Monitoring Report

Chowilla Surface Water Monitoring 2016/17

Ian Schneider & Paul Searle
Department of Environment, Water and Natural Resources

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Department of Environment, Water and Natural Resources
GPO Box 1047, Adelaide SA 5001

Telephone National (08) 8463 6946
International +61 8 8463 6946

Fax National (08) 8463 6999
International +61 8 8463 6999

Website http://www.environment.sa.gov.au

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Jan.Whittle@sa.gov.au

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Foreword

The Department of Environment, Water and Natural Resources (DEWNR) is responsible for the management of the State’s natural resources, ranging from policy leadership to on-ground delivery in consultation with government, industry and communities.

High-quality science and effective monitoring provides the foundation for the successful management of our environment and natural resources. This is achieved through undertaking appropriate research, investigations, assessments, monitoring and evaluation.

DEWNR’s strong partnerships with educational and research institutions, industries, government agencies, Natural Resources Management Boards and the community ensures that there is continual capacity building across the sector, and that the best skills and expertise are used to inform decision making.

Sandy Pitcher
CHIEF EXECUTIVE
DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES
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Introduction

The Chowilla Floodplain and anabranch system is a significant ecological asset of the Murray–Darling Basin and is listed under the Ramsar Convention on Wetlands of International Importance (the Ramsar Convention). The Chowilla Floodplain is part of The Living Murray (TLM) Chowilla Floodplain and Lindsay–Wallpolla Islands icon site.

Works described in this report were undertaken as part of the TLM intervention monitoring project Chowilla Floodplain Icon Site Surface Water Monitoring 2016/17. The Living Murray is a joint initiative funded by the New South Wales, Victorian, South Australian, ACT and Commonwealth governments and coordinated by the Murray-Darling Basin Authority (MDBA).

TLM Icon site management on the Chowilla Floodplain is coordinated the Department of Environment, Water and Natural Resources (DEWNR).

Chowilla surface water monitoring under TLM is undertaken by the Water Resource Monitoring Unit (WRMU) of the Science and Information Group, of the DEWNR.

A project plan was developed for surface water monitoring of the Chowilla Floodplain and environments for 2016/17 year. The Chowilla Floodplain Icon Site Surface Water Monitoring 2016/17 Project Plan details activities to be undertaken by WRMU for the 2016/17 reporting year.

This report provides a summary of surface water monitoring, maintenance and data collection related activities undertaken by WRMU for the 2016/17 reporting period.
Background

The Chowilla Floodplain and anabranch system is a significant ecological asset of the Murray–Darling Basin and is listed under the Ramsar Convention on Wetlands of International Importance (the Ramsar Convention). The Chowilla Floodplain is part of The Living Murray (TLM) Chowilla Floodplain and Lindsay–Wallpolla Islands icon site.

Works described in this report were undertaken as part of the Murray – Darling Basin Authority (MDBA) funded TLM intervention monitoring project Chowilla Floodplain Icon Site Surface Water Monitoring 2016/17.

Management of the Chowilla Floodplain is coordinated through the Department of Environment, Water and Natural Resources (DEWNR).

Chowilla surface water monitoring under TLM is undertaken by the Water Resource Monitoring Unit (WRMU) of the Science, Monitoring and Knowledge Division of the DEWNR. As outlined in the Chowilla Floodplain Icon Site Surface Water Monitoring 2016/17 Project Plan.

The Chowilla floodplain is an anabranch of the River Murray, with multiple inlet points to the system upstream of Lock 6 and a common outlet point downstream of Lock 6 through Chowilla Creek.

This report summarises monitoring activities in relation to the project objectives, which include:

1. Collection of surface water data from an existing surface water monitoring network located within the Chowilla anabranch system, two portable water quality monitoring stations and the weather station,

Data collection from the network is used to inform a number of ongoing investigations and provides critical input to the real-time management of Chowilla regulator operations. The data collected also informs a range of other Chowilla Floodplain Icon Site monitoring programs.

Infrastructure has been built on the Chowilla floodplain to facilitate managed inundation and environmental watering of the floodplain environment. A surface water monitoring network was previously established and monitoring undertaken during 2016/17 utilised this existing network.

