Crystal Brook Creek
Tree condition survey
November 2023 – October 2025

FINAL REPORT

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Riverwater Life Pty Ltd

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Disclaimer:

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Cover photo: Crystal Brook Creek looking downstream towards township, November 2023. Photograph by Todd Wallace.

Executive summary

Scope of this report

This report presents the data set for seven (7) standardised tree condition transects in the mid-reach of Crystal Brook Creek (South Australia), downstream of the Beetaloo Reservoir. Transects were established in November 2023 and resurveyed in November 2024 and October 2025. The transects were established to enable the ongoing monitoring of river red gum (*Eucalyptus camaldulensis*) condition. Field surveys were undertaken using the standardised *The Living Murray* tree condition method, with data analysed and reported utilising The Tree Condition Index (TCI) in which trees with TCI scores ≥10 are considered to be in good condition.

The data is evaluated in the context of the 'Environmental and Cultural Flows' project coordinated by the Northern and Yorke Landscape Board and funded by the South Australian Government's Landscape Priorities Fund, which specifies the objectives of:

- ***Increased health of water-dependent ecosystems and cultural sites and values restored through scheduled water releases at Barossa, Baroota and Beetaloo***
- ***Increased knowledge of hydrological requirements to maintain the health of these water-dependent ecosystems***

In order to achieve these objectives, it is recommended that an Environmental Target be established of:

90% of the river red gum trees need to maintain a TCI of ten or greater

and an Asset condition limit be established of:

at least 80% of the trees to have a TCI of greater than eight

TCI scores of ≤8 indicate a high degree of water stress and indicate that trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation, and multiple, back-to-back watering is likely to be required to achieve "good" condition. Because the strength of the response to environmental watering decreases as the TCI score decrease, avoiding the need for repeat watering by delivering water when trees are still in good condition should be a management priority. Therefore, we recommend that a Management Threshold i.e. ***More than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*** is also incorporated into the planning and delivery of environmental water along the Crystal Brook Creek.

Results

Environmental Target: The data shows that all sites are below the reference condition. However, condition has improved substantially at some sites between the baseline survey (2023) and the most recent surveys. In 2023, only one transect (CBrkTCI_5) had all (100%) trees meet the Environmental Target. In 2024, three transects (CBrkTCI_1, 5 and 7) had all (100%) trees meet this metric, and an additional two transects (CBrkTCI_3 and 6) met (passed) the Environmental Target. In October 2025, only two transects (CBrkTCI_1 and 5) had all (100%) trees meet this metric, but only one transect (CBrkTCI_4) did not meet the metric (Table 5).

Asset Condition Limit: All transects met (passed) the Asset Condition Limit in all survey periods.

Management Threshold: In October 2025, two transects (CBrkTCI_4 and CBrkTCI_6) each had seven trees with TCI scores ≤8. This pattern is similar to November 2024, when CBrkTCI_4 and CBrkTCI_6 also each had seven trees with TCI scores ≤8, and CBrkTCI_3 had four such trees. No transects exceeded the management threshold in either 2024 or 2025. This represents an improvement compared to 2023, when one transect (CBrkTCI_4) exceeded the management threshold with ten trees scoring ≤8, and three additional transects (CBrkTCI_2, CBrkTCI_3, and CBrkTCI_6) also had trees with TCI scores ≤8

Tree loss: Of the 210 trees comprising the 7 transects, 12 trees (6%) were totally defoliated (tree may be dead or very near to the critical point of loss). No tree loss was recorded in between the November 2023 and November 2024 surveys, nor the November 2024 and October 2025 surveys.

In addition to the routine assessment of condition using the TCI system which adds categorical scores for Crown Extent (CE) and Crown Density (CD), an assessment using change in mTCI score (calculated as the field score for Crown Extent multiplied by the field score for Crown Density) is presented. The mTCI approach is more sensitive to small changes in condition than the standardised TCI system. The results show a modest improvement in condition between 2024 and 2025 for most trees in transects 1-3 and 5. Little change occurred at transect 4, but there are modest declines in condition for most trees in transects 6 and 7. It is of note that the environmental flow delivered in the first half of spring 2024 delivered water to transects 1-5, but not transects 6 or 7. This suggests that in the absence of an effective environmental or unregulated flow, condition is likely to decline in the downstream sites.

Recommendations

A high percentage of viable trees throughout the assessment locations are characterised by the presence of epicormic growth. This is an indicator of partial recovery from preceding water stress. Based on the ongoing presence of trees with TCI scores ≤8 in transects 4 and 6, it is recommended that pending water availability, planning for delivery of environmental water commences as soon as practicable. This will (i) support the ongoing recovery of trees that have previously responded to improved soil water potential (as indicated by the high prevalence of epicormic growth), and (ii) stabilise the condition of sites where the 2025 survey results indicate a decline in condition is likely in the absence of an effective flow. It will also increase the likelihood of recovery and achieving the Environmental Target.

Whilst frequent (sub-decadal scale) recruitment is not required to maintain the existing ecological character of the creek, existing recruitment processes (seedling establishment and survival through to mature tree) are inadequate at the downstream locations. Consequently, it is recommended that environmental water releases be used to support the key recruitment processes of seedling survival and sapling growth when germination is recorded following unregulated spills and/or managed releases. In order to achieve this, it is recommended that population demographics are monitored through establishment of spatially standardised quadrats that specifically target the detection and tracking the abundance of early life stages (seedlings and saplings) post flows.

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1. Introduction

Scope of this report

This report presents the data set for seven (7) standardised tree condition transects in the mid-reach of Crystal Brook Creek (South Australia), downstream of the Beetaloo Reservoir. Transects were established in November 2023 and resurveyed in November 2024 and October 2025. The transects were established to enable the ongoing monitoring of river red gum (*Eucalyptus camaldulensis*) condition. Field surveys were undertaken using the standardised *The Living Murray* tree condition method, with data analysed and reported utilising The Tree Condition Index (TCI) in which trees with TCI scores ≥10 are considered to be in good condition. The data is evaluated in the context of the 'Environmental and Cultural Flows' project, coordinated by the Northern and Yorke Landscape Board and funded by the South Australian Government's Landscape Priorities Fund.

2. Methods

Site selection

It is preferable that monitoring for multiple attributes (e.g. tree condition, groundwater, soil condition, and understory vegetation) are co-located to maximise the interpretation of data and trajectory of condition. For this project, assessment sites were overlayed on locations that had been previously assessed (Jensen 2022) to maximise the management utility of collected data. Site locations are presented in Table 1 and Figure 1. The seven assessment areas (Table 1) were established as transects (not spatially constrained).

Table 1: Site locations (co-ordinates are for position of ground-based photo-points).

