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Monitoring the response of littoral and floodplain vegetation to weir pool raising - 2014

Susan Gehrig, Kate Frahn and Jason Nicol

SARDI Publication No. F2015/000390-1
SARDI Research Report Series No. 844

SARDI Aquatics Sciences
PO Box 120 Henley Beach SA 5022

June 2015

PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

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EXECUTIVE SUMMARY

Along the lower River Murray, a series of 11 Locks and Weirs are managed to provide stable water levels for irrigation and navigation, resulting in reductions in hydrological variability and complexity. Flow stabilisation tends to favour species adapted to comparatively stable, lentic conditions and potentially limit the life history processes of native biota adapted to lotic environments. Flow regulation along longitudinal gradients also contributes to reduced river-floodplain connectivity so that the River Murray is now constrained within its channel for prolonged periods, leading to a subsequent decline in riparian and floodplain vegetation condition. Various management interventions have been trialled along the River Murray to provide environmental benefits by means of water level management. Weir pool surcharge is one method used to increase river channel water level variability and deliver water to temporary wetlands and the low lying floodplain. A weir pool raising event was undertaken in the River Murray (weir pools 1 and 2) in spring 2014 and this report details an assessment of the response of littoral understorey and river red gum (*Eucalyptus camaldulensis*) trees.

While the primary aim of the project was to assess the response of vegetation to weir pool raising a secondary aim to assess the suitability of two different monitoring techniques was also undertaken. Therefore, the response of the littoral understorey plant communities and river red gums were assessed using two methodologies, the first of which intensively surveys an indicator site within each of the lower, middle and upper zones of Weir Pool 1 (between Lock 1 and 2), while the second focuses on providing spatial coverage along the lower, middle and upper zones of Weir Pool 2 (between Lock 2 and 3).

For Weir Pool 1, an indicator wetland was selected within each weir pool zone, where six paired river-wetland sites were established for monitoring of littoral understorey communities. Within the paired river-wetland sites, transects were established perpendicular to the waterline and species abundance (measured as frequencies) were determined from quadrats established at 0 cm (pool level), 10 cm elevation intervals from +0.1 m to +0.6 m (inclusive), +0.8 m and +1.0 m above pool to the wetland shoreline or riverbank. A tree condition site was also established within each zone (≤ 50 river red gums) and tree crown condition was assessed using the technique outlined by Souter *et al*. (2009; 2010) and changes in Plant Area Index (PAI) of river red gums were also assessed using hemispherical photographs. Littoral understorey vegetation and tree condition assessment surveys were undertaken in September 2014, when weir pool water levels were 0.3 m above pool level, before a further raising to +0.5 m in early-November.

Further surveys were also undertaken in January and April 2015 after water levels had returned to slightly below pool level (due to structural issues arising from Weir and Lock 1).

For Weir Pool 2, a range of wetlands were selected along each weir pool zone. Within each site, one or two paired river-wetland and tree condition sites (≤30 river red gums) were established. Littoral understorey vegetation and tree condition assessment surveys were undertaken using the same methods described above in September 2014, when weir pool water levels were raised to 6.4 m AHD (0.3 m above pool level), before a further raising of 0.2 m in early-November. A follow up was then undertaken in January 2015; five weeks after water levels had returned to pool level.

Overall, there were few significant changes in the plant community between surveys that were attributable to weir pool manipulation, particularly in the river channel. Riverbanks within Weir Pool 1 were often steep and densely vegetated with emergent species that did not significantly change in abundance between the 0 to +0.8 m elevations, although distinct changes in riverbank plant communities occurred at the +1.0 m elevation as a result of the presence of terrestrial winter annuals in September 2014. Similarly, along the riverbanks in Weir Pool 2, littoral understorey vegetation also remained largely unchanged between surveys, although there was a significant difference detected at the 0 m elevation (pool level), where open water was abundant in September 2014, but terrestrial damp and amphibious taxa abundances increased by January 2015.

Wetlands were generally more species rich than riverbanks and the littoral understorey plant communities typically exhibited temporal variability between surveys. At the lowest elevations, significant changes in understorey plant communities were evident, with increases in the abundances of a range of amphibious, floodplain and emergent taxa following inundation. At intermediate elevations (between +0.2 to + 0.5 m), the changes were predominantly driven by increased abundances of exotics, such as *Heliotropium europaeum* or *Paspalum distichum*, while at the highest elevations (>+0.6 m) the changes were driven by the seasonal presence of terrestrial winter annuals in September 2014.

