NSW GOVERNMENT

Manly Hydraulics Laboratory

NSW ESTUARY AND RIVER WATER QUALITY ANNUAL SUMMARY 2018–2019

Report MHL2696
November 2019

Prepared for:
NSW Department of Planning, Industry and Environment
Climate Change and Sustainability Division

Cover Photograph: Lake Ainsworth station

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October 2019

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Document Control

Issue/ Revision	Author	Reviewer	Approved for Issue	
			Name	Date
Draft	Melody Wu	Sarah-Kate Dakin	Adam Joyner	21/10/2019
Final	Melody Wu	Martin Fitzhenry, CCSD	Adam Joyner	4/11/2019

Report No. MHL2696
ISSN: 2205-5606 (Print)
ISSN: 2205-5614 (Online)
First published November 2019

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Foreword

Manly Hydraulics Laboratory (MHL) is a business unit within the Water Group of NSW Department of Planning, Industry and Environment[1]. The NSW water quality database has been developed by MHL to support a number of programs associated with coastal, floodplain and estuary management for Climate Change and Sustainability Division[2] of NSW Department of Planning, Industry and Environment and WaterNSW.

This annual summary presents an overview of water quality measurements captured by the automatic recording stations along the coastal estuaries and rivers of New South Wales, from 1 July 2018 to 30 June 2019. MHL maintains the automatic recording stations and catalogues the data collected. During the 2018–2019 monitoring period the overall data recovery rate was 98.3%.

The report provides information on how to access the data and additional data output types that are available on request.

Requests for further information should be directed to:

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WWW : http://mhl.nsw.gov.au/
Telephone : (02) 9949 0200

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  Manly Hydraulics Laboratory
  Report No. MHL 2692
  ISSN: 2205-5525 (Print)
  ISSN: 2205-5533 (Online)
- NSW Coastal Rainfall Annual Summary 2018–2019
  Manly Hydraulics Laboratory
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  ISSN: 2205-5576 (online)
- NSW Ocean and River Entrance Tidal Levels Annual Summary 2018–2019
  Manly Hydraulics Laboratory
  Report No. MHL 2693
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- NSW Wave Climate and Coastal Air Pressure Annual Summary 2018–2019
  Manly Hydraulics Laboratory
  Report No. MHL 2695
  ISSN: 2205-5584 (Print)
  ISSN: 2205-5592 (online)

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[1] From 1 July 2019, Manly Hydraulics Laboratory is part of the newly formed Department of Planning, Industry and Environment.

[2] Formerly NSW Office of Environment and Heritage (OEH).

Executive summary

This report contains:

- a brief description of the water quality programs
- guidelines on how to use this report
- information on how to access the database
- significant developments which occurred in 2018–2019
- the data summaries and station location maps for each station
- Appendix A, detailing the data available online
- Appendix B, showing data output formats available at MHL
- Appendix C, a list of other publications which may be of interest.

Contents

1. Water quality monitoring program

This report presents a summary of the water quality data currently collected by Manly Hydraulics Laboratory (MHL). The network of automatic recorders and the associated analysis routines enable efficient delivery of water quality data. As well as near real-time water quality information at 20 stations in NSW, extracts from the historical database of water quality data can be requested (refer to Appendix A).

The present program is based on a network of automatic recording stations installed at various estuaries (see Station Location Maps in Section 5). This network consists of 20 permanent stations funded by Climate Change and Sustainability Division[1] (CCSD), NSW Department of Planning, Industry and Environment and WaterNSW (see Table 1). A water quality sensor was commissioned at Wonboyn Lake station on 25 October 2018 to monitor variation in temperature and electrical conductivity. The logging systems consist of data loggers which record water quality information every 15 minutes. Data is transmitted via telemetry to the database every six hours. Coraki and Wonboyn Lake have been upgraded to communicate with a new high availability cloud-based database environment whereby data is transmitted every 15 minutes from the stations and presented on the web portal within 2–3 minutes of collection.

[1] Formerly NSW Office of Environment and Heritage (OEH).

Table 1 Station list

River/ estuary region	Station name	Station no.	MGA zone	Easting	Northing	Station owner	Data start	Overall data capture rate 2018–2019
Richmond	Lake Ainsworth	203455	56	557863	6816160	CCSD	10-Apr-18	100.0%
Richmond	Coraki	203403	56	527976	6793772	CCSD/WaterNSW	21-Oct-09	100.0%
Richmond	Oakland Road	203470	56	526684	6791185	WaterNSW	06-Mar-12	100.0%
Clarence	Rogans Bridge	204413	56	488813	6723401	CCSD/WaterNSW	03-Dec-09	98.5%
Clarence	Grafton	204400	56	493398	6715149	CCSD/WaterNSW	04-Dec-09	95.8%
Macleay	Kempsey	206402	56	485099	6561395	CCSD/WaterNSW	09-Feb-10	100.0%
Manning	Wingham	208400	56	440523	6473219	CCSD/WaterNSW	08-Dec-09	94.6%
Manning	Taree West	208420	56	447161	6469672	WaterNSW	30-Apr-10	98.6%
Myall Lakes	Bombah Point	209475	56	434680	6403299	CCSD	13-Jul-09	100.0%
Myall River	Tea Gardens	209480	56	421723	6385111	CCSD	20-Oct-09	100.0%
Paterson	Dunmore	210409	56	369238	6383269	CCSD/WaterNSW	15-Oct-09	98.2%
Paterson	Hinton Bridge	210410	56	373245	6379624	CCSD/WaterNSW	15-Oct-09	100.0%
Hunter	McKimms Corner	210455	56	368162	6378933	CCSD/WaterNSW	08-Oct-09	100.0%
Hunter	Hexham	210448	56	376768	6367608	CCSD/WaterNSW	13-Apr-11	100.0%
Hunter	Green Rocks	210432	56	377459	6378142	CCSD/WaterNSW	15-Oct-09	99.2%
Williams	Raymond Terrace	210452	56	382352	6375361	CCSD/WaterNSW	15-Oct-09	95.5%
Hawkesbury	Sackville	212406	56	303238	6292029	CCSD/WaterNSW	30-Oct-09	99.4%
Hawkesbury	Leets Vale	212461	56	309195	6299263	WaterNSW	22-Jun-10	88.2%
Shoalhaven	Grady's Caravan Park	215430	56	268024	6138282	CCSD/WaterNSW	06-Oct-10	100.0%
Wonboyn Lake	Wonboyn Lake	220452	55	758839	5873472	CCSD	25-Oct-18	97.0%
Overall								**98.3%**

The network features three distinctive water quality probe types for obtaining temperature and conductivity readings:

1. AquiStar CT2X: a submersible sensor with built-in data logging. The CT2X incorporates 4-pole electrode cell measurement technology with a probe resolution of EC ± 0.1 microsiemen/cm and temperature ± 0.01°C.
2. YSI Sonde 600XL: a multi-parameter probe with a probe resolution of EC ± (1-100) microsiemen/cm (range dependent) and temperature ± 0.01°C.
3. YSI EXO3 Sonde: a multi-parameter probe with a probe resolution of EC ± (0.1-10) microsiemen/cm (range dependent) and temperature ± 0.001°C.

Logger programs at all stations output water level, temperature and conductivity, specific conductivity at 25°C (microsiemens/cm) and salinity (Practical Salinity Units (psu)). This allows more usable near real-time data for the diverse range of end users.

Temperature and conductivity values are obtained directly from the instrumentation. Specific conductivity at 25°C is calculated using the equation:

$$\text{Specific Conductivity [µs/cm]} = C / (1+0.0198933 * (T-25))$$

where C = uncompensated EC, T = temperature

Salinity (PSU) is calculated using the UNESCO formula (seawater salinity calculation) and the full equation can be found in:

> UNESCO Technical Papers in Marine Science, #36 (1981a) 'The Practical Salinity Scale 1978 and the International Equation of State of Seawater 1980', *UNESCO Division of Marine Sciences* (Paris), pp. 25.

Water quality data is transferred to MHL's databases, located in the NSW Government Data Centre, using a variety of telemetry techniques including internet protocol, landline telephone and cellular networks. The incoming raw data is then made available in near real time to external users to view via the web.

The data is stored in MHL's database and subject to a quality assurance process which involves several control steps to ensure data quality is maintained. 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 in the Government Data Centre for disaster recovery and security purposes.

2. How to use this report

This report aims to streamline access to MHL's services and to the water quality 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. Extracts from the historical database of water quality data can be made available on request (refer to Appendix A).

All data presented in this report are recorded in Australian Eastern Standard Time (EST). Allowance for daylight saving time needs to be made by the user of the data if required.

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 outlines sample data output types.

There are various factors which can influence the water quality data presented in this report. The reader should be familiar with these factors and data recording limitations when interpreting it. These factors include:

- In coastal streams or estuaries, salt water often mixes with fresh water. The addition of salt water greatly increases conductivity, with the ocean typically recording an approximate level of 36 psu for salinity compared with almost zero for fresh water.
- In inland locations, freshwater inflows associated with rainfall events may lower conductivity. The auto scaling of the conductivity plots can visually over-emphasise these changes. Conversely, during low flow conditions the dissolved solids are more concentrated and therefore conductivity levels are higher. Caution should be exercised when interpreting the conductivity and derived salinity plots in this report recognising different scaling and the proximity of water quality station locations to the ocean.
- At monitoring stations impacted by tides, conductivity will be influenced by natural flows, as well as saltwater intrusion brought upstream with rising tides. The salinity value for any particular monitoring station can vary significantly between high and low tides. For example, during the 2018–2019 monitoring period, the salinity values at Tea Gardens varied by approximately 25 psu between high and low tides, and at Hexham variations of approximately 20 psu were observed. This measured variation should not be misread as noisy trace fluctuations (due to instrument limitations or malfunction), but rather it typically represents measured responses through the tidal cycle.

3. How to access the data

MHL provides a full online data access service via the internet for its clients, and a limited 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 requested.

4. Significant events and developments

4.1 Flood events

This section outlines events and developments which have influenced water quality monitoring during this reporting period. Floods introduce significant freshwater inflows which impact on electrical conductivity and temperature, as shown in the data summaries. During the 2018–2019 reporting period, no moderate or major events occurred at CCSD/WaterNSW stations with the exception of a short moderate tributary flood at Coutts Crossing on the Orara River on 18 December 2018 (tributary of the Clarence River, upstream of CCSD's Clarence River station at Rogans Bridge). The flood events are classified according to the NSW State Emergency Service's classification scale.

The NSW State Emergency Service defines the level of flooding as follows:

Minor flooding: Causes inconvenience. Low-lying areas next to watercourses are inundated, which may require the removal of stock and equipment. Minor roads may be closed and low-level bridges submerged.

Moderate flooding: In addition to the above, the evacuation of some houses may be required. Main traffic routes may be covered. The area of inundation is substantial in rural areas, requiring the removal of stock.

Major flooding: In addition to the above, extensive rural areas and/or urban areas are inundated. Properties and towns are likely to be isolated and major traffic routes likely to be closed. Evacuation of people from flood-affected areas may be required.

4.2 Highest recorded temperature and salinity readings

During 2018–2019 a number of stations experienced record temperature and salinity readings. The following stations captured the highest temperature reading during 2018–2019 fiscal year since monitoring started at each site:

- Richmond River at Lake Ainsworth (35.7°C) and Oakland Road (31.2°C)
- Manning River at Wingham (34.1°C)
- Paterson River at Dunmore (32.1°C) and Hinton Bridge (31.5°C)
- Hunter River at McKimms Corner (33.0°C), Green Rocks (34.4°C), Raymond Terrace (32.7°C) and Hexham (31.0°C)
- Hawkesbury River at Sackville (31.0°C)
- Shoalhaven River at Grady's Caravan Park (32.4°C).

The following stations captured the highest salinity reading during 2018–2019 fiscal year since monitoring started at each site:

- Richmond River at Coraki (0.99 psu) and Oakland Road (3.10 psu)
- Clarence River at Rogans Bridge and Grafton (7.34 psu)

- Macleay River at Kempsey (5.86 psu)
- Manning River at Wingham (18.68 psu)
- Myall Lakes at Bombah Point (21.35 psu)
- Hunter River at Green Rocks (16.26 psu)
- Shoalhaven River at Grady's Caravan Park (4.08 psu).

4.3 Cross-sectional profiling

A cross-sectional profile is undertaken within 10 m upstream or downstream of the in situ sensor to the opposite bank. The cross-section is divided into a minimum of five equidistant sections and electrical conductivity readings are taken from the surface to the bed at 0.3 m intervals. The profile information provides a cross-check as to whether the in situ sensor is providing data that is representative of the complete river cross-section.

In April, May, June and July 2019, cross-sectional water quality profiling was undertaken on the Richmond, Clarence, Macleay, Manning, Paterson, Hunter, Hawkesbury and Shoalhaven rivers, as part of the monitoring program. Refer to *Monitoring of Estuaries for Water Sharing Plans Annual Summary 2018–2019* (Report MHL2700) for more detail on the cross-sectional profiling results.

4.4 Station development

The following station developments and upgrades occurred during the 2018–2019 reporting period:

- The Rogans Bridge (Clarence River) station was replaced with a new water quality sensor on 19 September 2018 and 2 July 2019 when the previous one failed.
- The Grafton (Clarence River) station was replaced with a new water quality sensor on 26 March 2019 and 2 July 2019 when the previous one failed.
- The Wingham (Manning River) station was replaced with a new water quality sensor on 8 November 2018, 24 January 2019 and 11 June 2019 when the previous one failed.
- The Taree West (Manning River) station was replaced with a new water quality sensor on 10 May 2019 when the previous one failed.
- The Dunmore (Paterson River) station was replaced with a new water quality sensor on 30 October 2018 when the previous one failed.
- The McKimms Corner (Hunter River) station was replaced with a new water quality sensor on 1 April 2019 when the previous one failed.
- The Green Rocks (Hunter River) station was replaced with a new water quality sensor on 14 February 2019 when the previous one failed. Also, it was replaced with a new bubble unit for water level sensing after a leak was found.

- The Raymond Terrace (Hunter River) station was installed with a new EXO3 water quality sensor, a 100 m custom-made cable and copper slide on 13 August 2018 which increases the quality of the data and reliability of the data capture of the site. Also, the water level sensor was replaced with a new bubble unit, regulator and orifice line.
- The Sackville (Hawkesbury River) station was replaced with a new water quality sensor on 22 October 2018 and 17 May 2019 when the previous one failed.
- The Leets Vale (Hawkesbury River) station was replaced with a new water quality sensor on 22 October 2018 and 1 May 2019 when the previous one failed.
- The Koonawarra Bay (Lake Illawarra) station's and Cudgeree Bay (Lake Illawarra) station's water quality sensors have been decommissioned since 1 July 2018 as per Wollongong City Council's request.

Please note: the high number of sensor failures during 2018–19 is associated with the same type of sensor. This type of sensor is considered to be near its end of life for estuarine applications and is being systematically replaced, where possible, with more robust types of sensors.

4.5 Station issues

The Wingham (Manning River) station's solar panel and regulator were damaged by a fallen tree. A new solar panel and regulator were installed on 24 October 2018.

The Raymond Terrace (Hunter River) station's gas line and water quality sensor cable were damaged by sign pole installers on 9 August 2018. A new bubble unit, regulator and orifice line were installed on 13 August 2018. Also, its water quality sensor experienced water ingress from 28 May 2019. Thus, a standalone sensor was deployed on 25 June 2019 to maximise the data capture until a new water quality sensor arrived from the supplier in July 2019.

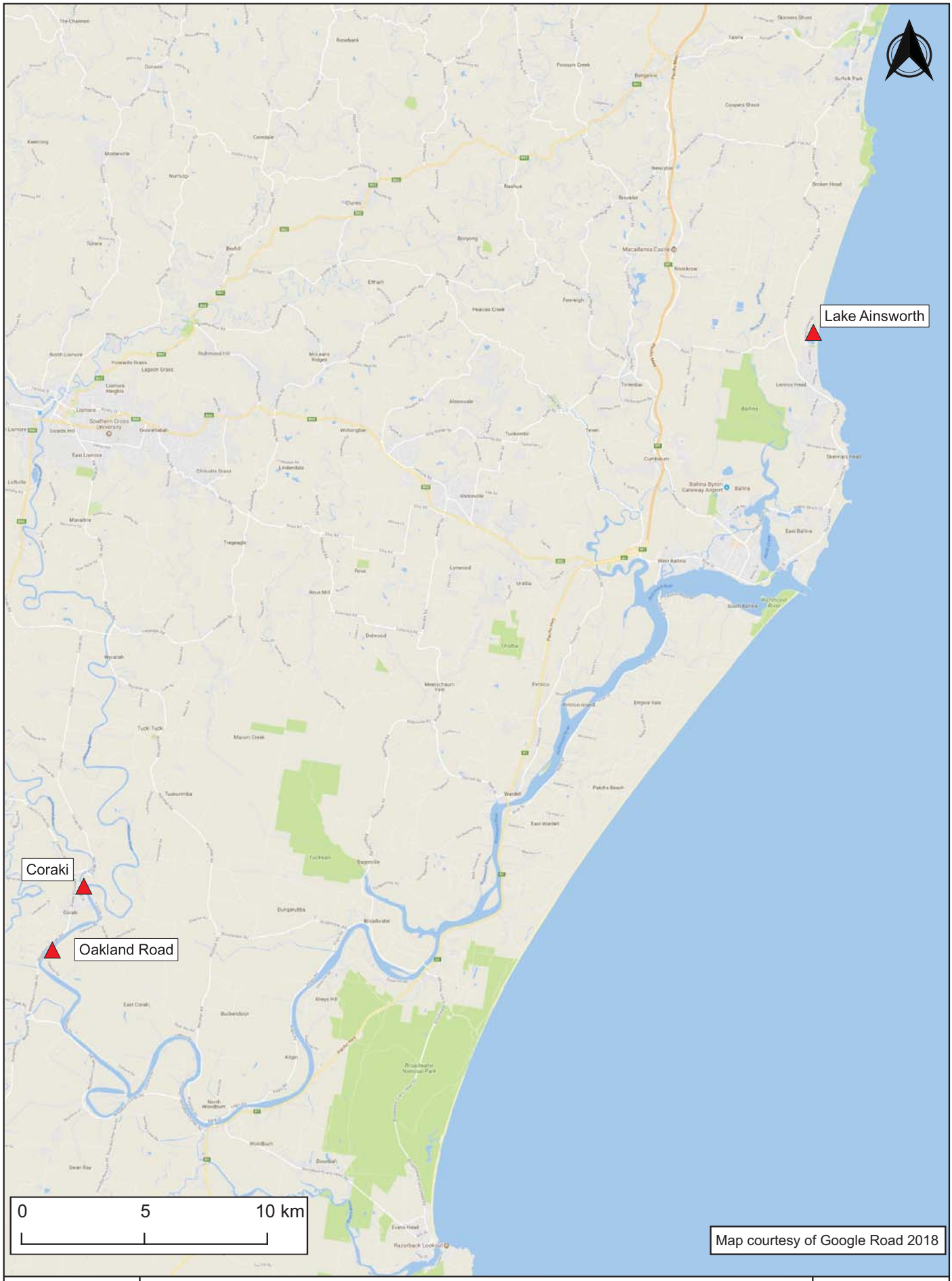
The Leets Vale (Hawkesbury River) station's gas line orifice was intermittently severely silted causing significant water level data loss. The orifice line was raised on 1 May 2019 to fix the issue. Level data from the nearest CCSD-owned station Wisemans Ferry Wharf is used on the data plot (refer to Figure 27).