Transect	Date established	Latitude	Longitude	MGA Zone	Easting	Northing
CBrk1_PP	15/11/2023	-33.228996	138.2311396	54H	241974	6319908
CBrk2_PP	15/11/2023	-33.285580	138.2392717	54H	242898	6313652
CBrk3_PP	15/11/2023	-33.330641	138.2398941	54H	243089	6308655
CBrk4_PP	14/11/2023	-33.343467	138.2127834	54H	240603	6307166
CBrk5_PP	14/11/2023	-33.347623	138.1962084	54H	239072	6306663
CBrk6_PP	14/11/2023	-33.349278	138.1609996	54H	235799	6306391
CBrk7_PP	14/11/2023	-33.332107	138.1360551	54H	233425	6308232

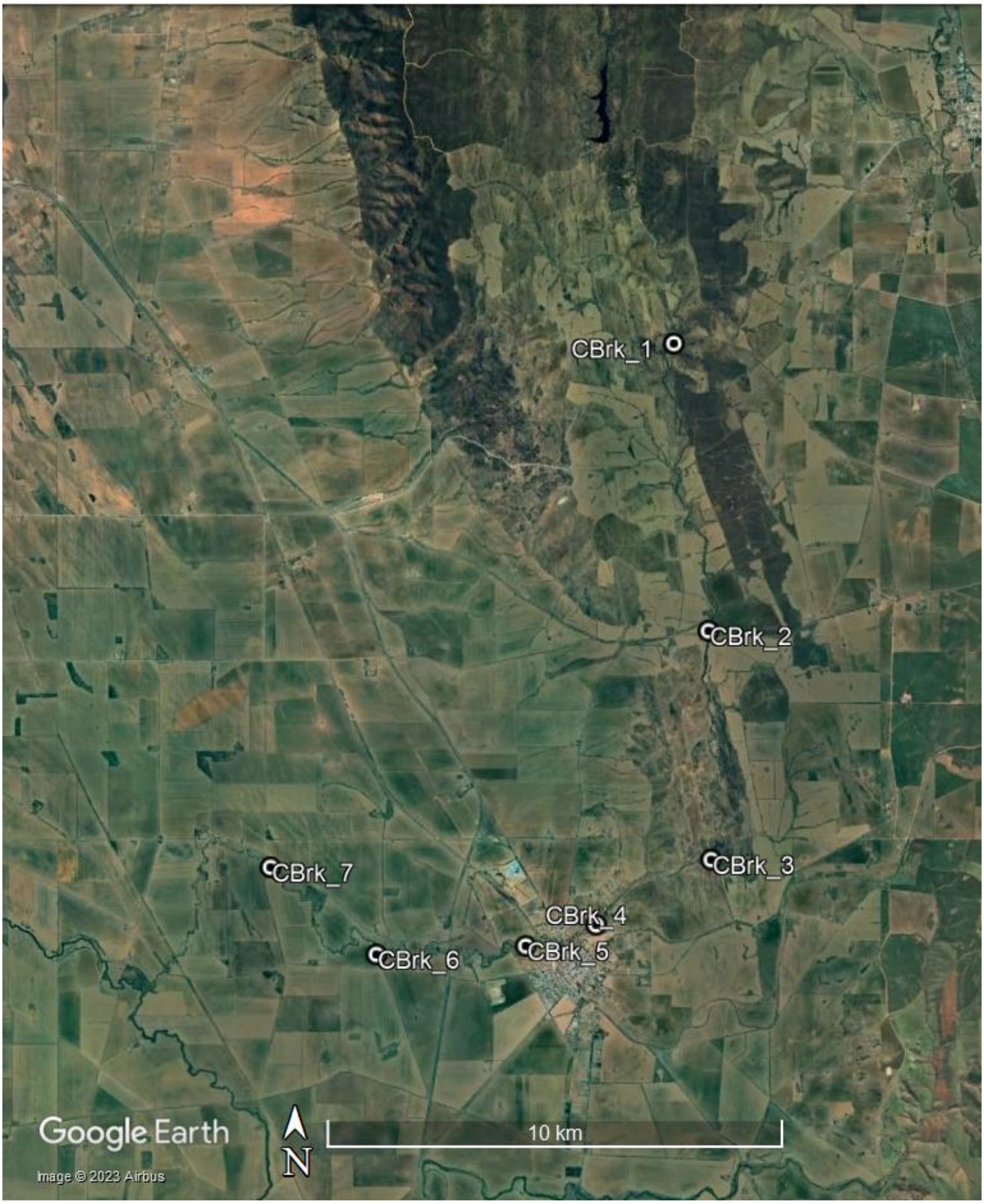

Figure 1: Locations of tree condition transects along Crystal Brook Creek downstream of Beetaloo Reservoir

Tree crown condition - assessment method The visual condition of trees was determined using the standardised *The Living Murray* tree condition method (Souter *et al.* 2010a). In brief, at each transect the condition of 30 trees was visually assessed for crown extent (CE) and crown density (CD) with field data on CE and CD recorded to the nearest 5%. Trees with diameter at breast height (DBH, measured at 1.3 m above ground level) ≥ 10 cm were selected. The tree selection process aimed to (i) provide a representation of the population demographic within the assessment location, (ii) utilise trees which are the “next nearest neighbour” from the starting point of each transect, (iii) remain within a similar elevation gradient within the meso habitat, and (iv) include live and dead trees if both are present. Trees that have died are included within the transect as this provides data on relative proportion of live/dead trees and facilitates an assessment of rate of loss (die off) when surveys are repeated over time.

For each tree, a semi-permanent tag (plastic, yellow ca. 70 x 70 mm) labelled with a unique identifier was affixed to the tree at approximately 1.3-1.8 m above ground level. The location (easting and northing) of each tree was recorded with a handheld GPS (nominal position accuracy of ±4 m). The unique identifier, species location, CE and CD data are recorded in the electronic data file that accompanies this report. Although not included in the TCI score system (Wallace *et al.* 2020), in the baseline survey period, the presence of epicormic growth (new shoots from the main trunk or major support branches) was noted if it substantially characterised the appearance of the tree, and was recorded as being either (i) early-stage epicormic growth; base of shoot < 1 cm diameter, (ii) mid-stage epicormic growth; base of shoot is 1-5 cm diameter, or (iii) late-stage epicormic growth; base of shoot is 5-10 cm diameter.

The field data was processed according to the method described in Wallace *et al.* (2020) in which field data is binned (a data management approach where continuous data values are placed into pre-defined intervals) into one of seven categories (Table 2). The Tree Condition Index (TCI) for each tree is then calculated by summing the scores for crown extent and crown density generating a score between 0 and 14 (Table 3).

Interpretation of Tree Condition Index scores

The TCI data is interpreted within a conceptual model of tree response to wetting and drying cycles (see Table 3 and Figure 2 in section 3). A TCI score of 10 or above represents a tree in “good” condition. TCI scores between 8 and 9 are “moderate” condition, between 5 and 7 are “poor condition”, and ≤4 is “very poor” condition. Trees with a TCI score of 0 are either (i) dead or unlikely to respond to watering, or (ii) be very near to the critical point of 'loss'. The strength of the response to environmental watering decreases as the TCI score decrease.

