09/2015 56.5	5/06/2016 65.5	5/06/2016 111.0	5/06/2016 162.5	5/06/2016 206.0	6/06/2016 209.0	1366.0

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	
Lisarow	6/11/2015 7.0	6/11/2015 11.5	6/11/2015 15.5	3/04/2016 18.0	3/04/2016 22.5	5/06/2016 37.0	5/06/2016 56.5	5/06/2016 91.5	5/06/2016 154.0	6/06/2016 179.5	6/06/2016 184.5	1303.0
Strickland	27/03/2016 8.0	27/03/2016 14.5	27/03/2016 24.0	27/03/2016 35.5	27/03/2016 57.0	27/03/2016 76.0	27/03/2016 77.0	5/06/2016 98.5	5/06/2016 169.0	6/06/2016 195.0	6/06/2016 198.5	1375.5
Narara	27/03/2016 8.5	27/03/2016 16.5	27/03/2016 26.5	27/03/2016 35.5	27/03/2016 54.0	27/03/2016 79.0	27/03/2016 79.5	5/06/2016 98.0	5/06/2016 165.5	6/06/2016 191.5	6/06/2016 194.5	1336.0
Mount Elliot	3/04/2016 6.5	3/04/2016 13.0	3/04/2016 20.0	3/04/2016 23.5	3/04/2016 35.0	3/04/2016 47.5	5/06/2016 58.0	5/06/2016 109.5	5/06/2016 170.5	5/06/2016 220.0	6/06/2016 231.5	1392.5
Wyoming	6/11/2015 9.0	6/11/2015 12.0	6/11/2015 13.0	3/04/2016 17.5	3/04/2016 32.5	27/03/2016 51.0	5/06/2016 54.5	5/06/2016 96.0	5/06/2016 160.5	5/06/2016 192.0	6/06/2016 197.5	1396.5
Kincumber	1/11/2015 9.0	1/11/2015 17.0	1/11/2015 21.5	1/11/2015 23.0	22/01/2016 32.5	16/03/2016 49.0	5/06/2016 76.0	5/06/2016 122.0	5/06/2016 177.5	5/06/2016 229.5	5/06/2016 232.5	1322.5
Webbs Creek	14/10/2015 9.0	16/12/2015 11.8	16/12/2015 19.8	16/12/2015 26.6	16/12/2015 34.8	16/12/2015 53.4	5/01/2016 78.8	5/01/2016 120.0	5/01/2016 152.4	6/01/2016 200.6	6/01/2016 220.6	990.4
Colo Junction	7/11/2015 9.6	16/12/2015 12.4	30/01/2016 16.6	30/01/2016 21.6	30/01/2016 24.8	16/12/2015 39.0	5/01/2016 53.2	5/01/2016 91.4	5/01/2016 122.8	6/01/2016 174.8	6/01/2016 186.8	928.2
Sackville D/S	16/06/2016 11.2	16/06/2016 17.8	10/12/2015 19.2	10/12/2015 32.2	10/12/2015 36.8	10/12/2015 36.8	5/01/2016 40.8	5/01/2016 65.8	5/01/2016 97.8	6/01/2016 141.6	6/01/2016 156.6	826.6
Kelso Creek	29/01/2016 12.5	29/01/2016 19.5	29/01/2016 24.0	29/01/2016 24.5	5/06/2016 32.0	5/06/2016 52.5	5/06/2016 81.0	5/06/2016 142.5	5/06/2016 204.0	5/06/2016 249.0	5/06/2016 255.0	959.0
Rixons Pass	26/03/2016 11.0	26/03/2016 20.5	26/03/2016 35.5	26/03/2016 52.5	26/03/2016 100.0	26/03/2016 166.5	26/03/2016 176.5	27/03/2016 177.0	5/06/2016 217.5	5/06/2016 304.0	6/06/2016 318.0	1598.0
Russell Vale	26/03/2016 13.5	26/03/2016 26.0	26/03/2016 46.5	26/03/2016 65.0	26/03/2016 110.5	26/03/2016 165.5	26/03/2016 173.5	27/03/2016 174.0	5/06/2016 183.0	5/06/2016 275.5	6/06/2016 291.0	1453.5
Mount Pleasant	1/11/2015 11.5	1/11/2015 22.0	1/11/2015 24.0	5/06/2016 27.5	5/06/2016 43.0	5/06/2016 73.0	5/06/2016 111.0	5/06/2016 172.0	5/06/2016 239.0	5/06/2016 340.5	6/06/2016 352.5	1414.0
Mount Kembla	21/01/2016 8.5	21/01/2016 16.5	21/01/2016 24.0	21/01/2016 29.0	21/01/2016 38.5	5/06/2016 67.5	5/06/2016 105.5	5/06/2016 169.5	5/06/2016 228.5	5/06/2016 313.0	6/06/2016 323.0	1261.0
Dombarton Loop	21/01/2016 9.0	21/01/2016 17.5	21/01/2016 26.0	21/01/2016 34.5	21/01/2016 42.5	5/06/2016 80.5	5/06/2016 138.0	5/06/2016 258.5	5/06/2016 358.0	6/06/2016 428.5	6/06/2016 436.0	1615.5

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	
Wongawilli	21/01/2016 8.0	21/01/2016 12.5	21/01/2016 21.0	21/01/2016 26.0	21/01/2016 33.0	5/06/2016 53.0	5/06/2016 93.5	5/06/2016 164.0	6/06/2016 230.5	6/06/2016 277.0	6/06/2016 283.0	1151.0
Port Kembla	21/01/2016 14.5	21/01/2016 22.5	21/01/2016 30.5	21/01/2016 36.0	21/01/2016 43.5	21/01/2016 55.0	5/06/2016 89.5	5/06/2016 137.0	5/06/2016 176.5	5/06/2016 301.0	6/06/2016 308.0	1179.5
Darkes Road	21/01/2016 9.5	21/01/2016 17.1	21/01/2016 28.9	21/01/2016 35.5	5/06/2016 46.7	5/06/2016 82.6	5/06/2016 118.9	5/06/2016 190.4	5/06/2016 251.5	5/06/2016 340.9	6/06/2016 345.5	1206.5
Cleveland Road	21/01/2016 9.5	21/01/2016 15.5	5/06/2016 25.0	5/06/2016 34.5	5/06/2016 48.5	5/06/2016 81.0	5/06/2016 125.5	5/06/2016 189.5	5/06/2016 246.5	5/06/2016 337.5	6/06/2016 343.5	1194.5
Huntley Colliery	21/01/2016 13.0	21/01/2016 24.5	21/01/2016 37.5	21/01/2016 41.0	21/01/2016 43.5	5/06/2016 79.0	5/06/2016 122.0	5/06/2016 206.5	5/06/2016 291.5	6/06/2016 354.5	6/06/2016 360.0	1397.5
Upper Calderwood	26/01/2016 8.0	26/01/2016 12.0	5/06/2016 21.5	5/06/2016 29.0	5/06/2016 44.0	5/06/2016 83.0	5/06/2016 126.0	5/06/2016 212.0	5/06/2016 300.0	6/06/2016 367.0	6/06/2016 374.0	1338.5
Little Lake	1/02/2016 10.5	21/01/2016 17.0	21/01/2016 22.0	16/03/2016 23.0	16/03/2016 36.0	16/03/2016 42.0	25/08/2015 63.5	25/08/2015 111.5	25/08/2015 155.5	6/06/2016 229.5	6/06/2016 237.0	1087.5
North Macquarie	5/06/2016 10.0	5/06/2016 17.5	5/06/2016 30.5	5/06/2016 38.0	5/06/2016 51.5	5/06/2016 87.5	5/06/2016 154.5	5/06/2016 219.0	5/06/2016 284.0	5/06/2016 371.0	6/06/2016 377.5	1188.5
Clover Hill	5/06/2016 7.5	5/06/2016 14.5	5/06/2016 25.0	5/06/2016 34.0	5/06/2016 55.0	5/06/2016 111.5	5/06/2016 187.0	5/06/2016 312.5	5/06/2016 498.0	6/06/2016 564.0	6/06/2016 570.0	1689.5
Nurrewin	5/06/2016 8.0	26/08/2015 12.5	5/06/2016 22.0	5/06/2016 29.5	5/06/2016 51.5	5/06/2016 114.0	5/06/2016 192.5	5/06/2016 312.0	5/06/2016 512.5	6/06/2016 575.0	6/06/2016 580.5	1715.0
Yellow Rock Road	16/03/2016 7.0	16/03/2016 12.5	16/03/2016 19.5	16/03/2016 24.0	5/06/2016 33.0	5/06/2016 67.0	5/06/2016 115.0	5/06/2016 183.0	5/06/2016 267.0	6/06/2016 366.5	6/06/2016 369.0	1351.0
Barlows Bay	22/06/2016 8.5	22/06/2016 16.5	22/06/2016 20.5	30/01/2016 24.5	4/06/2016 32.0	4/06/2016 78.5	5/06/2016 96.0	5/06/2016 140.0	5/06/2016 193.5	6/06/2016 290.0	6/06/2016 313.0	1291.0
Regatta Point	29/11/2015 10.5	29/11/2015 16.0	17/04/2016 22.0	17/04/2016 26.0	17/04/2016 31.5	17/04/2016 54.0	4/06/2016 69.0	5/06/2016 96.5	5/06/2016 147.5	6/06/2016 256.5	6/06/2016 282.5	1261.0

[1] Some measure of data loss occurred at these stations. See individual plots for further details

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 90 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 1996-June 2016	3

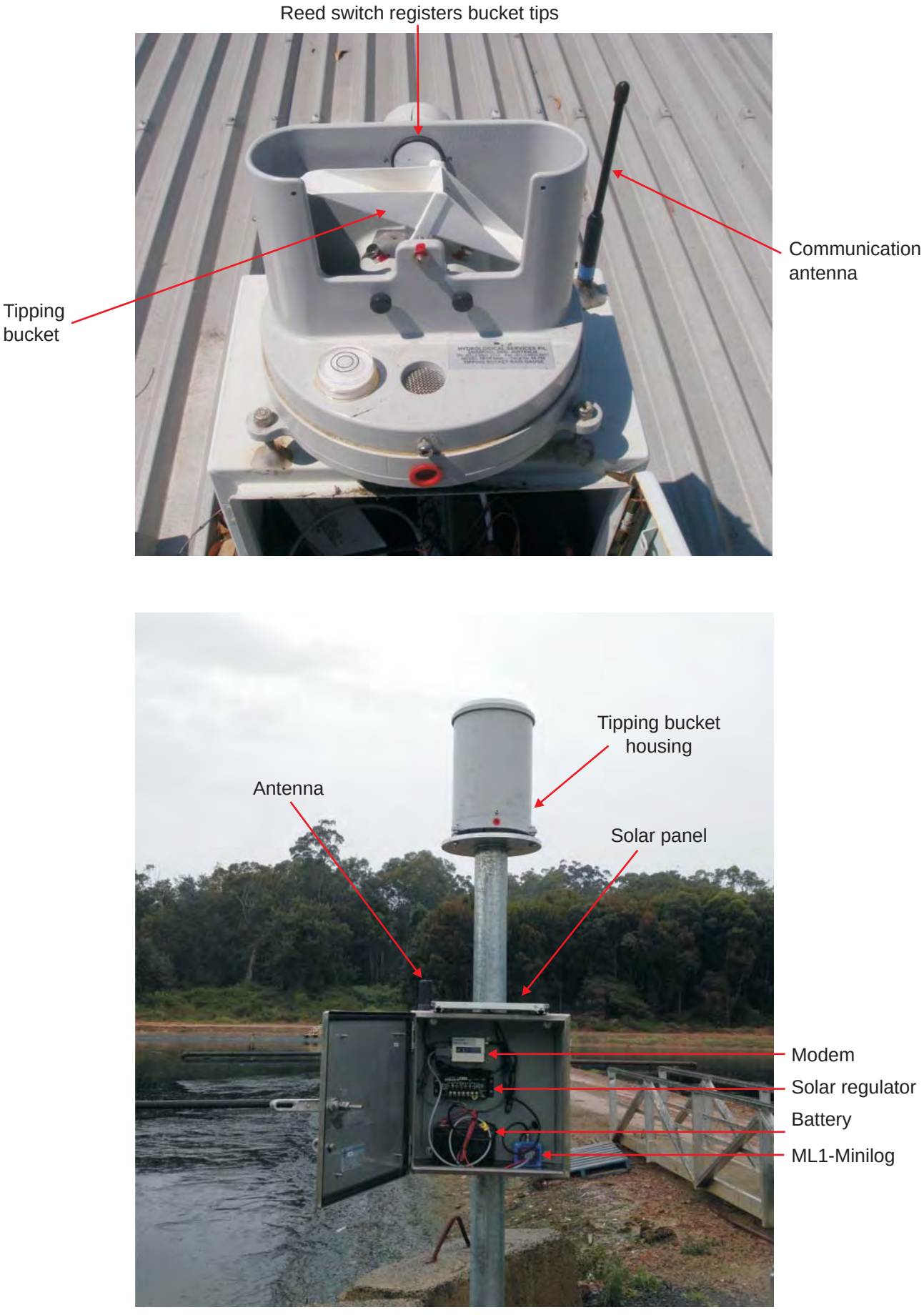
Region	Short name	Station no.	MGA	Easting	Northing	Figure
Station Locality Map	Tweed River and Brunswick River Regions					4
Tweed	Cudgera	558046	56	549668	6859164	5
Brunswick	Main Arm	558053	56	542469	6847276	6
Brunswick	Huonbrook	558049	56	537723	6841573	7
Brunswick	Myocum	558036	56	550528	6837390	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					13
Bellinger	Perry Drive	559019	56	510142	6650416	14
Bellinger	Shepards 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	209401	56	450568	6442279	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 (North) 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) 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 (Mid) Region					88
South Coast	Barlows Bay	218415	56	239464	5988955	89
South Coast	Regatta Point	219405	56	236881	5971060	90

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 2013	B3
Sample rain gauge tip times	B4



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TYPICAL PLUVIOMETER STATION

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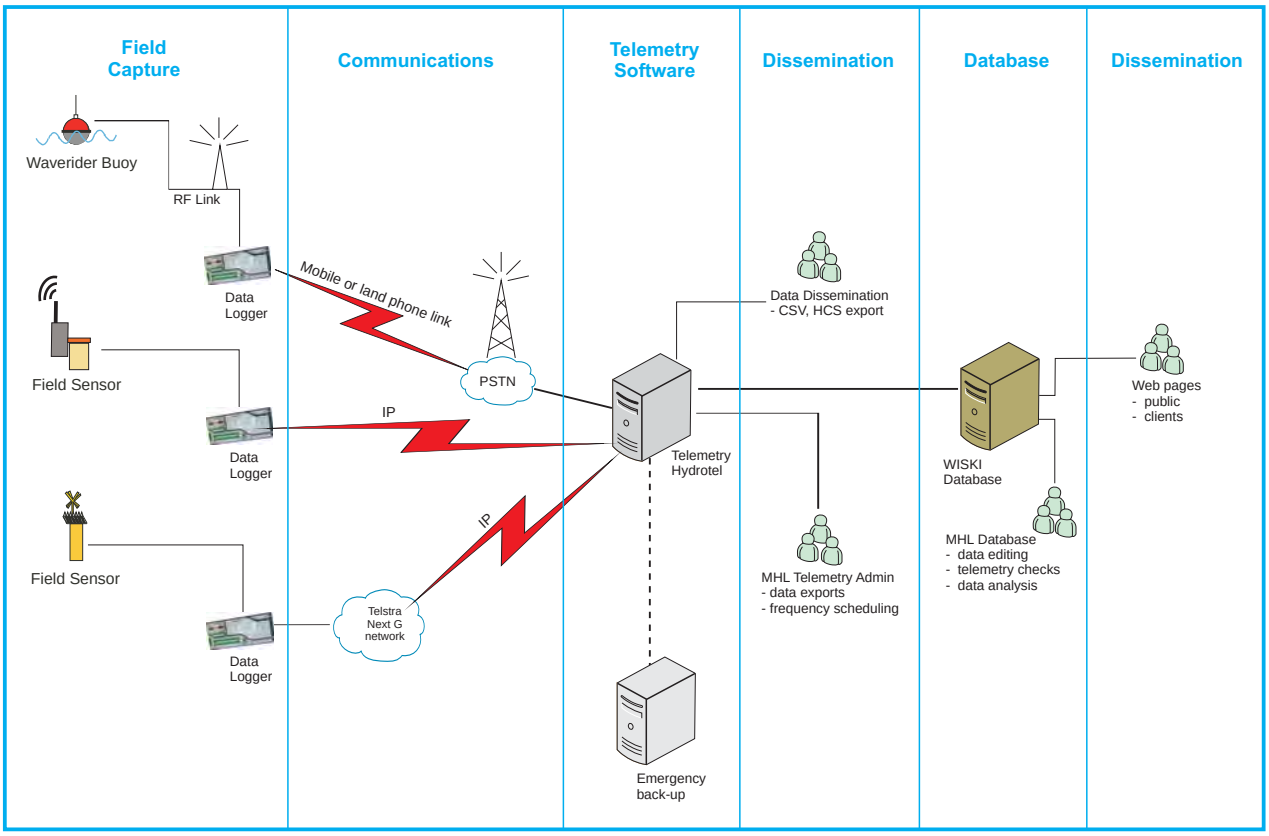
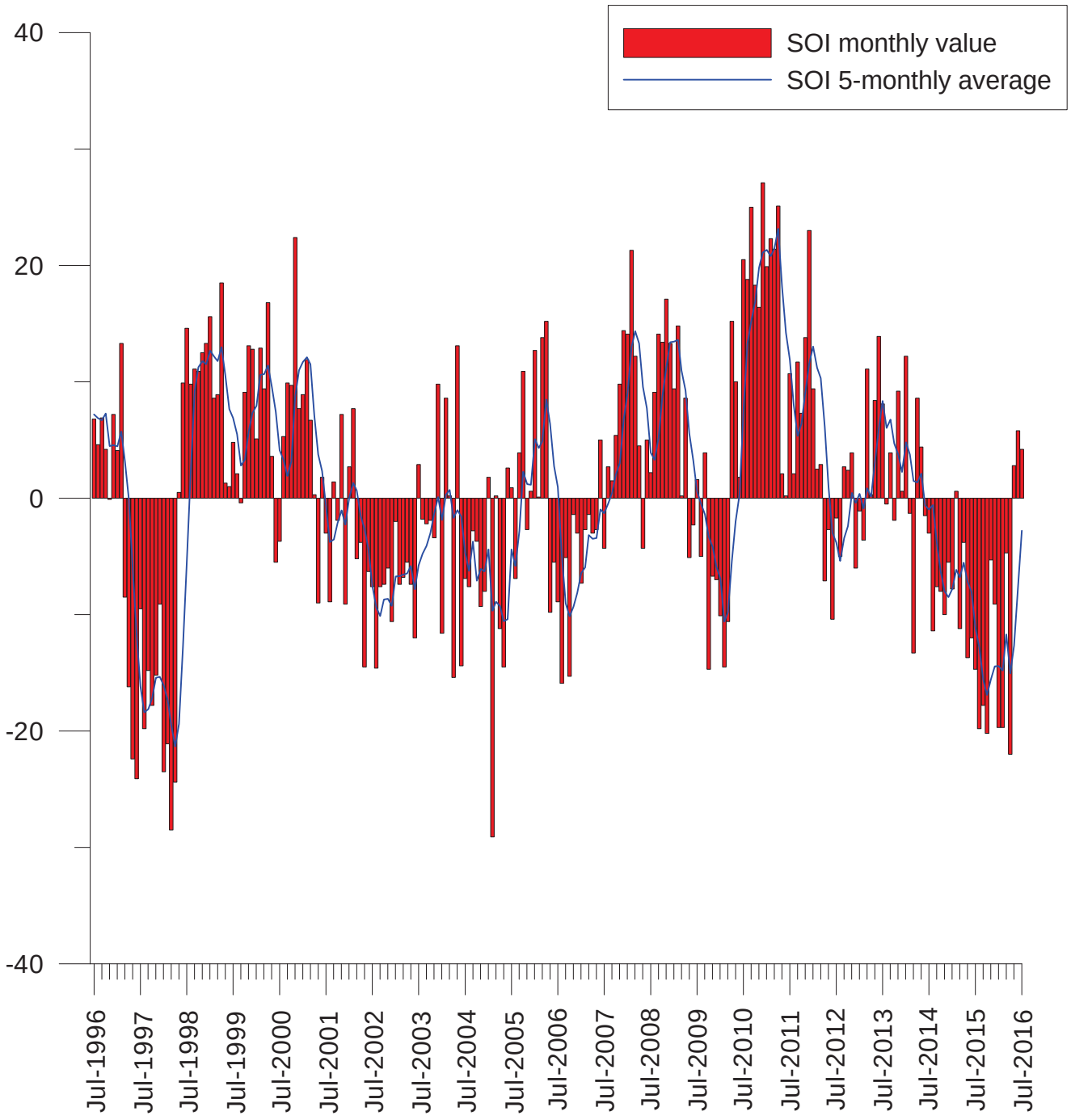
Figure 1

DRAWING 2476-01.cdr


Field Capture
Communications
Telemetry Software
Dissemination
Database
Dissemination
Waverider Buoy
RF Link
Data Logger
Mobile or land phone link
PSTN
Field Sensor
IP
Data Logger
Telemetry Hydrotel
Data Dissemination
- CSV, HCS export
Web pages
- public
- clients
WISKI Database
Field Sensor
IP
Telstra Next G network
Data Logger
MHL Telemetry Admin
- data exports
- frequency scheduling
MHL Database
- data editing
- telemetry checks
- data analysis
Emergency back-up



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SOUTHERN OSCILLATION INDEX
JULY 1996–JUNE 2016

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Figure 3
DRAWING 2476-01.cdr

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RAINFALL STATION LOCATIONS
TWEED RIVER AND BRUNSWICK RIVER REGIONS

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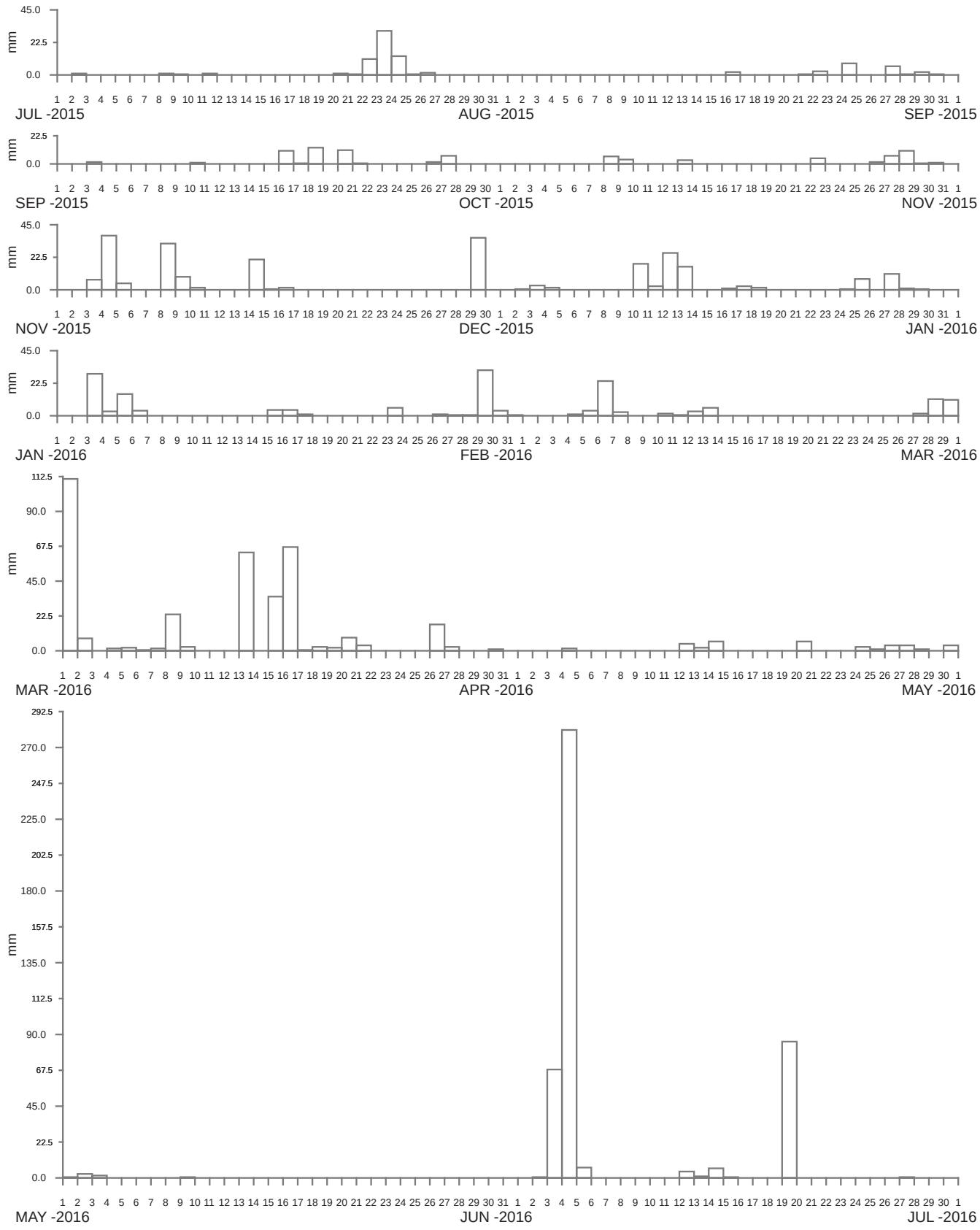
Figure 4

DRAWING 2476-04.cdr



DATA LOSS

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CUDGERA AT CABBAGE GUM ROAD
2015–2016

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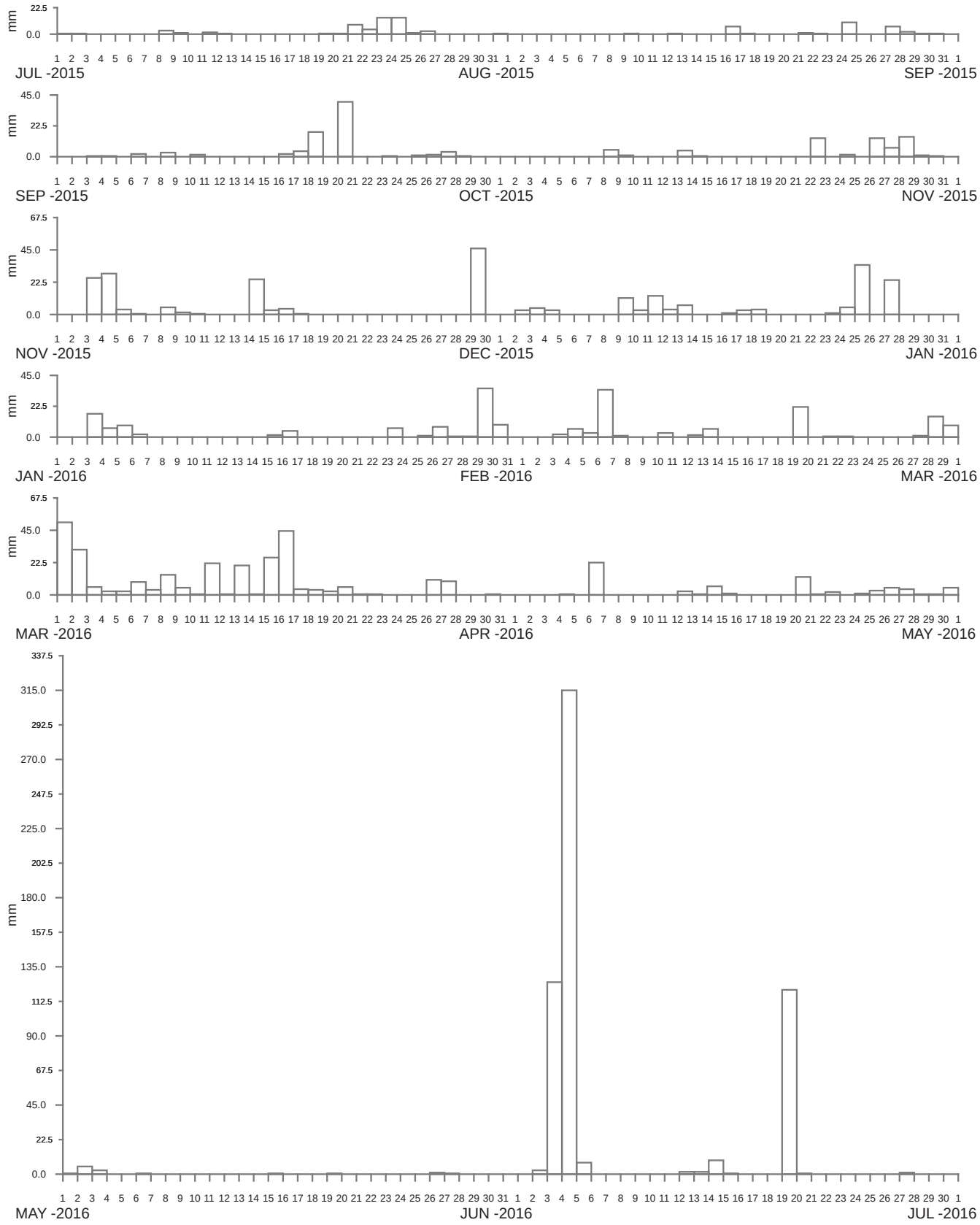
Figure 5

DRAWING 2476-05.cdr



DATA LOSS

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MAIN ARM AT MAIN ARM ROAD
2015–2016

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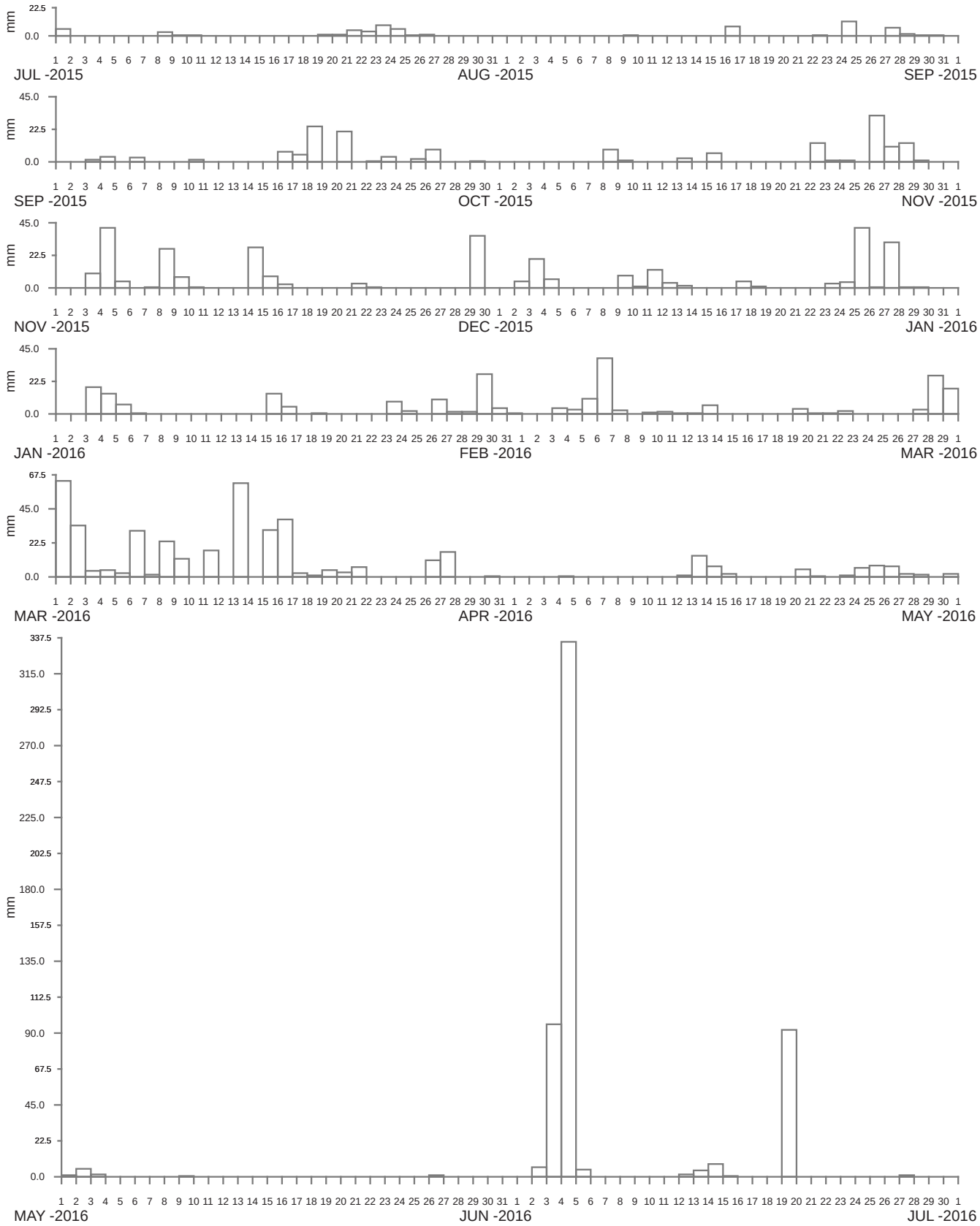
Figure 6

DRAWING 2476-06.cdr



DATA LOSS

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HUONBROOK AT WILSONS CREEK ROAD
2015–2016

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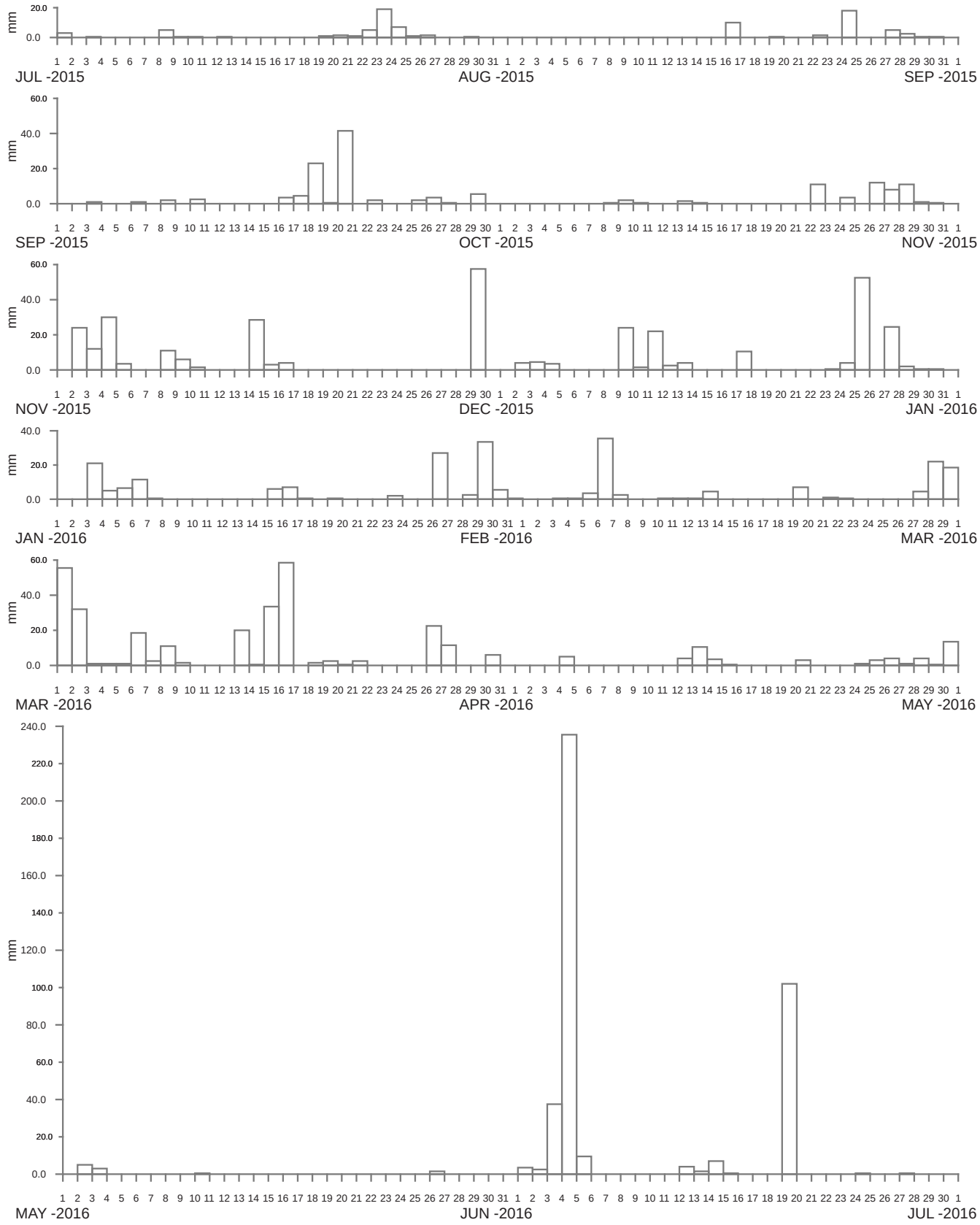
Figure 7

DRAWING 2476-07.cdr



DATA LOSS

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MYOCUM AT KINGSVALE ROAD
2015–2016

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Figure 8

DRAWING 2476-08.cdr

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RAINFALL STATION LOCATIONS
RICHMOND RIVER REGION

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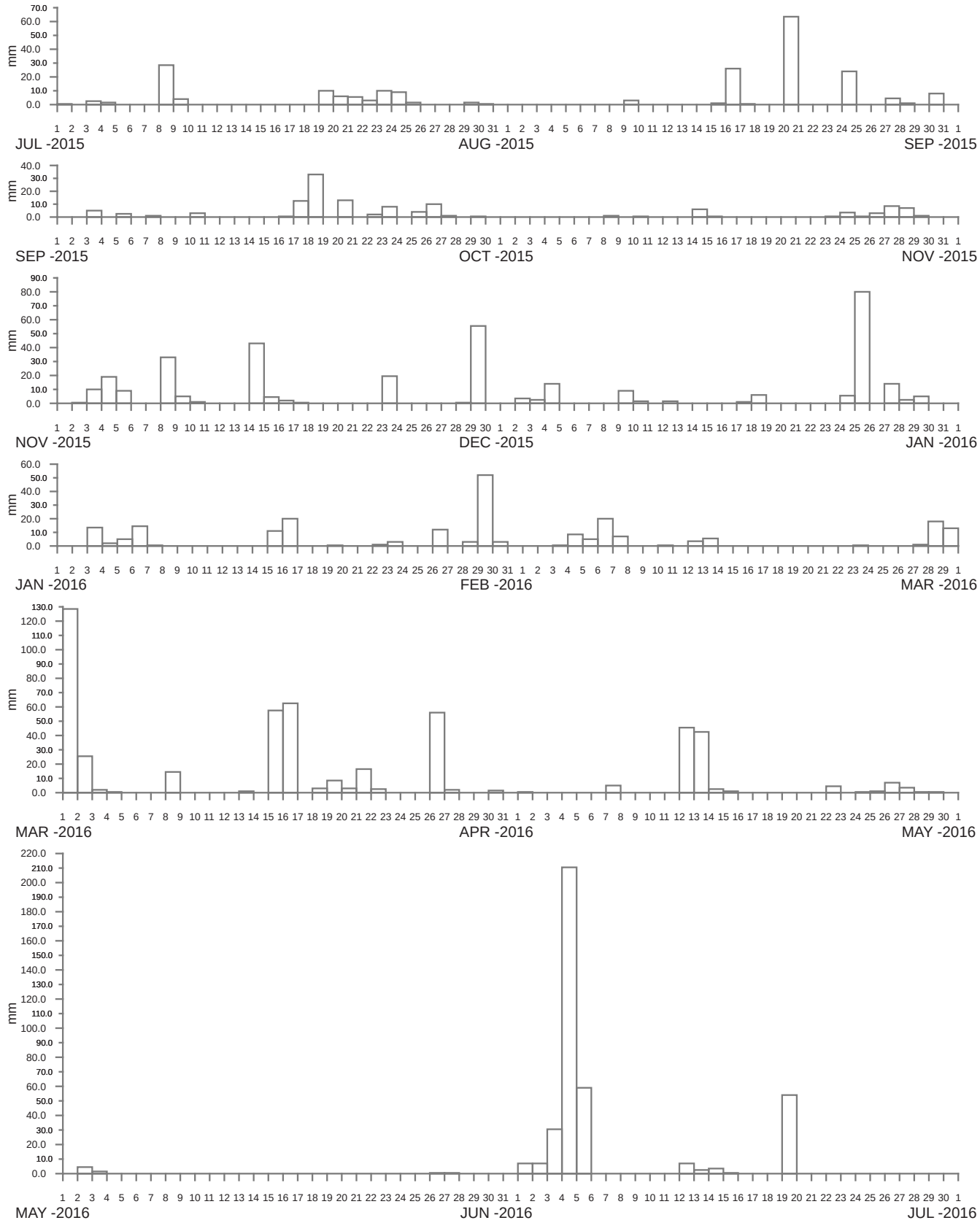
Figure 9

DRAWING 2476-09.cdr



DATA LOSS

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LAKE AINSWORTH AT LENNOX HEAD
2015–2016

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Figure 10

DRAWING 2476-10.cdr

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RAINFALL STATION LOCATIONS
BELLINGER RIVER REGION (NORTH)

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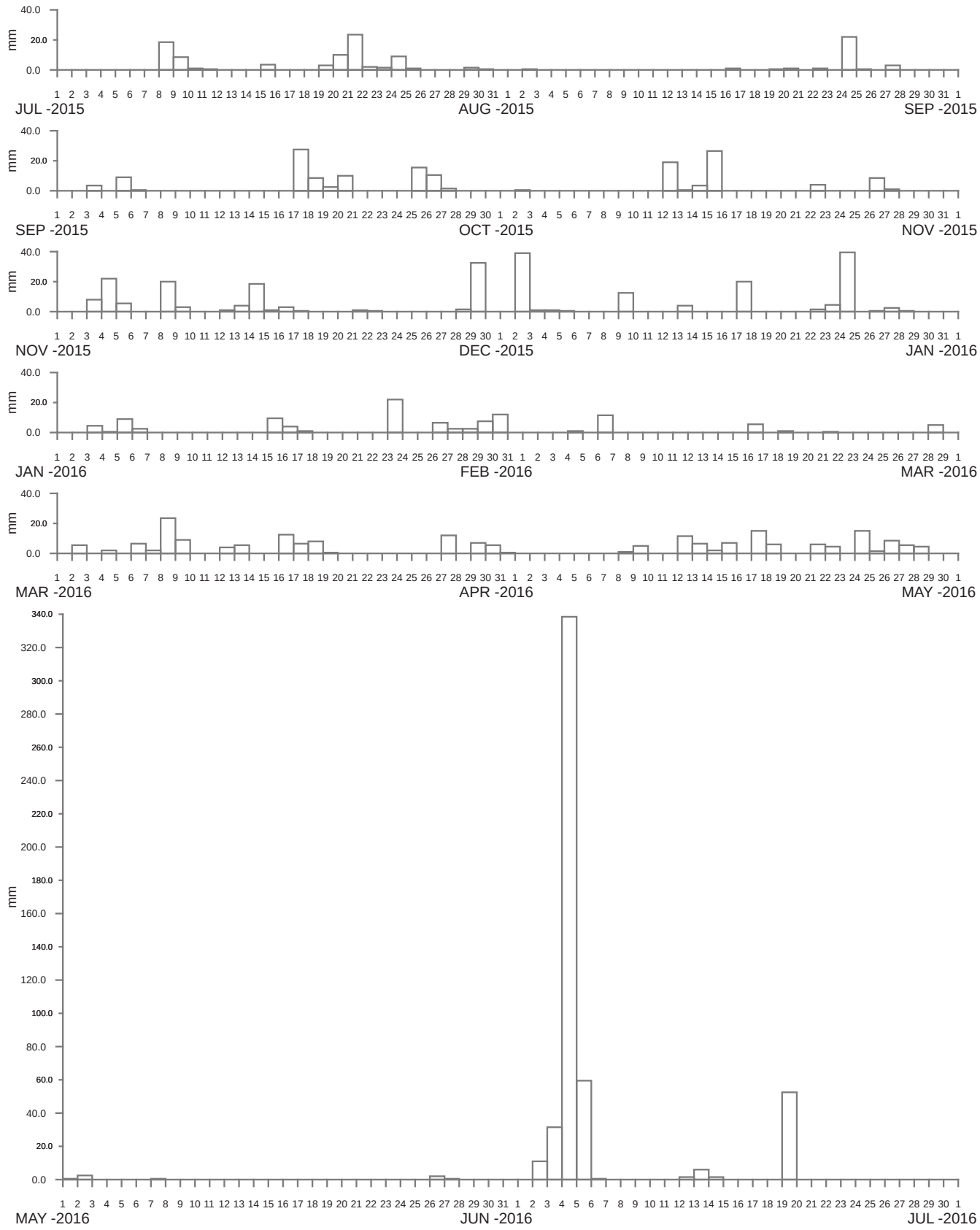
Figure 11