During August 2016 a managed inundation event was initiated with a target operating height of 19.796mAHD (3.45 metres above normal operating level) in Chowilla Creek (A4261091), with this target reached in late September. This level increased further during the subsequent natural high flow period, reaching 19.968mAHD in early December.

Water monitoring information collected by WRMU included the following parameters:

- Water Level (WL)
- Water Flow (Qg)
- Electrical Conductivity (EC)
- Dissolved Oxygen (DO)
- Meterological parameters (Multiple)

WRMU monitored 16 automated sites during the 2016/17 reporting period. Three of these sites are located in the River Murray main channel, two of these located in backwater environments and were reinstated to support the managed inundation event. One monitoring site is an automatic weather station. In addition to this, point gauging was undertaken at two of the automated flow sites and two dedicated point gauging sites.
Monitoring of complementary water quality and water level information by other programs occurs along reaches surrounding Chowilla sites. Review of water information captured through programs external to the Chowilla monitoring does not form part of this report.

A locality map showing the extent and location of Chowilla monitoring and complimentary external sites is provided below in Figure 1 and a summary of Chowilla monitoring sites and parameters is provided in Table 1.

Figure 1. Chowilla monitoring locations
### Table 1. Chowilla Floodplain monitoring sites and parameters monitored

<table>
<thead>
<tr>
<th>Hydstra Site ID</th>
<th>Site Name</th>
<th>Parameter Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4261027</td>
<td>Salt Creek at SA/NSW Border</td>
<td>EC, WL, Q</td>
</tr>
<tr>
<td>A4260600</td>
<td>I Bank upstream Hyperna Creek</td>
<td>WL, Qg</td>
</tr>
<tr>
<td>A4260595</td>
<td>Punkah Creek at Scab Inspectors House</td>
<td>EC</td>
</tr>
<tr>
<td>A4260580</td>
<td>Punkah Creek at Sheeps Bridge</td>
<td>EC*, DO</td>
</tr>
<tr>
<td>A4261109</td>
<td>Punkah Creek at Sheeps Bridge</td>
<td>WL</td>
</tr>
<tr>
<td>A4260579</td>
<td>Slaneys Creek 150m Upstream Chowilla Confluence</td>
<td>EC</td>
</tr>
<tr>
<td>A4261107</td>
<td>Chowilla Creek upstream Monoman Creek</td>
<td>EC*, DO</td>
</tr>
<tr>
<td>A4260576</td>
<td>Monoman Bridge upstream Chowilla Creek</td>
<td>WL</td>
</tr>
<tr>
<td>A4261091</td>
<td>Chowilla Creek downstream Monoman Creek</td>
<td>WL, Qg</td>
</tr>
<tr>
<td>A4261224</td>
<td>Chowilla Creek 1.5km Upstream River Murray junction</td>
<td>EC*, DO</td>
</tr>
</tbody>
</table>

**Portable Water Quality Units**

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<th>Parameter Monitored</th>
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</thead>
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<tr>
<td>A4261166</td>
<td>Coppermine Waterhole</td>
<td>DO</td>
</tr>
<tr>
<td>A4261160</td>
<td>Gum Flat</td>
<td>DO</td>
</tr>
</tbody>
</table>

**River Murray Main Channel**

<table>
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<th>Hydstra Site ID</th>
<th>Site Name</th>
<th>Parameter Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4261022</td>
<td>Customs House Pontoon</td>
<td>EC*, DO</td>
</tr>
<tr>
<td>A4260705</td>
<td>River Murray upstream Chowilla Creek (AMTD 613.3km)</td>
<td>EC</td>
</tr>
<tr>
<td>A4261168</td>
<td>River Murray Downstream Chowilla Creek (AMTD 609.0km)</td>
<td>EC*, DO</td>
</tr>
</tbody>
</table>

**All Weather Station**

<table>
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<th>Site Name</th>
<th>Parameter Monitored</th>
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<tbody>
<tr>
<td>A4261167</td>
<td>Chowilla All Weather Station (AWS)</td>
<td>Multiple</td>
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</table>

