



NSW ESTUARY AND RIVER WATER QUALITY ANNUAL SUMMARY 2020–2021

Report MHL2859
February 2022

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Biodiversity and Conservation Division

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Foreword

NSW government's professional specialist advisor, Manly Hydraulics Laboratory (MHL), was commissioned by the Biodiversity and Conservation Division (BCD) of the NSW Department of Planning, Industry and Environment and WaterNSW to develop the NSW water quality database. MHL maintains the automatic recording stations and catalogues the collected data. The water quality database supports a number of programs associated with coastal, floodplain and estuary management.

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 2020 to 30 June 2021. The overall data recovery rate was 95.8%.

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

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Other annual summaries in this series include:

- NSW Estuary and River Water Levels Annual Summary 2020–2021
Manly Hydraulics Laboratory
Report No. MHL 2855
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- NSW Ocean and River Entrance Tidal Levels and Coastal Air Pressure Annual Summary 2020–2021
Manly Hydraulics Laboratory
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- NSW Coastal Rainfall Annual Summary 2020–2021
Manly Hydraulics Laboratory
Report No. MHL 2857
ISSN: 2205-5568 (Print)
ISSN: 2205-5576 (online)
- NSW Wave Climate Annual Summary 2020–2021
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Executive summary

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 2020 to 30 June 2021. The overall data recovery rate was 95.8%. The target recovery rate of 95% or more is achieved for the 2021–2021 reporting period.

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 2020–2021
- the data summaries and station location maps for each station
- **Appendix A**, detailing the data available online
- **Appendix B**, a list of other publications which may be of interest.

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1 Water quality monitoring program

This report presents a summary of the water quality data currently collected by Manly Hydraulics Laboratory (MHL) at 21 monitoring stations in NSW. The network of automatic recorders and the associated analysis routines enable efficient delivery of water quality data. Readers can also request specific water quality data extracts from the historical database (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 21 permanent stations funded by the Department of Planning, Industry and Environment's Biodiversity and Conservation Division (BCD) and WaterNSW (see [Table 1](#)). The logging systems consist of data loggers which record water quality information every 15 minutes.

Table 1 Station list

River/ estuary region	Station name	Station no.	MGA zone	Easting	Northing	Station owner	Data start	Overall data capture rate 2020–2021
Richmond	Lake Ainsworth	203455	56	557863	6816160	BCD	10-Apr-18	100.0%
Richmond	Coraki	203403	56	527976	6793772	BCD/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	BCD/WaterNSW	03-Dec-09	79.9%*
Clarence	Grafton	204400	56	493398	6715149	BCD/WaterNSW	04-Dec-09	99.6%
Macleay	Kempsey	206402	56	485099	6561395	BCD/WaterNSW	09-Feb-10	81.9%*
Lake Cathie	Lake Cathie	207441	56	486162	6509679	BCD	18-Jun-20	87.4%
Manning	Wingham	208400	56	440523	6473219	BCD/WaterNSW	08-Dec-09	89.6%*
Manning	Taree West	208420	56	447161	6469672	WaterNSW	30-Apr-10	99.7%
Myall Lakes	Bombah Point	209475	56	434680	6403299	BCD	13-Jul-09	91.6%*
Myall River	Tea Gardens	209480	56	421723	6385111	BCD	20-Oct-09	100.0%
Paterson	Dunmore	210409	56	369238	6383269	BCD/WaterNSW	15-Oct-09	100.0%
Paterson	Hinton Bridge	210410	56	373245	6379624	BCD/WaterNSW	15-Oct-09	100.0%
Hunter	McKimms Corner	210455	56	368162	6378933	BCD/WaterNSW	08-Oct-09	100.0%
Hunter	Hexham	210448	56	376768	6367608	BCD/WaterNSW	13-Apr-11	100.0%
Hunter	Green Rocks	210432	56	377459	6378142	BCD/WaterNSW	15-Oct-09	100.0%
Williams	Raymond Terrace	210452	56	382352	6375361	BCD/WaterNSW	15-Oct-09	100.0%
Hawkesbury	Sackville	212406	56	303238	6292029	BCD/WaterNSW	30-Oct-09	91.3%*
Hawkesbury	Leets Vale	212461	56	309195	6299263	WaterNSW	22-Jun-10	92.9%*
Shoalhaven	Grady's Caravan Park	215430	56	268024	6138282	BCD/WaterNSW	06-Oct-10	98.7%
Wonboyn Lake	Wonboyn Lake	220452	55	758839	5873472	BCD	25-Oct-18	99.7%
Overall								95.8%

* Significant flood events have impacted overall data capture rates at some stations in 2020-21.

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

1. AqStar 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 $\pm 0.01^\circ\text{C}$.
2. YSI Sonde 600XL: a multi-parameter probe with a probe resolution of EC $\pm 1-100$ microsiemen/cm (range dependent) and temperature $\pm 0.01^\circ\text{C}$.
3. YSI EXO3 Sonde: a multi-parameter probe with a probe resolution of EC $\pm 0.1-10$ microsiemen/cm (range dependent) and temperature $\pm 0.001^\circ\text{C}$.

Logger programs at all stations output water level, temperature, conductivity and specific conductivity, as well as salinity in 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 compensated to 25°C is calculated using the equation:

$$\text{specific conductivity } [\mu\text{s/cm}] = C / (1 + 0.0198933 * (T - 25))$$

where C = uncompensated conductivity, T = temperature

Salinity (psu) is calculated using the UNESCO formula for seawater salinity. The full equation is found at:

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 collection, processing and storage system hosted on cloud computing platforms, using telemetry techniques based on common internet protocols and data connections over cellular telephone networks. External users can view the near real time raw data via the web.

The raw data is also transferred in a separate process to an MHL database hosted in NSW government data centres (GovDC) where it is subject to a quality assurance process involving several control steps to maintain data quality.

Data is backed up daily and archived to offline storage at regular intervals.

2 How to use this report

This report streamlines access to MHL's services and to the water quality database.

The NSW coastline is divided into geographic regions based on river systems to present water monitoring information. 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.

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 2020–2021 monitoring period, the salinity values at Tea Gardens varied by approximately 29 psu between high and low tides, and at Hexham variations of approximately 21 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://www.mhl.nsw.gov.au/>.

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

Order quality controlled data via the MHL web page (<http://www.mhl.nsw.gov.au>) by emailing data-request@mhl.nsw.gov.au. Regular users can request development of customised decision support tools for supply of data using the same email address.

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. **Table 2** lists the 2020–2021 flood warnings as described by the NSW State Emergency Service's (SES) classification scale.

Table 2 NSW flood classifications 2020–2021

River basin	Date	Flood classification
Richmond River	December 2020	Moderate
	March 2021	Minor to moderate
Clarence River	December 2020	Minor
	March 2021	Moderate to major
Macleay River	March 2021	Moderate
Manning River	March 2021	Minor to Major
Myall River	March 2021	Moderate
Hunter and Williams River	March 2021	Minor
Paterson River	March 2021	Major
Hawkesbury River	March 2021	Major
Shoalhaven River	March 2021	Minor
	May 2021	Minor

The SES 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 salinity readings

Peak salinity levels at each station are reviewed for the 2020–2021 monitoring period. Only one station showed peak salinity levels higher than previous years' measurements, namely Lake Cathie.

On 2 December 2020, the Lake Cathie station captured a high salinity reading of 47.3 psu. Lake Cathie is an intermittently closed and open lake and lagoon (ICOLL). The lake appeared to be closed to the ocean during the period 30 September 2020 to 8 January 2021 (i.e. limited tidal flushing) based on the water level trace (**Figure 11**).

4.3 Cross-sectional profiling

Cross-sectional profiles at monitoring stations are used to indicate how representative in situ sensor readings are of the complete river cross-section for the conditions at the time of 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.

In April, May, June and July 2021, 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 2020–2021* (Report MHL2863) for more detail on the cross-sectional profiling results.

4.4 Station development

The following station developments and upgrades occurred during the 2020–2021 reporting period:

- The Grafton (Clarence River) station was replaced with a new water quality sensor on 20 May 2021 when the previous one failed.
- The Wingham (Manning River) station was replaced with a new water quality sensor on 2 January 2021 when the previous one failed.
- The Hinton Bridge (Paterson River) station was installed with a water pumping system to clean water quality sensors on 15 June 2021. The water pumping system flushes water over the sensors to inhibit debris and silt accumulation thereby improving system performance and reducing maintenance requirements.
- The Green Rocks (Hunter River) station was upgraded with a new EXO3 water quality sensor and a 100 m custom-made cable and slide on 16 June 2021, which increases the quality and reliability of the data capture at the site.
- The Wonboyn Lake (Wonboyn Lake) station was upgraded with a new EXO3 water quality sensor and a 15 m cable and slide on 17 November 2020, which increases the quality and reliability of the data capture at the site.

4.5 Station issues

Floods damaged several monitoring stations during the 2020–2021 reporting period. COVID-19 pandemic-related travelling restrictions and new equipment supply issues (due to a worldwide shortage of raw materials, SIM cards and freight impacts) resulted in delays to station repairs. MHL deployed temporary standalone water quality stations to maintain data capture. Readers should exercise caution when using standalone water quality information as the temporary deployment location can be different to the parent station.

The Rogans Bridge (Clarence River) station's water quality cable was damaged by flood waters on 17 December 2020. A new cable was installed on 4 February 2021. The newly installed cable was then damaged by external party construction work on 27 February 2021. A standalone water quality sensor was deployed on 31 March 2021 to maximise data capture until supply of a new 200 m custom-made cable in November 2021.

The Kempsey (Macleay River) station's water quality sensor and cable were damaged by flood waters on 23 March 2021. A standalone sensor was deployed on 28 April 2021. However, no data was captured due to water ingress into the standalone sensor. A new water quality sensor and cable were installed on 13 July 2021.

The Wingham (Manning River) station's gas line orifice was damaged during the flood on 16 March 2021, and the water quality sensor and cable failed after the flood on 28 April 2021. A standalone water quality sensor was deployed on 12 May 2021 to maximise data capture. A new gas line orifice was installed on 13 April 2021. The water quality station will be reinstated with supply of a new 250 m custom-made cable expected in January 2022. Level data from the nearest Manning River station (Taree West) is displayed in the Wingham station data plot (refer to **Figure 13**).

The Bombah Point (Myall Lakes) station's equipment was damaged by flood inundation in March 2021. A standalone water level and water quality sensor were deployed on 21 April 2021 to maximise the data capture until the station was fully reinstated on 7 September 2021. The standalone water quality sensor failed from 25 July 2021 when water entered the battery compartment (likely due to a battery leakage and associated gas opening the pressure release valve on the battery cover). Level data from the nearest station (Bulahdelah) is displayed in the data plot (refer to **Figure 16**).

The Sackville (Hawkesbury River) station's gas line orifice, water quality sensor and water quality cable were damaged during the March 2021 flood event. A standalone water level and water quality sensor were deployed on 14 April 2021 and 28 April 2021, respectively, to maximise the data capture. A new gas line orifice and a water quality sensor with cable were installed on 5 May 2021 and 17 June 2021, respectively. Level data from the nearest station (Colo Junction) is displayed in the data plot (refer to **Figure 28**).

The Leets Vale (Hawkesbury River) station's equipment was damaged as the station was inundated during the March 2021 flood. A standalone water level and water quality sensor were deployed on 15 April 2021 to maximise data capture until the station was fully reinstated on 4 November 2021. Level data from the nearest station (Wisemans Ferry Wharf) is displayed in the data plot (refer to **Figure 29**).

Grady's Caravan Park (Shoalhaven River) station's gas orifice line was damaged when the bank collapsed during the August 2020 flood. A new gas orifice line was installed on 10 September 2020.

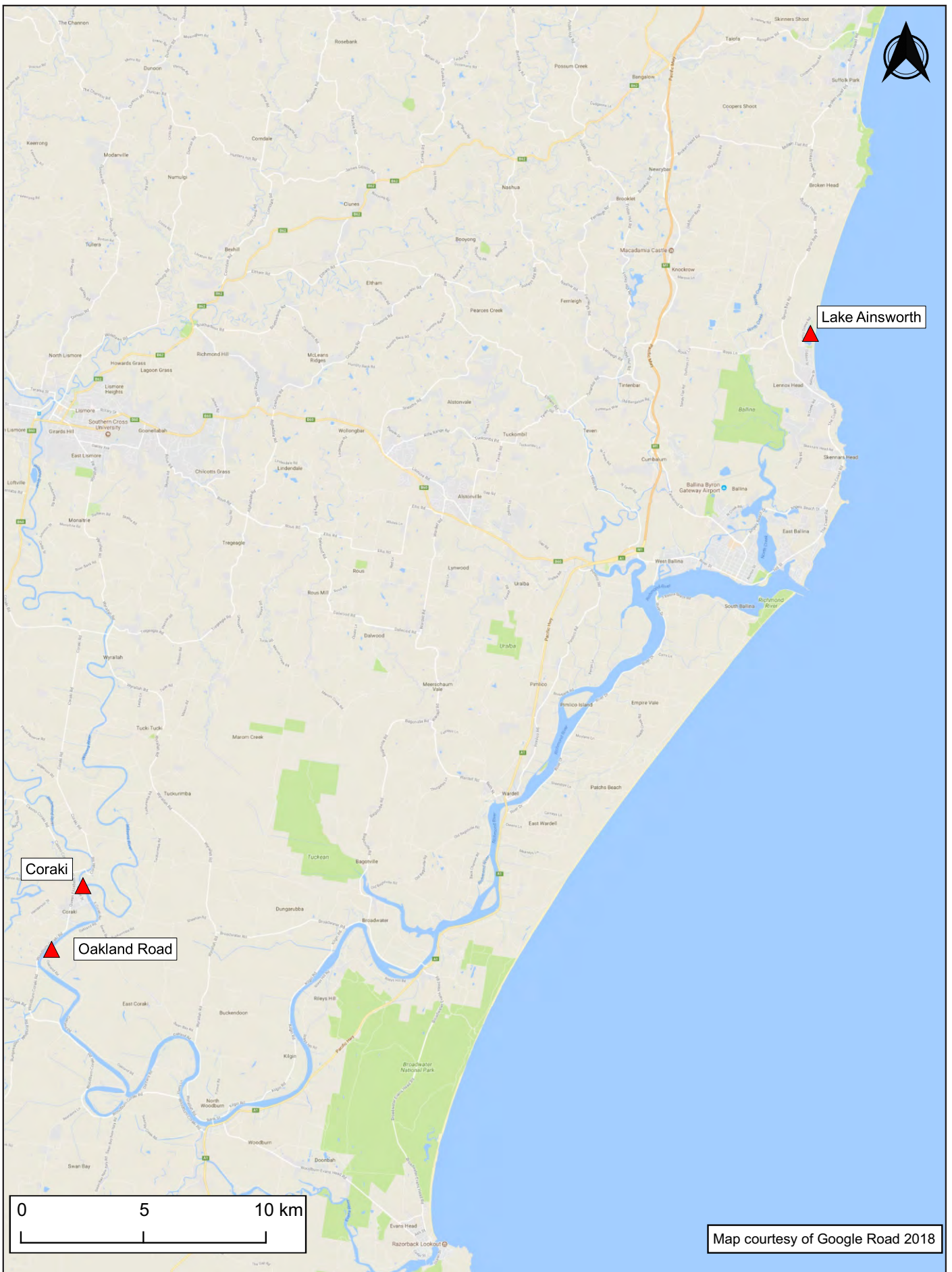
5 Water quality monitoring summary

This section documents locality maps and quality assured water quality monitoring summaries for each station. **Table 3** provides an index to the figures presented. Daily rainfall data from the nearest available BCD or Bureau of Meteorology (BoM) rain gauge is added to the figure to recognise 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 3 Index of figures

River/estuary region	Station name	Station no.	Comparative BCD or BoM rainfall station name	Figure
Station Locality Map	Richmond River Region			1
Richmond River	Lake Ainsworth	203455	Lake Ainsworth	2
Richmond River	Coraki	203403	Lismore Airport AWS [^]	3
Richmond River	Oakland Road	203470	Lismore Airport AWS [^]	4
Station Locality Map	Clarence River Region			5
Clarence River	Rogans Bridge	204413	Grafton Research [^]	6
Clarence River	Grafton	204400	Grafton Research [^]	7
Station Locality Map	Macleay River Region			8
Macleay River	Kempsey	206468	Aldavilla Downstream	9
Station Locality Map	Lake Cathie			10
Lake Cathie	Lake Cathie	207441	Port Macquarie Airport AWS [^]	11
Station Locality Map	Manning River Region			12
Manning River	Wingham	208400	Nabiac	13
Manning River	Taree West	208420	Nabiac	14
Station Locality Map	Great Lakes Region			15
Myall Lakes	Bombah Point	209475	Bulahdelah	16
Station Locality Map	Port Stephens Region			17
Myall River	Tea Gardens	209480	Bulahdelah	18
Station Locality Map	Paterson River Region			19
Paterson River	Dunmore	210409	Belmore Bridge	20
Paterson River	Hinton Bridge	210410	Belmore Bridge	21
Station Locality Map	Hunter River Region			22
Hunter River	McKimms Corner	210455	Belmore Bridge	23
Hunter River	Green Rocks	210432	Hexham Bridge	24
Williams River	Raymond Terrace	210452	Hexham Bridge	25
Hunter River	Hexham Bridge	210448	Hexham Bridge	26
Station Locality Map	Hawkesbury River Region			27
Hawkesbury River	Sackville	212406	Sackville Downstream	28
Hawkesbury River	Leets Vale	212461	Webbs Creek	29
Station Locality Map	Shoalhaven River Region			30
Shoalhaven River	Grady's Caravan Park	215430	Nowra Boatshed [^] (Shoalhaven River)	31
Station Locality Map	Wonboyn Lake			32
Wonboyn Lake	Wonboyn Lake	220452	Green Cape AWS [^]	33

[^] Daily rainfall data from the BoM's Climate Data Online website has not been quality controlled by MHL.