DRAWING 2476-11.cdr



DATA LOSS

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WOOLI RIVER AT WOOLI CARAVAN PARK
2015–2016

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Figure 12

DRAWING 2476-12.cdr

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RAINFALL STATION LOCATIONS
BELLINGER RIVER REGION

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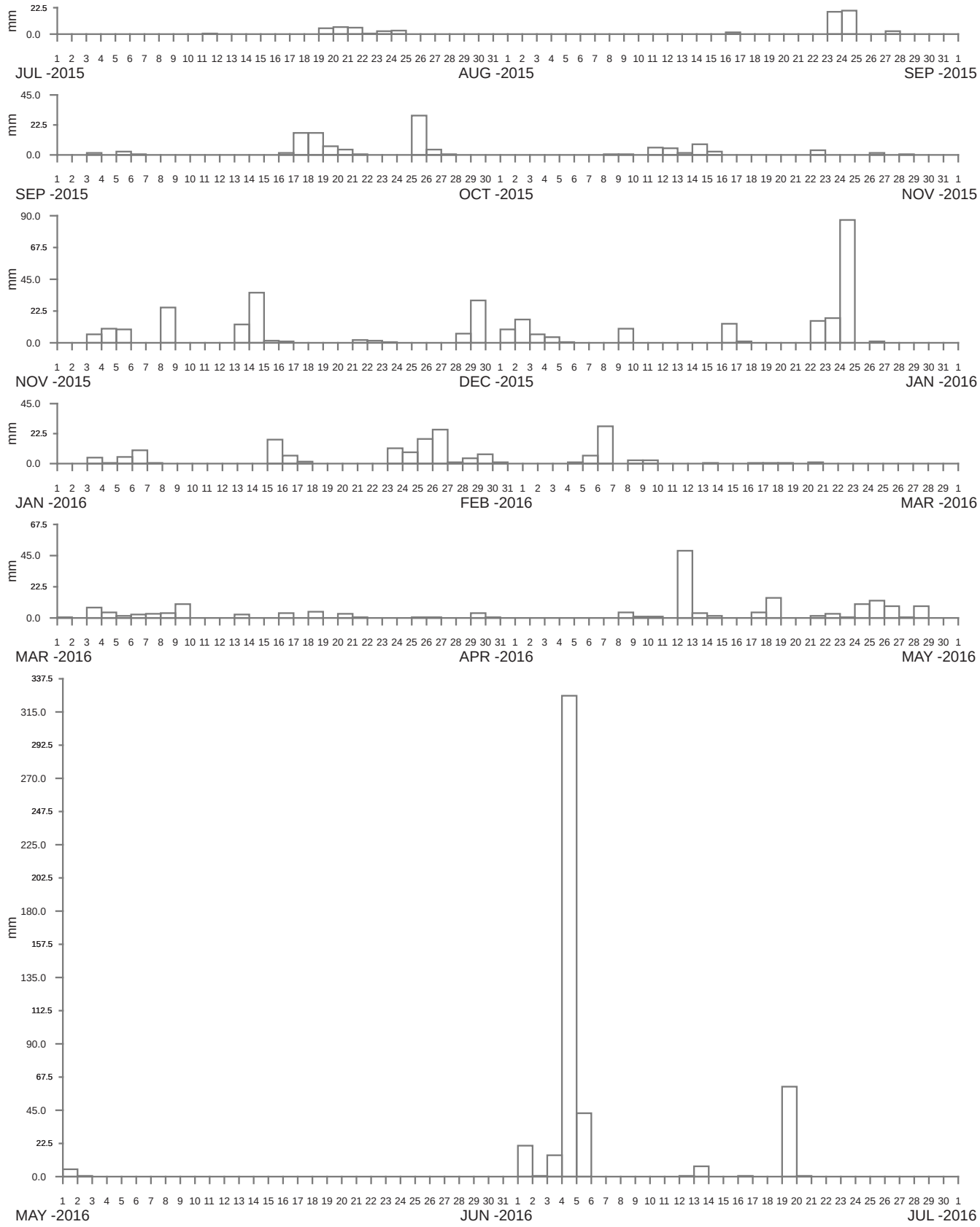
Figure 13

DRAWING 2476-13.cdr



DATA LOSS

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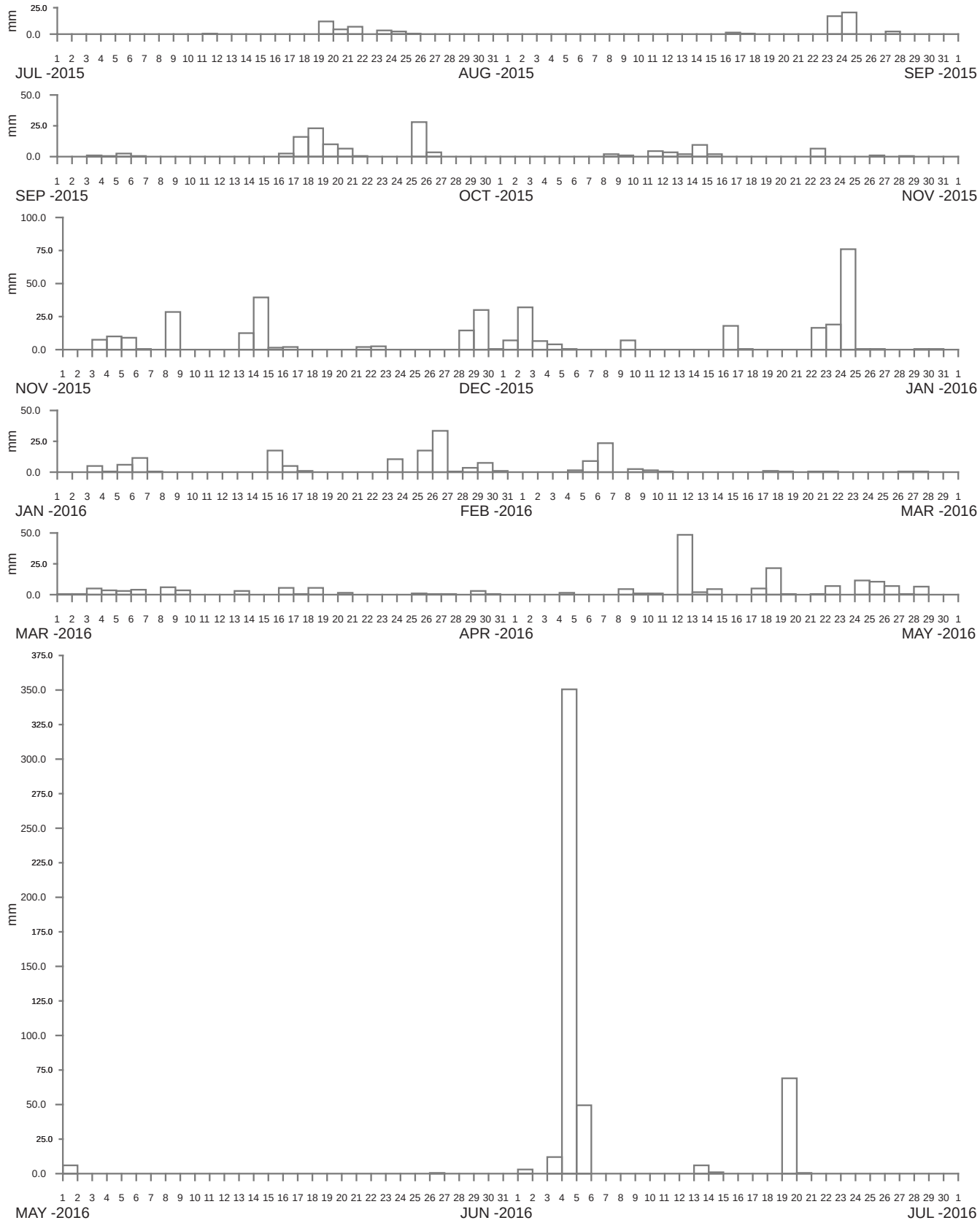
Manly Hydraulics Laboratory

COFFS HARBOUR AT PERRY DRIVE
2015–2016

MHL Report 2476

Figure 14

DRAWING 2476-14.cdr



DATA LOSS

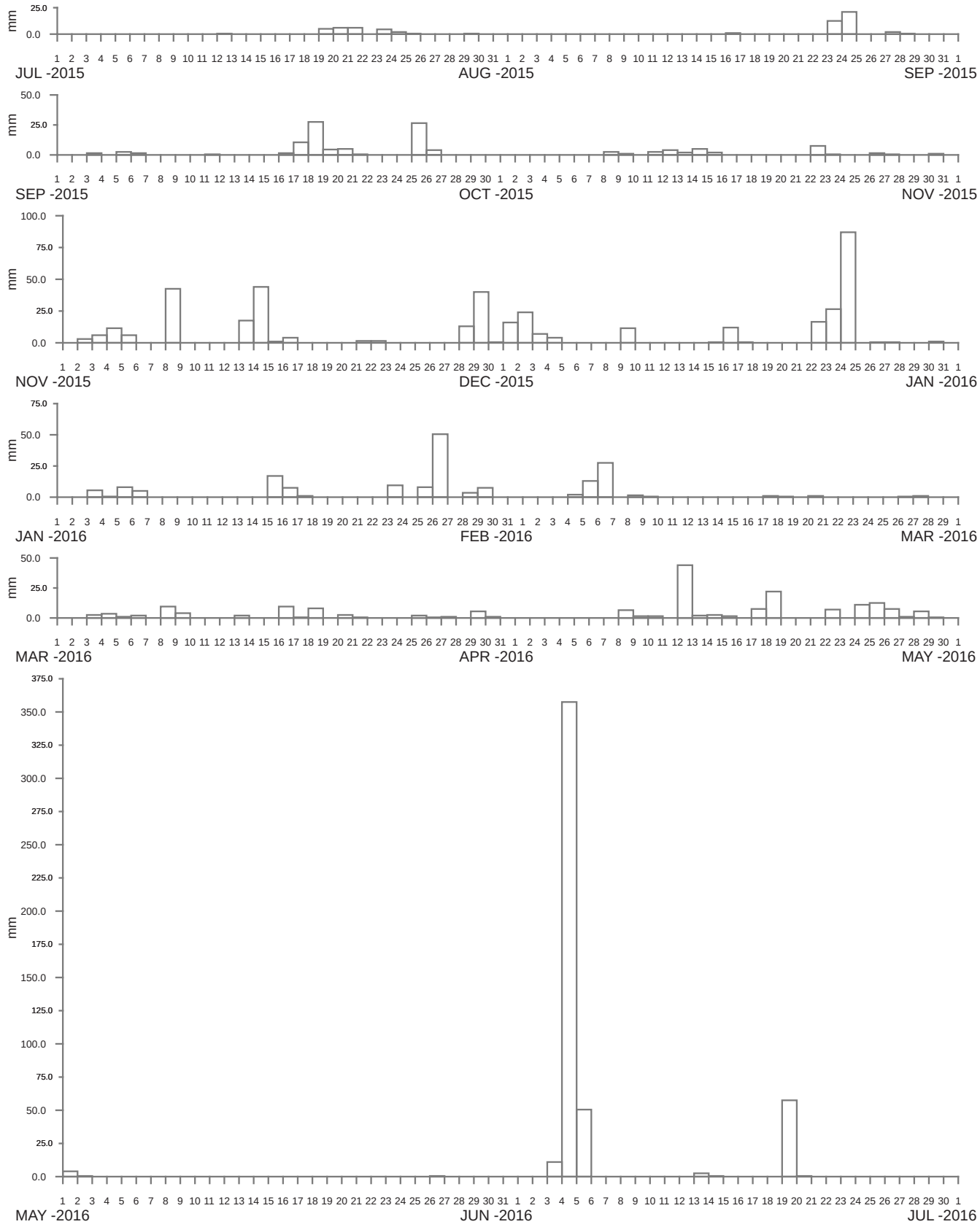
Public Works
Manly Hydraulics Laboratory

COFFS HARBOUR AT SHEPARDS LANE
2015–2016

MHL Report 2476

Figure 15

DRAWING 2476-15.cdr



DATA LOSS

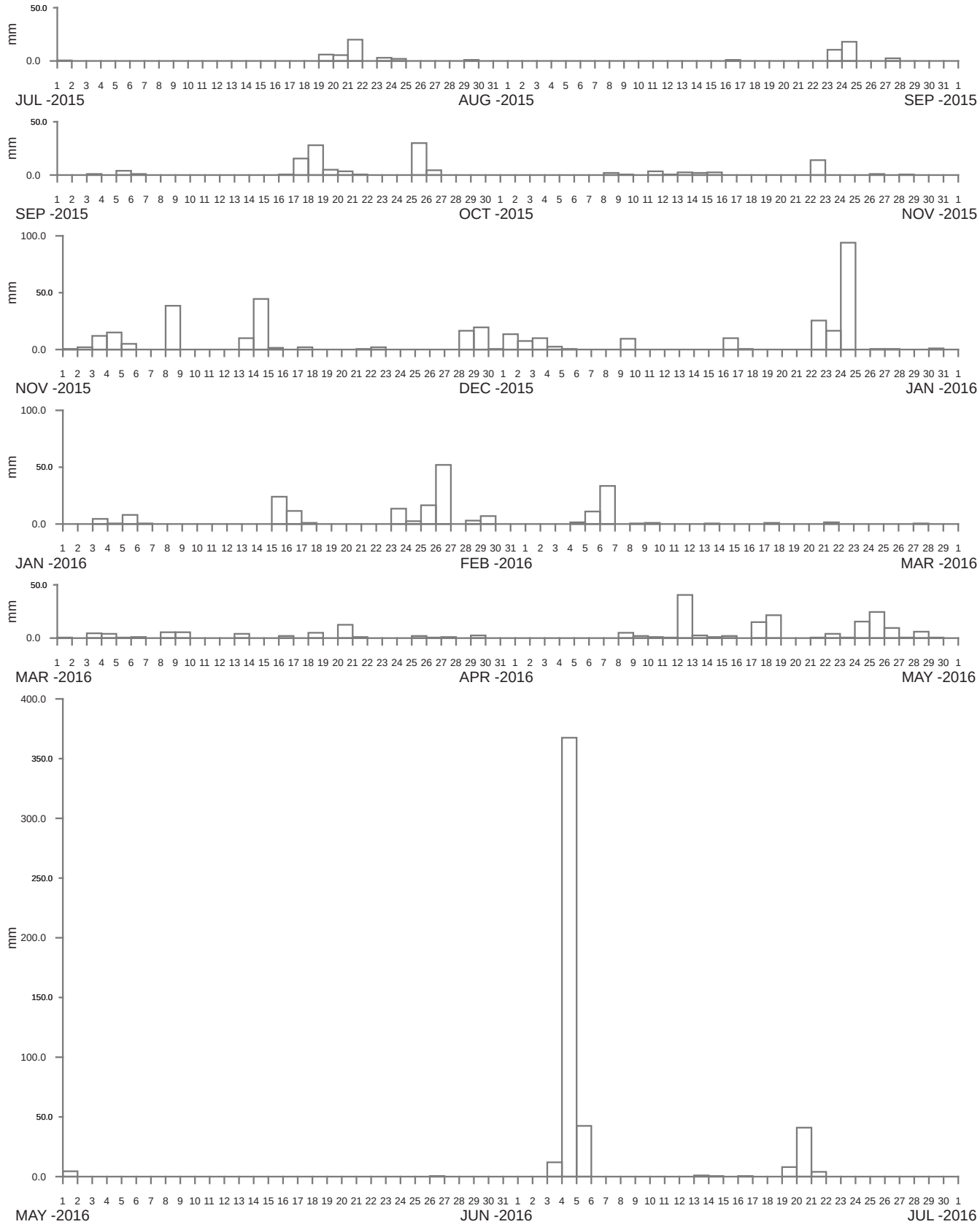
Public Works
Manly Hydraulics Laboratory

COFFS HARBOUR AT RED HILL
2015–2016

MHL Report 2476

Figure 16

DRAWING 2476-16.cdr



DATA LOSS

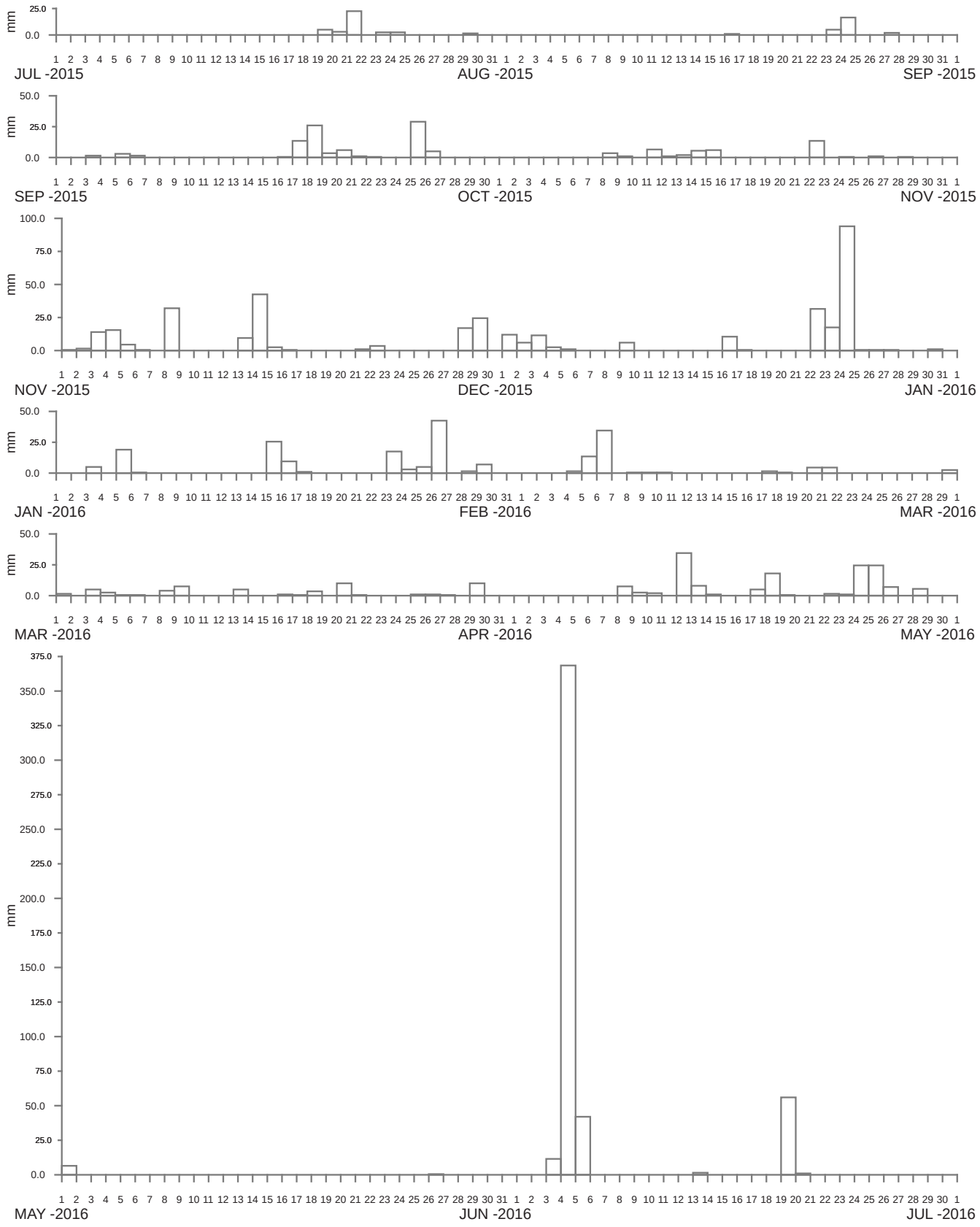
Public Works
Manly Hydraulics Laboratory

NEWPORTS CREEK AT ENGLANDS ROAD 2015–2016

MHL Report 2476

Figure 17

DRAWING 2476-17.cdr



DATA LOSS

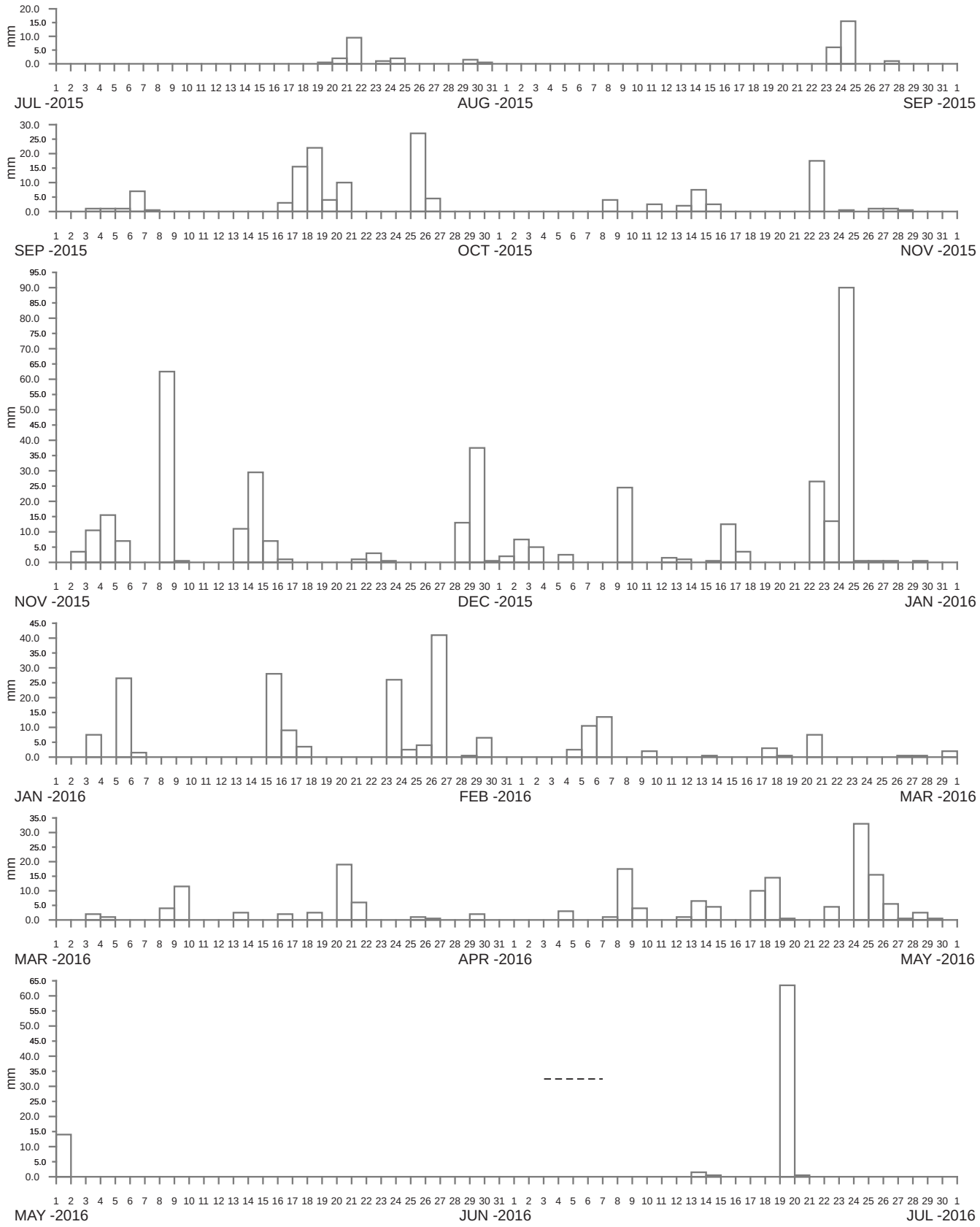
Public Works
Manly Hydraulics Laboratory

MIDDLE BOAMBEE AT CEDARVALE ROAD 2015–2016

MHL Report 2476

Figure 18

DRAWING 2476-18.cdr



DATA LOSS

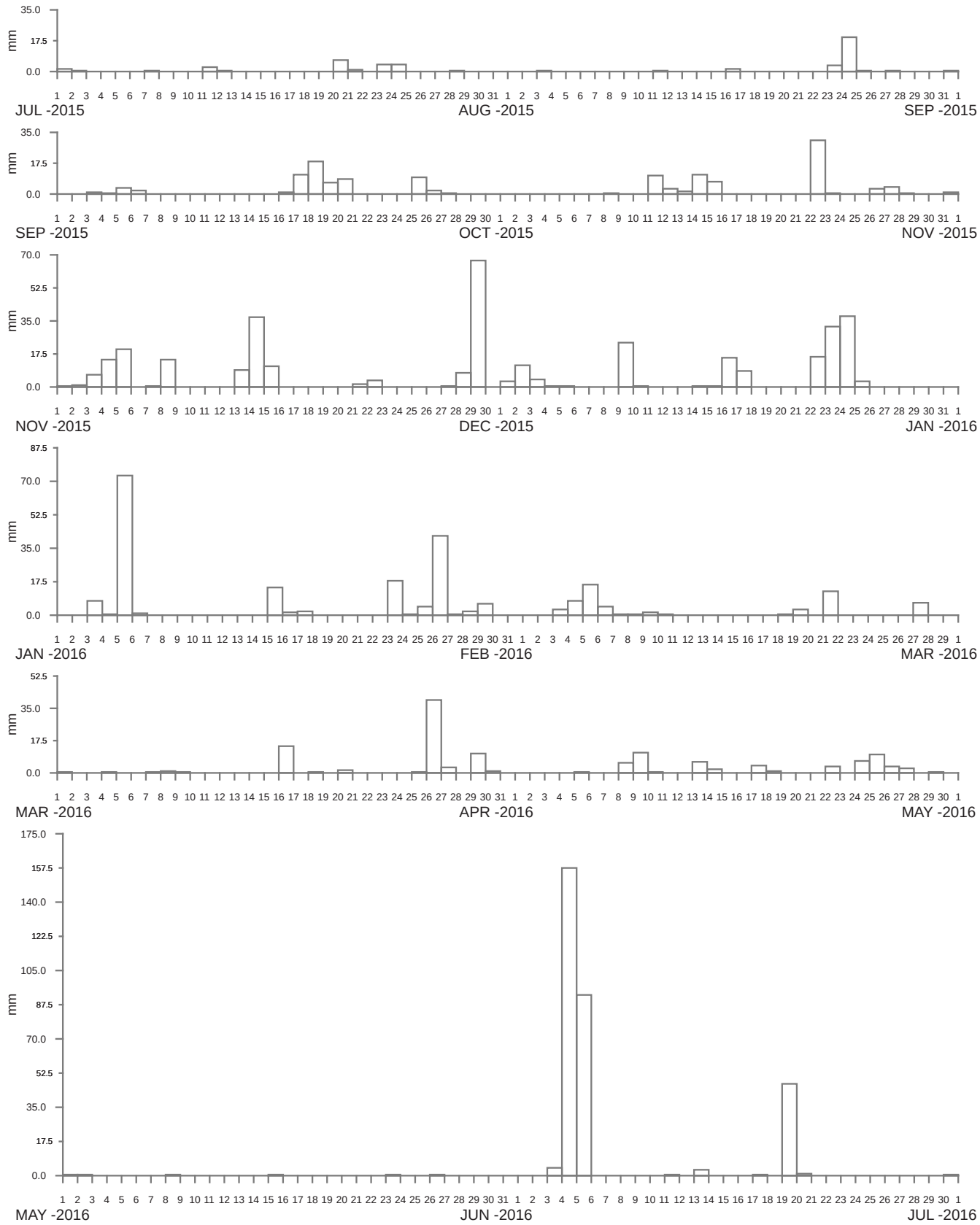
Public Works
Manly Hydraulics Laboratory

NORTH BONVILLE AT NORTH BONVILLE ROAD 2015–2016

MHL Report 2476

Figure 19

DRAWING 2476-19.cdr



Public Works
Manly Hydraulics Laboratory

KOOROOWI AT KALANG ROAD
2015–2016

MHL Report 2476

Figure 20

DRAWING 2476-20.cdr

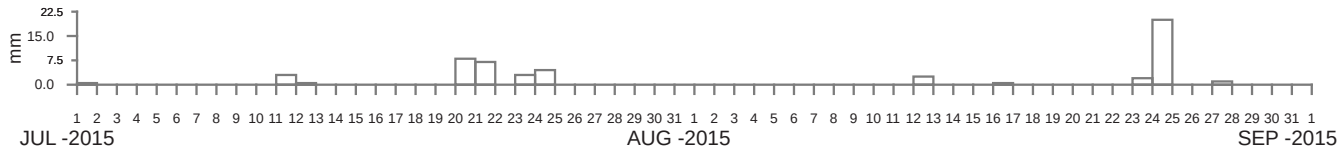
Public Works
Manly Hydraulics Laboratory

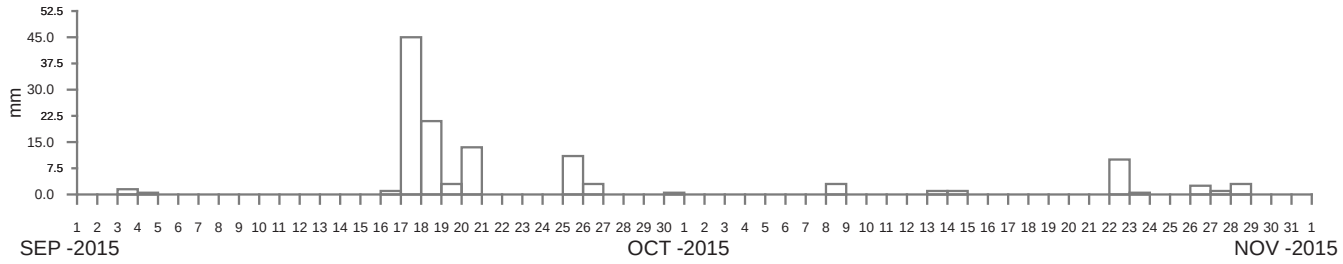
RAINFALL STATION LOCATIONS
NAMBUCCA RIVER REGION

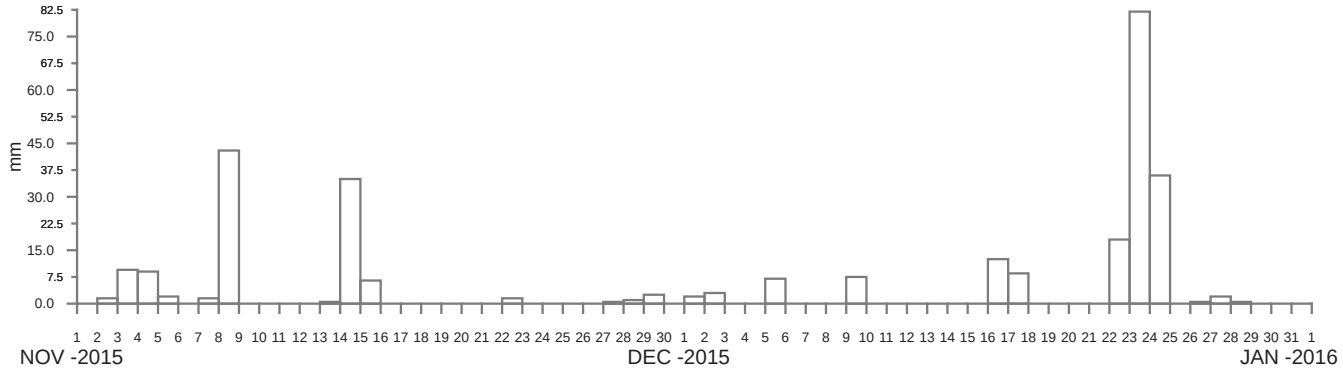
MHL Report 2476

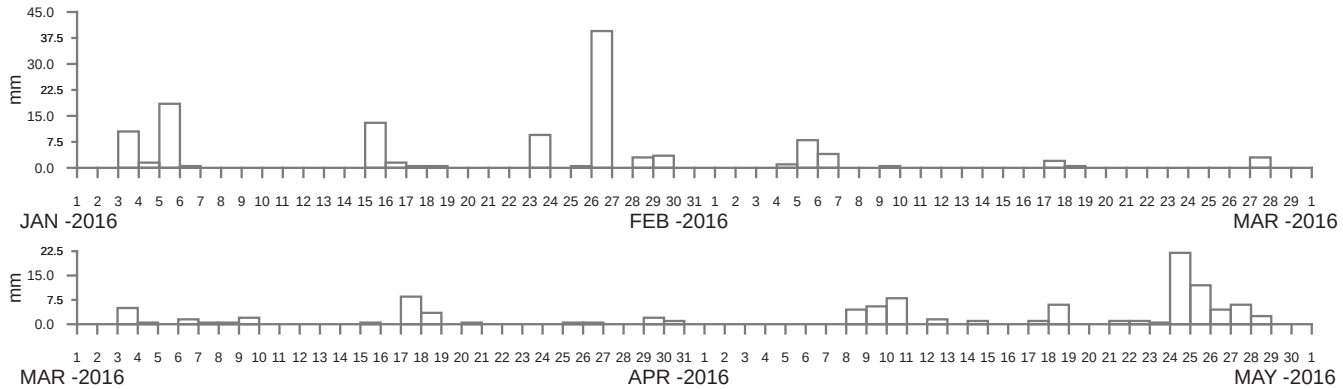
Figure 21

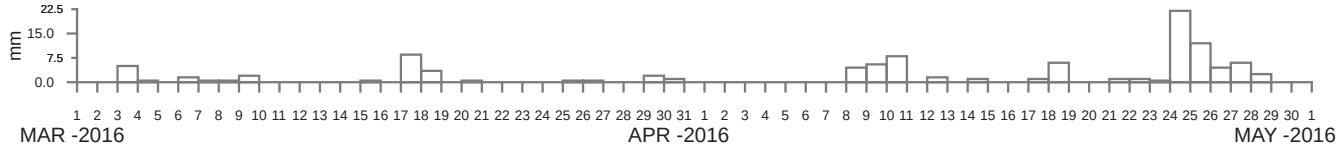
DRAWING 2476-21.cdr

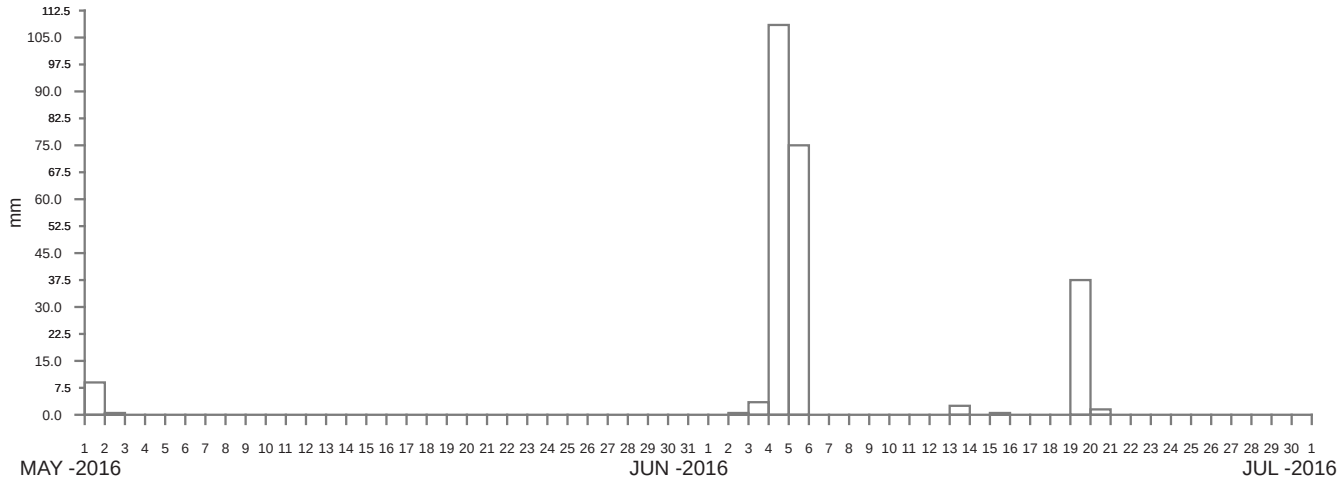












---------- DATA LOSS

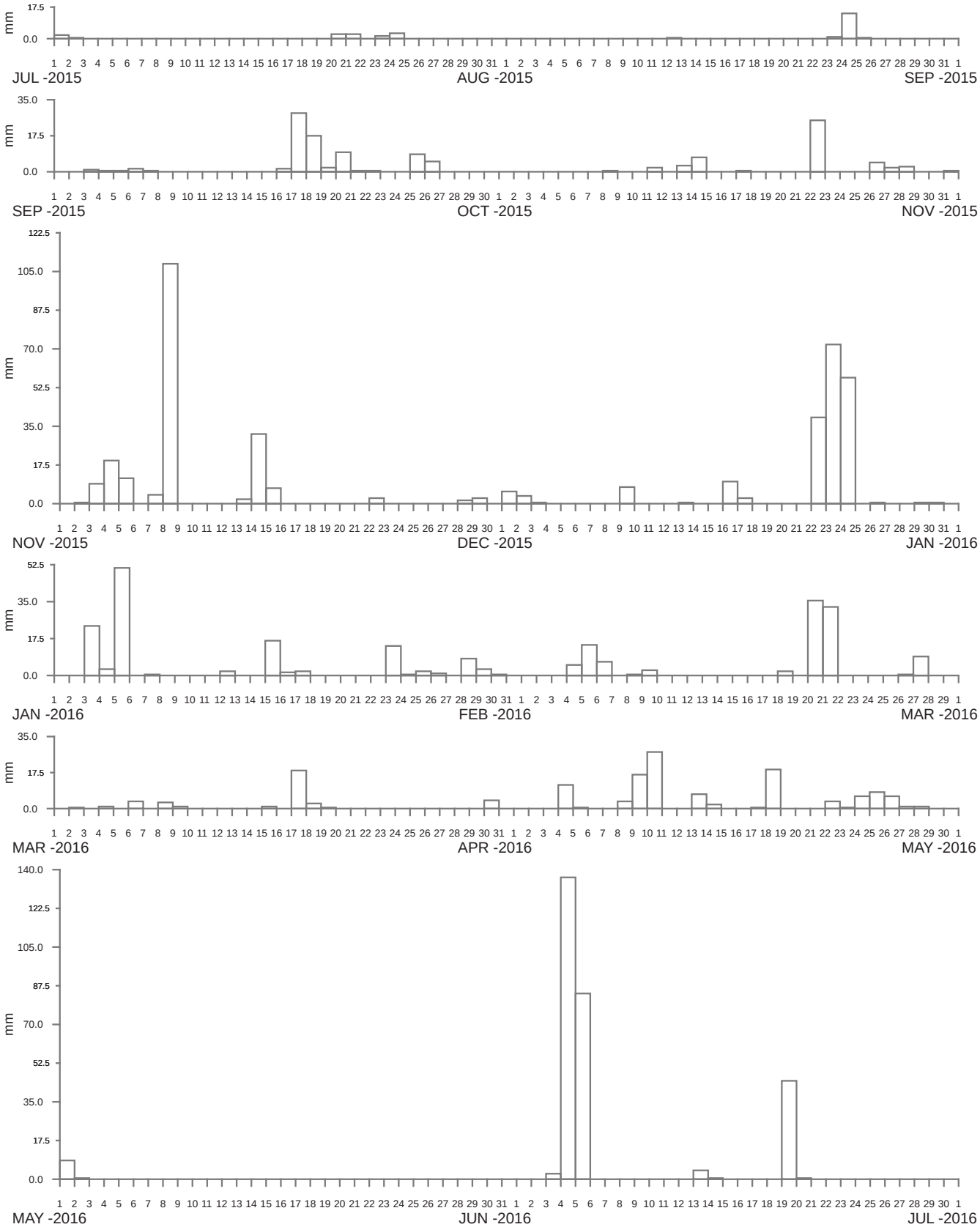
Public Works
Manly Hydraulics Laboratory

