Coleambally IRRIGATION

# Annual Compliance Report 2023

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The Annual Compliance Report 2022/23 is provided to meet the reporting requirements of Coleambally Irrigation Co-operative Limited (CICL) against operating licences:

- Combined Water Supply Work Approval and Water Use Approval 40CA401473 (Murrumbidgee regulated river water source) and Combined Water Supply Work Approval;
- Water Use Approvals for Groundwater extraction 40CA403808 and 40WA404593; and
- Environment Protection Licence No 4652.

I am pleased to advise that from 1 July 2022 to 30 June 2023, CICL has complied with all monitoring and reporting requirements of the:

- Combined Water Supply Work Approval and Water Use Approval 40CA401473, including the CICL Monitoring and Reporting Plan dated 16 March 2018;
- Groundwater Works Approvals 40CA403808, 40WA404593 and
- Environment Protection Licence No 4652.

To the best of my knowledge the information presented in this report is certified as being complete, true and accurate.

Clifford Ashby

Chief Executive Officer

# 5. Executive Summary



The 2022/23 irrigation season saw a continuation of the wet conditions experienced in the previous season. Rainfall recorded for the irrigation season far exceeded the long-term average and was the highest rainfall recorded between July and June since 2010/11. The mid-Murrumbidgee Valley experienced a significant flooding event from September 2022 through to January 2023.

The season commenced with a general security allocation of 35% that reached 100% by the 16th of January. The key water statistics for the preceding two seasons are provided in the following table:

*Table 5.1: Water usage in Coleambally Irrigation Area of Operations*

| Key Statistics | 2022/23 | 2021/22 | 2020/21 |
|---|---|---|---|
| Final Allocation | 100% | 100% | 100% |
| Metered Usage to Customers | 240,796 ML | 249,873 ML | 258,881 ML |

Rainfall totals in the district exceeded the seasonal average with 683.8 mm recorded for the water year compared to the Long Term Average (LTA) of 401.4 mm.

The total evaporation for the 2022/23 water year was 1,393.4 mm which was lower than the LTA of 1,727.8 mm. The area under supplied irrigation water was 48,071 ha, compared to 57,808 ha in the 2021/22 water year.

*Table 5.2: Crop areas and total metered usage (ML)*

| Crop | Area (Ha) | Total metered usage (ML) |
|---|---|---|
| Rice | 4,878 | 62,626 |
| Horticulture | 1,556 | 5,394 |
| Other Summer Crops | 21,340 | 130,325 |
| Winter Crops | 20,297 | 28,405 |
| Stock and Garden | N/A | 8,258 |
| Undefined | N/A | 5,788 |
| **Total** | **48,071** | **240,796** |

*Note: The crop area data is supplied by CICL's customers at the beginning of the irrigation season and is independently verified by various means, however, the data serves only as an approximation of the area irrigated.*

The high rainfall rate contributed to an increase in average watertable heights. The area of land with the water table within 2 m of the surface has increased to 514 ha, from 177 ha in the previous season, but still only accounts for less than 1% of the Coleambally Irrigation Area.

There were 5 reportable water quality incidents in the 2022/23 season at licenced discharge points where pollutants exceeded Notifiable levels as part of routine monitoring.

# 6. Plans of the Area of Operations, Authorised Works and Monitoring Sites



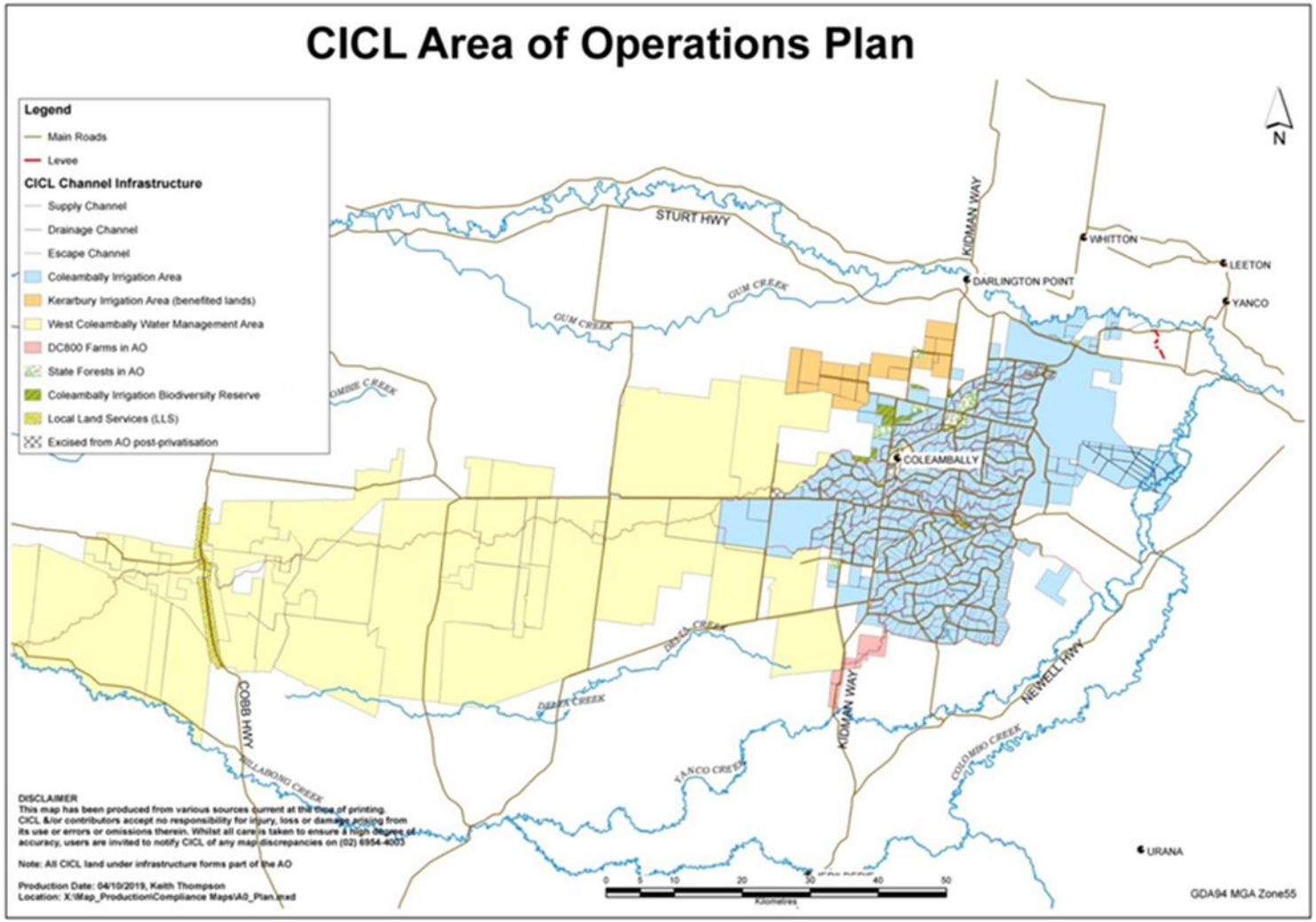
## 6.1 Coleambally Irrigation Area of Operations

The following section is provided to satisfy condition 2.1 of the CICL Monitoring and Reporting Plan, which requires a plan to be presented of the Area of Operations as existing at 30 June including any amendments made by the inclusion and exclusion of lands.

The Coleambally Irrigation Area of Operations is located between the towns of Darlington Point and Jerilderie, New South Wales, in the southern Murray-Darling Basin of Australia as depicted in Figure 6.1.

From the 1 July 2022 to 30 June 2023 there were no requests made to the Minister to include or exclude land from the Area of Operations.

*Figure 6.1: Current Area of Operations of CICL including benefited lands*




*Note: The term "benefited lands" is given to land that receives a benefit from our licence and/or licenced works but which are not defined as being within the Area of Operations.*

## 6.2 Plans of Works and Monitoring Sites

The following section is provided to satisfy condition 2.2 of the CICL Monitoring and Reporting Plan, which requires a plan (or plans) to be presented showing the current location of works listed in Schedule 1 of the CICL Monitoring and Reporting Plan and all monitoring sites listed in Attachments 1 and 2 of the Plan as at 30 June, including the location and extent of areas that are permanently or temporarily inundated to store or dispose of water, the boundary of the Area of Operations, the major supply and drainage channels and the major watercourses located within and adjacent to the Area of Operations.

The Combined Approval 40CA401473 and the Groundwater Work Approvals 40CA403808 and 40WA404593 include three water extraction works, namely: Coleambally Main Canal Off-take, Col Bore and Hort Bore.

The CICL Monitoring and Reporting Plan also includes four drainage discharge points; Coleambally Catchment Drain (CCD), Drainage Canal DC800 (DC800A), Coleambally Outfall Drain A (CODA) and Coleambally Outfall Drain D (CODD).

Figure 6.2 illustrates the location of all authorised water supply works and discharge monitoring sites as well as the location of the Kerarbury Channel Off-take Regulator, which supplies water to the benefited lands of the Kerarbury Irrigation Area. This map also includes the location and extent of the Coleambally Main Canal Off-stream Storage, the boundary of the Area of Operations, the channel and drainage network and the location of adjacent watercourses.

A total of 737 piezometers are located across the Area of Operations to monitor groundwater conditions in the shallow Shepparton Formation aquifer. The distribution of piezometers across the Area of Operations is shown in Figure 6.3.