**STATION LOCATIONS
RICHMOND RIVER REGION**

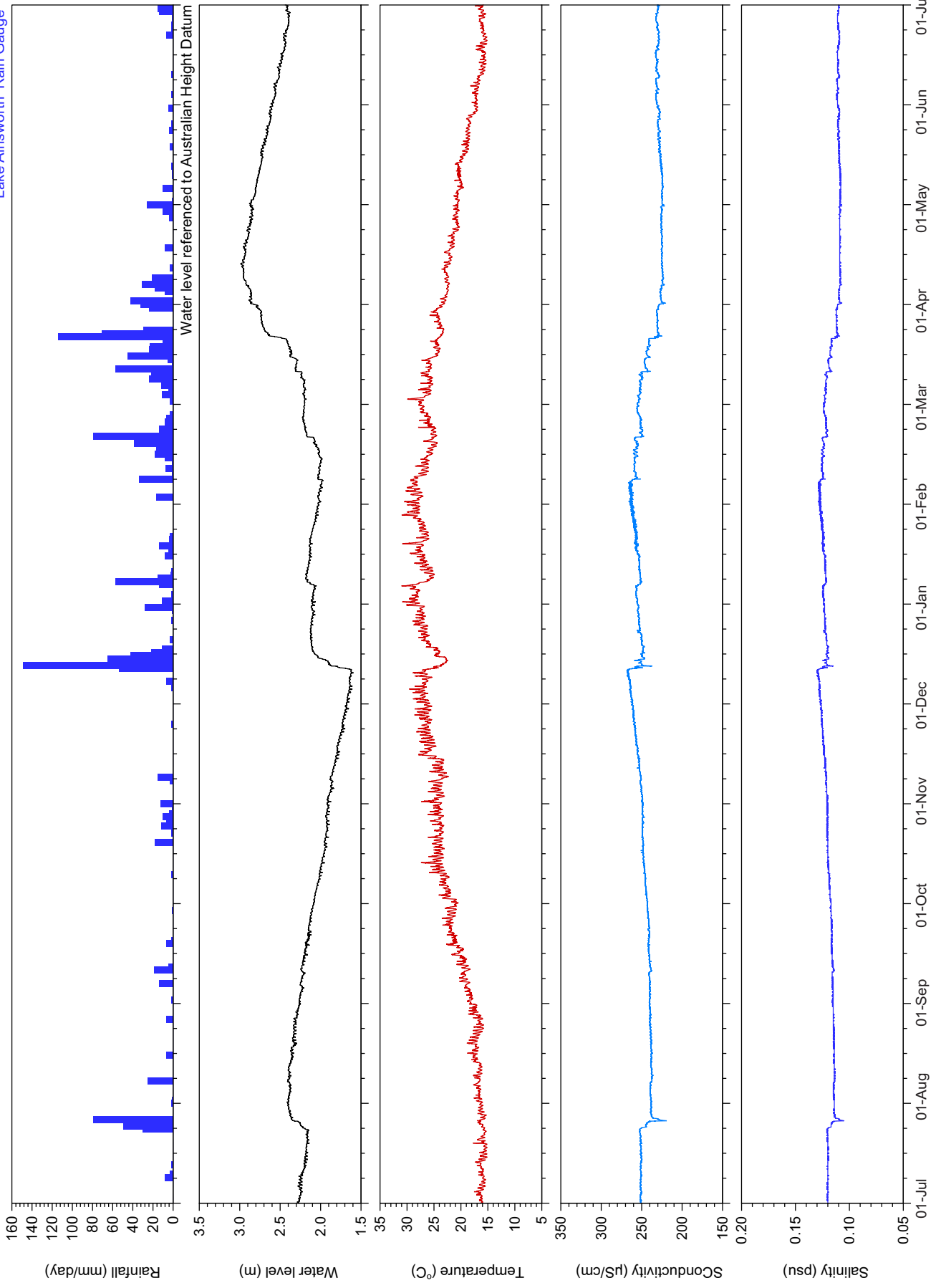
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Figure

1

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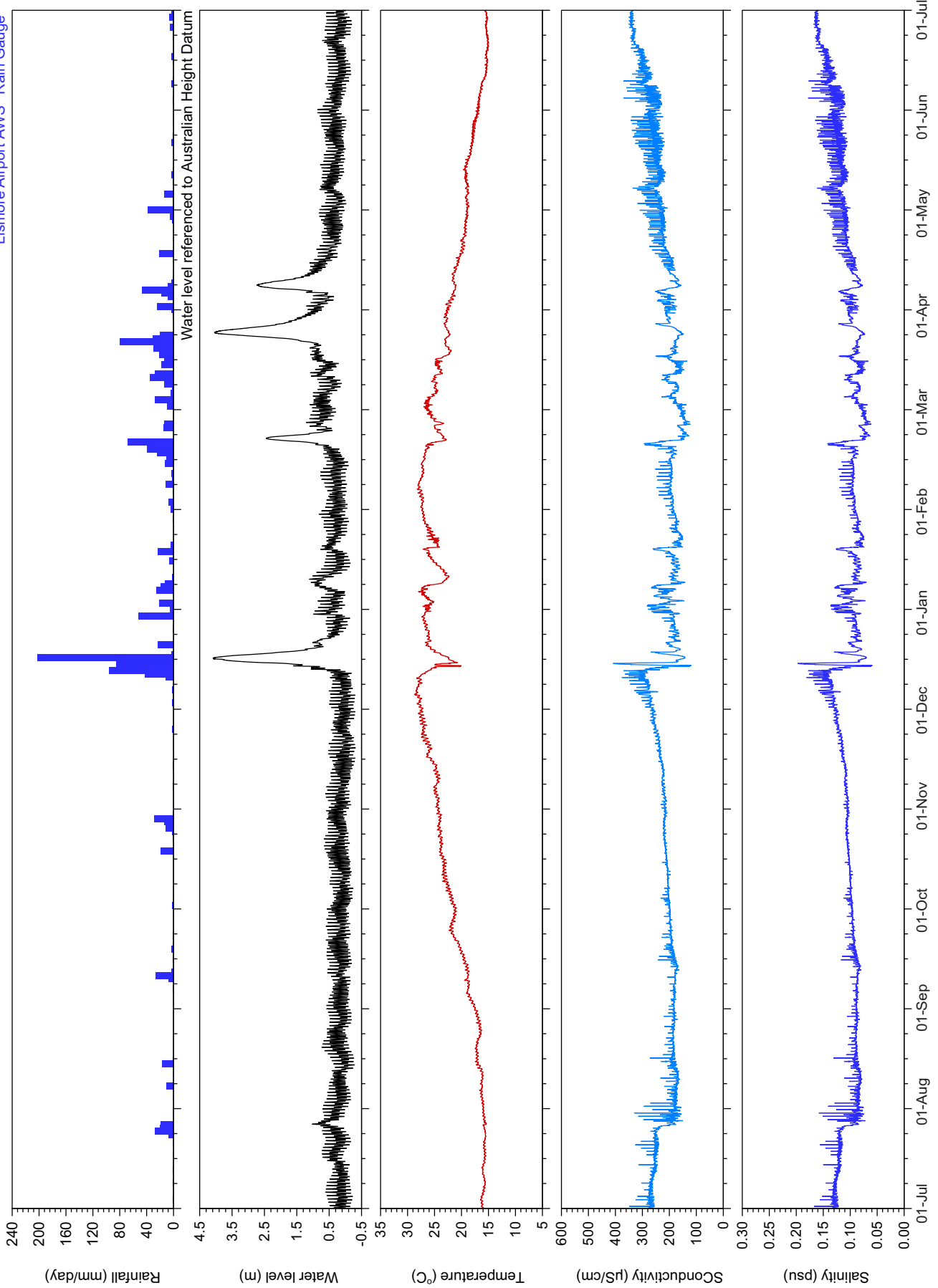


WATER LEVEL AND WATER QUALITY DATA
2020–2021
LAKE AINSWORTH

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Figure
2

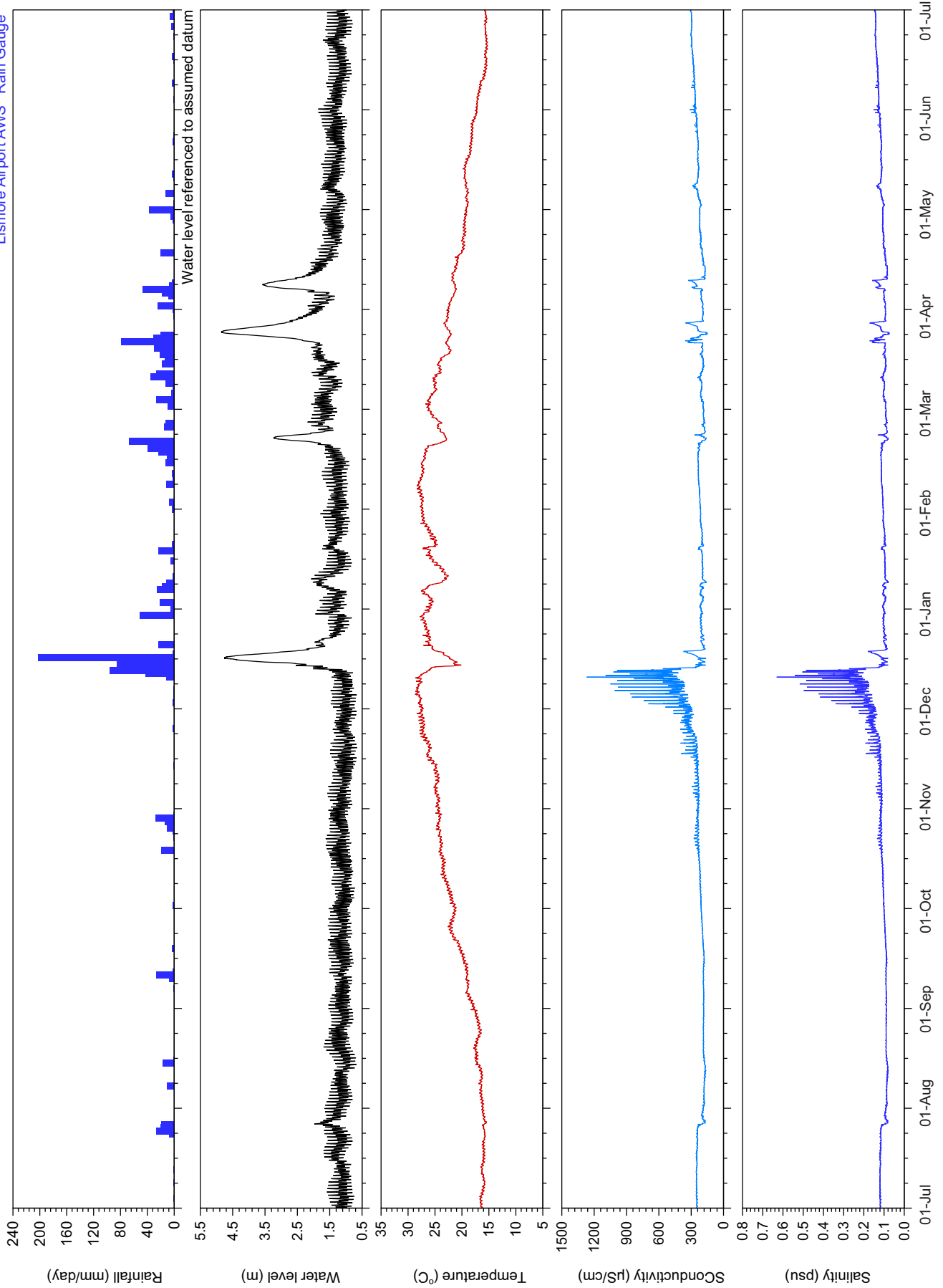


WATER LEVEL AND WATER QUALITY DATA
2020–2021
CORAKI

Manly
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Laboratory

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Figure
3



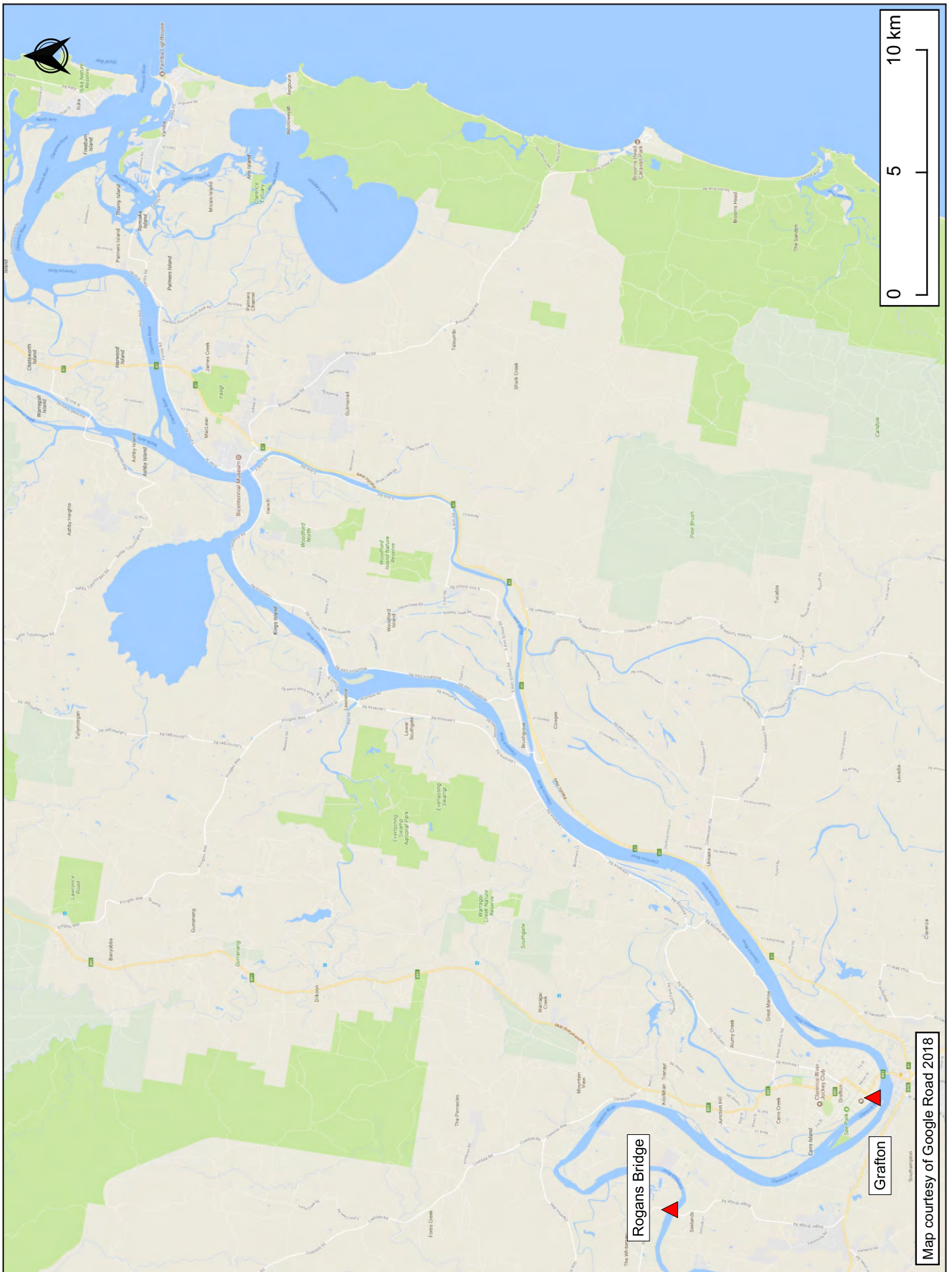
WATER LEVEL AND WATER QUALITY DATA
2020–2021
OAKLAND ROAD