5. Water quality monitoring summary

This section documents locality maps and quality assured water quality monitoring summaries for each station. Table 2 provides an index to the figures presented. Daily rainfall data from the nearest available CCSD or Bureau of Meteorology (BoM) rain gauge is added to the figure to show the influence of rainfall events. Rain gauges associated with the water quality results are indicative only and are not necessarily representative of the rainfall influence on water quality readings at the location of the water quality probes. Note that all parameters with the exception of total daily rainfall are presented at 3-hourly intervals for annual plot resolution purposes, which explains the apparent truncated low tides observed on some water level plots.

Table 2 Index of figures

River/estuary region	Station name	Station no.	Comparative CCSD/BoM rainfall station name	Figure
Station Locality Map	Richmond River Region			1
Richmond River	Lake Ainsworth	203455	Lake Ainsworth	2
Richmond River	Coraki	203403	Coraki (Richmond Terrace)	3
Richmond River	Oakland Road	203470	Coraki (Richmond Terrace)	4
Station Locality Map	Clarence River Region			5
Clarence River	Rogans Bridge	204413	Wooli Caravan Park	6
Clarence River	Grafton	204400	Wooli Caravan Park	7
Station Locality Map	Macleay River Region			8
Macleay River	Kempsey	206468	Aldavilla Downstream	9
Station Locality Map	Manning River Region			10
Manning River	Wingham	208400	Nabiac	11
Manning River	Taree West	208420	Nabiac	12
Station Locality Map	Great Lakes Region			13
Myall Lakes	Bombah Point	209475	Bulahdelah	14
Station Locality Map	Port Stephens Region			15
Myall River	Tea Gardens	209480	Bulahdelah	16
Station Locality Map	Paterson River Region			17
Paterson River	Dunmore	210409	Belmore Bridge	18
Paterson River	Hinton Bridge	210410	Belmore Bridge	19
Station Locality Map	Hunter River Region			20
Hunter River	McKimms Corner	210455	Belmore Bridge	21
Hunter River	Green Rocks	210432	Hexham	22
Williams River	Raymond Terrace	210452	Hexham	23
Hunter River	Hexham	210448	Hexham	24
Station Locality Map	Hawkesbury River Region			25
Hawkesbury River	Sackville	212406	Sackville DS	26
Hawkesbury River	Leets Vale	212461	Colo Junction	27
Station Locality Map	Shoalhaven River Region			28
Shoalhaven River	Grady's Caravan Park	215430	Yellow Rock Road	29
Station Locality Map	Wonboyn Lake			30
Wonboyn Lake	Wonboyn Lake	220452	Green Cape Lighthouse	31



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STATION LOCATIONS
RICHMOND RIVER REGION

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Figure 1

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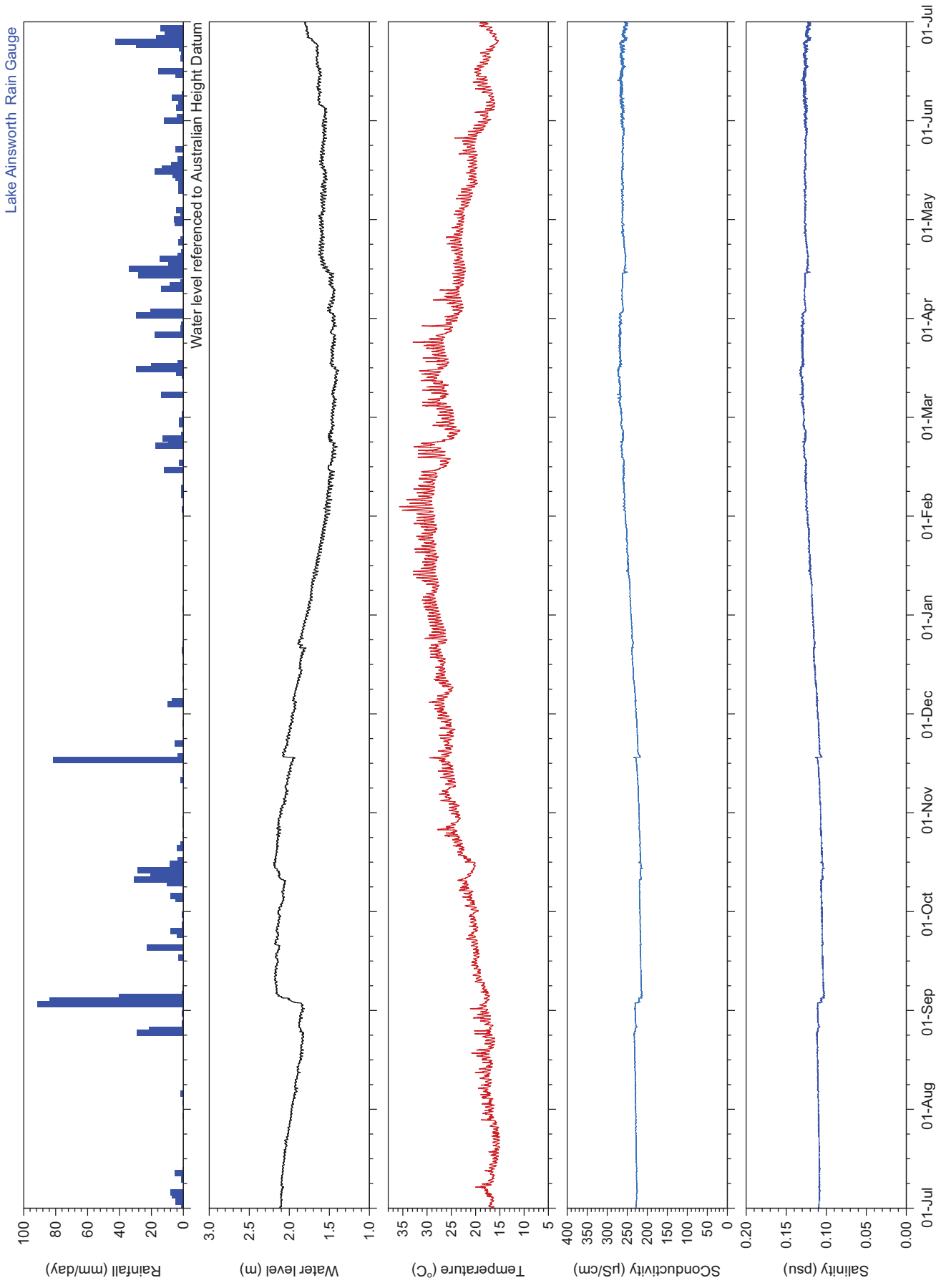

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
LAKE AINSWORTH

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Figure 2

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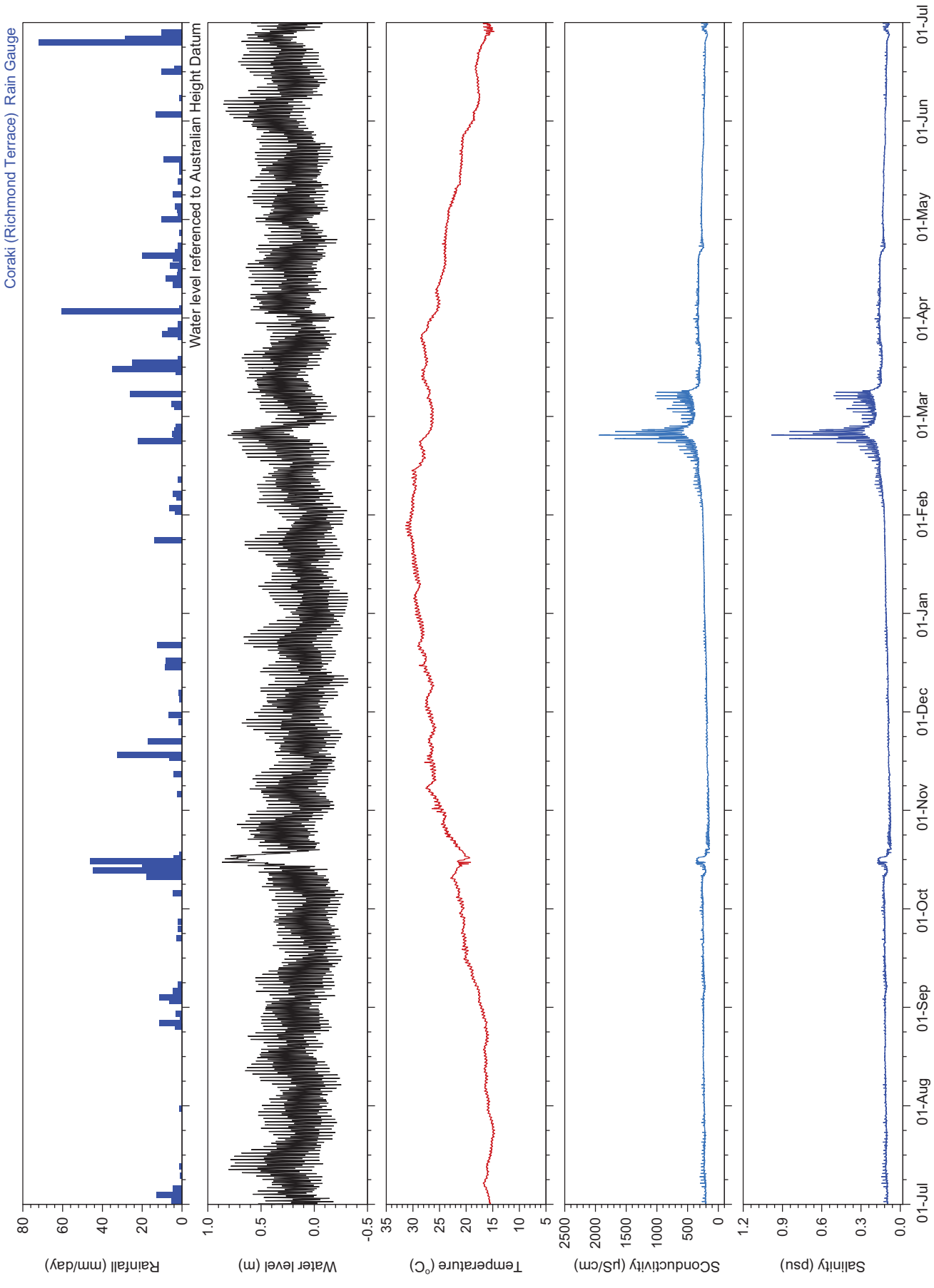

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
CORAKI

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Figure 3

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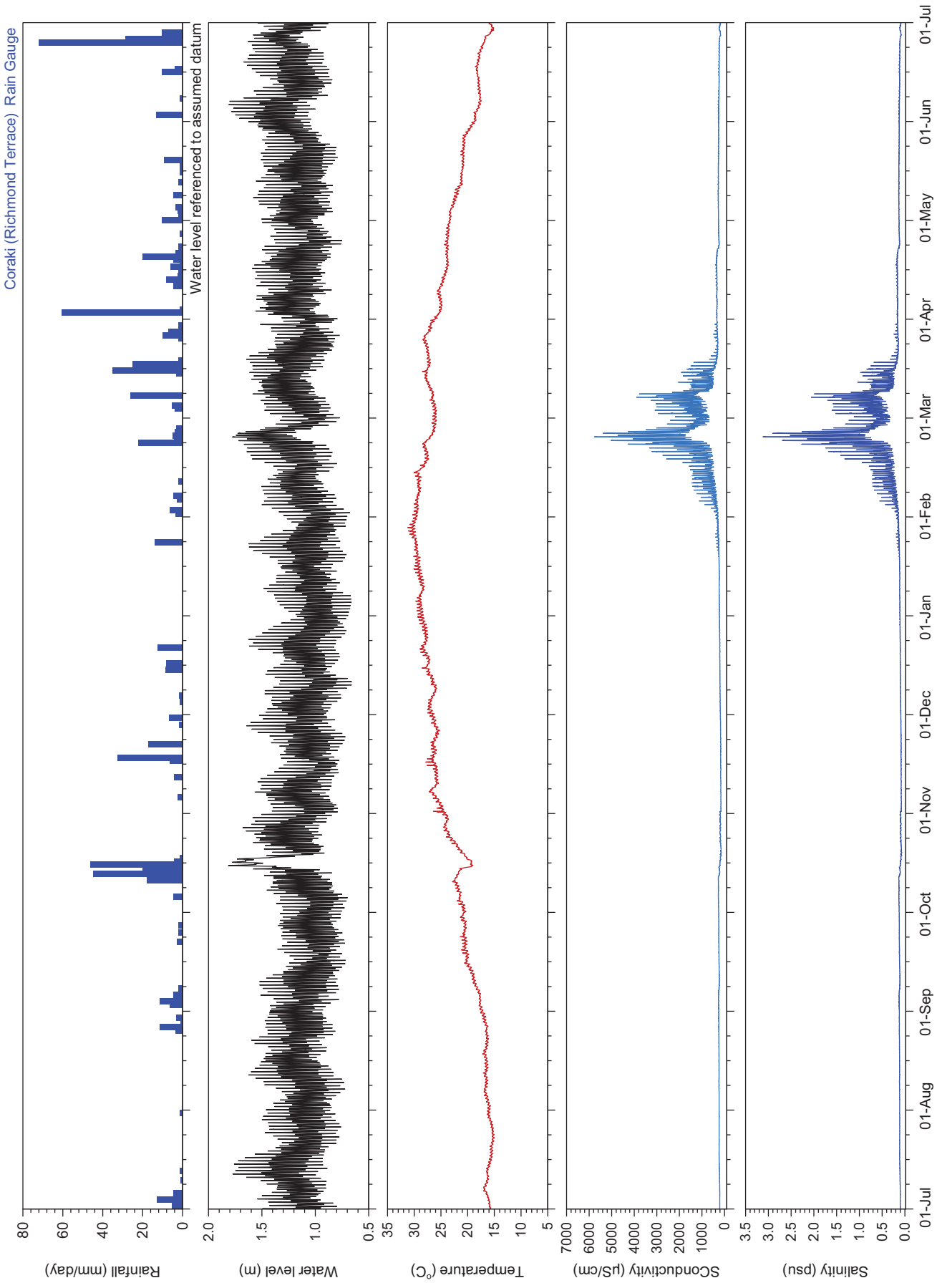

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
OAKLAND ROAD

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Figure 4

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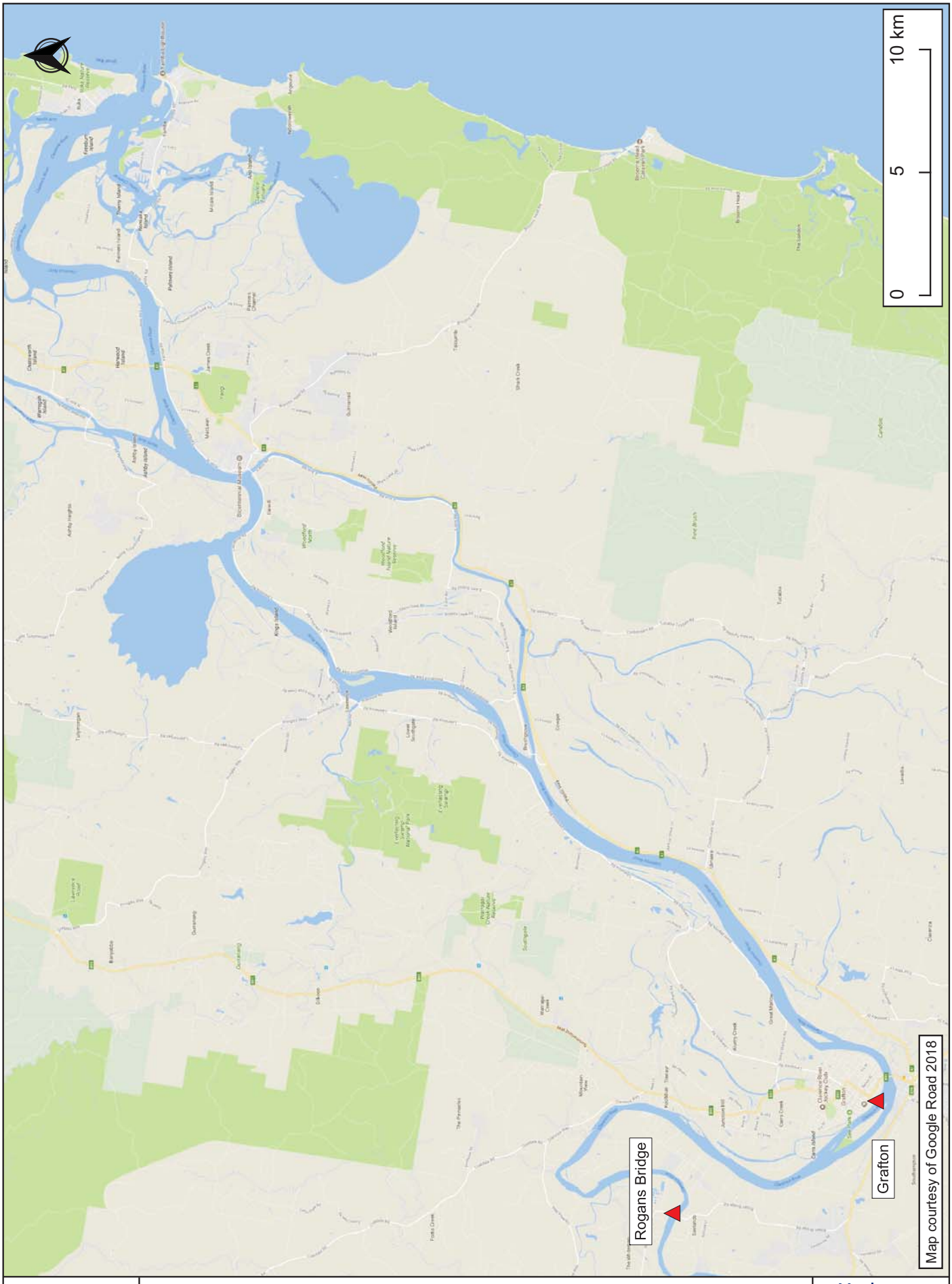

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STATION LOCATIONS
CLARENCE RIVER REGION