NAMBUCCA RIVER AT STUARTS ISLAND DOWNSTREAM
2015–2016

MHL Report 2476

Figure 22

DRAWING 2476-22.cdr



DATA LOSS

Public Works
Manly Hydraulics Laboratory

NAMBUCCA RIVER AT UTUNGUN
2015–2016

MHL Report 2476

Figure 23

DRAWING 2476-23.cdr

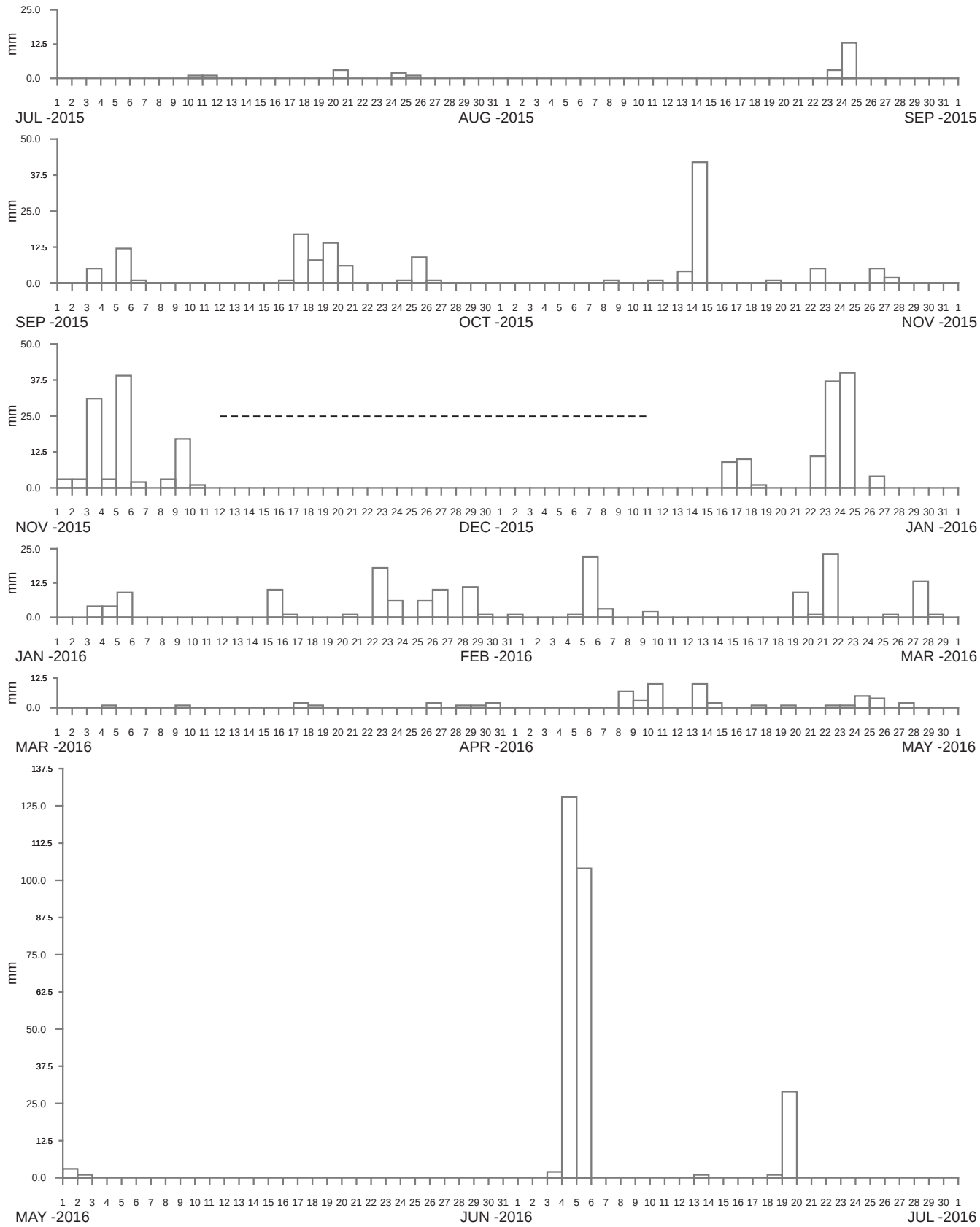
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
MACLEAY RIVER AND HASTINGS RIVER REGION

MHL Report 2476

Figure 24

DRAWING 2476-24.cdr



DATA LOSS

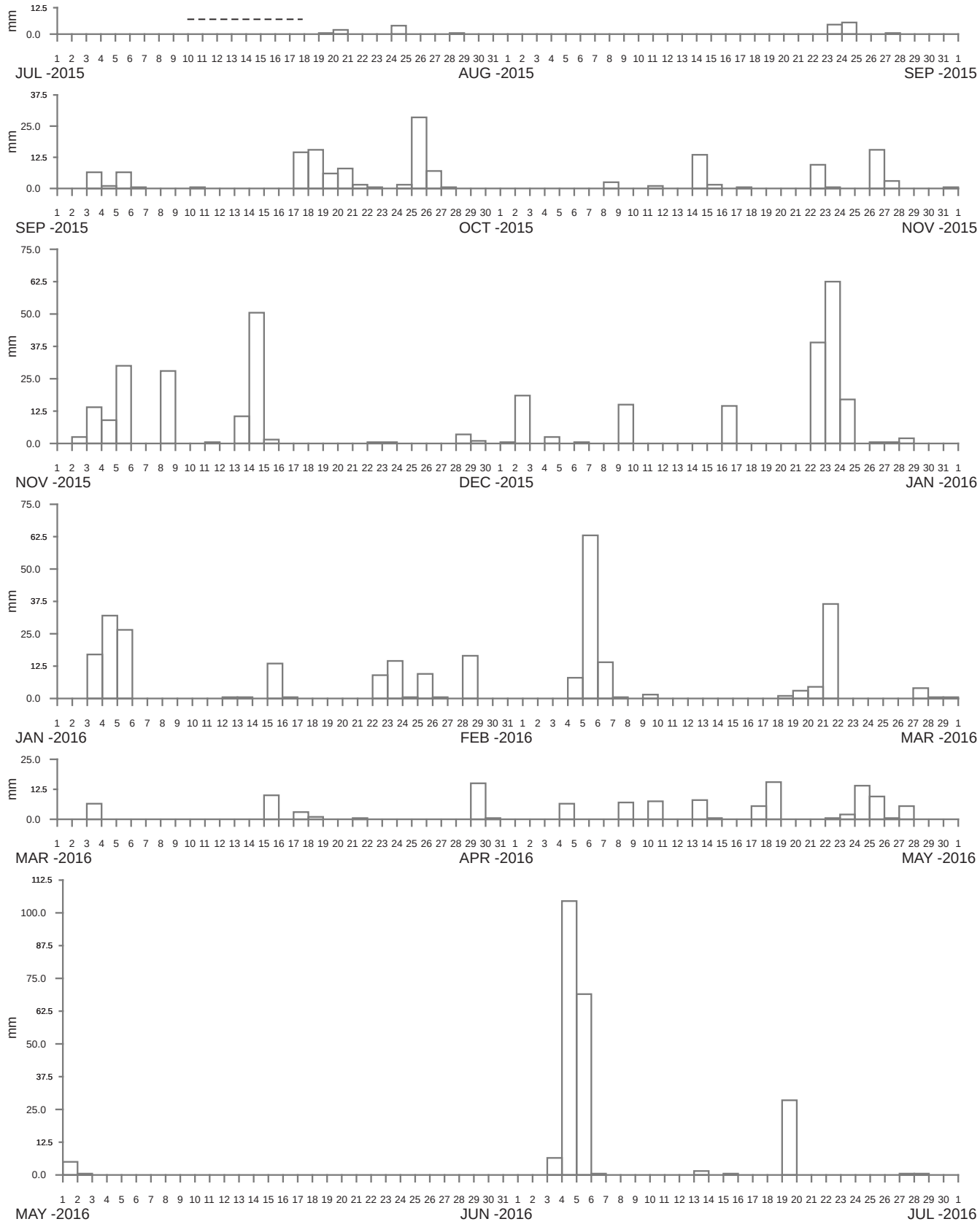
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

MACLEAY RIVER AT ALDAVILLA DOWNSTREAM
2015–2016

MHL Report 2476

Figure 25

DRAWING 2476-25.cdr



DATA LOSS

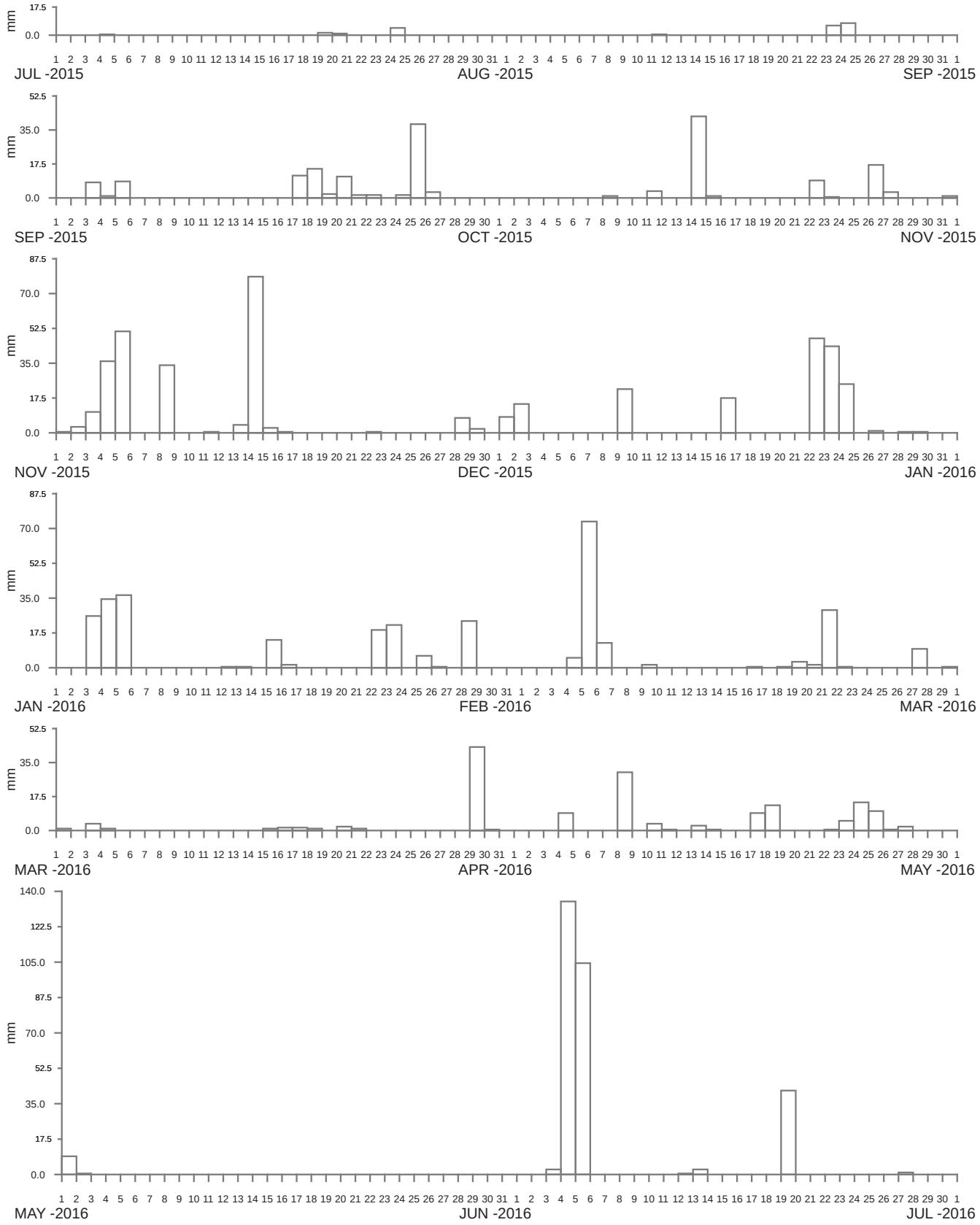
Public Works
Manly Hydraulics Laboratory

MARIA RIVER AT GREEN VALLEY
2015–2016

MHL Report 2476

Figure 26

DRAWING 2476-26.cdr



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

Public Works
Manly Hydraulics Laboratory

WILSONS RIVER AT TELEGRAPH POINT
2015–2016

MHL Report 2476

Figure 27

DRAWING 2476-27.cdr

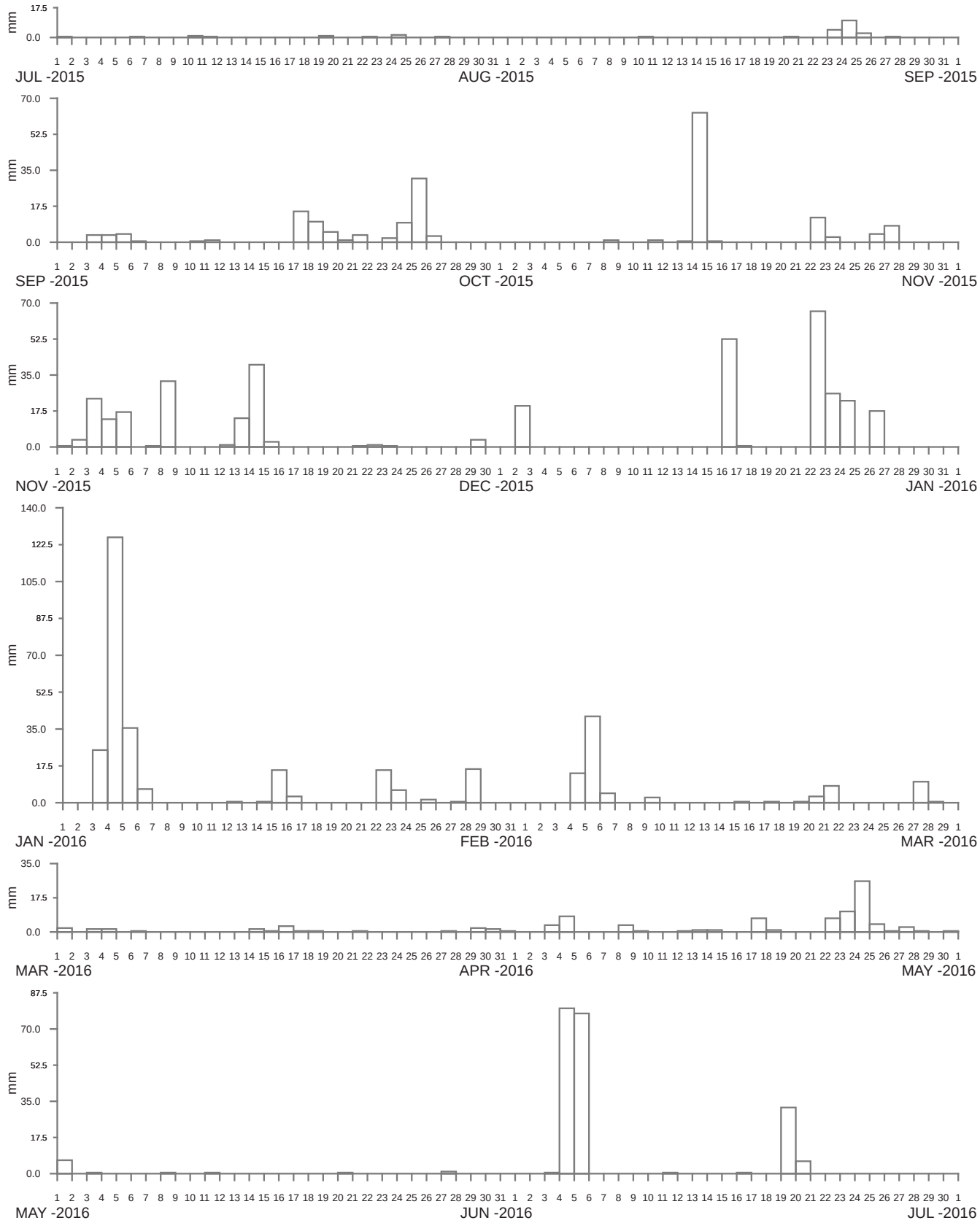
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
CAMDEN HAVEN REGION

MHL Report 2476

Figure 28

DRAWING 2476-28.cdr



DATA LOSS

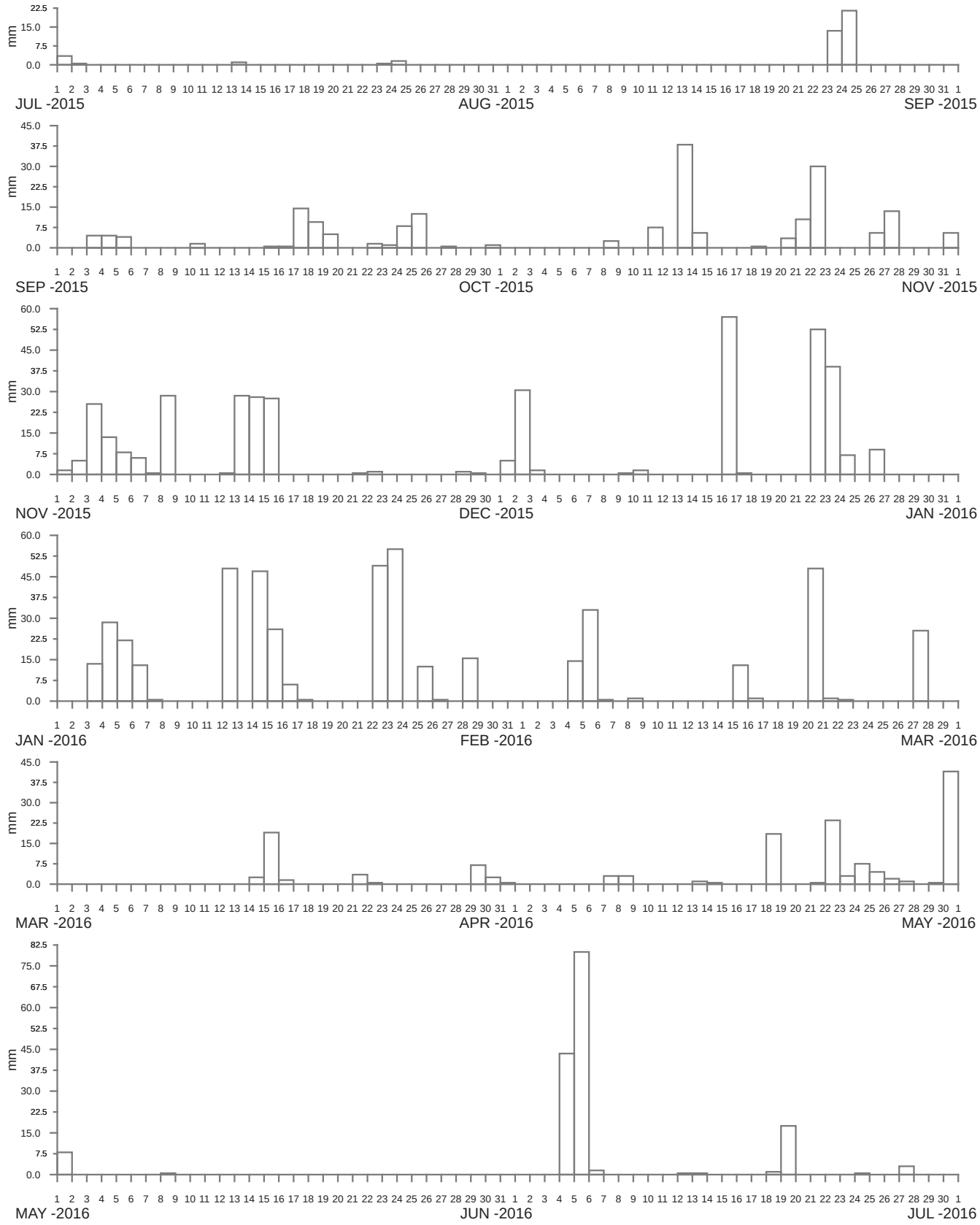
Public Works
Manly Hydraulics Laboratory

CAMDEN HAVEN AT LOGANS CROSSING
2015–2016

MHL Report 2476

Figure 29

DRAWING 2476-29.cdr



DATA LOSS

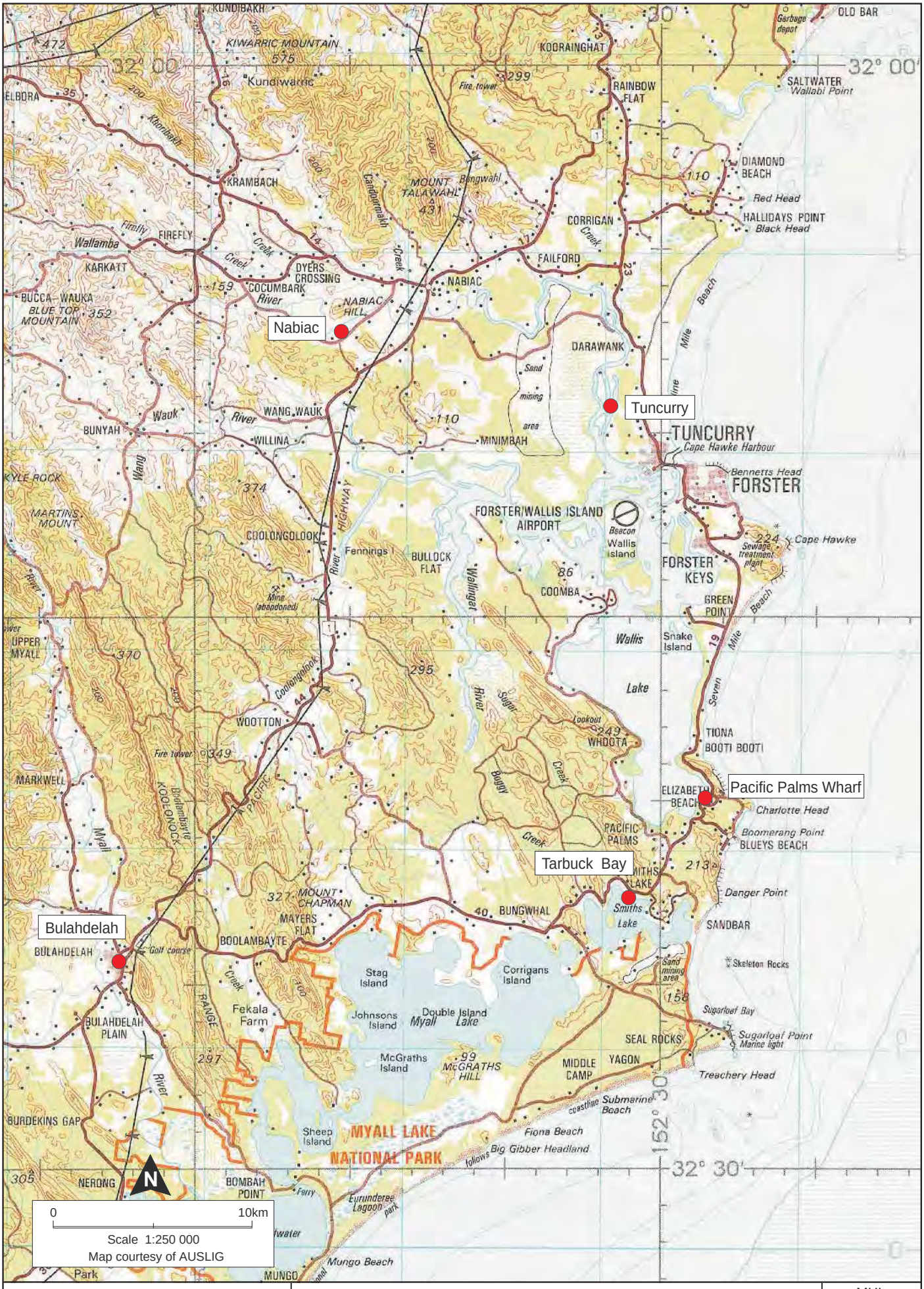
Public Works
Manly Hydraulics Laboratory

MANNING RIVER AT MT GEORGE
2015–2016

MHL Report 2476

Figure 30

DRAWING 2476-30.cdr



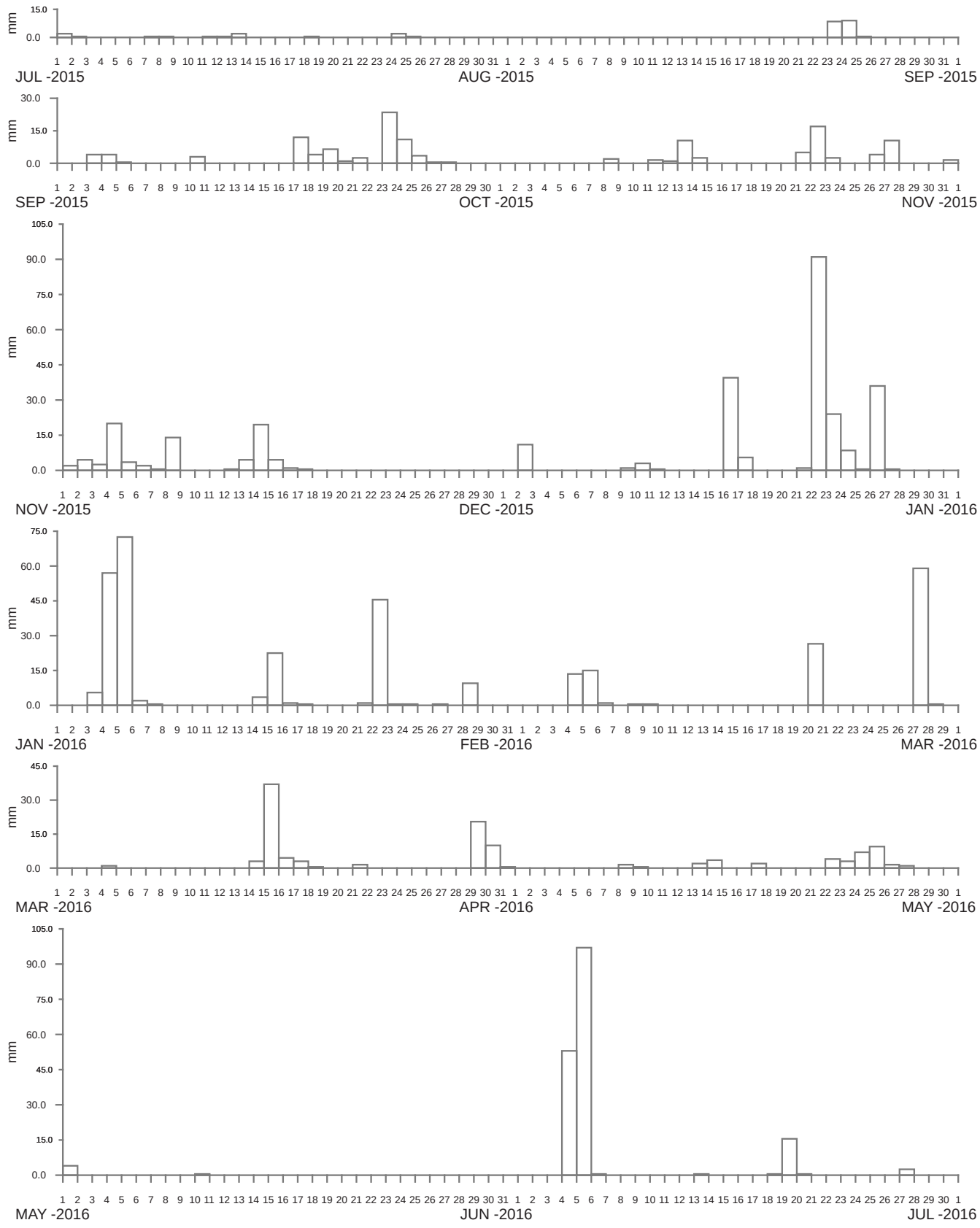
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
KARUAH RIVER REGION

MHL Report 2476

Figure 31

DRAWING 2476-31.cdr



DATA LOSS

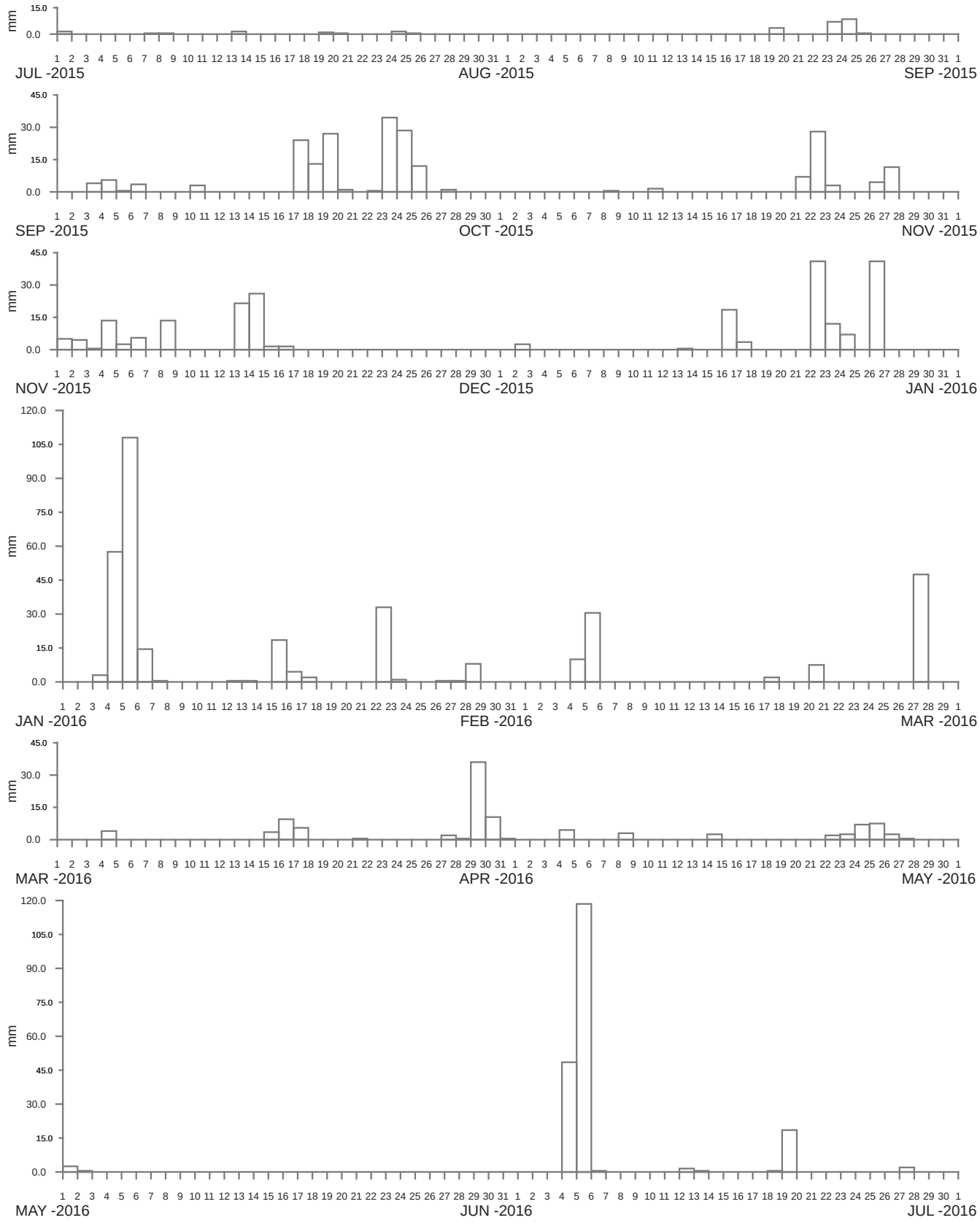
Public Works
Manly Hydraulics Laboratory

WALLAMBA RIVER AT NABIAC
2015–2016

MHL Report 2476

Figure 32

DRAWING 2476-32.cdr



DATA LOSS

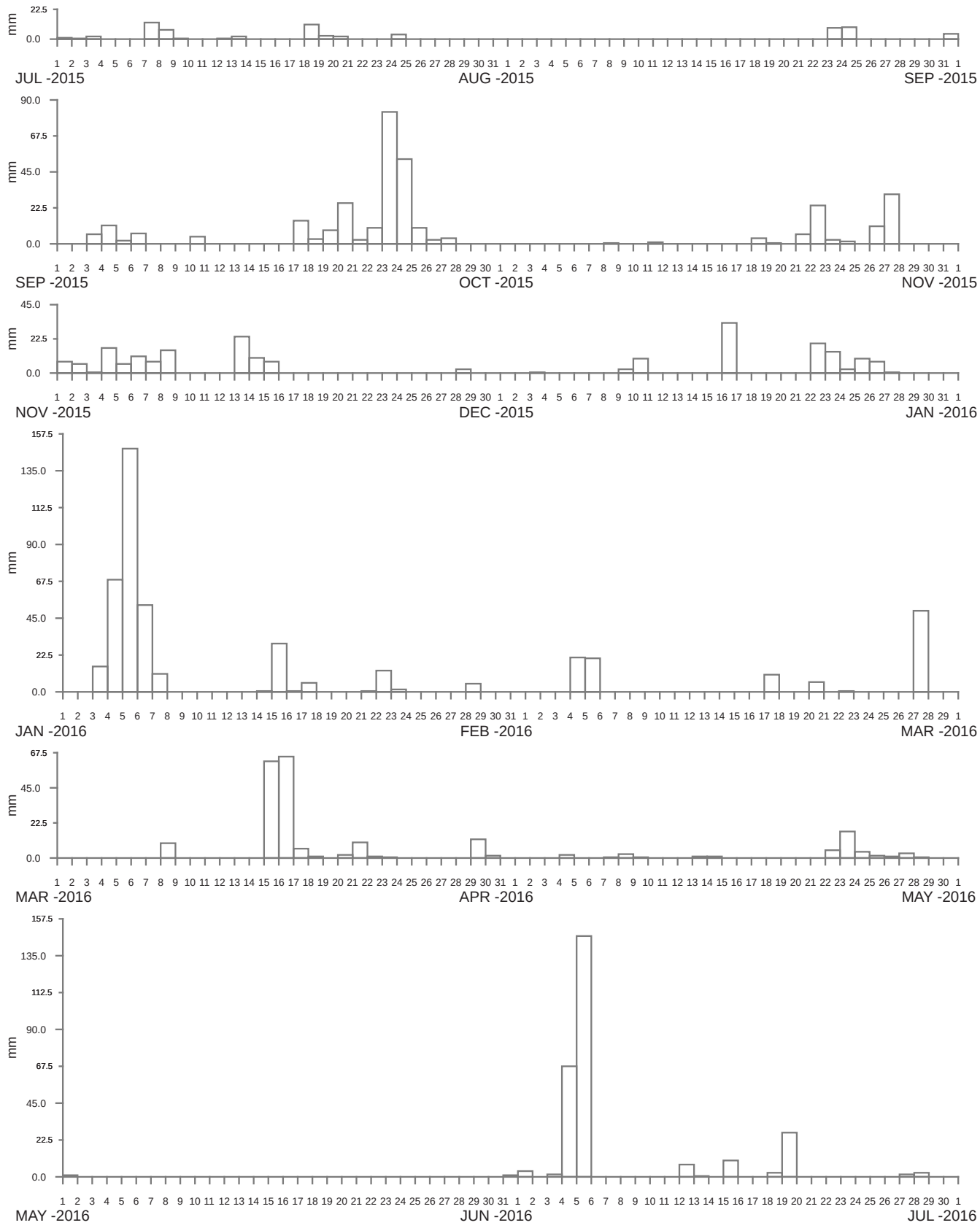
Public Works
Manly Hydraulics Laboratory

WALLAMBA RIVER AT TUNCURRY
2015–2016

MHL Report 2476

Figure 33

DRAWING 2476-33.cdr



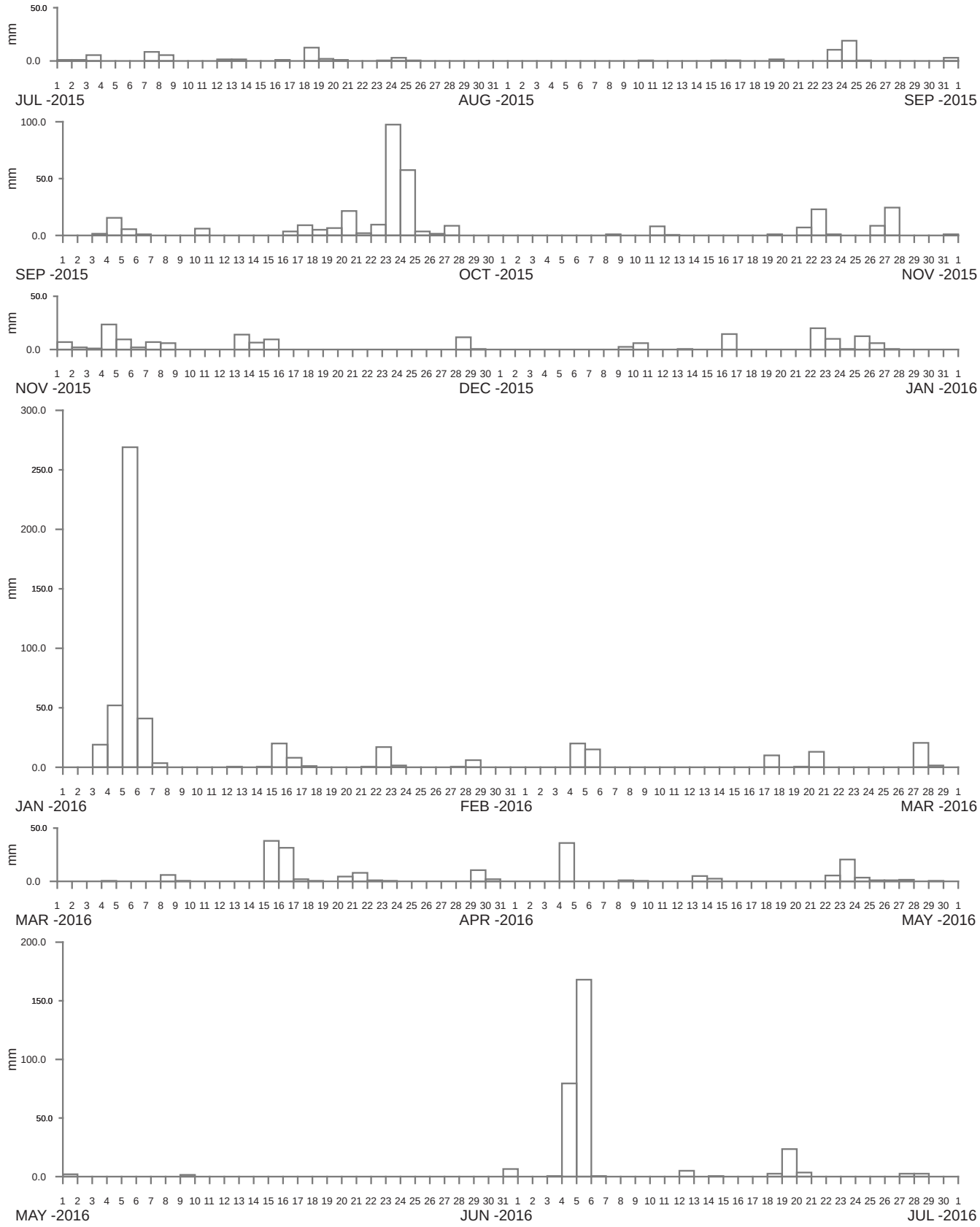
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

WALLIS LAKES AT PACIFIC PALMS WHARF
2015–2016

MHL Report 2476

Figure 34

DRAWING 2476-34.cdr



DATA LOSS

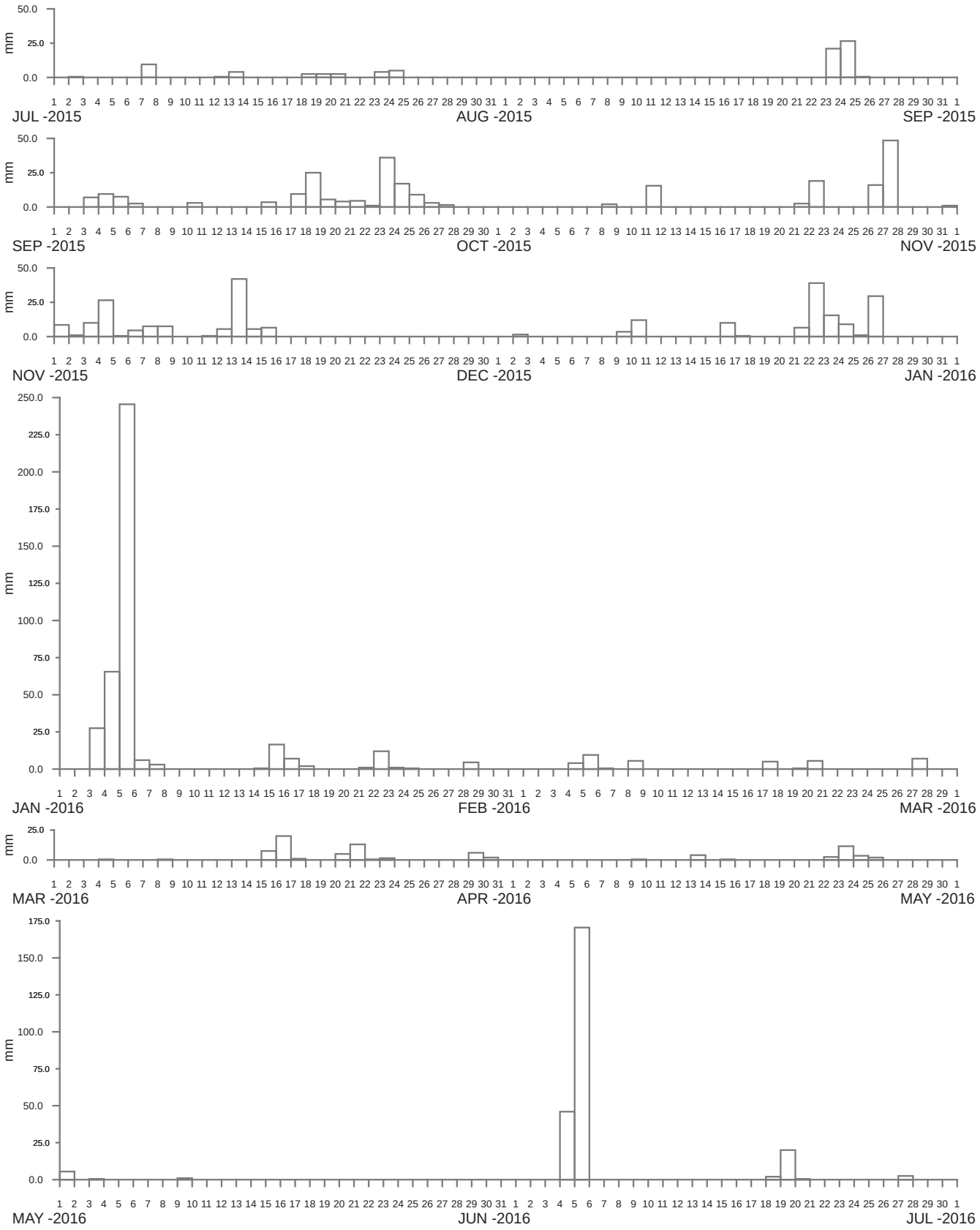
Public Works
Manly Hydraulics Laboratory

SMITHS LAKE AT TARBUCK BAY
2015–2016

MHL Report 2476

Figure 35

DRAWING 2476-35.cdr



DATA LOSS

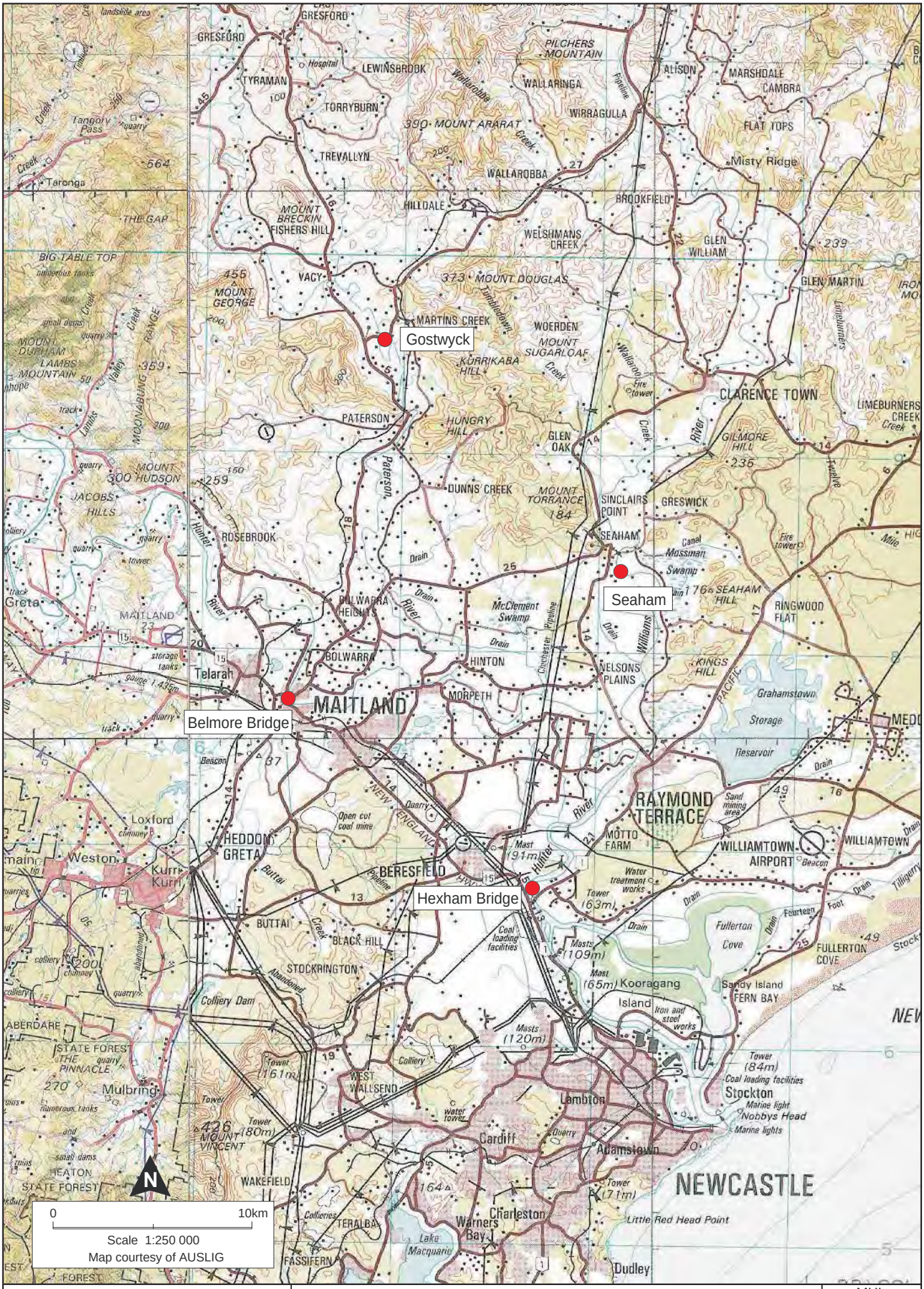
Public Works
Manly Hydraulics Laboratory