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Figure

4



STATION LOCATIONS
CLARENCE RIVER REGION

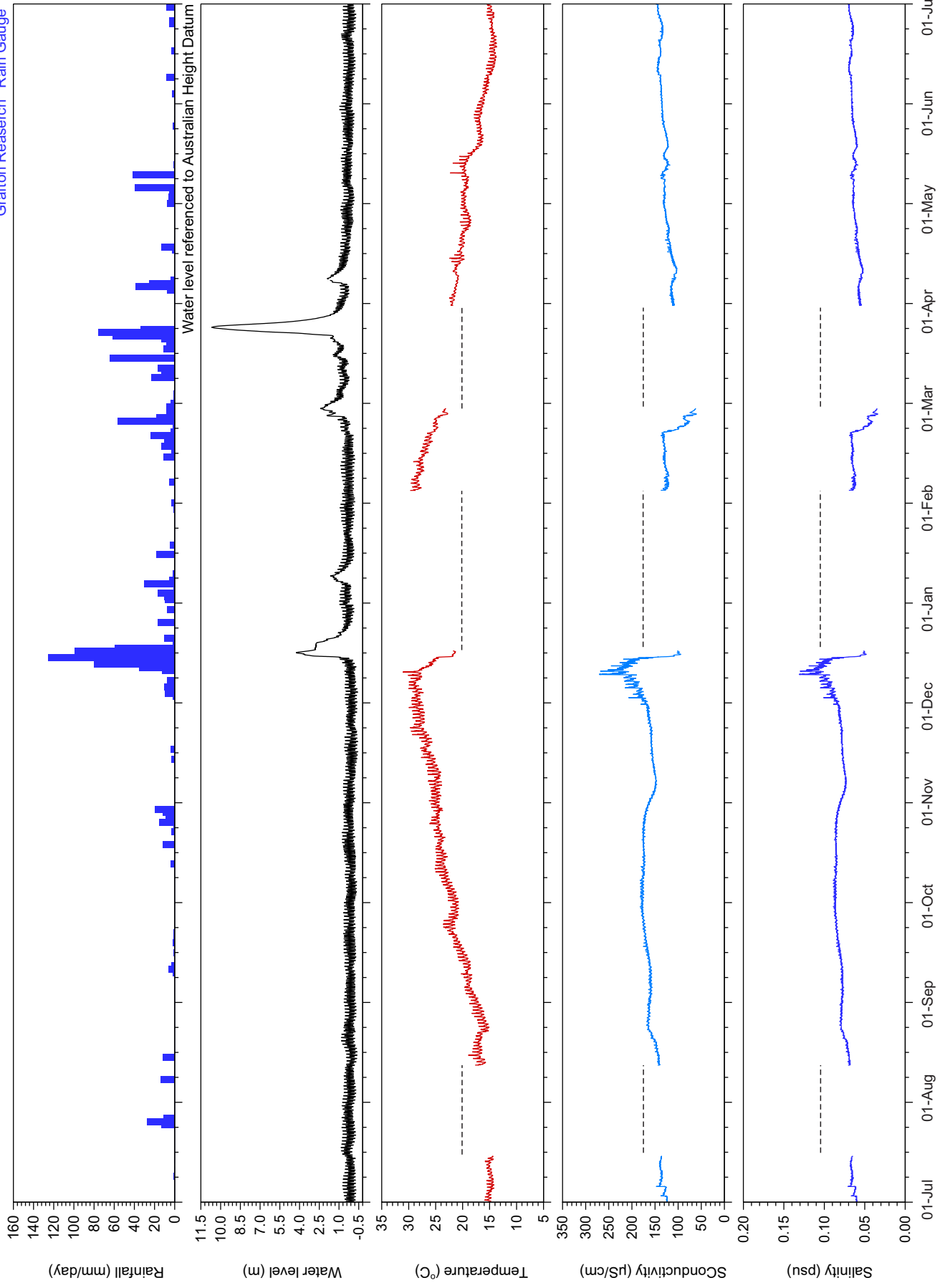
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Figure

5

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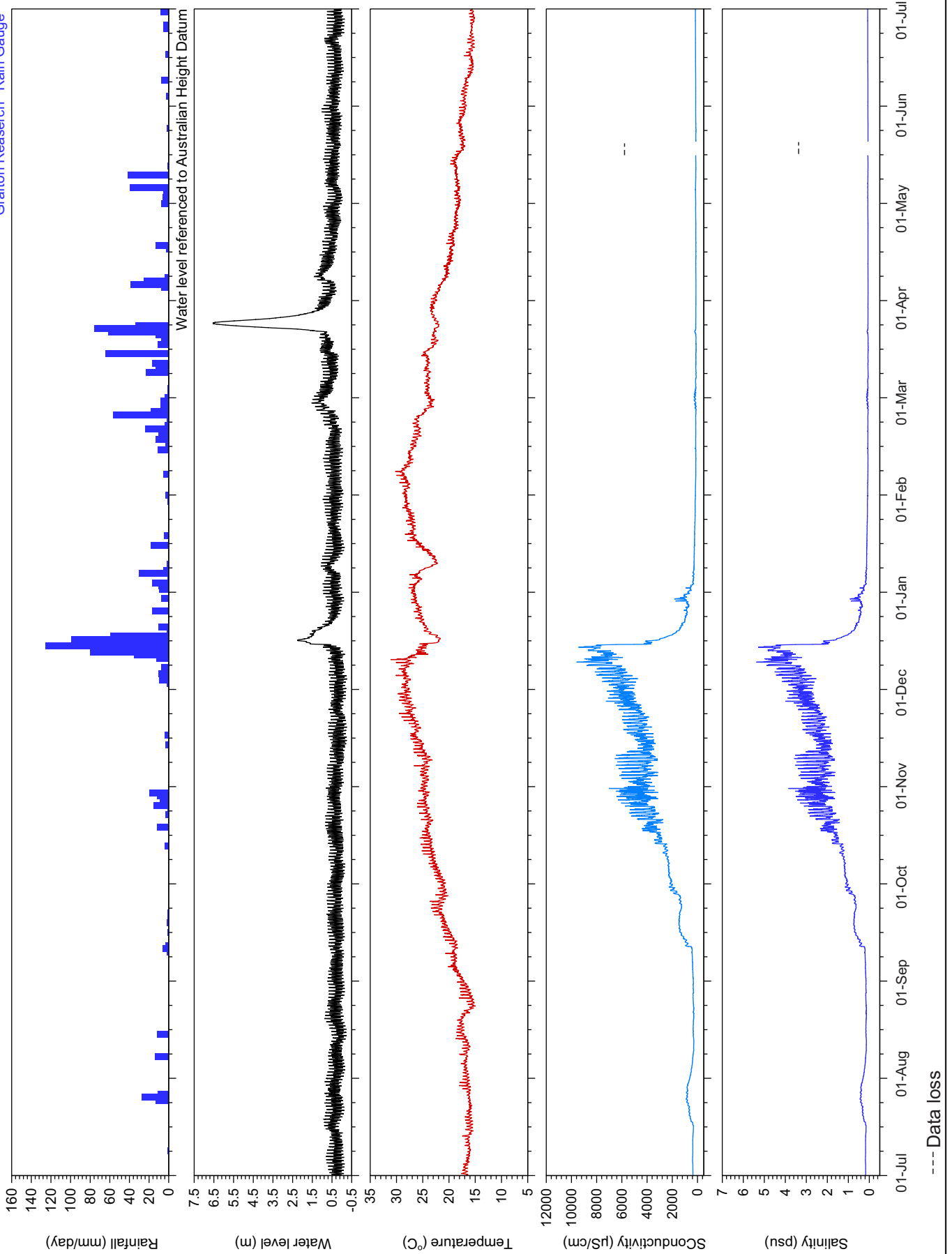


--- Data loss Data loss due to equipment failure, flood damage and council construction work



WATER LEVEL AND WATER QUALITY DATA
2020–2021
ROGANS BRIDGE

Manly
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Figure
6
DRAWING 2859-06.cdr



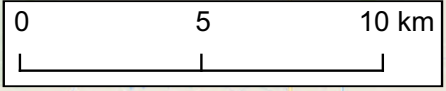
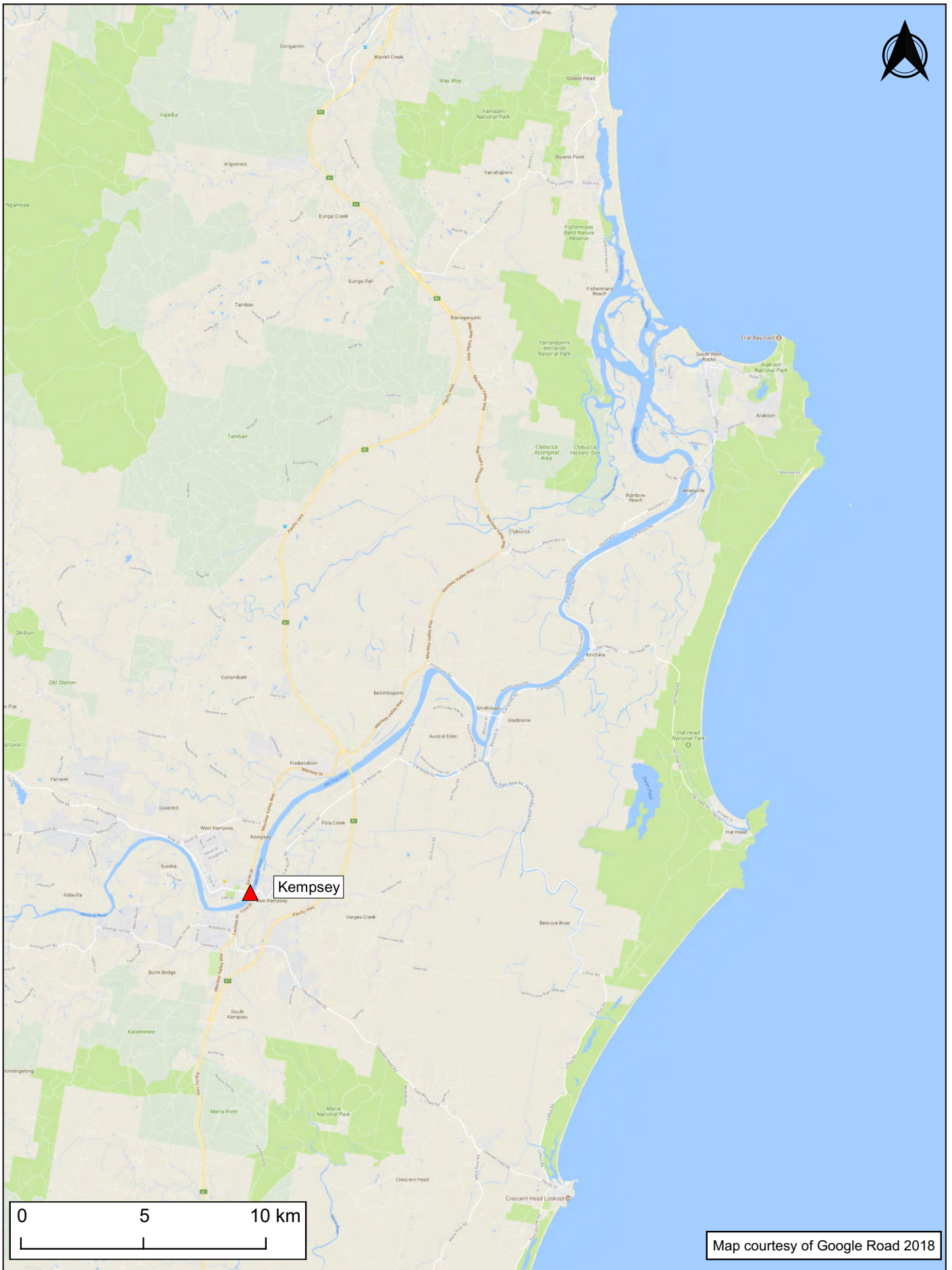
WATER LEVEL AND WATER QUALITY DATA
2020–2021
GRAFTON

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Figure

7



Map courtesy of Google Road 2018



STATION LOCATIONS MACLEAY RIVER REGION

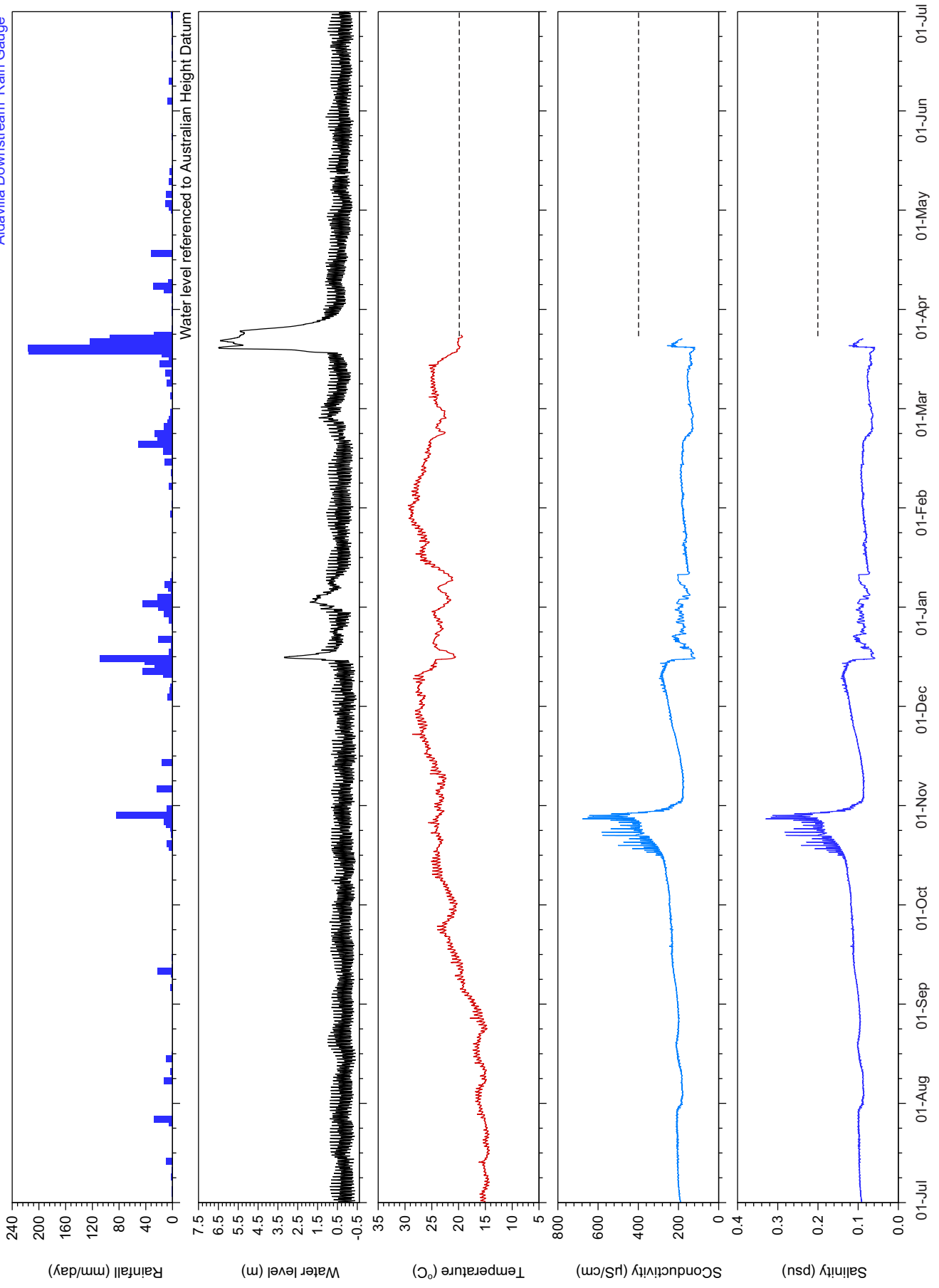
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Figure

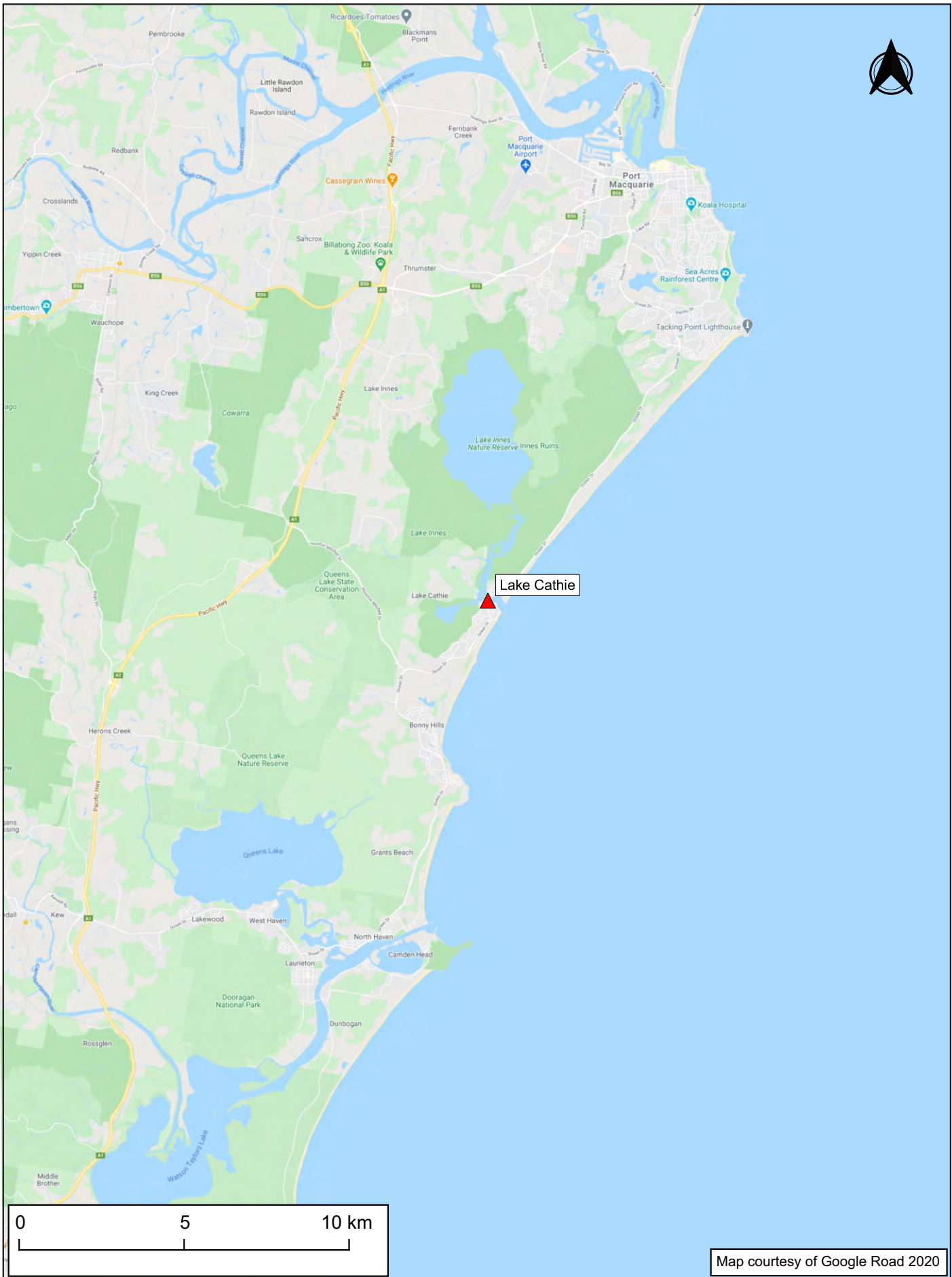
8

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WATER LEVEL AND WATER QUALITY DATA
2020–2021
KEMPSEY

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Figure
9
DRAWING 2869-09.cdr