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Figure 5

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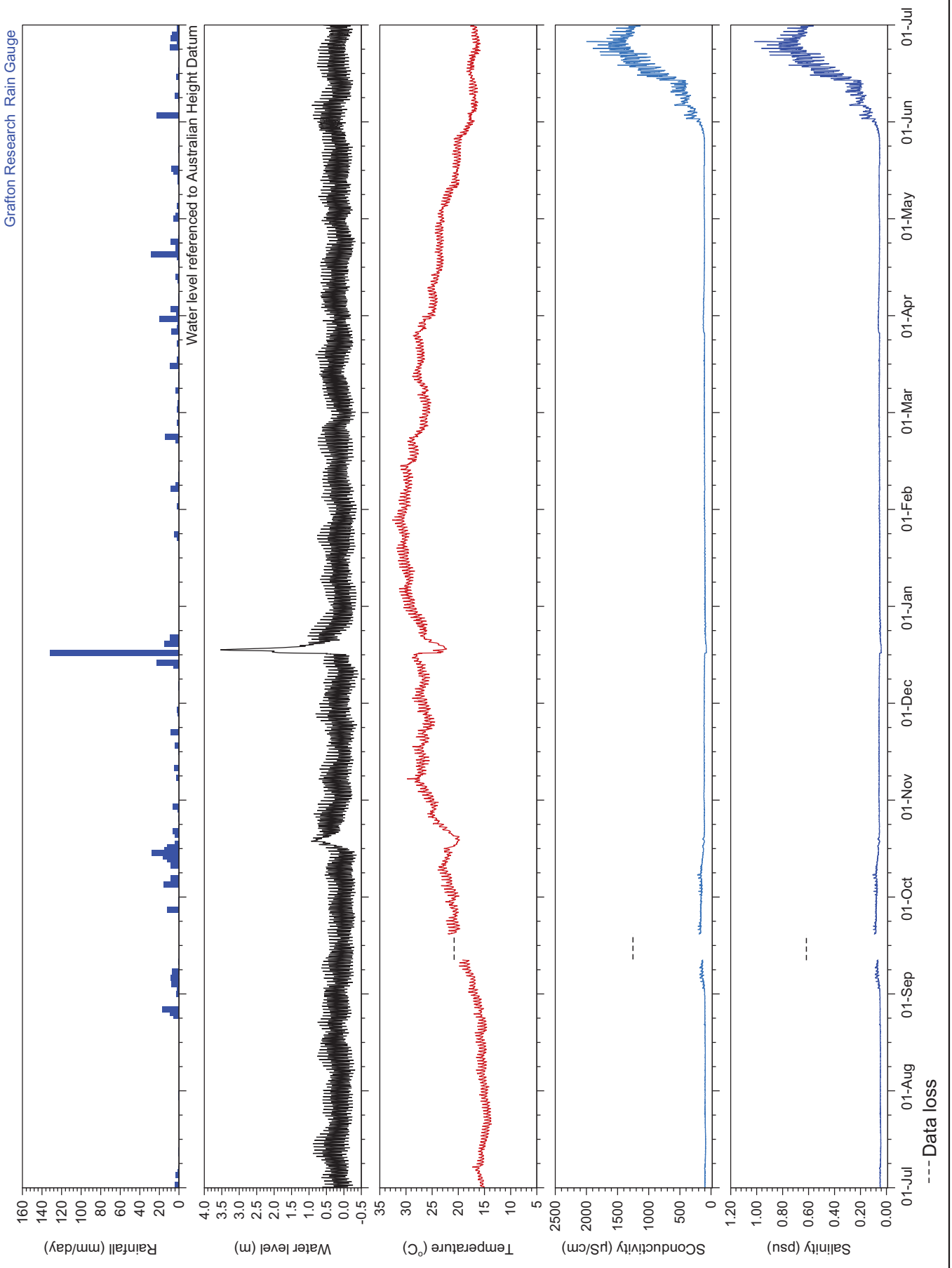

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
ROGANS BRIDGE

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Figure 6

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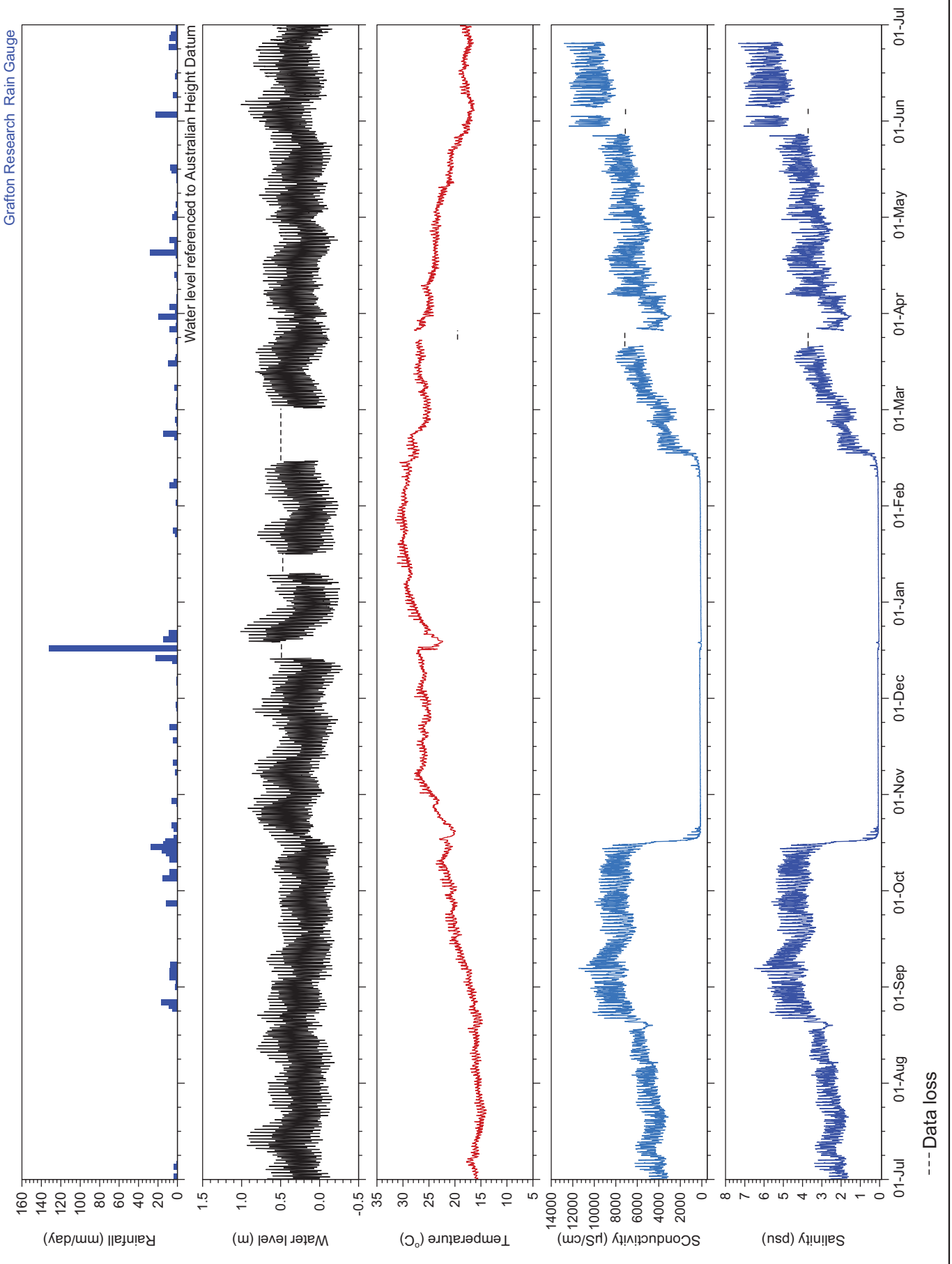

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
GRAFTON

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Figure 7

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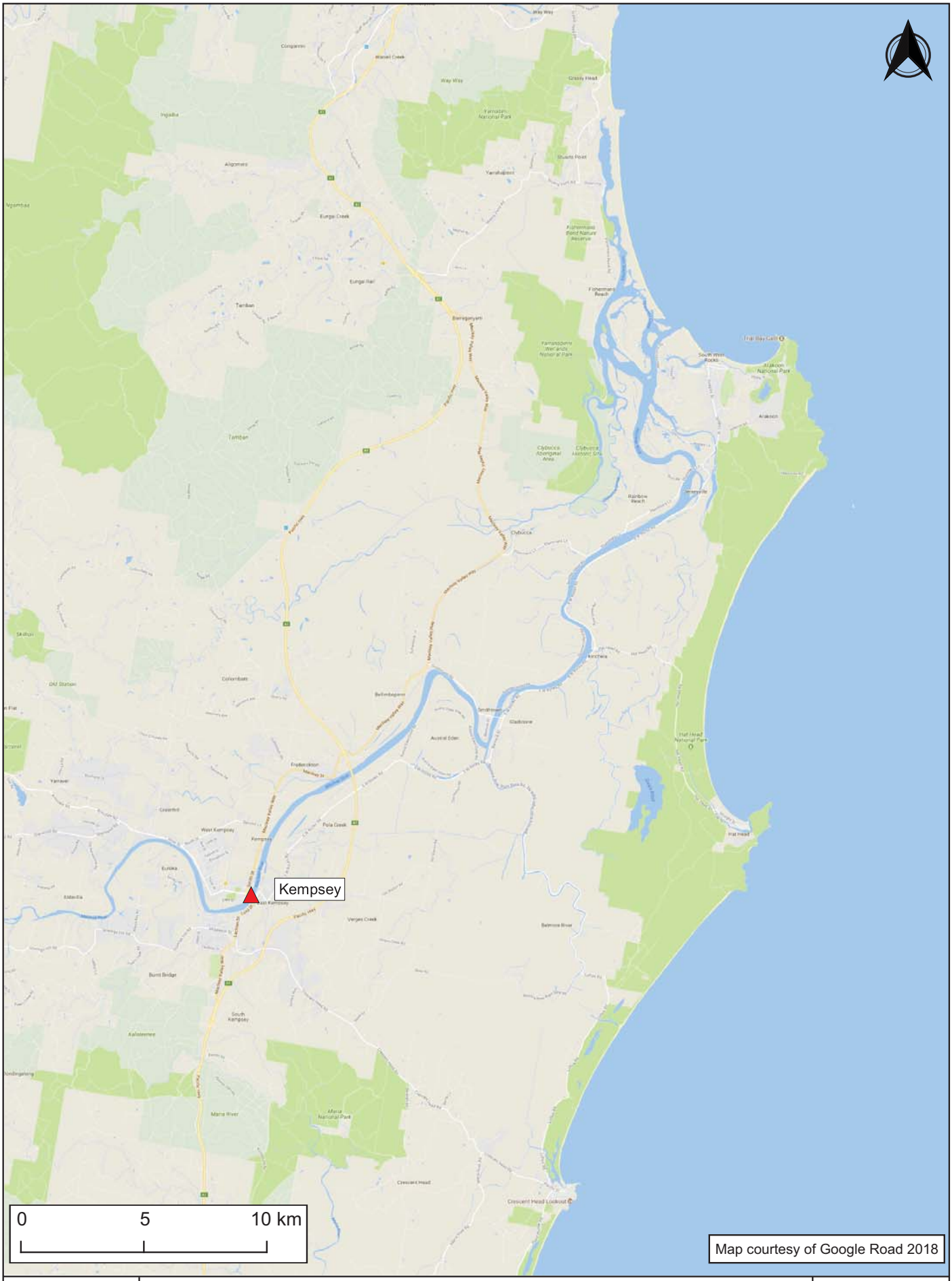

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STATION LOCATIONS
MACLEAY RIVER REGION

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Figure 8

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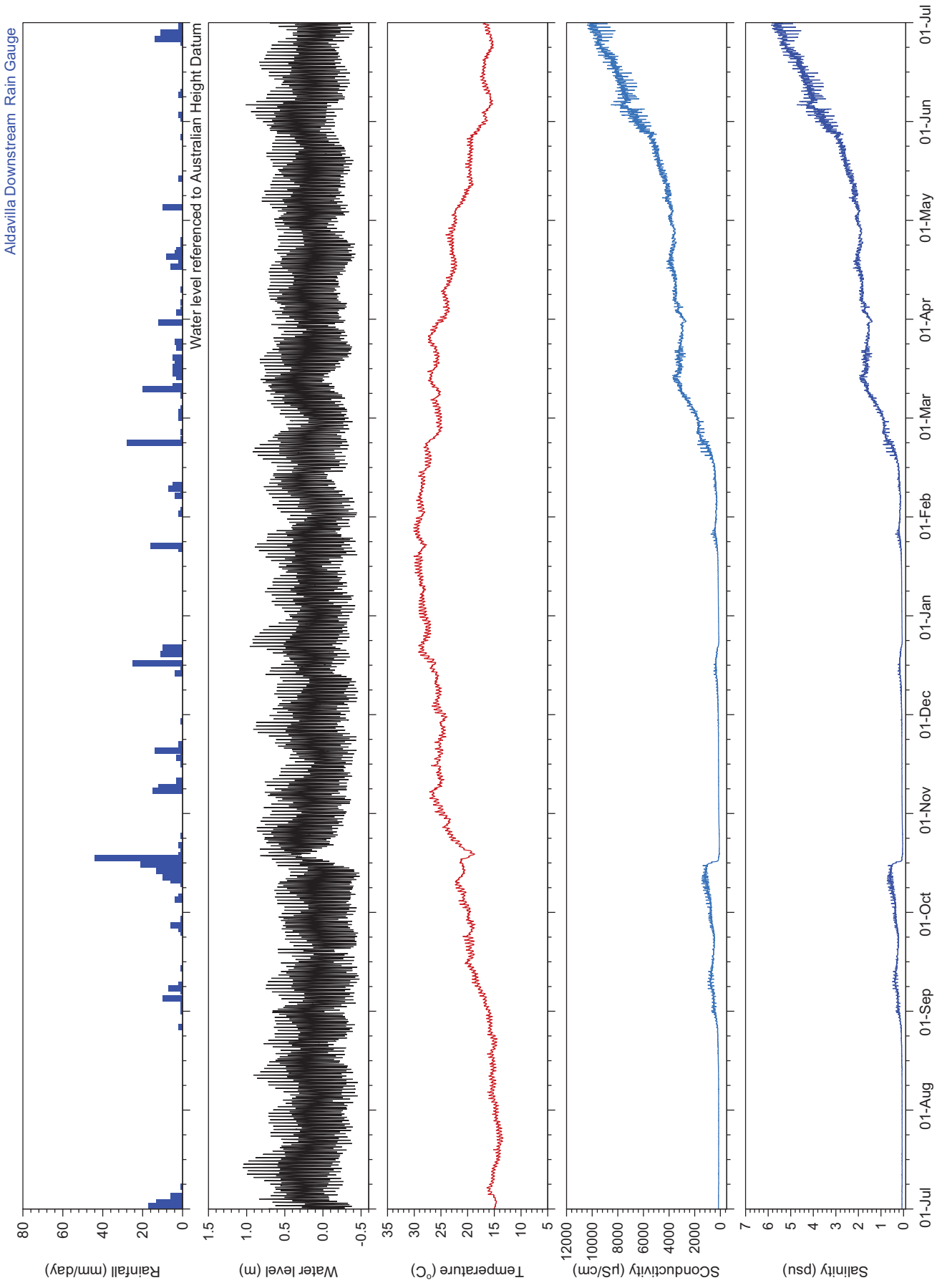

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
KEMPSEY

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Figure 9

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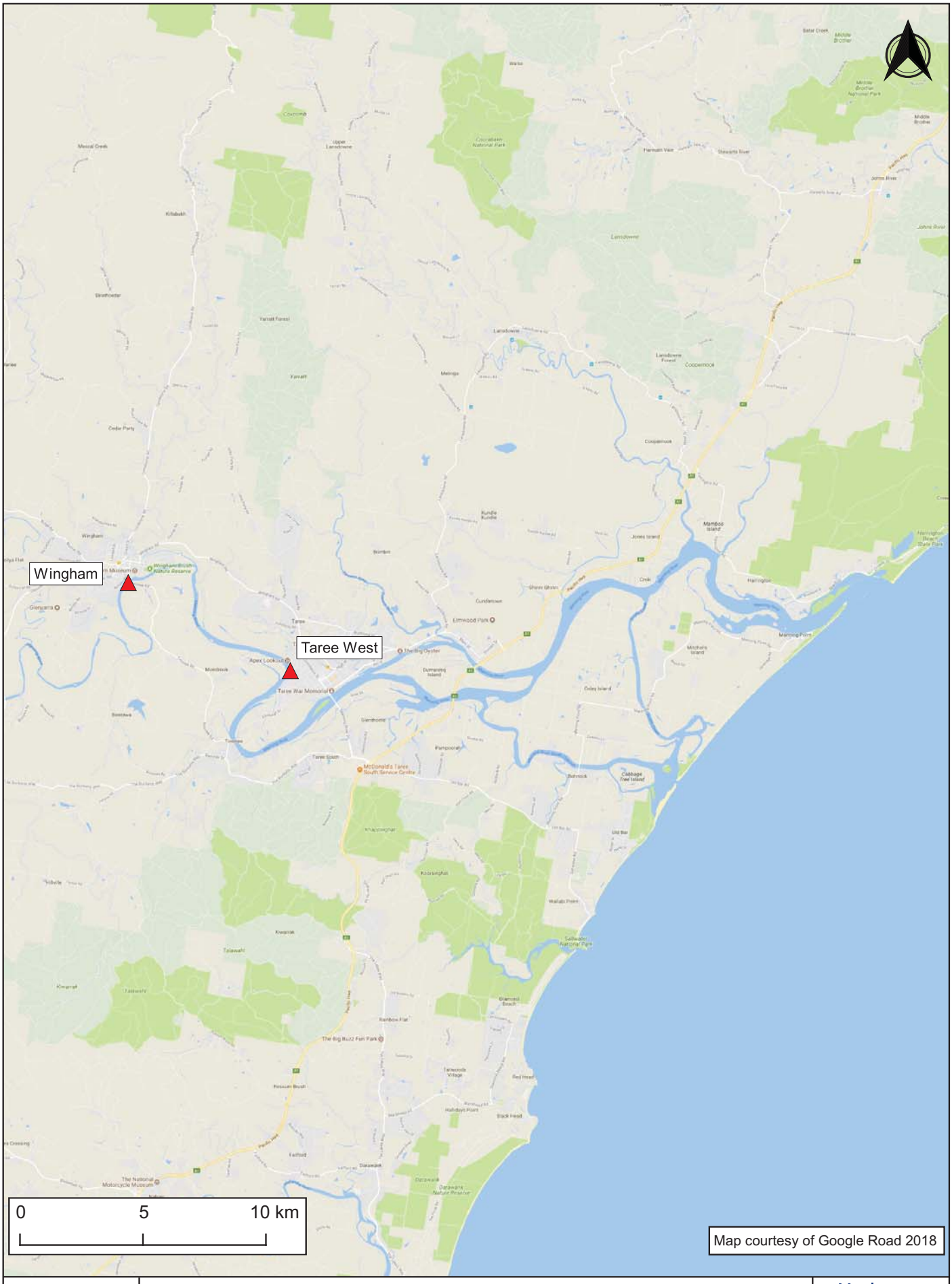

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STATION LOCATIONS
MANNING RIVER REGION

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Figure 10

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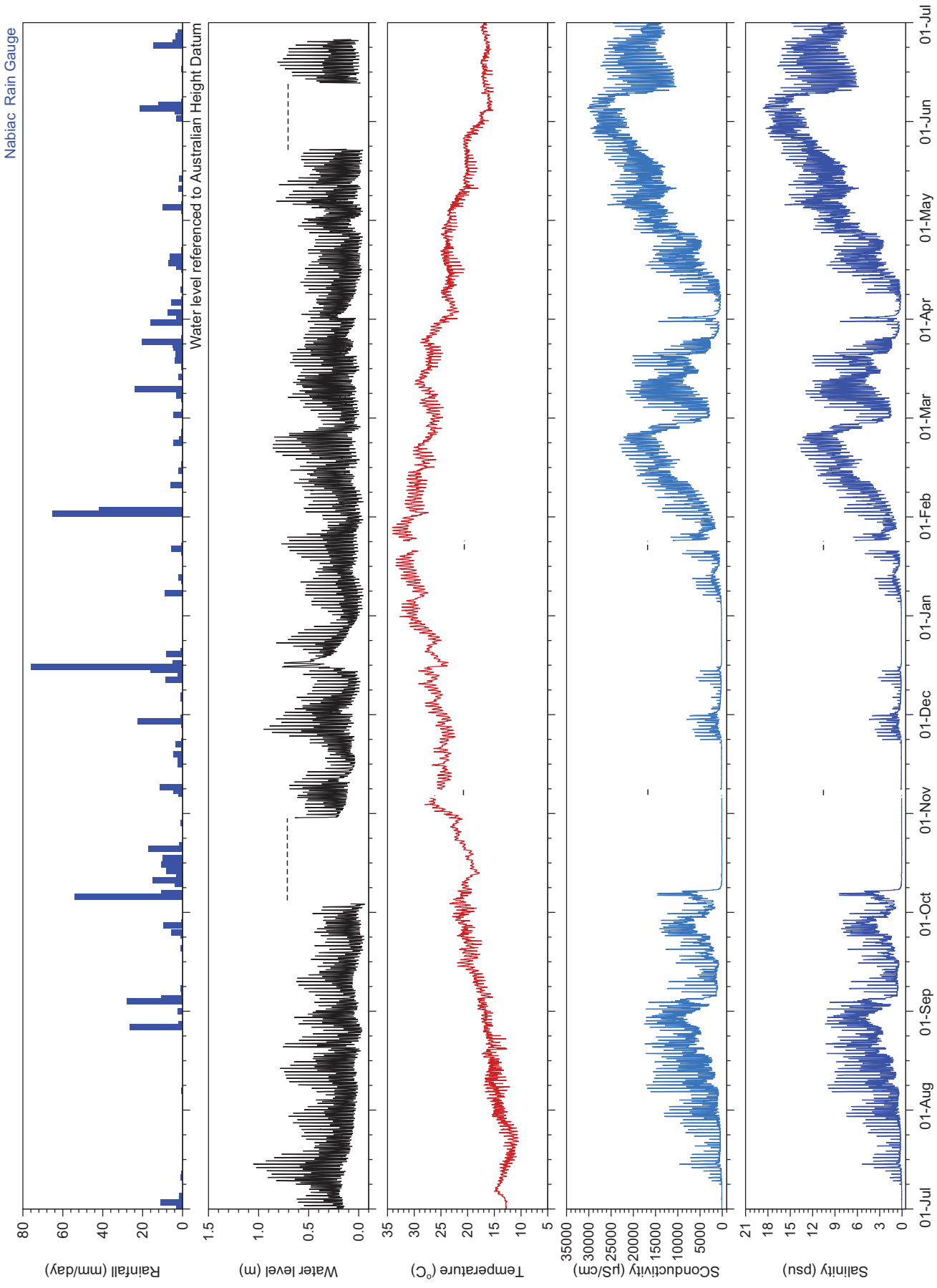