Population demographics

The age-class distribution of trees is an indicator for recruitment and survival, and the growth of young trees must at least match the mortality of old trees if a stand is to remain viable (George *et al.* 2005). Whilst size is a poor indicator of age, it does provide insight into the demographic of the transect, and the relative frequency of recruitment events within a meso-habitat. As part of the baseline survey (Wallace 2023), data on size was collected following the principles detailed in the Joint Ventures Monitoring and Evaluation report (VTAG 2019). In brief, DBH for each tree in the transect (alive and dead) was measured and recorded to the nearest 0.1 cm according to the following rules:

- Measurement was made at 1.3 m above ground measured along the stem, where the tree is on a slope, 1.3 m was measured on the uphill side of the tree. Where the tree is on a lean, 1.3 m was measured on the underside of the lean.
- The measuring tape was located at 90° to the axis of the stem at 1.3 m.
- Where a tree has multiple stems at 1.3 m, the DBH of each stem was recorded. The DBH data were converted to area, summed to produce a “total area” and then converted to a proxy DBH (equivalent to DBH if the tree only had one primary stem).

Photo-points

In order to facilitate provision of a long-term visual record of change(s) in condition, a single ground-based photo-point was established for each transect. Each photo-point is orientated so as to provide a representation of the transect location including (i) key geomorphological features where practicable, and (ii) maximising the number of transect trees captured in the image. In each case markers (ca 70 mm x 70 mm) were installed, one at the location at which the photograph is taken from (the primary marker) and one on another tree (downstream) as a sight marker in the centre of the image. The location of the primary marker was recorded with a handheld GPS, and the direction (in degrees) from the primary marker to the sighter marker was recorded. The photographer was positioned at the primary marker, and where possible (due to elevation and aspect), the viewfinder was centred on the sighter marker. Ground based photo-points are intended to be taken during each survey period.

In addition to the ground-based photo-points, aerial images were also collected during the baseline survey period (Wallace 2023) using a remotely piloted aircraft (drone). At each location, two images were collected (1) facing either up or downstream with the camera at a ca. 25^{o} angle, and (2) an overhead view with the camera pointing directly downwards.

Table 2: Tree crown cover and crown density categories and scores (Souter *et al.* 2010a).

Score	Description	Percentage of assessable crown
0	None	0 %
1	Minimal	1-10 %
2	Sparse	11-20 %
3	Sparse – Medium	21-40 %
4	Medium	41-60 %
5	Medium – Major	61-80 %
6	Major	81-90 %
7	Maximum	91-100 %

Table 3: Score system for TCI and corresponding condition description. Adapted from Wallace et al., (2020).

TCI score	Condition Description	
0	Non-viable	Tree may be dead or very near to the critical point of loss. A small proportion of trees may respond to delivery of water, but are likely to be in a precarious position i.e. response may not be sustained and tree may not recover
2-4	Very poor	Tree viable but in very poor condition and in a precarious position i.e. continuation of dry conditions is likely to lead to death. Trees with low TCI scores have a slow response. A single watering may stabilise condition. Multiple, back to back watering will be required to achieve "good" condition
5-7	Poor	Most trees would be expected to respond positively to watering. Inundation may stabilise condition or result in an improvement. Trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation. Multiple, back to back watering is likely to be required to achieve "good" condition
8-9	Moderate	Most trees with TCI scores ≥ 8 would be expected to respond positively to watering and increase to the next condition class. However, these trees may become defoliated under ongoing dry conditions.
10-12	Good	Trees are expected to have a moderate degree of resilience and should be able to withstand a short dry period with minimal loss of condition
13-14	Excellent	Trees are expected to have a high degree of resilience and should be able to withstand a short period with minimal loss of condition

3. Reporting Framework

Objectives and targets

The 'Environmental and Cultural Flows' project coordinated by the Northern and Yorke Landscape Board and funded by the South Australian Government's Landscape Priorities Fund, specifies the objectives of:

- ***Increased health of water-dependent ecosystems and cultural sites and values restored through scheduled water releases at Barossa, Baroota and Beetaloo***
- ***Increased knowledge of hydrological requirements to maintain the health of these water-dependent ecosystems***

In order to achieve these objectives, it is recommended that an Environmental Target be established of:

90% of the river red gum trees need to maintain a TCI of ten or greater

and an Asset condition limit of

at least 80% of the trees to have a TCI of greater than eight

The project specifies that to achieve the ecological target, the environmental water releases for river red gums should deliver a flow event at least two in five years. If the trees are failing the target, then additional watering should be considered, however, **an asset condition trigger requiring at least 80% of the trees to have a TCI of greater than eight** will provide additional protections to ensure there is minimal loss of mature trees. Should this trigger be reached, the time since previous inundation or watering event is irrelevant and a release should occur by the end of the following winter.

Conceptual model of stress and recovery

A conceptual model outlining the stress-recovery model for floodplain eucalypts is presented in Figure 2 (from Wallace *et al.* 2020). That model highlights that delivery of environmental water would ideally be triggered before tree TCI scores fall below 8 to preclude the long recovery times and intensive management regimes required to restore severely stressed woodlands. As per the conceptual model (Figure 2 and Table 3), TCI scores of ≤8 indicate a high degree of water stress, and TCI scores below 8 indicate that trees may be at the edge of the resilience period, i.e. continuation of dry conditions is likely to lead to a marked loss of condition or defoliation, and multiple, back to back watering is likely to be required for trees to improve sufficiently to achieve "good" condition. Because the strength of the response to environmental watering decreases as the TCI score decrease, avoiding the need for repeat (high frequency) watering by delivering water when trees are still in good condition should be a management priority.

Therefore, it is recommended that the Asset condition limit be supplemented with a management threshold that triggers earlier action, in order to limit the potential for long-term or potentially irreversible damage, and improve the potential to improve condition sufficiently to achieve, and subsequently maintain the Ecological Objective (Wallace *et al.* 2021). It is recommended that the Management Threshold utilised throughout the lower River Murray (e.g. Wallace and Whittle 2014; Wallace 2022b, 2022a) i.e. ***more than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*** is adopted.