MYALL RIVER AT BULAHDELAH
2015–2016

MHL Report 2476

Figure 36

DRAWING 2476-36.cdr



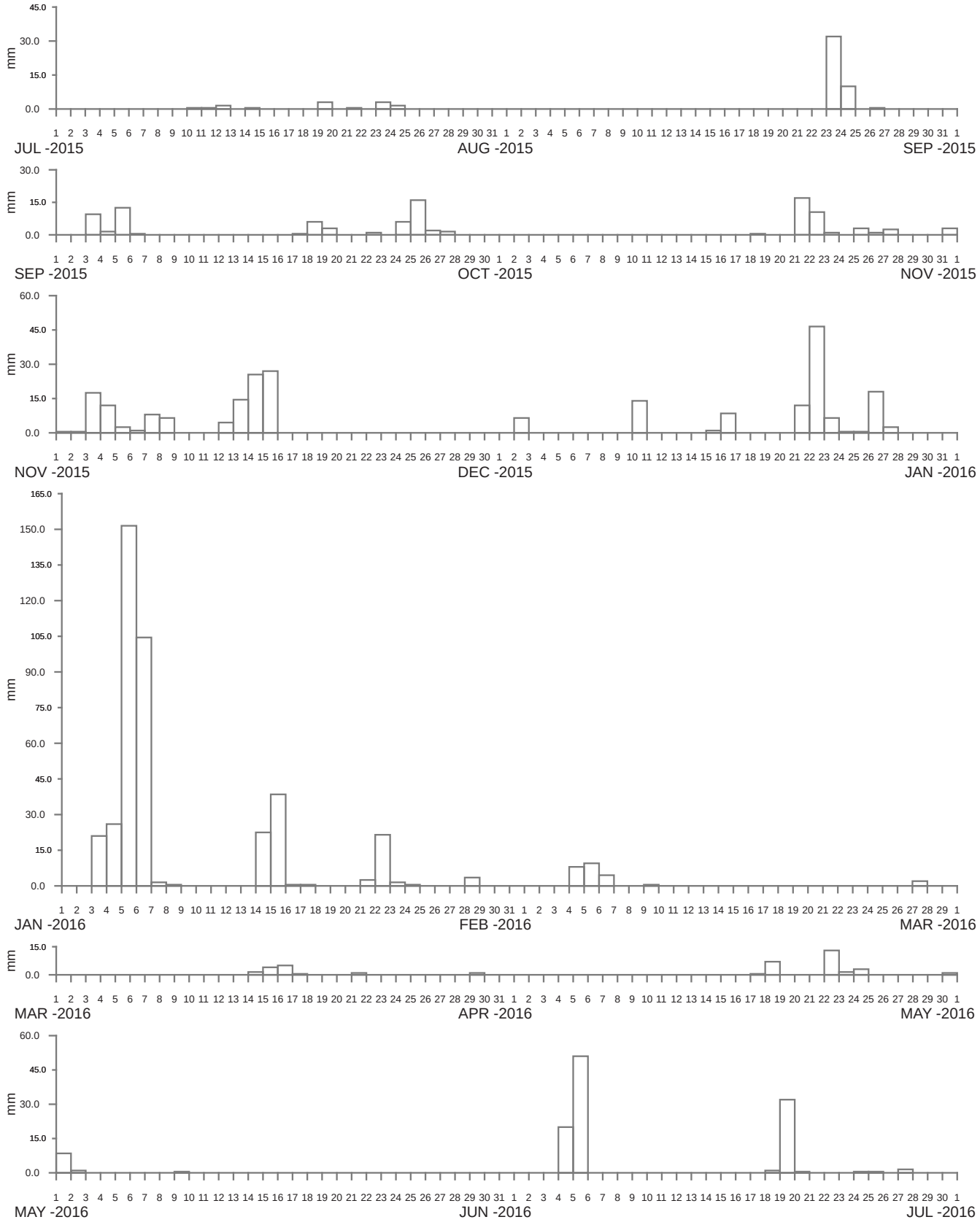
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
HUNTER RIVER (NORTH) REGION

MHL Report 2476

Figure 37

DRAWING 2476-37.cdr



DATA LOSS

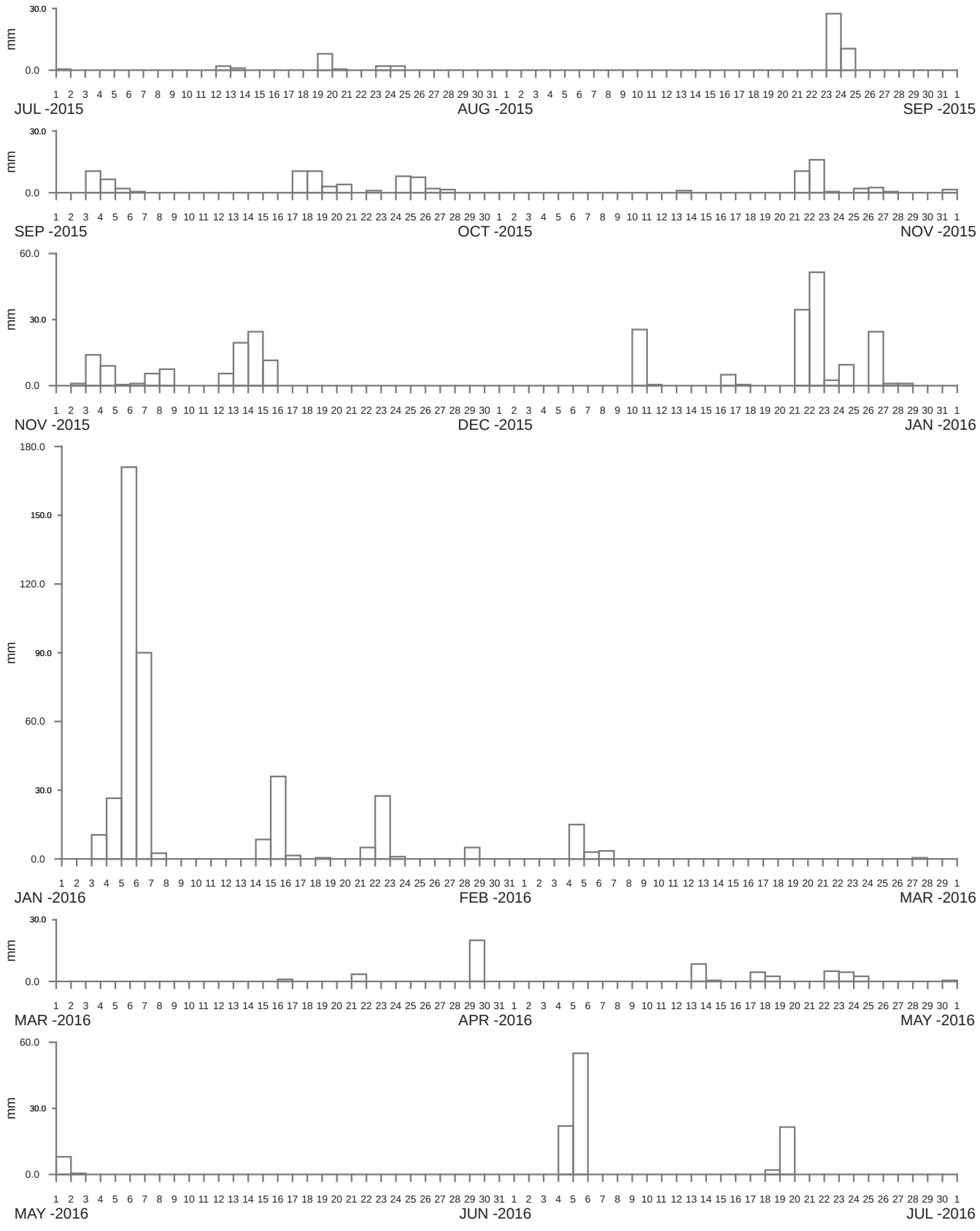
Public Works
Manly Hydraulics Laboratory

PATERSON RIVER AT GOSTWYCK
2015–2016

MHL Report 2476

Figure 38

DRAWING 2476-38.cdr



DATA LOSS

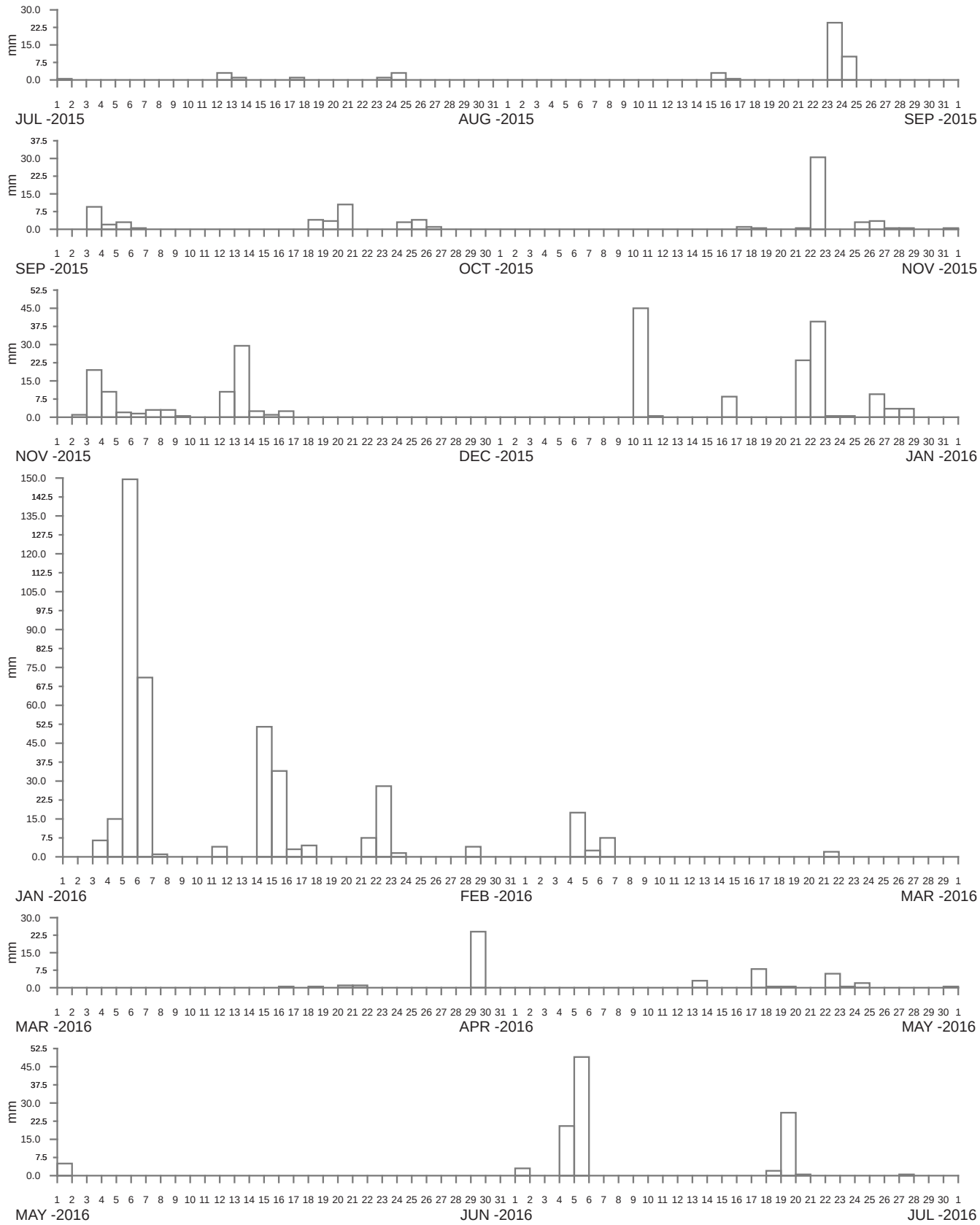
Public Works
Manly Hydraulics Laboratory

WILLIAMS RIVER AT SEAHAM
2015–2016

MHL Report 2476

Figure 39

DRAWING 2476-39.cdr



DATA LOSS

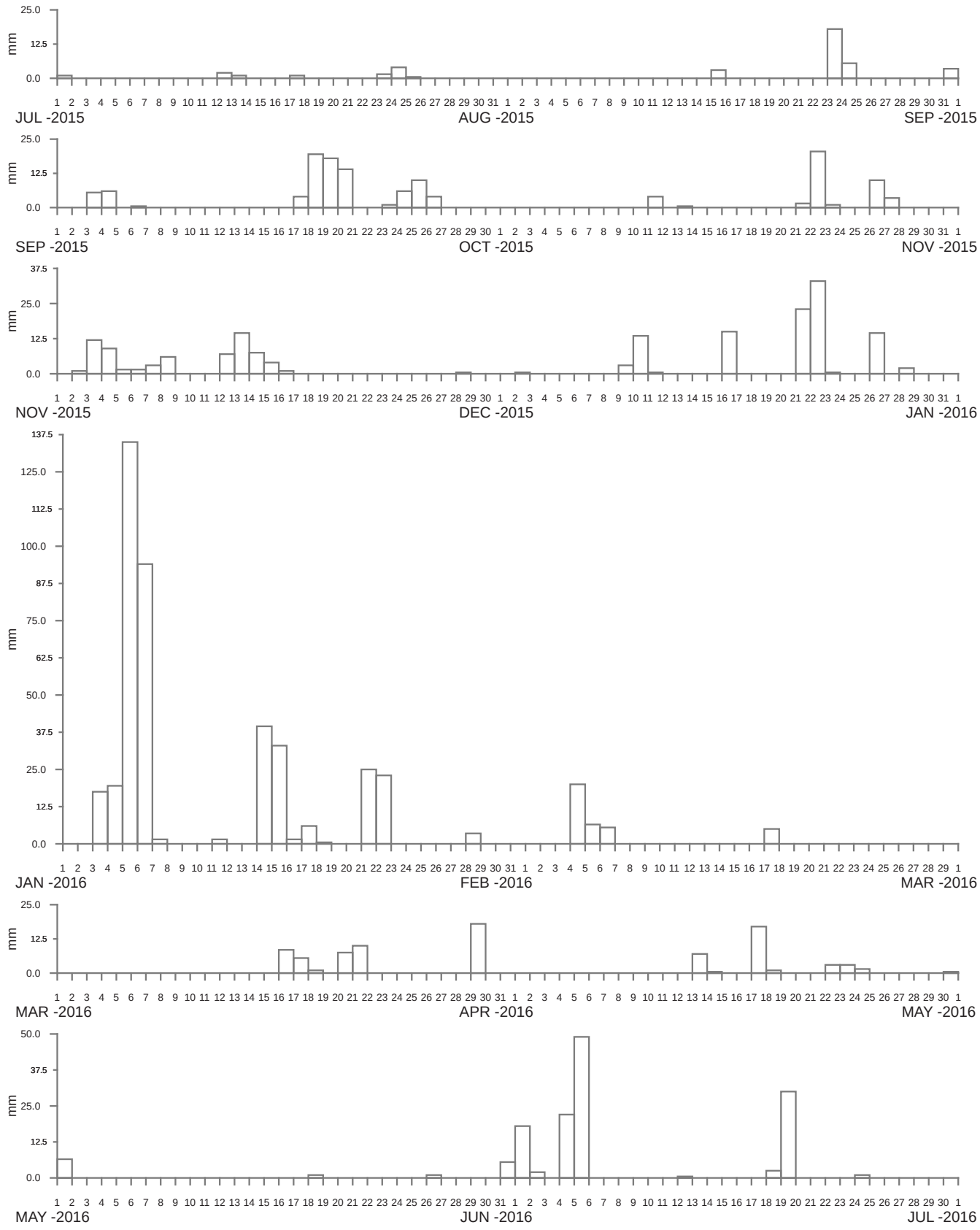
Public Works
Manly Hydraulics Laboratory

HUNTER RIVER AT BELMORE BRIDGE
2015–2016

MHL Report 2476

Figure 40

DRAWING 2476-40.cdr



DATA LOSS

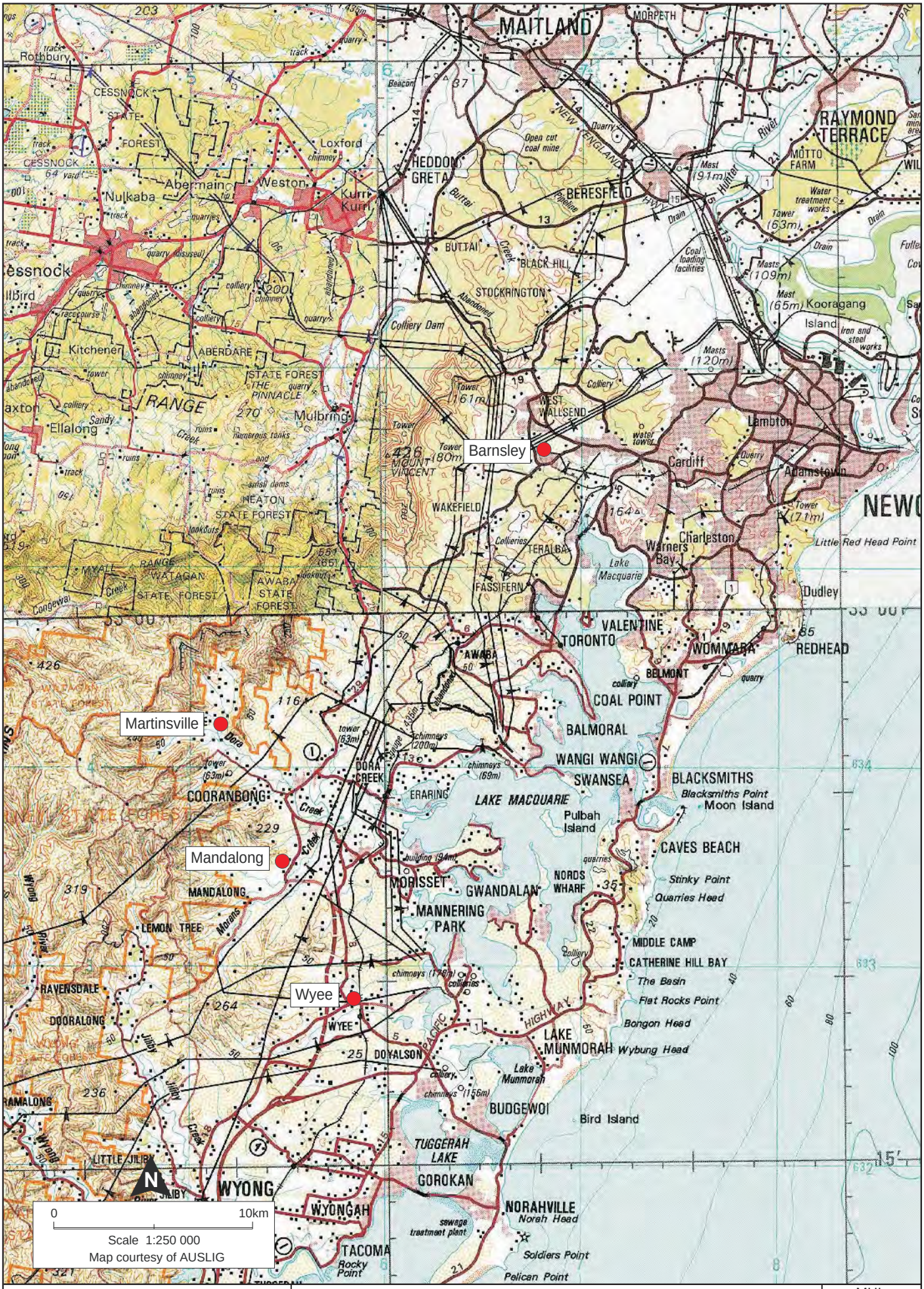
Public Works
Manly Hydraulics Laboratory

HUNTER RIVER AT HEXHAM BRIDGE
2015–2016

MHL Report 2476

Figure 41

DRAWING 2476-41.cdr



NSW GOVERNMENT

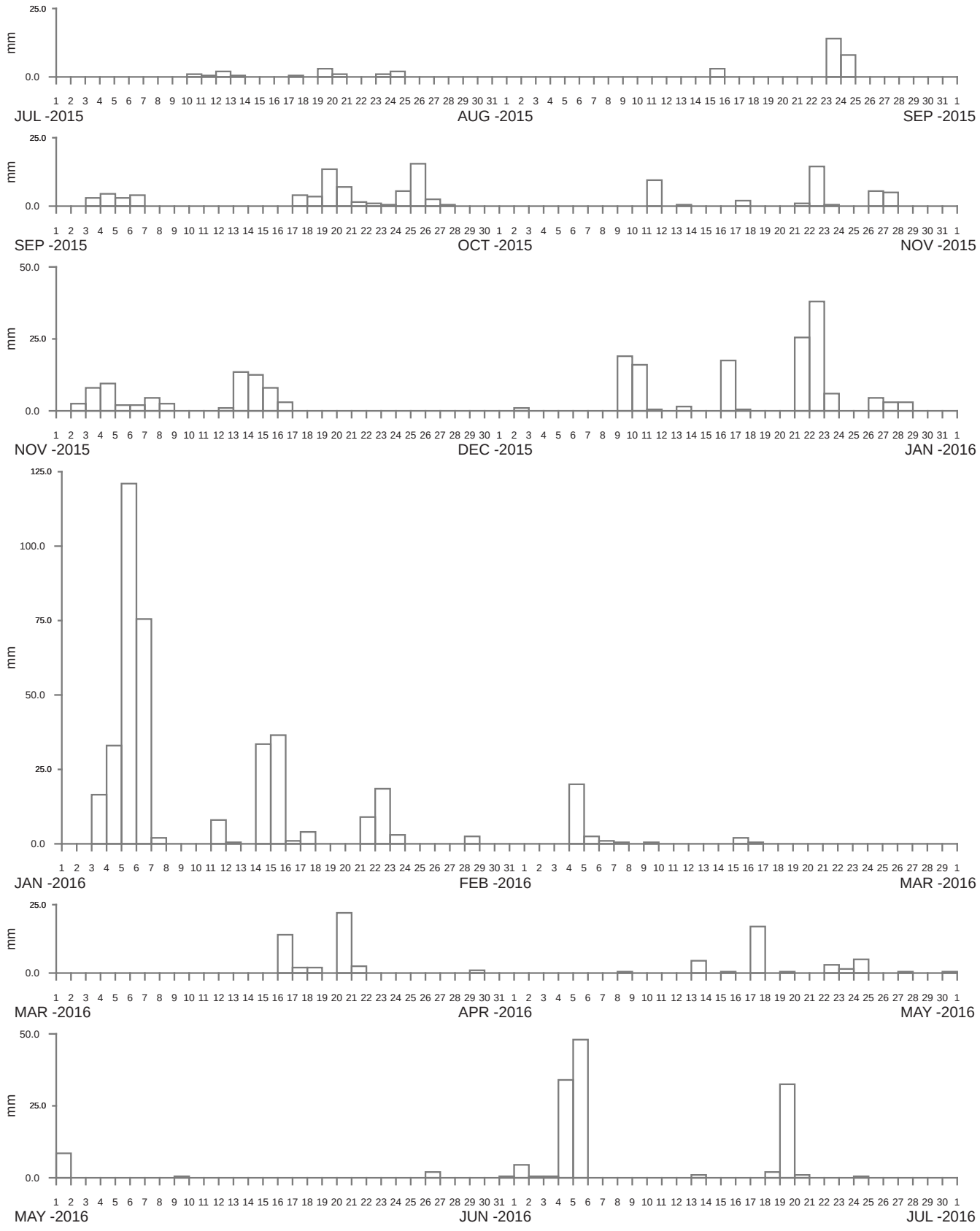
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
MACQUARIE-TUGGERAH LAKES (NORTH) REGION

MHL Report 2476

Figure 42

DRAWING 2476-42.cdr



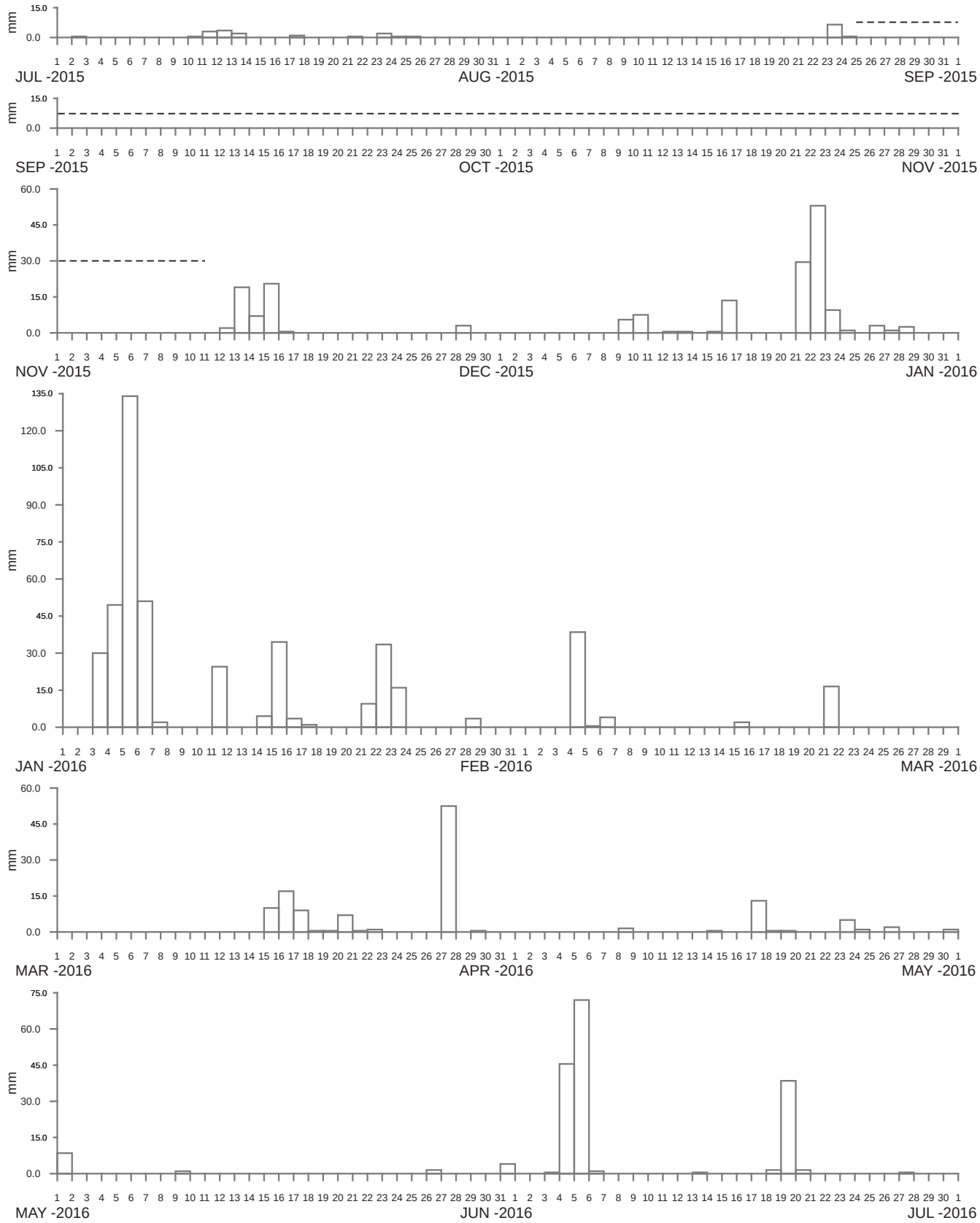
Public Works
Manly Hydraulics Laboratory

BARNSLEY AT JOHNSON AVENUE
2015–2016

MHL Report 2476

Figure 43

DRAWING 2476-43.cdr



DATA LOSS

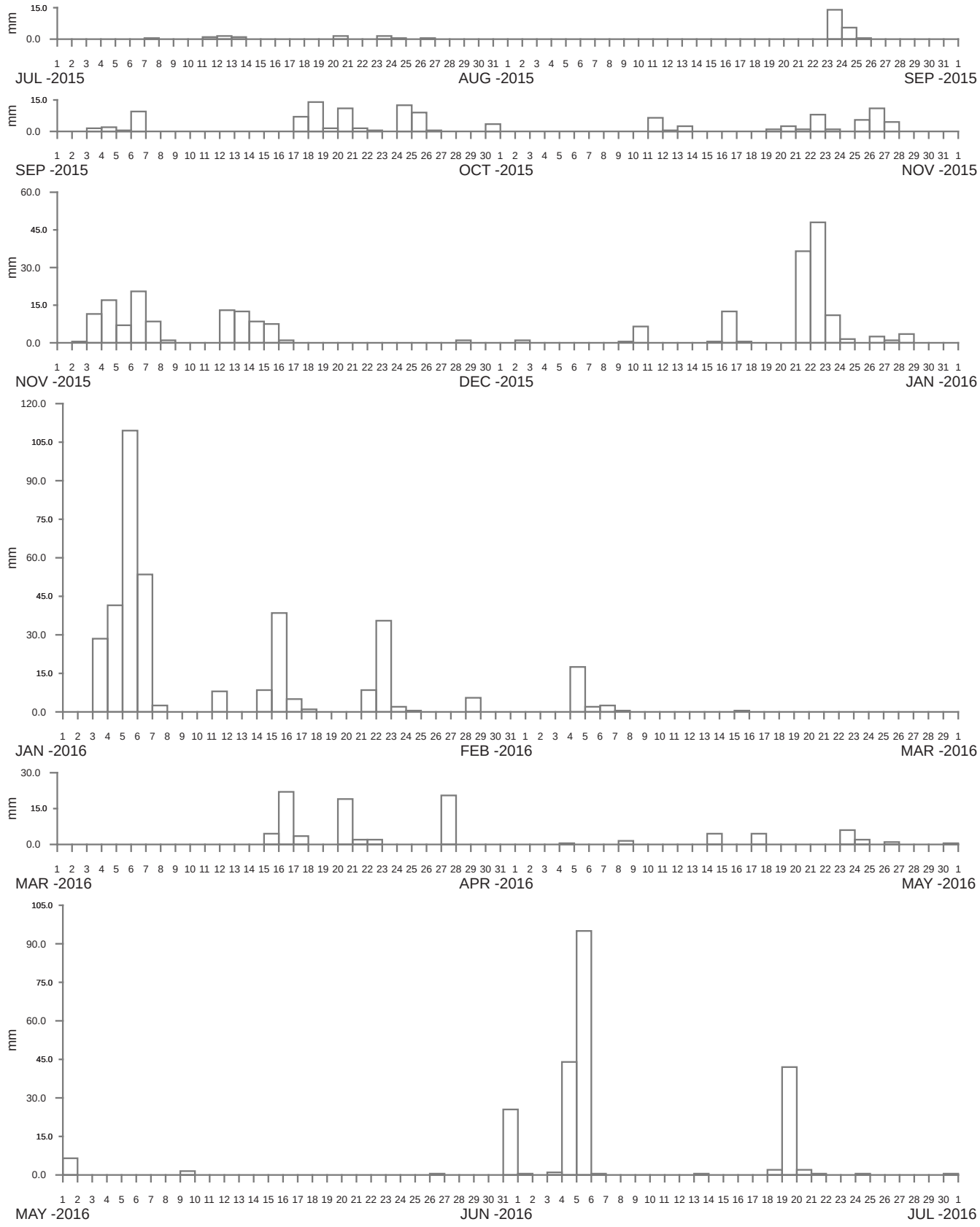
Public Works
Manly Hydraulics Laboratory

MARTINSVILLE AT MARTINSVILLE ROAD
2015–2016

MHL Report 2476

Figure 44

DRAWING 2476-44.cdr



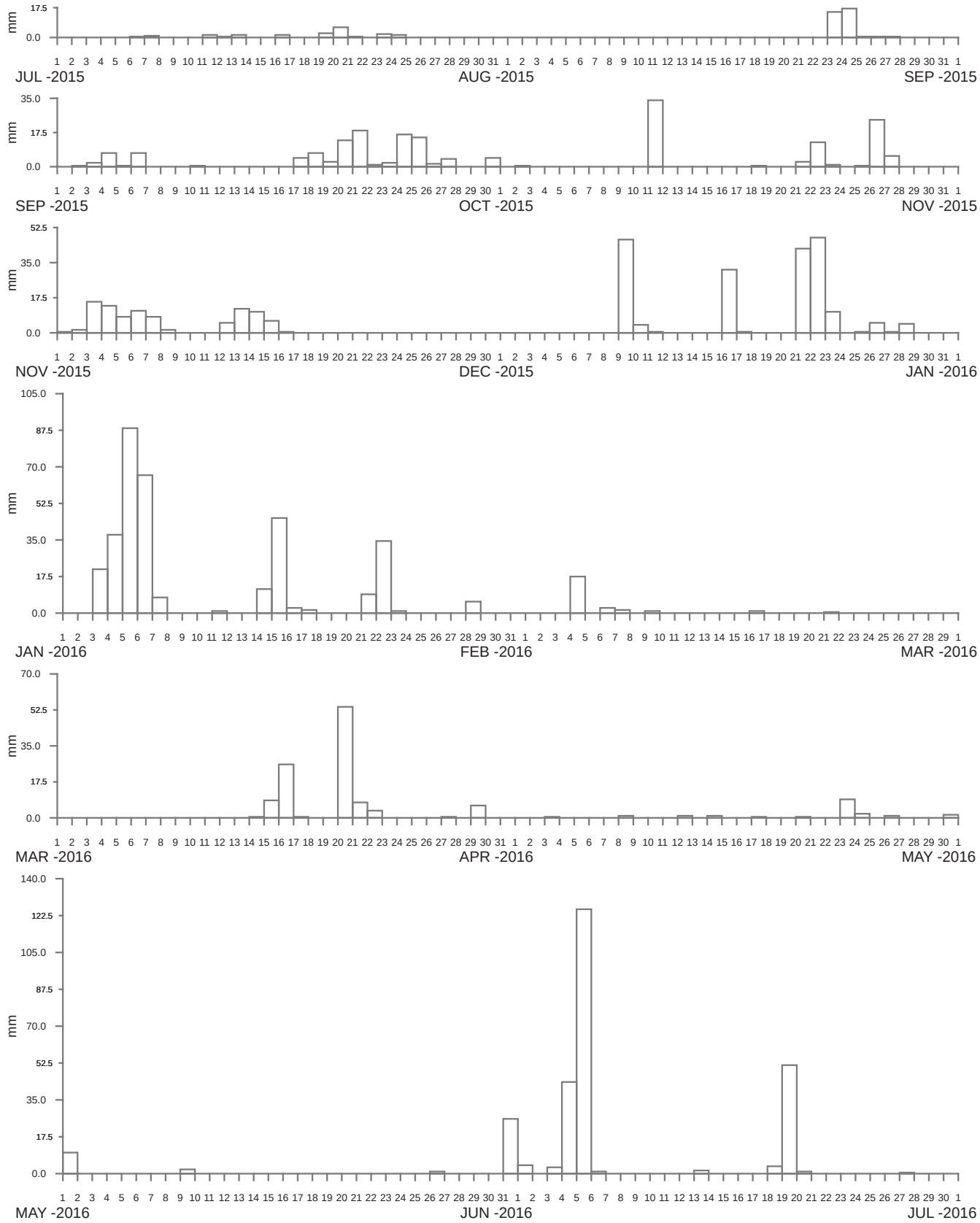
Public Works
Manly Hydraulics Laboratory

MANDALONG AT DEAVES ROAD
2015–2016

MHL Report 2476

Figure 45

DRAWING 2476-45.cdr



DATA LOSS

Public Works
Manly Hydraulics Laboratory

WYEE AT COLLUNGRA STREET
2015–2016

MHL Report 2476

Figure 46

DRAWING 2476-46.cdr

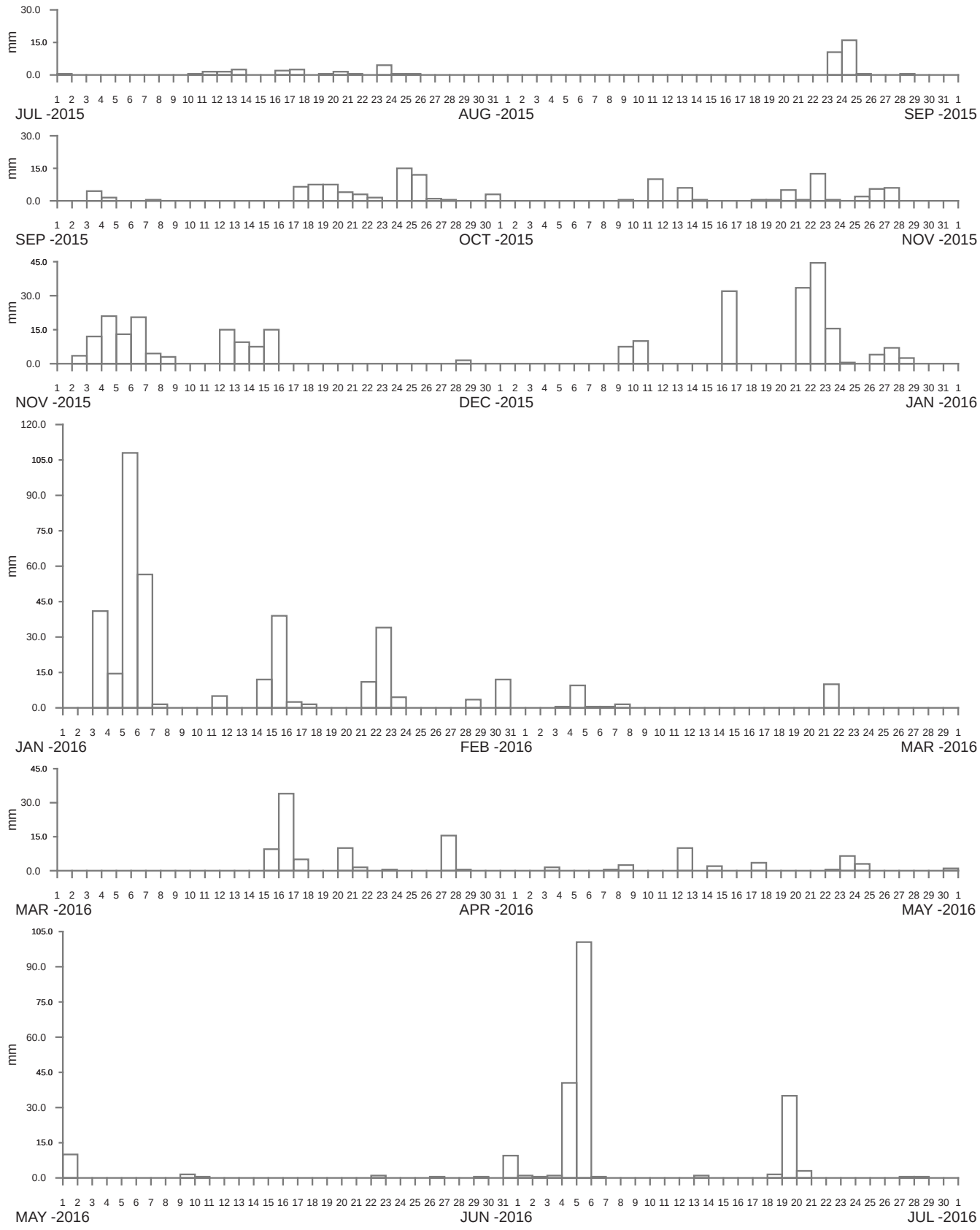
Public Works
Manly Hydraulics Laboratory

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

MHL Report 2475

Figure 47

DRAWING 2476-47.cdr



DATA LOSS

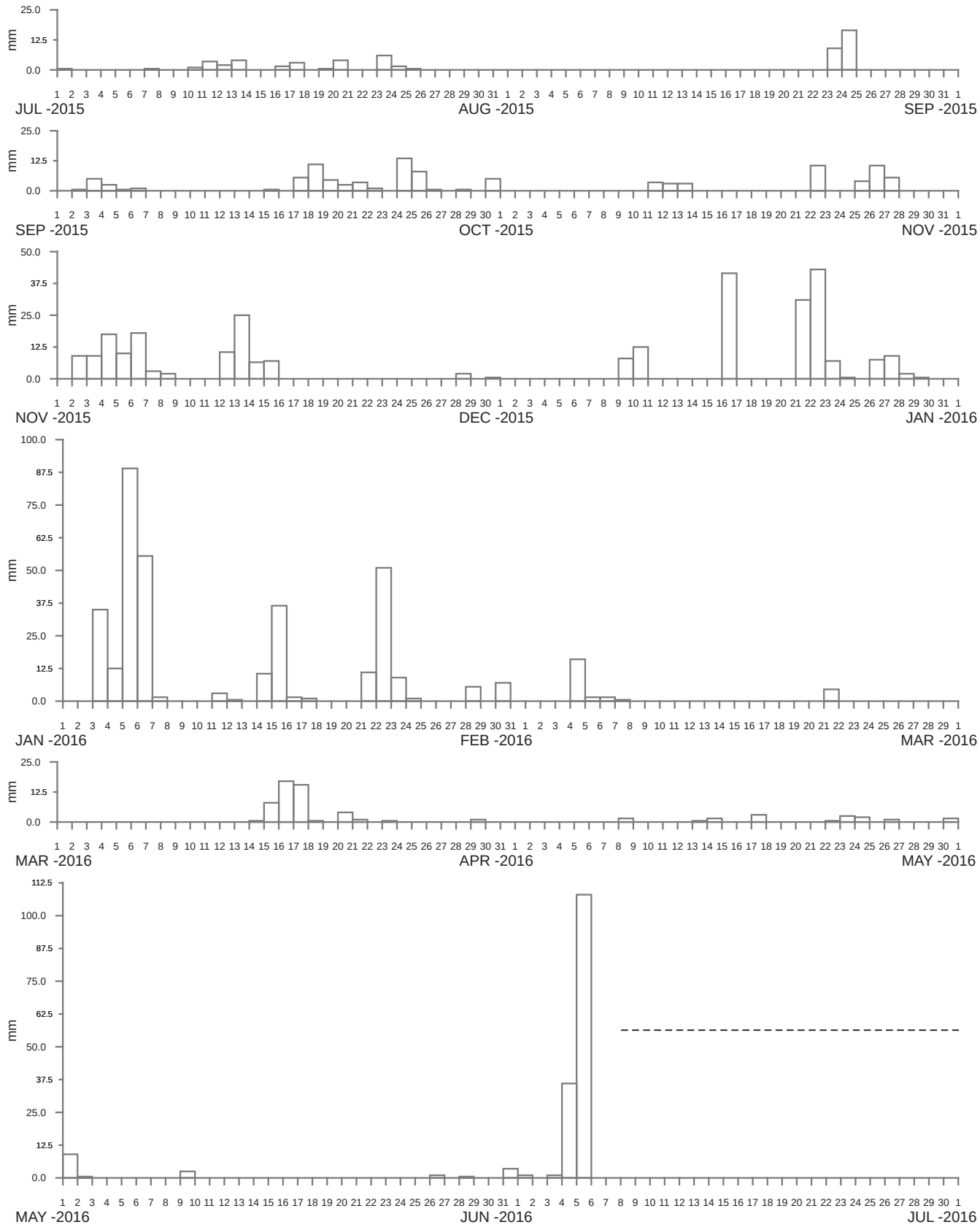
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