Map courtesy of Google Road 2020



**STATION LOCATIONS
LAKE CATHIE**

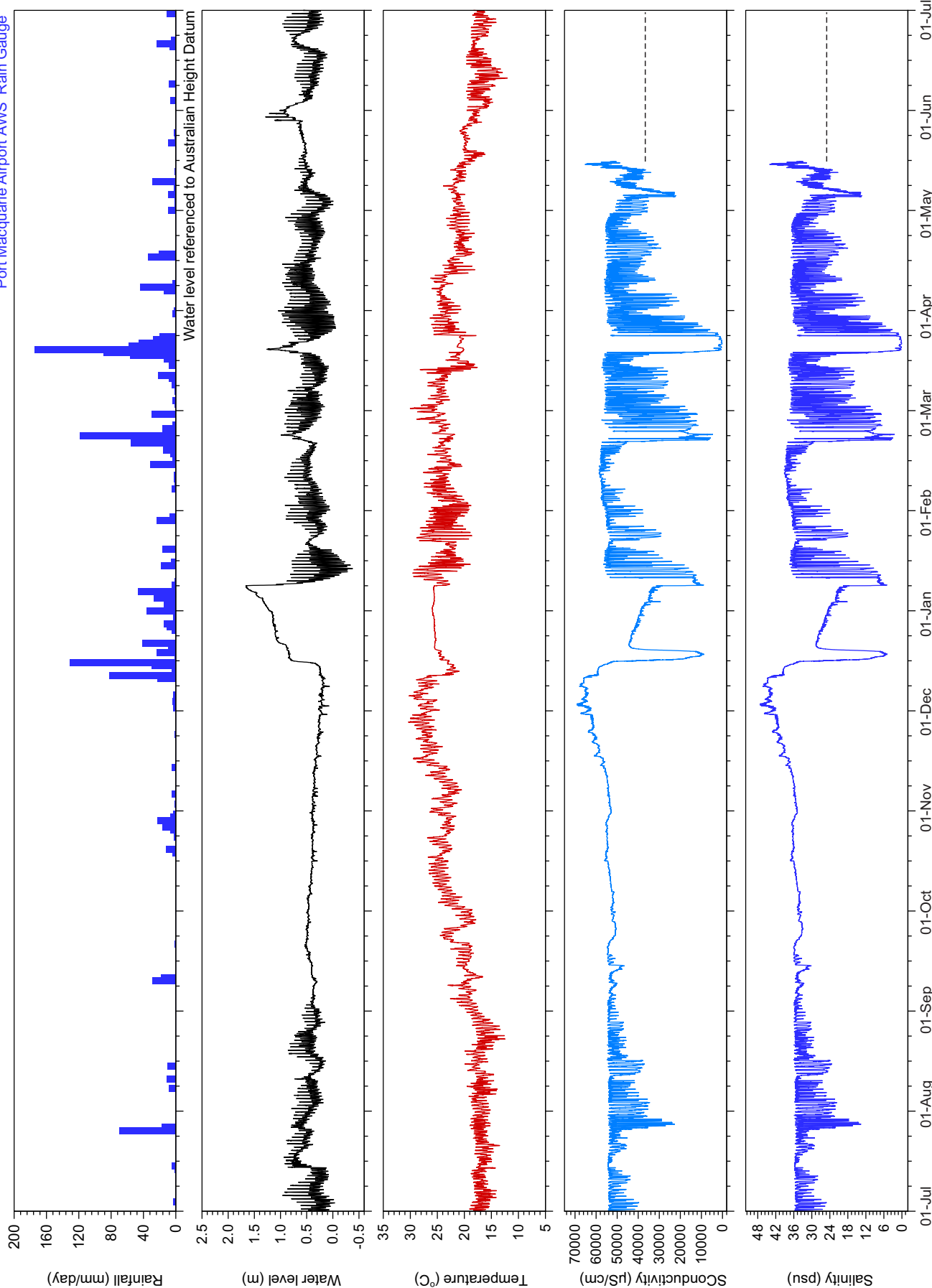
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Figure

10

DRAWING 2859-10.cdr

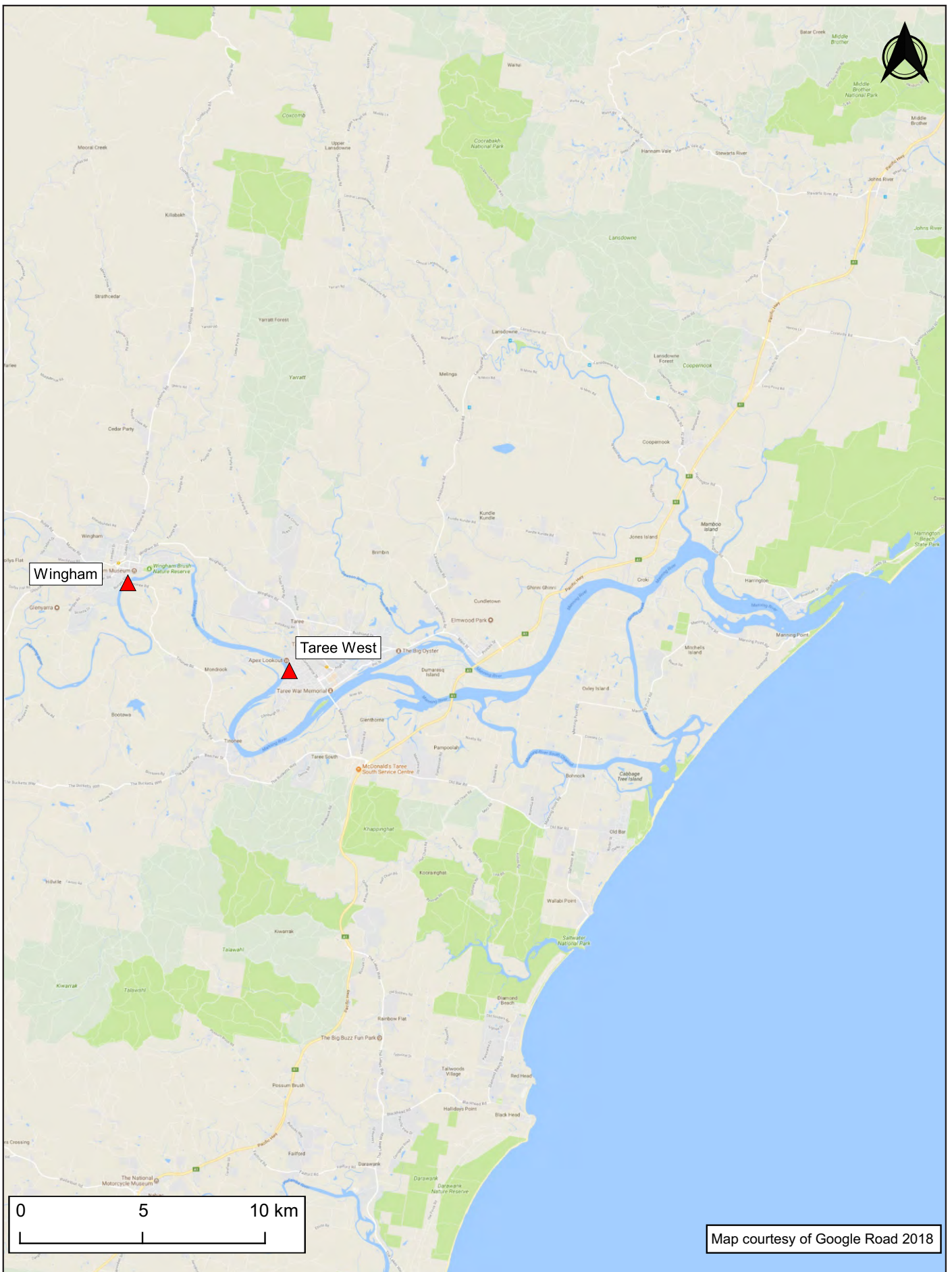


WATER LEVEL AND WATER QUALITY DATA
2020–2021
LAKE CATHIE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
11



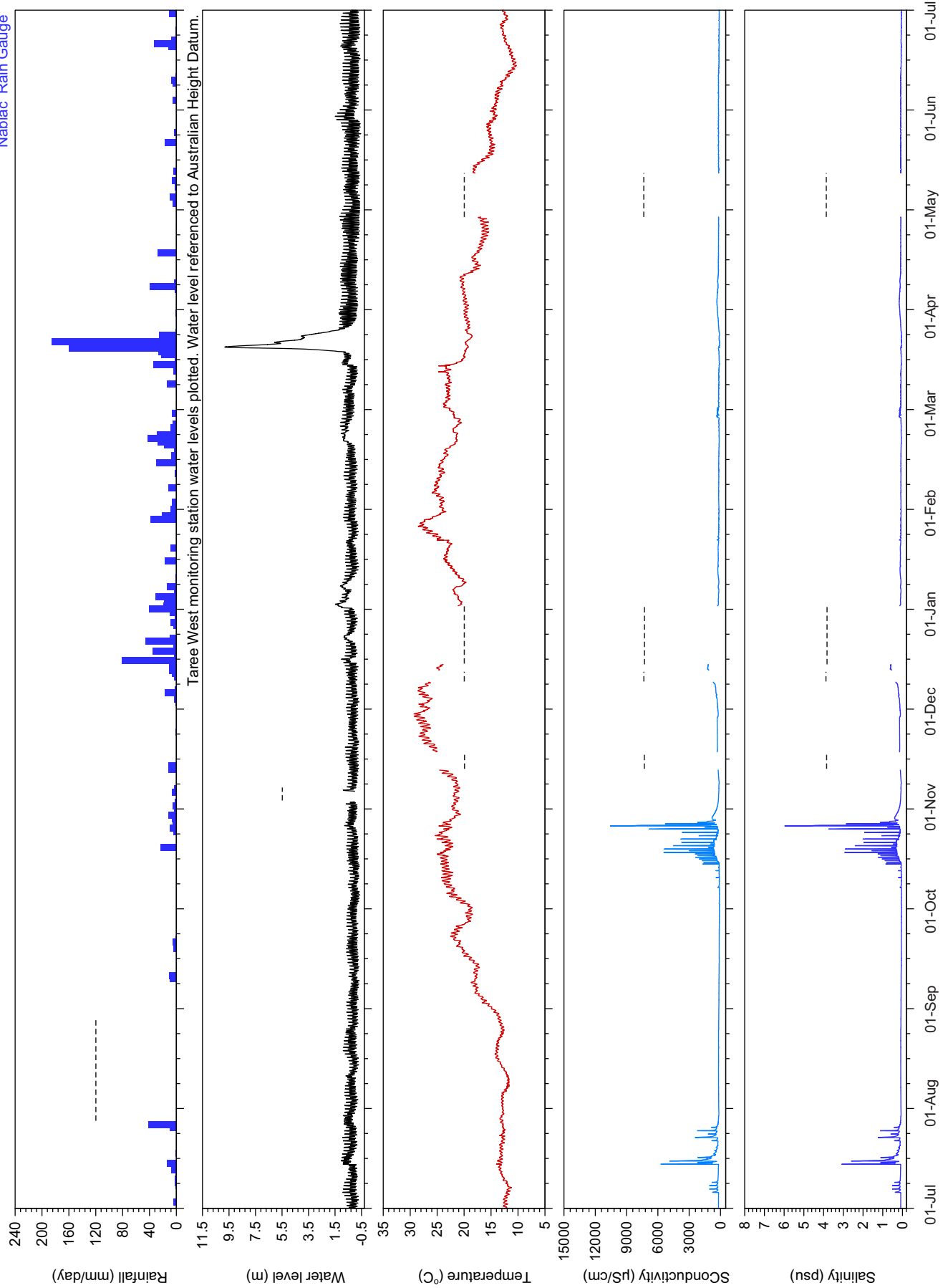
STATION LOCATIONS
MANNING RIVER REGION

Manly
Hydraulics
Laboratory

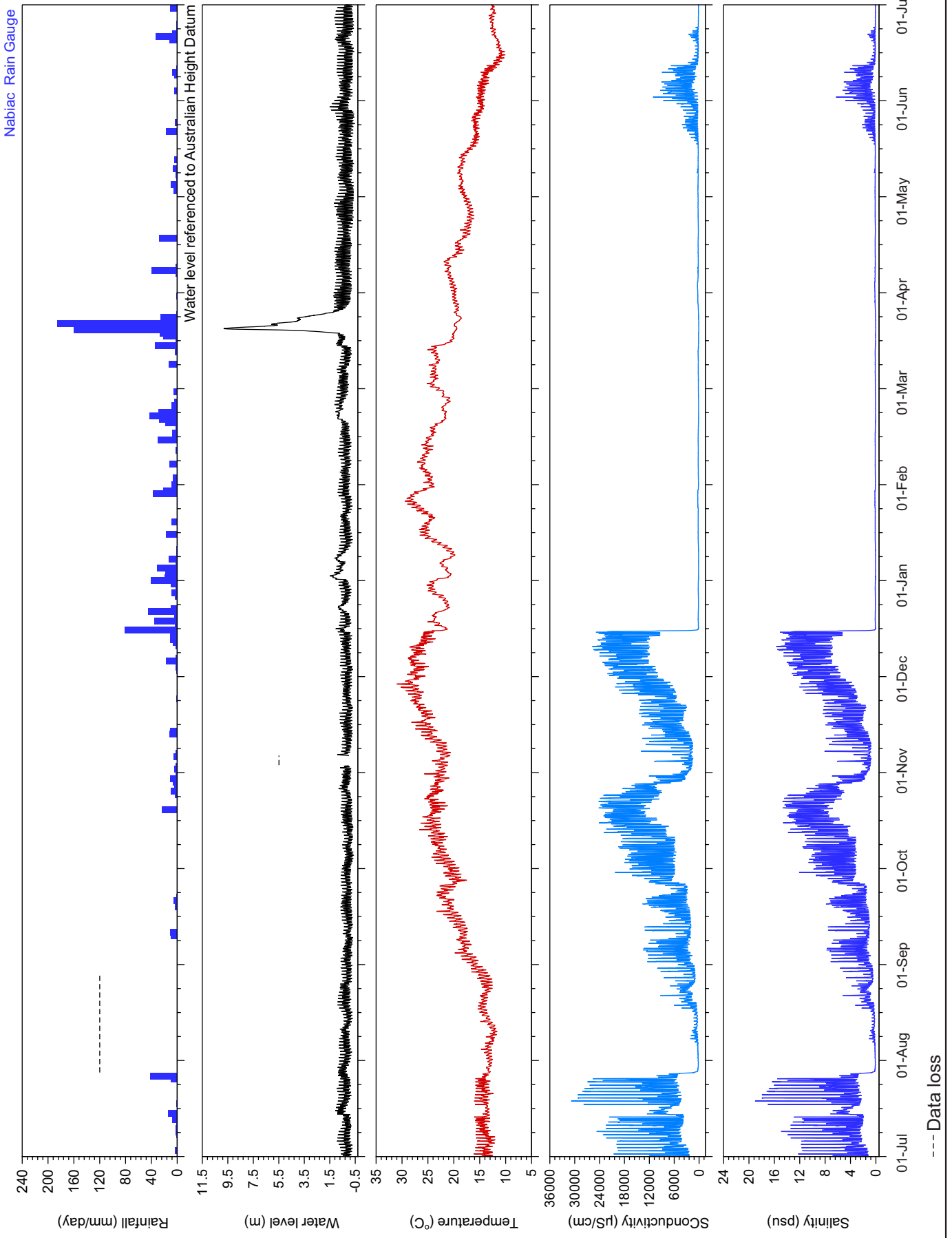
Report MHL2859

Figure
12

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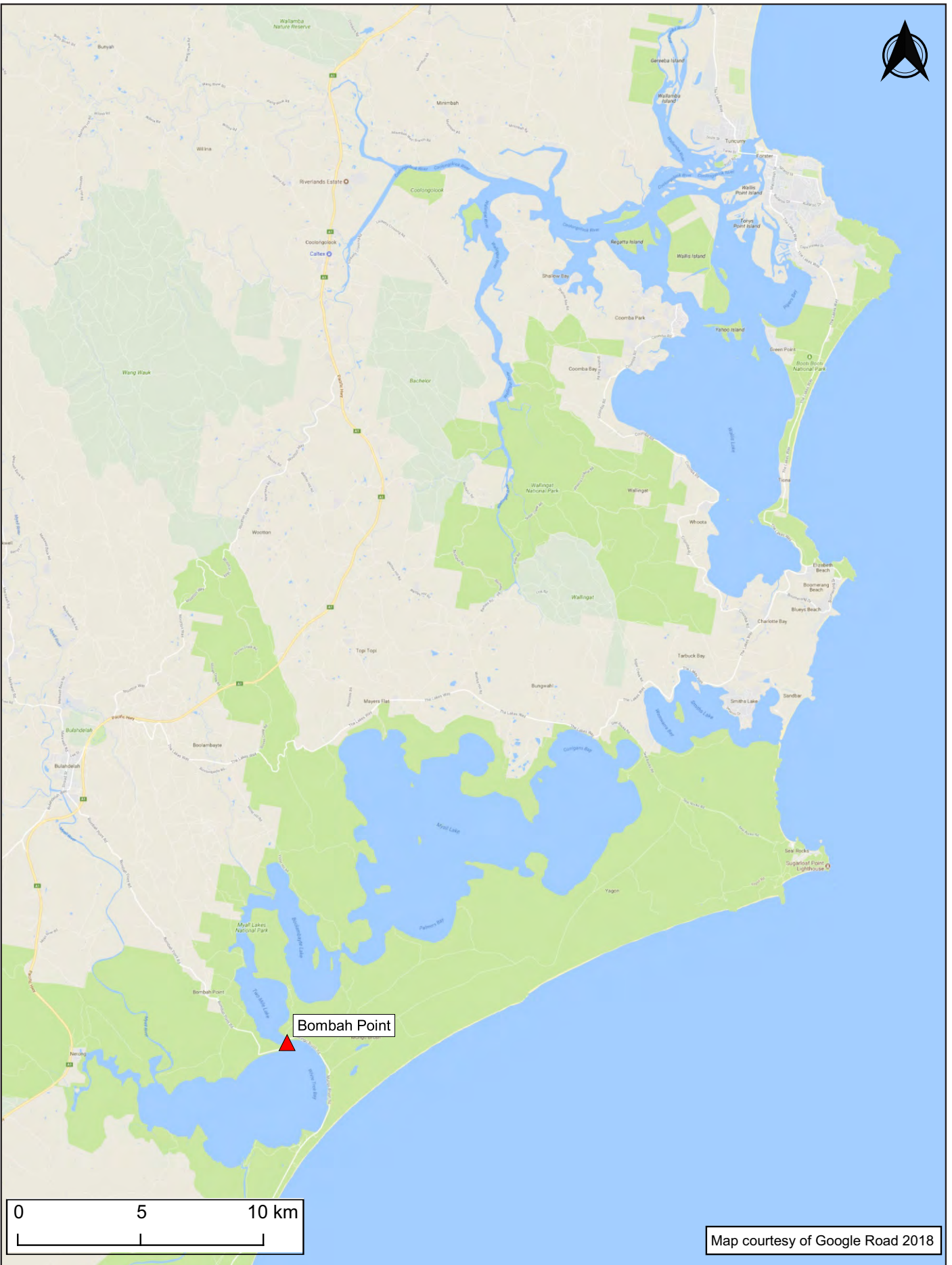