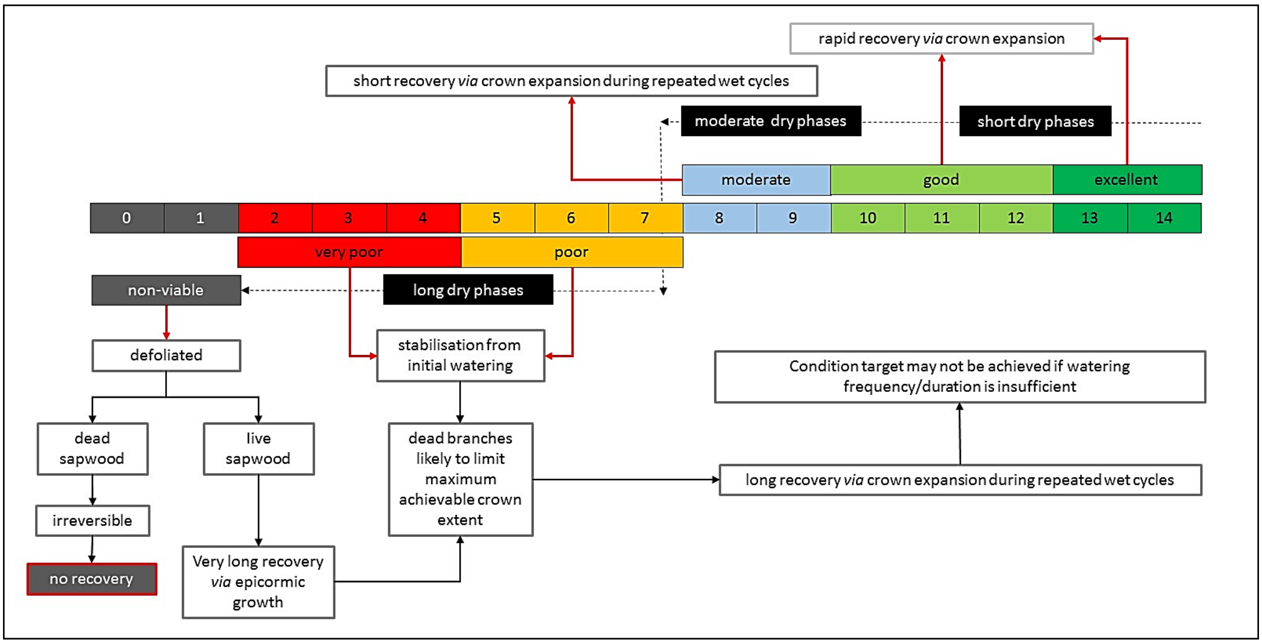

Figure 2: From Wallace *et al.* (2020); Conceptual model of stress-recovery (state transition model) for floodplain eucalypts that builds on Wallace (2015b), Souter et al. (2010b) and Bond et al. (2018) and recognises that (i) trajectories for crown decline and recovery occur via different pathways rather than a simple linear reversal, and (ii) recovery and decline do not proceed at the same rates. TCI values range from 0 (non-viable) to 14 (excellent). Short-interval dry periods facilitate maintaining condition within the good-excellent range (trees with TCI ≥10). Moderate-interval dry periods degrade crown condition to moderate condition (i.e. TCI 8 and 9) but a return to near natural inundation return intervals will restore trees to "good" condition within less than 3 years. Long-interval dry periods result in a major decline from poor to very poor condition (TCI 4 to 6), and a much longer period is required to recover trees. Very poor condition trees (TCI ≤4) undergo a much slower recovery rate and may become non-viable and fail to recover because of a lack of live sapwood to support transpiration. Delivery of environmental water would ideally be triggered before tree TCI scores fall below 8 to preclude the long recovery times and intensive management regimes required to restore severely stressed woodlands.

Reference conditions

Reporting of the percent of trees above/below a desired target or above a management threshold is useful for summary reporting but provides limited context for supporting decisions on the priority of delivery of environmental water. Presenting TCI data against a hypothetical data set that could be considered representative of good stand condition increases the utility of the condition data. In order to facilitate this, data for a hypothetical transect in which 90% of trees have TCI scores ≥10 is presented. A spline curve was fitted to this hypothetical data set to generate a reference condition (Figure 3) against which observational data from the established transects can be considered. The histogram shows the recorded percentage of trees that fall within each TCI score, relative to (i) the reference condition described above, (ii) the metric for the Ecological Target and (iii) the threshold for management action of "*more than 10% of established viable trees with DBH > 10 cm receive TCI scores ≤8*". It is evident from this reference frame, that if the Ecological Target is met, there should be no viable trees with TCI scores ≤8. With this guiding context, the position of the tree condition data relative to the Ecological Target, the management threshold and the hypothetical reference condition (the spline curve), provides insight into the trajectory of trees within any given transect over time, and hence the priority for watering areas that can be actively managed.

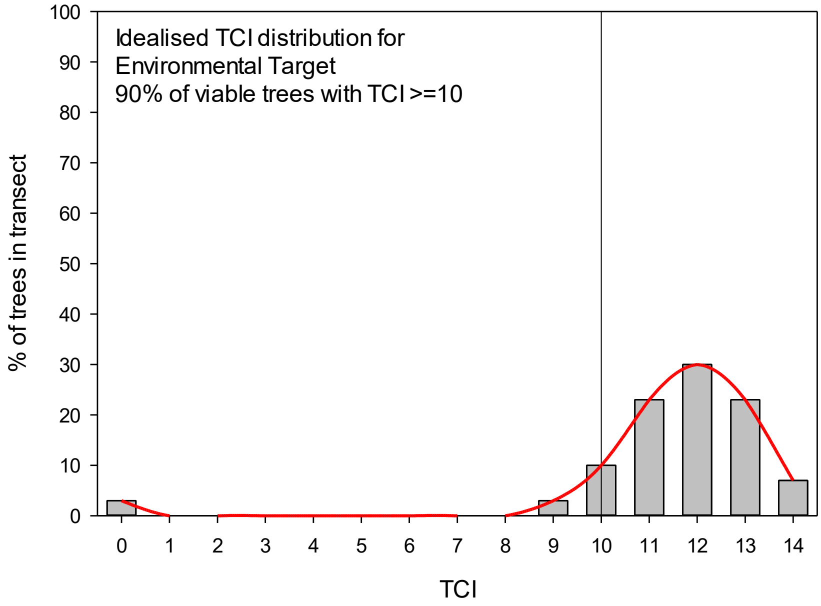

Figure 3. Hypothetical transect in which 90% of trees have TCI scores ≥10. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) fitted to this hypothetical data set generates a reference condition against which observational data from existing transects can be considered. It is evident that within this reference frame, that if the Ecological Target is met, there should be no viable trees with TCI scores ≤8.

Priority for environmental water delivery

An assessment of the priority for e-water delivery was undertaken based on the combination of position relative to the ecological target and management threshold, utilising the framework presented by Wallace (2018) (see table 4 for assessment matrix). A secondary assessment was undertaken by considering the percentage of viable trees with TCI scores ≥10 minus the percentage of viable trees with TCI scores between 2 and 8 (per Wallace 2022b).

Table 4. Matrix for assessment of priority for e-water delivery based on the combination of position relative to the ecological target and management threshold (from Wallace (2018)).