**Point Gauging Sites**

<table>
<thead>
<tr>
<th>Hydstra Site ID</th>
<th>Site Name</th>
<th>Parameter Monitored</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4261064</td>
<td>Slaneys Creek 200m upstream Salt Creek</td>
<td></td>
</tr>
<tr>
<td>A4260578</td>
<td>Pipeclay Creek 175m upstream Chowilla Confluence</td>
<td></td>
</tr>
</tbody>
</table>

EC: electrical conductivity (surface), EC*: electrical conductivity (surface and bed), WL: water level, DO: dissolved oxygen, Qg: Continuous and point flow gauging, Q: Point gauging, Multiple: parameter list in site summary.
River Murray Flows

Calculated River Murray flows to South Australia during the reporting period ranged from 3600 ML/day in July 2016 and June 2017 and peaked at 94565 ML/day on 31 November 2016. The November flow to SA was the highest recorded in 23 years. The calculated flow to SA for the 2016/17 period is provided below for context when reviewing monitored site data (Figure 2).

During the high, unregulated flows period infrastructure was opened or removed. Weirs at Locks 6 and 5 were removed on 9/11/16 and 18/11/16, respectively. The Lock 6 weir was reinstated on 20/12/16 and the Lock 5 weir on 20/12/16.

Figure 2. Calculated flow to South Australia 2016/17
Monitoring Site Review

During the 2016/17 reporting period, monitoring at 13 existing sites was maintained and monitoring instrumentation at two sites was re-instated. Flow gauging activities were undertaken at 5 sites to support a managed inundation event and to validate data collection at two automated flow gauging sites.

Typical monitoring sites are implemented as bank (Figure 3) or pontoon (Figure 4) deployments and are equipped with a telemetry capability for near real time data transfer and backup.

Operation for all monitoring sites is supported by routine download and maintenance visits by WRMU staff to provide data integrity, effective infrastructure operation and longevity. Download and maintenance visits were undertaken at an average six weekly frequency for all sites. During each routine visit, field verification measurements were recorded, data was downloaded locally and site infrastructure maintenance activities was undertaken. Routine activities to ensure effective instrument operation include sensor cleaning and general site maintenance (e.g. clearing site of weeds at bank sites, cleaning pontoon decks and solar panels).

All data collected is stored and processed in the DEWNR corporate time series database, HYDSTRA. All data was validated using field verification readings and trend analysis with adjacent sites. All plots produced for this report are generated using the HYDSTRA database, with site parameters and units shown above each plot.

Monitoring information is reported below and grouped according to monitored parameter.

Figure 3. Standard bank site deployment

Figure 4. Standard pontoon deployment
**Chowilla Floodplain EC Monitoring**

A4261027 – Salt Creek at SA/NSW Border

A4260595 – Punkah Creek at Scab Inspectors House

A4260580 – Punkah Creek at Sheeps Bridge

A4260579 – Slaney’s Creek 150m Upstream Chowilla Confluence

A4261107 – Chowilla Creek upstream Monoman Creek

A4261224 – Chowilla Creek 1.5km Upstream River Murray junction

Six sites within the Chowilla floodplain are equipped to monitor conductivity. Both A4261027 and A4260595 are equipped with surface EC sensors. Site A4261027 is located on Salt Creek at the SA/New South Wales border and A4260595 is situated on Punkah Creek to the north of the anabranch system near the southern extent of Lake Littra. Equipped with both surface and bed EC, monitoring site A4260580 is similarly located on Punkah Creek but lies downstream and west of A4260595 to the south east of Lake Limbra.

Slaney’s Creek flows to the north east, south of Punkah Island, to a confluence with Chowilla Creek. Site A4260579 lies 150m upstream of this confluence. Site A4261107 lies approximately 5.5km downstream of Slaney’s Creek. The final floodplain EC monitoring site is A4261224 which is located 70m upstream of the Chowilla Regulator. Both A4261107 and A4261224 are equipped to monitor both surface and bed EC.

A consistent conductivity trend is shared across all sites. Whilst conductivity was generally stable and comparatively low during the period of regulator operation, salinity at all sites rose significantly following the peak of the natural high water event in December 2016. The impact of salt accessions to the anabranch system is more pronounced in the upper Chowilla sites situated in Salt and Punkah Creeks, responses at sites in the lower anabranch are generally lower possibly due to dilution flows from Slaney’s Creek mitigating the salinity rise. Site A4260579 at Slaney’s Creek experienced the lowest salinity rise during the recession period, with EC more closely aligned with main channel salinity.