WATER LEVEL AND WATER QUALITY DATA
2020–2021
WINGHAM



WATER LEVEL AND WATER QUALITY DATA
 2020–2021
 TAREE WEST

Manly
 Hydraulics
 Laboratory
 Report MHL2859
 Figure
 14
DRAWING 2859-14.cdr



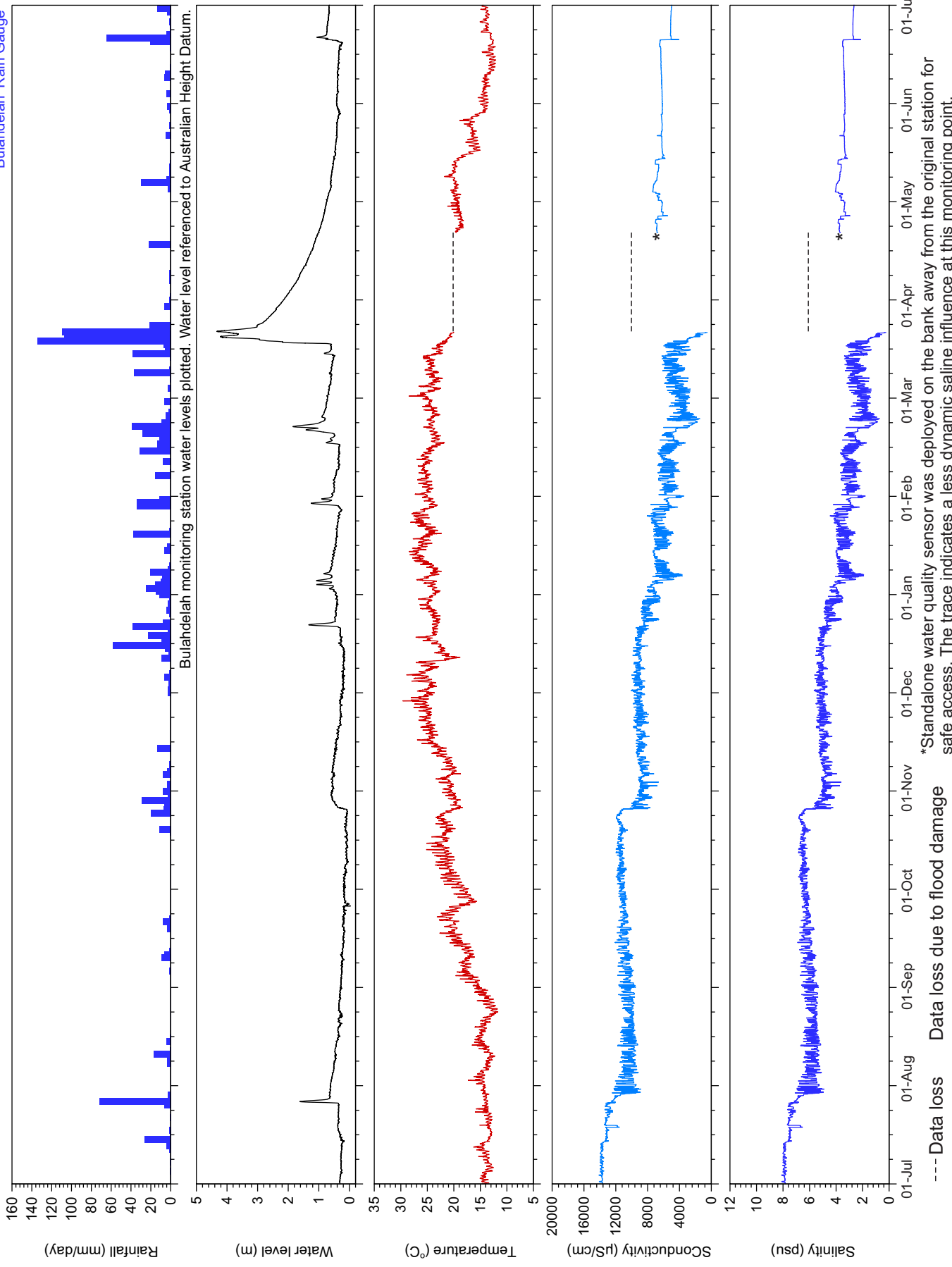
STATION LOCATIONS GREAT LAKES REGION

**Manly
Hydraulics
Laboratory**

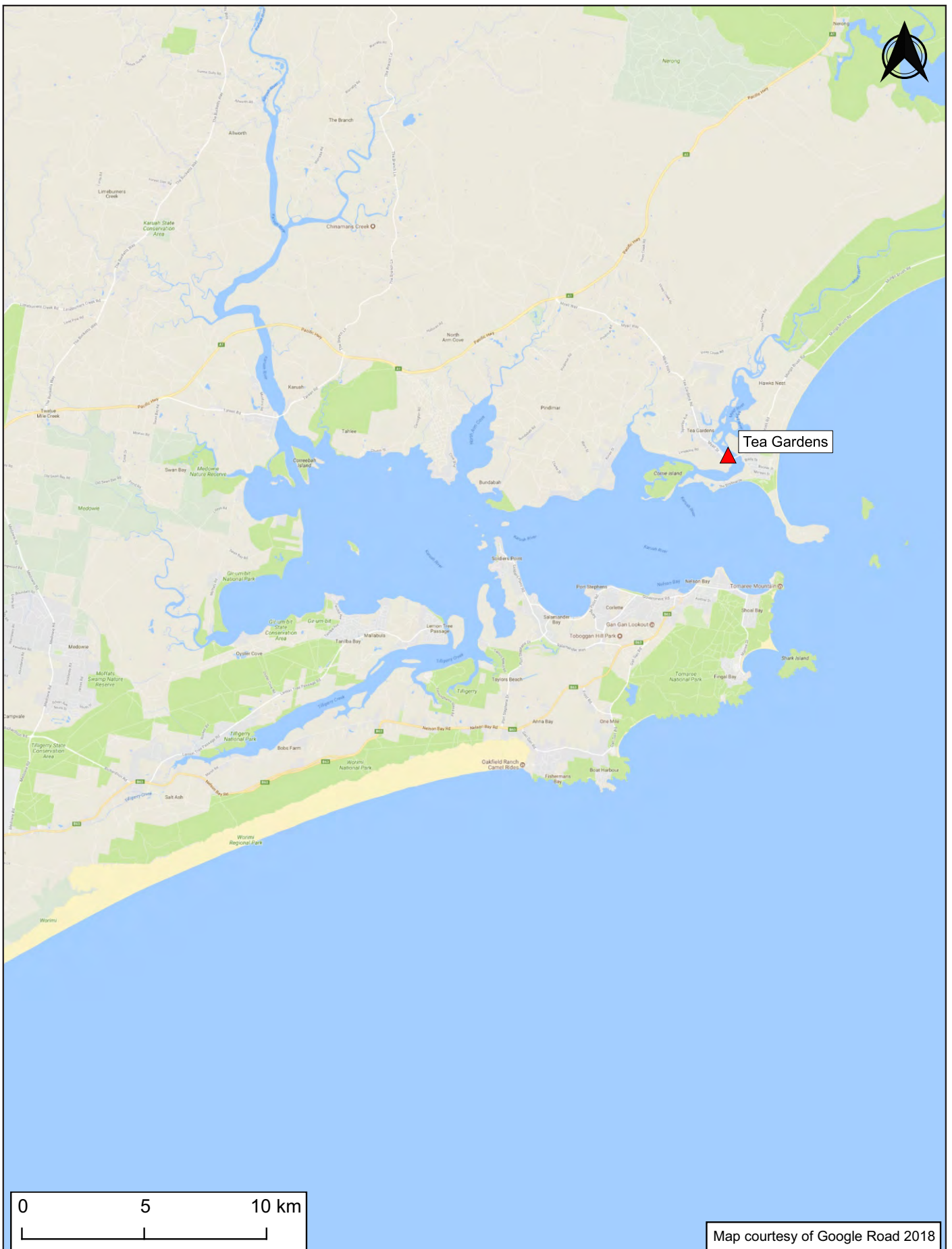
Report MHL2859

Figure
15

DRAWING 2859-15.cdr



WATER LEVEL AND WATER QUALITY DATA
2020–2021
BOMBAH POINT



STATION LOCATIONS
PORT STEPHENS REGION

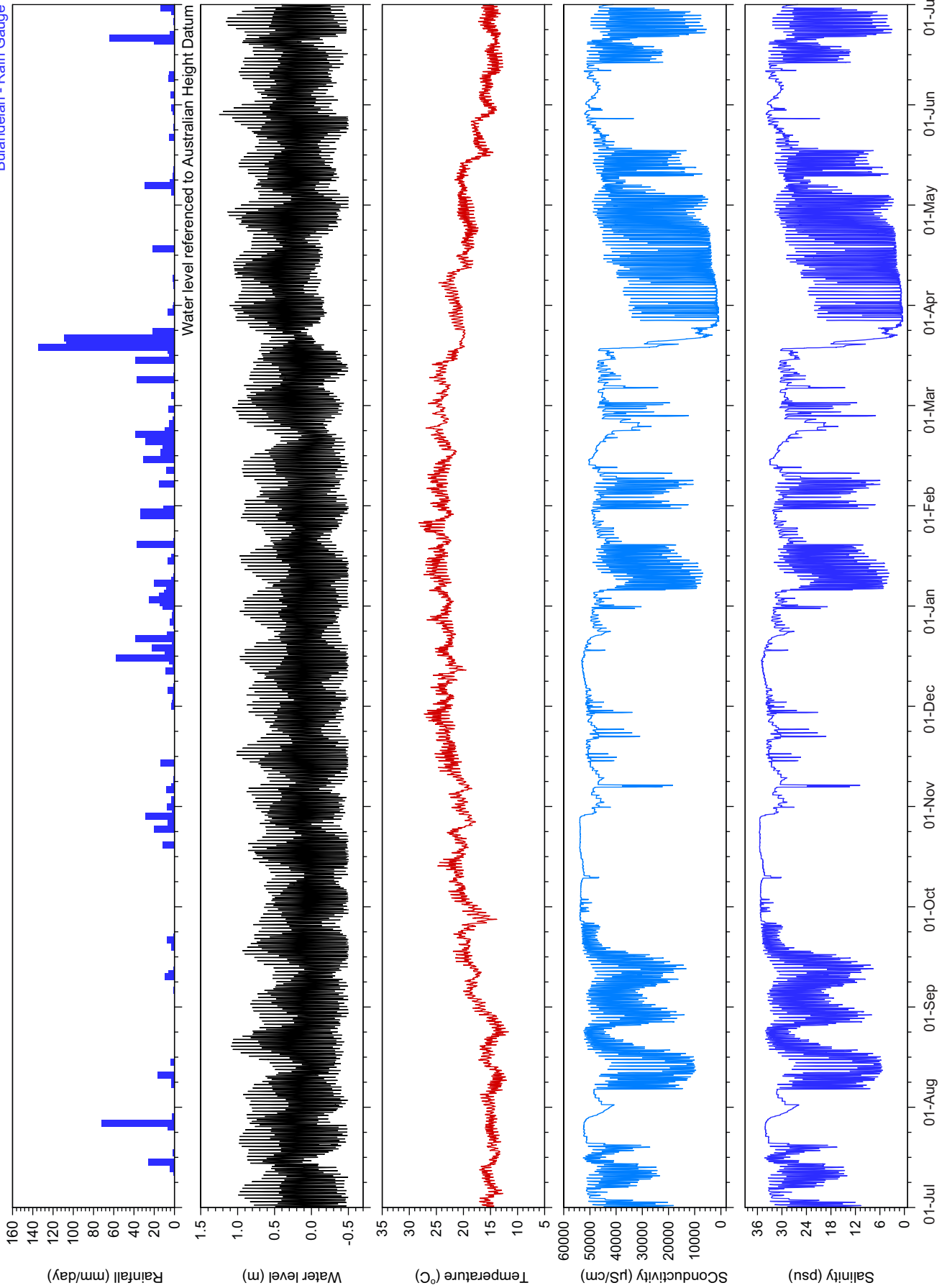
Manly
Hydraulics
Laboratory

Report MHL2859

Figure

17

DRAWING 2859-17.cdr

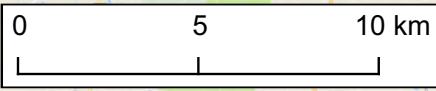
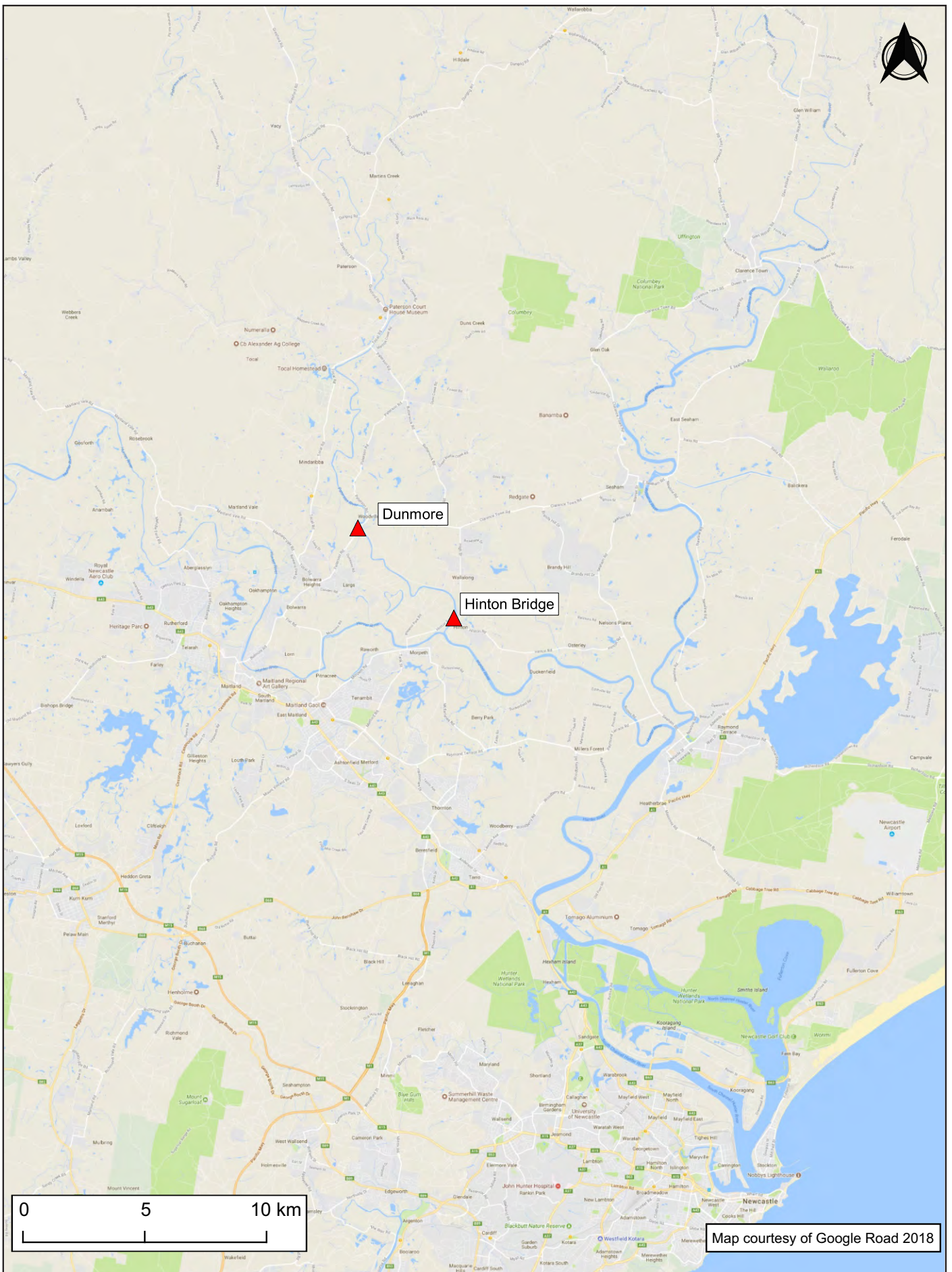