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
WINGHAM

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Figure 11

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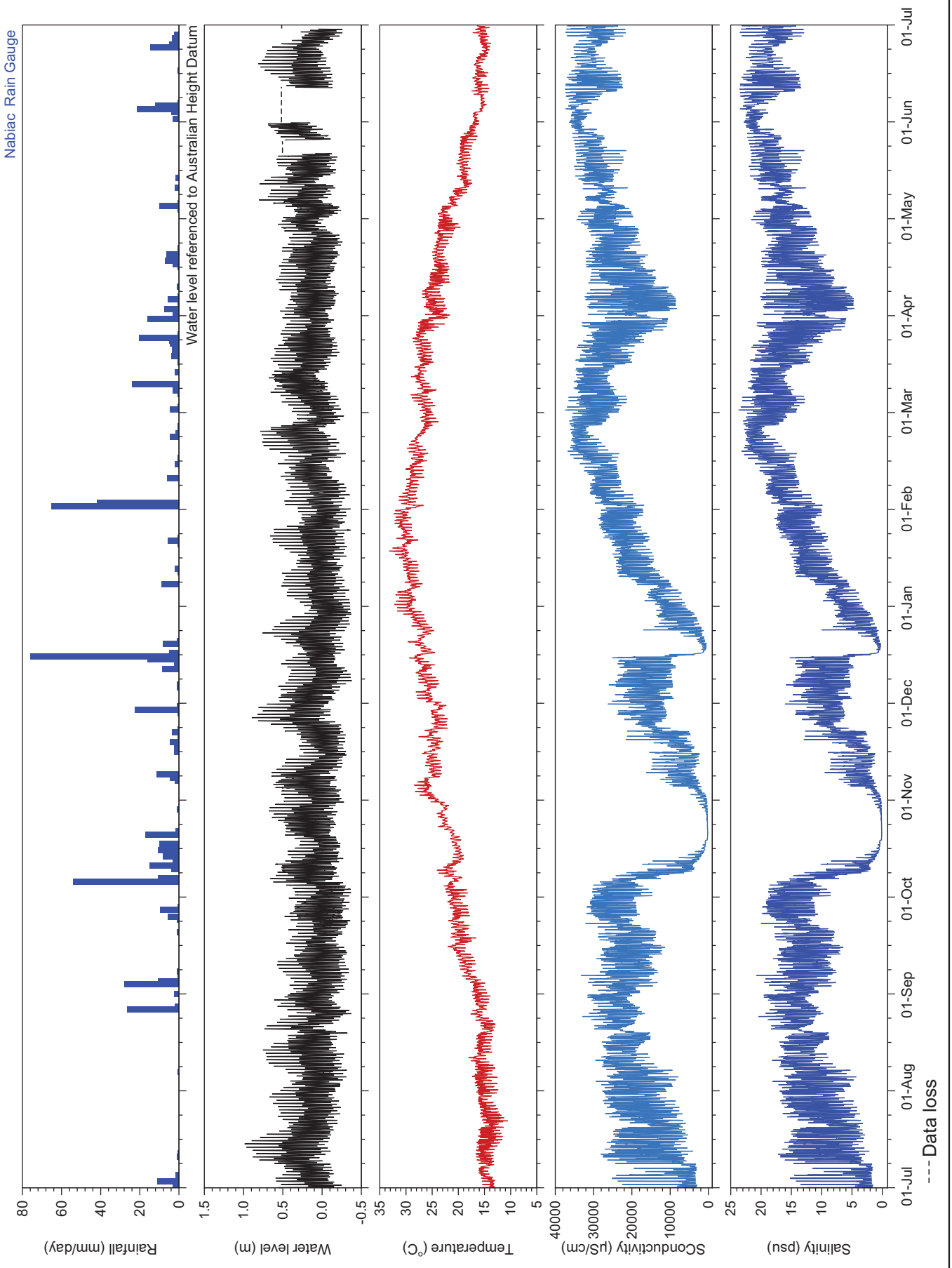

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WATER LEVEL AND WATER QUALITY DATA
2018–2019
TAREE WEST

Manly Hydraulics Laboratory

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Figure 12

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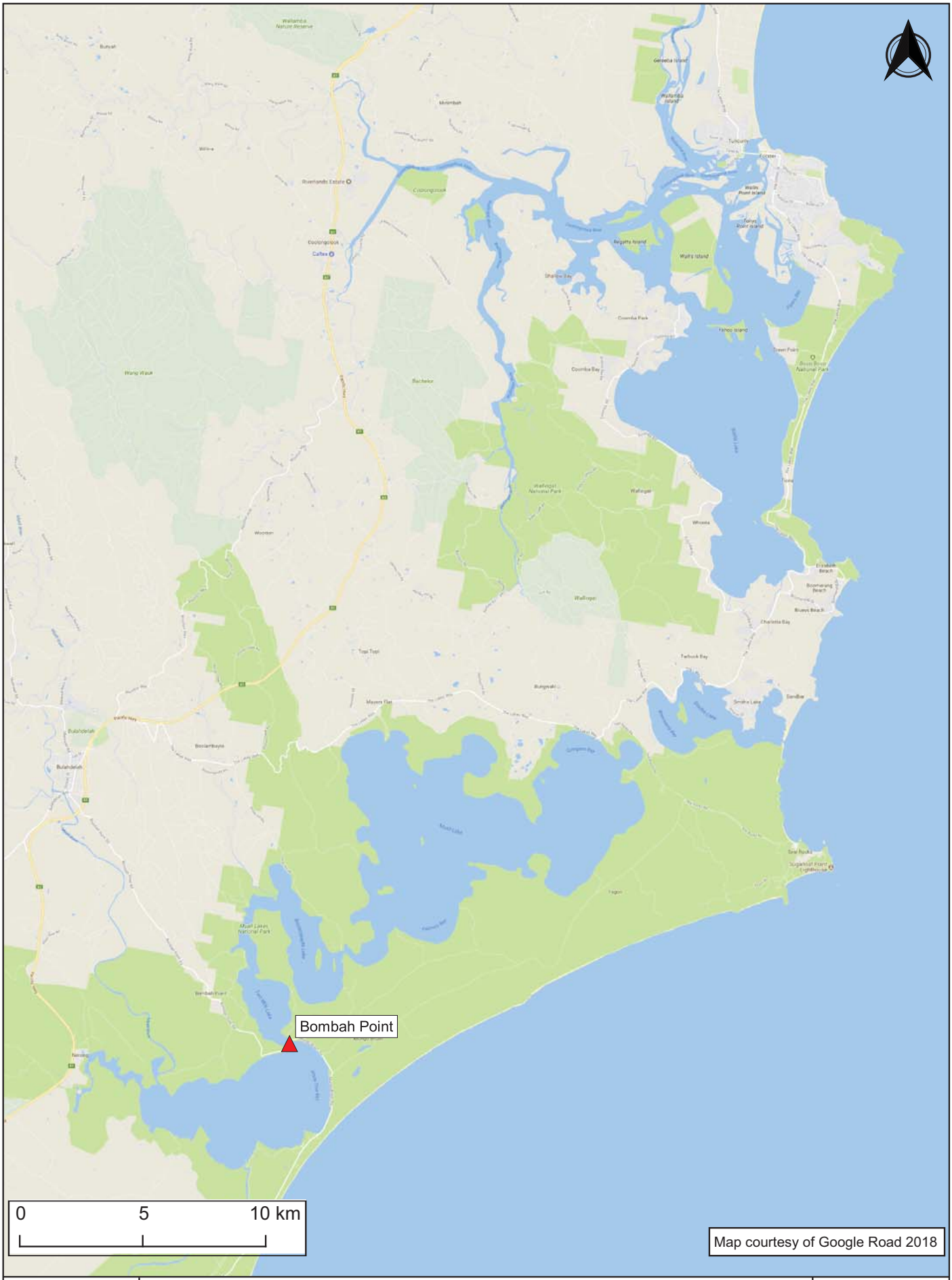

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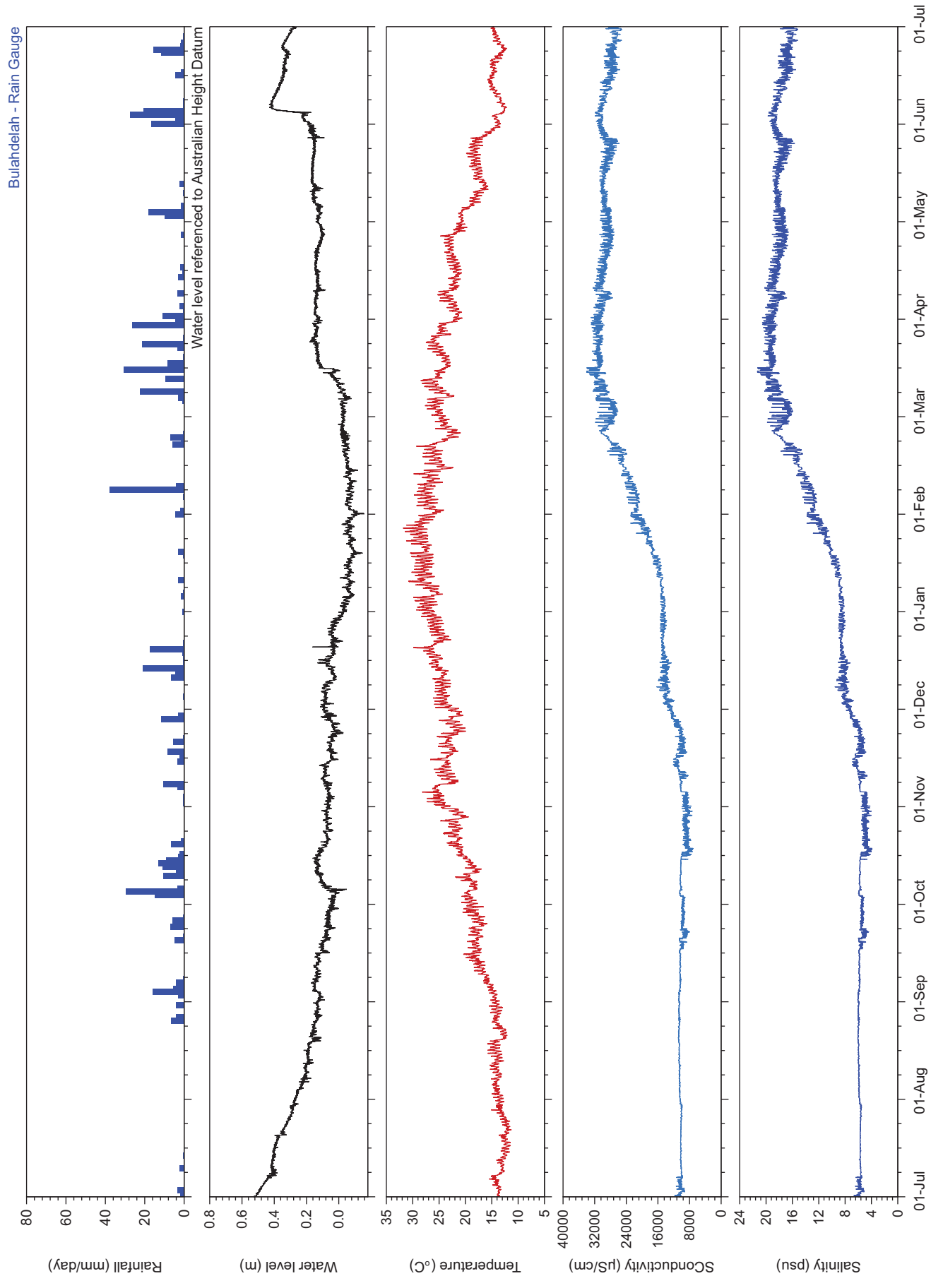
STATION LOCATIONS
GREAT LAKES REGION

Manly Hydraulics Laboratory

Report MHL2696

Figure 13

DRAWING 2696-13.cdr



NSW GOVERNMENT

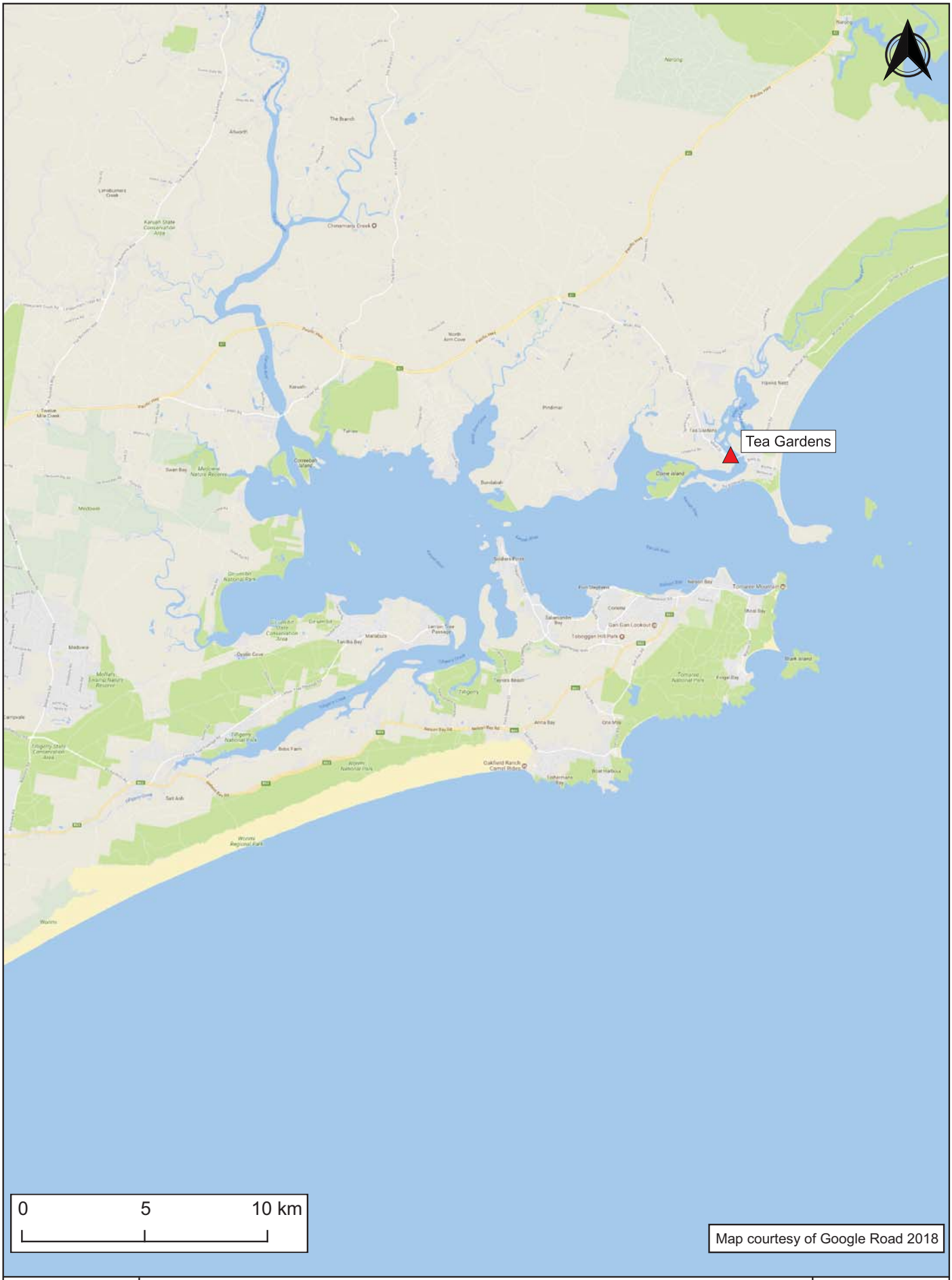
WATER LEVEL AND WATER QUALITY DATA
2018–2019
BOMBAH POINT

Manly Hydraulics Laboratory

Report MHL2696

Figure 14

DRAWING 2696-14.cdr



Map courtesy of Google Road 2018

NSW GOVERNMENT

STATION LOCATIONS
PORT STEPHENS REGION

Manly Hydraulics Laboratory

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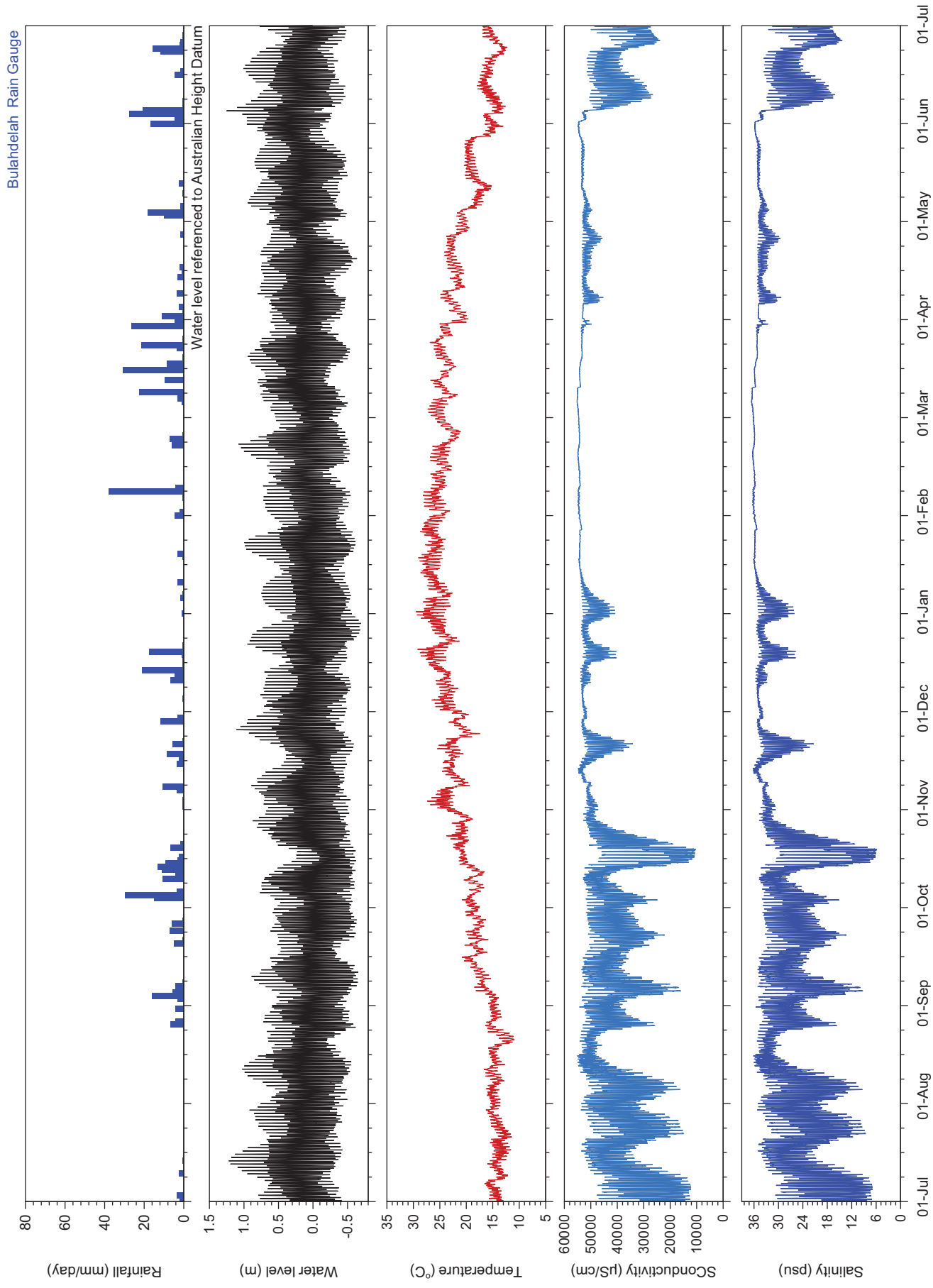
Figure 15