*Figure 6.2: CICL Works Plan*

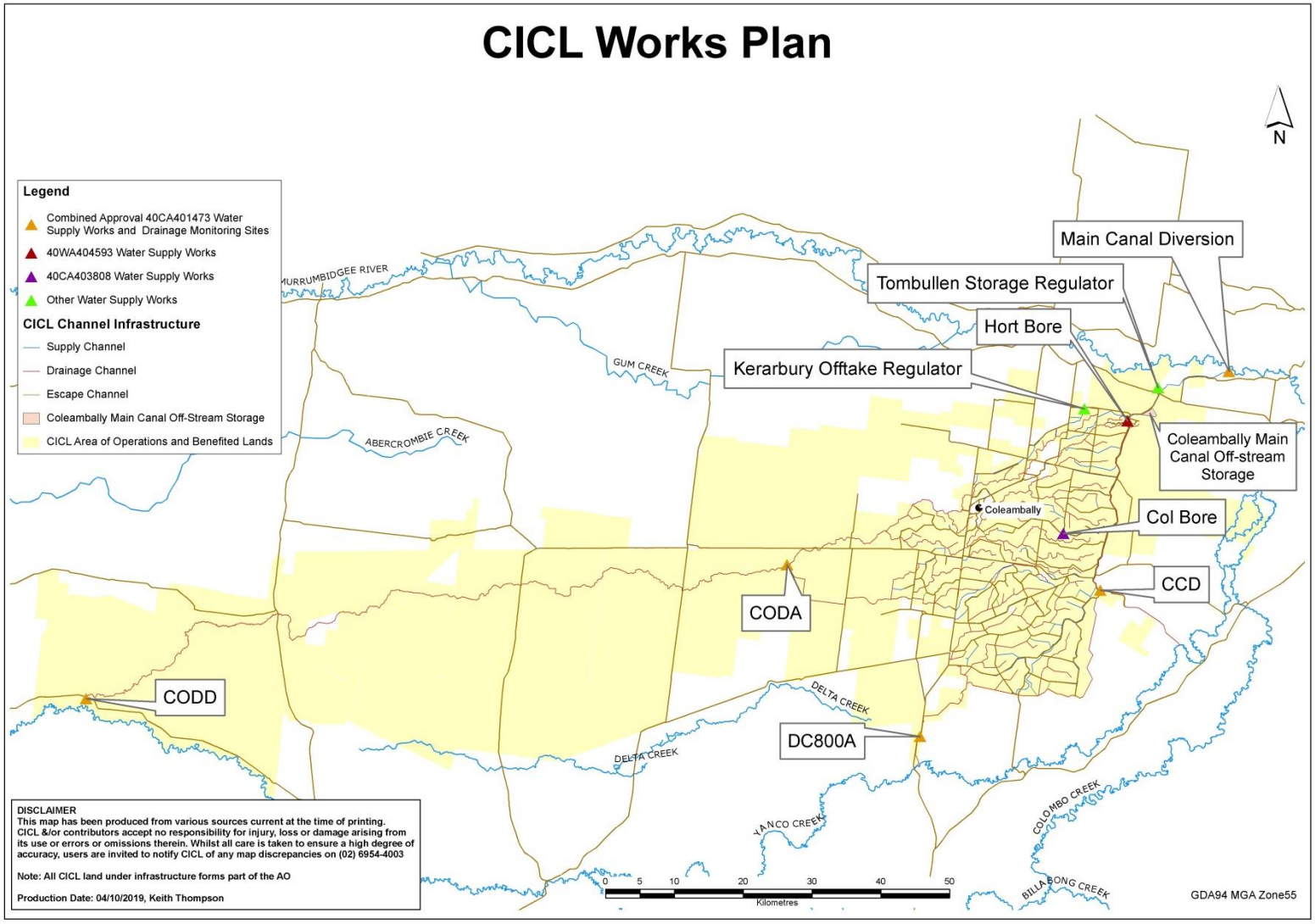
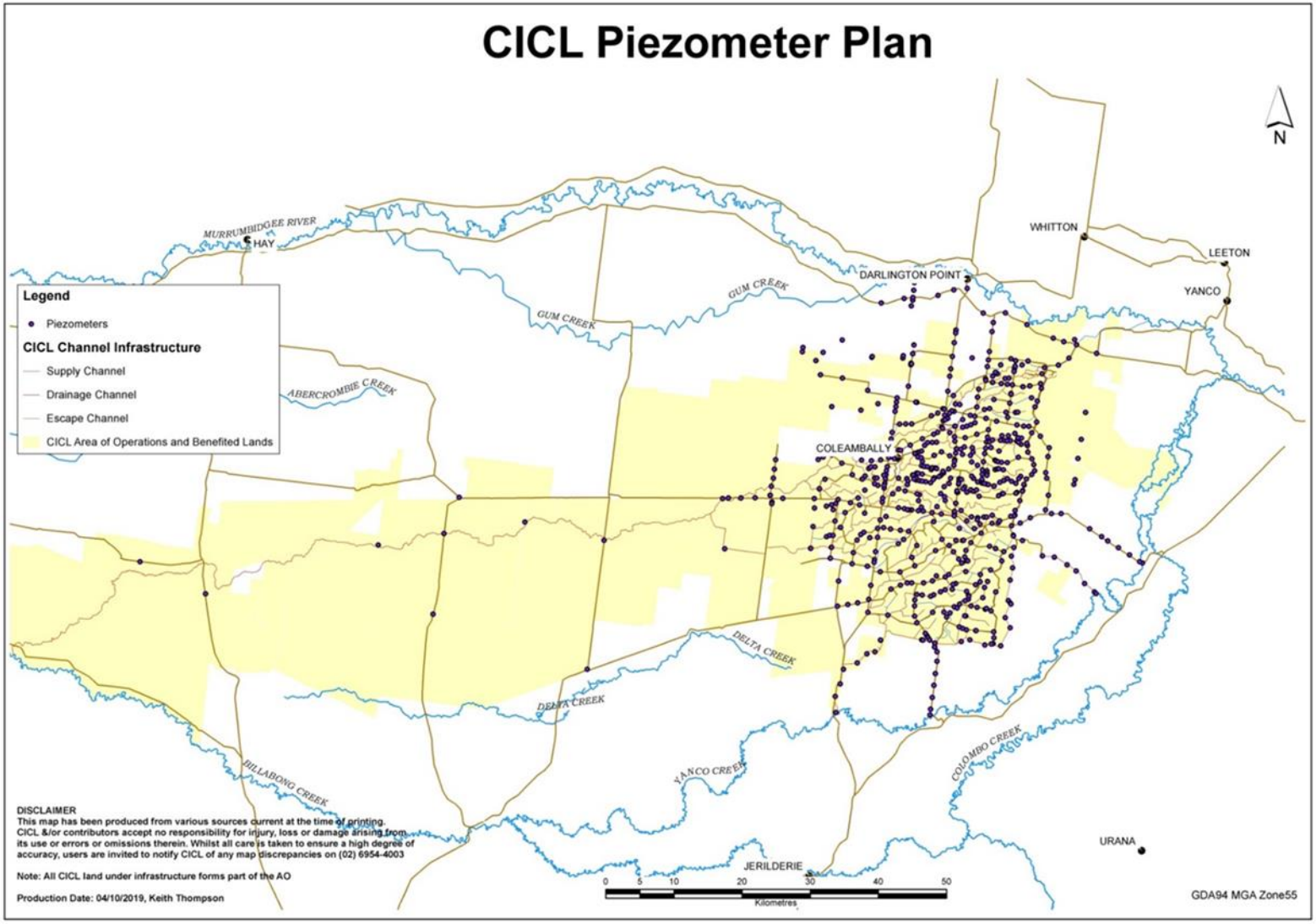


*Figure 6.3: CICL Piezometer Plan*

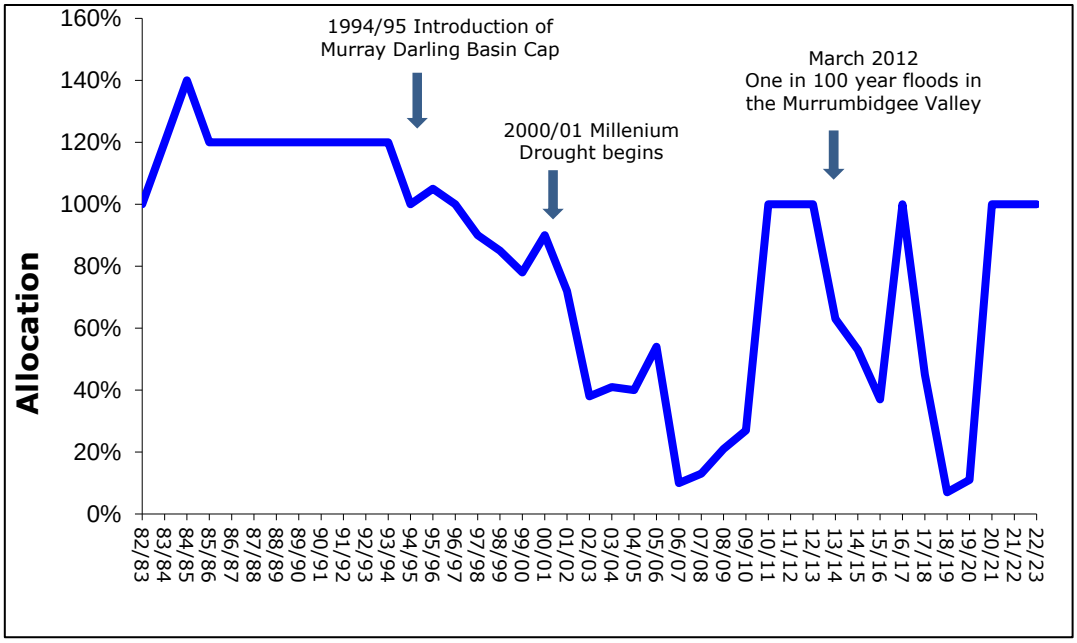


## 7.1 Water Allocation

The following section is provided to satisfy condition 2.5 of the CICL Monitoring and Reporting Plan, which requires commentary on the trends evident from the discharge, groundwater, extraction and water use monitoring data in the context of climate and water allocation conditions.

The 2022/23 irrigation season saw a closing allocation of 100% for the third consecutive season. The season's starting general security water allocation was 35%. The prior season's opening allocation was 30%. The final allocation for the year of 100%, announced in mid January, compared to 100% announced in early November in the previous year.

*Figure 7.1: Annual general security allocations in the Murrumbidgee Valley since 1982/83*



## 7.2 Surface and Groundwater Extraction

The following section is provided to satisfy condition 2.10 of the CICL Monitoring and Reporting Plan, which requires reconciled monthly water volumes in megalitres extracted under licences held by CICL or any other licences nominating CICL authorised water supply works and deliveries to customers. The data presented below reflects the reconciled volumes and may not reflect time of extraction.

*Table 7.1: 2022/23 Reconciled monthly water volumes (ML) taken through Water Supply Works against Water Access Licences*

| **Surface Water Licences (Works Approval 40CA401473)** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Total (ML)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Security Access Licence **40AL401469** | 0 | 0 | 0 | 0 | 2,005 | 0 | 101 | 0 | 0 | 0 | 0 | 0 | 2,106 |
| High Security Access Licence **40AL417488** | 0 | 0 | 0 | 2,009 | 1,402 | 2,592 | 316 | 0 | 0 | 0 | 0 | 0 | 6,319 |
| General Security Access Licence **40AL401471** | 0 | 9,313 | 2,385 | 0 | 0 | 0 | 0 | 42,312 | 42,708 | 7,170 | 19,806 | 0 | 123,694 |
| General Security Access Licence **40AL405267** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| High Security Access Licence **40AL401470** | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| High Security S & T Access Licence **40AL418050** | 0 | 0 | 0 | 0 | 3,269 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,269 |
| Conveyance Access Licence **40AL402990** | 0 | 0 | 0 | 0 | 0 | 36,099 | 57,288 | 13,978 | 0 | 0 | 0 | 0 | 107,365 |
| Supplementary Access Licence **40AL402991** | 0 | 1,000 | 4,000 | 1,000 | 1,000 | 3,000 | 0 | 0 | 0 | 0 | 0 | 0 | 10,000 |
| **Total** | 0 | 10,313 | 6,385 | 3,009 | 7,746 | 41,691 | 57,705 | 56,290 | 42,708 | 7,170 | 19,806 | 0 | **252,823** |
| **Aquifer Access Licence 40AL403806** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Total (ML)** |
| Col Bore (Works Approval **40CA403808**) | 0 | 0 | 0 | 0 | 0 | 0 | 156 | 0 | 0 | 0 | 0 | 375 | 531 |
| Hort Bore (Works Approval **40WA404593**) | 11 | 0 | 0 | 0 | 0 | 0 | 142 | 0 | 0 | 0 | 0 | 2 | 155 |
| **Total** | 11 | 0 | 0 | 0 | 0 | 0 | 298 | 0 | 0 | 0 | 0 | 377 | 686 |
| **Authorised Credits** | | | | | | | | | | | | | 287 |
| **Environmental/River Operational** | 0 | 0 | 521 | 0 | 0 | 8,437 | 11,953 | 11,284 | 12,151 | 4,943 | 12,482 | 0 | **61,771** |
| **Combined Total** | 11 | 10,313 | 6,906 | 3,009 | 7,746 | 50,128 | 69,956 | 67,574 | 54,859 | 12,113 | 32,289 | 377 | **315,567** |

*Note: Monthly water volumes for surface water licences are reported in calendar month and aquifer access licence monthly volumes are reported in mid-month.*

Tables 7.2 to 7.4 are provided to satisfy condition 2.5 of the CICL Monitoring and Reporting Plan, which requires discussion of the trends evident from extraction data in the context of comparable data for at least the two previous years and a year at least five years prior.