Where installed, bed EC data generally maintained the trend of the surface EC and limited separation was evident.

Good quality, continuous data was collected at Salt Creek site A4261027 for the duration of the reporting period. As flow and levels in the anabranch increased from 21/11/16 due to the natural high flow event, instrumentation from sites A4260595 in Punkah Creek and A4260579 in Slaney’s Creek were removed to prevent potential damage. Instrument operation at both sites was restored on 21/12/17. Following re-instatement, equipment at Slaney’s Creek (A4260579) malfunctioned resulting in a loss of data from 24/12/16 until function and collection of good quality, continuous data resumed on 17/1/17.

Overall data quality and continuity of data collection at Sites A4261107 on Chowilla Creek and A4261224 above the regulator was good, although instrument malfunctions led to a short period of data loss at each site. A gap in data occurred between 14/11/16 to 22/11/16 at A4261107 and between 19/6/17 to 9/7/17 for A4261224, while the bed EC sensor at these sites operated consistently.

Summary plots of surface EC for upper Chowilla and lower Chowilla floodplain sites are presented in Figure 5 and Figure 6, with bed EC data shown in Figure 7.
Figure 5. Upper Chowilla surface EC monitoring

Figure 6. Lower Chowilla surface EC monitoring
Figure 7. Chowilla floodplain bed EC monitoring
**Chowilla Floodplain DO Monitoring**

A4260580– Punkah Creek at Sheeps Bridge

A4261107 – Chowilla Creek upstream Monoman Creek

A4261224– Chowilla Creek 1.5km Upstream River Murray junction

Monitoring of DO on the floodplain is undertaken at Site A4260580 in Punkah Creek and in Chowilla Creek upstream of Monoman Creek and at the Chowilla Regulator. Monitoring of DO in the Main Channel occurred upstream of Old Customs House and downstream of the Chowilla Woolshed (A4261022 and A4261168).

All three sites display a consistent trend in the variation of DO until March 2017, effectively capturing the drop in DO to anoxic levels during the high flow period with this trend also reflected in the Main Channel sites. The DO sensor installed in Chowilla Creek at A4261224 began failing after 9/3/17 but due to a lack of availability of spare equipment could not be replaced.

A summary of monitored DO for the three sites is provided below in Figure 8, with a data summary for the Main Channel sites provided for comparison.

![Dissolved Oxygen Monitoring Chart](image_url)

**Figure 8.** Chowilla anabranch DO monitoring
Chowilla Wetland Monitoring Sites

A4261160–Gum Flat

A4261166–Coppermine Waterhole

Two backwater monitoring sites have been deployed on the Chowilla Floodplain, one site to the north at Gum Flat in November 2013 and a second site 400m west of the Chowilla Environmental Regulator at Coppermine Waterhole in October 2014. Both sites were inactive at the commencement of the reporting year and were activated late in 2016.

In August 2016 DO monitoring equipment was reinstated at Coppermine Waterhole (A4261166) and in September 2016 a DO sensor was reinstated at Gum Flat (A4261160).

Both sites produced good quality DO data until their removal. Site A4261160 at Gum Flat was removed on 1/12/16 to prevent potential instrumentation damage during the high flow period and Coppermine (A4261166) was removed on 27/12/17 following the recession of high flows.

Whilst DO monitored at Gum Flat (A4261160) appears to broadly reflect the DO trend shown in Punkah and Chowilla Creeks, DO monitored at Coppermine Waterhole appears to demonstrate a relative disconnect from DO trends observed in the Creek systems.

A summary of DO in the back water locations is shown below in Figure 9.

![Figure 9. Gum Flat and Coppermine Waterhole DO monitoring](image-url)
**Chowilla – River Murray Main Channel**

A4261022– River Murray upstream Old Customs House (AMTD 637.1km)

A4260705– River Murray upstream Chowilla Creek (AMTD 613.3km)

A4261168– River Murray DS Chowilla Woolshed Adj Chowilla HS

Water quality within the River Murray main channel is monitored using 3 pontoon sites. The most upstream site is located 200m downstream of the SA and Victorian border (A4261022), upstream of Customs House. Sites A4260705 and A4261168 are located downstream of Lock 6. Monitoring site A4260705 is situated approximately 1km upstream of the Chowilla confluence with the River Murray main channel and A4261168 is located 3km downstream of the confluence.