WHITEMANS RIDGE AT WATAGANS FOREST DRIVE
2015–2016

MHL Report 2476

Figure 48

DRAWING 2476-48.cdr



DATA LOSS

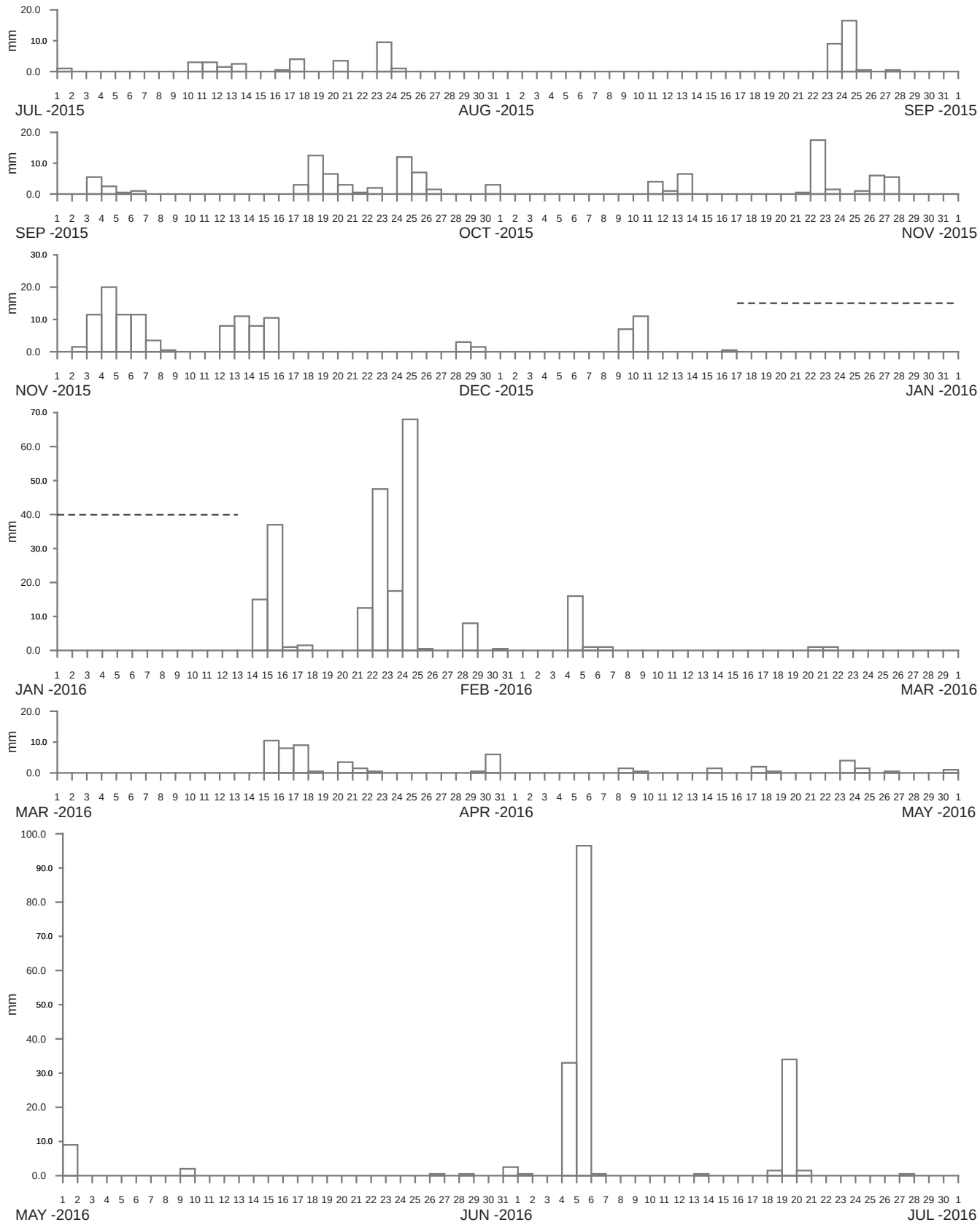
Public Works
Manly Hydraulics Laboratory

YARRAMALONG AT BUMBLE HILL ROAD
2015–2016

MHL Report 2476

Figure 49

DRAWING 2476-49.cdr



DATA LOSS

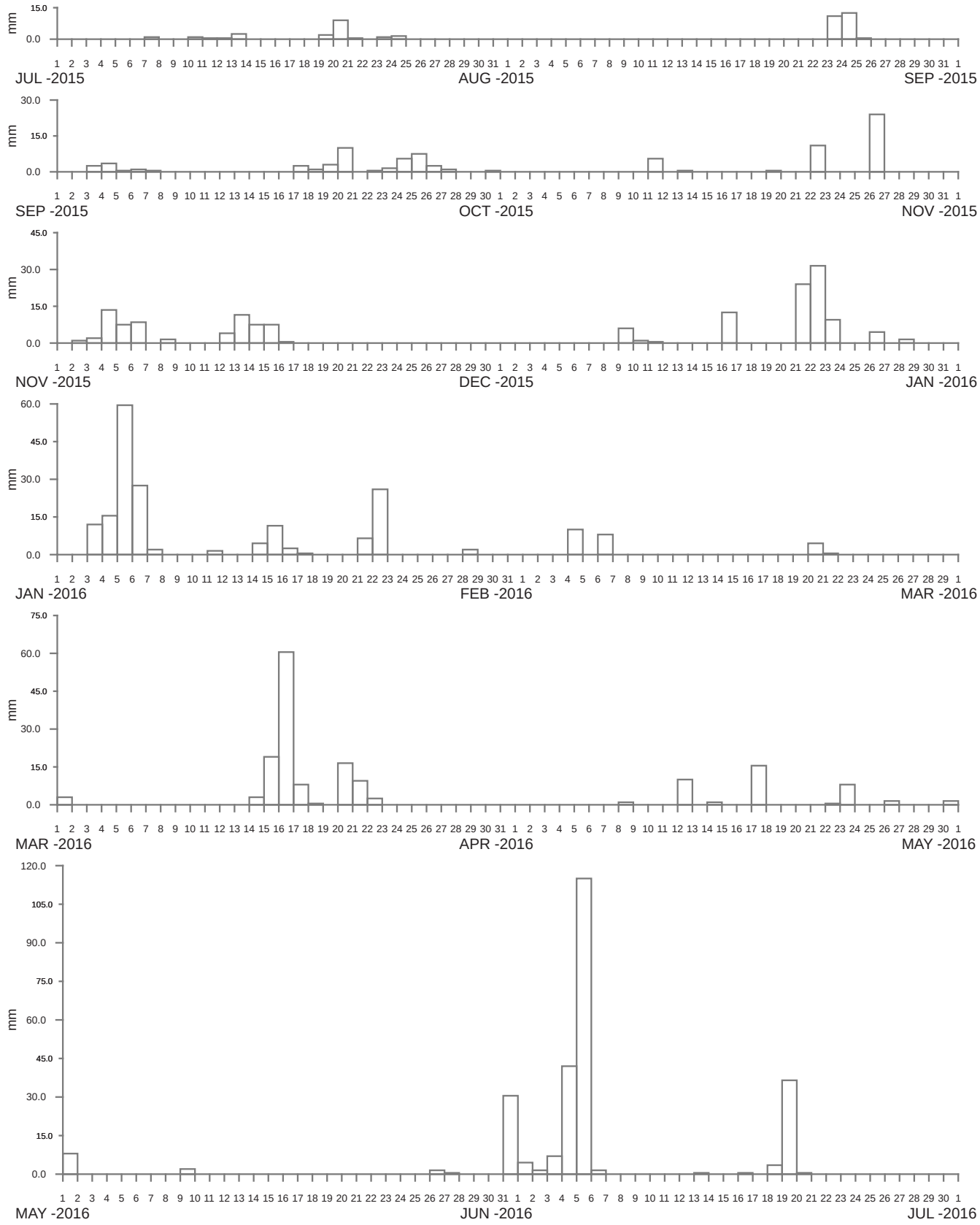
Public Works
Manly Hydraulics Laboratory

KULNURA AT GEORGE DOWNS DRIVE
2015–2016

MHL Report 2476

Figure 50

DRAWING 2476-50.cdr



DATA LOSS

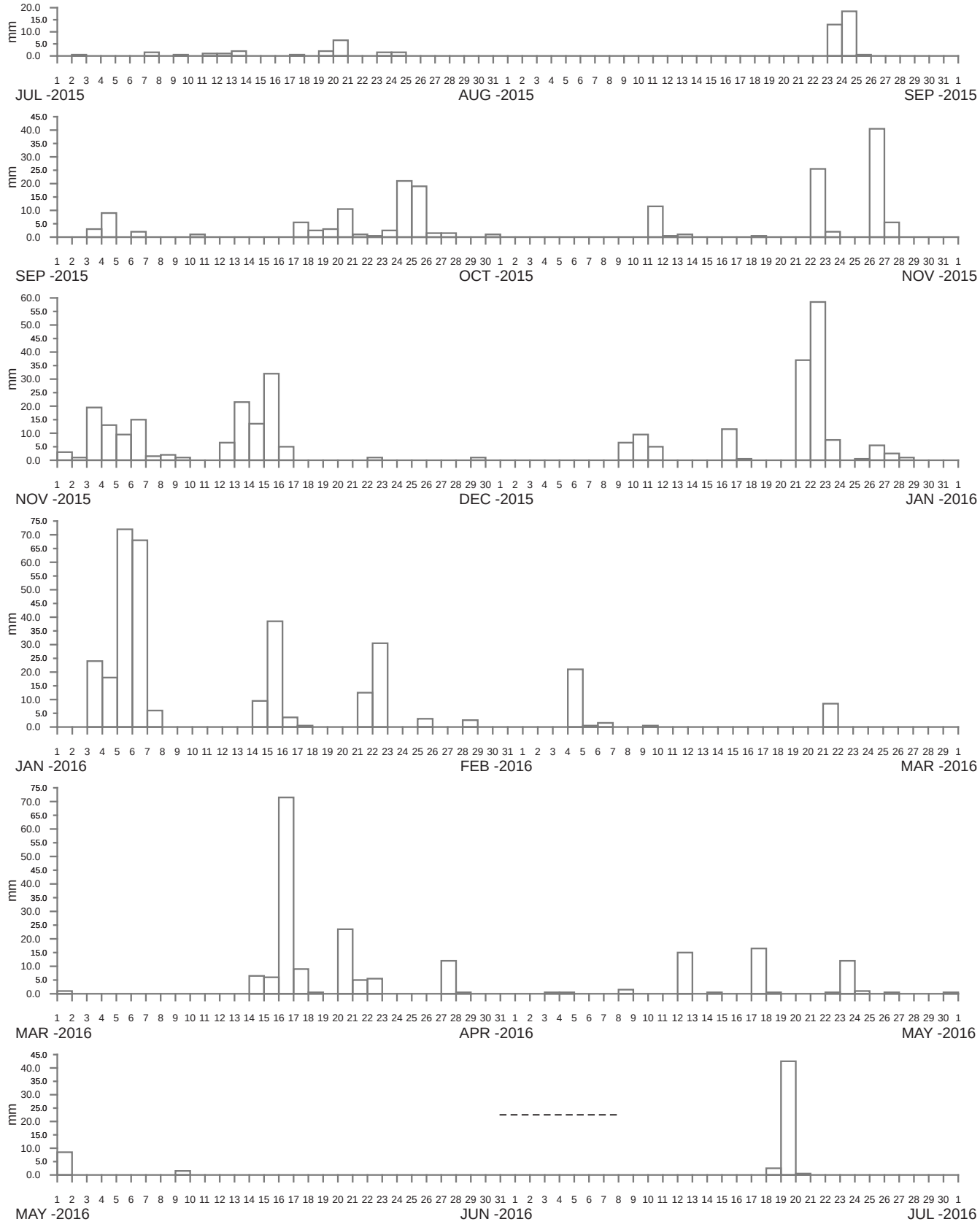
Public Works
Manly Hydraulics Laboratory

TUGGERAH LAKE AT TOUKLEY
2015–2016

MHL Report 2476

Figure 51

DRAWING 2476-51.cdr



DATA LOSS

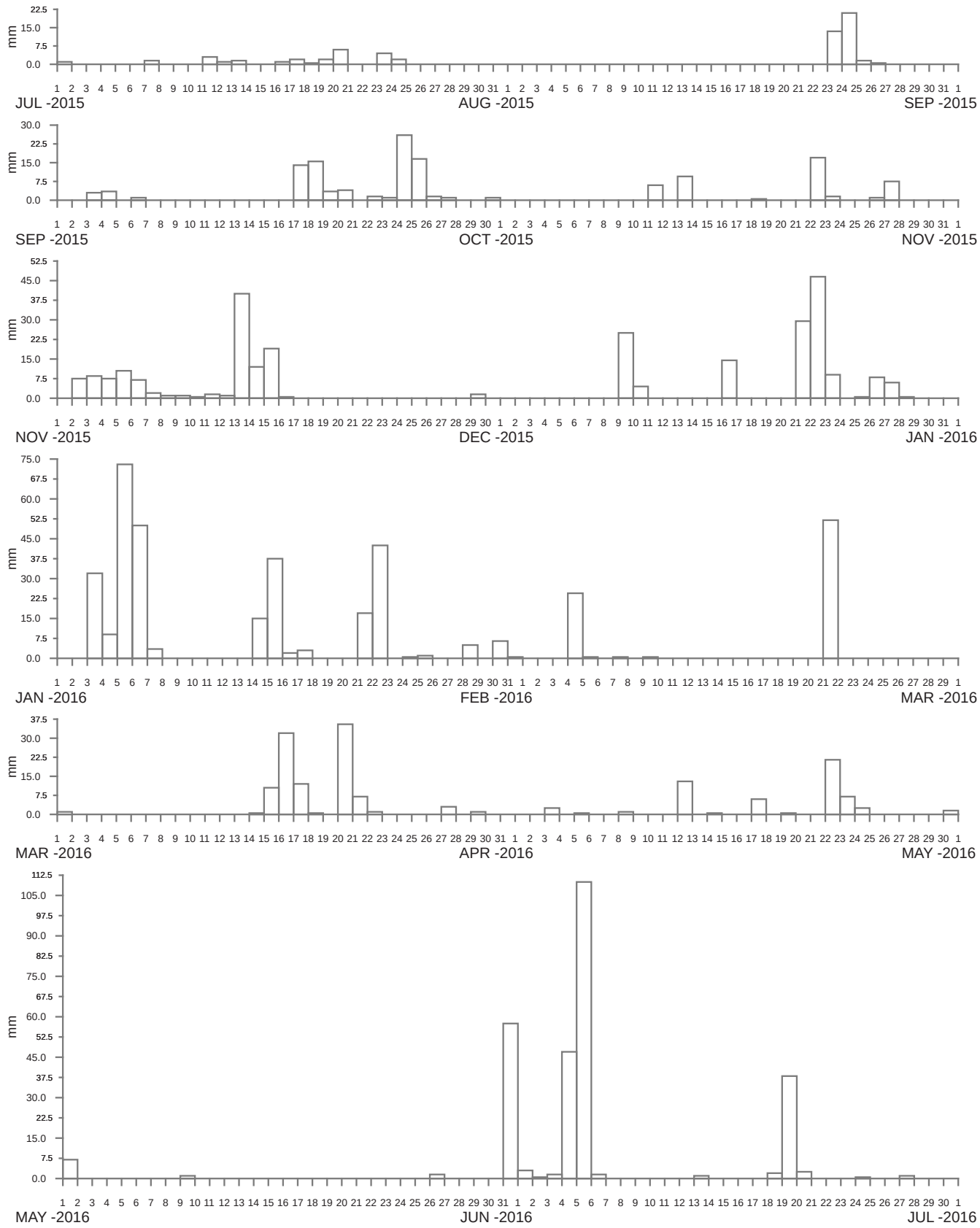
Public Works
Manly Hydraulics Laboratory

HAMLYN TERRACE AT WARNERVALE ROAD
2015–2016

MHL Report 2476

Figure 52

DRAWING 2476-52.cdr



DATA LOSS

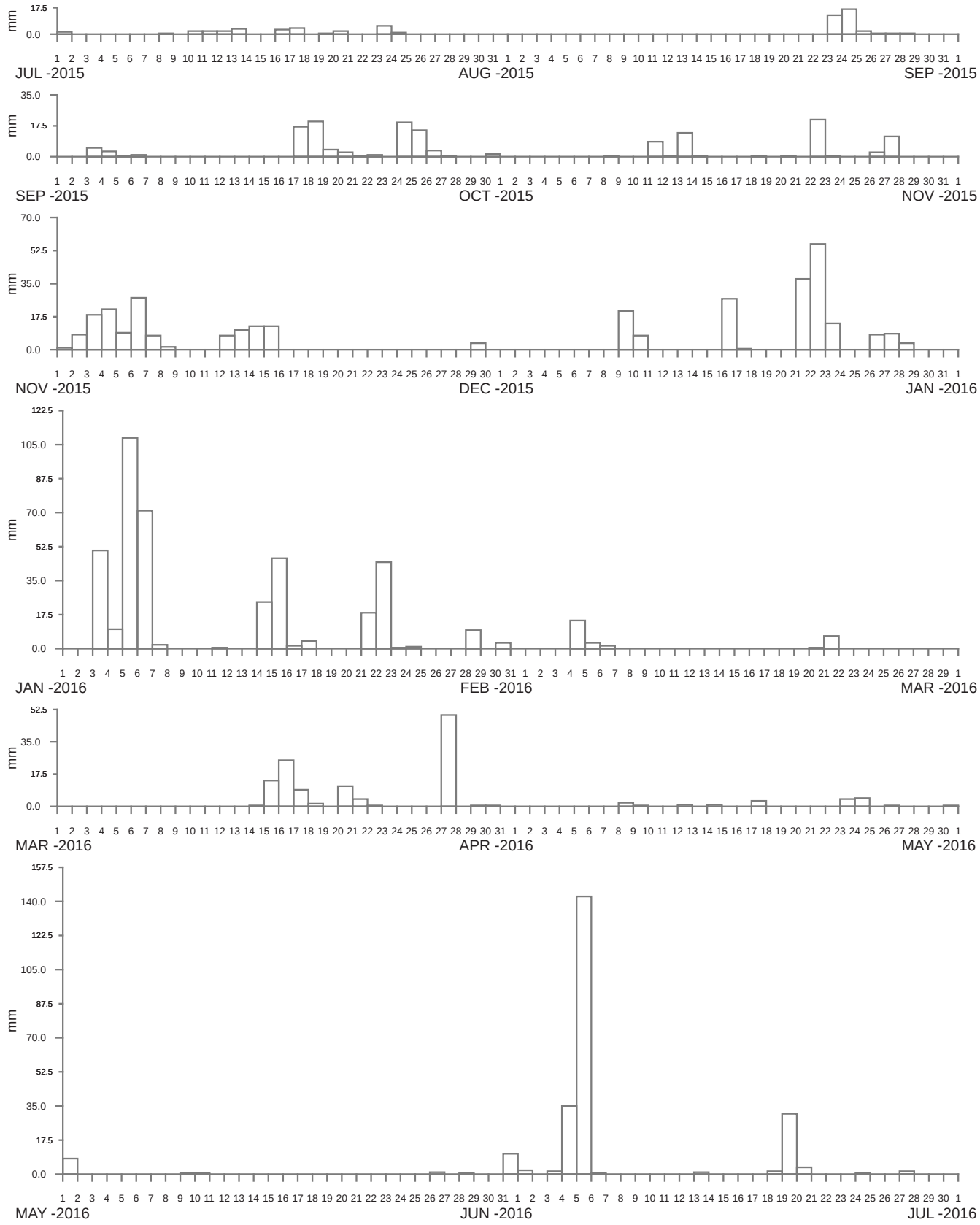
Public Works
Manly Hydraulics Laboratory

MARDI DAM AT OLD MAITLAND ROAD
2015–2016

MHL Report 2476

Figure 53

DRAWING 2476-53.cdr



DATA LOSS

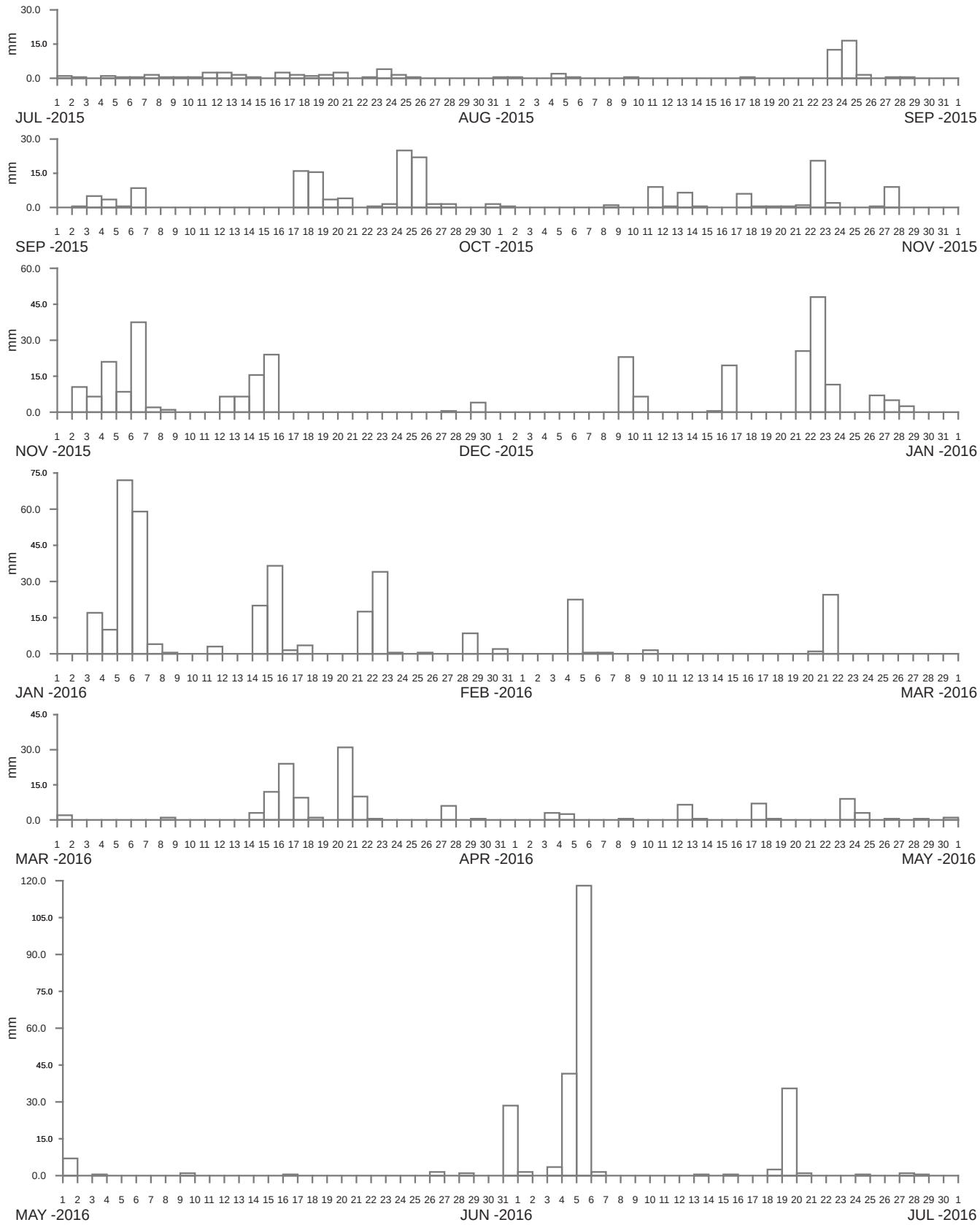
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

STERLAND AT RED HILL FOREST ROAD
2015–2016

MHL Report 2476

Figure 54

DRAWING 2476-54.cdr



DATA LOSS

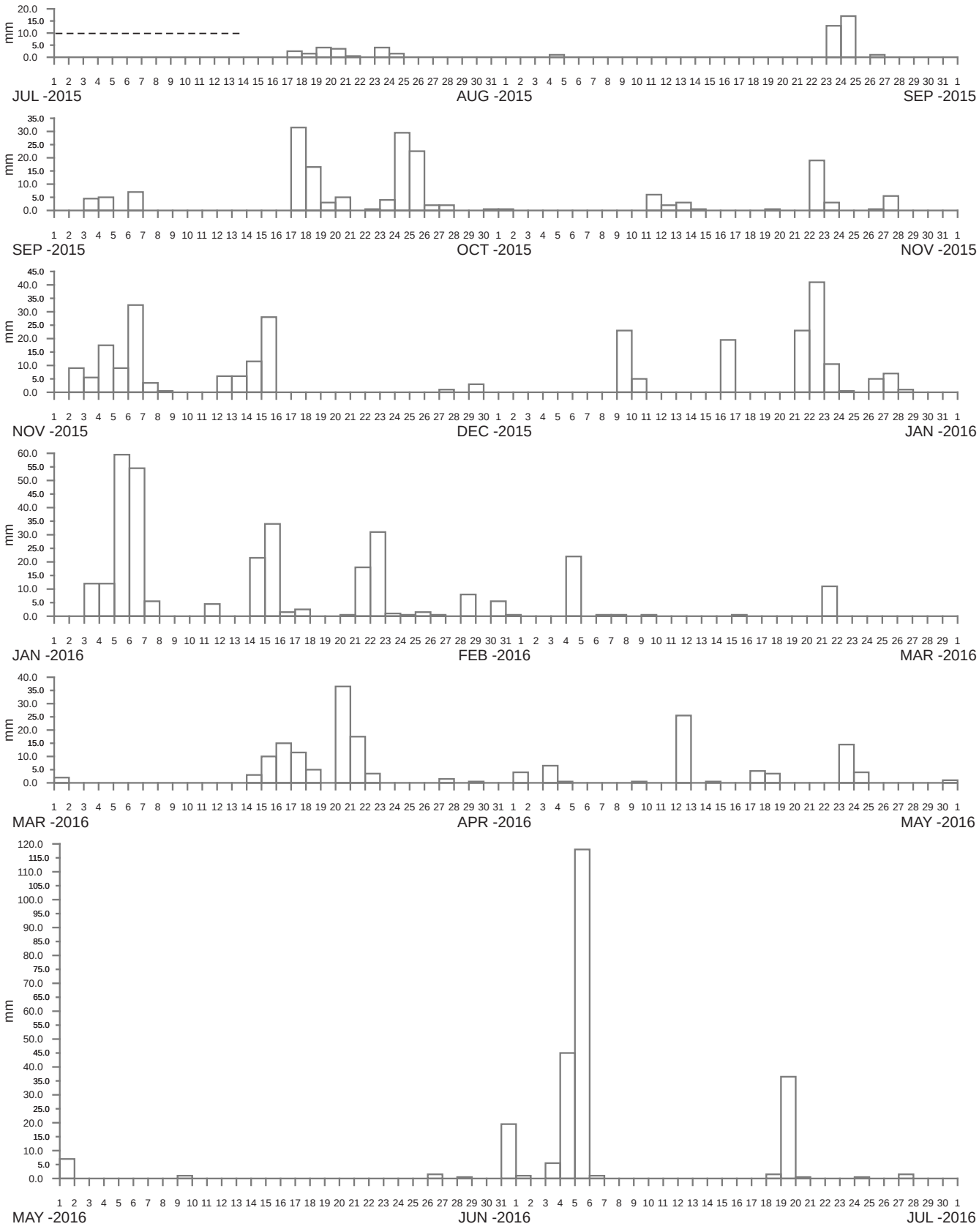
Public Works
Manly Hydraulics Laboratory

KANGY ANGY AT ORCHARD ROAD
2015–2016

MHL Report 2476

Figure 55

DRAWING 2476-55.cdr



DATA LOSS

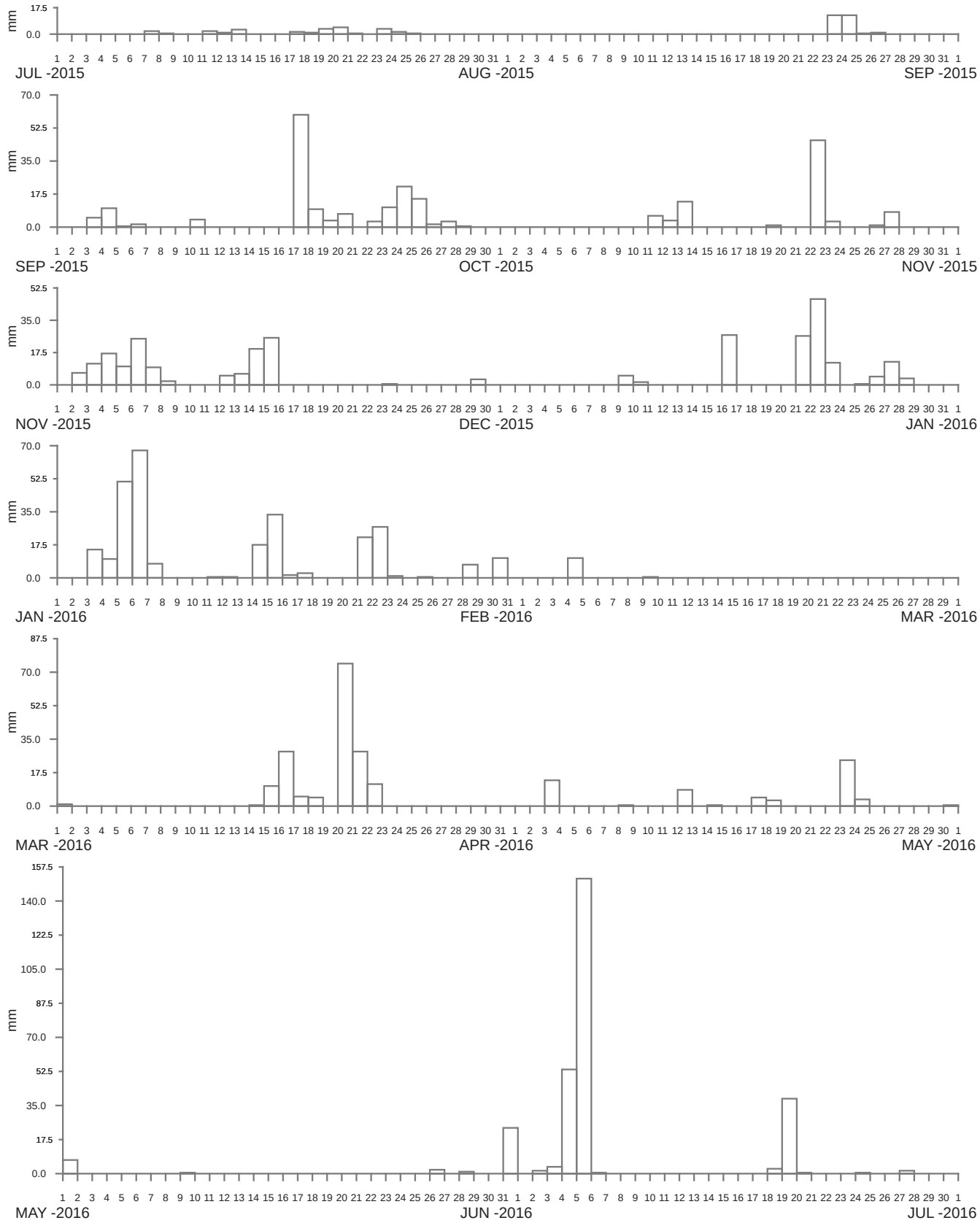
Public Works
Manly Hydraulics Laboratory

BERKELEY VALE AT BERKELEY VALE ROAD
2015–2016

MHL Report 2476

Figure 56

DRAWING 2476-56.cdr



DATA LOSS

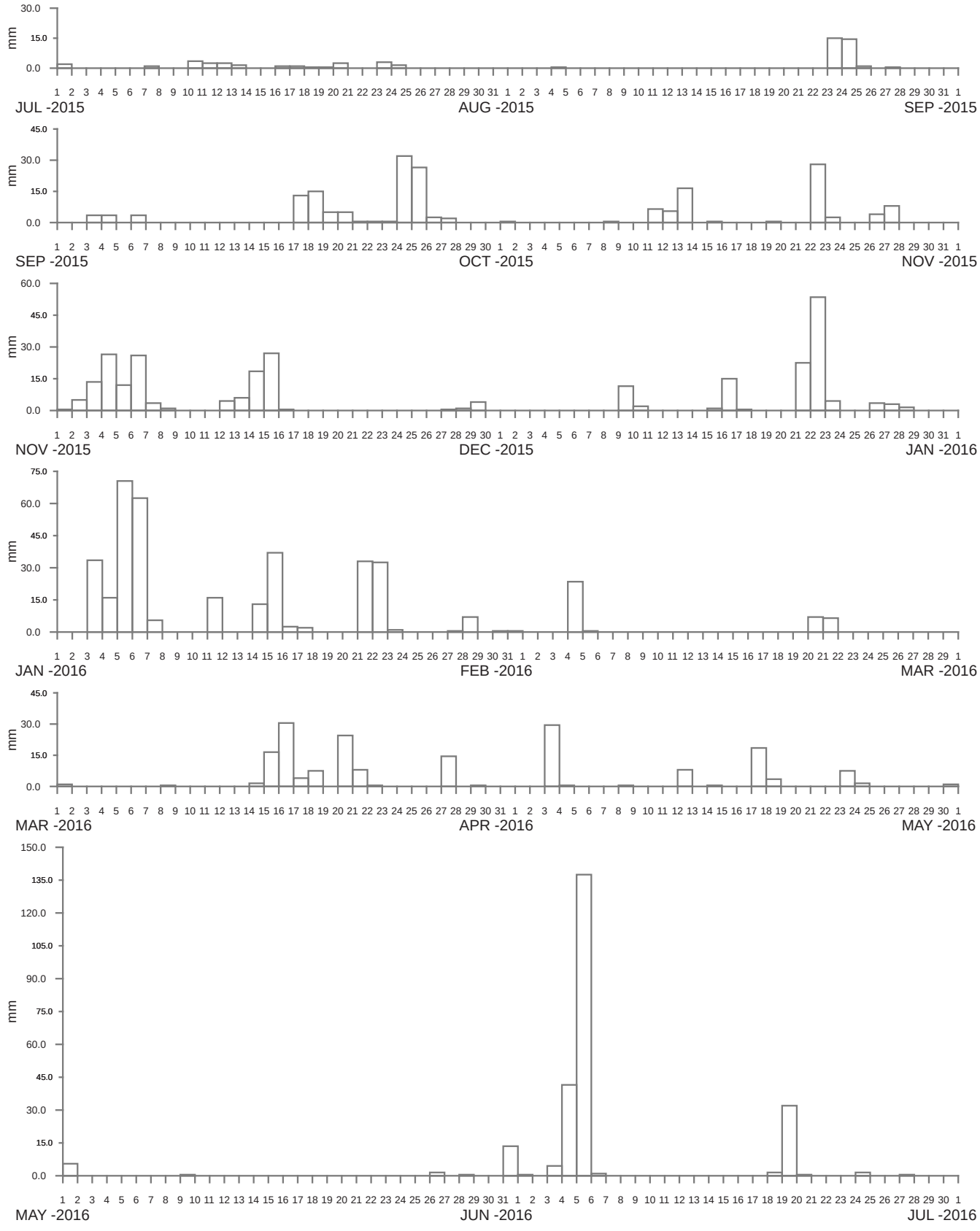
Public Works
Manly Hydraulics Laboratory

BATEAU BAY AT SEWAGE TREATMENT WORKS 2015–2016

MHL Report 2476

Figure 57

DRAWING 2476-57.cdr



DATA LOSS

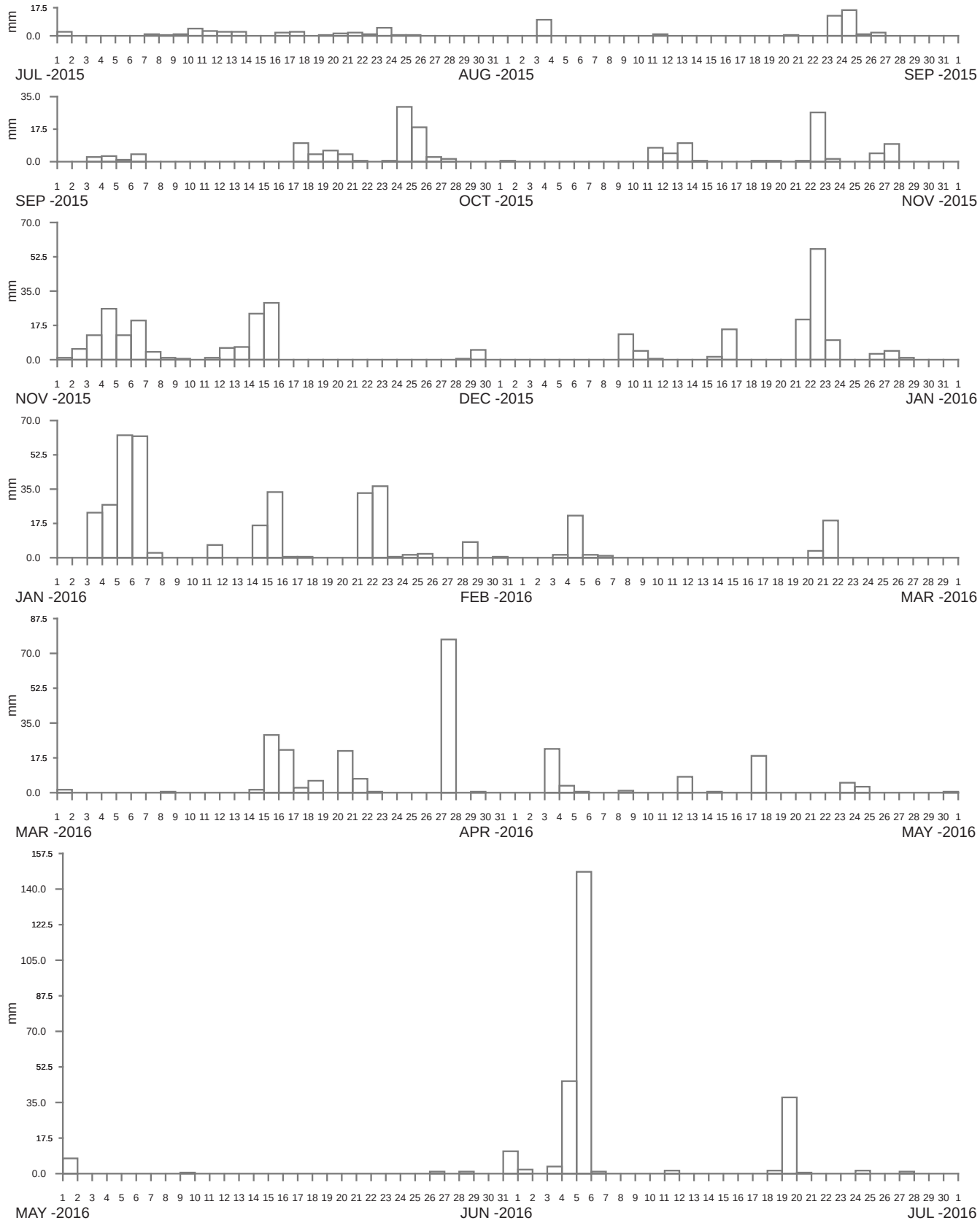
Public Works
Manly Hydraulics Laboratory

LISAROW AT FAGANS ROAD
2015–2016

MHL Report 2476

Figure 58

DRAWING 2476-58.cdr



DATA LOSS

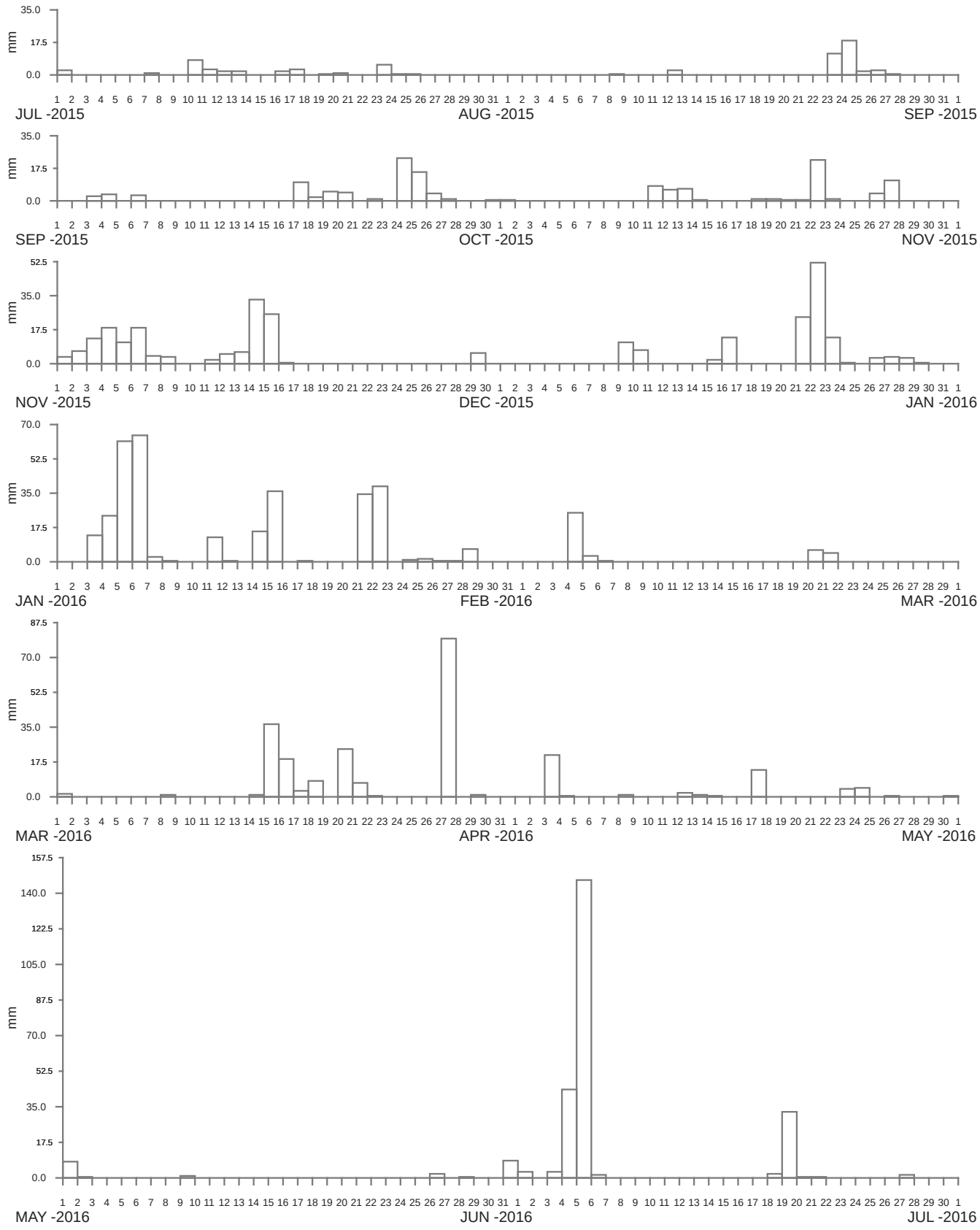
Public Works
Manly Hydraulics Laboratory