TCI Priority ranking	
very low	target met and no trees with TCI scores ≤8
low	target met and <10% of trees with TCI scores ≤8
moderate	target met but >10% of trees with TCI scores ≤8
high	target not met and <10% of trees with TCI scores ≤8
very high	target not met and >10% of trees with TCI scores ≤8

4. Results

Tree crown condition

Environmental Target: The data shows that all sites are below (left skewed relative to) the reference condition (Figure 4). However, condition has improved substantially at some sites between the baseline survey (2023) and the most recent surveys. In 2023, only one transect (CBrkTCI_5) had all (100%) trees meet the Environmental Target. In 2024, three transects (CBrkTCI_1, 5 and 7) had all (100%) trees meet this metric, and an additional two transects (CBrkTCI_3 and 6) met (passed) the Environmental Target. In October 2025, only two transects (CBrkTCI_1 and 5) had all (100%) trees meet this metric, but only one transect (CBrkTCI_4) did not meet the metric (Table 5).

Asset Condition Limit: All transects met (passed) the Asset Condition Limit in all survey periods (Table 6B).

Management Threshold: In October 2025, two transects (CBrkTCI_4 and CBrkTCI_6) each had seven trees with TCI scores ≤8. This pattern is similar to November 2024, when CBrkTCI_4 and CBrkTCI_6 also each had seven trees with TCI scores ≤8, and CBrkTCI_3 had four such trees. No transects exceeded the management threshold in either 2024 or 2025. This represents an improvement compared to 2023, when one transect (CBrkTCI_4) exceeded the management threshold with ten trees scoring ≤8, and three additional transects (CBrkTCI_2, CBrkTCI_3, and CBrkTCI_6) also had trees with TCI scores ≤8.

Tree loss: Of the 210 trees comprising the 7 transects, 12 trees (6%) were totally defoliated (tree may be dead or very near to the critical point of loss). No tree loss was recorded in between the November 2023 and November 2024 surveys, nor the November 2024 and October 2025 surveys.

In addition to the routine assessment of condition using the TCI system which adds categorical scores for Crown Extent (CE) and Crown Density (CD), an assessment using change in mTCI score (calculated as the field score for Crown Extent multiplied by the field score for Crown Density) is presented. The mTCI approach is more sensitive to small changes in condition than the standardised TCI system. The results (Figure 4) show a modest improvement in condition between 2024 and 2025 for most trees in transects 1-3 and 5. Little change occurred at transect 4, but there are modest declines in condition for most trees in transects 6 and 7. This suggests that in the absence of an effective environmental or unregulated flow, condition is likely to decline in the downstream sites. It is of note that the environmental flow delivered in the first half of spring 2024 delivered water to transects 1-5, but not transects 6 or 7. This suggests that in the absence of an effective environmental or unregulated flow, condition is likely to decline in the downstream sites.

Epicormic Growth

Of the 210 trees comprising the 7 transects, 100 (51% of) viable trees were characterised by the presence of epicormic growth. This is considered an indicator of partial recovery from preceding water stress and reflects the progressive improvements in condition scores observed at most transects. The high prevalence of epicormic growth is considered a strong indicator that either high seasonal rainfall, an unregulated release (spill), or delivery of a managed environmental water release will be required to support a continuation of condition recovery and achievement of the Ecological Objective.

Priority for environmental water delivery

In October 2025, transect CBrkTCI_4 was rated as “high priority” for delivery of environmental water. All other transects were rates as “very low” or “low” priority. In November 2024, transects CBrkTCI_2 and 4 were rated as “high priority” for environmental water delivery with transect CBrkTCI_4 considered to be the highest priority. This is an improvement from 2023, when transects CBrkTCI_1-4 were all rated as “high priority” (Table 6D and 6E).

Using the alternative priority ranking (priority ranking B, Table 6E), which is calculated as *the % of viable trees with TCI scores ≥10 minus % of viable trees with TCI scores from 2-8* (values close to 100 indicate very low priority, values less than 50 indicate very high priority), transects 1, 5 and 7 were rated low priority (≥90) in November 2024. In October 2025, transects 1, 2, 3, 5 and 7 were rated low priority Between the 2024 and 2025 surveys, watering priority was stable at transects 1, 4, 5 and 6, and improved (was lower) at transects 2 and 3. Priority worsened (was higher) at transect 7.

Table 5. Results for position relative to the Ecological Target, Asset Condition Limit and Management Threshold for river red gum in the mid-reach of Crystal Brook Creek downstream of the Beetaloo Reservoir based on October 2025 survey data (values are percentage of viable trees meeting the condition metric). Priority ranking A is based on the matrix presented in Table 4.

Transect	Tree type	Ecological Target (TCI ≥10)	Asset Condition Limit (TCI ≥8)	Management Threshold (TCI = 2-8)	priority ranking A	priority ranking B
CBrkTCI_1	RRG	100	100	0	very low	100
CBrkTCI_2	RRG	90	100	0	very low	90
CBrkTCI_3	RRG	93	100	0	very low	93
CBrkTCI_4	RRG	86	97	7	high	79
CBrkTCI_5	RRG	100	100	0	very low	100
CBrkTCI_6	RRG	93	97	7	low	86
CBrkTCI_7	RRG	97	100	0	very low	97

Table 6A. Percent (%) of trees meeting Ecological Target in 2023, 2024 and 2025.

Transect	Nov-23	Nov-24	Oct-25
CBrkTCI_1	88	100	100
CBrkTCI_2	79	83	90
CBrkTCI_3	86	93	93
CBrkTCI_4	79	86	86
CBrkTCI_5	100	100	100
CBrkTCI_6	93	93	93
CBrkTCI_7	97	100	97

Table 6B. Percent (%) of trees meeting the Asset Condition Limit in 2023, 2024 and 2025.

Transect	Nov-23	Nov-24	Oct-25
CBrkTCI_1	100	100	100
CBrkTCI_2	100	100	100
CBrkTCI_3	100	100	100
CBrkTCI_4	93	97	97
CBrkTCI_5	100	100	100
CBrkTCI_6	97	97	97
CBrkTCI_7	100	100	100

Table 6C. Percent (%) of trees exceeding the Management Threshold in 2023, 2024 and 2025.

Transect	Nov-23	Nov-24	Oct-25
CBrkTCI_1	0	0	0
CBrkTCI_2	3	0	0
CBrkTCI_3	4	4	0
CBrkTCI_4	10	7	7
CBrkTCI_5	0	0	0
CBrkTCI_6	7	7	7
CBrkTCI_7	0	0	0

Table 6D. Results for environmental watering Priority Ranking A in 2023, 2024 and 2025. Priority ranking A is based on the criteria outlined in Table 4.

Transect	Nov-23	Nov-24	Oct-25
CBrkTCI_1	high	very low	very low
CBrkTCI_2	high	high	very low
CBrkTCI_3	high	low	very low
CBrkTCI_4	high	high	high
CBrkTCI_5	very low	very low	very low
CBrkTCI_6	low	low	low
CBrkTCI_7	very low	very low	very low

Table 6E. Results for environmental watering Priority Ranking B in 2023, 2024 and 2025. Priority ranking B is based on the % of viable trees with TCI scores ≥10 minus % of viable trees with TCI scores from 2-8 (values close to 100 indicate very low priority, values less than 50 indicate very high priority).