For all three extraction points 2022/23 data is compared with the previous two seasons' data and with the 2016/17 season. Table 7.2 shows monthly reconciled volumes at the Coleambally Main Canal Off-take and may not reflect time of extraction.

*Table 7.2: Reconciled monthly water volumes (ML) extracted at Main Canal Off-take (calendar month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 0 | 0 | 0 | 0 |
| August | 10,313 | 31,822 | 28,362 | 1,658 |
| September | 6,906 | 12,904 | 27,429 | 10,384 |
| October | 3,009 | 31,930 | 25,571 | 17,485 |
| November | 7,746 | 10,159 | 49,860 | 51,219 |
| December | 50,128 | 61,470 | 60,112 | 72,930 |
| January | 69,658 | 51,466 | 62,369 | 92,801 |
| February | 67,574 | 62,536 | 44,015 | 74,156 |
| March | 54,859 | 36,551 | 42,353 | 61,006 |
| April | 12,113 | 14,979 | 15,084 | 23,496 |
| May | 32,288 | 11,118 | 13,974 | 12,608 |
| June | 0 | 0 | 0 | 0 |
| **Total** | **314,594** | **324,935** | **369,129** | **417,743** |

Tables 7.3 and 7.4 show monthly extractions from both Col Bore and Hort Bore. The Hort Bore is primarily used to supply high security water on demand outside of the normal CICL irrigation supply period.

The Col Bore was constructed by a qualified driller, as indicated by the construction log and in accordance with conditions (MW7040-00001) as confirmed during the *NRAR Compliance Audit and Inspection: Col Bore and Hort Bore* undertaken July 2020. During the reporting period the Col Bore maintained compliance under the NSW Non-Urban Water Metering Policy.

The Hort Bore was constructed in accordance with conditions (MW7040-00001) as confirmed during the *NRAR Compliance Audit and Inspection: Col Bore and Hort Bore* undertaken July 2020. During the reporting period the Hort Bore maintained compliance under the NSW Non-Urban Water Metering Policy.

Due to the difference between WaterNSW and CICL's timing of reading the meters, the data presented below reflects the reconciled volumes and may not reflect time of extraction.

Groundwater bore usage is largely influenced by the value of temporary surface water relative to pumping costs. Consequently overall extractions from our groundwater bores is lower compared to 2021/22.

*Table 7.3: Reconciled monthly volumes (ML) extracted at Col Bore (mid-month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 0 | 0 | 0 | 0 |
| August | 0 | 0 | 0 | 0 |
| September | 0 | 0 | 0 | 0 |
| October | 0 | 0 | 0 | 0 |
| November | 0 | 0 | 30 | 340 |
| December | 0 | 0 | 437 | 425 |
| January | 156 | 148 | 83 | 626 |
| February | 0 | 378 | 251 | 626 |
| March | 0 | 271 | 10 | 448 |
| April | 0 | 0 | 0 | 250 |
| May | 0 | 0 | 0 | 0 |
| June | 375 | 0 | 0 | 0 |
| **Total** | **531** | **797** | **811** | **2,715** |

*Table 7.4: Reconciled monthly volumes (ML) extracted at Hort Bore (mid-month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 11 | 0 | 0 | 0 |
| August | 0 | 8 | 2 | 0 |
| September | 0 | 3 | 3 | 0 |
| October | 0 | 0 | 44 | 0 |
| November | 0 | 0 | 88 | 0 |
| December | 0 | 5 | 57 | 0 |
| January | 142 | 0 | 37 | 326 |
| February | 0 | 0 | 276 | 325 |
| March | 0 | 0 | 102 | 288 |
| April | 0 | 0 | 0 | 322 |
| May | 0 | 0 | 0 | 478 |
| June | 2 | 4 | 11 | 54 |
| **Total** | **155** | **20** | **620** | **1,793** |

## 7.3 Estimated Annual Evaporation and Rainfall

The following section is provided to satisfy condition 2.13 a) and b) of the CICL Monitoring and Reporting Plan, which requires estimated annual volumes for rainfall and evapo-transpiration.

CICL records both rainfall and evaporation at the CICL Depot. Table 7.5 shows annual rainfall and evaporation was recorded as 683.8 mm and 1,393.4 mm respectively, this represents 170% and 81% of the long-term average (LTA).

*Table 7.5: Rainfall and evaporation recorded at CICL Depot weather station in 2022/23 (calendar month)*

| Month | Rainfall (mm) | LTA Rainfall (mm) | Evaporation (mm) | LTA Evaporation (mm) |
|---|---|---|---|---|
| July | 9.5 | 32.3 | 39.5 | 38.8 |
| August | 51.8 | 34.4 | 47.8 | 64.2 |
| September | 62.3 | 33.4 | 67.7 | 100.9 |
| October | 236.6 | 40.4 | 103.4 | 162.4 |
| November | 108.6 | 32.9 | 142.9 | 209.4 |
| December | 31.2 | 31.1 | 214.6 | 260.4 |
| January | 33.0 | 34.6 | 214.9 | 272.7 |
| February | 0.0 | 28.0 | 223.0 | 224.5 |
| March | 35.0 | 30.3 | 163.0 | 183.4 |
| April | 51.2 | 31.8 | 84.7 | 110.6 |
| May | 10.8 | 34.7 | 52.7 | 62.9 |
| June | 53.8 | 37.5 | 39.2 | 37.6 |
| **Total** | **683.8** | **401.4** | **1,393.4** | **1,727.8** |

## 7.4 Water Discharge

The following section is provided to satisfy condition 2.11 of the CICL Monitoring and Reporting Plan, which requires a report on the monthly water volumes in megalitres from discharge monitoring sites. This section is also provided to satisfy condition 2.5 which requires a discussion of the trends evident from discharge monitoring sites from at least the two previous years and a year at least five years prior.

Tables 7.6 to 7.9 show monthly average drainage flows at four discharge monitoring points. For all four discharge monitoring points 2022/23 data is compared with the previous two seasons' data and with the 2016/17 season.

The licenced discharge monitoring points have WaterNSW gauge sites present. However the flow data obtained from the sites is generally not considered to be accurate. In addition to backwater impacts from downstream creek levels, weed growth and backwater from downstream structures may impact the accuracy of the stage-discharge rating curves particularly at CODA (410110), CCD (410191) and CODD (410133). Where CICL possesses accurate flow data from adjacent CICL FlumeGate regulators this data may be used to substitute the WaterNSW data.

Table 7.10 shows the monthly total volume of water supplied through the Boona and Argoon escapes which supply planned releases of water through CODA and CODWonga. This table is provided to satisfy condition M2.5 of EPL 4652, which requires samples of irrigation wastewater for the months specified under condition M2.3 except when water discharged through the drainage system is comprised entirely of supply water.

Table 7.11 shows the monthly total volume of water released without credit, released from drains and released to customers to satisfy condition 2.11 of the CICL Monitoring and Reporting Plan.

*Table 7.6: Monthly flow volumes (ML) at CCD FlumeGate escape on the Coleambally Catchment Drain (substituted for CCD (410191)) (calendar month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 0 | 0 | 0 | 0 |
| August | 0 | 49 | 0 | 0 |
| September | 0 | 64 | 1,959 | 100 |
| October | 1,264 | 83 | 2,161 | 419 |
| November | 799 | 30 | 1,677 | 0 |
| December | 0 | 2,859 | 4,554 | 2,433 |
| January | 0 | 4,992 | 1,439 | 2,852 |
| February | 954 | 5,829 | 1,638 | 4,155 |
| March | 3,936 | 626 | 2,522 | 7,564 |
| April | 91 | 852 | 1,592 | 784 |
| May | 5,695 | 85 | 1,889 | 699 |
| June | 0 | 964 | 0 | 70 |
| **Total** | **12,739** | **16,433** | **19,431** | **19,076** |
| **Average** | **1,062** | **1,369** | **1,619** | **1,590** |
| **Median** | **46** | **356** | **1,658** | **559** |

*Note: The Coleambally Catchment Drain is used to deliver water into Yanco Creek for WaterNSW. The CCD FlumeGate escape only records flows exiting the CICL supply system and may not reflect total flow volumes through the Coleambally Catchment Drain. Please refer to section 10.1 for more information.*

*Table 7.7: Monthly flow volumes (ML) at DC800A (410108) on the Drainage Channel DC800 (calendar month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 1 | 94 | 28 | 295 |
| August | 19 | 149 | 694 | 102 |
| September | 406 | 757 | 1,099 | 365 |
| October | 4,743 | 434 | 657 | 23 |
| November | 2,972 | 2,405 | 893 | 211 |
| December | 1,661 | 2,152 | 2,850 | 621 |
| January | 2,152 | 3,792 | 2,432 | 233 |
| February | 2,368 | 4,269 | 1,215 | 897 |
| March | 2,106 | 1,626 | 2,250 | 2,589 |
| April | 1,483 | 2,214 | 567 | 909 |
| May | 629 | 222 | 140 | 355 |
| June | 1,222 | 1,579 | 687 | 1,269 |
| **Total** | **19,762** | **19,693** | **13,512** | **7,869** |
| **Average** | **1,647** | **1,641** | **1,126** | **656** |
| **Median** | **1,572** | **1,603** | **794** | **360** |

*Note: DC800 is also used to deliver water into Yanco Creek for WaterNSW.*

*Table 7.8: Monthly flow volumes (ML) at CODWonga FlumeGate on the Coleambally Outfall Drain (substituted for CODA (410110)) (calendar month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 0 | 41 | 32 | 694 |
| August | 562 | 872 | 184 | 254 |
| September | 1,268 | 802 | 542 | 1,995 |
| October | 19,566 | 203 | 0 | 2,102 |
| November | 7,884 | 2,580 | 1,288 | 1,133 |
| December | 4,649 | 2,734 | 2,052 | 49 |
| January | 6,824 | 2,310 | 0 | 1,104 |
| February | 4,876 | 1,742 | 2,829 | 1,941 |
| March | 2,450 | 3,442 | 3,824 | 4,406 |
| April | 2,313 | 1,082 | 1,342 | 2,216 |
| May | 1,880 | 22 | 323 | 1,333 |
| June | 1,747 | 2,273 | 642 | 2,565 |
| **Total** | **54,019** | **18,103** | **13,058** | **19,792** |
| **Average** | **4,502** | **1,509** | **1,088** | **1,649** |
| **Median** | **2,382** | **1,412** | **592** | **1,637** |