STRICKLAND AT MANGROVE ROAD
2015–2016

MHL Report 2476

Figure 59

DRAWING 2476-59.cdr



DATA LOSS

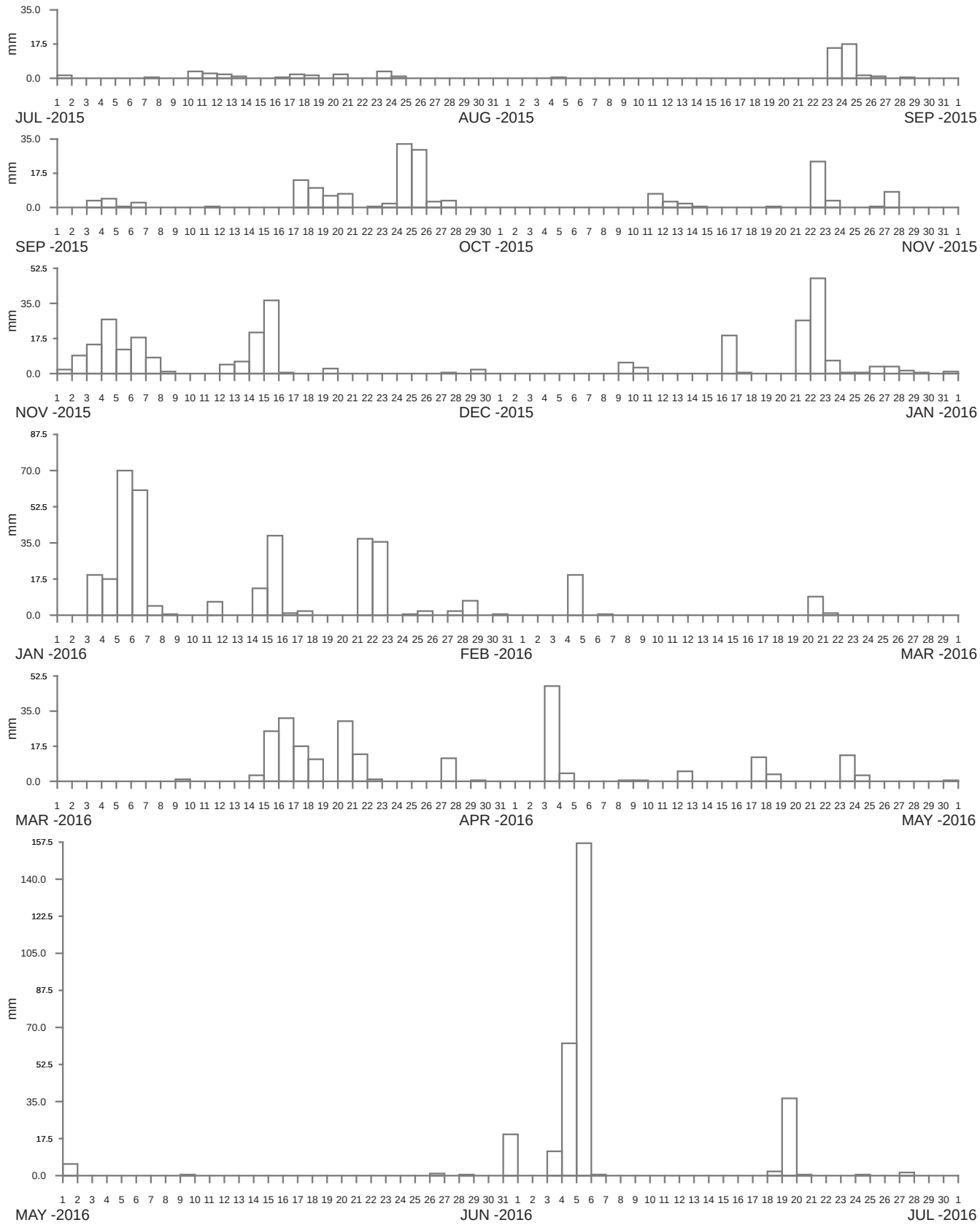
Public Works
Manly Hydraulics Laboratory

NARARA AT RESEARCH ROAD
2015–2016

MHL Report 2476

Figure 60

DRAWING 2476-60.cdr



DATA LOSS

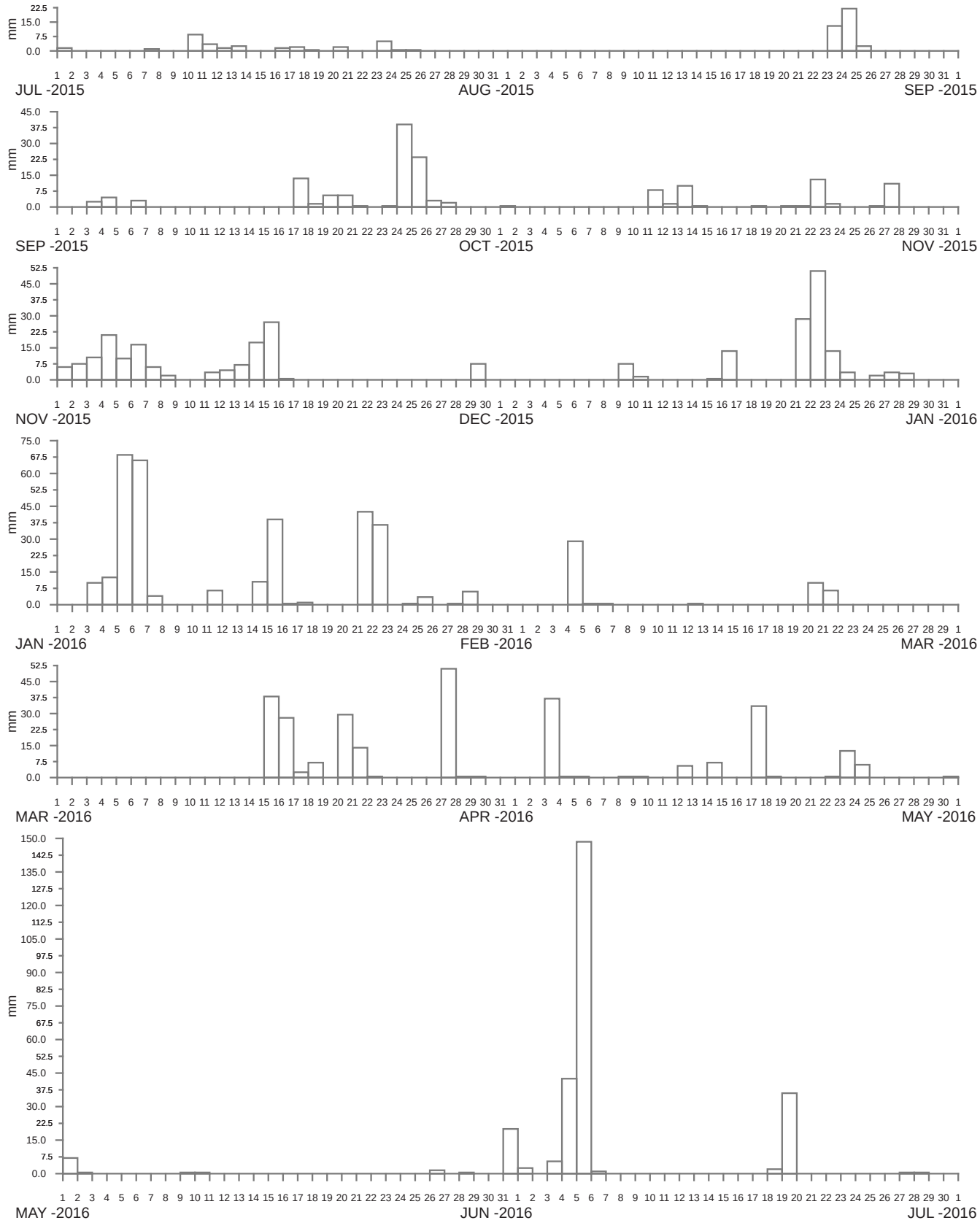
Public Works
Manly Hydraulics Laboratory

MOUNT ELLIOT AT TOOMEYS ROAD
2015–2016

MHL Report 2476

Figure 61

DRAWING 2476-61.cdr



DATA LOSS

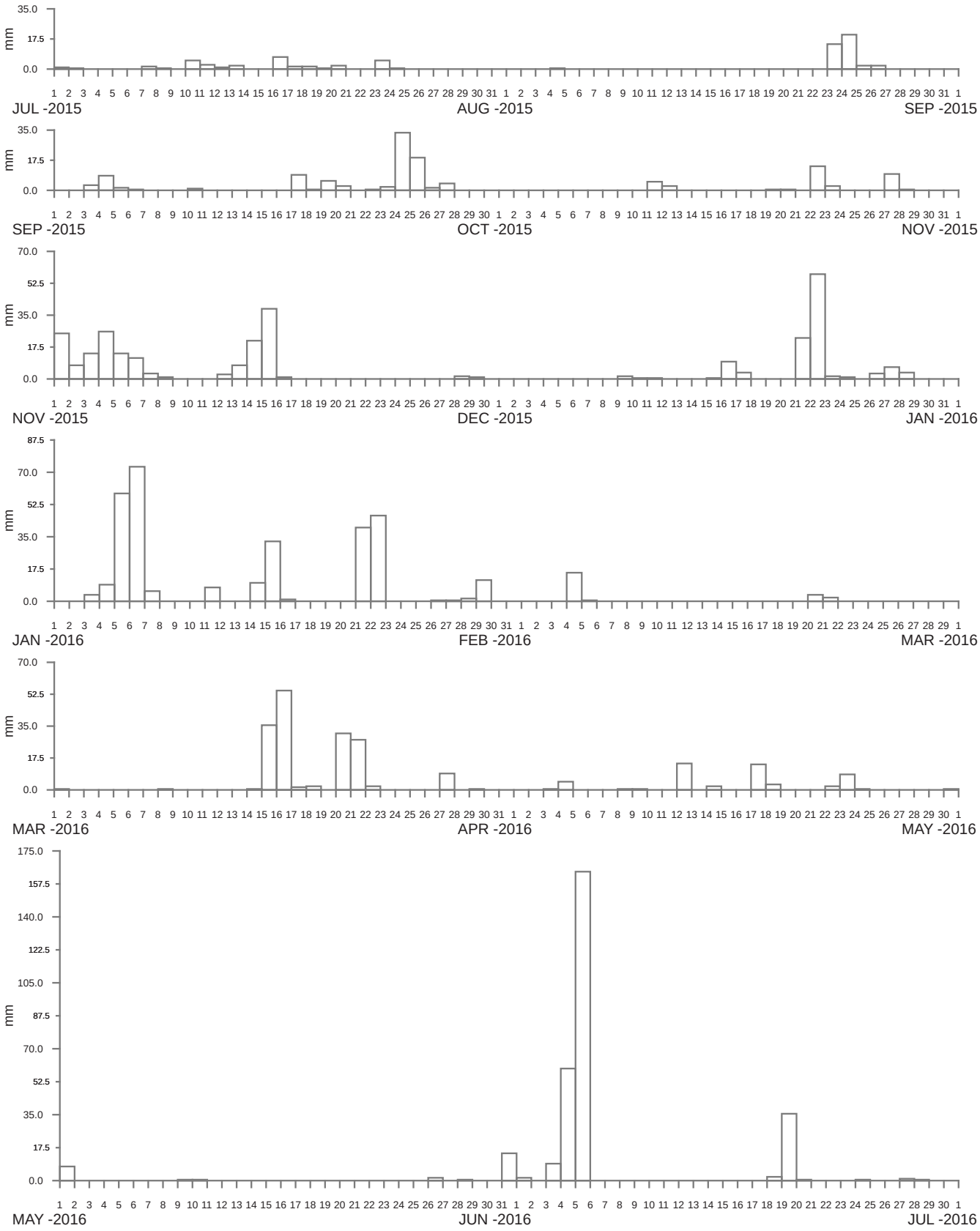
Public Works
Manly Hydraulics Laboratory

WYOMING AT LAYCOCK STREET
2015–2016

MHL Report 2476

Figure 62

DRAWING 2476-62.cdr



DATA LOSS

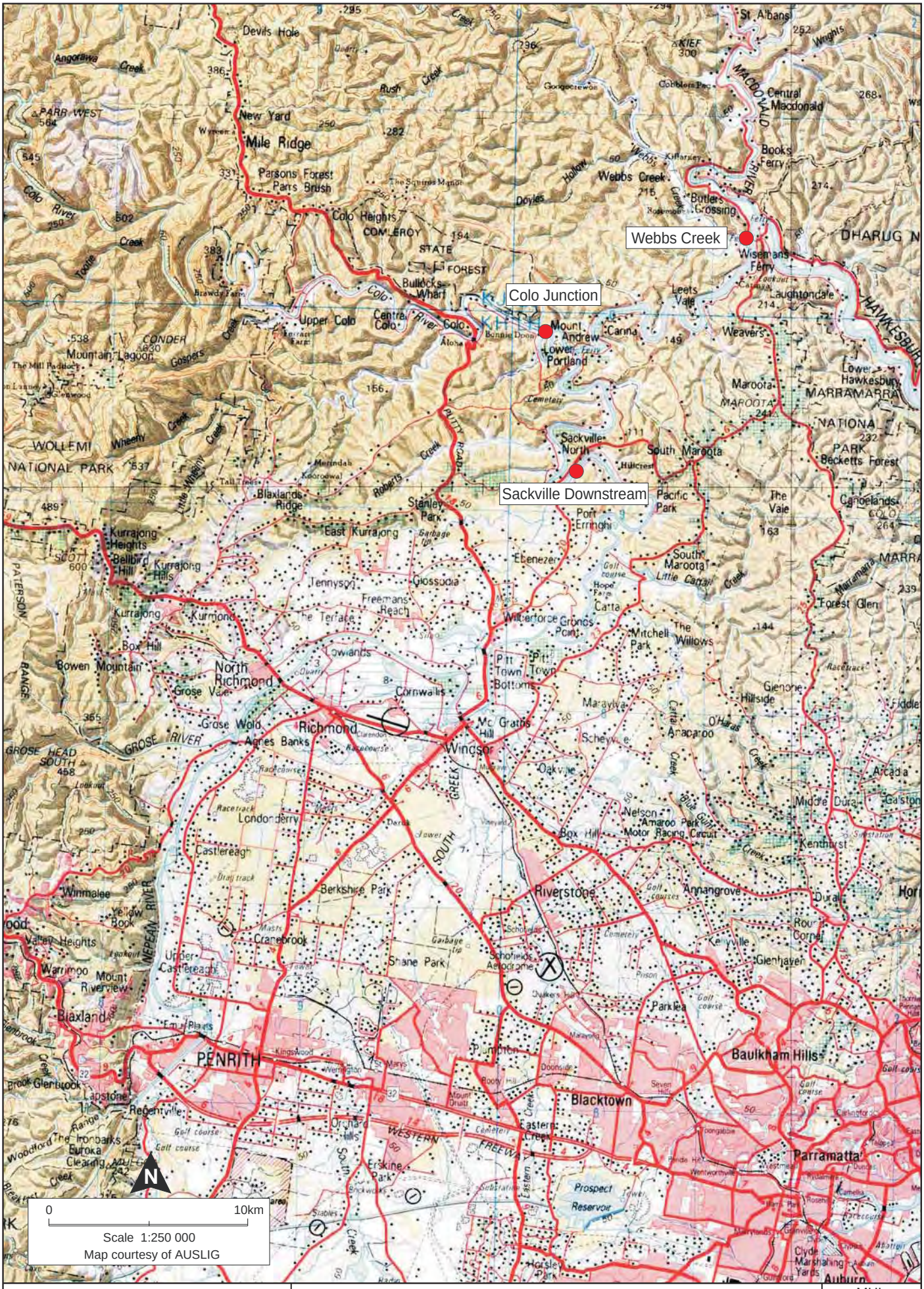
Public Works
Manly Hydraulics Laboratory

KINCUMBER AT DOYLE STREET
2015–2016

MHL Report 2476

Figure 63

DRAWING 2476-63.cdr



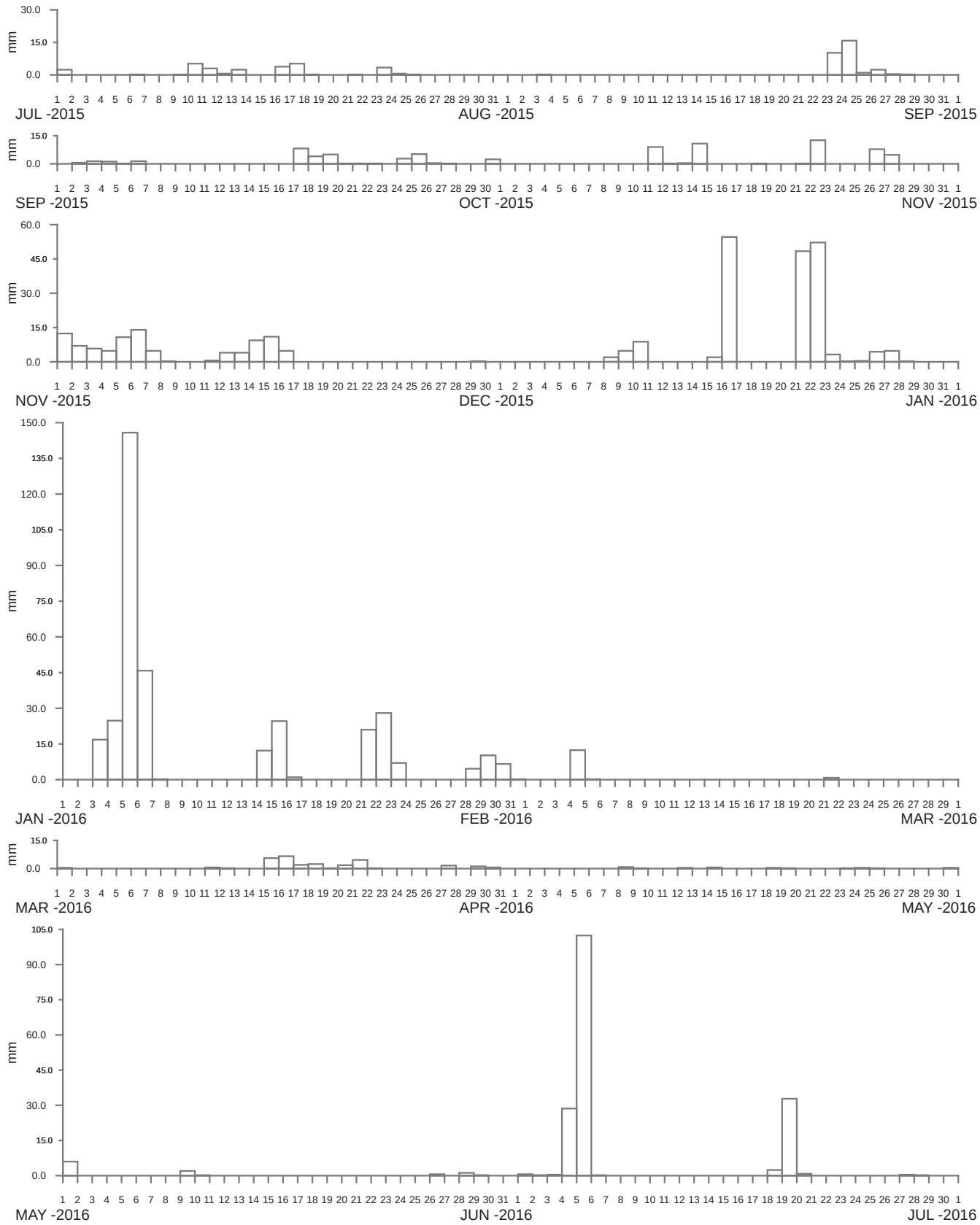
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
HAWKESBURY RIVER (MID) REGION

MHL Report 2476

Figure 64

DRAWING 2476-64.cdr



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

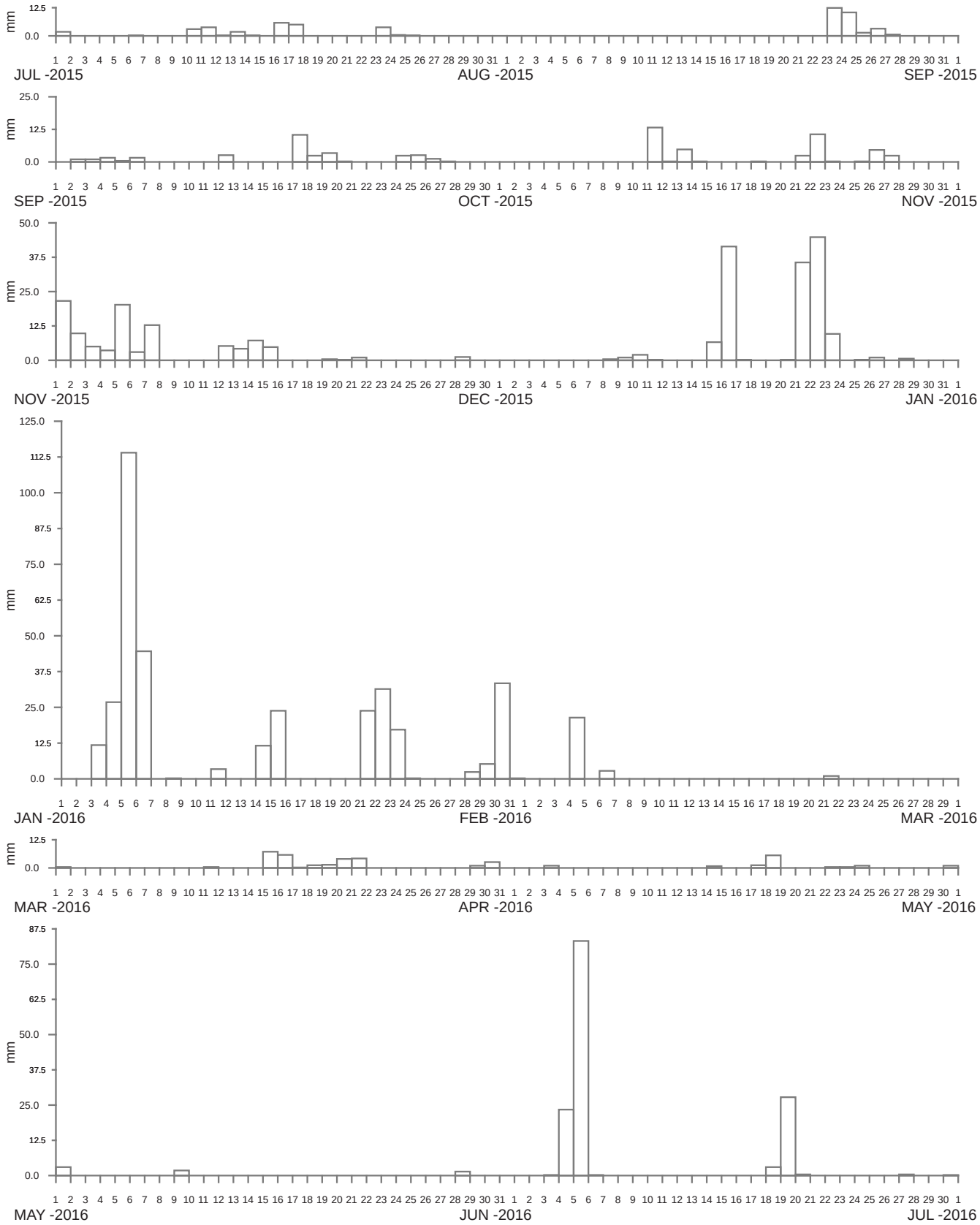
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

HAWKESBURY RIVER AT WEBBS CREEK
2015–2016

MHL Report 2476

Figure 65

DRAWING 2476-65.cdr



DATA LOSS

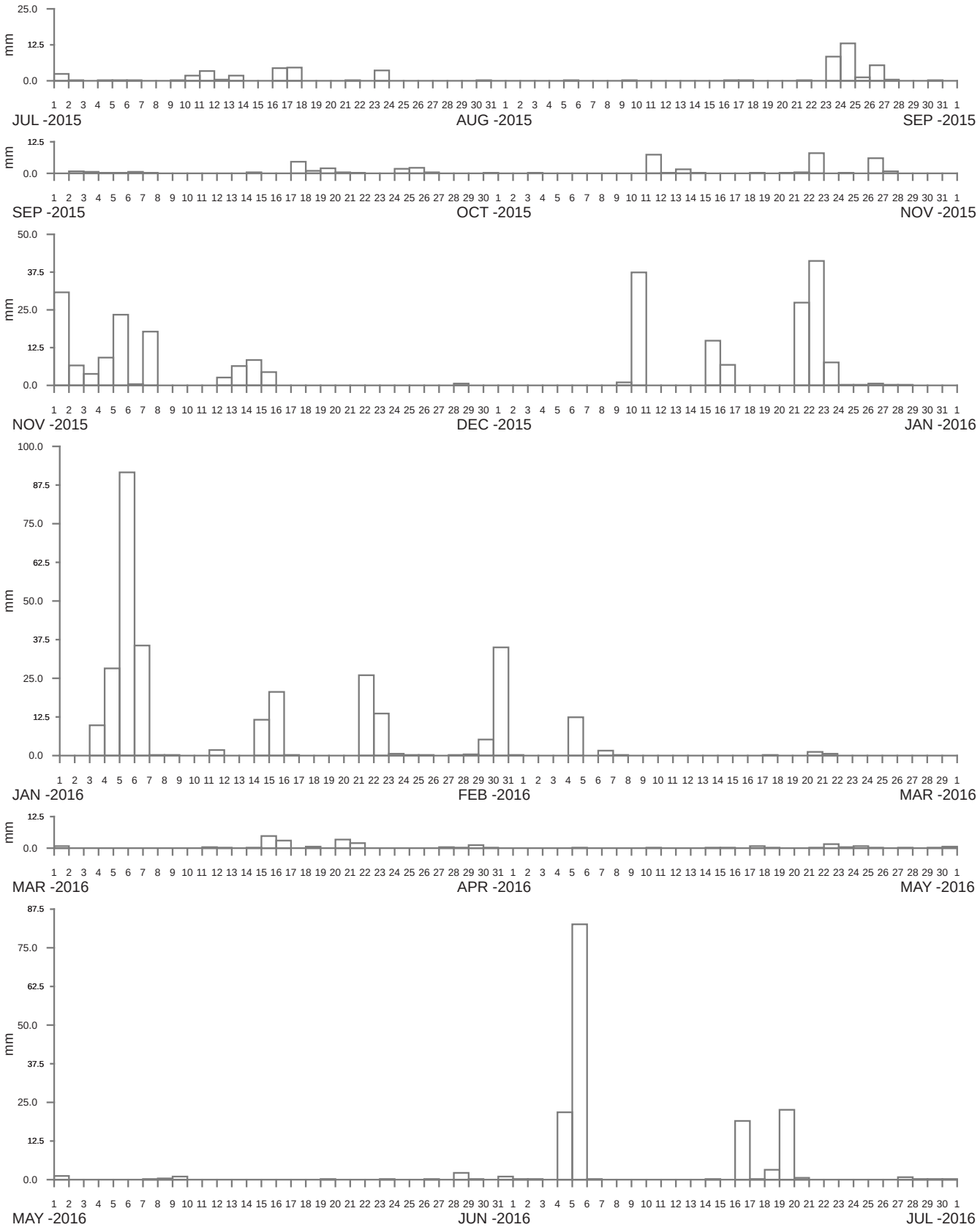
Public Works
Manly Hydraulics Laboratory

HAWKESBURY RIVER AT COLO JUNCTION
2015–2016

MHL Report 2476

Figure 66

DRAWING 2476-66.cdr



DATA LOSS

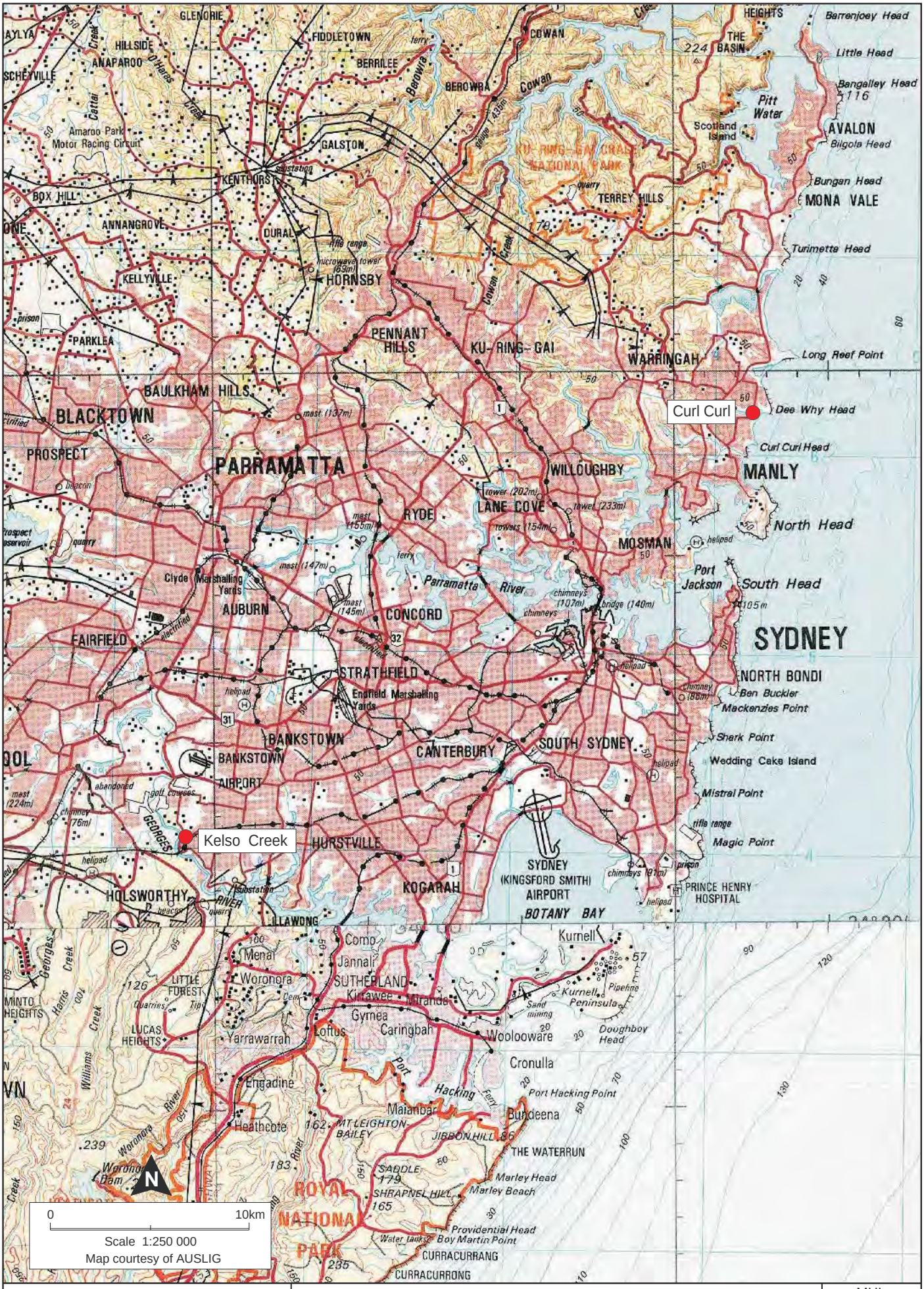
Public Works
Manly Hydraulics Laboratory

HAWKESBURY RIVER AT SACKVILLE DOWNSTREAM 2015–2016

MHL Report 2476

Figure 67

DRAWING 2476-67.cdr



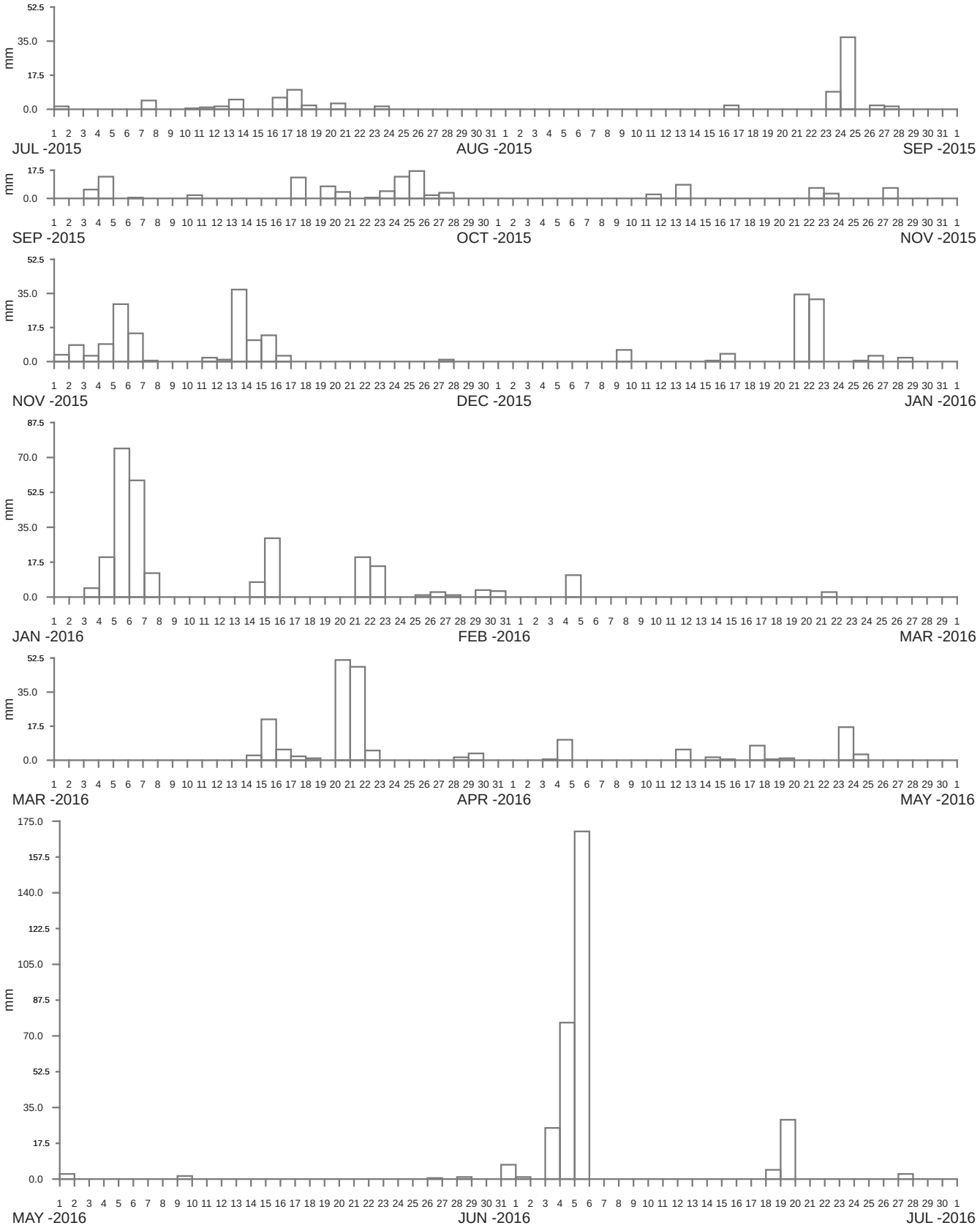
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
SYDNEY COASTAL REGION

MHL Report 2476

Figure 68

DRAWING 2476-68.cdr



DATA LOSS

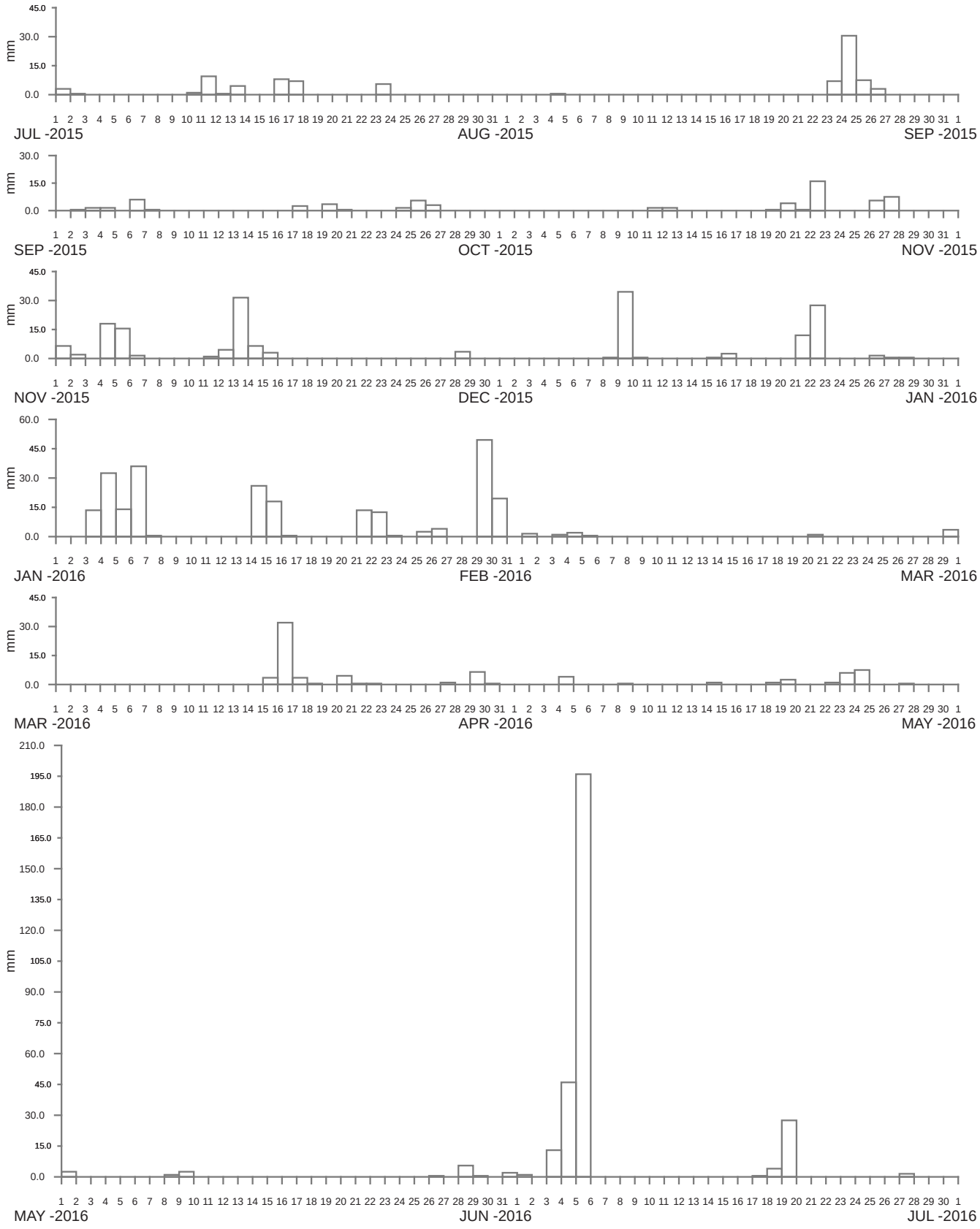
Public Works
Manly Hydraulics Laboratory

CURL CURL LAGOON AT CURL CURL
2015–2016

MHL Report 2476

Figure 69

DRAWING 2476-69.cdr



DATA LOSS

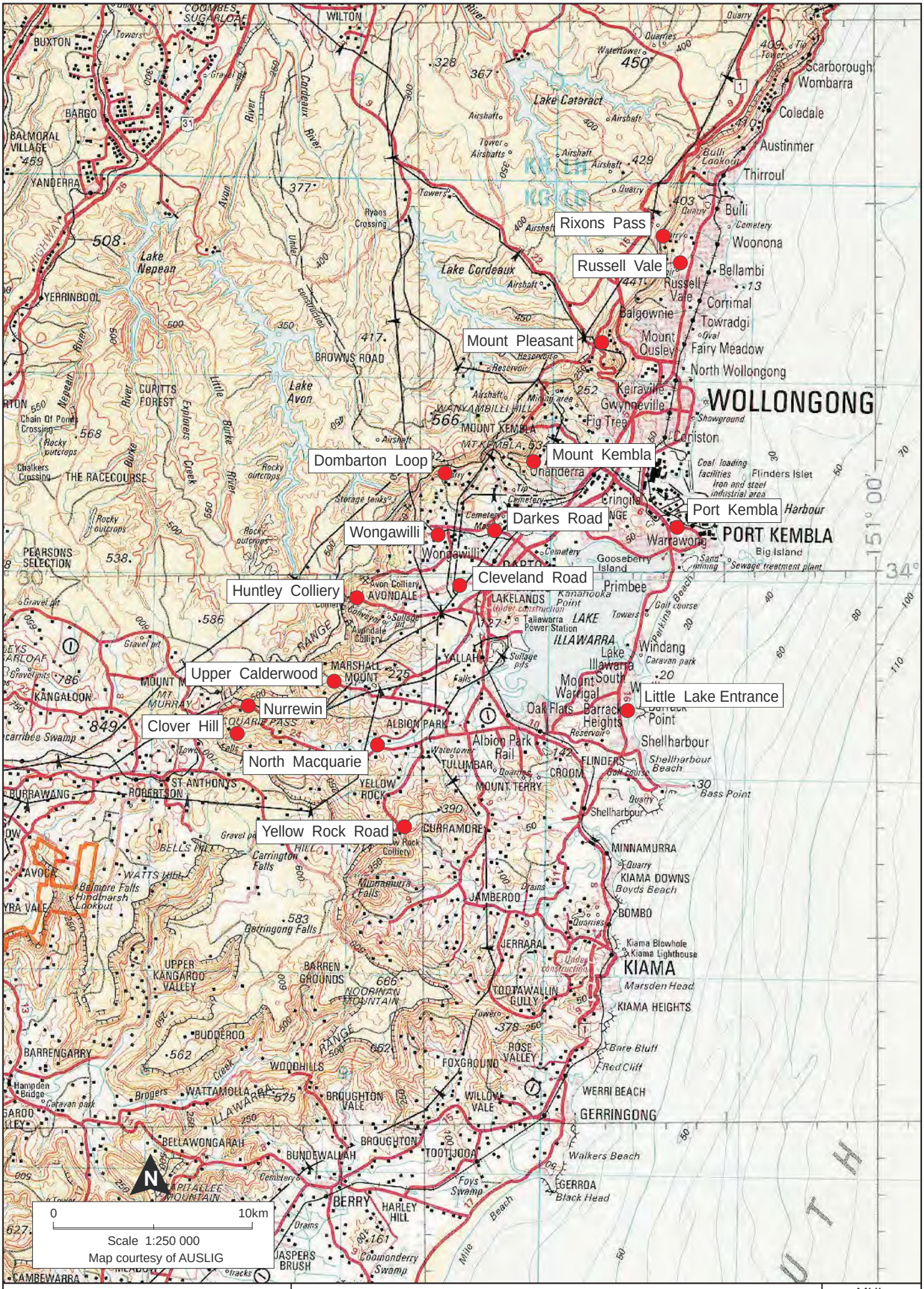
Public Works
Manly Hydraulics Laboratory