Transect	Nov-23	Nov-24	Oct-25
CBrkTCI_1	88	100	100
CBrkTCI_2	76	83	90
CBrkTCI_3	82	89	93
CBrkTCI_4	69	79	79
CBrkTCI_5	100	100	100
CBrkTCI_6	86	86	86
CBrkTCI_7	97	100	97

Photo-points

The ground based photo-points are presented in Figures 7-13. Aerial photo-points are presented in the baseline report (Wallace 2023).

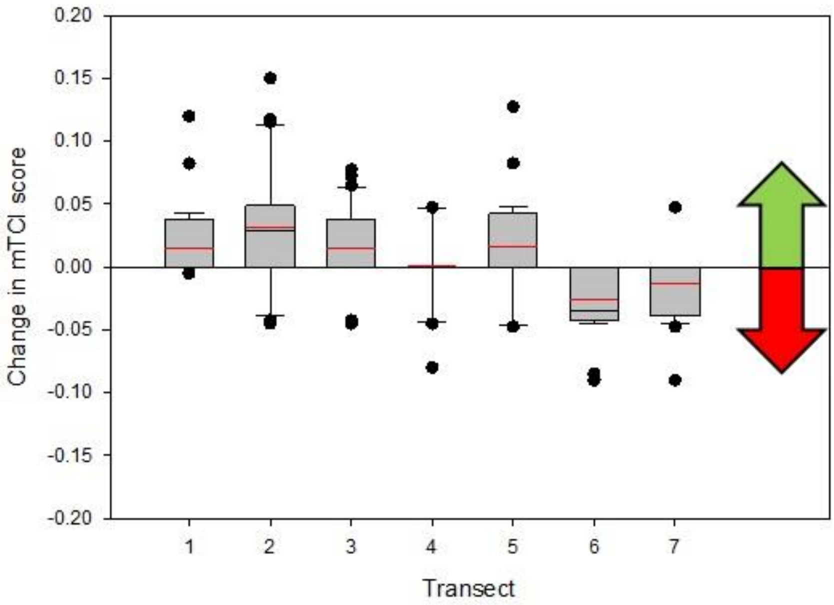

Figure 4. Change in mTCI score between the 2024 and 2025 surveys. The horizontal reference line at 0.00 indicates no change. Data points above the line indicate improvement, data points below the line represent decline in condition. Boxes contain 75th percentile, whiskers enclose 90th percentiles. Solid and red lines within box represent median and mean respectively. Circles denote outliers. It is of note that the environmental flow delivered in the first half of spring 2024 delivered water to transects 1-5, but not transects 6 or 7.

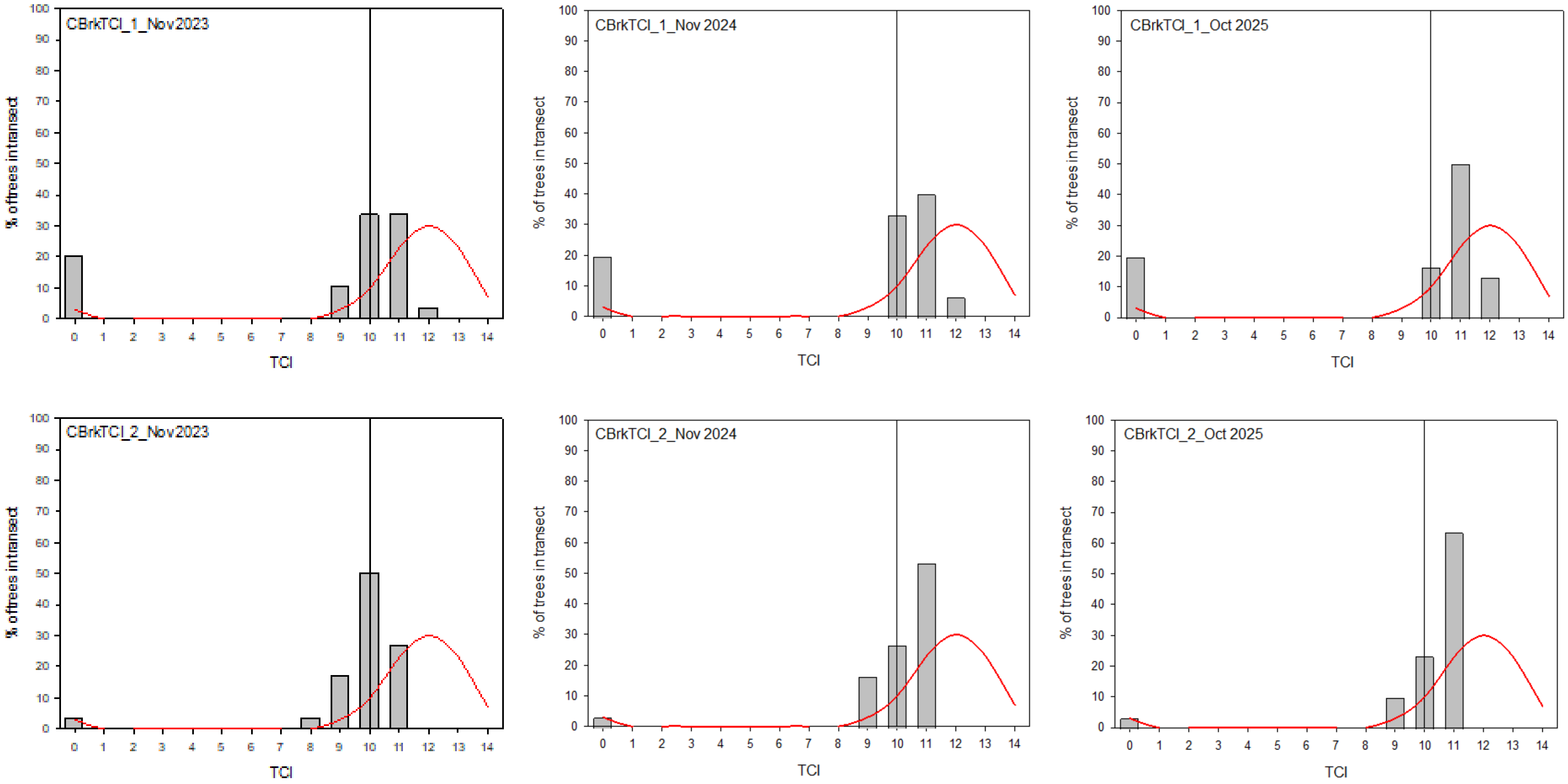

Figure 5 Proportion of river red gum in each TCI score group at Crystal Brook Creek in November 2023, November 2024 and October 2025. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