*Note: The Coleambally Outfall Drain is also used to supply customers with water.*

*Table 7.9: Monthly flow volumes (ML) at CODD (410133) on the Coleambally Outfall Drain (calendar month)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 0 | 19 | 0 | 71 |
| August | 0 | 0 | 0 | 56 |
| September | 0 | 0 | 0 | 490 |
| October | 13,270 | 0 | 0 | 1,194 |
| November | 70,336 | 0 | 0 | 89 |
| December | 69,525 | 22 | 72 | 130 |
| January | 609 | 75 | 2 | 58 |
| February | 777 | 0 | 0 | 64 |
| March | 291 | 11 | 112 | 6 |
| April | 524 | 0 | 0 | 167 |
| May | 222 | 0 | 0 | 45 |
| June | 700 | 0 | 74 | 20 |
| **Total** | **156,254** | **127** | **260** | **2,390** |
| **Average** | **13,021** | **11** | **22** | **199** |
| **Median** | **567** | **0** | **0** | **68** |

*Note: Monthly flow volumes at CODD have historically been substituted with data from an adjacent FlumeGate escape (CODOaklands). Due to significant flooding the FlumeGate escape was inoperable for the 2022/23 season. Please refer to section 10.1 for more information.*

*Table 7.10: 2022/23 Monthly flow volumes (ML) at Boona and Argoon FlumeGate escapes*

| Month | Boona FlumeGate Escape | Argoon FlumeGate Escape |
|---|---|---|
| July | 0 | 0 |
| August | 0 | 610 |
| September | 168 | 1,103 |
| October | 195 | 420 |
| November | 72 | 431 |
| December | 177 | 488 |
| January | 0 | 868 |
| February | 0 | 860 |
| March | 0 | 1,029 |
| April | 6 | 88 |
| May | 0 | 1,226 |
| June | 172 | 541 |
| **Total** | **790** | **7,664** |

*Table 7.11: 2022/23 Monthly flow volumes (ML) released without credit, released from drains and released to customers*

| Month | Released without credit from escapes (calendar month) | Discharged for environmental or river operational purposes (calendar month) | Delivered to CICL Customers (mid-month) |
|---|---|---|---|
| July | 0 | 0 | 0 |
| August | 5 | 0 | 249 |
| September | 117 | 521 | 6,963 |
| October | 1,895 | 0 | 2,231 |
| November | 1,441 | 0 | 862 |
| December | 40 | 8,437 | 20,437 |
| January | 66 | 11,953 | 48,259 |
| February | 4 | 11,284 | 54,541 |
| March | 0 | 12,151 | 55,891 |
| April | 122 | 4,943 | 22,308 |
| May | 5 | 12,483 | 10,880 |
| June | 1,375 | 0 | 18,175 |
| **Total** | **5,070** | **61,772** | **240,796** |

## 7.5 Distribution of Irrigation Intensity

The following section is provided to satisfy condition 2.13 i) of the CICL Monitoring and Reporting Plan, which requires a report on the distribution of irrigation intensity in at least three intensity ranges for the main supply sub-divisions.

The irrigation intensity for the main supply sub-divisions is represented in Table 7.12.

The Coleambally Irrigation Area consists of all farms with access to the CICL drainage network and is comprised of farmland that has historically been the most intensively irrigated farmland within the Area of Operations.

The West Coleambally Water Management Area is comprised of landholdings that have access to the supply network from the Coleambally Outfall Drain and has historically been the least intensively irrigated farmland within the Area of Operations.

Coleambally External refers to those landholders that are situated adjacent to the Coleambally Irrigation Area but do not have access to the CICL drainage network.

*Table 7.12: 2022/23 Regional distribution of irrigation intensity (ML/ha)*

| Region | Use (ML) | Area (ha) | Intensity (ML/ha) | % of use |
|---|---|---|---|---|
| Coleambally Irrigation Area | 186,531 | 79,495 | >1ML | 77 |
| West Coleambally Water Management Area | 8,517 | 313,578 | <0.1ML | 4 |
| Coleambally External | 45,748 | 71,129 | >0.1ML<1ML | 19 |
| **Total** | **240,796** | **464,202** | | |

## 7.6 Crop Water Use

The following section is provided to satisfy conditions 2.5 and 2.13 c) through to h) of the CICL Monitoring and Reporting Plan, which requires discussion of the trends evident in the estimated annual water deliveries for rice, horticulture, other summer crops, winter crops, domestic and stock uses, and their estimated annual crop area.

Table 7.13 shows the estimated annual values for water deliveries for crop types, with the applicable areas for the water uses estimated from locally relevant crop water use factors.

*Table 7.13: 2022/23 Crop area, total crop use*

| Crop | Area (Ha) | Total ML |
|---|---|---|
| Rice | 4,878 | 62,626 |
| Horticulture | 1,556 | 5,394 |
| Other Summer Crops (including pasture) | 21,340 | 130,325 |
| Winter Crops | 20,297 | 28,405 |
| Stock and Garden | | 8,258 |
| Undefined | | 5,788 |
| **Total** | **48,071** | **240,796** |

The crop area data is supplied by CICL's customers at the beginning of the irrigation season and is independently verified by various means, however, the data serves only as an approximation of the area irrigated.

The irrigated crop area within the Coleambally Area of Operations for the 2022/23 season decreased by approximately 17% over the previous season. Flooding and high rainfall from September through to November impacted the ability of our customers to sow summer crops. Water use intensity for both summer and winter crops was higher than the previous season, with low temporary water price and below average rainfall in January and February contributing to high water use.

Table 7.14 on the following page indicates the change in area of seven major crops in the Coleambally Irrigation Area over the last 25 years.

*Table 7.14: Crop areas and relative water usage over time*

| Season | Rice | | Corn/Maize | | Soybeans | | Cotton | | Wheat | | Pasture | | Canola | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Area (ha) | Proportion of delivery (%) | Total (%) |
| 2022/23 | 4,878 | 20.70 | 4,024 | 10.11 | 350 | 1.26 | 10,614 | 24.40 | 11,646 | 5.38 | 4,838 | 4.90 | 6,319 | 2.94 | 69.7 |
| 2021/22 | 4,643 | 23.5 | 4,583 | 10.3 | 153 | 0.4 | 13,298 | 31.8 | 16,275 | 10.9 | 5,485 | 3.8 | 5,425 | 3.9 | 84.6 |
| 2020/21 | 4,944 | 31.0 | 4,654 | 13.9 | 380 | 0.9 | 6,269 | 18.9 | 16,875 | 13.9 | 5,269 | 5.2 | 3,064 | 2.5 | 86.3 |
| 2019/20 | 320 | 3.4 | 856 | 9.2 | 0 | 0 | 934 | 10.0 | 2,147 | 23.0 | 2,285 | 24.4 | 566 | 6.1 | 76.1 |
| 2018/19 | 236 | 3.2 | 2,252 | 24.1 | 0 | 0 | 3,641 | 39.8 | 7,541 | 11.0 | 3,945 | 9.1 | 1,115 | 2.2 | 89.4 |
| 2017/18 | 6,869 | 35.0 | 4,442 | 14.0 | 2,393 | 1.0 | 5,796 | 21.0 | 6,387 | 6.0 | 3,921 | 5.0 | 2,323 | 2.0 | 88.0 |
| 2016/17 | 11,484 | 53.6 | 5,105 | 13.5 | 892 | 1.9 | 6,623 | 17.9 | 8,462 | 3.5 | 10,679 | 4.1 | 1,512 | 1.2 | 95.7 |
| 2015/16 | 3,603 | 34.6 | 8,462 | 13.5 | 1,883 | 3.0 | 5,105 | 20.6 | 11,484 | 14.8 | 6,623 | 7.0 | 892 | 0.1 | 94.0 |
| 2014/15 | 9,103 | 44.0 | 6,757 | 13.0 | 1,666 | 2.0 | 2,602 | 7.0 | 14,226 | 18.0 | 4,737 | 4.0 | 1,716 | 1.0 | 91.0 |
| 2013/14 | 12,500 | 43.6 | 4,358 | 8.4 | 1,734 | 2.4 | 5,587 | 6.9 | 15,071 | 9.8 | 5,264 | 2.8 | 2,540 | 1.5 | 75.4 |
| 2012/13 | 19,071 | 52.7 | 4,872 | 7.7 | 2,583 | 3.9 | 2,089 | 3.0 | 13,698 | 7.2 | 6,545 | 3.6 | 4,182 | 1.3 | 79.4 |
| 2011/12 | 16,745 | 62.1 | 4,767 | 8.2 | 2,238 | 2.7 | 5,280 | 7.9 | 15,989 | 8.7 | 7,472 | 4.0 | 5,244 | 1.6 | 91.2 |
| 2010/11 | 14,512 | 68.3 | 4,367 | 7.2 | 1,240 | 1.5 | 885 | 1.4 | 11,334 | 5.1 | 8,119 | 4.2 | 3,381 | 1.5 | 89.2 |
| 2009/10 | 3,668 | 46.0 | 311 | 2.0 | 495 | 1.0 | 0 | 0 | 10,635 | 10.0 | 6,903 | 12.0 | 2,523 | 2.0 | 73.0 |
| 2008/09 | 2,135 | 33.1 | 2,472 | 3.4 | 308 | 1.4 | 0 | 0 | 4,215 | 9.5 | 4,481 | 16.3 | 1,471 | 4.9 | 68.7 |
| 2007/08 | 90 | 1.4 | 941 | 1.2 | 152 | 0.7 | 0 | 0 | 6,575 | 20.0 | 5,004 | 20.0 | 1,584 | 6.1 | 49.4 |
| 2006/07 | 8,518 | 54.3 | 1,863 | 7.6 | 478 | 0.8 | 0 | 0 | 12,509 | 15.9 | 9,958 | 7.8 | 1,602 | 1.0 | 87.4 |
| 2005/06 | 18,025 | 62.8 | 3,306 | 7.0 | 2,106 | 2.9 | 0 | 0 | 13,610 | 8.4 | 15,440 | 8.7 | 1,748 | 0.9 | 90.6 |
| 2004/05 | 8,142 | 44.0 | 3,671 | 7.2 | 1,495 | 2.2 | 0 | 0 | 20,287 | 18.8 | 12,865 | 10.8 | 2,681 | 1.3 | 84.3 |
| 2003/04 | 12,597 | 55.8 | 3,545 | 5.7 | 1,938 | 3.5 | 0 | 0 | 21,192 | 15.0 | 12,131 | 7.5 | 1,763 | 0.7 | 88.0 |
| 2002/03 | 11,395 | 46.0 | 4,788 | 9.3 | 1,788 | 1.0 | 0 | 0 | 21,346 | 20.4 | 10,183 | 7.4 | 2,095 | 1.7 | 85.8 |
| 2001/02 | 27,493 | 67.5 | 3,808 | 4.2 | 3,297 | 3.4 | 0 | 0 | 21,103 | 9.2 | 11,581 | 6.1 | 2,191 | 0.6 | 91.0 |
| 2000/01 | 30,440 | 73.9 | 4,074 | 5.7 | 4,551 | 5.9 | 0 | 0 | 14,276 | 4.6 | 11,998 | 4.7 | 2,153 | 0.4 | 95.2 |
| 1999/00 | 24,138 | 77.7 | 1,178 | 3.1 | 2,185 | 3.9 | 0 | 0 | 12,649 | 6.1 | 7,485 | 4.4 | 2,152 | 0.7 | 95.9 |
| 1998/99 | 24,491 | 73.8 | 1,059 | 1.3 | 4,339 | 5.7 | 0 | 0 | 13,963 | 1.7 | 13,879 | 8.1 | 2,184 | 1.7 | 92.3 |

## 7.7 Water Balance for the Area of Operations

The following section is provided to satisfy condition 2.12 of the CICL Monitoring and Reporting Plan, which requires an annual water balance estimate for the supply system taking into account deliveries, net channel losses and changes in the volume of water held in offline storages. This section is also provided to satisfy condition R4.3 (a) of the Environment Protection Licence, which requires the volume of all inflows of water to the premises, the volume of all surface water discharges from the premises and an estimate of all accessions of water to groundwater in or outside of the premises.