KELSO CREEK AT KELSO CREEK
2015–2016

MHL Report 2476

Figure 70

DRAWING 2476-70.cdr



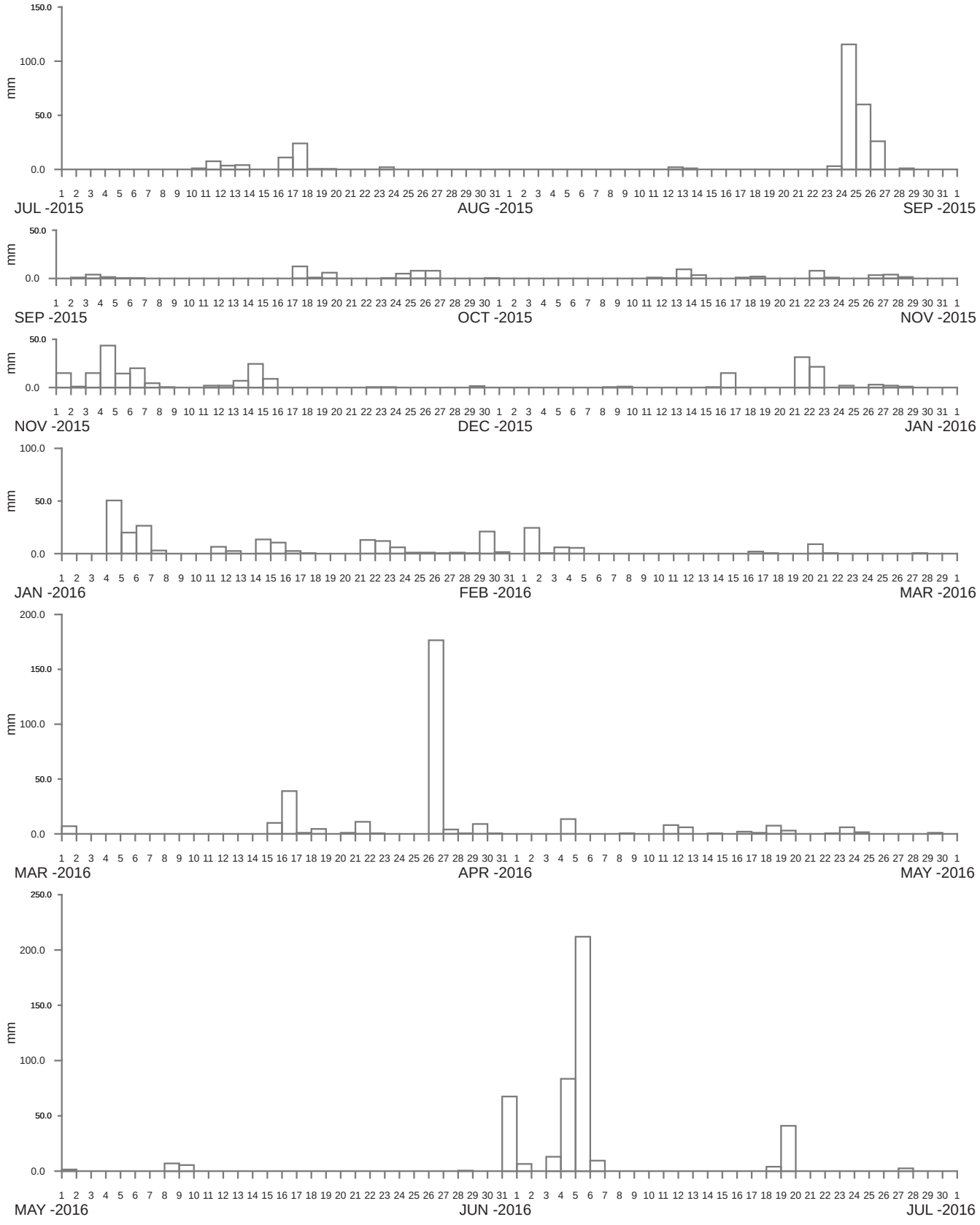
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
WOLLONGONG COASTAL REGION

MHL Report 2476

Figure 71

DRAWING 2476-71.cdr



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

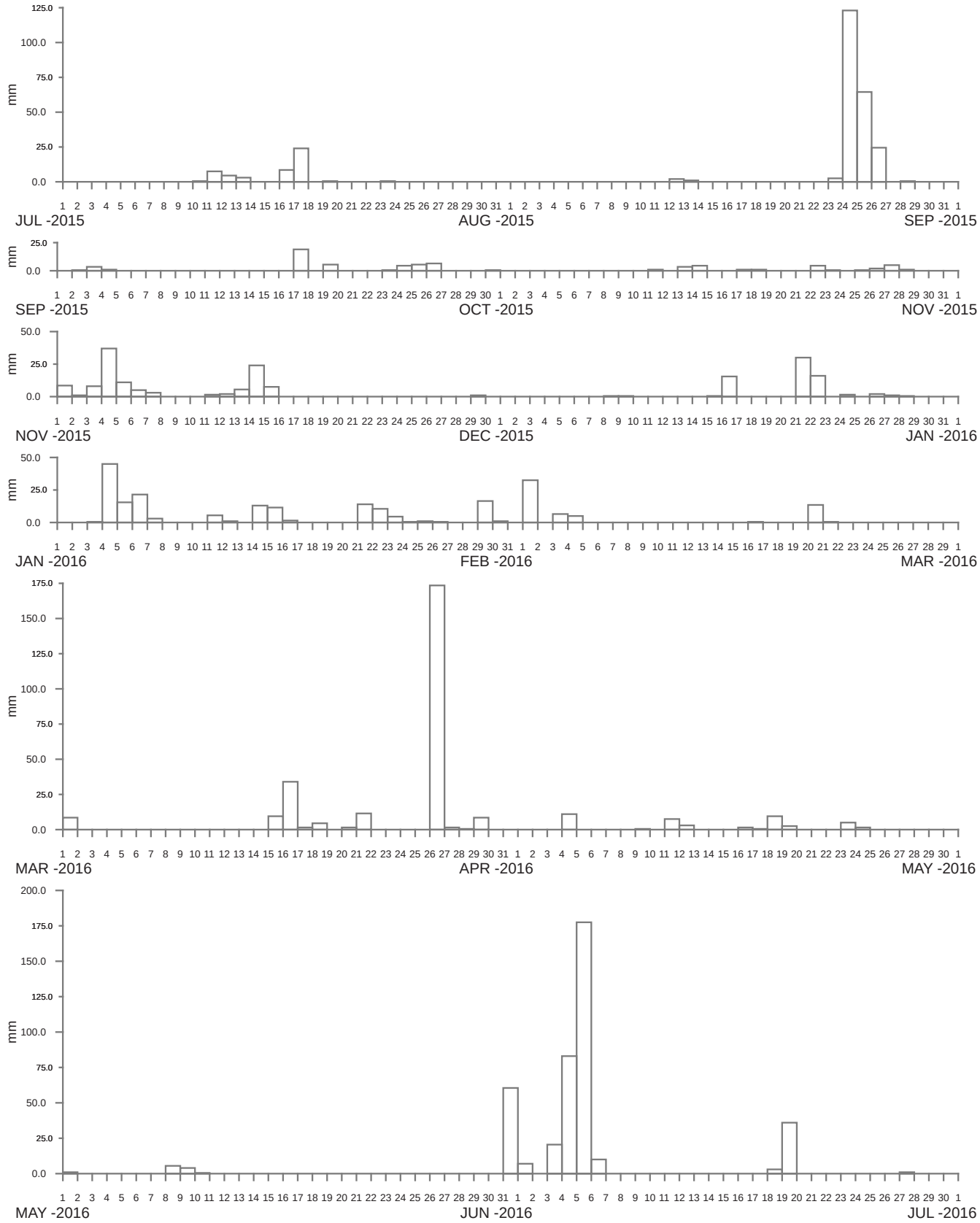
Public Works
Manly Hydraulics Laboratory

RIXONS PASS AT RIXONS PASS ROAD
O2015–2016

MHL Report 2476

Figure 72

DRAWING 2476-72.cdr



DATA LOSS

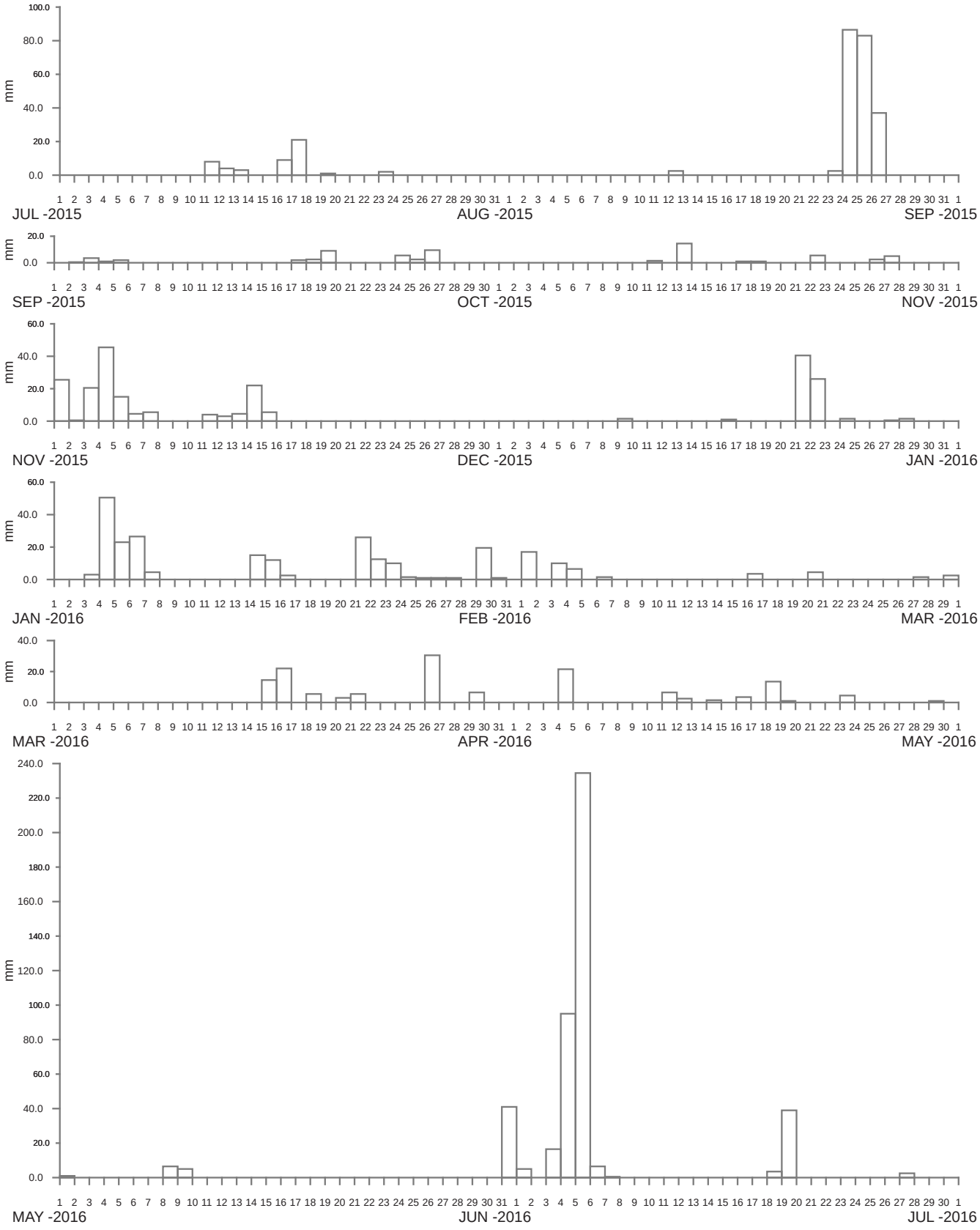
Public Works
Manly Hydraulics Laboratory

RUSSELL VALE AT WHITING CRESCENT
2015–2016

MHL Report 2476

Figure 73

DRAWING 2476-73.cdr



DATA LOSS

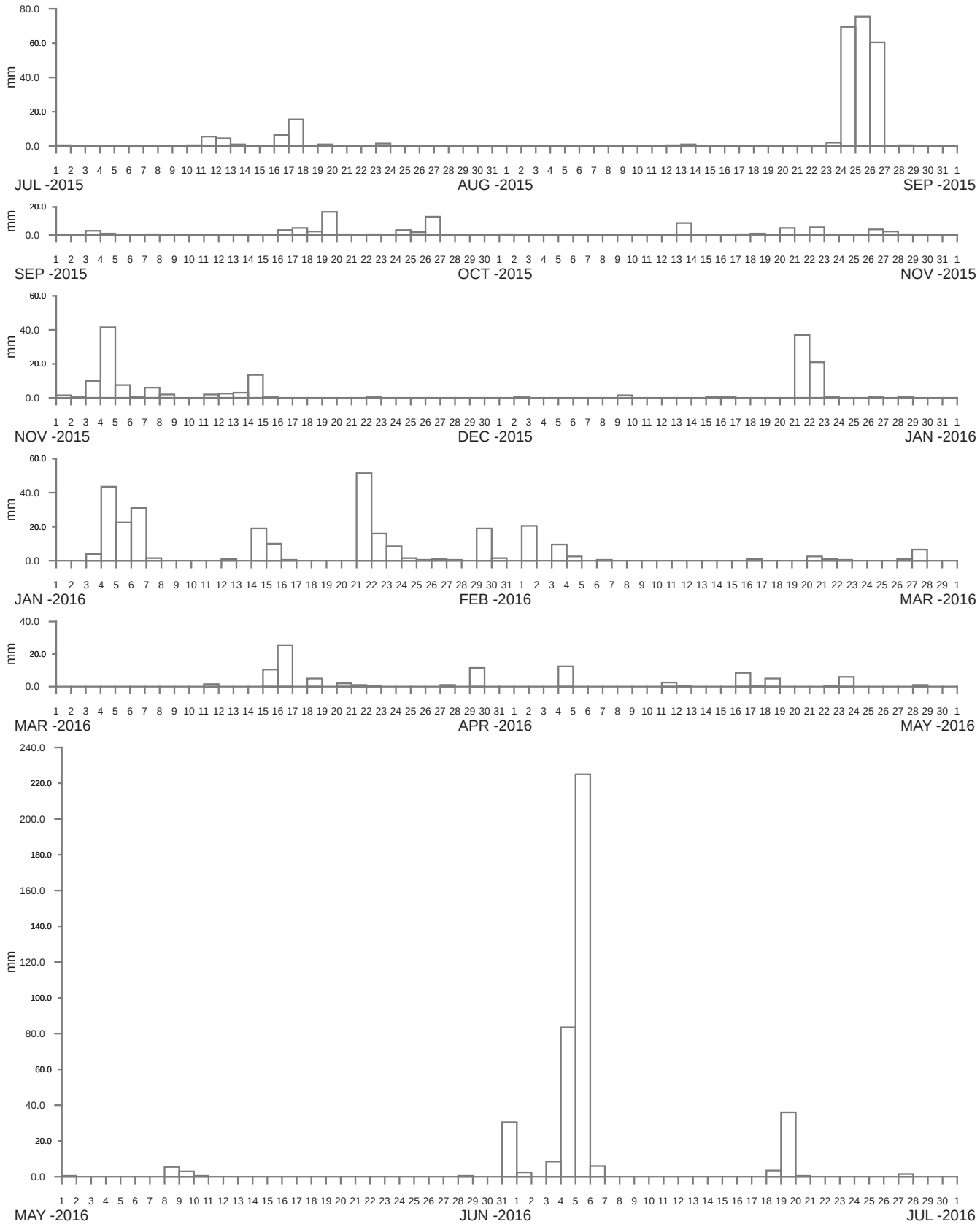
Public Works
Manly Hydraulics Laboratory

MOUNT PLEASANT AT PARRISH AVENUE
2015–2016

MHL Report 2476

Figure 74

DRAWING 2476-74.cdr



DATA LOSS

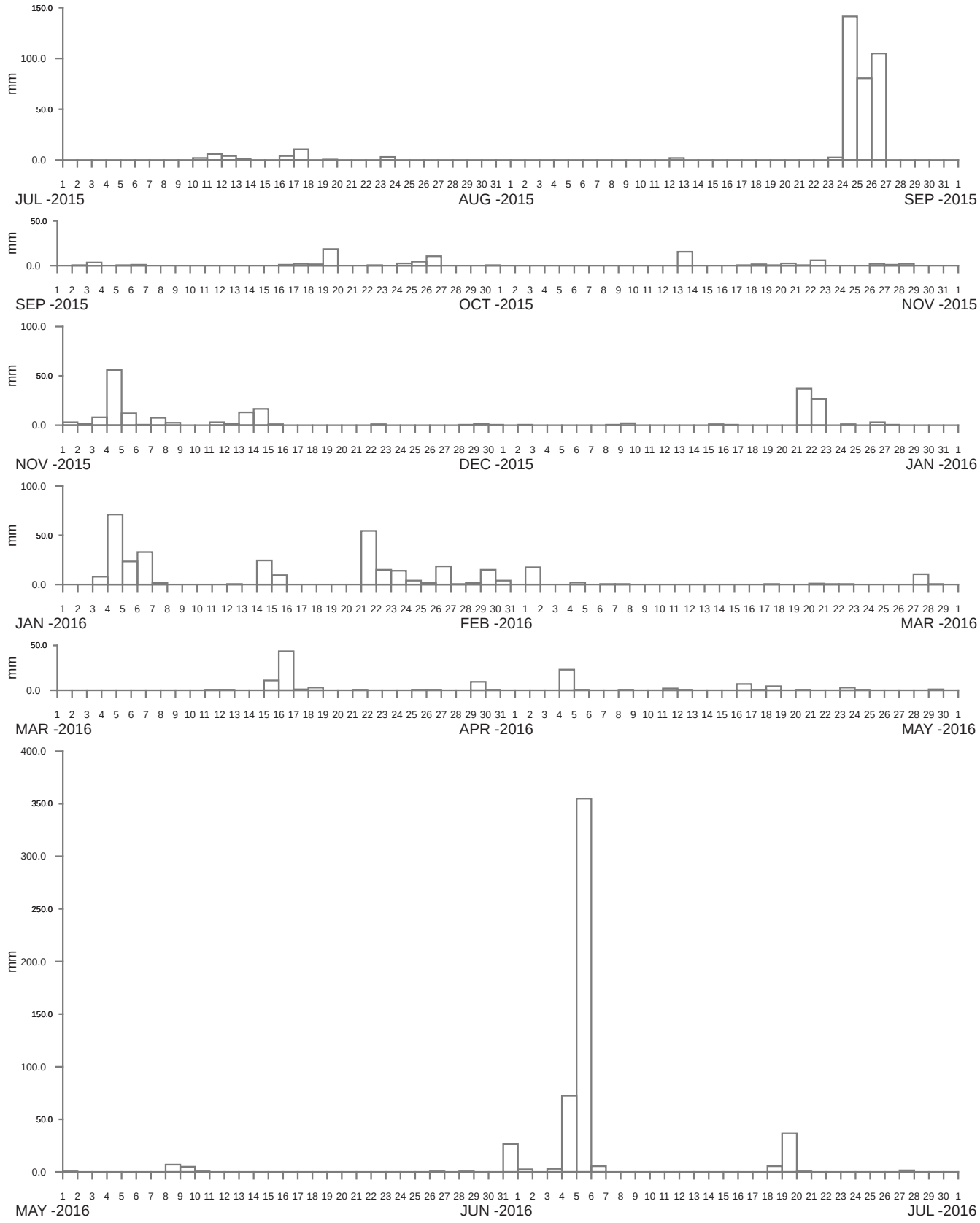
Public Works
Manly Hydraulics Laboratory

MOUNT KEMBLA AT STAFF ROAD
2015–2016

MHL Report 2476

Figure 75

DRAWING 2476-75.cdr



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

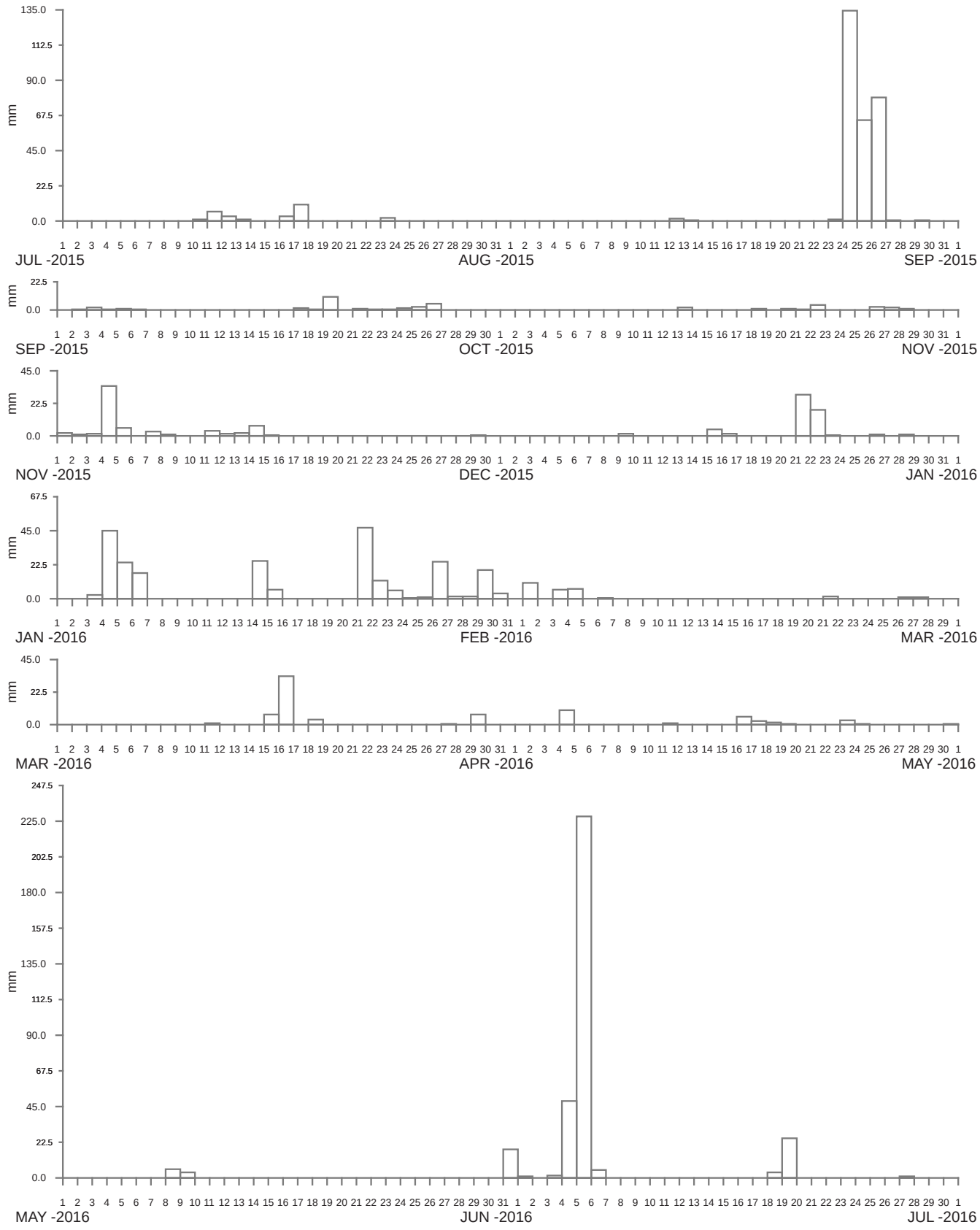
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

DOMBARTON LOOP AT PAYNES ROAD
2015–2016

MHL Report 2476

Figure 76

DRAWING 2476-76.cdr



DATA LOSS

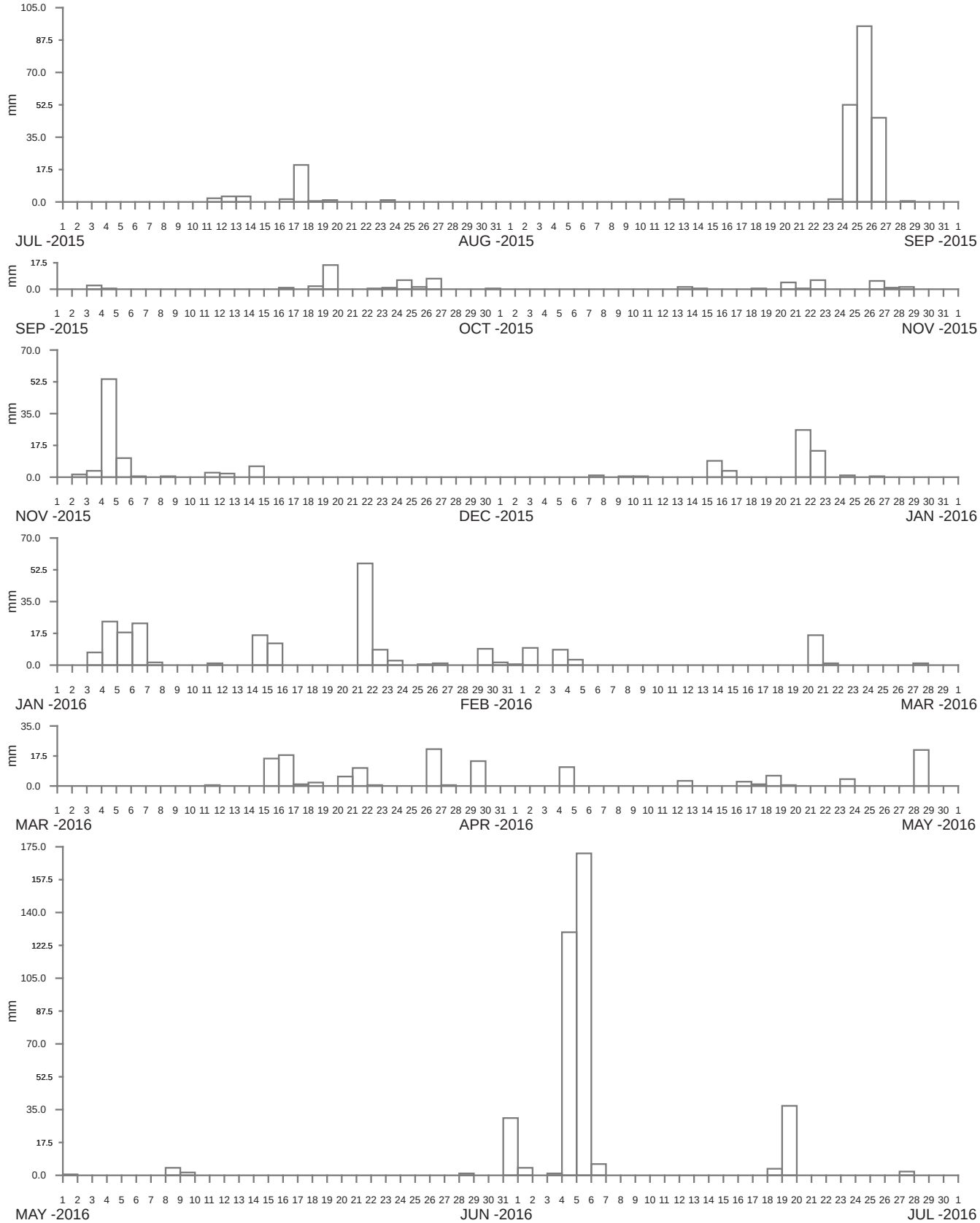
Public Works
Manly Hydraulics Laboratory

WONGAWILLI AT JERSEY FARM ROAD
2015–2016

MHL Report 2476

Figure 77

DRAWING 2476-77.cdr



DATA LOSS

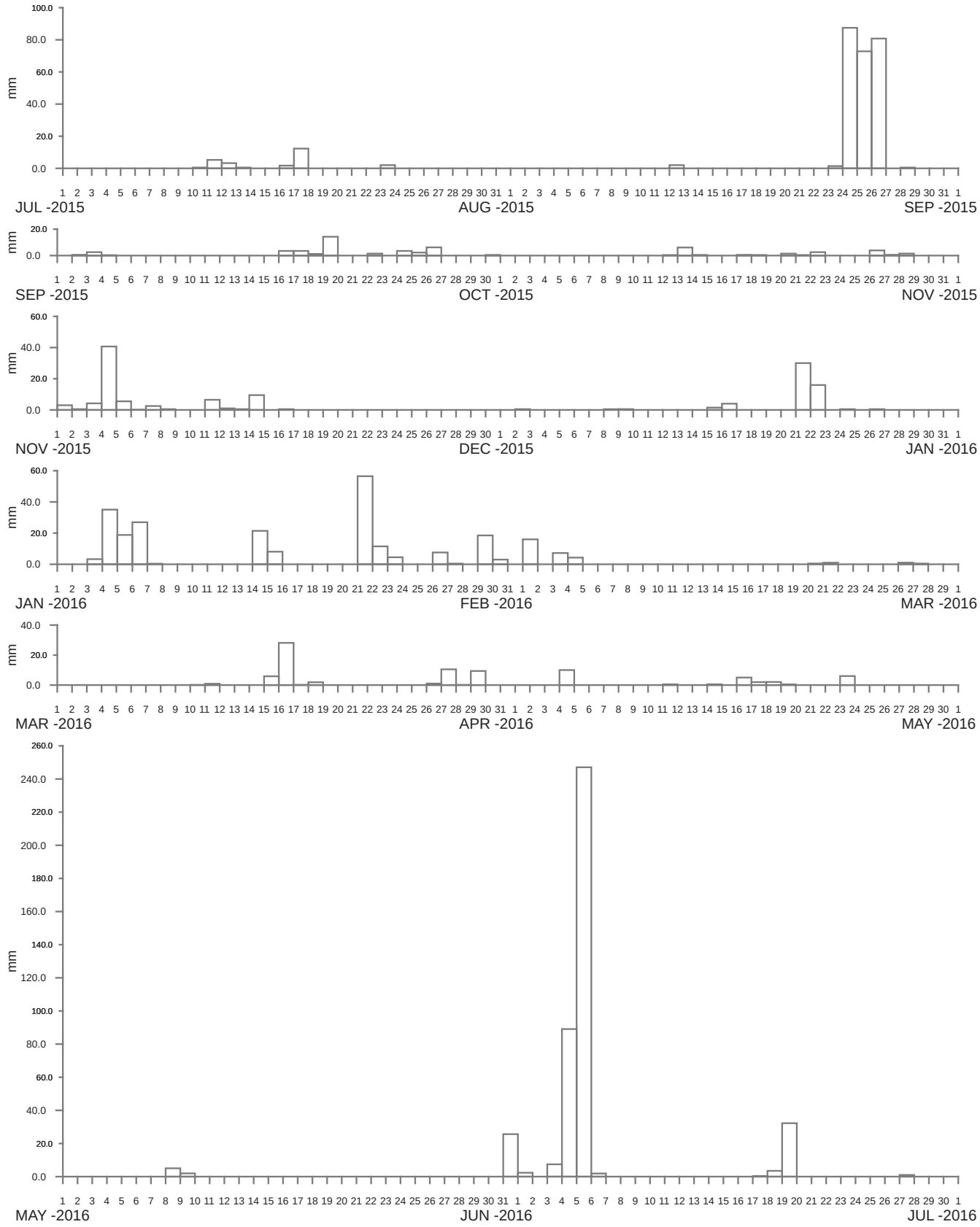
Public Works
Manly Hydraulics Laboratory

PORT KEMBLA AT FIVE ISLANDS ROAD
2015–2016

MHL Report 2476

Figure 78

DRAWING 2476-78.cdr



DATA LOSS

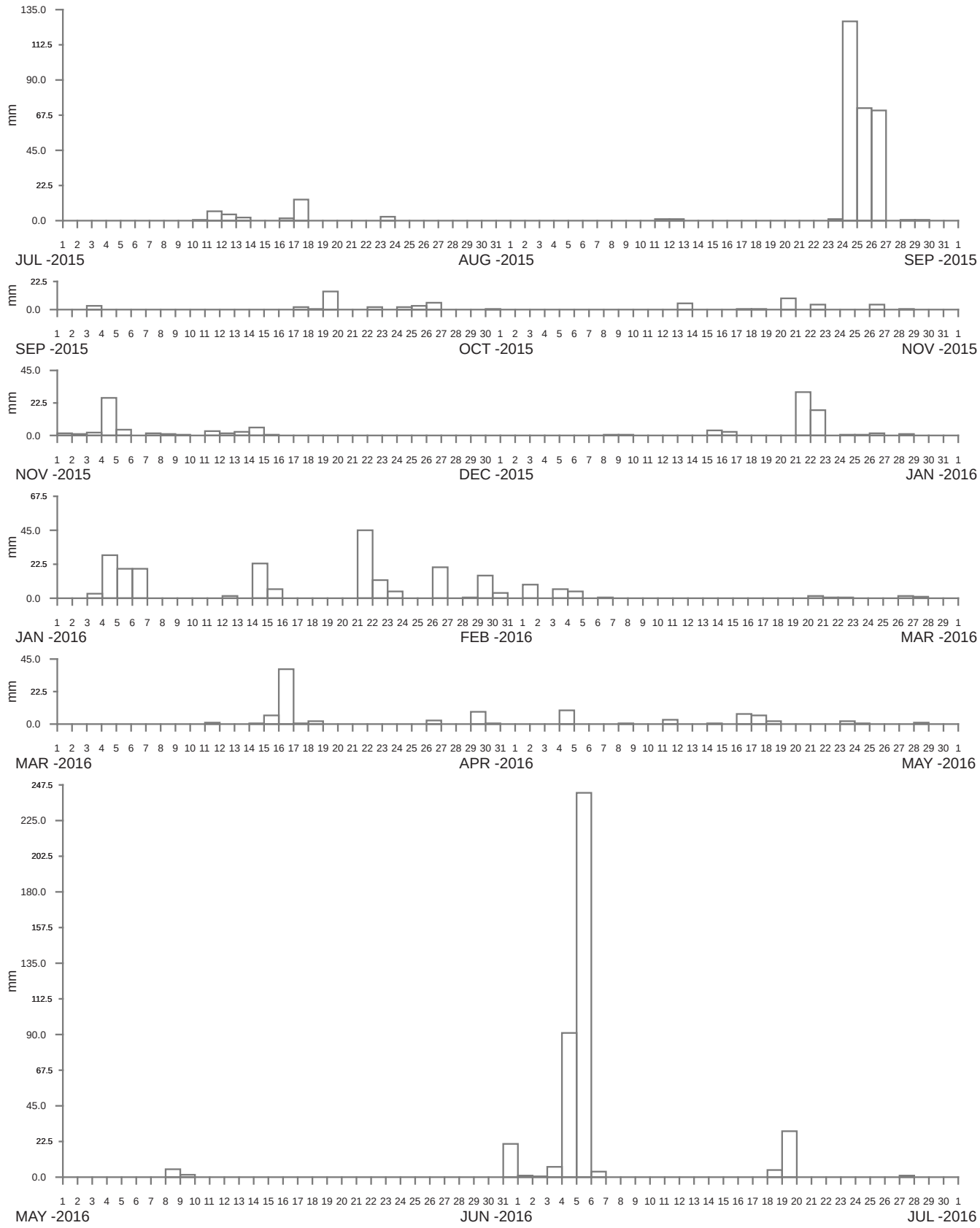
Public Works
Manly Hydraulics Laboratory

DAPTO AT DARKES ROAD
2015–2016

MHL Report 2476

Figure 79

DRAWING 2476-79.cdr



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

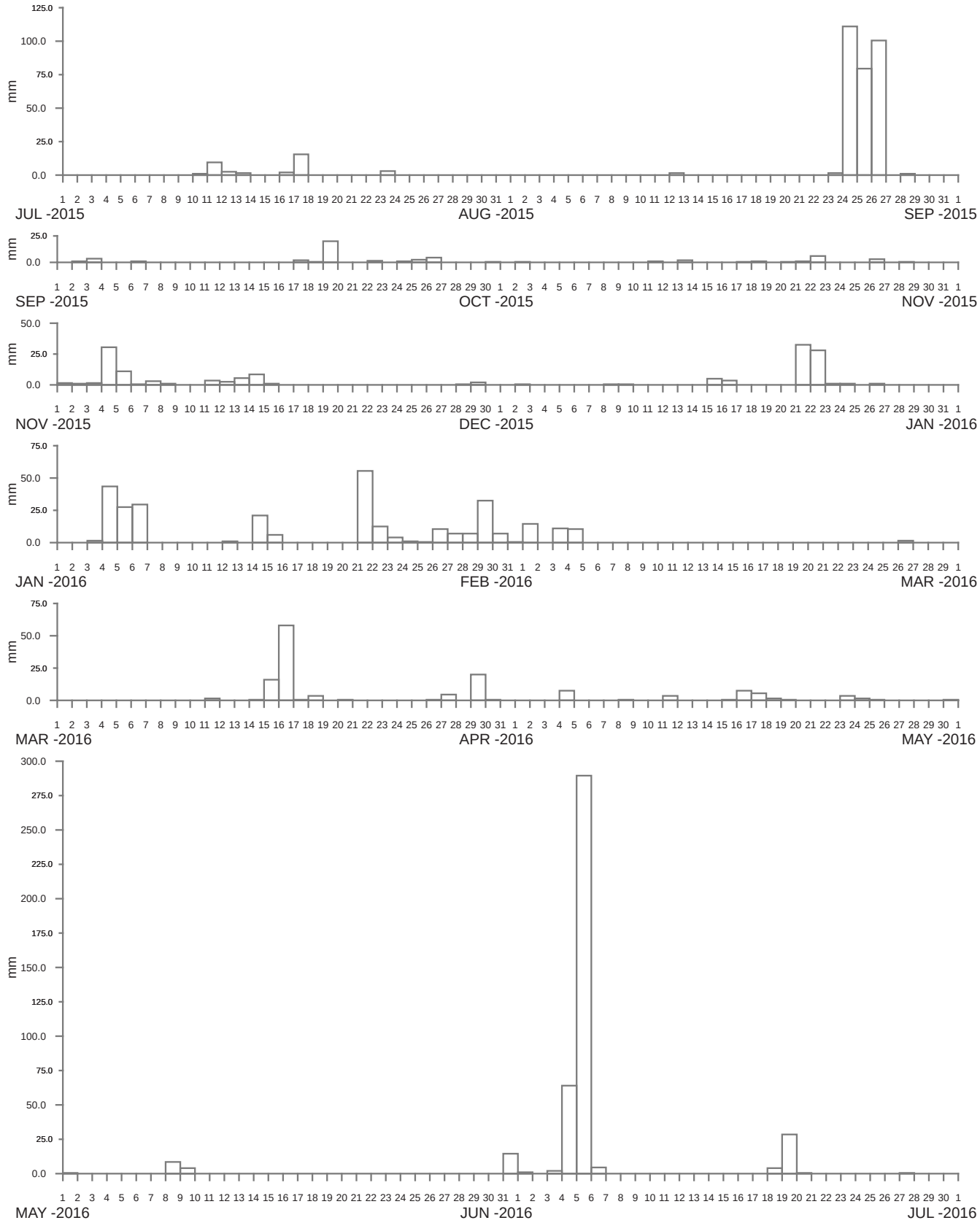
NSW GOVERNMENT
Public Works
Manly Hydraulics Laboratory

CLEVELAND ROAD AT CLEVELAND ROAD
2015–2016

MHL Report 2476

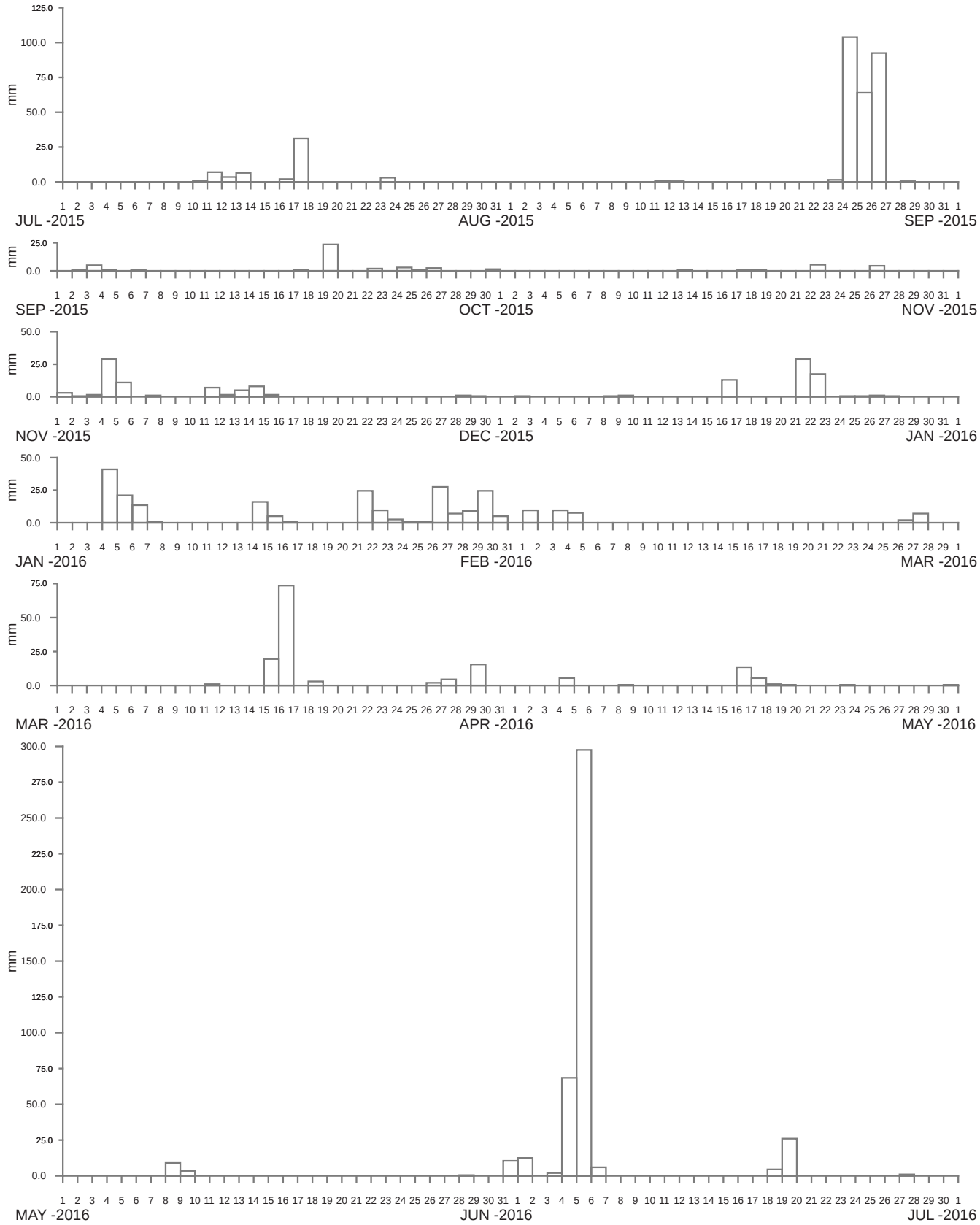
Figure 80

DRAWING 2476-80.cdr



DATA LOSS

NSW GOVERNMENT Public Works Manly Hydraulics Laboratory	HUNTLEY COLLIERY AT AVONDALE ROAD 2015–2016	MHL Report 2476 Figure 81 DRAWING 2476-81.cdr