The upstream Customs House site (A4261022) is an ‘end of valley site’ and is primarily funded by the MDBA, with the Chowilla project funding only DO and bed EC. Site A4260705 does not have a bed EC sensor installed.

To prevent damage to instrumentation, instruments were removed from A4261022 during the increased River Murray flows on 25/11/16 and reinstated 6/12/16 as flows abated. An instrument malfunction resulted in a short period of bed EC data loss between 15/2/17 and 7/3/17, after which bed EC data collection was restored.

Upstream of Chowilla Creek at A4260705, good quality continuous surface EC data was collected throughout the reporting period. Whilst the pontoon was impacted and damaged by a houseboat on approximately 7/2/17, data quality or continuity was not affected.

Downstream of the Chowilla Creek confluence, DO and EC instrumentation was removed from A4261168 to prevent damage during the high flow period. Operation at the site ceased on 29/11/16 and was restored on 21/12/16. The bed EC sensor at this site became increasingly unreliable leading up to the high water event and failed on 19/11/16. The instrument was removed for the high flows but was not reinstated until 7/3/17 due to project spares availability.

The two monitoring sites upstream of Chowilla Creek (A4261022 and A4260705) show a consistent trend throughout the reporting period, with surface sensors and the bed EC sensor at A4261022 demonstrating limited variance. Downstream of Chowilla Creek at A4261168, the influence of the Chowilla Creek outflows to the River Murray salinity is clear and during the high flow recession period from December 2016, both surface and bed EC rises significantly in the main channel.

Data produced by the Main Channel DO sites is shown in Figure 8 with Floodplain DO summaries for comparison. A graphical summary of surface EC in the River Murray main channel is provided below in Figure 10 and for bed EC in Figure 11.
Figure 10. River Murray Main Channel surface EC monitoring data

Figure 11. River Murray Main Channel bed EC monitoring data
Chowilla Floodplain Water Level and Flow Monitoring

- A4260600 – I Bank upstream Hyperna Creek
- A4261027 – Salt Creek at SA/NSW Border
- A4261109 – Punkah Creek at Sheeps Bridge
- A4260576 – Monoman Bridge upstream Chowilla Creek
- A4261091 – Chowilla Creek downstream Monoman Creek
- A4261064 – Slaneys Creek 200m upstream Salt Creek (point gauging)
- A4260578 – Pipeclay Creek 175m upstream Chowilla Confluence (point gauging)

Water level (WL) and flow information is collected at 7 sites within the Chowilla anabranch system. Two of these sites are automated WL/Flow sites, 3 are WL and 2 have no infrastructure and are used for point gauging only.

In the upper anabranch, dedicated WL sites are located at Salt Creek (A4261027) at the SA/NSW border, at site A4261109 on Punkah Creek adjacent to the A4260580 pontoon and on Monoman Creek at the Monoman Creek Bridge (A4260576).

Monitoring sites A4260600 and A4261091 are bank mounted acoustic flow sites which also monitor WL. Continuous time series data collected at these sites is complemented by regular point gaugings which are used for validation purposes.

The flow site A4260600 is installed on the fast flowing I Bank Creek inlet, 270m west of the Hypurna Creek confluence. Instrumentation at I Bank (A4260600) is more than 10 years old and had previously been installed at another location within Chowilla. To prevent damage to instrumentation within the bank site enclosure, these were removed during the high flow event on 18/11/16.

The accuracy of data collected at this site has been impaired by three incidents in the course of the reporting year. On 6/7/16 a small tree fell into the watercourse upstream of the site, modifying velocities past the flow site and causing the site to overestimate flow. On 15/8/16 a larger tree immediately upstream of the site also fell into the watercourse causing a second increase in velocity past the flow sensor and enhancing the flow error. The instruments were reinstated following the peak flows in December 2016 but gauge boards and the flow sensor were subsequently damaged by small craft navigating the narrow creek and the fallen trees. Previous attempts to locate alternate gauging sites on the creek failed to locate a viable section.