WATER LEVEL AND WATER QUALITY DATA
2020–2021
TEA GARDENS

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
18



Map courtesy of Google Road 2018



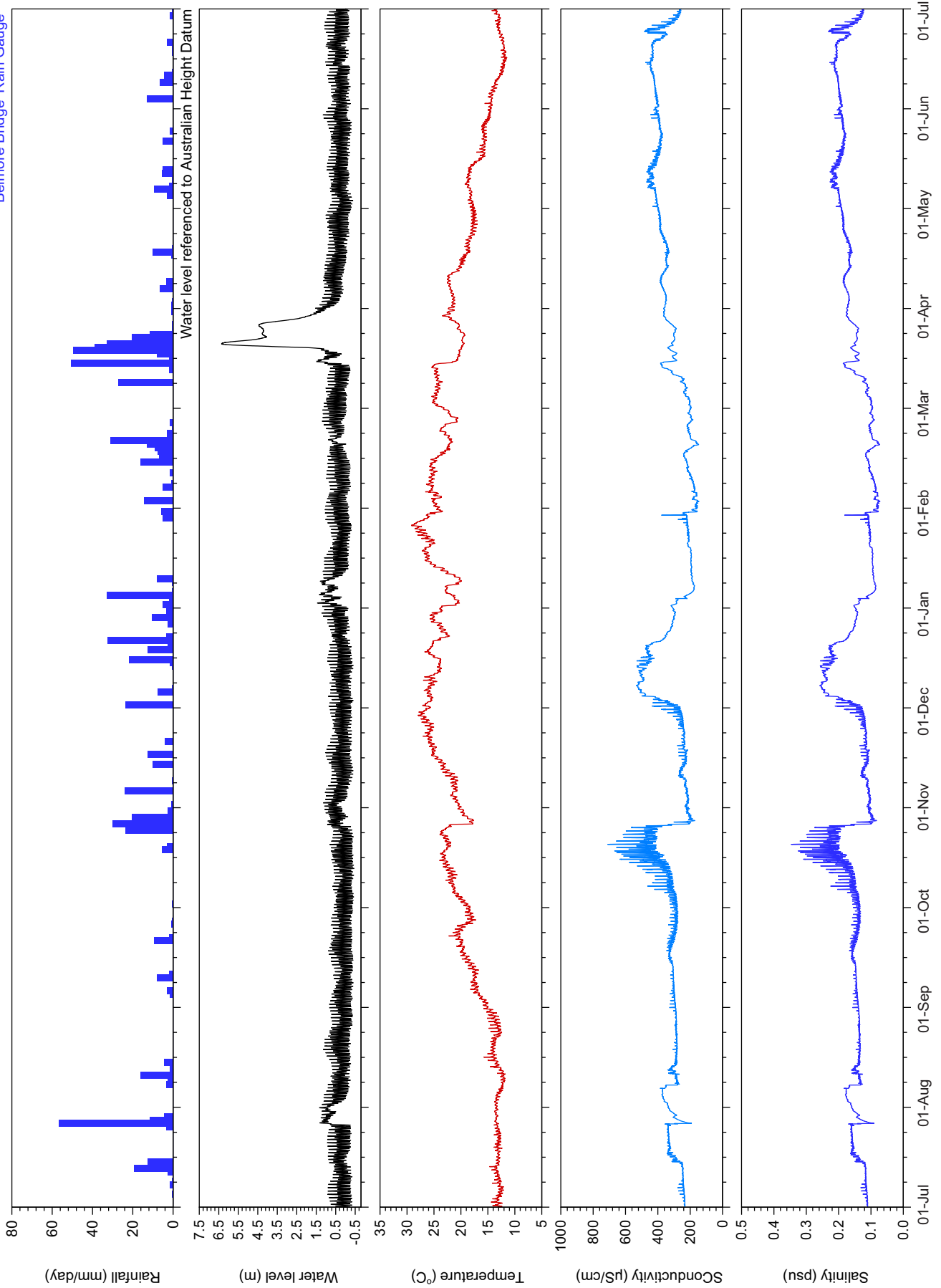
STATION LOCATIONS PATERSON RIVER REGION

**Manly
Hydraulics
Laboratory**

Report MHL2859

Figure
19

DRAWING 2859-19.cdr

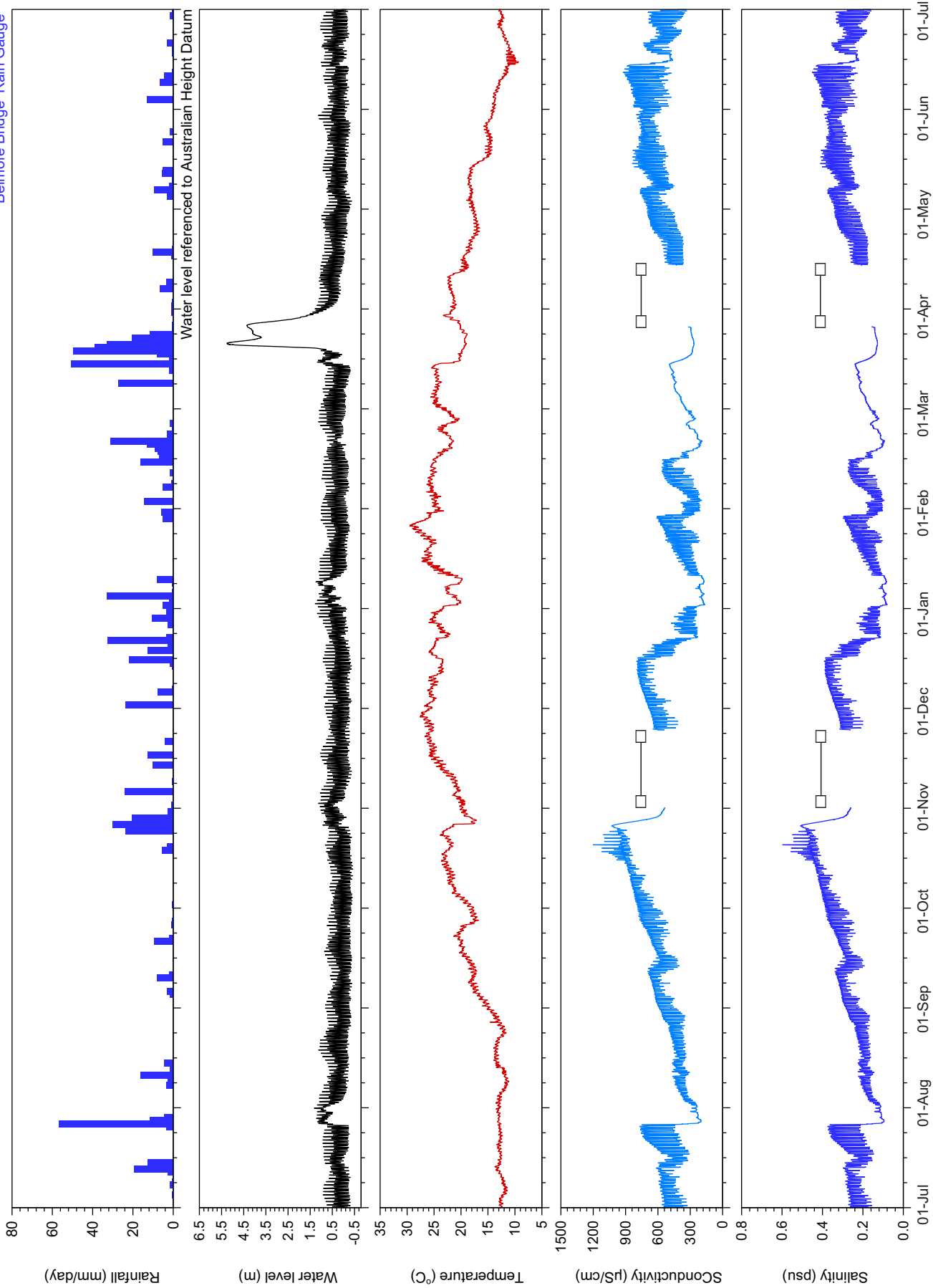


WATER LEVEL AND WATER QUALITY DATA
2020–2021
DUNMORE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
20



□ Data not plotted - site inspection indicated that the salinity sensor sensitivity was impacted by siltation
 Salinity trace resolution is maintained over longer periods between cleaning since the pumping station was installed on 15 June 2021