DATA LOSS

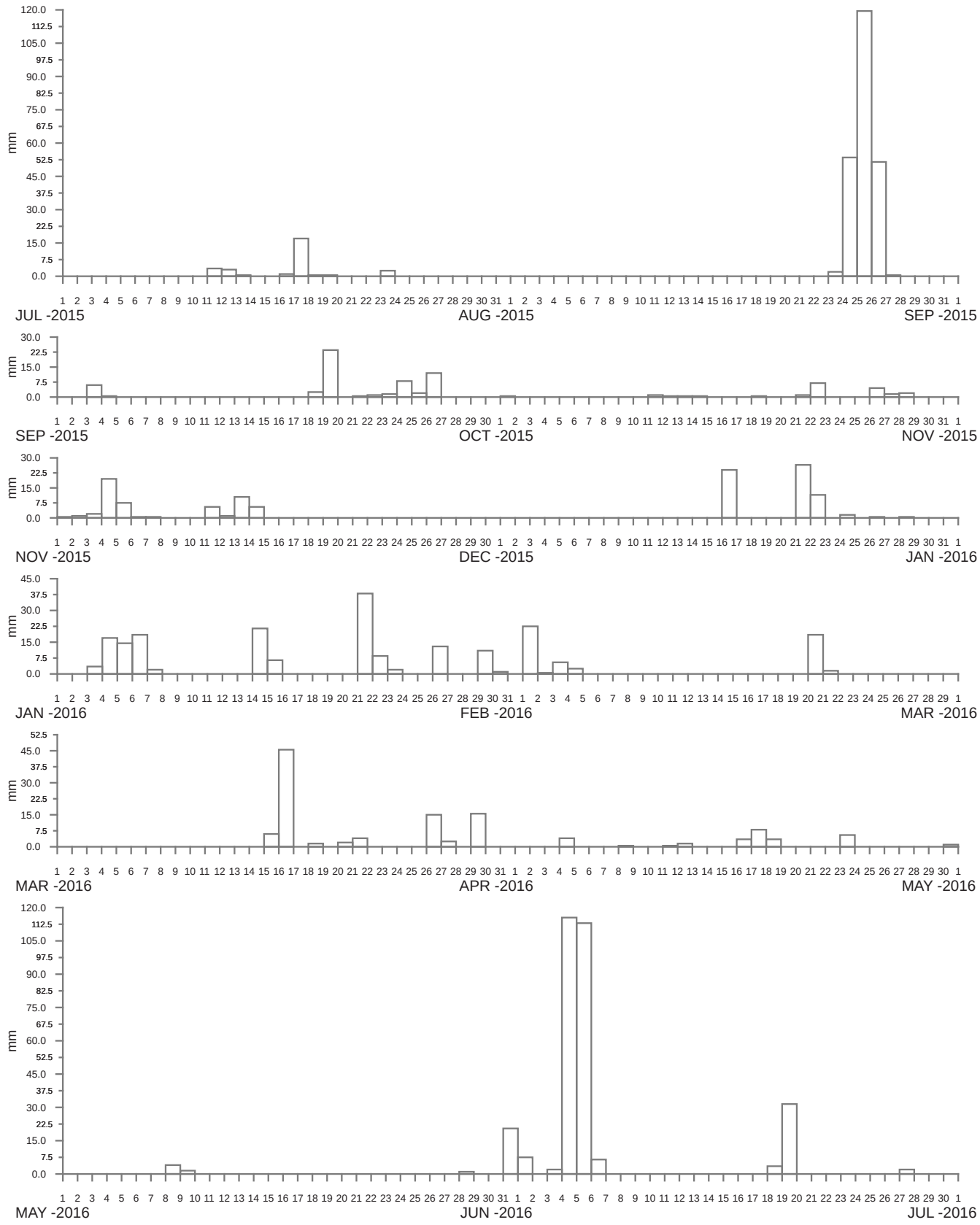
Public Works
Manly Hydraulics Laboratory

UPPER CALDERWOOD AT CALDERWOOD ROAD 2015–2016

MHL Report 2476

Figure 82

DRAWING 2476-82.cdr



DATA LOSS

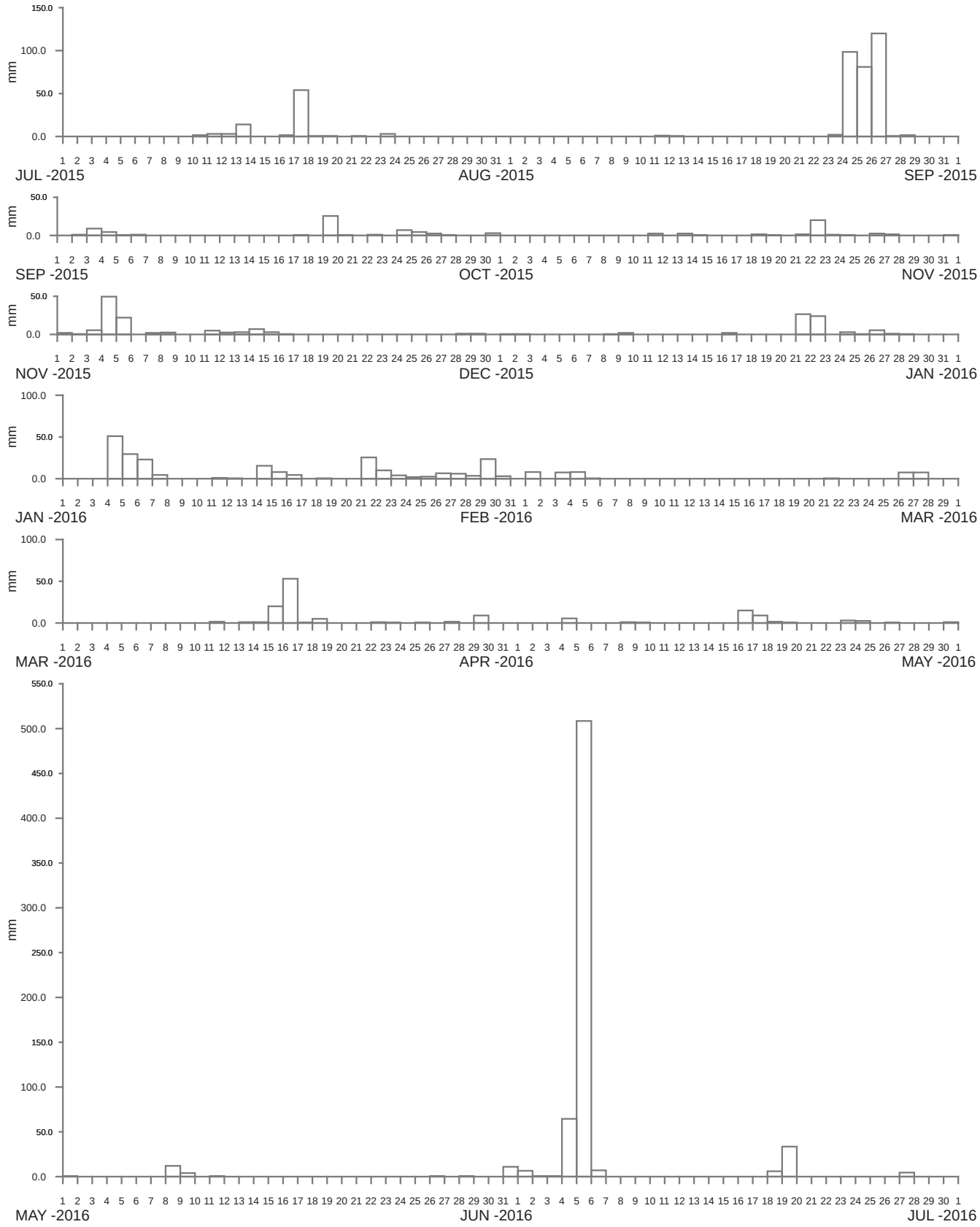
Public Works
Manly Hydraulics Laboratory

LITTLE LAKE ENTRANCE AT LITTLE LAKE
2015–2016

MHL Report 2476

Figure 83

DRAWING 2476-83.cdr



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

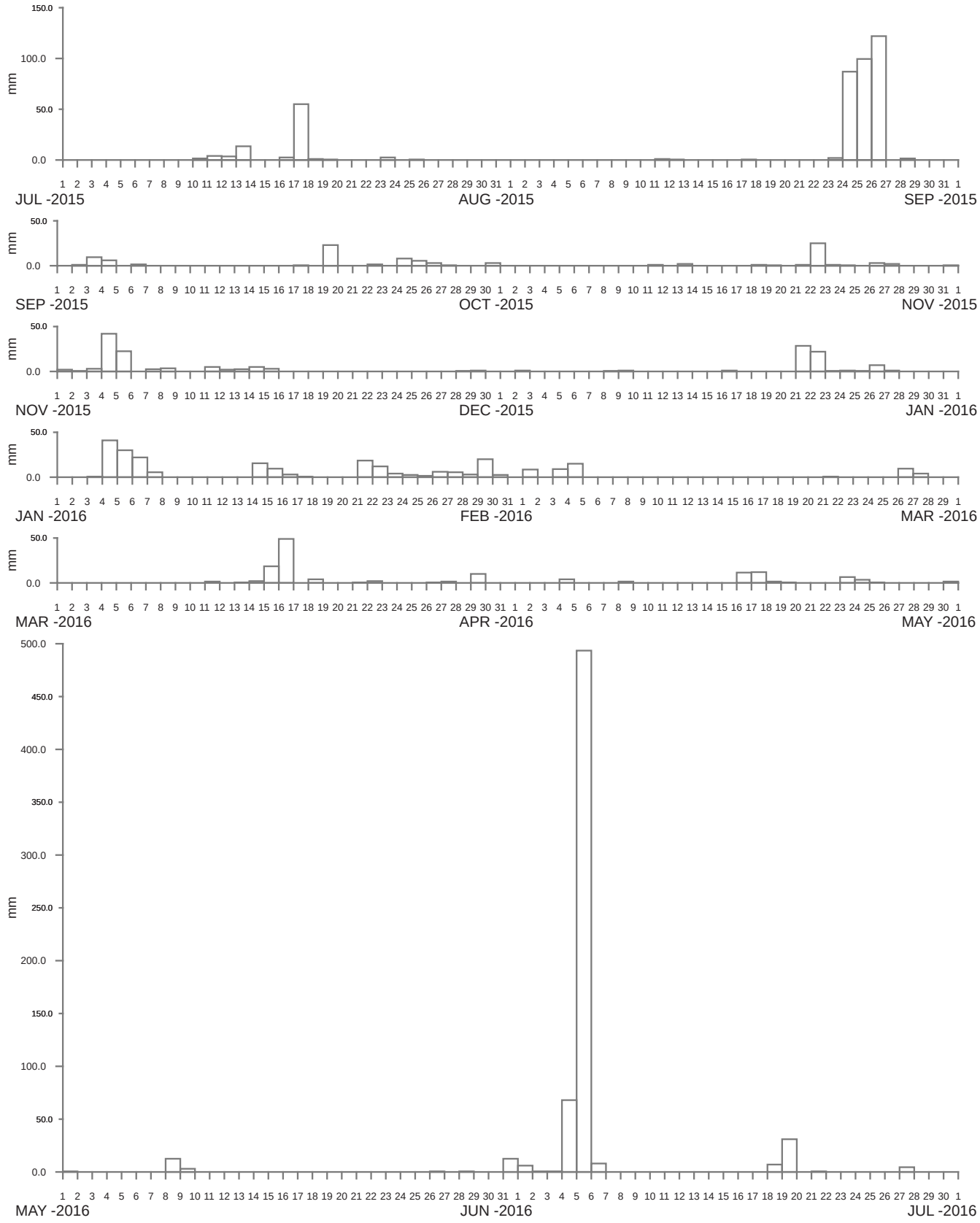
Public Works
Manly Hydraulics Laboratory

NURREWIN AT ILLAWARRA HIGHWAY
2015–2016

MHL Report 2476

Figure 84

DRAWING 2476-84.cdr



DATA LOSS

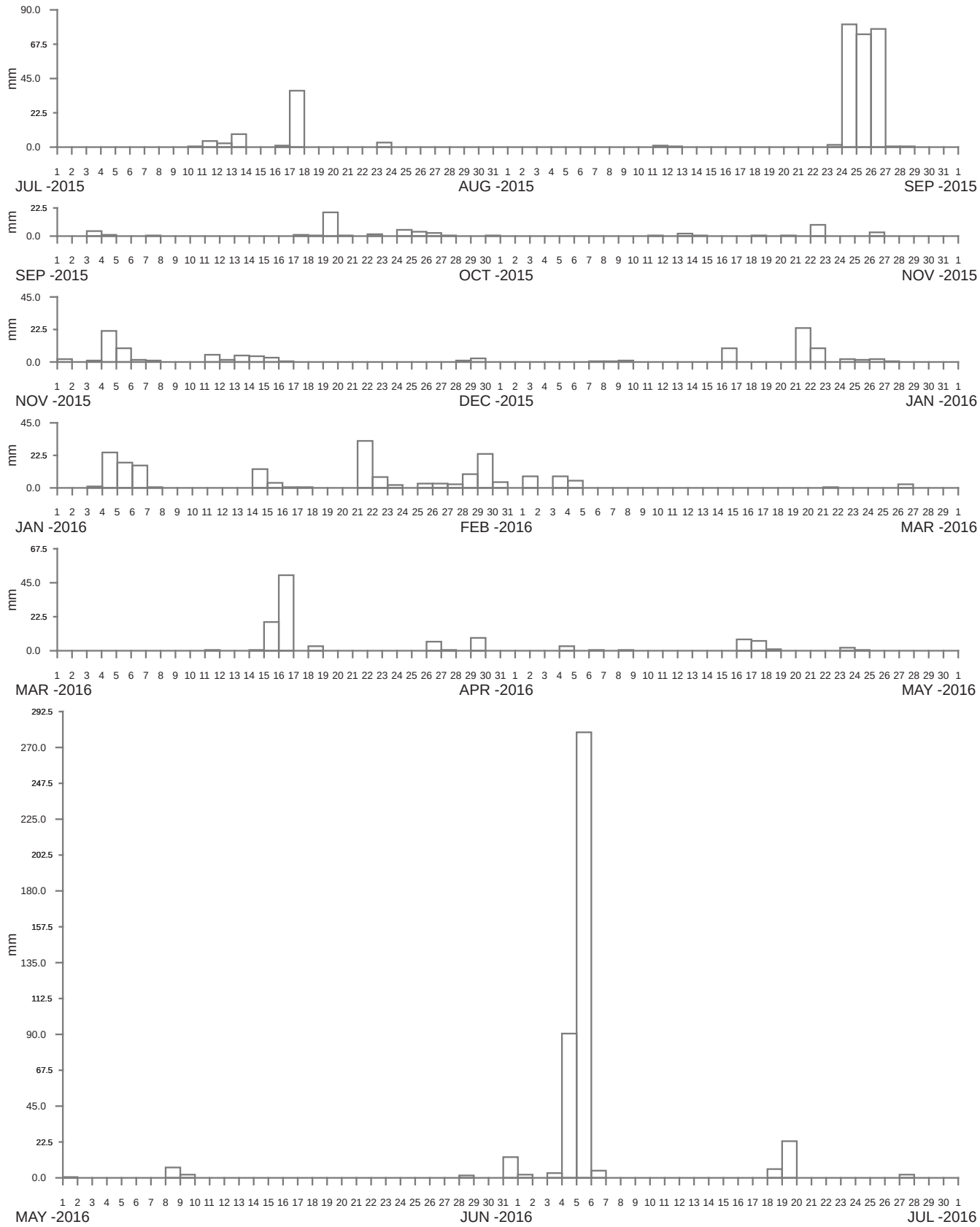
Public Works
Manly Hydraulics Laboratory

CLOVER HILL AT CLOVER HILL ROAD
2015–2016

MHL Report 2476

Figure 85

DRAWING 2476-85.cdr



DATA LOSS

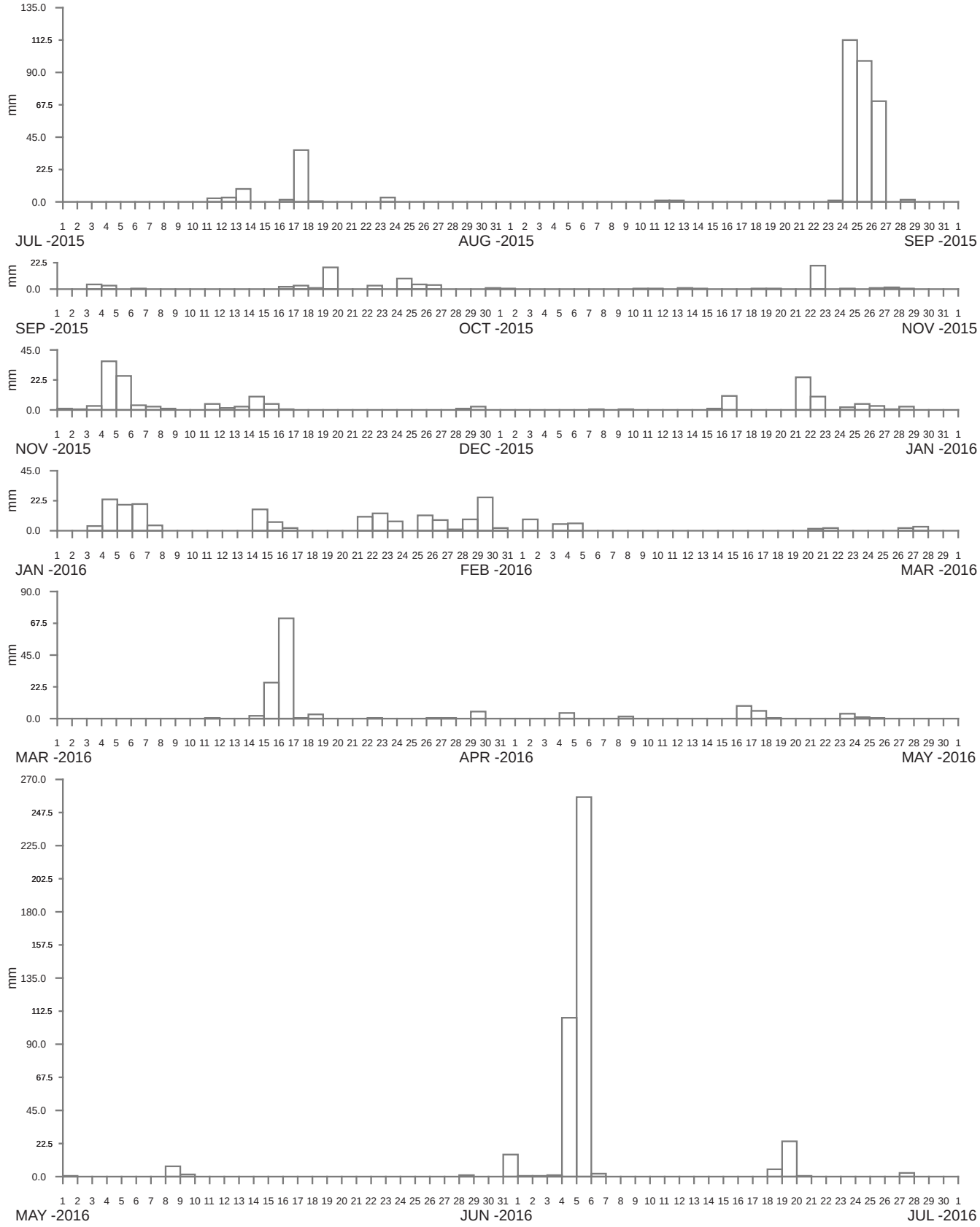
Public Works
Manly Hydraulics Laboratory

NORTH MACQUARIE AT NORTH MACQUARIE ROAD 2015–2016

MHL Report 2476

Figure 86

DRAWING 2476-86.cdr



DATA LOSS

Public Works
Manly Hydraulics Laboratory

YELLOW ROCK ROAD AT YELLOW ROAD ROAD
2015–2016

MHL Report 2476

Figure 87

DRAWING 2476-87.cdr

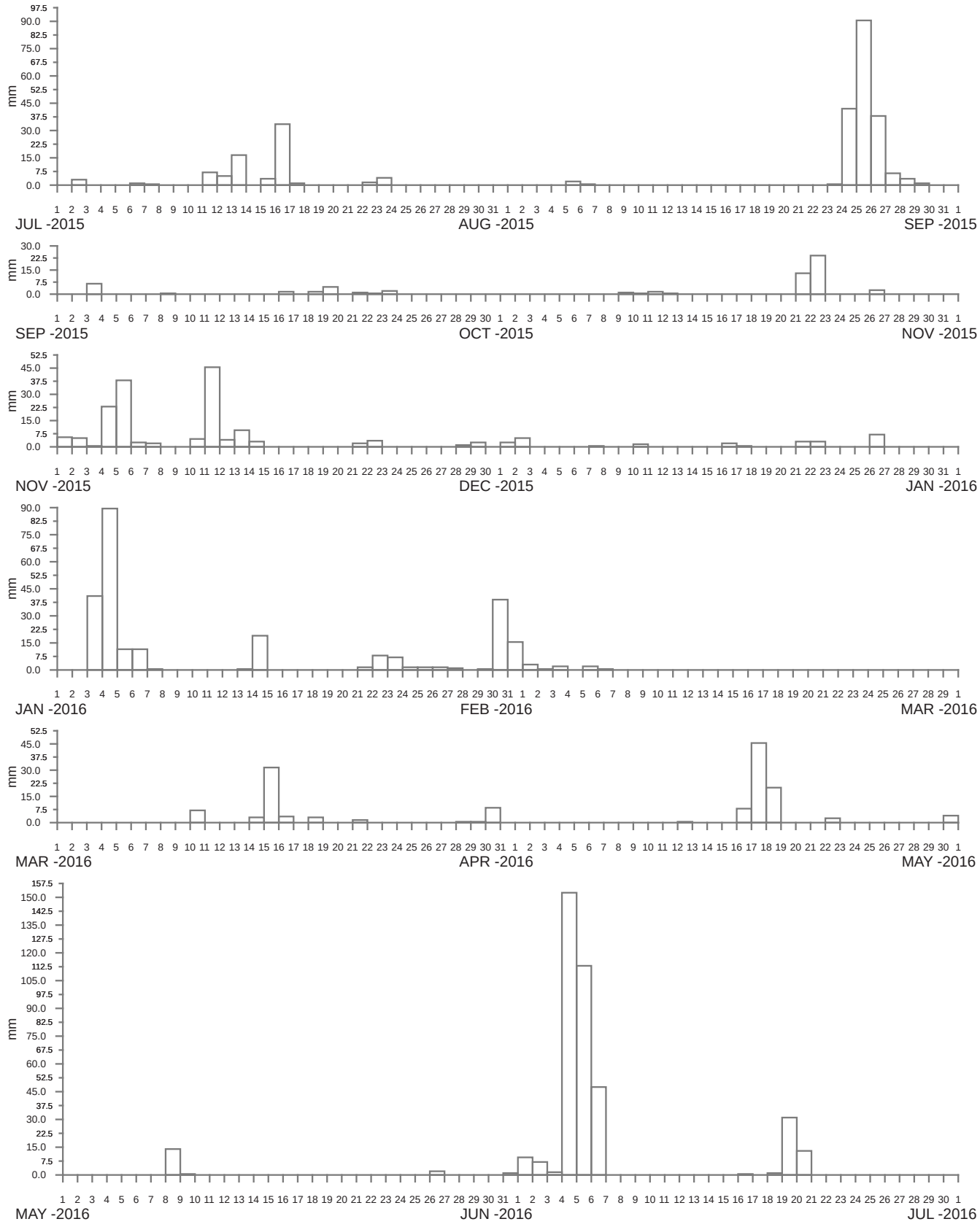
Public Works
Manly Hydraulics Laboratory

RAINFALL STATION LOCATIONS
SOUTH COAST (MID) REGION

MHL Report 2476

Figure 88

DRAWING 2476-88.cdr



DATA LOSS

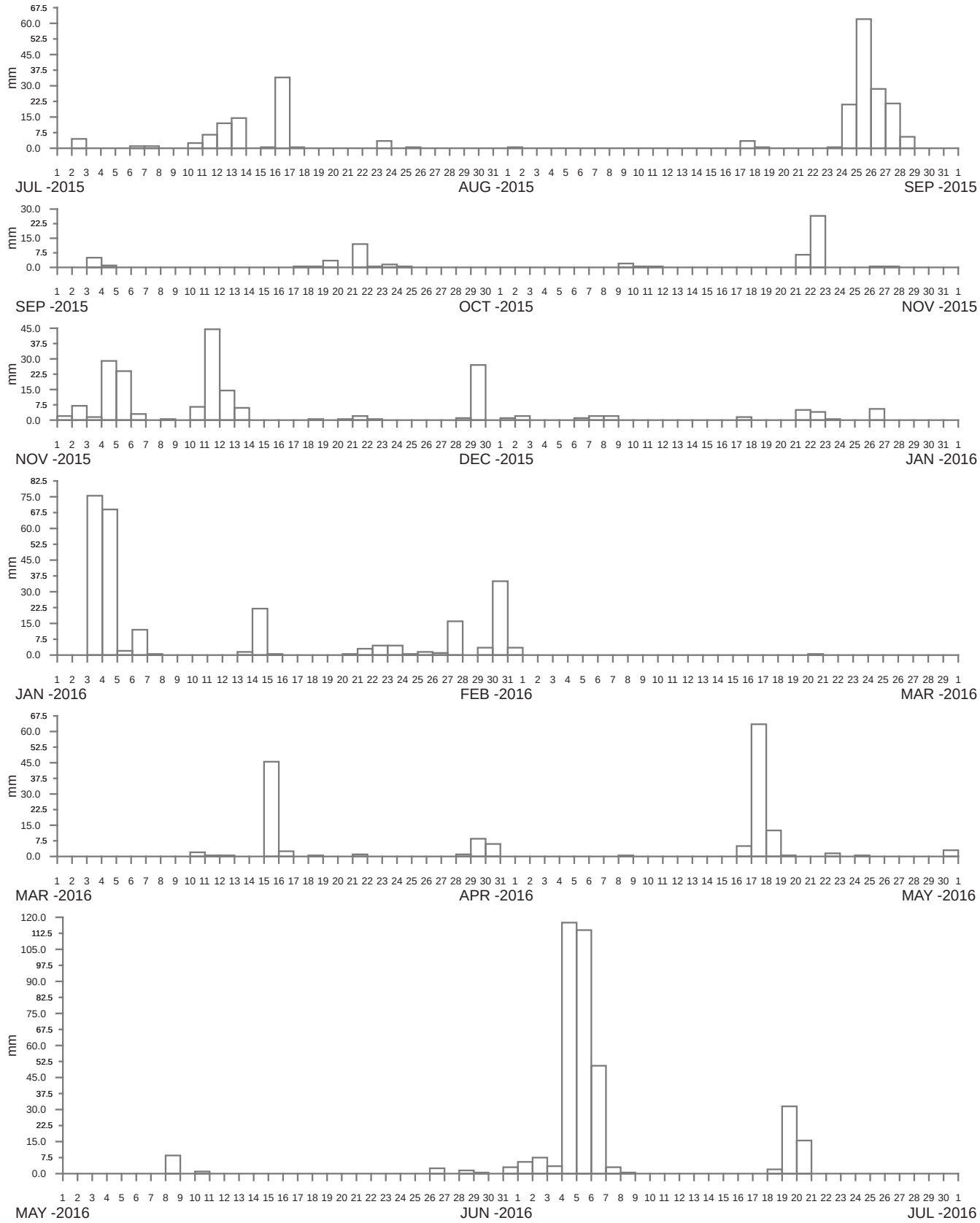
Public Works
Manly Hydraulics Laboratory

WAGONGA INLET AT BARLOWS BAY
2015–2016

MHL Report 2476

Figure 89

DRAWING 2476-89.cdr



DATA LOSS

Public Works
Manly Hydraulics Laboratory

WALLAGA LAKE AT REGATTA POINT
2015–2016

MHL Report 2476

Figure 90

DRAWING 2476-90.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	Shepards 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	Utungun	Dec 1991–ongoing
Macleay	Euroka U/S	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–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
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

Region	Station	Period of data
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
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

Region	Station	Period of data
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	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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SAMPLE DAILY AND MONTHLY RAINFALL PLOTS

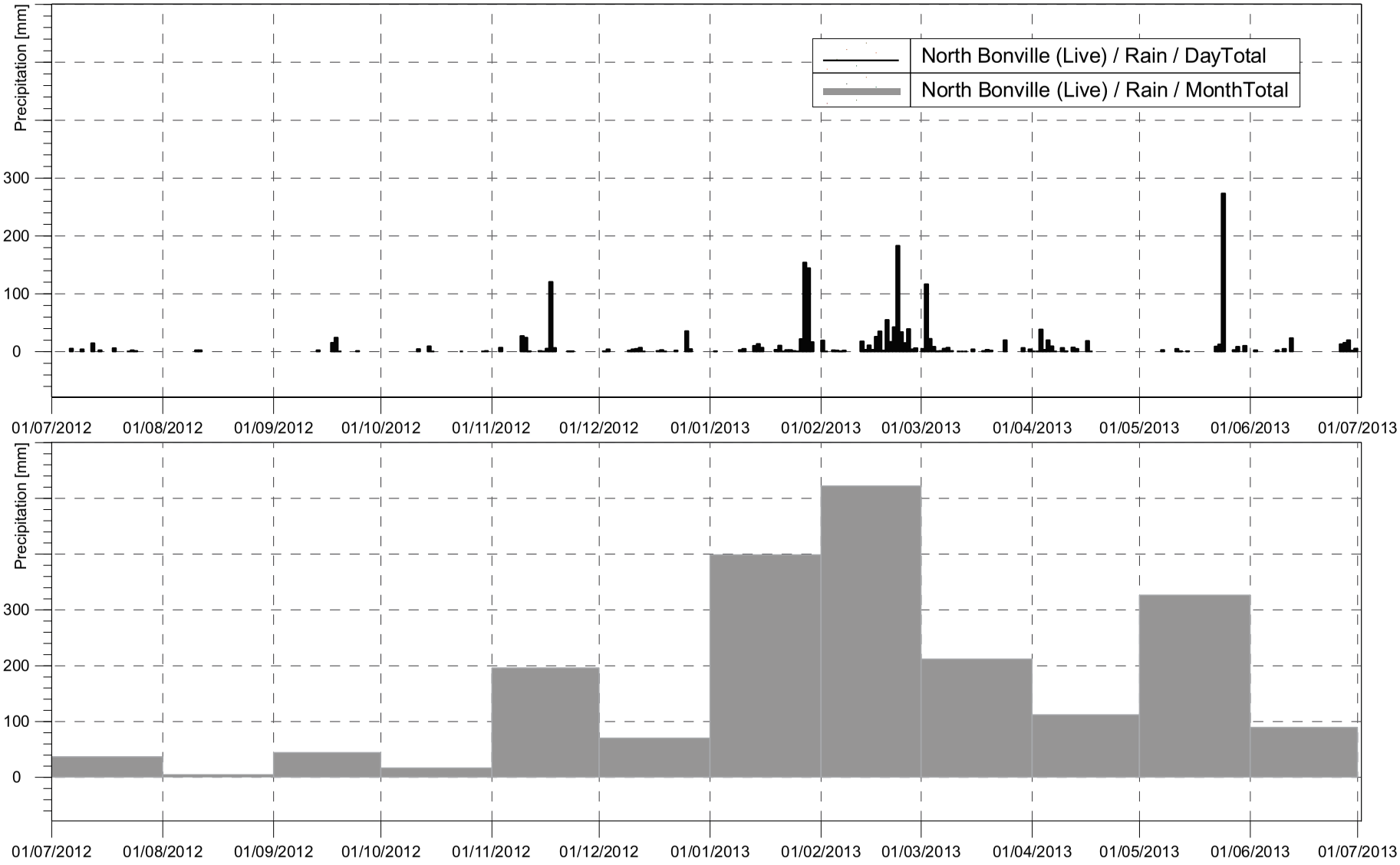

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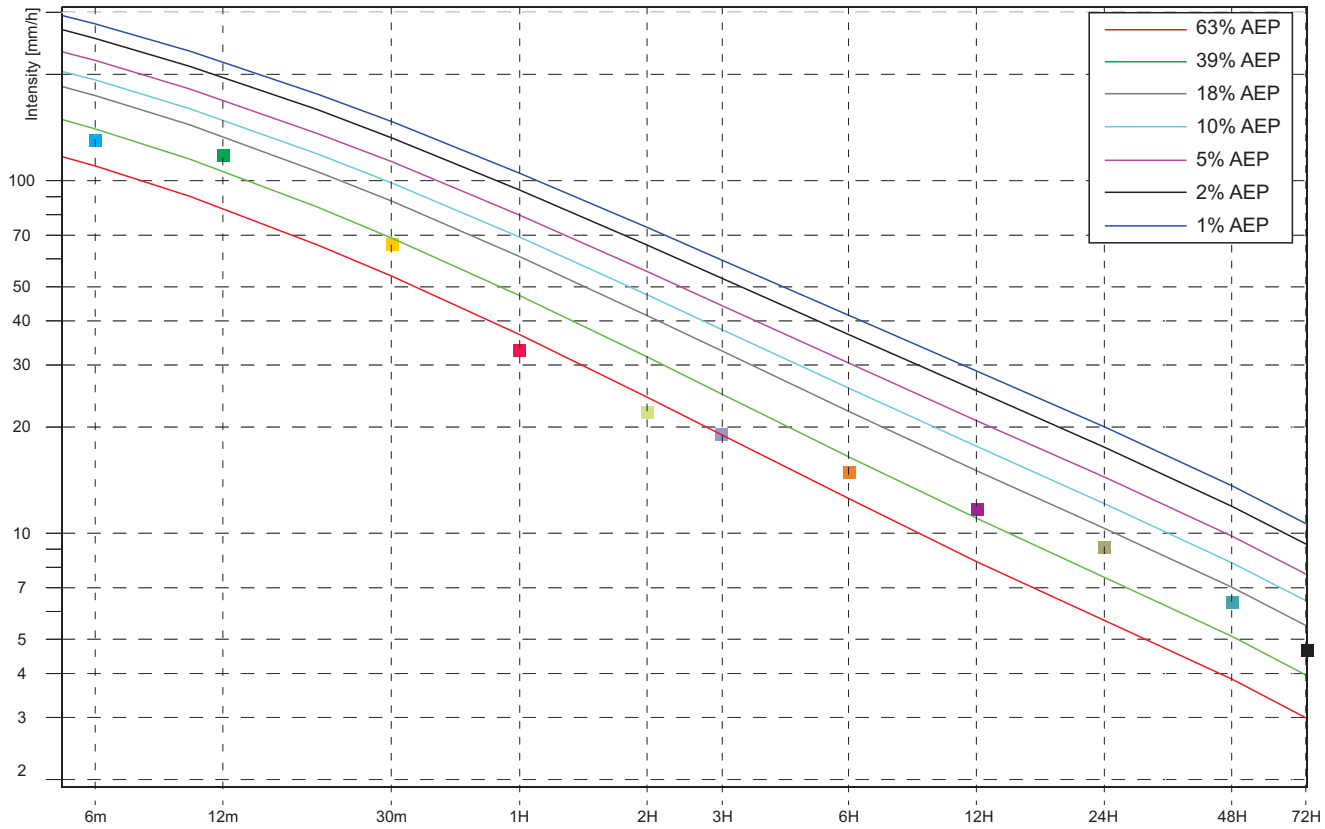
Figure B1

DRAWING 2476-B1.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

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SAMPLE INTENSITY-FREQUENCY-DURATION FORMULATED IN 1987

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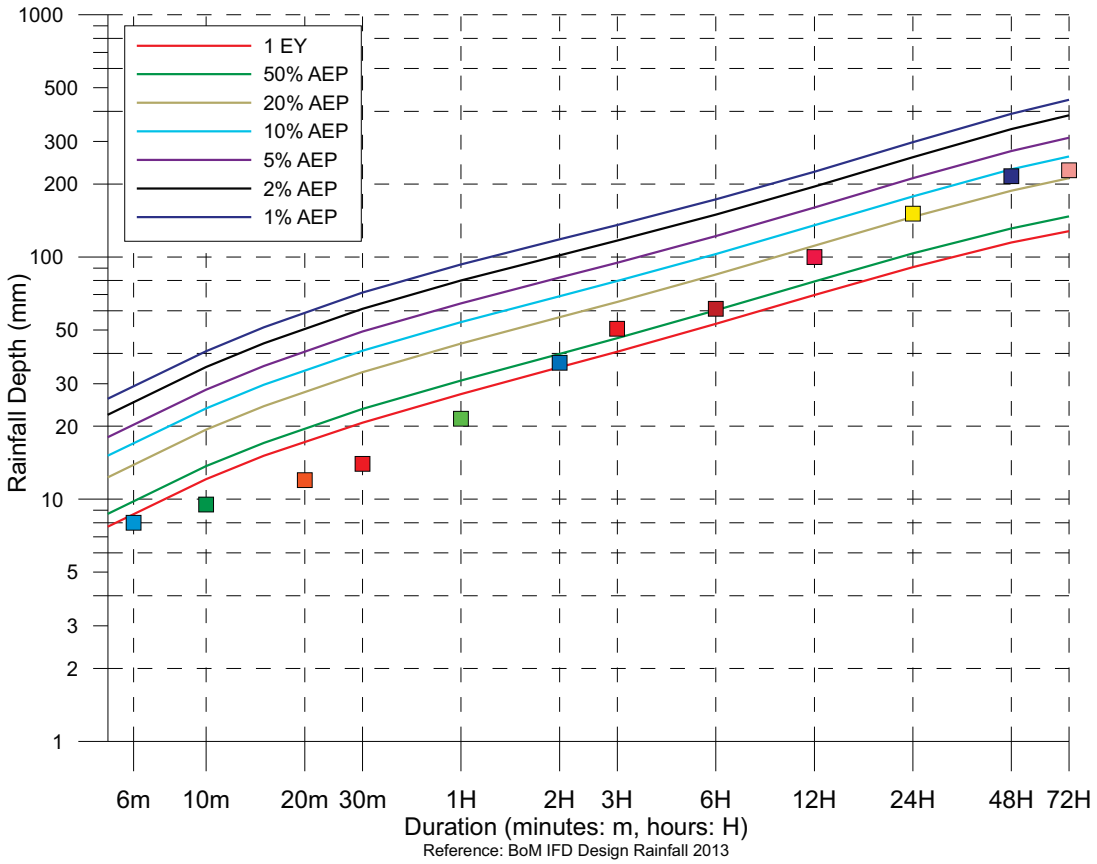
Figure B2

DRAWING 2476-B2.cdr

Site owner: MHL Latitude: -33.1752 Longitude: 151.4835

AEP= Annual Exceedance Probability
EY = Exceedance per Year



Reference: BoM IFD Design Rainfall 2013

Wyee Basin Rainfall Depth 01 April 2015 – 05 May 2015		
Duration (minutes: m) (hours: H)	**Rainfall Depth (mm)**	**Time/Date**
6m	8.0	01:24_04/04/2015
10m	9.5	01:20_04/04/2015
20m	12.0	01:12_04/04/2015
30m	14.0	20:56_21/04/2015
1H	21.5	20:58_20/04/2015
2H	36.5	20:16_21/04/2015
3H	50.5	20:14_21/04/2015
6H	61.0	20:00_20/04/2015
12H	100.0	01:16_04/04/2015
24H	151.0	23:22_20/04/2015
48H	215.5	01:48_20/04/2015
72H	228.0	22:36_19/04/2015

The Bureau of Meteorology (with reference to the Australian Rainfall and Runoff, Institute of Engineers 2013) states: *AEP is defined as The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.*
- The term Annual Exceedance Probability (AEP) will be used for design events (rainfalls and floods) including and rarer (less frequent) than those with a 10% AEP.
- Events that are more frequent than those with a 50% AEP will be expressed as X Exceedances per Year (EY). For example, a design event (rainfall or flood) with a 6-month recurrence interval will be expressed as having 2 Exceedances per Year (2EY).
- The use of Average Recurrence Interval (ARI) is discouraged as it is problematic for frequent events in seasonal climates and leads to confusion with the public for rare events.

For further information on the relationship between EY, AEP, ARI, and uses in engineering design, please refer to BoM Frequently Asked Questions under New AR&R probability terminology: http://www.bom.gov.au/water/designRainfalls/ifd/ifd-faq.shtml

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SAMPLE INTENSITY-FREQUENCY-DURATION FORMULATED IN 2013

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Figure B3

DRAWING 2476-B3.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)

Appendix C

Publications of interest

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).

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).

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).

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).

Flood Reports

MHL Flood Reports:

- *NSW North Coast Flood Summary January–March 2013*, MHL Report No. 2202
- *Northern Rivers May 2009 Flood Report*, MHL Report No. 1965
- *NSW Coffs Harbour and Bellinger River Regions April 2009 Flood Summary*, MHL Report No. 1913
- *NSW Coffs Harbour, Bellinger and Nambucca Rivers Region February 2009 Flood Summary*, MHL Report No. 1908

- *Bellinger and Coffs Harbour Regions January 2008 Flood Summary*, MHL Report No. 1804
- *Clarence River January 2008 Flood Summary*, MHL Report No. 1803
- *Richmond River January 2008 Flood Summary*, MHL Report No. 1802
- *Tweed and Brunswick Rivers January 2008 Flood Summary*, MHL Report No. 1802
- *NSW Hawkesbury and Nepean June 2007 Flood Summary*, MHL Report No. 1756
- *NSW Hunter Valley, Wallamba River and Myall River June 2007 Flood Summary*, MHL Report No. 1755
- *NSW Central Coast June 2007 Flood Summary*, MHL Report No. 1754
- *NSW North Coast March 2006 Flood Summary*, MHL Report No. 1482
- *NSW North Coast January 2007 Flood Summary*, MHL Report No. 1469
- *NSW North Coast Flood Summary June 2005*, MHL Report No. 1426
- *NSW Hunter and Central Coast Flood Summary April 2015,* MHL Report No. 2364

Other references

Bureau of Meteorology 2002, 'Climate Glossary – Southern Oscillation Index' *Australian Government*. Retrieved from http://www.bom.gov.au/climate/glossary/soi.shtml

The Institution of Engineers 1987, *Australian Rainfall and Runoff*

Engineers Australia and Bureau of Meteorology 2013, *Australian Rainfall and Runoff (Revision Project 1)*

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