Table 7.15 indicates the estimated annual volumes of net channel losses, including evaporation, rainfall and seepage for the 2022/23 irrigation season.

*Table 7.15: 2022/23 Annual water balance for each water supply work*

| Source | Volume (ML) |
|---|---|
| River | 314,881 |
| Groundwater | 686 |
| **Total Extractions** | **315,567** |
| Customers | 240,796 |
| River Operational & Environmental | 61,771 |
| **Total Deliveries** | **302,567** |
| Evaporation | 6,109 |
| Seepage | 9,048 |
| Rainfall | -8,162 |
| Discharged without credit | 5,070 |
| Offline storage loss | 935 |
| Change in storage volume | 0 |
| **Total Losses** | **13,000** |

Sections 8.1 and 8.2 are provided to comply with condition 2.5 of the CICL Monitoring and Reporting Plan, which requires a discussion of the trends evident from the salinity monitoring data for at least the two previous years and a year at least five years prior.

## 8.1 Extraction Salinity

Salinity data was omitted from all sites during periods where no flow was detected. Where flow was present with no salinity reported the monthly average was used.

The monthly average salinity readings for the Main Canal Off-take were generally higher in the 2022/23 season compared to the previous season, possibly due to the effect of widespread flooding in the Murrumbidgee River upstream of the Main Canal Off-take. The data in Tables 8.2 to 8.3 illustrates that monthly average salinity in the last two seasons at the Col Bore and Hort Bore has remained stable.

*Table 8.1: Monthly average salinity (µS/cm) at Main Canal Off-take*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | No Flow | No Flow | No Flow | 187 |
| August | 150 | 136 | 227 | 207 |
| September | 177 | 156 | 176 | 200 |
| October | 169 | 155 | 162 | 218 |
| November | 161 | 141 | 156 | 203 |
| December | 161 | 155 | 95 | 200 |
| January | 111 | 135 | 90 | 153 |
| February | 122 | 135 | 144 | 119 |
| March | 133 | 121 | 128 | 119 |
| April | 277 | 154 | 214 | 149 |
| May | 286 | 155 | 138 | 156 |
| June | No Flow | No Flow | No Flow | 192 |
| **Average** | **175** | **144** | **153** | **175** |
| **Median** | **161** | **148** | **150** | **190** |

*Table 8.2: Monthly average salinity (µS/cm) at Col Bore*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | No Flow | No Flow | No Flow | No Flow |
| August | No Flow | No Flow | No Flow | No Flow |
| September | No Flow | No Flow | No Flow | No Flow |
| October | No Flow | No Flow | No Flow | No Flow |
| November | No Flow | No Flow | 760 | 610 |
| December | No Flow | No Flow | 760 | 610 |
| January | 763 | 763 | 760 | 610 |
| February | No Flow | 763 | 767 | 610 |
| March | No Flow | 763 | 767 | 610 |
| April | No Flow | No Flow | No Flow | 610 |
| May | No Flow | No Flow | No Flow | No Flow |
| June | 763 | No Flow | No Flow | No Flow |
| **Average** | **763** | **763** | **763** | **610** |
| **Median** | **763** | **763** | **760** | **610** |

*Table 8.3: Monthly average salinity (µS/cm) at Hort Bore*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 195 | No Flow | No Flow | No Flow |
| August | No Flow | 195 | 189 | No Flow |
| September | No Flow | 195 | 189 | No Flow |
| October | No Flow | No Flow | 189 | No Flow |
| November | No Flow | No Flow | 199 | No Flow |
| December | No Flow | 195 | 194 | No Flow |
| January | 195 | No Flow | 199 | 280 |
| February | No Flow | No Flow | 198 | 280 |
| March | No Flow | No Flow | 198 | 280 |
| April | No Flow | No Flow | No Flow | 280 |
| May | No Flow | No Flow | No Flow | 280 |
| June | 195 | 195 | 198 | 280 |
| **Average** | **195** | **195** | **195** | **280** |
| **Median** | **195** | **195** | **198** | **280** |

## 8.2 Discharge Salinity

Salinity data was omitted from all sites during periods where no flow was detected. Where flow was present with no salinity reported, the monthly average was used.

Tables 8.4 to 8.7 show monthly average salinity readings at four discharge monitoring points. Electrical Conductivity (EC) data is provided from WaterNSW gauging stations. However, to obtain more accurate readings, data without flow from a metered site are omitted and likewise metered flows without salinity are given monthly corrected average EC. In these Tables, 2022/23 data is compared with data from the previous two seasons and with the 2016/17 season.

The monthly average salinity in the 2022/23 season at the discharge monitoring points has generally increased compared to previous seasons. Of note is the monthly average salinity at CCD, which is significantly higher than all previous seasons between February and June. This may be attributed to the seasonal effects of flood water exiting the system through the CCD drain, or the backflow effects of the Yanco creek on the WaterNSW meter.

*Table 8.4: Monthly average salinity at Discharge Point CCD (410191) on the Coleambally Catchment Drain (µS/cm)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | No Flow | No Flow | No Flow | No Flow |
| August | No Flow | 152 | No Flow | No Flow |
| September | No Flow | 134 | 269 | 260 |
| October | 153 | 148 | 222 | 333 |
| November | 187 | 16 | 236 | 371 |
| December | No Flow | 242 | 125 | 214 |
| January | No Flow | 244 | 167 | 328 |
| February | 553 | 151 | 154 | 166 |
| March | 680 | 138 | 131 | 133 |
| April | 455 | 161 | 274 | 231 |
| May | 445 | 174 | 132 | 197 |
| June | No Flow | 149 | No Flow | 305 |
| **Average** | **412** | **155** | **190** | **254** |
| **Median** | **450** | **151** | **167** | **246** |

*Table 8.5: Monthly average salinity at Discharge Point DC800A (410108) on the Drainage Channel DC800 (µS/cm)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | 198 | 266 | 121 | 228 |
| August | 545 | 280 | 196 | 243 |
| September | 220 | 300 | 239 | 214 |
| October | 180 | 323 | 253 | 247 |
| November | 198 | 296 | 303 | 351 |
| December | 297 | 246 | 238 | 345 |
| January | 229 | 163 | 238 | 332 |
| February | 191 | 160 | 239 | 252 |
| March | 175 | 169 | 197 | 178 |
| April | 202 | 169 | 227 | 228 |
| May | 313 | 180 | 369 | 258 |
| June | 289 | 163 | 265 | 261 |
| **Average** | **253** | **226** | **240** | **261** |
| **Median** | **211** | **213** | **239** | **249** |

*Table 8.6: Monthly average salinity at Discharge Point CODA (410110) on the Coleambally Outfall Drain (µS/cm)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | No Flow | 128 | 196 | 445 |
| August | 110 | 128 | 223 | 475 |
| September | 114 | 176 | 158 | 327 |
| October | 273 | 244 | No Flow | 246 |
| November | 381 | 153 | 213 | 246 |
| December | 500 | 211 | 325 | 240 |
| January | 353 | 360 | No Flow | 198 |
| February | 241 | 284 | 506 | 152 |
| March | 271 | 331 | 541 | 269 |
| April | 287 | 215 | 501 | 238 |
| May | 377 | 203 | 147 | 252 |
| June | 236 | 217 | 87 | 284 |
| **Average** | **286** | **221** | **290** | **281** |
| **Median** | **273** | **213** | **218** | **249** |

*Table 8.7: Monthly average salinity at Discharge Point CODD (410133) on the Coleambally Outfall Drain (µS/cm)*

| Month | 2022/23 | 2021/22 | 2020/21 | 2016/17 |
|---|---|---|---|---|
| July | No Flow | 206 | No Flow | 275 |
| August | No Flow | No Flow | No Flow | 275 |
| September | No Flow | No Flow | No Flow | 275 |
| October | 184 | No Flow | No Flow | 275 |
| November | 230 | No Flow | No Flow | 434 |
| December | 303 | 255 | 157 | 524 |
| January | 515 | 296 | 157 | 502 |
| February | 326 | No Flow | No Flow | 502 |
| March | 299 | 213 | 157 | 502 |
| April | 279 | No Flow | No Flow | 238 |
| May | 310 | No Flow | No Flow | 273 |
| June | 267 | No Flow | 157 | 267 |
| **Average** | **301** | **243** | **157** | **362** |
| **Median** | **299** | **234** | **157** | **275** |

## 8.3 Simple Salt Balance

The following section is provided to satisfy conditions 2.14, 2.15 and 2.16 of the CICL Monitoring and Reporting Plan, which requires a report on the volume, salinity and salt load of extractions and discharges with a simple annual salt balance representing the imported, exported and retained salt load for the area.

The salt load is calculated using a daily average EC and total daily salt load. Where daily salinity was not available the monthly average salinity (µS/cm) was used to calculate salt load.

The following tables depict actual numbers for flow (ML) and computed salt load (tonnes) based on daily readings however the salinity (µS/cm) is displayed as a monthly average.