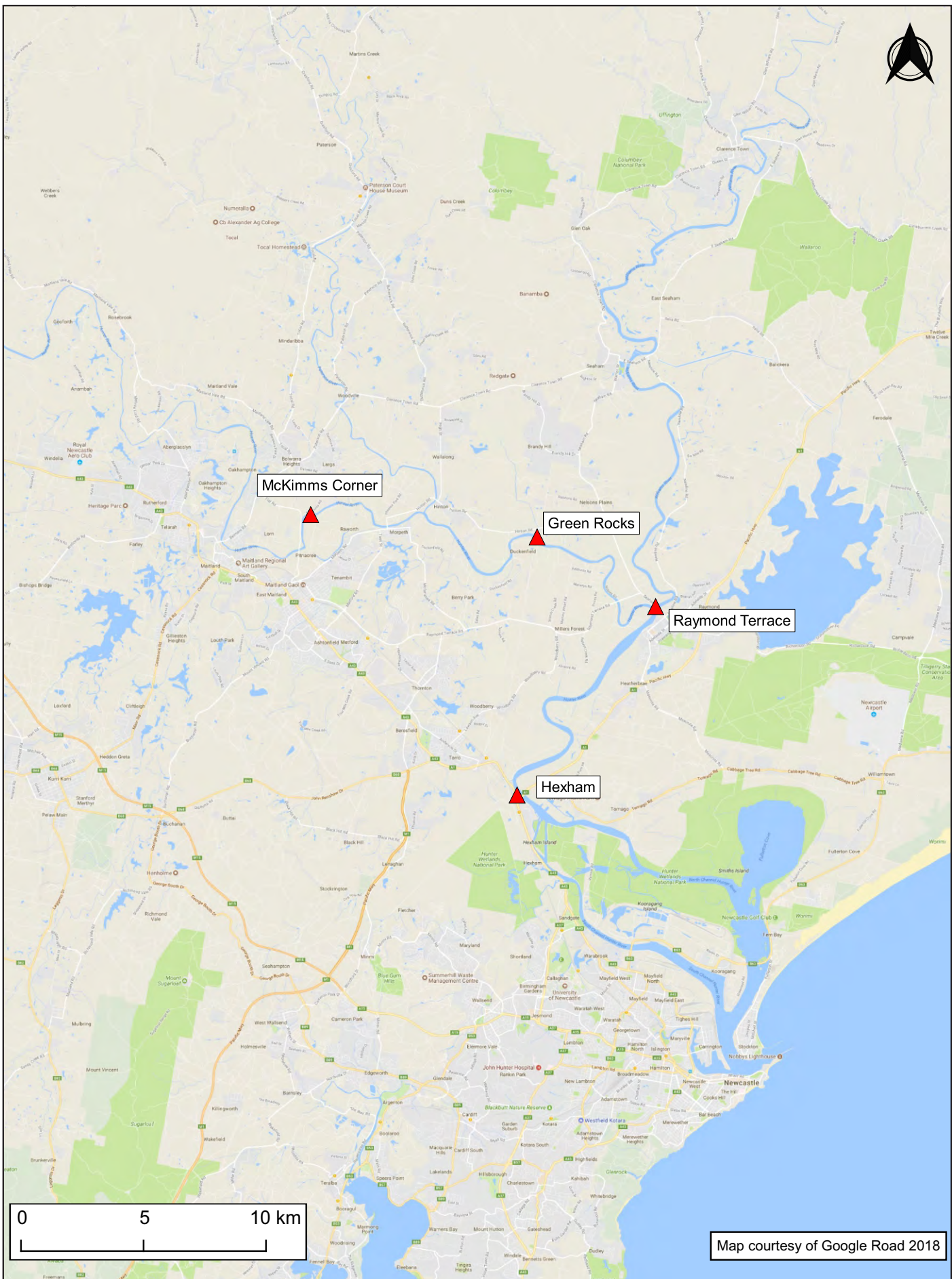


WATER LEVEL AND WATER QUALITY DATA
 2020–2021
 HINTON BRIDGE

Manly
 Hydraulics
 Laboratory

Report MHL2859

Figure
 21



Map courtesy of Google Road 2018

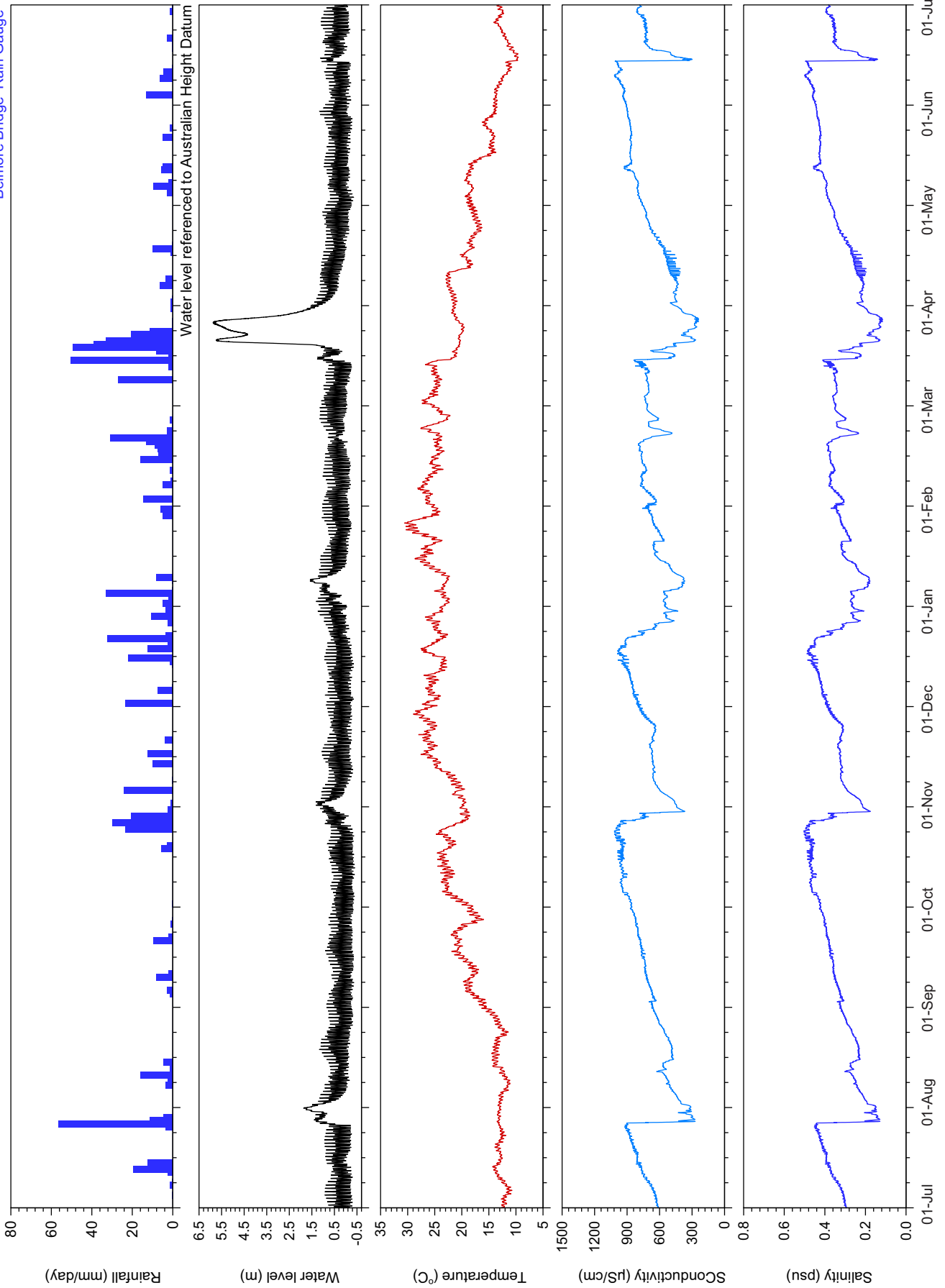


STATION LOCATIONS HUNTER RIVER REGION

**Manly
Hydraulics
Laboratory**

Report MHL2859
Figure
22

DRAWING 2859-22.cdr

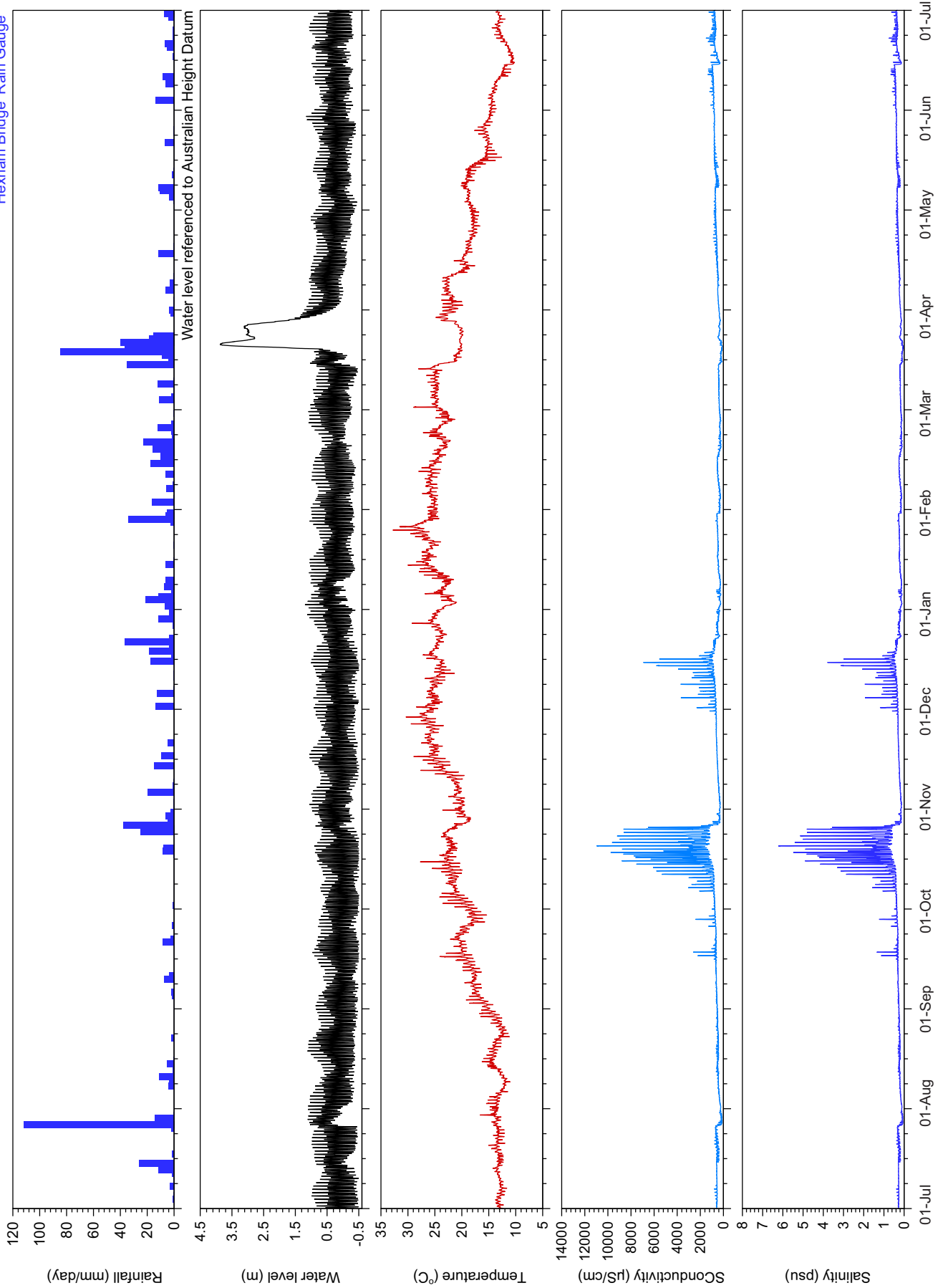


WATER LEVEL AND WATER QUALITY DATA
2020–2021
McKIMMS CORNER

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
23

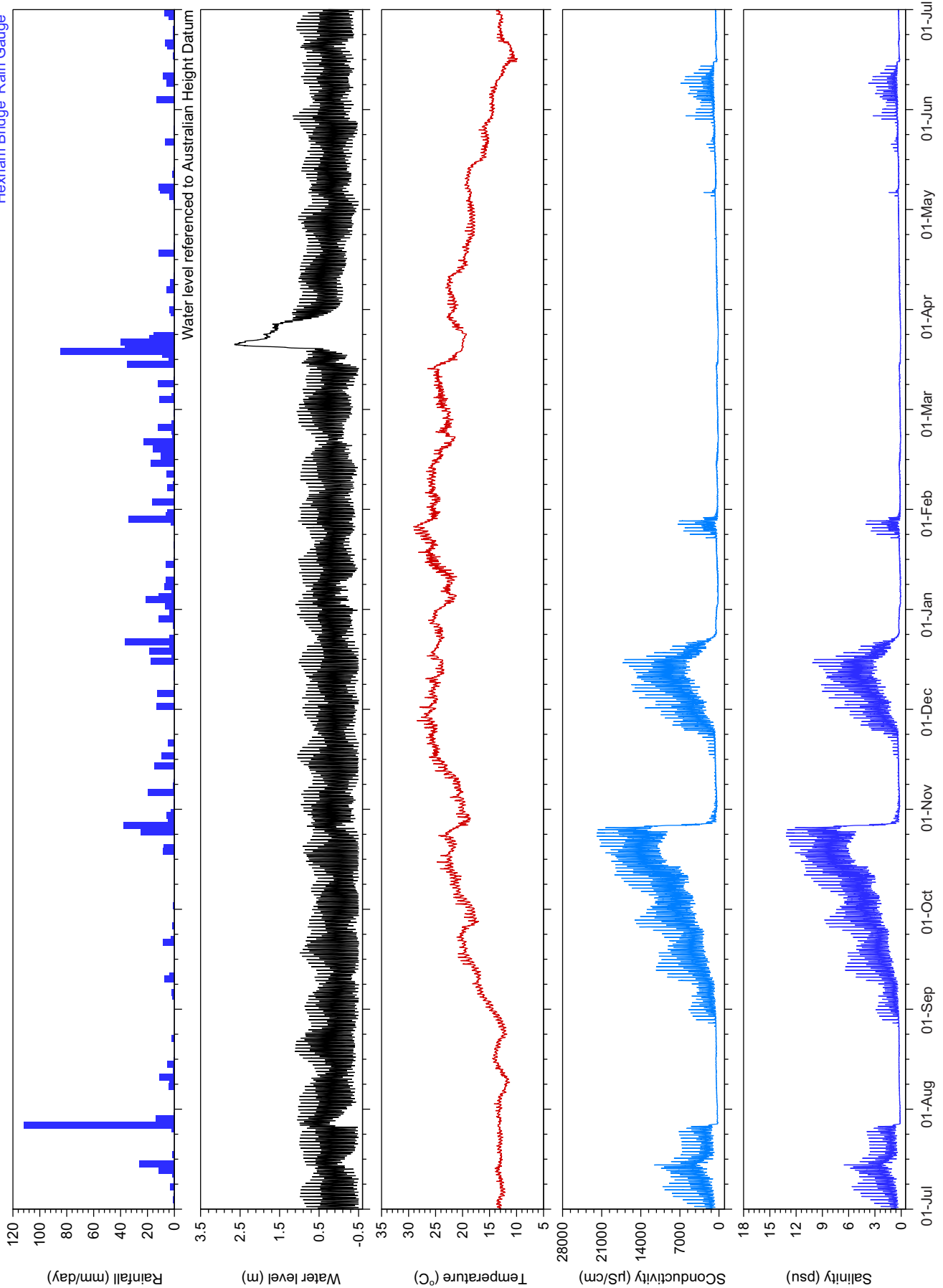


WATER LEVEL AND WATER QUALITY DATA
2020–2021
GREEN ROCKS

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
24

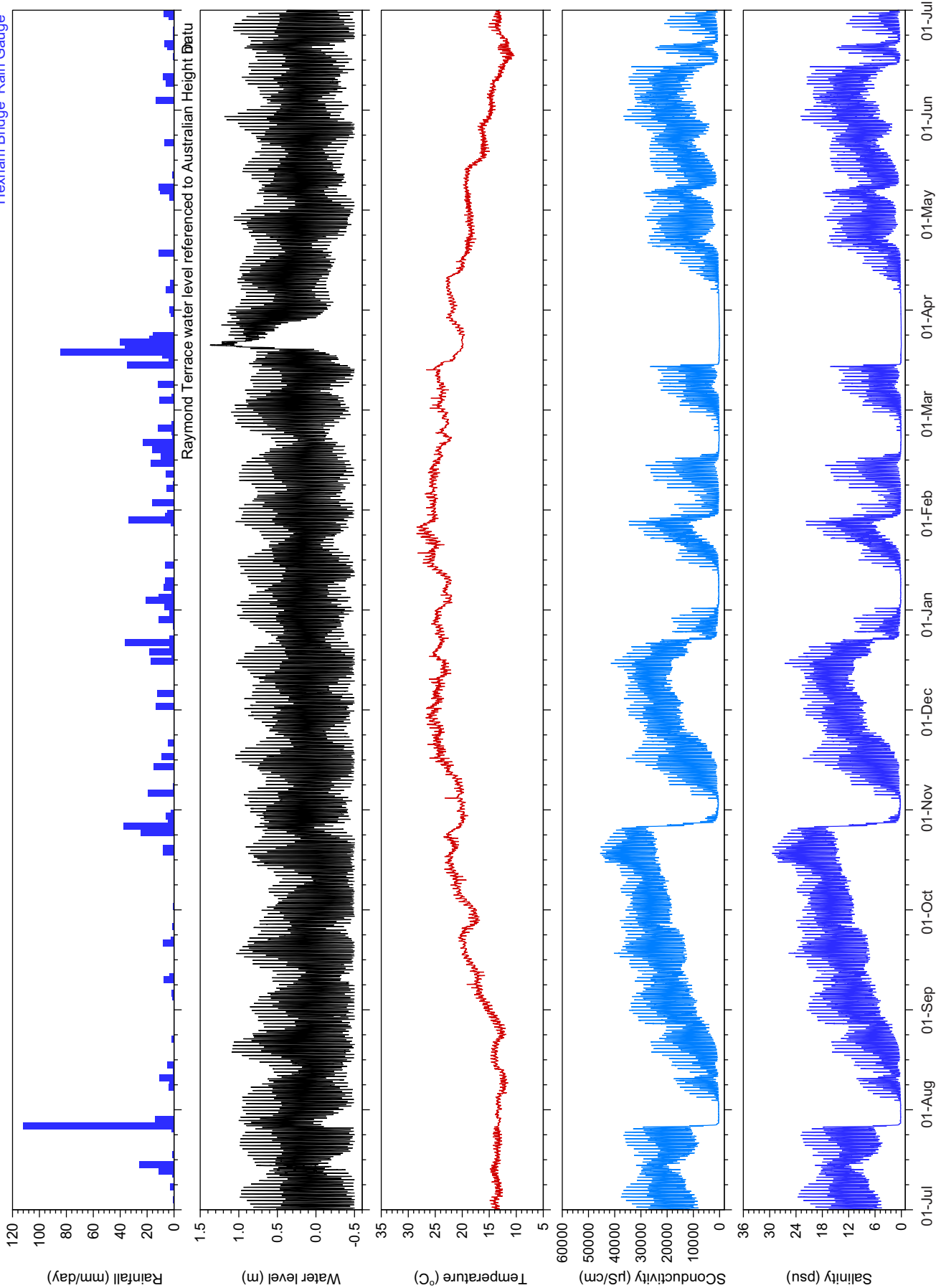


WATER LEVEL AND WATER QUALITY DATA
2020–2021
RAYMOND TERRACE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
25

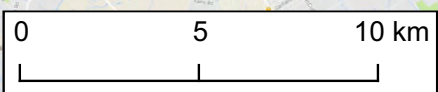
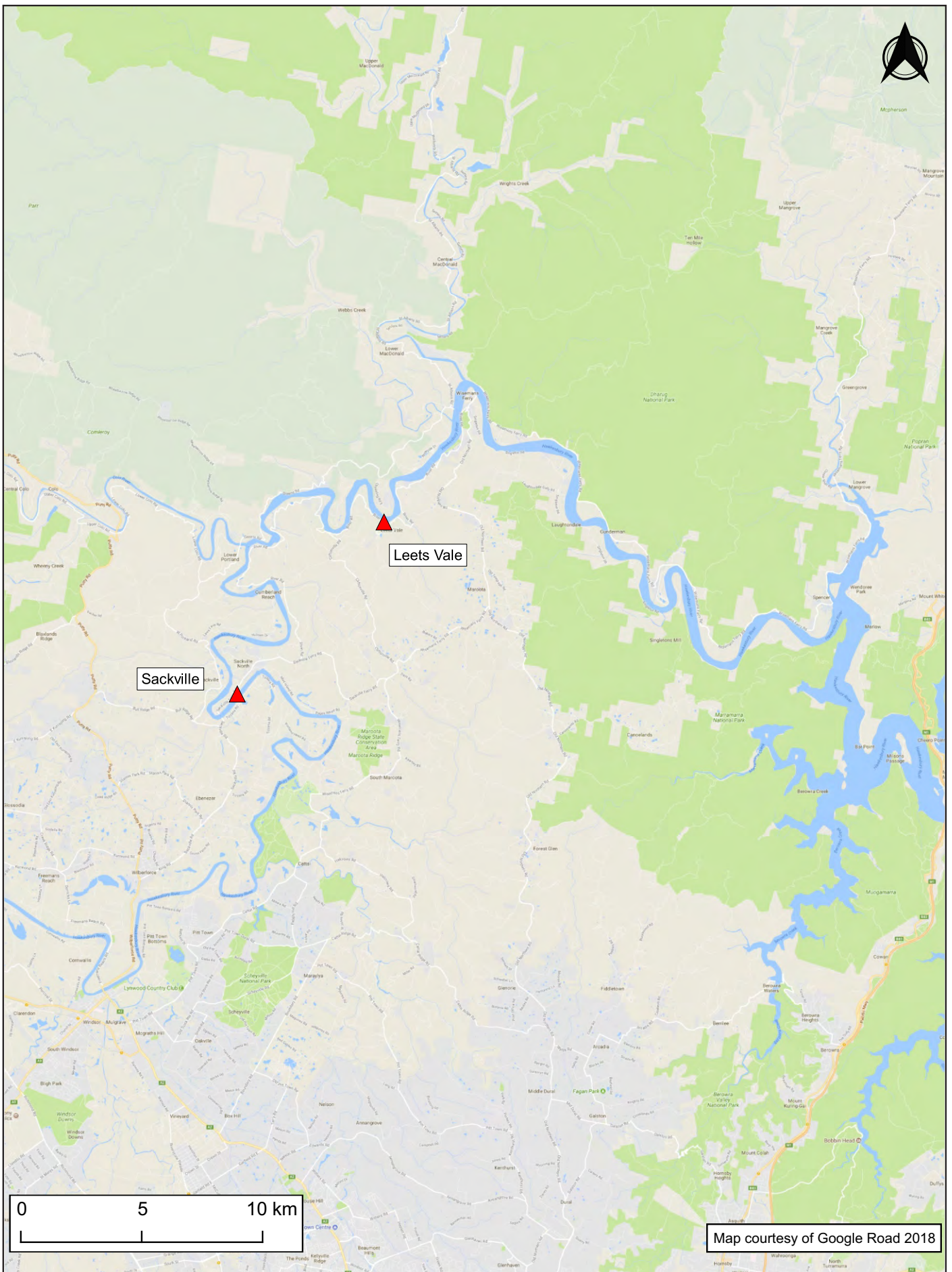