DRAWING 2696-15.cdr



NSW GOVERNMENT

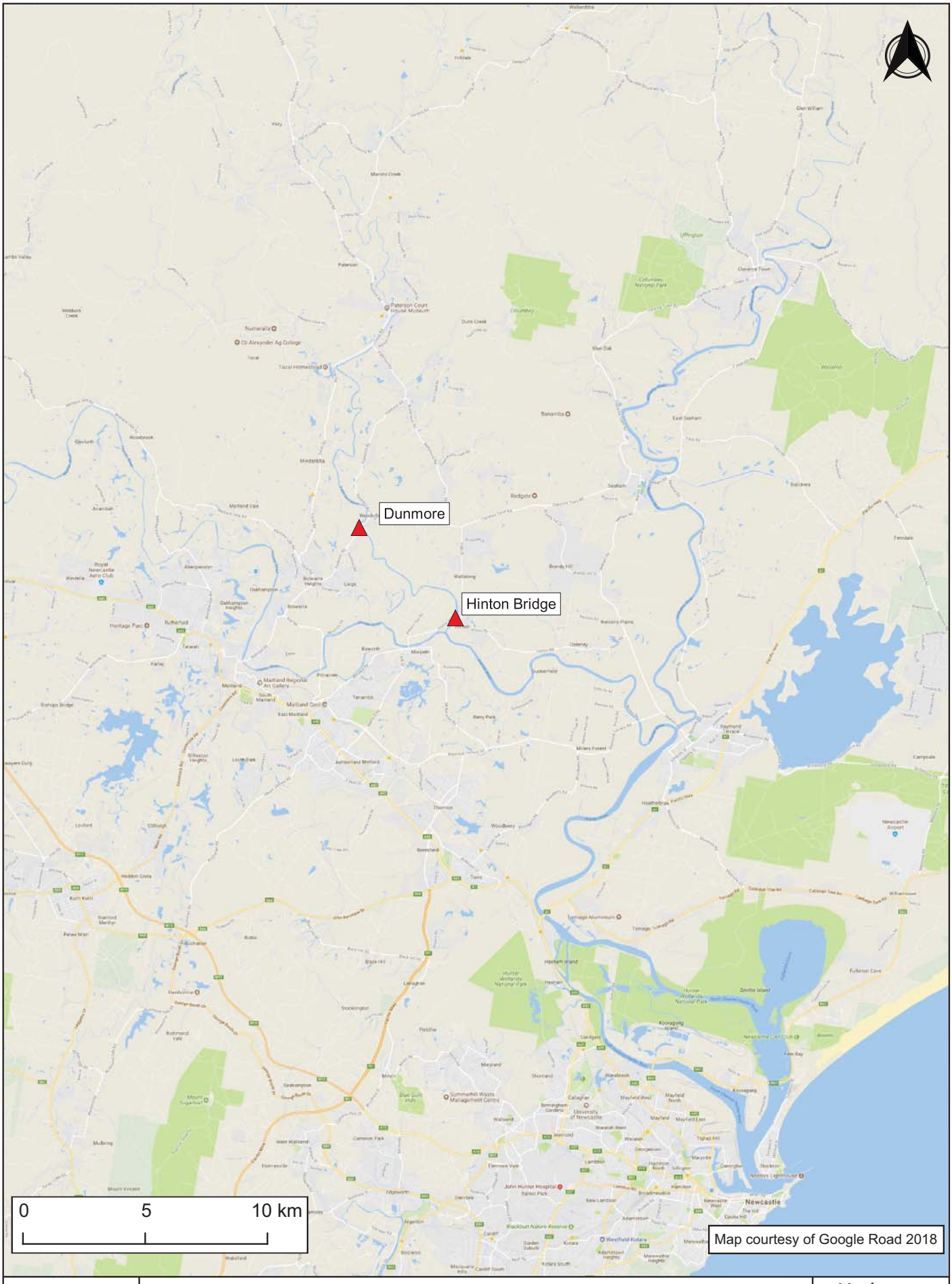
WATER LEVEL AND WATER QUALITY DATA
2018–2019
TEA GARDENS

Manly Hydraulics Laboratory

Report MHL2696

Figure 16

DRAWING 2696-16.cdr



NSW GOVERNMENT

STATION LOCATIONS
PATERSON RIVER REGION

Manly Hydraulics Laboratory

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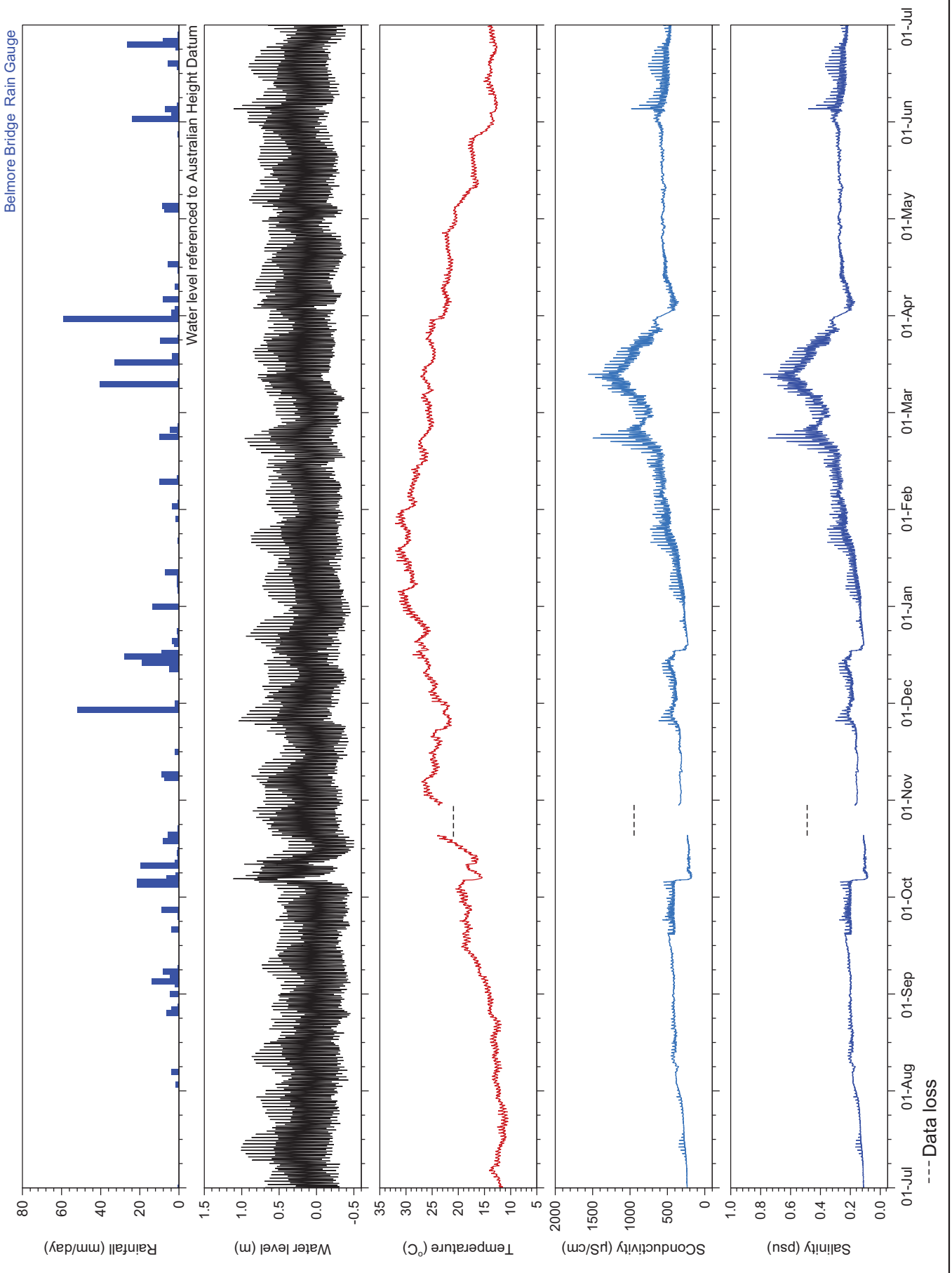
Figure

17

DRAWING 2696-17.cdr



NSW GOVERNMENT

WATER LEVEL AND WATER QUALITY DATA
2018–2019
DUNMORE

Manly Hydraulics Laboratory

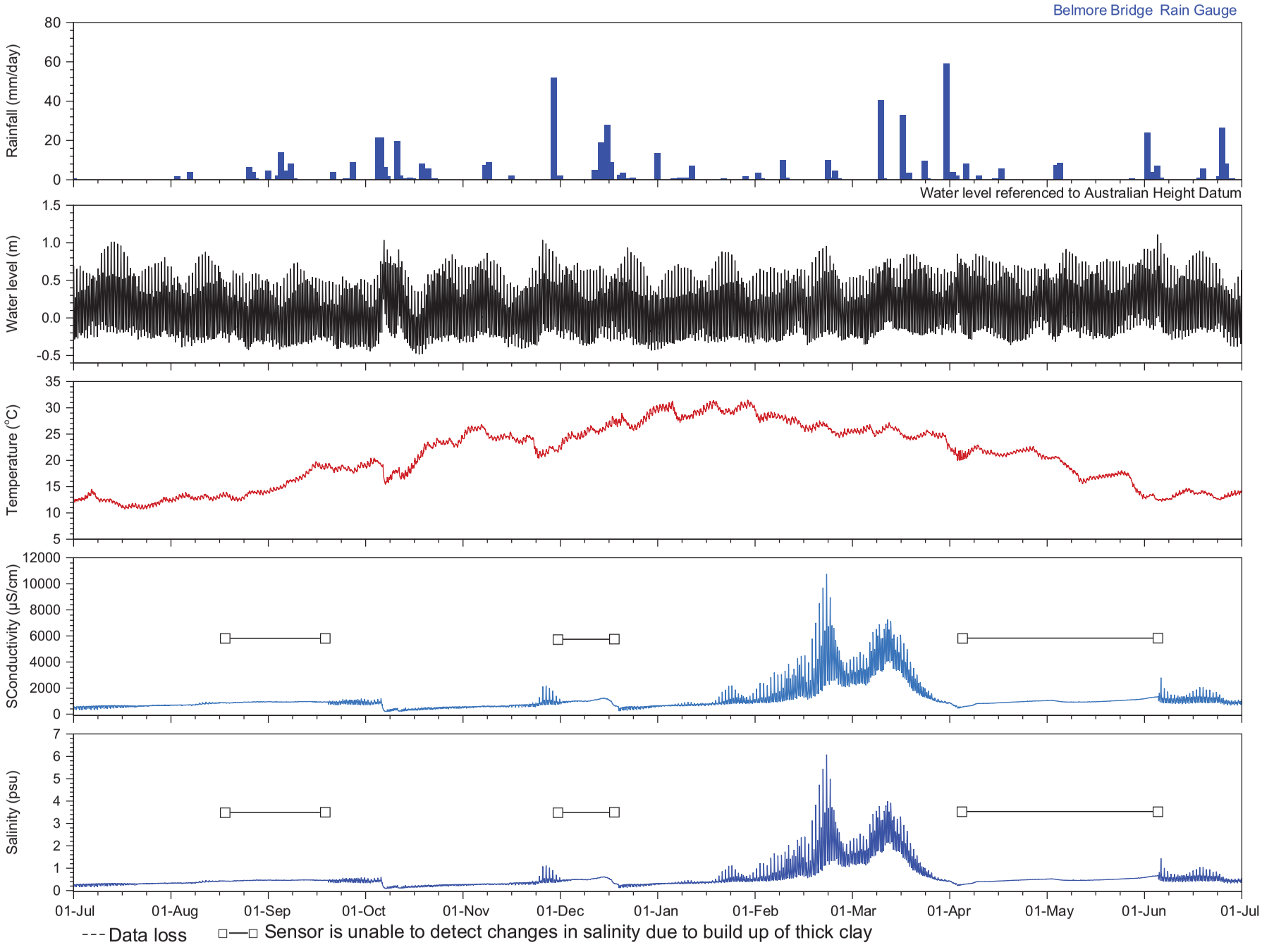
Report MHL2696

Figure 18

DRAWING 2696-18.cdr

NSW GOVERNMENT

WATER LEVEL AND WATER QUALITY DATA
2018–2019
HINTON BRIDGE



Manly Hydraulics Laboratory

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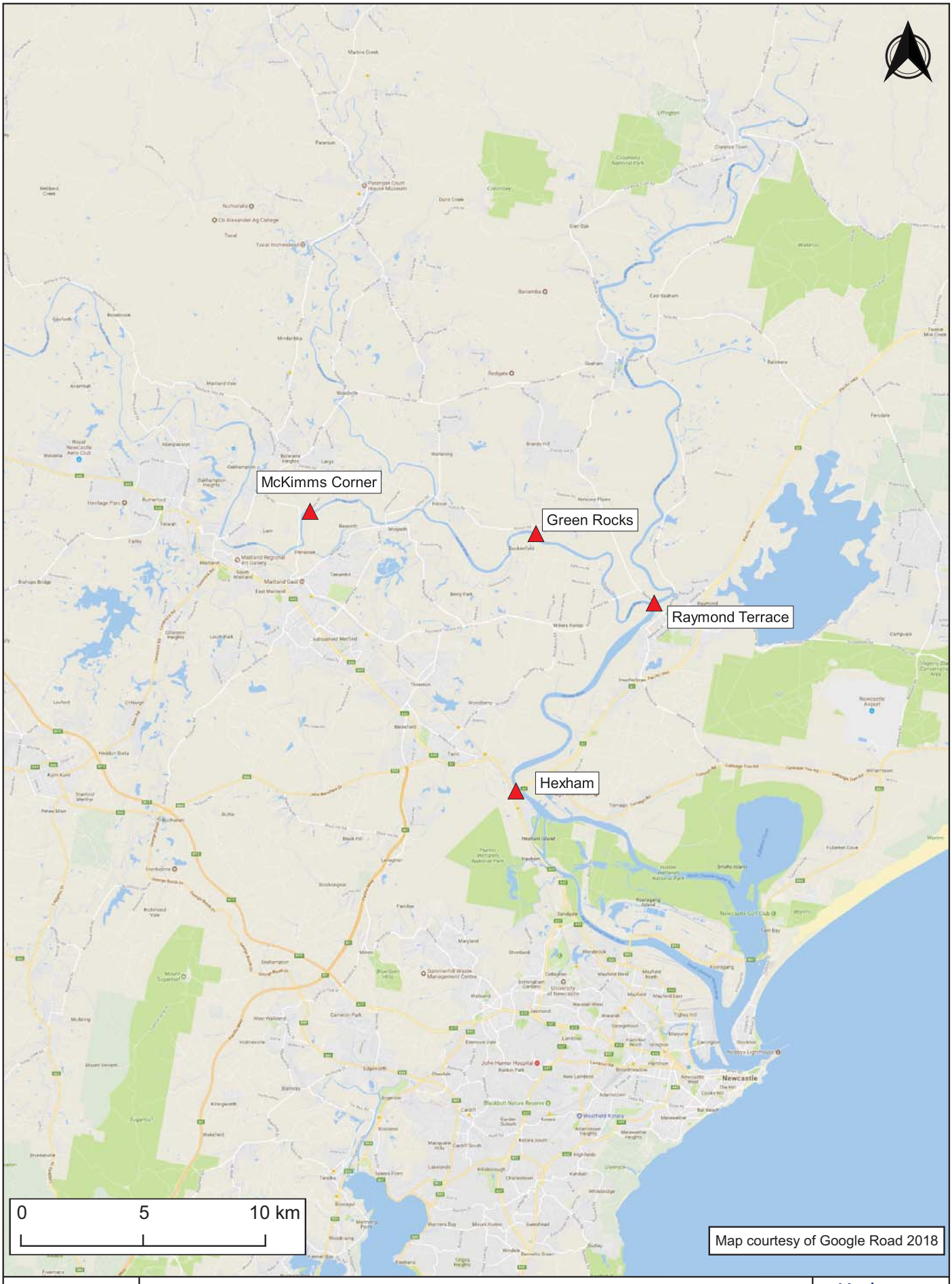
Figure 19