*Table 8.8: Salinity (µS/cm) and salt load (Tonnes) entering CICL's Area of Operations in 2022/23*

| 2022/23 | Main Canal | | | Col Bore | | | Hort Bore | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | ML | µS/cm | Salt (T) | ML | µS/cm | Salt (T) | ML | µS/cm | Salt (T) |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 195 | 1 |
| August | 10,313 | 150 | 924 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 6,905 | 177 | 779 | 0 | 0 | 0 | 0 | 0 | 0 |
| October | 3,009 | 169 | 328 | 0 | 0 | 0 | 0 | 0 | 0 |
| November | 7,746 | 161 | 796 | 0 | 0 | 0 | 0 | 0 | 0 |
| December | 52,491 | 161 | 5,384 | 0 | 0 | 0 | 0 | 0 | 0 |
| January | 67,296 | 111 | 4,774 | 156 | 763 | 76 | 142 | 195 | 18 |
| February | 67,611 | 122 | 5,300 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 54,963 | 133 | 4,320 | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 12,114 | 277 | 2,217 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 32,433 | 286 | 6,042 | 0 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 375 | 763 | 183 | 2 | 195 | 0 |
| **Sub Total** | **314,881** | | **30,864** | **531** | | **259** | **155** | | **19** |
| **Salt Total** | **31,142** | **ML Total** | **315,567** | | | | | | |

# 8. Salinity and Salt Load



Tombullen is an in-line storage used by WaterNSW to buffer Murrumbidgee downstream demand. It is located off the main canal at the start of CICL's supply system. Whilst it is not a discharge monitoring site under the CICL Monitoring and Reporting Plan it does, however, account for a significant volume of water (and hence, salt) delivered by CICL through our main extraction site each season. For the salt load tables actual volume (ML) and computed total salt (Tonnes) are used, however salinity (µS/cm) is displayed as a monthly average.

*Table 8.9: Salinity (µS/cm) and salt load (Tonnes) exiting Coleambally Irrigation Area in 2022/23*

| 2022/23 | Drainage Canal DC800A | | | Coleambally Outfall Drain A (CODA) | | | Coleambally Catchment Drain (CCD) | | | Tombullen | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **ML** | **µS/cm** | **Salt (T)** | **ML** | **µS/cm** | **Salt (T)** | **ML** | **µS/cm** | **Salt (T)** | **ML** | **µS/cm** | **Salt (T)** |
| July | 1 | 198 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 19 | 545 | 3 | 562 | 110 | 59 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 406 | 221 | 58 | 1,268 | 114 | 175 | 0 | 0 | 0 | 521 | 167 | 56 |
| October | 4,743 | 180 | 491 | 19,566 | 273 | 3,521 | 1,264 | 153 | 124 | 0 | 0 | 0 |
| November | 2,972 | 198 | 312 | 7,884 | 381 | 1,673 | 799 | 187 | 95 | 0 | 0 | 0 |
| December | 1,661 | 297 | 322 | 4,649 | 500 | 1,499 | 0 | 0 | 0 | 8,437 | 166 | 875 |
| January | 2,151 | 229 | 309 | 6,824 | 353 | 1,395 | 0 | 0 | 0 | 11,953 | 110 | 832 |
| February | 2,368 | 191 | 280 | 4,876 | 241 | 742 | 954 | 553 | 346 | 9,822 | 118 | 772 |
| March | 2,106 | 175 | 232 | 2,450 | 271 | 412 | 3,936 | 680 | 1,684 | 7,991 | 135 | 640 |
| April | 1,483 | 202 | 194 | 2,313 | 287 | 398 | 91 | 455 | 26 | 4,865 | 317 | 1,016 |
| May | 629 | 313 | 124 | 1,880 | 377 | 458 | 5,695 | 445 | 1,627 | 6,706 | 328 | 1,452 |
| June | 1,223 | 289 | 242 | 1,747 | 236 | 300 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sub Total** | **19,762** | | **2,567** | **54,019** | | **10,632** | **12,739** | | **3,902** | **50,295** | | **5,643** |
| **Salt Total** | **22,744** | **ML Total** | **136,815** | | | | | | | | | |

The seasonal flow, salinity and salt load for the CODD is displayed separately in Table 8.10 as it is situated directly downstream from the site CODA. Including both sites in the same table would lead to double counting of the salt and flow data.

*Table 8.10: Volume of water exiting CICL's Operational Area at CODD (410133), monthly average salinity (µS/cm) and calculated salt load (Tonnes) in 2022/23*

| 2022/23 | Coleambally Outfall Drain D (CODD) | | |
|---|---|---|---|
| **Month** | **ML** | **µS/cm** | **Salt (T)** |
| July | 0 | 0 | 0 |
| August | 0 | 0 | 0 |
| September | 0 | 0 | 0 |
| October | 13,270 | 184 | 1,622 |
| November | 70,336 | 230 | 10,392 |
| December | 69,525 | 303 | 12,683 |
| January | 609 | 515 | 181 |
| February | 777 | 326 | 163 |
| March | 291 | 299 | 52 |
| April | 524 | 279 | 96 |
| May | 222 | 310 | 44 |
| June | 700 | 267 | 114 |
| **Total** | **156,254** | | **25,347** |

*Note: Due to a significant flood event the volume of water exiting CICL's Operational area in November and December has been interpolated using a limited data set. Please refer to section 10.1 for more information.*

Table 8.11 represents a simple annual salt balance comprising the imported, exported and retained salt load for the area associated with each separate water supply work.

*Table 8.11: Simple salt balance (Tonnes) in 2022/23*

| Inflow Sites | Imported Salt (T) | Outflow Sites | Exported Salt (T) |
|---|---|---|---|
| Main Canal Off-take | 30,864 | Drainage Canal DC800 A (DC800A) | 2,567 |
| Col Bore | 259 | Coleambally Outfall Drain A (CODA) | 10,632 |
| Hort Bore | 19 | Coleambally Catchment Drain (CCD) | 3,902 |
| | | Tombullen | 5,643 |
| **Total** | **31,142** | | **22,744** |
| **Balance** | **8,398** | | |

# 9. Groundwater Conditions within the Area of Operations



The following section is provided to satisfy condition 2.17 of CICL Monitoring and Reporting Plan, which requires a report on monitoring of groundwater conditions by means of piezometers in accordance with monitoring and reporting requirements.

CICL has a network of piezometers throughout its Area of Operations which is used to monitor groundwater conditions. Attachment 2 of the CICL Monitoring and Reporting Plan requires that piezometers be read annually in August (+/- 2 weeks). It is CICL's practice to read them again in March to have a more complete understanding of groundwater conditions affecting our area. The related data is analysed using Esri ArcGIS and MS Excel software.

In August 2023, 673 of CICL's 737 licensed piezometers were read of which 83 were recorded as being dry. Of the 64 piezometers not read, 14 were recorded as destroyed, 4 were recorded as not found and 46 were recorded as blocked.

Piezometers are read to an accuracy of +/- 5 cm with the data obtained presented as per the Licence monitoring requirements. Data analysis and mapping is based on a split set of data being: pressure levels from the upper Shepparton aquifer via piezometers < 12 m deep; and pressure levels from the lower Shepparton aquifer via piezometers 12–60 m deep.

Readings from the upper Shepparton Aquifer represent the water table, while readings from the lower Shepparton aquifer represent the piezometric level of the lower confined aquifer.

All piezometers with a recorded depth are mapped, except those recorded as dry, blocked, buried or otherwise damaged.

For comparative purposes, piezometric levels in the previous two years and in the baseline year of 1998 are presented along with the current year. The inclusion of the previous two years highlights the change in conditions from the last season to the present, whilst the inclusion of the baseline year allows a comparison with groundwater conditions in 1998.

Figure 9.1 is a contour map of the piezometric levels below natural surface for August 2023. A 3D surface of piezometric levels was created from point measurements (depth to piezometric level below natural surface at each piezometer) by using the Inverse Distance Weighted (IDW) method of interpolation. This method requires inputs of XY locational coordinates and a Z coordinate for the piezometric level.

Tables 9.1 and 9.2 are tabular representations of Figure 9.1. From Table 9.1 for 0-12 m depth piezometers 33,314 ha or 35% of the mapped groundwater area were located in the 0-4 m zone in 2023, which in Figure 9.1 is represented in red, orange and yellow combined. This compares to 17,522 ha in 2022. For the same period there was also an increase in piezometric level, known as standing water level, within 2 metres of the surface from 177 ha to 514 ha.

In 2019/20 CICL improved the reporting practices for piezometric levels resulting in portions of land within the Coleambally Irrigation Area denoted by the label 'no data'. This area equates to 1,901 ha or 2% of the Coleambally Irrigation Area for the 0-12 m piezometric level. 56 piezometers within the 0-12 m range were recorded as dry in August 2023, compared to 66 in August 2022.

# 9. Groundwater Conditions within the Area of Operations



*Table 9.1: Piezometric level below natural surface; 0-12 m piezometers; August 2023 comparison of areas 1998, 2021 & 2022*

| Piezometric Level Below Natural Surface (m) | Years and Area of Piezometric Level (ha) | | | | Change in Area of Piezometric Level (ha) [+ = increasing][- = decreasing] | |
|---|---|---|---|---|---|---|
| | 2023 | 2022 | 2021 | 1998 | 2023 vs 1998 | 2023 vs 2022 |
| Less than 2 metres | 514 | 177 | 61 | 36,041 | -35,527 | 337 |
| Between 2 and 4 metres | 32,800 | 17,345 | 10,115 | 41,559 | -8,759 | 15,455 |
| Greater than 4 metres | 60,587 | 76,400 | 83,146 | 18,202 | 42,385 | -15,813 |
| No data | 1,901 | 1,880 | 2,480 | 0 | 1,901 | 21 |
| **Total** | **95,802** | **95,802** | **95,802** | **95,802** | | |

*Table 9.2: Piezometric level below natural surface; 12-60 m piezometers; August 2023 comparison of areas 1998, 2021 & 2022*

| Piezometric Level Below Natural Surface (m) | Years and Area of Piezometric Level (ha) | | | | Change in Area of Piezometric Level (ha) [+ = increasing][- = decreasing] | |
|---|---|---|---|---|---|---|
| | 2023 | 2022 | 2021 | 1998 | 2023 vs 1998 | 2023 vs 2022 |
| Less than 2 metres | 24 | 23 | 59 | 23,024 | -23,000 | 1 |
| Between 2 and 4 metres | 17,442 | 6,561 | 2,900 | 33,481 | -16,039 | 10,881 |
| Greater than 4 metres | 78,336 | 89,218 | 92,843 | 39,297 | 39,039 | -10,882 |
| No data | 0 | 0 | 0 | 0 | | |
| **Total** | **95,802** | **95,802** | **95,802** | **95,802** | | |

Table 9.2 compares the 12–60 m range in 2023 and demonstrates that the watertable has risen from the previous two seasons, particularly within the 2-4 m range, which is assumed to be in response to the higher rainfall experienced and increased irrigation. In 2021 there was 2,900 ha with a piezometric level between 2 and 4 metres of the surface, and in 2023 that figure has increased to 17,442 ha.

17,466 ha or 18% of mapped standing water level area existed in the 0-4 m zone in 2023. This area is higher than the 6.9% in 2022.