A graphical summary of data collected at the site is provided below in Figure 12, with the overestimation of continuous flow vs point gaugings clearly evident.

Flow site A4261091 is located on the bank of Chowilla Creek, approximately 1.8km upstream of the Chowilla Regulator structure, below the Monoman Creek outflow. Validation through point gaugings demonstrated that this WL and flow site recorded good quality, continuous data throughout the reporting period.

A graphical summary of A4261091 continuous flow and point gaugings is provided below in Figure 13.

Good quality, continuous water level data was captured for Salt Creek, Punkah Creek, Monoman Creek and Chowilla Creek throughout the high flow peak and the reporting year. Whilst good quality, continuous data was collected at A4260600, data collection effectively ceased at this site on 26/12/16.

A summary of monitored water level within the Chowilla floodplain is presented below in Figure 14.
Figure 12.  I Bank Creek Flow Monitoring

Figure 13.  Chowilla Creek Flow Monitoring
Figure 14. Chowilla Floodplain WL Monitoring

Point gaugings were undertaken at 5 sites on 13/9/16 to inform operation of the regulator infrastructure and a managed inundation event. A summary of gaugings location for this event is shown in Figure 15 and results are contained in Appendix A.

A summary of point gaugings undertaken on the Chowilla floodplain during the 2016/17 reporting period is provided below in Table 2.
## Table 2. Chowilla flow gauging summary

<table>
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<tr>
<th>Hydstra Site ID</th>
<th>Site Name</th>
<th>Gauging Date</th>
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<td>A4260600</td>
<td>I Bank Creek upstream Hyperna Creek Chowilla</td>
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</tr>
<tr>
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<td></td>
<td>13/09/16</td>
</tr>
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<tr>
<td>A4260578</td>
<td>Pipeclay Creek 175m upstream Chowilla Confluence</td>
<td>13/09/16</td>
</tr>
<tr>
<td>A4261027</td>
<td>Salt Creek at SA/NSW Border Chowilla</td>
<td>13/09/16</td>
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<tr>
<td>A4261064</td>
<td>Slaney's Creek 200m upstream Salt Creek</td>
<td>13/09/16</td>
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<td>Chowilla Creek downstream Monoman Creek</td>
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<td></td>
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## Figure 15. Chowilla Floodplain flow gauging locations
Chowilla Automatic Weather Station

A4261167 Chowilla Automatic Weather Station (AWS)

The Chowilla Automatic Weather Station is located 700m north of Lock 6. The AWS was installed in February 2012 and has collected continuous good quality data since that time.

Parameters monitored by the site are:
- Rainfall
- Barometric pressure
- Dry bulb temperature
- Humidity
- Wind direction
- Wind velocity
- Solar radiation intensity

The AWS recorded 343mm of rainfall for the reporting year.

A summary of data collected during the 2016/17 reporting year is provided below in Figure 16.
Discussion and Recommendations

The high flow regime during 2016 impacted heavily on the ability to access and maintain monitoring sites and data quality in the region. Urgent and competing demands for resourcing has the potential to compromise site function and data quality during these times, with the impact felt beyond the immediate recession. A review of high water response and actions may benefit future events such as this.

Monitoring of DO is a relatively new parameter deployed by WRMU. Currently one sensor type has been deployed under the Chowilla program. Experiences gained over the past year demonstrated that a more intensive maintenance regime may be required for these sites to maintain sensor performance.

During the reporting year, the potential for infrastructure damage by third parties was realised at 2 sites (A4260705 and A4260600).

Around 7/2/17, the upstream Chowilla Creek site was impacted by a houseboat which caused significant damage to the pontoon and equipment (Figure 17), including damage to the galvanized enclosure, loss of a mast and solar panel and required an urgent visit to keep the site operational. A police report was lodged regarding the incident and damage to the pontoon and equipment. The site was repaired using available spares and site operation was maintained throughout but no recovery of cost to repair the pontoon was achieved.