DRAWING 2696-19.cdr



NSW GOVERNMENT

STATION LOCATIONS
HUNTER RIVER REGION

Manly Hydraulics Laboratory

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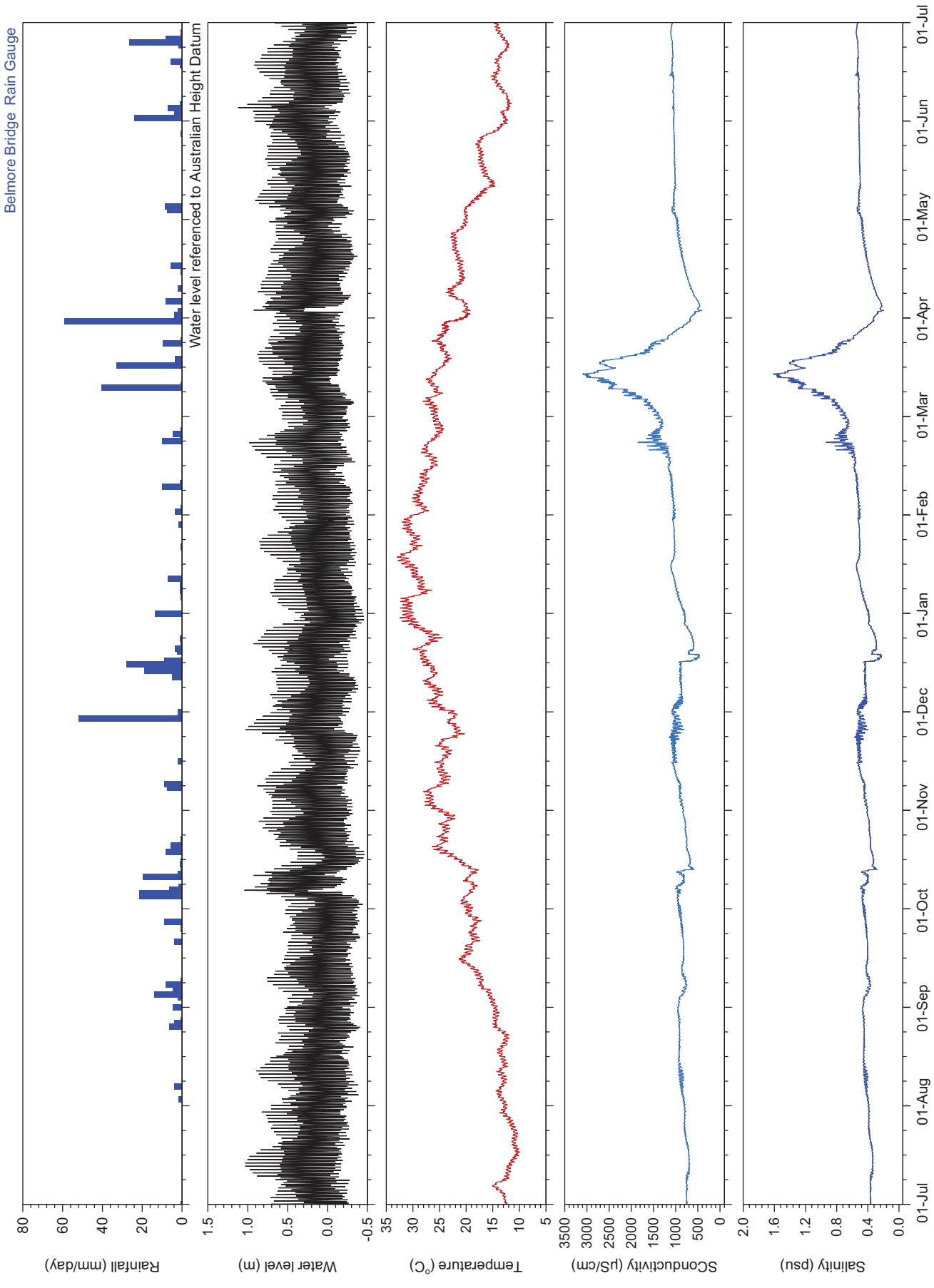
Figure 20

DRAWING 2696-20.cdr



NSW GOVERNMENT

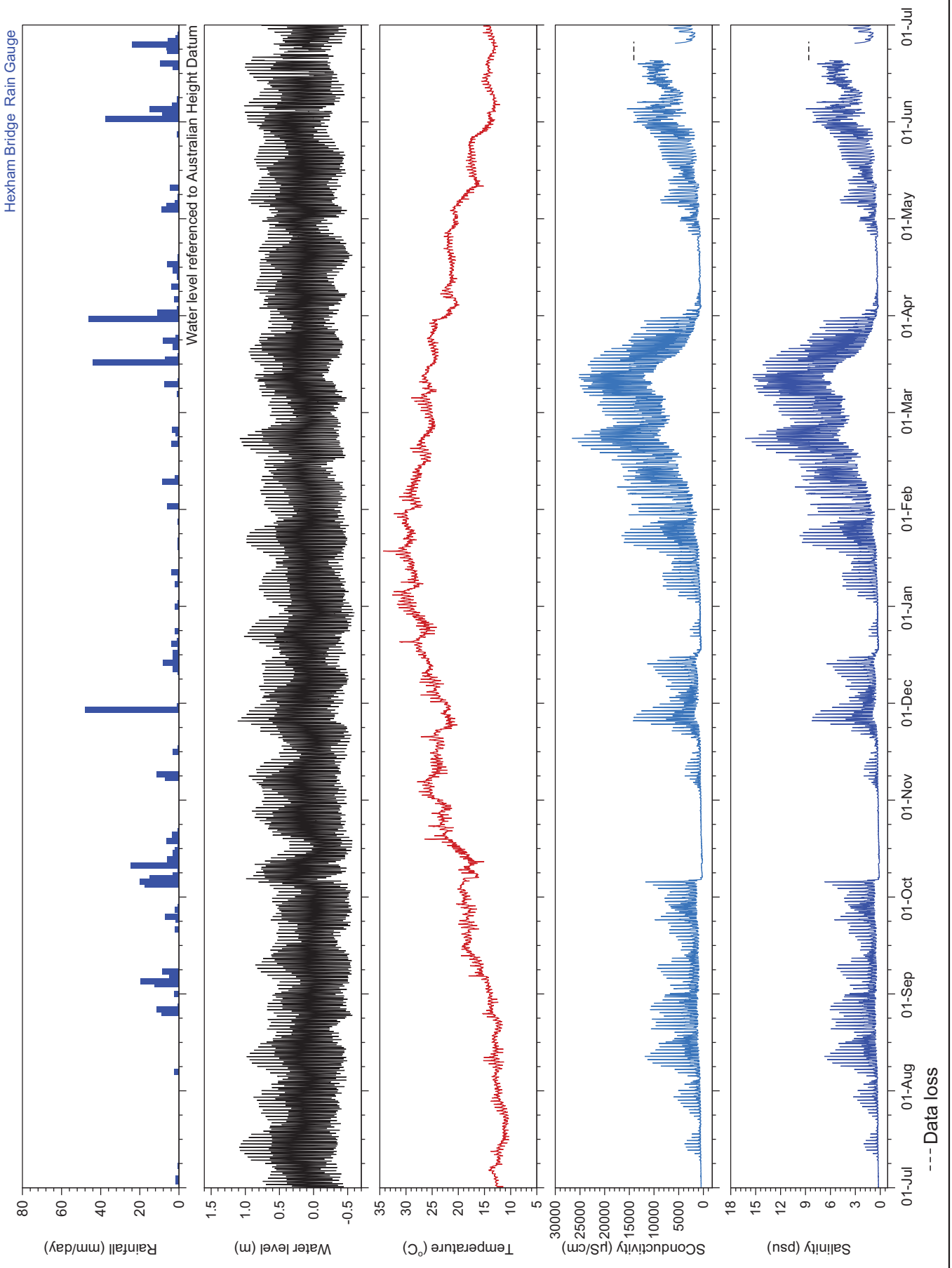
WATER LEVEL AND WATER QUALITY DATA
2018–2019
McKIMMS CORNER

Manly Hydraulics Laboratory

Report MHL2696

Figure 21

DRAWING 2696-21.cdr



NSW GOVERNMENT

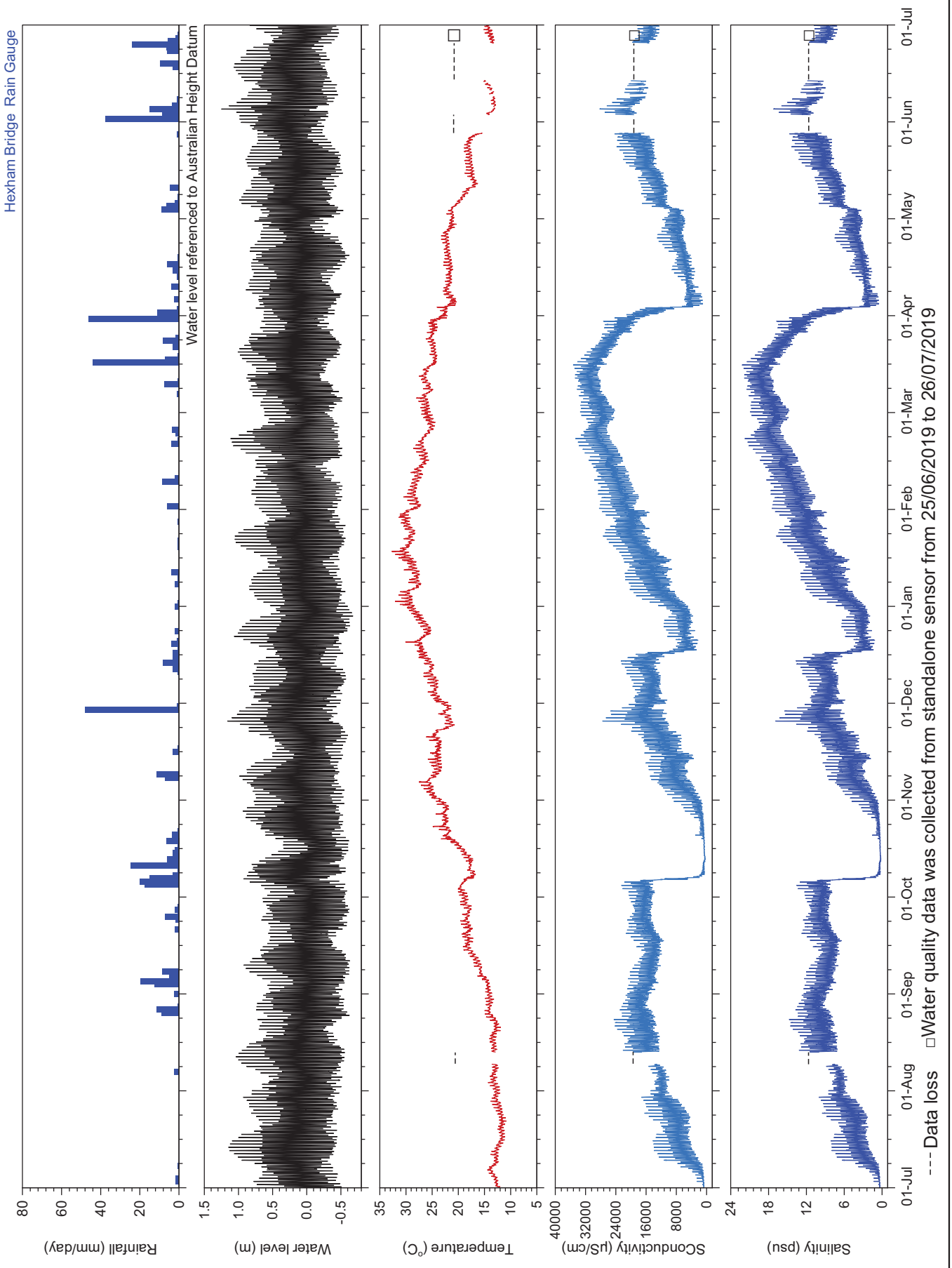
WATER LEVEL AND WATER QUALITY DATA
2018–2019
GREEN ROCKS