*Figure 9.1: Piezometric level below natural surface; 0-12 m and 12-60 m piezometers August 2023*

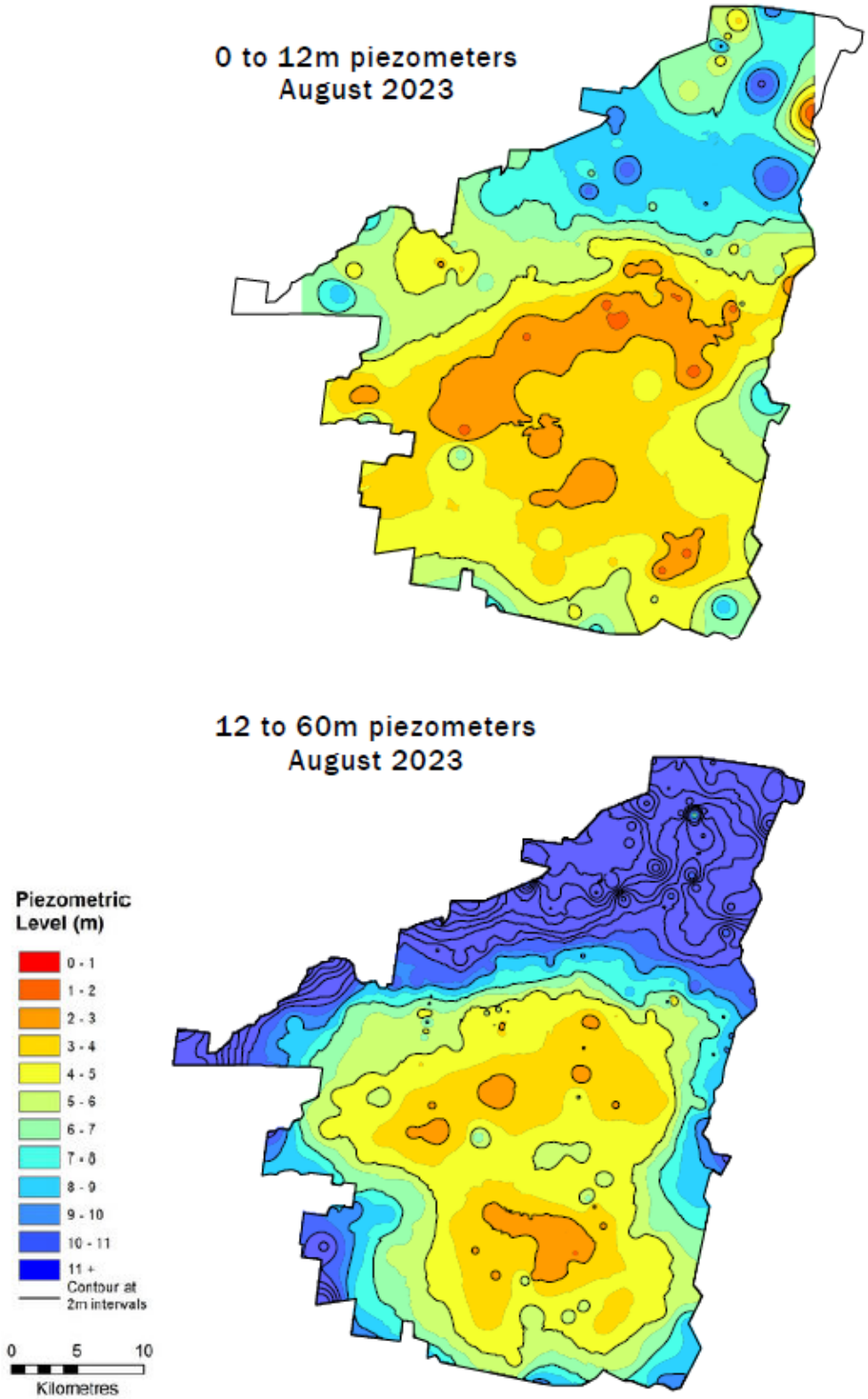


Figure 9.2 depicts the piezometric level as converted to the Australian Height Datum (AHD) and mapped for all the 0-12 m and 12-60 m piezometers. These are the upper and lower parts of the Shepparton Aquifer, respectively. These levels represent the piezometric level height above sea level and can be used to identify the direction of groundwater flow. In general, the direction of groundwater flow is West-South-West.

Tables 9.3 and 9.4 are tabular representations of Figure 9.2.

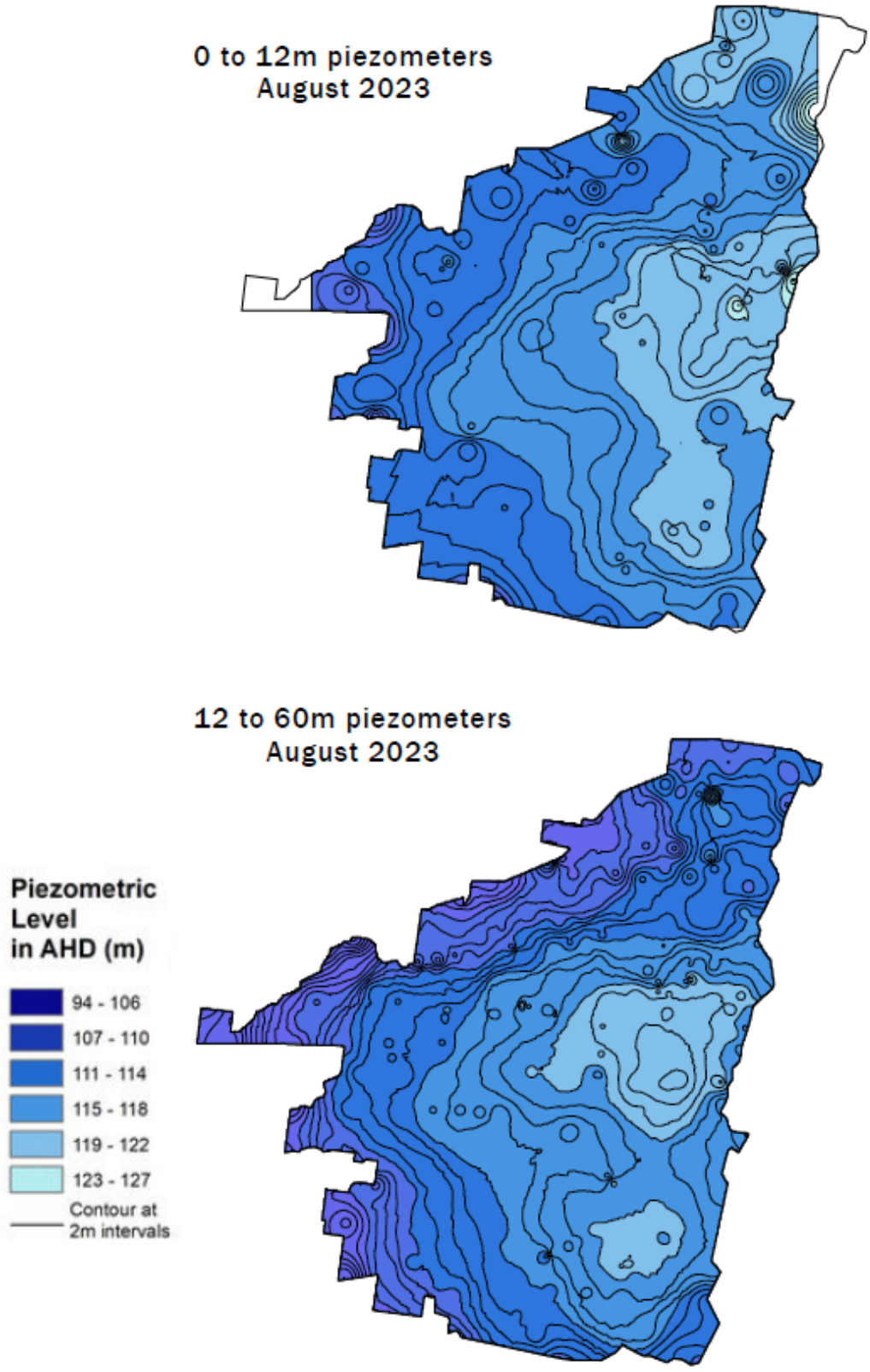
*Table 9.3: Piezometric level (mAHD); 0-12 m piezometers; August 2023 versus September 1998*

| Piezometric Level (AHD) | 2023 Area (Ha) | 1998 Area (Ha) |
|---|---|---|
| 123 – 127 (higher) | 699 | 4,151 |
| 119 - 122 | 23,333 | 39,182 |
| 115 - 118 | 37,728 | 31,548 |
| 111 - 114 | 30,991 | 11,211 |
| 107 - 110 | 1,150 | 5,724 |
| 94 – 106 (lower) | 0 | 3,986 |
| No Data | 1,901 | 0 |
| **Total** | **95,802** | **95,802** |

*Table 9.4: Piezometric level (mAHD); 12-60 m piezometers; August 2023 versus September 1998*

| Piezometric Level (AHD) | 2023 Area (Ha) | 1998 Area (Ha) |
|---|---|---|
| 123 – 127 (higher) | 0 | 6,381 |
| 119 - 122 | 11,822 | 42,337 |
| 115 - 118 | 32,476 | 34,921 |
| 111 - 114 | 34,472 | 11,432 |
| 107 - 110 | 13,000 | 731 |
| 94 – 106 (lower) | 4,032 | 0 |
| No Data | 0 | 0 |
| **Total** | **95,802** | **95,802** |

*Figure 9.2: Piezometric level (mAHD); 0-12 m and 12-60 m piezometers August 2023*



## 10.1 Data Omissions and Discrepancies

This section identifies the variations, discrepancies, data omissions and details of any actions undertaken or proposed to remedy any monitoring or reporting deficiencies in satisfying condition 2.6 of the CICL Monitoring and Reporting Plan.

The mid-Murrumbidgee Valley experienced a significant flooding event from September 2022 through to January 2023. Both the NSW DPI hydrometrics sites and CICL FlumeGate regulators were submerged or otherwise inoperable for long periods, resulting in unreliable data. Due to the significant flooding unknown volumes of water entered and exited the CICL Area of Operation, bypassing licenced sites. Under condition 3 of the CICL Monitoring and Reporting Plan CICL may include data of acceptable quality from other sources to meet the monitoring and reporting requirements of the Plan. Data for all licenced sites have been provided where possible, with data substitutions appropriately noted in Table 10.1.

The flow data for the CODA site has been calculated using data from both the CODA (410110) and CICL FlumeGate CODWonga. From 8 October to 20 November 2022 the FlumeGate was inoperable due to flooding, and data from CODA (410110) has been substituted. From 24 to 27 February 2023 the FlumeGate was inoperable due to telemetry issues, with the flow rate calculated by interpolation.

The flow data from the CICL FlumeGate Escape is used in conjunction with the continuous EC data from the WaterNSW gauge to compute salt load. The WaterNSW CCD gauge is impacted by backwater during periods of high flow in the Yanco and Billabong creeks and is considered unreliable. The Coleambally Catchment Drain (CCD) is a supply point for WaterNSW customers and these flows are measured at the adjacent CICL delivery point rather than the WaterNSW gauging station.

The flow data for the CODD site has been calculated using data from the CODD (410133). CODD (410133) is subject to backflows from Billabong creek and is normally considered unreliable. In previous seasons we have substituted this data for flow volumes from the CICL FlumeGate CODOaklands, however due to the floods the FlumeGate was inoperable for the majority of the season. From 13 November 2022 to 20 December 2022 CODD (410133) was inoperable due to flooding, with the flow rate calculated by interpolation.