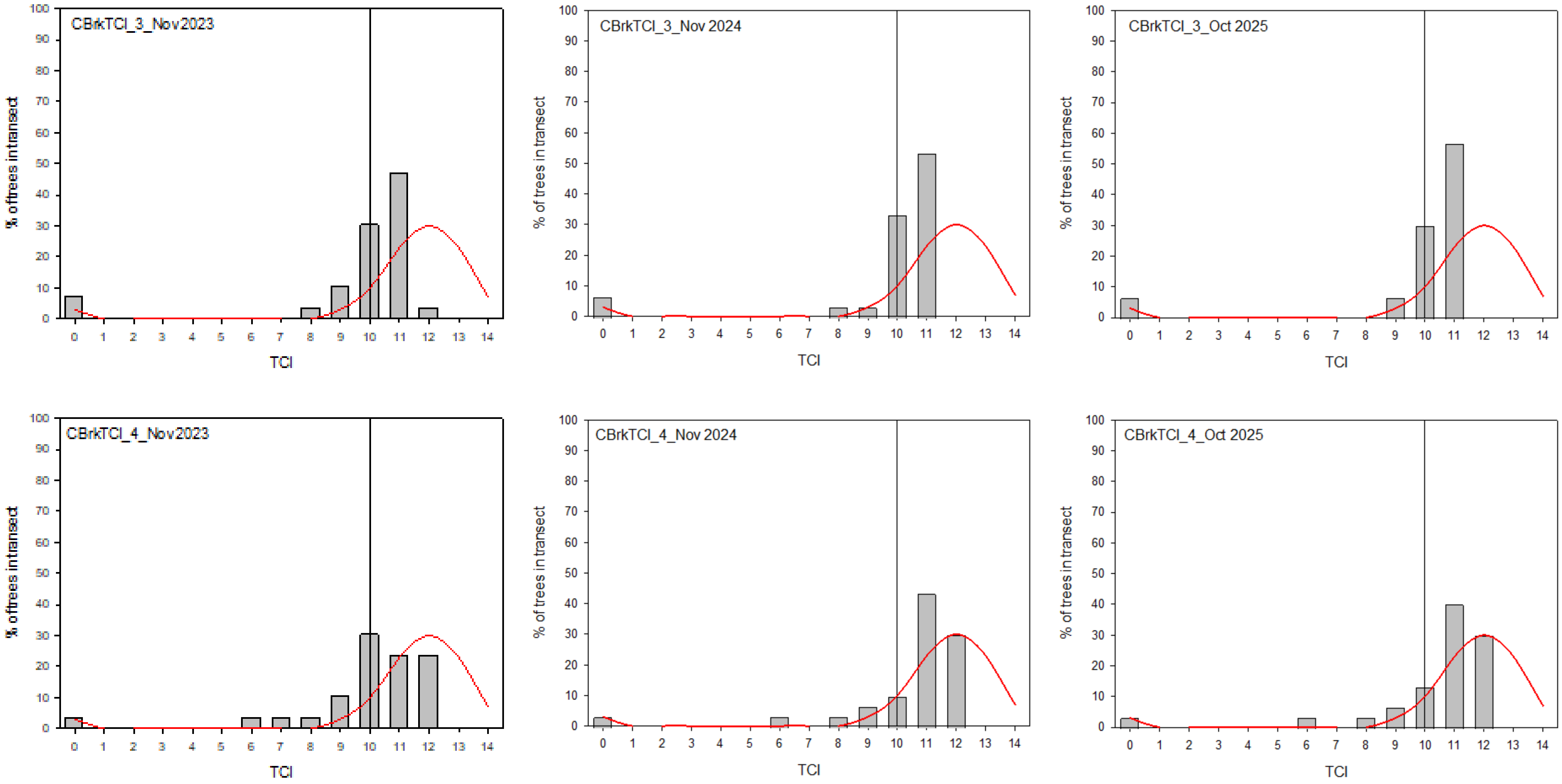

Figure 5 cont. Proportion of river red gum in each TCI score group at Crystal Brook Creek in November 2023, November 2024 and October 2025. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