![Infrastructure damage (A4260705)](image)

A significant loss of flow and level data occurred at the I Bank site A4260600 when a) the acoustic flow sensor was rendered inaccurate by 2 fallen trees and a subsequent velocity change and b) gauge board was knocked down and sensor damaged by small vessels navigating the narrow waterway and avoiding the fallen trees. Despite several attempts, the effective operation of the site could not be restored as the tree could not be removed and no parts were available to repair the damaged instrumentation. The effect of the fallen trees on velocity and discharge is shown below in Figure 18, with the overestimation of flow vs point gaugings shown previously in Figure 12. Arrangements to have the fallen trees removed commenced during the reporting period.
Figure 18  Flow sensor disruption (A4260600)

Chowilla AWS has proved to be a practical addition to the Chowilla monitoring network since its installation in 2012. In addition to providing important data to input to other monitoring programmes, field staff commonly access rainfall data from this site to inform and plan field and other activities.

At the conclusion of the 2016/17 financial year, a pool of spares was purchased by DEWNR for the Chowilla program, including 4 new EC sensors and 2 new DO sensors. The DO sensors are manufactured by In-Situ and are to be tested alongside the Zebra D-Opto units currently deployed at Chowilla sites. A range of infrastructure spares were also purchased to support the ongoing maintenance of the Chowilla bank and pontoon sites.
Appendices
## Appendix A. Chowilla Gauging Point Summary

### Chowilla Gauging Points

#### Daily Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Flow To SA (ML/day)</th>
<th>Flow From SA (ML/day)</th>
<th>Site number</th>
<th>Site Name</th>
<th>Date</th>
<th>Mean Velocity</th>
<th>Total Q (m³/s)</th>
<th>Discharge (ML/day)</th>
<th>Water Level (m AHD)</th>
<th>Salinity (us/cm)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>13/09/2016</td>
<td>A4260900</td>
<td>I Bank Ck us Hyperna</td>
<td>496962</td>
<td></td>
<td>13/09/2016</td>
<td>0.237</td>
<td>6.654</td>
<td>574.90</td>
<td>19.980</td>
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<td>Site 40</td>
<td>487239</td>
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<td>13/09/2016</td>
<td>0.241</td>
<td>116.87</td>
<td>9233.56</td>
<td>19.440</td>
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<tr>
<td>13/09/2016</td>
<td>A4261091 - Logger</td>
<td>Acoustic Flow site result</td>
<td>487239</td>
<td></td>
<td>13/09/2016</td>
<td>0.249</td>
<td>112.00</td>
<td>9727.00</td>
<td>19.440</td>
<td>118</td>
<td></td>
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<tr>
<td>13/09/2016</td>
<td>A4261064</td>
<td>Little Slaney Creek</td>
<td>495713</td>
<td></td>
<td>13/09/2016</td>
<td>0.271</td>
<td>18.333</td>
<td>1583.97</td>
<td>19.955</td>
<td>118</td>
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<tr>
<td>13/09/2016</td>
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<td>Pipeclay Ck/Chowilla</td>
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<td>13/09/2016</td>
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<td>19.695</td>
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### Lock 6 Flow (ML/day)

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### Lock 6 Upstream (Level)

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### Lock 6 Downstream (Level)

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<th>Level (m)</th>
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<td>18.44</td>
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</table>
1 Units of measurement