Manly Hydraulics Laboratory

Report MHL2696

Figure 22

DRAWING 2696-22.cdr



NSW GOVERNMENT

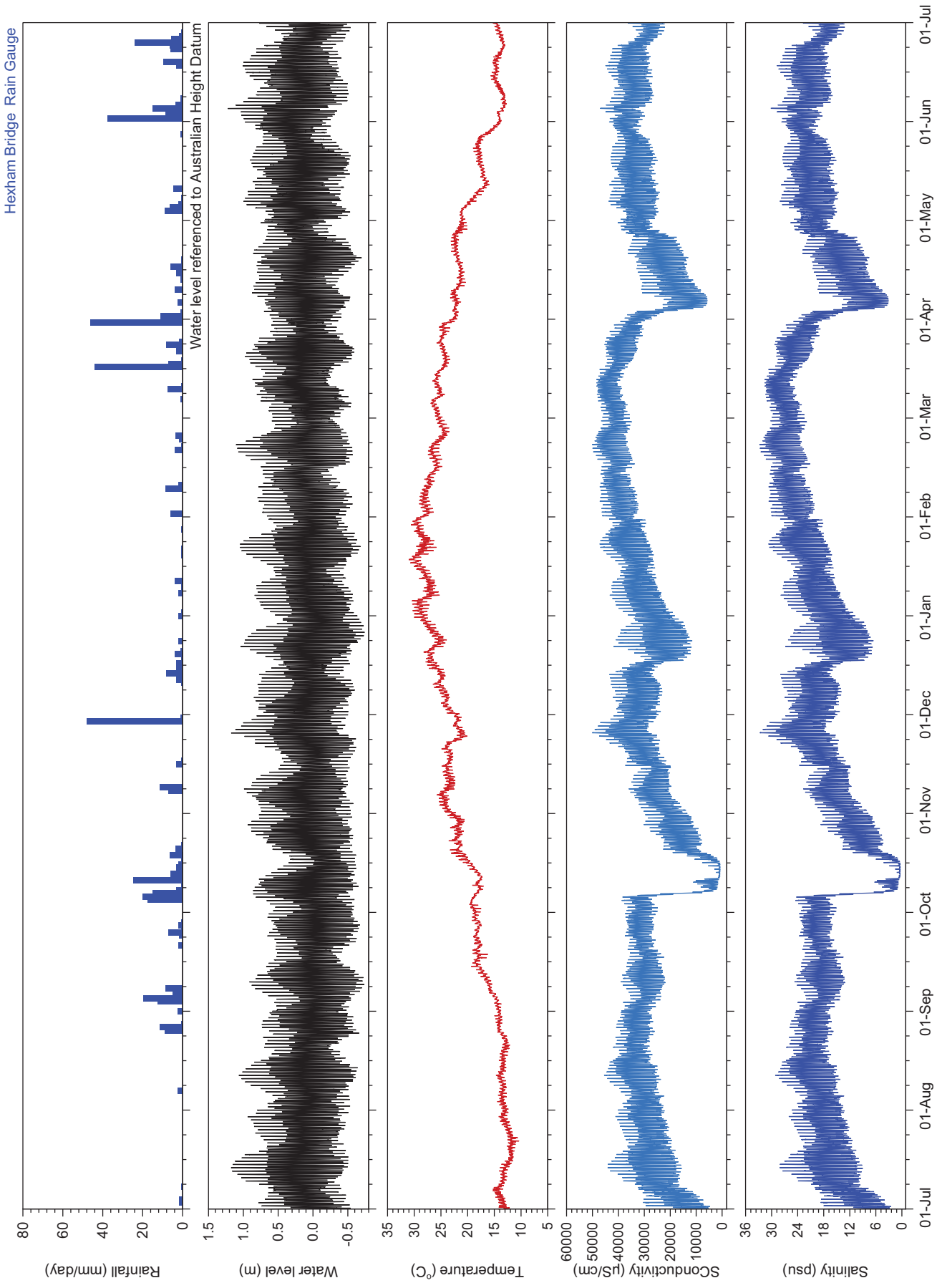
WATER LEVEL AND WATER QUALITY DATA
2018–2019
RAYMOND TERRACE

Manly Hydraulics Laboratory

Report MHL2696

Figure 23

DRAWING 2696-23.cdr



NSW GOVERNMENT

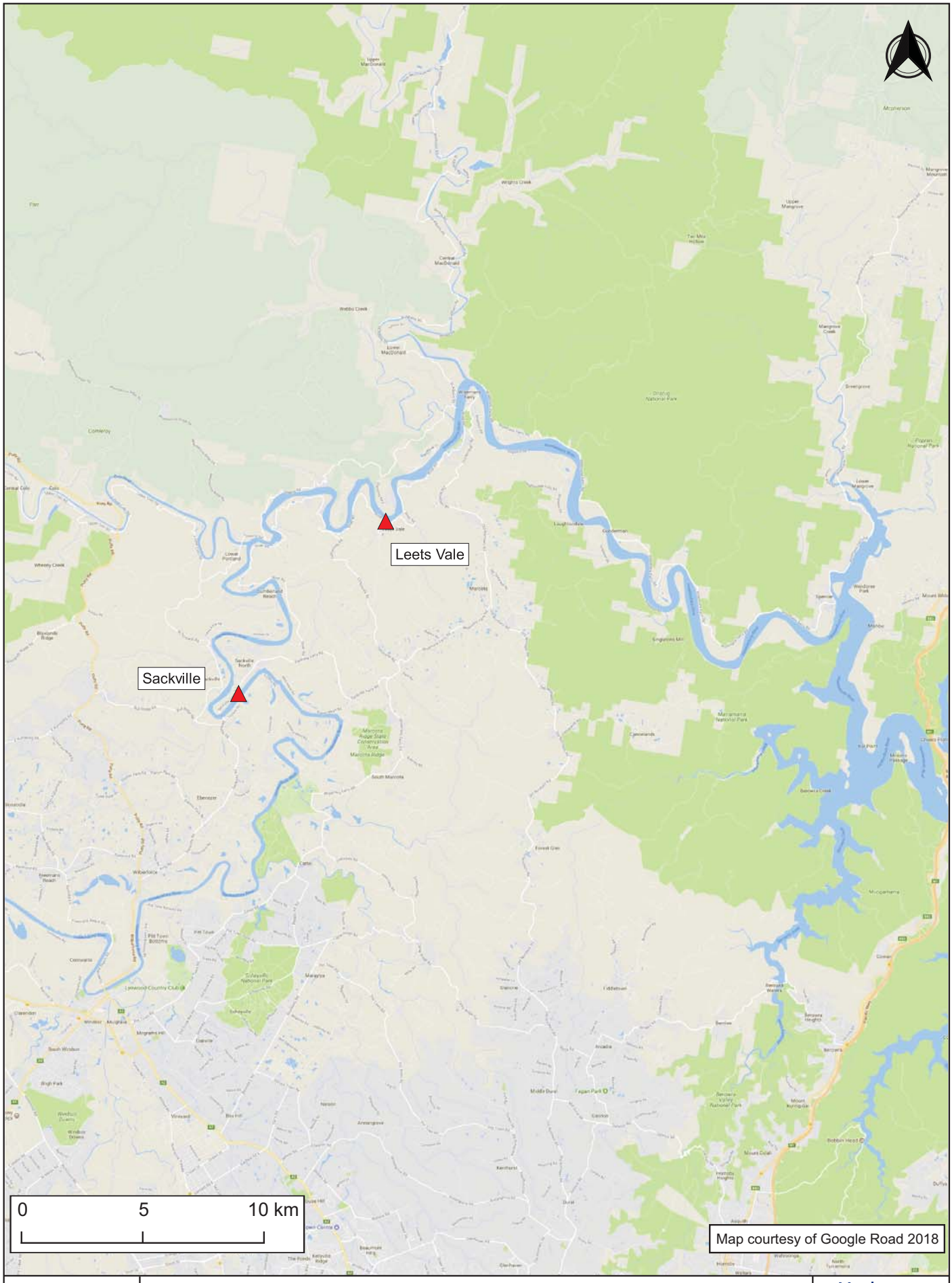
WATER LEVEL AND WATER QUALITY DATA
2018–2019
HEXHAM BRIDGE

Manly Hydraulics Laboratory

Report MHL2696

Figure 24

DRAWING 2696-24.cdr



NSW GOVERNMENT

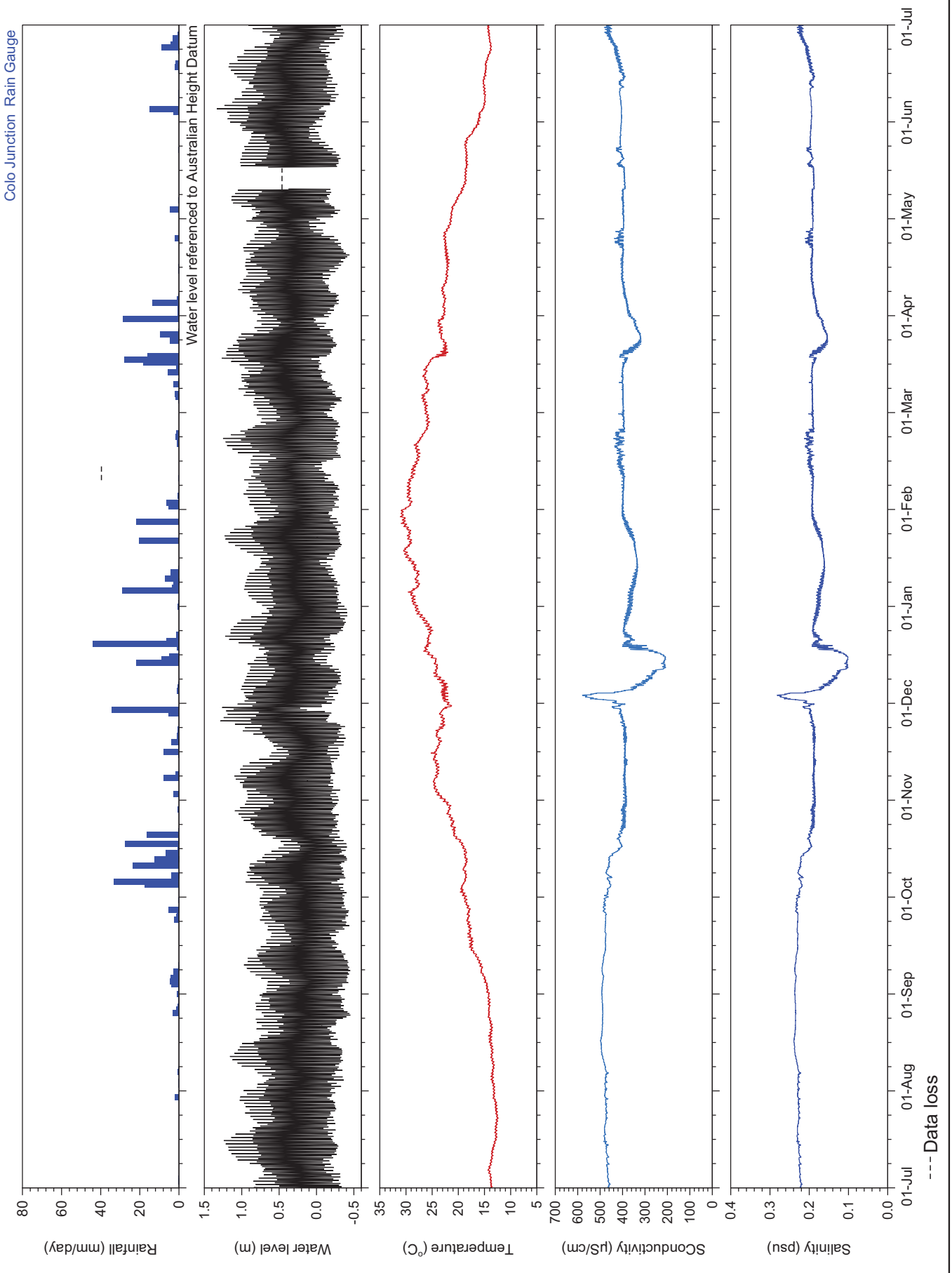
STATION LOCATIONS
HAWKESBURY RIVER REGION

Manly Hydraulics Laboratory

Report MHL2696

Figure 25

DRAWING 2696-25.cdr



NSW GOVERNMENT

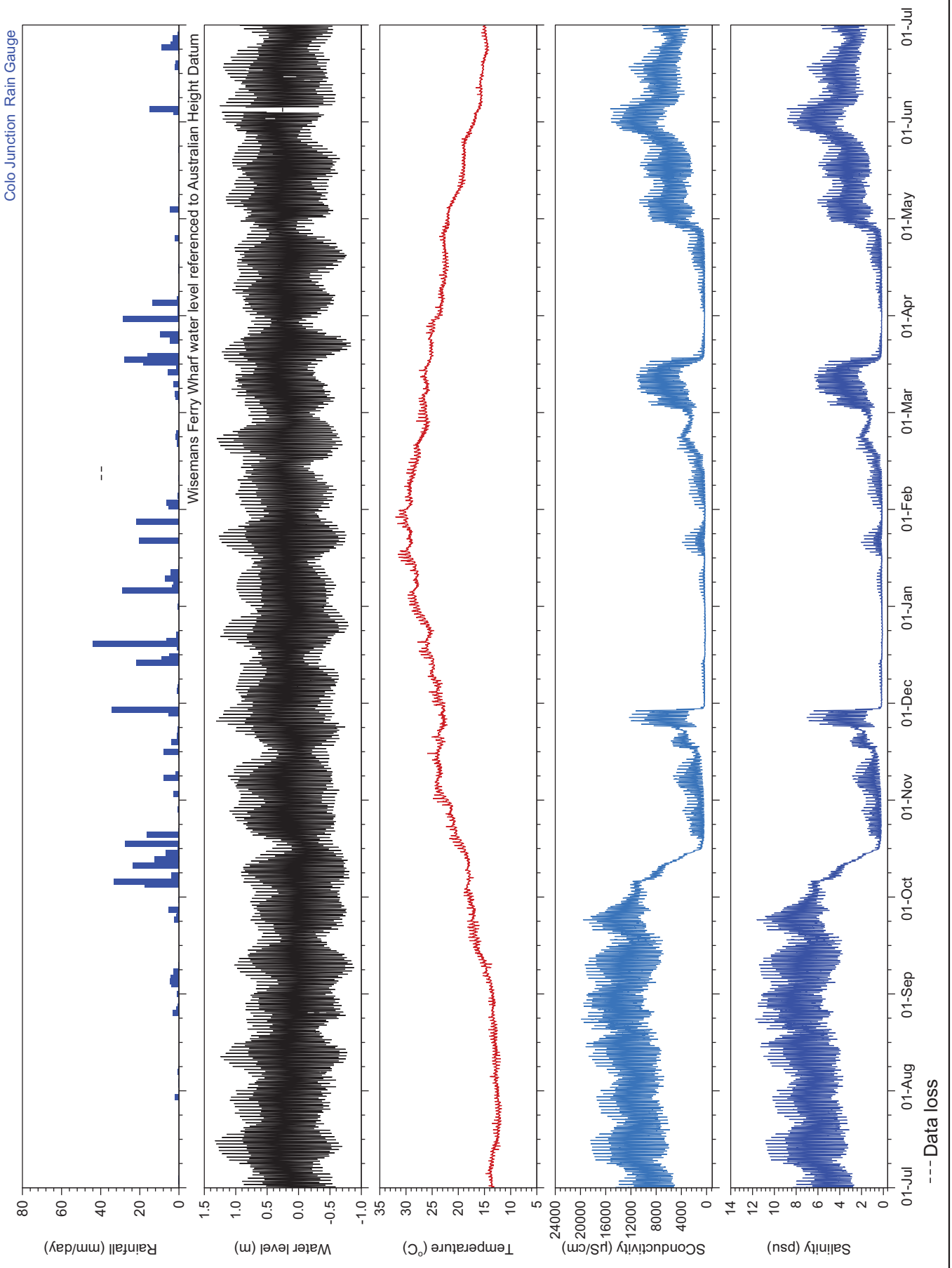
WATER LEVEL AND WATER QUALITY DATA
2018–2019
SACKVILLE

Manly Hydraulics Laboratory

Report MHL2696

Figure 26

DRAWING 2696-26.cdr



NSW GOVERNMENT

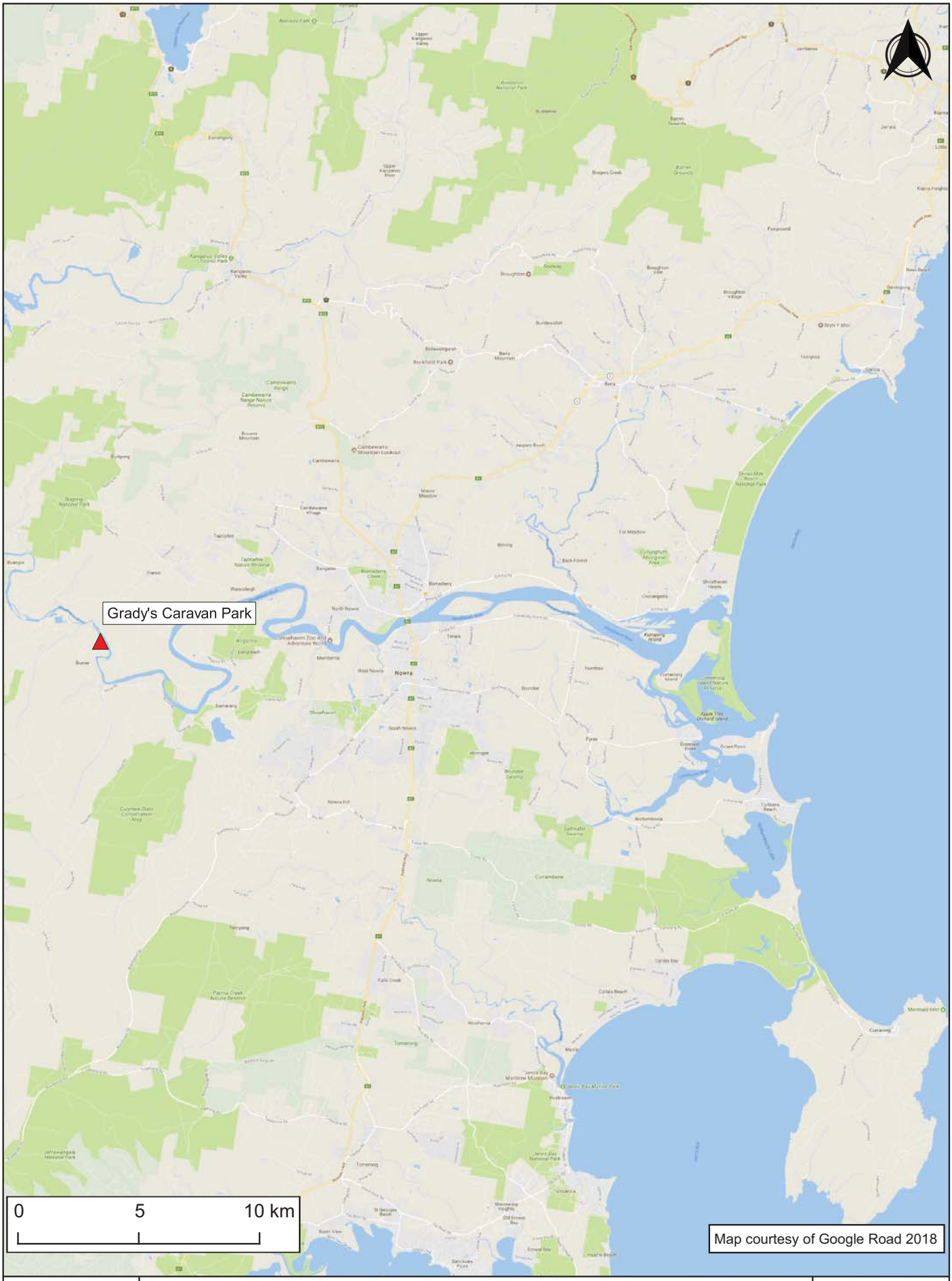
WATER LEVEL AND WATER QUALITY DATA
2018–2019
LEETS VALE

Manly Hydraulics Laboratory

Report MHL2696

Figure 27

DRAWING 2696-27.cdr



NSW GOVERNMENT

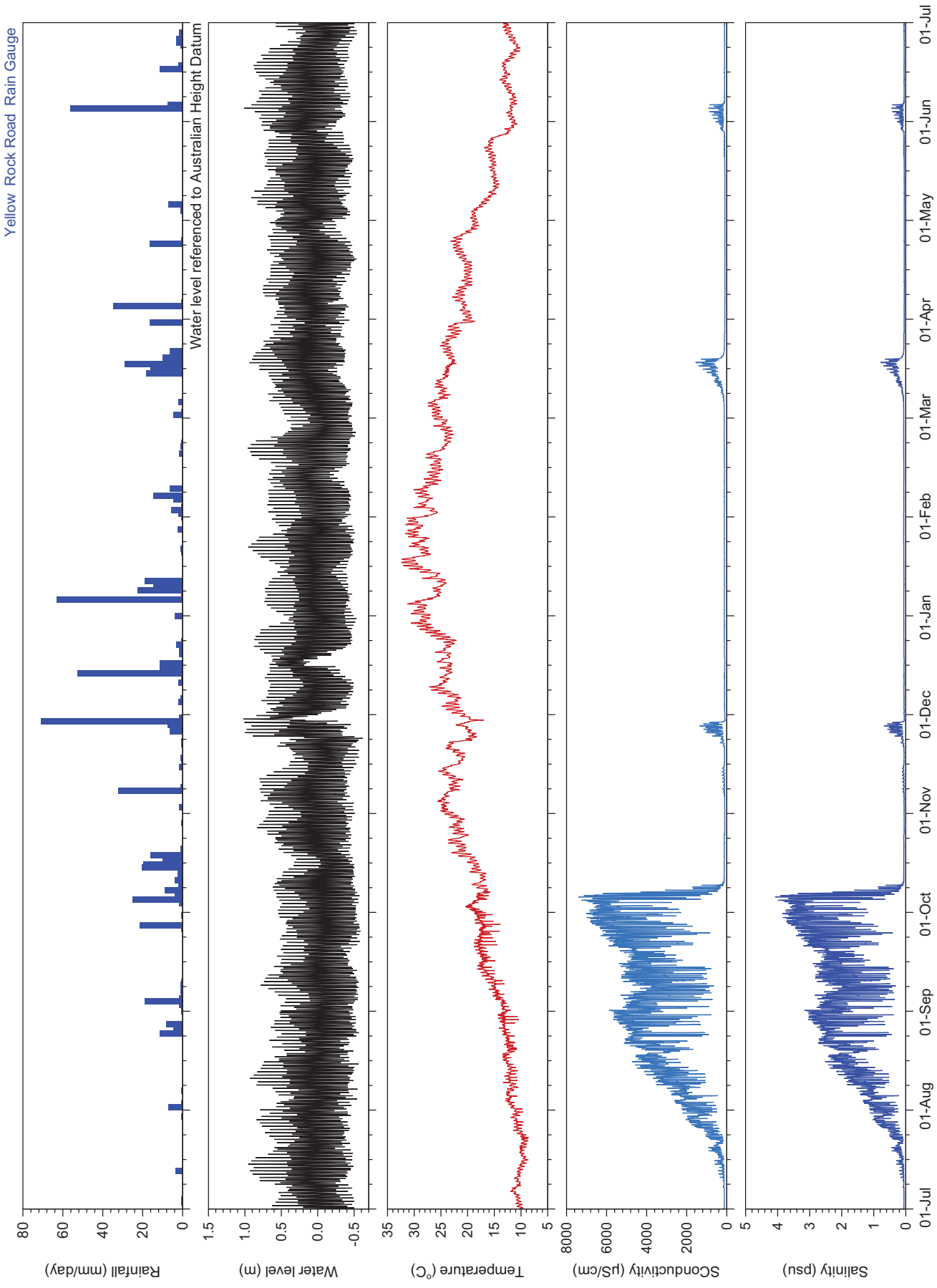
STATION LOCATIONS
SHOALHAVEN RIVER REGION