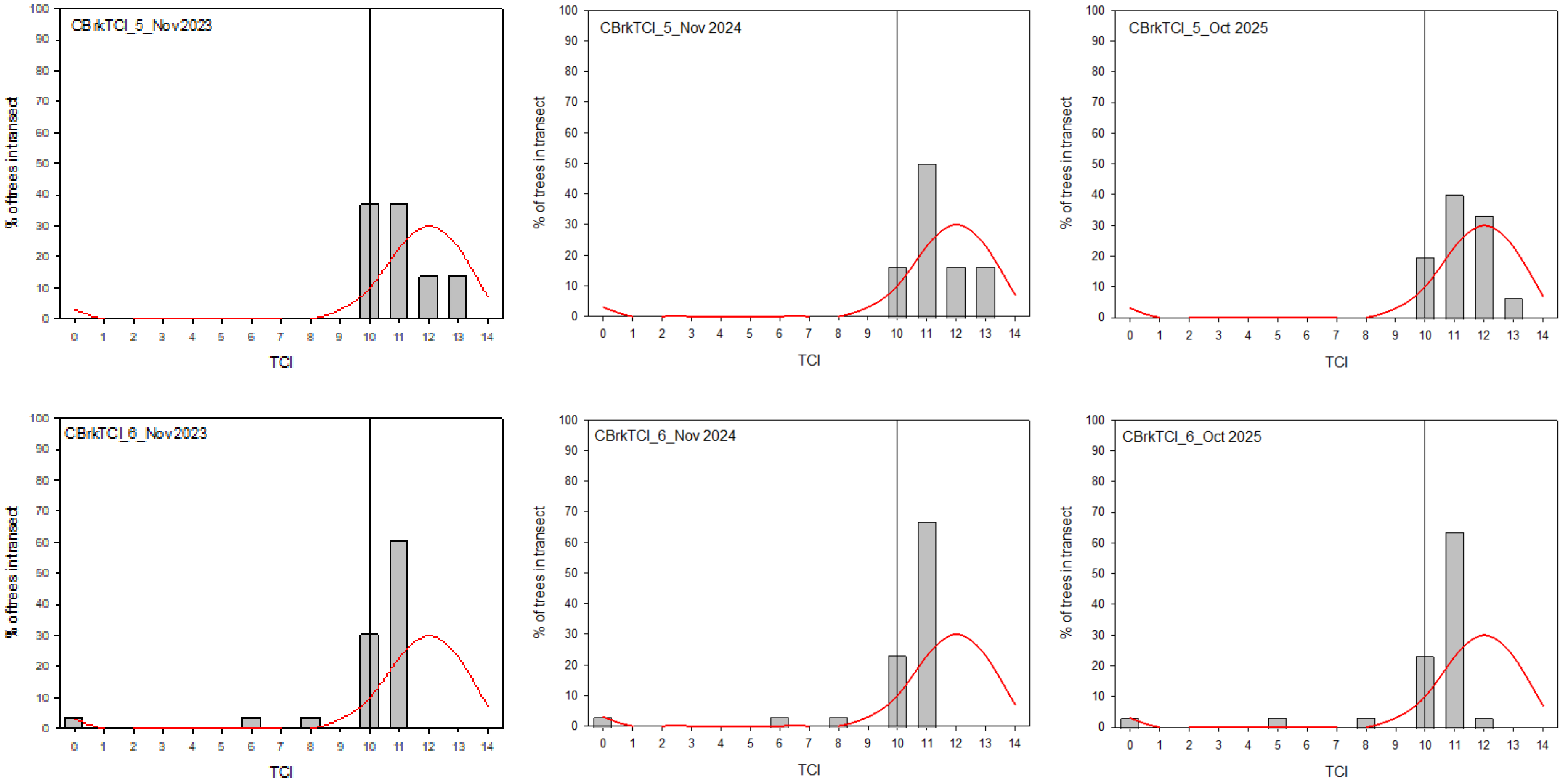

Figure 5 cont. Proportion of river red gum in each TCI score group at Crystal Brook Creek in November 2023, November 2024 and October 2025. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

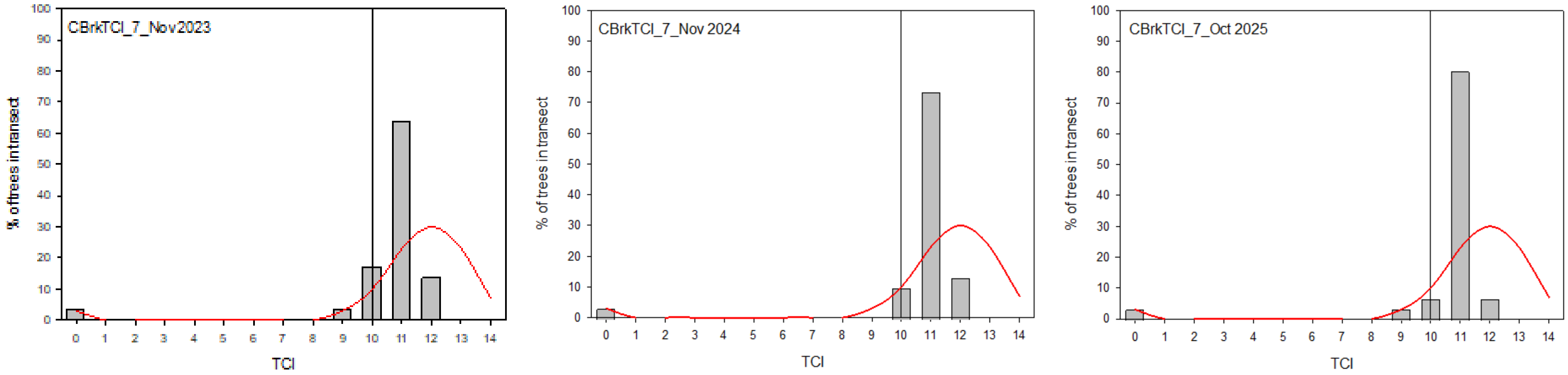

Figure 5 cont. Proportion of river red gum in each TCI score group at Crystal Brook Creek in November 2023, November 2024 and October 2025. The vertical reference line at TCI = 10 represents the Environmental Target, the spline curve (red line) is the reference condition against which observational data from monitored transects can be considered.

Figure 6: Ground based photo-point of CBrkTCI_1. Clockwise from top left November 2023, November 2024 and October 2025. Image is looking downstream.

Figure 7: Ground based photo-point of CBrkTCI_2. Clockwise from top left November 2023, November 2024 and October 2025. Right hand side of photo is upstream.

Figure 8: Ground based photo-point of CBrkTCI_3. Clockwise from top left November 2023, November 2024 and October 2025. Right hand side of photo is downstream.

Figure 9: Ground based photo-point of CBrkTCI_4. Clockwise from top left November 2023, November 2024 and October 2025. Image is looking downstream.

Figure 10: Ground based photo-point of CBrkTCI_5. Clockwise from top left November 2023, November 2024 and October 2025. Image is looking downstream.

Figure 11: Ground based photo-point of CBrkTCI_6. Clockwise from top left November 2023, November 2024 and October 2025. Image is looking upstream.

Figure 12: Ground based photo-point of CBrkTCI_7. Clockwise from top left November 2023, November 2024 and October 2025. Image is looking upstream.

5. Recommendations

Planned delivery of environmental water

Within Crystal Brook Creek, it is considered likely that perched low salinity groundwater lenses replenished by seepage from the reservoir, rainfall and in-channel flows, are a key source of soil water sustaining the growth and persistence of river red gums along the creek.

A high percentage of viable trees throughout the assessment locations are characterised by the presence of epicormic growth. This is an indicator of partial recovery from preceding water stress. Based on the ongoing presence of trees with TCI scores ≤8 in transects 4 and 6, it is recommended that pending water availability, planning for delivery of environmental water commences as soon as practicable. This will support the ongoing recovery of trees that have previously responded to improved soil water potential (as indicated by the high prevalence of epicormic growth) and increase the likelihood of recovery and achieving the Environmental Target.

Flows to support recruitment processes

Whilst size is a poor indicator of age, the data (Wallace 2023) demonstrates successful recruitment over recent decades has occurred in the more upstream sites (CBrkTCI_1-5), as indicated by a relatively high number of trees with DBH <50 cm. In contrast, the lack of recruitment in recent decades at the more downstream transects CBrkTCI_6 and 7 is demonstrated by the distinct lack of trees with DBH <50 cm.

River red gum in the south-western most section of the Murray-Darling Basin generally produce buds in January-February (summer), typically flowering between September-December (spring–early summer) every two years, with mature fruit retained in the crown for up to two years (George 2004; Jensen *et al.* 2007). Consequently, the likelihood of a successful germination event is dependent on antecedent conditions, and the likelihood of germinant survival through sapling stage is dependent on conditions following germination; either a follow-up flow or high rainfall, and low grazing pressure from domestic stock and native herbivores. It is of note that a relatively high percentage of trees were flowering at the time of the November 2023 and 2024 surveys, and a large percentage of trees were carrying buds during the October 2025 surveys, indicating that an environmental flow could have potential to support a germination event.

Whilst frequent (sub-decadal scale) recruitment is not required to maintain the existing ecological character of the creek, existing recruitment processes (seedling establishment and survival through to mature tree) are inadequate at the downstream locations. Consequently, it is recommended that environmental water releases be used to support the key recruitment processes of seedling survival and sapling growth when germination is recorded following unregulated spills and/or managed releases. In order to achieve this, it is recommended that population demographics are monitored through establishment of spatially standardised quadrats that specifically target the detection and tracking the abundance of early life stages (seedlings and saplings) post flows.

6. References

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