1.1 Units of measurement commonly used (SI and non-SI Australian legal)

<table>
<thead>
<tr>
<th>Name of unit</th>
<th>Symbol</th>
<th>Definition in terms of other metric units</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>day</td>
<td>d</td>
<td>24 h</td>
<td>time interval</td>
</tr>
<tr>
<td>gigalitre</td>
<td>GL</td>
<td>$10^9$ m$^3$</td>
<td>volume</td>
</tr>
<tr>
<td>gram</td>
<td>g</td>
<td>$10^{-3}$ kg</td>
<td>mass</td>
</tr>
<tr>
<td>hectare</td>
<td>ha</td>
<td>$10^4$ m$^2$</td>
<td>area</td>
</tr>
<tr>
<td>hour</td>
<td>h</td>
<td>60 min</td>
<td>time interval</td>
</tr>
<tr>
<td>kilogram</td>
<td>kg</td>
<td>base unit</td>
<td>mass</td>
</tr>
<tr>
<td>kilolitre</td>
<td>kL</td>
<td>1 m$^3$</td>
<td>volume</td>
</tr>
<tr>
<td>kilometre</td>
<td>km</td>
<td>$10^3$ m</td>
<td>length</td>
</tr>
<tr>
<td>litre</td>
<td>L</td>
<td>$10^{-3}$ m$^3$</td>
<td>volume</td>
</tr>
<tr>
<td>megalitre</td>
<td>ML</td>
<td>$10^3$ m$^3$</td>
<td>volume</td>
</tr>
<tr>
<td>metre</td>
<td>m</td>
<td>base unit</td>
<td>length</td>
</tr>
<tr>
<td>microgram</td>
<td>µg</td>
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<td>mass</td>
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<tr>
<td>microlitre</td>
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<td>volume</td>
</tr>
<tr>
<td>milligram</td>
<td>mg</td>
<td>$10^{-3}$ g</td>
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</tr>
<tr>
<td>millilitre</td>
<td>mL</td>
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<tr>
<td>millimetre</td>
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<tr>
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<td>s</td>
<td>base unit</td>
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</tr>
<tr>
<td>tonne</td>
<td>t</td>
<td>1000 kg</td>
<td>mass</td>
</tr>
<tr>
<td>year</td>
<td>y</td>
<td>365 or 366 days</td>
<td>time interval</td>
</tr>
</tbody>
</table>

1.2 Shortened forms

DEWNR Department of Environment, Water and Natural Resources

EC electrical conductivity (µS/cm)

RMO River Murray Operations

DO dissolved oxygen (ppm)

ppm parts per million

SA MDB South Australian Murray-Darling Basin

SARFIIP South Australian Riverland Floodplain Infrastructure Implementation Program

WL water level (m)

WRM Water Resource Monitoring Unit
2 Glossary

**Anabranch** — A branch of a river that leaves the main channel

**AWS** — Automatic Weather Station

**DEWNR** — Department of Environment, Water and Natural Resources (Government of South Australia)

**DO** — Dissolved Oxygen

**EC** — Electrical conductivity; 1 EC unit = 1 micro-Siemens per centimetre (µS/cm) measured at 25°C; commonly used as a measure of water salinity as it is quicker and easier than measurement by TDS

**Floodplain** — Of a watercourse means: (1) floodplain (if any) of the watercourse identified in a local water management plan; adopted under the Act; or (2) where (1) does not apply — the floodplain (if any) of the watercourse identified in a development plan under the Development (SA) Act 1993; or (3) where neither (1) nor (2) applies — the land adjoining the watercourse that is periodically subject to flooding from the watercourse

**Hydstra** — A DEWNR time series data management system that stores continuously recorded water-related data such as water level, salinity and temperature; it provides a powerful data analysis, modelling and simulation system; contains details of site locations, setup and other supporting information

**Infrastructure** — Artificial lakes; dams or reservoirs; embankments, walls, channels or other works; buildings or structures; or pipes, machinery or other equipment

**MDBA** — Murray–Darling Basin Authority

**Monitoring** — (1) The repeated measurement of parameters to assess the current status and changes over time of the parameters measured (2) Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals, and other living things

**Salinity** — The concentration of dissolved salts in water or soil, expressed in terms of concentration (mg/L) or electrical conductivity (EC)

**Surface water** — (a) water flowing over land (except in a watercourse), (i) after having fallen as rain or hail or having precipitated in any another manner, (ii) or after rising to the surface naturally from underground; (b) water of the kind referred to in paragraph (a) that has been collected in a dam or reservoir

**Watercourse** — A river, creek or other natural watercourse (whether modified or not) and includes: a dam or reservoir that collects water flowing in a watercourse; a lake through which water flows; a channel (but not a channel declared by regulation to be excluded from the this definition) into which the water of a watercourse has been diverted; and part of a watercourse

**Water quality monitoring** — An integrated activity for evaluating the physical, chemical, and biological character of water in relation to human health, ecological conditions, and designated water uses

**Water resource monitoring** — An integrated activity for evaluating the physical, chemical, and biological character of water resources, including (1) surface waters, groundwaters, estuaries, and near-coastal waters; and (2) associated aquatic communities and physical habitats, which include wetlands