Manly Hydraulics Laboratory

Report MHL2696

Figure 28

DRAWING 2696-28.cdr



NSW GOVERNMENT

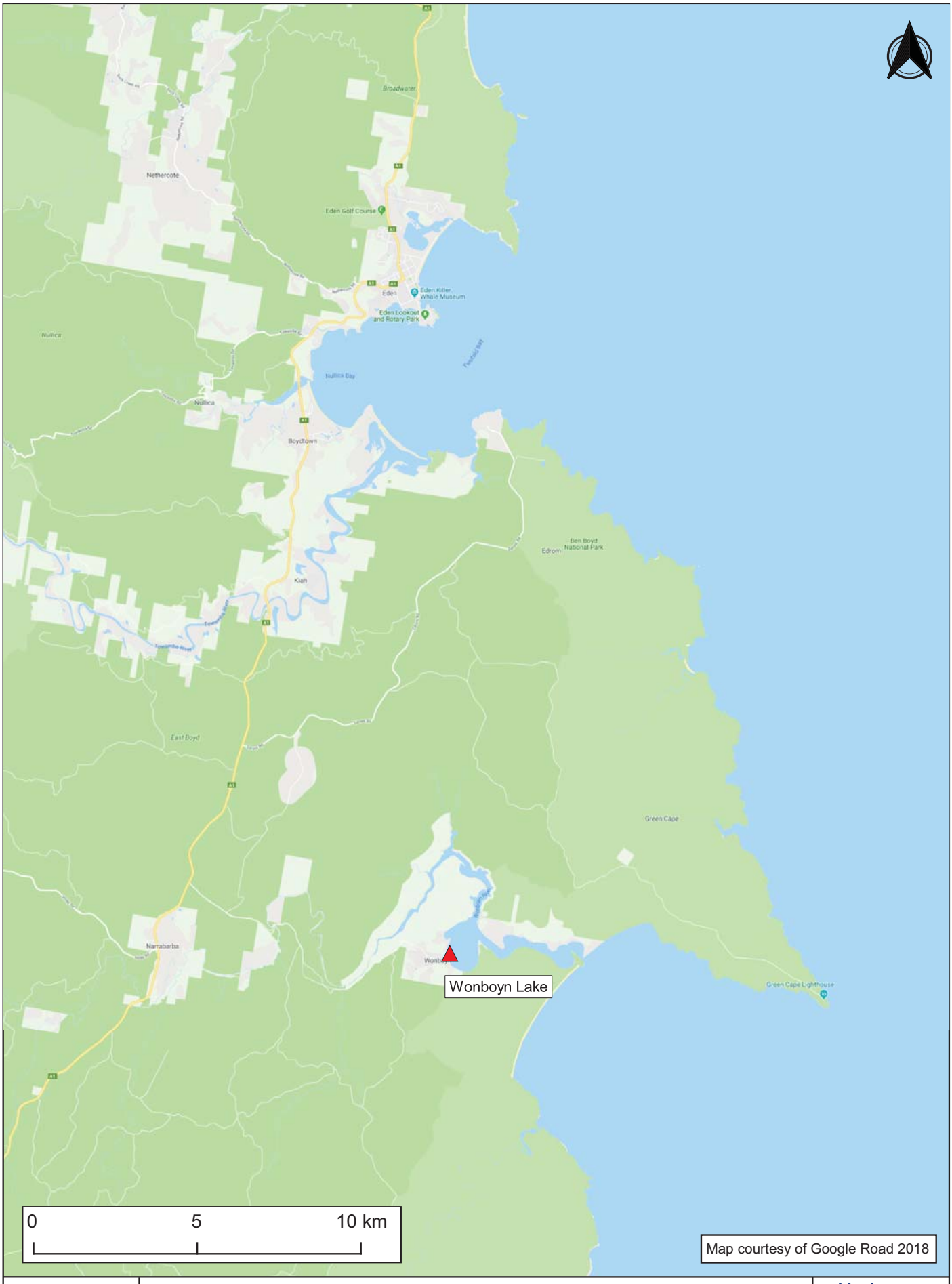
WATER LEVEL AND WATER QUALITY DATA
2018–2019
GRADY'S CARAVAN PARK

Manly Hydraulics Laboratory

Report MHL2696

Figure 29

DRAWING 2696-29.cdr



NSW GOVERNMENT

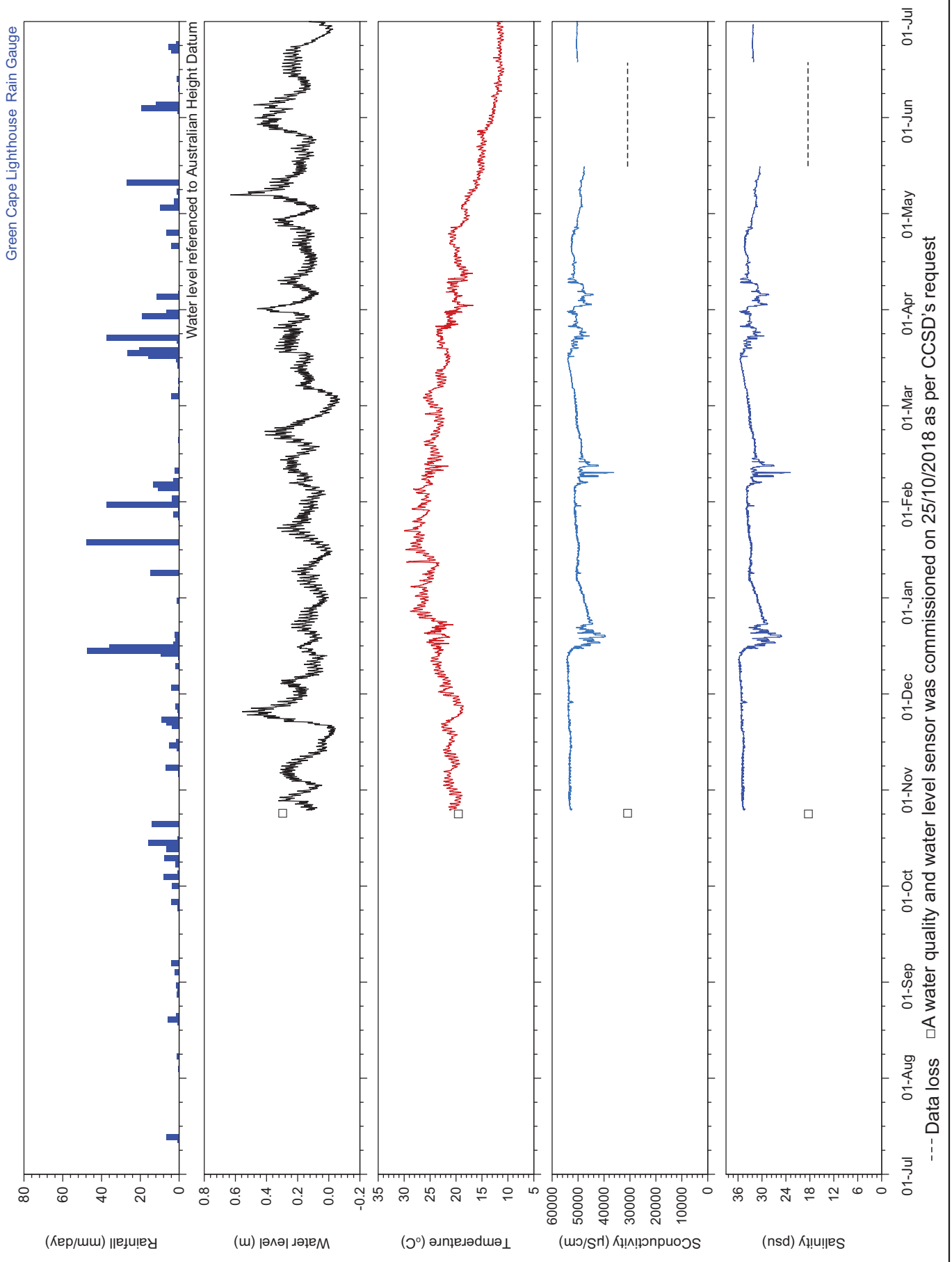
STATION LOCATIONS
WONBOYN LAKE

Manly Hydraulics Laboratory

Report MHL2696

Figure 30

DRAWING 2696-30.cdr



NSW GOVERNMENT

WATER LEVEL AND WATER QUALITY DATA
2018–2019
WONBOYN LAKE

Manly Hydraulics Laboratory

Report MHL2696

Figure 31

DRAWING 2696-31.cdr

Appendix A Data on-line

Please note that water quality data might not be continuous for the period specified.

Data on-line

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Brunswick River at Mullumbimby	Mullumbimby	202402	08-Apr-98	18-Mar-99	1000
Richmond River at Coraki	Coraki	203403	20-Sep-94	ongoing	749
Richmond River at Oakland Road	Oakland Road	203470	06-Mar-12	ongoing	
Tucombil Canal at Tucombil Highway Bridge	Tucombil Highway Bridge	203411	21-Aug-97	29-Aug-98	961
Rocky Mouth Creek at Rocky Mouth Creek	Rocky Mouth Creek	203432	06-Sep-94	21-Aug-96	794
Tucombil Canal at Tucombil Floodgate	Tucombil Floodgate	203434	09-Sep-94	29-Sep-95	961
Richmond River at Bungawalbin	Bungawalbin	203450	09-Sep-94	28-Aug-13	
Lennox Head at Lake Ainsworth	Lake Ainsworth	203455	15-Nov-95	ongoing	851
Clarence River at Grafton	Grafton	204400	02-Mar-99	ongoing	1065
Clarence River at Rogans Bridge	Rogans Bridge	204413	09-Mar-99	ongoing	1065
Clarence River at Mylneford	Mylneford	204460	21-May-10	29-Jan-13	
Nambucca River at Macksville	Macksville	205416	17-Feb-99	22-Feb-00	1050
Coffs Creek at Coffs Creek Highway Bridge	Coffs Creek Highway Bridge	205439	14-Dec-92	23-Nov-96	
Bonville Creek at Bonville	Bonville	205480	08-Aug-97	15-Feb-99	985
Borirgala Creek at Borirgala Creek	Borirgala Creek	206450	06-Apr-01	26-Sep-01	1151
Macleay River at South West Rocks	South West Rocks	206456	01-Mar-96	01-Mar-99	986
Macleay River at Euroka Upstream	Euroka Upstream	206458	07-Dec-09	17-Jun-11	
Macleay River at Kempsey	Kempsey	206402	09-Feb-10	ongoing	
Maria River at Green Valley	Green Valley	207406	30-Sep-94	01-Nov-95	760
Lake Cathie at Lake Cathie	Lake Cathie	207441	18-Aug-93	07-Sep-94	
Manning River at Wingham	Wingham	208400	08-Dec-09	ongoing	
Manning River at Taree	Taree	208410	16-Feb-10	30-Oct-13	
Manning River at Taree West	Taree West	208420	30-Apr-10	ongoing	
Myall River at Bombah Point	Bombah Point	209475	09-Jul-96	ongoing	906
Myall River at Tea Gardens	Tea Gardens	209480	20-Oct-09	ongoing	
Paterson River at Dunmore	Dunmore	210409	15-Oct-09	ongoing	
Paterson River at Hinton Bridge	Hinton Bridge	210410	03-Dec-93	ongoing	750
Wallis Creek at Wallis Creek Downstream	Wallis Creek Downstream	210428	21-Sep-95	01-Oct-98	965
Hunter River at Green Rocks	Green Rocks	210432	03-Dec-93	ongoing	750
Hunter River at Hexham Bridge	Hexham Bridge	210448	17-Dec-93	ongoing	750

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Hunter River at Fullerton Cove Salinity Buoy	Fullerton Cove Salinity Buoy	210149	21-Jun-13	01-Jul-16	
Williams River at Raymond Terrace	Raymond Terrace	210452	15-Oct-09	ongoing	
Hunter River at McKimms Corner	McKimms Corner	210455	08-Oct-09	ongoing	
Hunter River at Belmore Bridge	Belmore Bridge	210458	01-Dec-93	ongoing	750
Nepean River at Castlereagh	Castlereagh	212404	01-Jul-94	01-Jul-98	
Hawkesbury River at Sackville	Sackville	212406	01-Jul-94	ongoing	
Hawkesbury River at Colo Junction	Colo Junction	212407	07-Nov-09	05-Jul-13	
Hawkesbury River at Ebenezer	Ebenezer	212427	01-Jul-94	01-Jul-98	
Hawkesbury at Wisemans Ferry Wharf	Wisemans Ferry Wharf	212460	10-Jun-10	19-Jul-13	
Hawkesbury at Leets Vale	Leets Vale	212461	22-Jun-10	ongoing	
Lake Illawarra at Cudgeree Bay	Cudgeree Bay	214416	09-Feb-93	ongoing	994
Lake Illawarra at Koonawarra Bay	Koonawarra Bay	214440	15-Jun-93	ongoing	994
Shoalhaven at Grady's Caravan Park	Grady's Caravan Park	215430	06-Oct-10	ongoing	
Wollumboola Lake at Wollumboola	Wollumboola	215454	01-Feb-99	06-Jan-11	1145
Crookhaven River at Crookhaven Heads	Crookhaven Heads	215471	06-Mar-95	07-Apr-95	
Currarong Creek at Currarong Creek	Currarong Creek	216405	04-Mar-96	04-Mar-97	858
Swan Lake at Swan Lake	Swan Lake	216425	02-Feb-99	02-Feb-00	
Clyde River at Nelligen	Nelligen	216453	17-Sep-96	17-Sep-97	889
Tomaga at George Bass Drive	George Bass Drive	216455	28-Aug-96	28-Aug-97	890
Tuross River at Coila Lake	Coila Lake	218405	08-Mar-96	21-Nov-96	848
Wagonga River at Barlows Bay	Barlows Bay	218415	30-Aug-96	30-Aug-97	888
Wallaga Lake at Regatta Point	Regatta Point	219405	06-Mar-95	07-Apr-95	
Bega River at Bega	Bega	219410	24-Feb-10	21-May-13	
Back Lagoon at Back Lagoon	Back Lagoon	219415	25-Sep-97	25-Sep-98	963
Lake Curalo at Lake Curalo	Lake Curalo	220420	09-Mar-96	09-Mar-98	920
Wonboyn River at Agnew Wharf	Agnew Wharf	220425	20-Aug-97	20-Aug-98	964
Wonboyn Lake at Hemingway Creek	Wonboyn Lake	220452	25-Oct-18	ongoing	

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Bartletts Creek at Bartletts Creek	Bartletts Creek	Station number not assigned	06-Jun-95	19-Mar-96	780
Leddays Creek at Leddays Creek	Leddays Creek	Station number not assigned	02-Jun-95	31-Jul-96	780
Officer Drain at Officer Drain (near Ritchies Creek)	Officer Drain	Station number not assigned	02-Jun-95	21-Mar-96	780
McLeods Drain at McLeods Drain (near Stotts Creek)	McLeods Drain	Station number not assigned	21-Mar-96	31-Jul-96	780
McLeods Drain Offshoot at McLeods Drain Offshoot	McLeods Drain Offshoot	Station number not assigned	21-Mar-96	31-Sep-96	780
Cudgen Lake at Cudgen Lake	Cudgen Lake	Station number not assigned	14-Dec-92	05-Nov-93	674
Cudgen Creek at Cudgen Lake West	Cudgen Lake West	Station number not assigned	08-Oct-93	05-Nov-93	674
Cudgen Creek at Cudgen Creek	Cudgen Creek	Station number not assigned	15-Dec-92	05-Nov-93	674
Simpsons Creek at Belongil	Belongil	Station number not assigned	06-Dec-94	17-Dec-96	
Richmond River at Shaws Bay	Shaws Bay	Station number not assigned	11-Mar-99	12-Apr-00	755, 849
Marshalls Creek at Capricornia Canal	Capricornia Canal	Station number not assigned	24-Mar-97	31-Mar-11	1051
Marshalls Creek at New Brighton	New Brighton	Station number not assigned	17-Mar-97	24-Apr-98	1000
Brunswick River at Pacific Highway Bridge	Pacific Highway Bridge	Station number not assigned	18-Mar-97	18-Mar-99	1000
Simpsons Creek at Simpsons Creek	Simpsons Creek	Station number not assigned	03-Apr-98	18-Mar-99	1000
Tuckean Broadwater at Tuckean	Tuckean	Station number not assigned	30-Oct-95	29-Oct-96	850
Richmond River at Empire Vale Creek	Empire Vale Creek	Station number not assigned	08-May-98	12-Oct-99	1032
Roberts Creek at Roberts Creek	Roberts Creek	Station number not assigned	20-May-94	24-May-96	784

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Clarence River at Tarrent Bridge	Tarrent Bridge	Station number not assigned	04-Mar-99	11-Apr-00	1065
Andersons Inlet at Middle Island MM1	Middle Island MM1	Station number not assigned	06-Apr-01	15-Dec-06	986
Andersons Inlet at Middle Island MM2	Middle Island MM2	Station number not assigned	19-Mar-96	03-Feb-99	986
Andersons Inlet at Double Island	Double Island	Station number not assigned	19-Mar-96	03-Feb-99	986
Macleay River at Andersons Inlet	Andersons Inlet	Station number not assigned	06-Apr-01	27-Sep-01	1151
Maria River at Connection Creek	Connection Creek	Station number not assigned	22-Sep-94	26-Oct-95	760
Hastings River at Lake Innes	Lake Innes	Station number not assigned	19-Aug-93	07-Sep-94	760
Scotts Creek at Scotts Creek	Scotts Creek	Station number not assigned	20-Oct-98	22-Oct-99	1029
Wallis Lake at Peach Tree Point	Peach Tree Point	Station number not assigned	30-Jul-97	09-Mar-99	987
Wallis Lake at Wallamba	Wallamba	Station number not assigned	30-Jul-97	25-Aug-98	987
Wallis Lake at Booti Island	Booti Island	Station number not assigned	31-Jul-97	25-Aug-98	987
Wallis Lake at Darawakh Creek	Darawakh Creek	Station number not assigned	26-Aug-98	08-Mar-99	987
Smiths Lake at Smiths Lake	Smiths Lake	Station number not assigned	04-May-95	16-May-96	771
Myall Lake at Mayers Point	Mayers Point	Station number not assigned	10-Jul-96	04-Mar-98	906
Myall River at Monkey Jacket	Monkey Jacket	Station number not assigned	09-Jul-96	04-Mar-98	906
Lake Wollumboola at Lake Wollumboola	Lake Wollumboola Floating	Station number not assigned	07-Dec-00	19-Jun-01	1145
Tuross Lake at Trunketabella	Trunketabella	Station number not assigned	04-May-94	11-Mar-98	921

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Wallaga Lake at Meads Bay	Meads Bay	Station number not assigned	03-Feb-99	10-Feb-00	1048
Hexham Swamp at Ironbark Creek Downstream	Ironbark Creek Downstream	Station number not assigned	08-Aug-02	30-Jun-09	
Hexham Swamp at Ironbark Creek Upstream	Ironbark Creek Upstream	Station number not assigned	09-Aug-02	27-Oct-04	
Hexham Swamp at Morris Jetty	Morris Jetty	Station number not assigned	07-Aug-02	30-Jun-09	
Hunter River at Fishery Creek	Fishery Creek	Station number not assigned	08-Aug-02	07-Mar-03	
Hunter River at Fishery Creek 2	Fishery Creek 2	Station number not assigned	11-Jun-03	29-Aug-03	
Hexham Swamp at Shortland Wetland Centre	Shortland Wetland Centre	Station number not assigned	10-Mar-99	04-Jul-00	1058
Hexham Swamp at SWC Canoe Trail	SWC Canoe Trail	Station number not assigned	07-Aug-02	09-Jan-03	1221
Lake Macquarie at Swansea Channel Site 4	Swansea Channel Site 4	Station number not assigned	28-Mar-96	14-Jun-96	770
Lake Macquarie at Swansea Channel Site 5	Swansea Channel Site 5	Station number not assigned	15-Apr-96	10-May-96	770
Orphan site at Berowra Water Quality	Berowra Creek Water Quality	Station number not assigned	26-May-95	29-Nov-95	745
Berowra Creek at Berowra Waters Marina	Berowra Waters Marina	Station number not assigned	22-Aug-01	23-Nov-01	
Narrabeen Lagoon at Pittwater Road Bridge	Pittwater Road Bridge	Station number not assigned	23-Feb-96	15-Nov-05	
Manly Lagoon at Riverview Parade	Riverview Parade	Station number not assigned	02-Feb-96	05-Jan-07	
Manly Lagoon at Manly Dam	Manly Dam	Station number not assigned	29-Jan-96	22-Aug-01	
Shoalhaven River at Wharf Road	Wharf Road	Station number not assigned	06-Mar-95	07-Apr-95	
Shoalhaven River at DPI Waterra Bridge	DPI Waterra Point	Station number not assigned	07-Mar-95	07-Apr-95	

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Clyde River at Clyde Site 7	Clyde River Site 7	Station number not assigned	25-Sep-96	08-Oct-96	792
Clyde River at Clyde Site 16	Clyde River Site 16	Station number not assigned	25-Sep-96	08-Oct-96	
Wonboyn River Upstream of Wonboyn Lake	Wonboyn River	Station number not assigned	21-Aug-97	06-Sep-98	

Appendix B Sample outputs

NSW GOVERNMENT

SAMPLE DATA PLOTS

Manly Hydraulics Laboratory

Report MHL2696

Figure B1

DRAWING 2696-B1.cdr

Station Name, Port Stephens (Live),,
Station Number,209471,,
Latitude,+152:10:56.06,,
Longitude,-32:42:53.57,,
Datum,PSHD,,
,,,
date,time,value,value.status
5/07/2011,0:00:00,1.61325,6 (Good)
5/07/2011,0:15:00,1.56495,6 (Good)
5/07/2011,0:30:00,1.47403,6 (Good)
5/07/2011,0:45:00,1.39316,6 (Good)
5/07/2011,1:00:00,1.3186,6 (Good)
5/07/2011,1:15:00,1.22369,6 (Good)
5/07/2011,1:30:00,1.10246,6 (Good)
5/07/2011,1:45:00,1.03073,6 (Good)
5/07/2011,2:00:00,0.949726,6 (Good)
5/07/2011,2:15:00,0.84358,6 (Good)
5/07/2011,2:30:00,0.756913,6 (Good)
5/07/2011,2:45:00,0.658031,6 (Good)
5/07/2011,3:00:00,0.573691,6 (Good)
5/07/2011,3:15:00,0.504744,6 (Good)
5/07/2011,3:30:00,0.423529,6 (Good)
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5/07/2011,4:00:00,0.317804,6 (Good)
5/07/2011,4:15:00,0.276461,6 (Good)
5/07/2011,4:30:00,0.214138,6 (Good)
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5/07/2011,5:00:00,0.182245,6 (Good)
5/07/2011,5:15:00,0.190659,6 (Good)
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5/07/2011,5:45:00,0.22192,6 (Good)
5/07/2011,6:00:00,0.237748,6 (Good)
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5/07/2011,6:30:00,0.337178,6 (Good)
5/07/2011,6:45:00,0.395157,6 (Good)
5/07/2011,7:00:00,0.441683,6 (Good)
5/07/2011,7:15:00,0.495641,6 (Good)

Appendix C Other publications of interest

Data reports

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), 2573 (16-17), 2617 (17-18), 2692 (18–19).

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), 2574 (16-17), 2618 (17-18), 2693 (18–19).

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), 2575 (16-17), 2619 (17-18), 2694 (18–19).

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), 2576 (16-17), 2620 (17-18), 2695 (18–19).

MHL Estuary and River Water Quality Summaries available:

MHL Report Nos. 2161 (11-12), 2222 (12-13), 2295 (13-14), 2387 (14-15), 2478 (15-16), 2577 (16-17), 2621 (17-18), 2696 (18–19).

Salinity profiling

NSW Public Works 2010, *Bellinger and Kalang Rivers Data Collection July 2008–September 2009,* Manly Hydraulics Laboratory, Report No. 1951.

NSW Public Works 2012, *NSW Estuaries Salinity Data Compilation*, Manly Hydraulics Laboratory, Report No. 1812.

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