*Table 10.1: Data sources for licence sites*

| NSW DPI-Hydrometrics site number | NSW DPI-Water Licenced Site | NSW EPA Licenced Site | ACR Comment |
|---|---|---|---|
| 410110 | CODA | 1. CODWonga | Salinity from CODA (410110)<br>Flow from CICL FlumeGate CODWonga and from CODA (410110) |
| 410108 | DC800A | 2. DC800A | Salinity and flow from DC800A (410108) |
| 410191 | CCD | 3. CCD | Salinity from CCD (410191)<br>Flow from CICL FlumeGate CCD Escape |
| 410133 | CODD | 4. CODOaklands | Salinity and flow from CODD (410133) |

CICL applied for and received a Groundwater Works Approval (40WA418096) for a bore in 2020. This bore has not yet been constructed and as such no data for the Works Approval has been provided in this report.

# 11. New Measures to Limit Groundwater Recharge and Salinity Discharge



The following section is provided to satisfy condition 2.9 of the CICL Monitoring and Reporting Plan, which requires a discussion of any new measures implemented during the year and results of measures commenced in the previous year to reduce recharge of groundwater and discharge of salt from the Area of Operations.

## 11.1 Water Use Policy

Coleambally Irrigation has a Water Use Policy in place which is intended to limit the environmental impacts of irrigation recharge on the water table. This policy imposes a water use intensity limit and limitations on the approved areas to farm rice on all farms with access to CICL drainage. The standard water use intensity maximum limit is 7.2 ML per ha, which was derived from CSIRO studies on sustainable irrigation limits for the Coleambally Irrigation Area in order to limit accessions to the water table. Given the low water use and a very small area of the CIA with watertables within 2 m of the surface the CICL Board adjusted the water use intensity limit for the 2022/23 season to 8 ML per ha.

## 11.2 Salinity Discharge

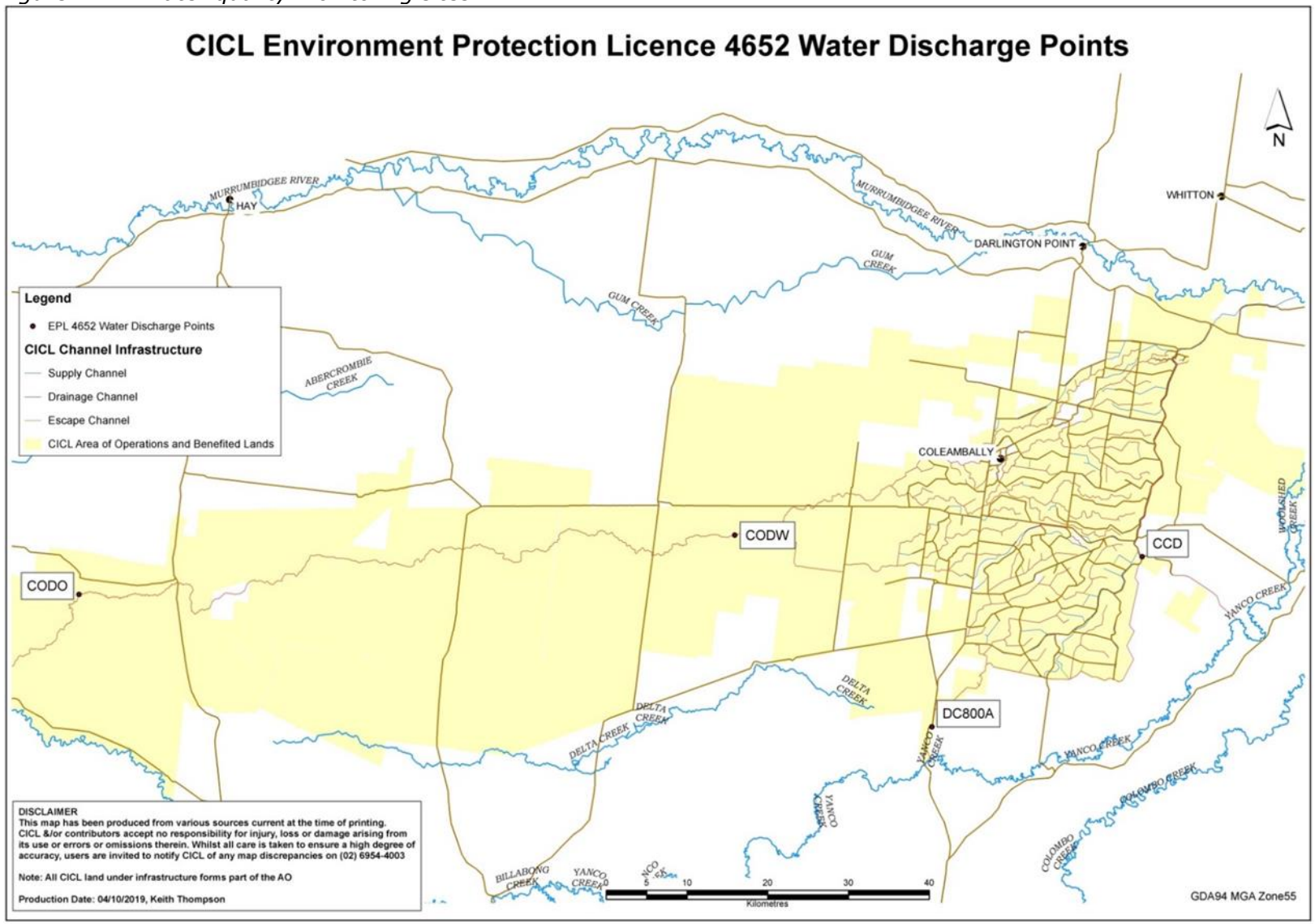
There were no new measures proposed or implemented in the 2022/23 season. Coleambally Irrigation is a net importer of salt and as such the effects of climate and water allocation conditions are not considered with regards to salinity and salt load.

## 12.1 Water Quality

CICL's surface water quality program is aimed at monitoring supply and drainage water quality within CICL's Area of Operations, including at the licensed discharge points. The program monitors flow, turbidity, dissolved oxygen, salinity, chemical and nutrient levels at various points to comply with licence conditions. CICL's water quality monitoring sites are shown in Figure 12.1.

At the licensed sites, flow, salinity and the temperature of drainage water are monitored continuously. Monthly water samples are collected from these sites and are analysed for the presence of chemicals as required by CICL's Environment Protection Licence. Water samples are also collected and analysed from one supply site at the Main Canal Off-take when flowing. An EC sensor was installed in July 2022 at the Main Canal Off-take to provide data used to calculate the salt load.

*Figure 12.1: Water quality monitoring sites*



## 12.2 Environmental Monitoring

The following section is provided to satisfy condition M4 of the Environment Protection Licence, which requires irrigation wastewater sampling for Molinate for a period of 9 weeks from mid-October at licenced discharge sites.

There were no detections of Molinate exceeding either the Notification Level or Action Level (see Table 12.1). At DC800A Metolachlor was detected at a concentration above the Notification Level in week 6, and Diuron was detected above the Action level in week 6. At CODWonga Diuron was detected above the Notification Level in week 4, and above the Action Level in weeks 3 and 6.

*Table 12.1 Environmental monitoring licence point results in 2022/23*

| Date | CODWonga Molinate (µg/L) | DC800A Molinate (µg/L) | CCD Molinate (µg/L) | Report No. |
|---|---|---|---|---|
| Week 1 | <0.005 | <0.005 | <0.005 | ES2236382 |
| Week 2 | <0.005 | <0.005 | <0.005 | ES2237460 |
| Week 3 | <0.005 | <0.005 | <0.005 | ES2238259 |
| Week 4 | <0.005 | <0.005 | <0.005 | ES2239321 |
| Week 5 | <0.005 | <0.005 | <0.005 | ES2240327 |
| Week 6 | <0.005 | <0.005 | <0.005 | ES2241399 |
| Week 7 | <0.005 | <0.005 | <0.005 | ES2242145 |
| Week 8 | <0.005 | <0.005 | <0.005 | ES2243215 |
| Week 9 | <0.005 | <0.005 | <0.005 | ES2243801 |

## 12.3 Chemical Use

The following section is provided to satisfy condition O3.9 of the Environment Protection Licence, which requires a record to be kept of all chemical applications greater than 10 litres of chemical concentrate directly to or within close proximity to any water within the infrastructure owned or controlled by CICL.

In absolute terms chemical usage by CICL is down 20% this season compared to last season.

*Table 12.2: CICL chemical usage in 2022/23*

| Product | Active Constituent | Litres or Kg | Application |
|---|---|---|---|
| Access | Triclopyr, Picloram | 23 | Boxthorns |
| Associate | Metsulfuron methyl | 31 | Boxthorns |
| Ammonium Sulphate | Ammonium Sulphate | 140 | Spray adjuvant |
| Crucial | Glyphosate | 13 | Weed control |
| Cutlass | Dicamba | 635 | Weed grass control |
| Dalapon | 2-2-DPA | 195 | Cumbungi, water couch |
| Dicamba | Dicamba | 34 | Weed grass control |
| Diesel | | 1,380 | Spray adjuvant |
| Glyphosate 450 | Glyphosate | 28 | Weed control |
| Grazon | Triclopr, Picloram | 87 | Brush weeds |
| Roundup | Glyphosate | 1,665 | Weed control |
| Terrad'or | Tiafenacil | 67 | Weed control |

## 12.4 Reportable Incidents

The following section is provided to satisfy condition R4.3 (c) of the Environment Protection Licence, which requires a summary of all pollution events which have been reported under the conditions of the licence.

High rainfall and flooding events from September 2022 to January 2023 led to significant flooding which precluded the ability to undertake remedial action. From 24 November to 18 January 2023 the NSW EPA waived the requirement to report pollution incidents occurring as a direct result of flooding. Despite significant ongoing flooding through December and January water quality testing was continued and incidents reported to the EPA.

There were 5 incidents in 2022/23 where the Pollution Incident Response Management Plan was activated.

On 6 September 2022, as part of our monthly water quality testing, Simazine was detected above Action Level and Chlorpyrifos was detected above Notification Level at DC800. In subsequent testing on 20 September 2022 neither Simazine nor Chlorpyrifos was detected above Notification Level, however Diuron was detected above Notification Level at DC800.

On 24 October 2022, as part of our weekly Environmental Monitoring Program, Diuron was detected above Action Level at CODWonga. In subsequent testing on 31 October 2022 Diuron was not detected above Notification Level at CODWonga, however Diuron was detected above Notification Level at DC800. On 7 October no pesticides were detected above Notification Level at any sites.

On 14 November 2022, as part of our weekly Environmental Monitoring Program, Diuron was detected above Action Level at CODWonga and DC800, and Metolachlor was detected above Notification Level at DC800. In subsequent testing on 22 November 2022 no pesticides were detected above Notification Level at any sites.

On 3 January 2023, as part of our Monthly water quality testing, Metolachlor and Diuron were detected above Notification Level at DC800.