WATER LEVEL AND WATER QUALITY DATA
2020–2021
HEXHAM BRIDGE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
26

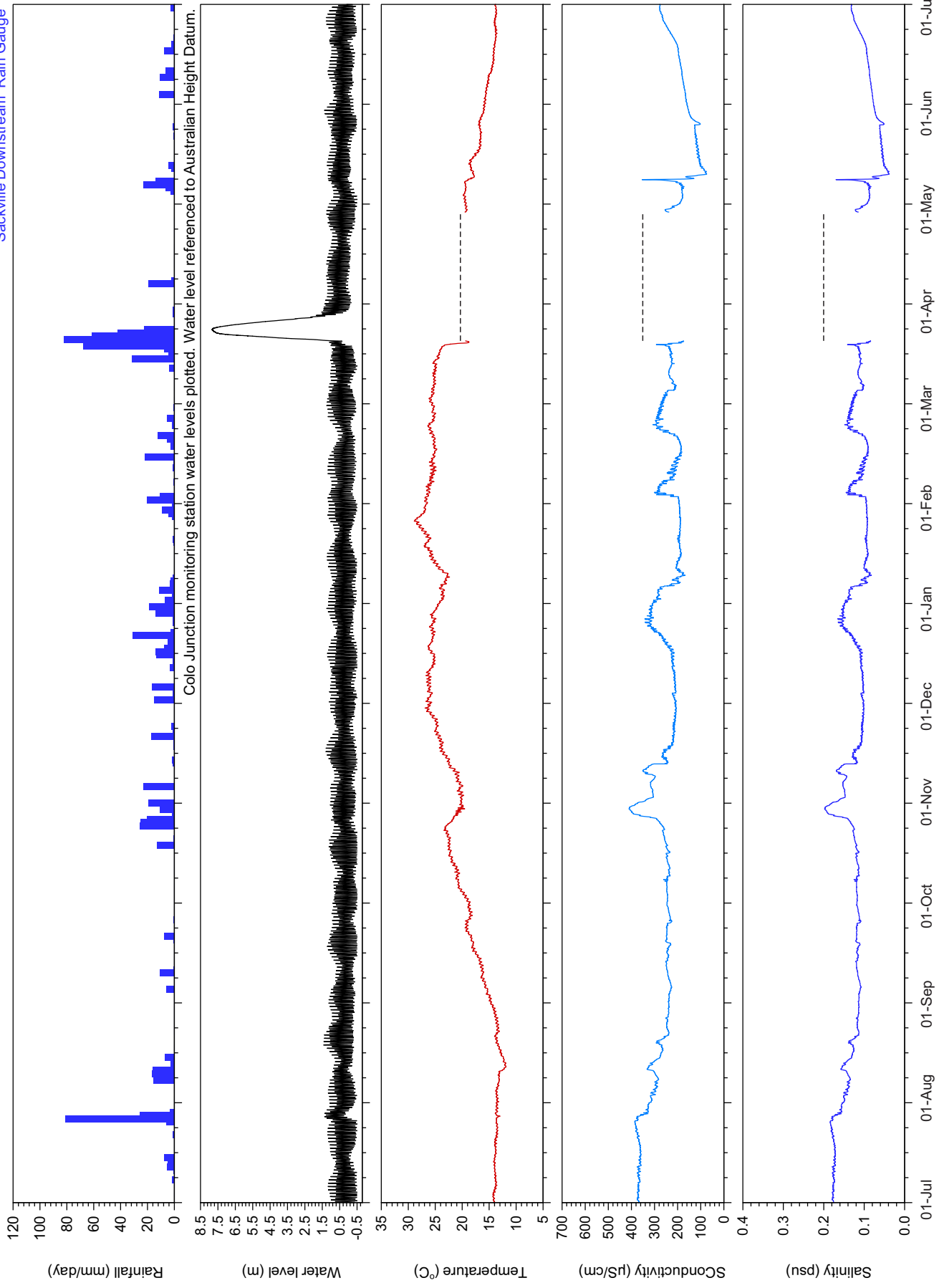


Map courtesy of Google Road 2018



STATION LOCATIONS HAWKESBURY RIVER REGION

**Manly
Hydraulics
Laboratory**
Report MHL2859
Figure
27
DRAWING 2859-27.cdr

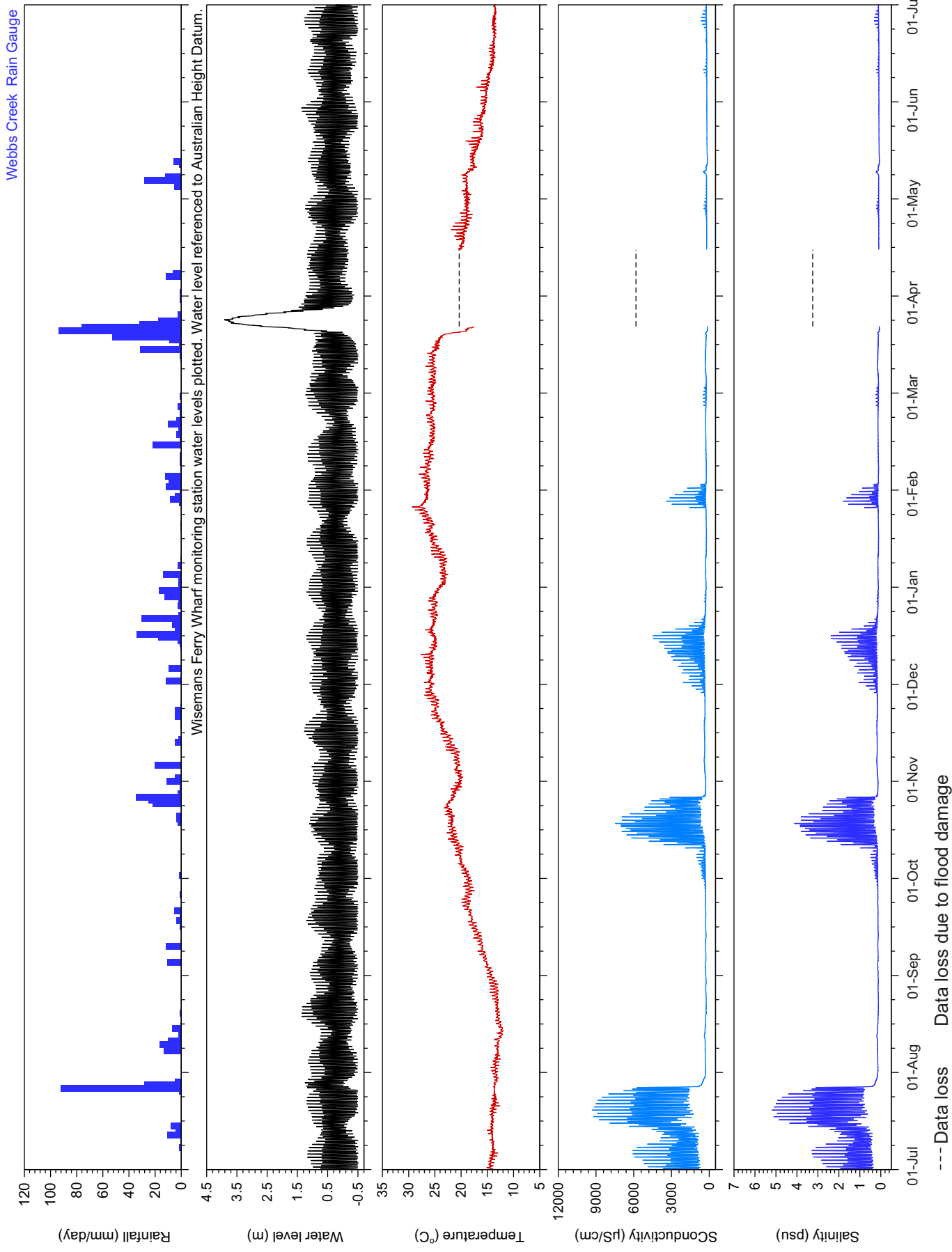


WATER LEVEL AND WATER QUALITY DATA
2020–2021
SACKVILLE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
28

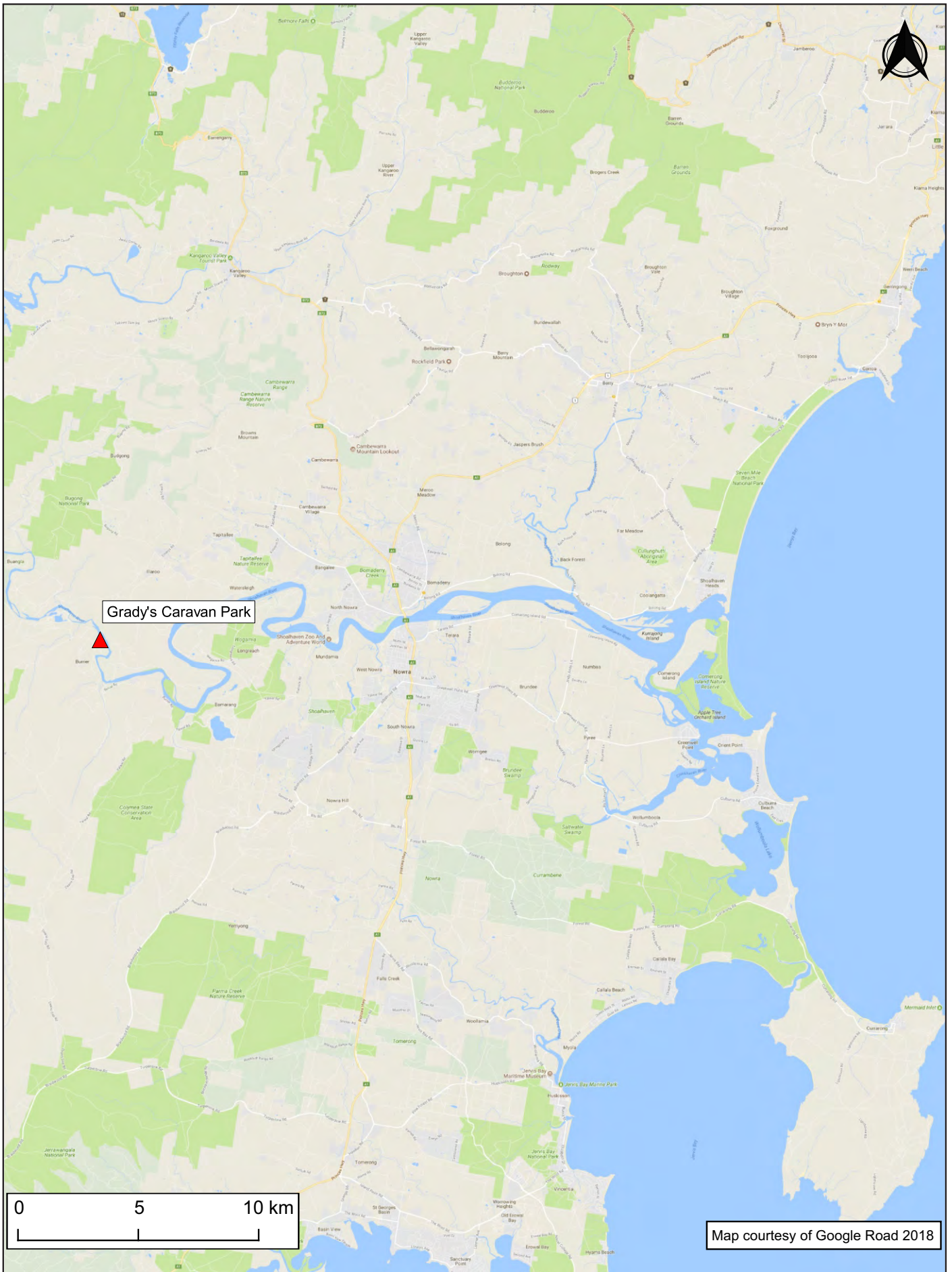


WATER LEVEL AND WATER QUALITY DATA
2020–2021
LEETS VALE

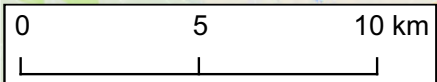
Manly
Hydraulics
Laboratory

Report MHL2859

Figure
29



Grady's Caravan Park



Map courtesy of Google Road 2018



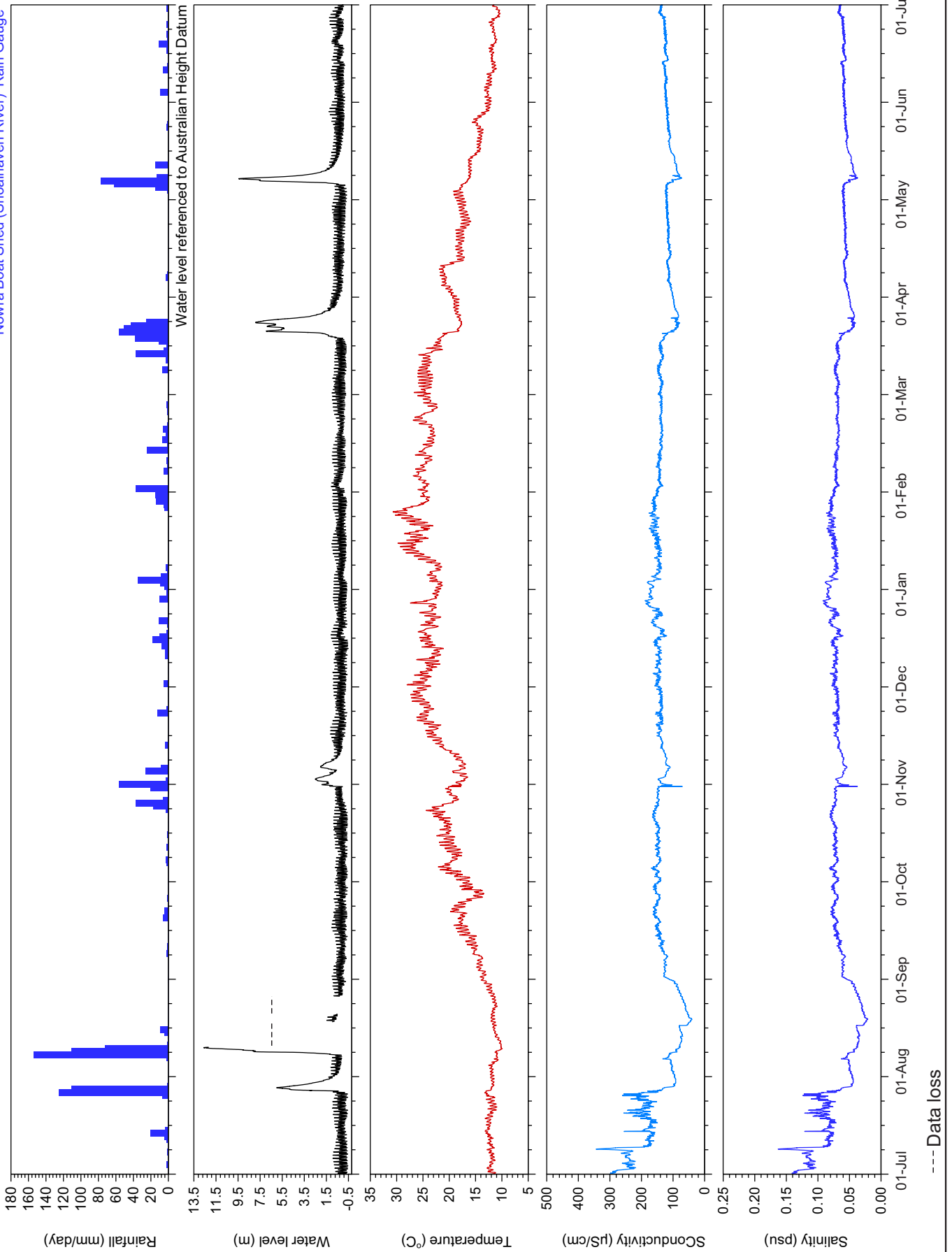
STATION LOCATIONS
SHOALHAVEN RIVER REGION

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
30

DRAWING 2859-30.cdr



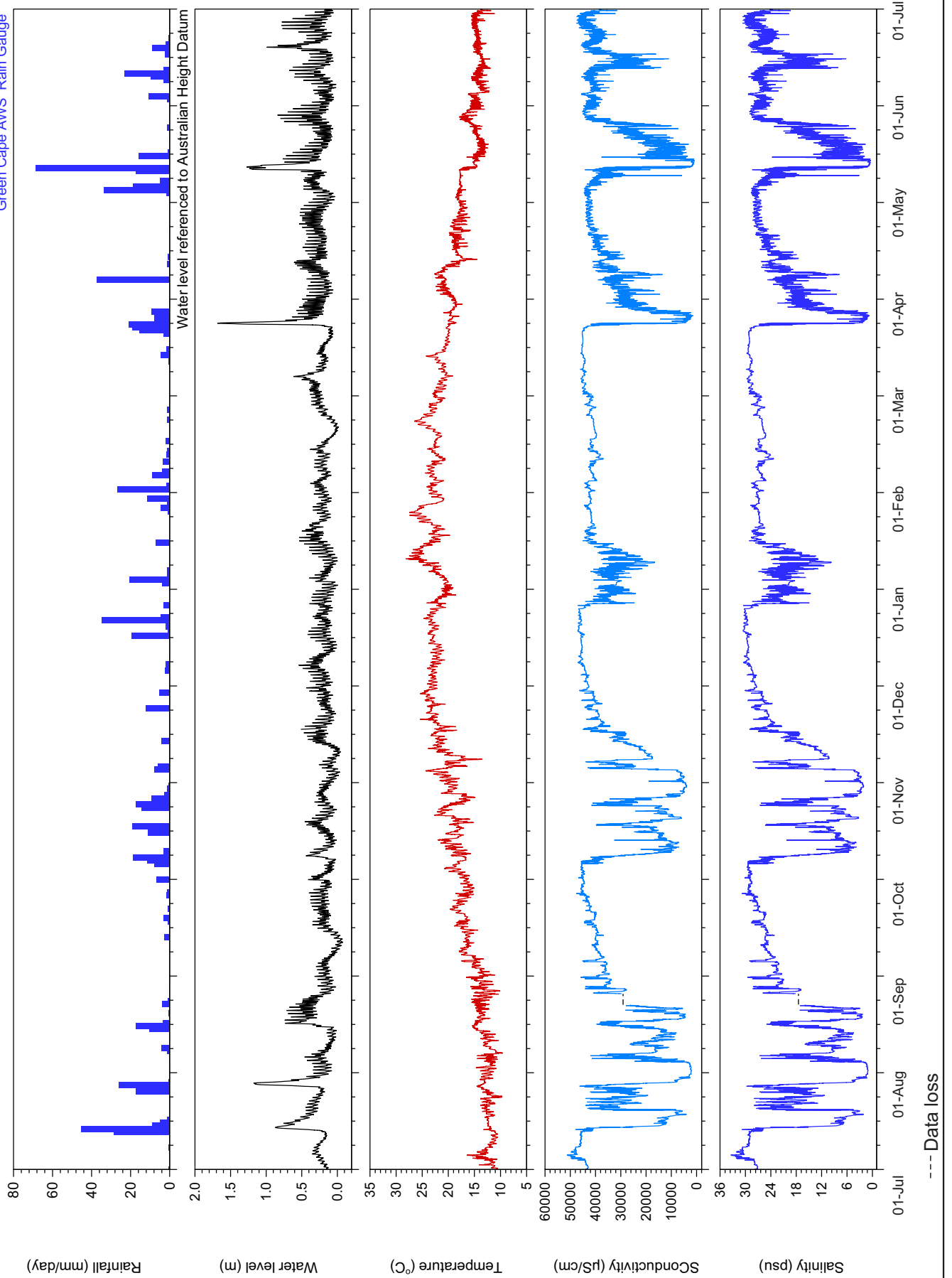
WATER LEVEL AND WATER QUALITY DATA
2020–2021
GRADY'S CARAVAN PARK

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
31

Green Cape AWS Rain Gauge



WATER LEVEL AND WATER QUALITY DATA
2020–2021
WONBOYN LAKE

Manly
Hydraulics
Laboratory

Report MHL2859

Figure
33

DRAWING 2859-33.cdr

Appendix A Digitised continuous data

Please note that water quality data might not be continuous between a station's tabled start and end dates.

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	ongoing	
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

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Hunter River at Hexham Bridge	Hexham Bridge	210448	17-Dec-93	ongoing	750
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 Cudgerree Bay	Cudgerree 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

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Tuross Lake at Trunketabella	Trunketabella	Station number not assigned	04-May-94	11-Mar-98	921
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	

Station long name	Station name	Station number	Start date	End date	Additional MHL report number reference
Shoalhaven River at DPI Waterra Bridge	DPI Waterra Point	Station number not assigned	07-Mar-95	07-Apr-95	
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 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), 2769 (19–20), 2855 (20–21).

MHL annual ocean tide levels and coastal air pressure 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), 2770 (19–20), 2856 (20–21).

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), 2771 (19–20), 2857 (20–21).

MHL annual wave climate and coastal air pressure summaries available:

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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), 2773 (19–20), 2859 (20–21).

Salinity profiling

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