There were also distinct differences between weir pool zones in regards to littoral understorey vegetation. Specifically the lower zones of each weir pool tended to be characterised by a larger number of indicator species than the middle and upper zones, hence the observed changes in plant communities at the lowest elevations following inundation were often more pronounced in the lower river reaches.

Changes in river red gum condition across weir pools and between surveys were highly variable. There were noticeable changes in tree crown condition assessments between zones, with an overall shift from the majority of trees being in moderate condition to the majority of trees being in moderate to good condition. Unexpectedly there was a discernible improvement in tree crown condition in the upper zones of both weir pools between surveys (particularly Weir Pool 2), compared to the lower and middle zones. This particular zone was anticipated to the be the least likely affected by weir pool manipulations; however, prior to weir pool raising, there was a small unregulated flow that increased water levels up to 1.05 m in the tailwater and upper zones (below Locks 2 and 3) during July and August 2014. Hence trees within the upper zones were potentially exposed to a longer duration of inundation and increased water availability (lateral bank recharge), than trees within the lower and middle zones. Furthermore the magnitude of the water level rise was greater in the upper zone than the rise provided by the weir pool raising.

The most significant changes observed in littoral understorey and riparian tree condition were observed in Weir Pool 2, which used an experimental design to provide greater spatial coverage across a zone compared to the method used in Weir Pool 1, which was designed to intensively survey an indicator site within each zone. Increasing the spatial coverage of plant communities assessed in Weir Pool 2, increased the statistical power and helped to detect responses that were not as adequately detected in Weir Pool 1, although this specific method was more time consuming and resource dependent.

While there were observed changes in the littoral understorey vegetation at the lower elevations of riverbanks (Weir Pool 2 only) and wetlands, these changes were slight and not likely to have been biologically significant. However, if weir pool manipulations were to occur more frequently and for longer, the opportunities for increasing diversity and re-distribution of taxa at these lower elevations may increase. As weir pool manipulations of this height and duration did not appear to have much influence on riverbank plant communities it is recommended that future monitoring of vegetation response concentrate on wetlands. Monitoring of wetland littoral understorey may be best designed to compare responses between different wetland types (i.e. permanent versus temporary), target the response of key indicator taxa (and/or functional groups) and/or assess the potential impacts of particular pest plants that may be encouraged through weir pool manipulations.

Future monitoring of riparian tree responses would ideally include the range of floodplain trees distributed across the river-floodplain gradient (*Eucalyptus camaldulensis, Eucalyptus* *largiflorens* and *Acacia stenophylla*) as this would potentially help to define the extent of inundation and/or lateral bank recharge. For future weir pool manipulations, physiological measurements indicative of changes in water status of long-lived vegetation are recommended as a means of assessing response. Tree responses to increased water availability may be expressed as rapid changes (hours – days) in physiological parameters, but the lag time for detecting improvements in crown extent/condition are typically longer (weeks to months) and therefore may be missed. Thus, measurement of physiological parameters may allow instantaneous and accurate assessment of response relative to typical tree condition approaches. In addition, measurements of changes in soil moisture and salinity across the monitoring period would help to elucidate the magnitude and extent of lateral bank recharge and define causal relationships between changes in tree condition and hydrology.

1. INTRODUCTION

1.1. Background

Since the 1920s, the lower River Murray has become a highly regulated system with a series of eleven low level weirs between Mildura and the Lower Lakes (Walker 1985). The weirs are primarily managed to provide stable water levels for irrigation and navigation (Maheshwari *et al.* 1995), resulting in decreased hydrological variability, increased water level stability, and reduced hydraulic complexity (Walker *et al*. 1995; Bunn *et al.* 2006). Altered river channel hydrodynamics as a result of river regulation, may no longer facilitate the life history processes of native biota adapted to dynamic lotic environments (e.g. flow-cued spawning fish and/or flood dependent vegetation) but instead favour the proliferation of generalist biota (native and non-native), which are more tolerant of comparatively stable lentic conditions (Geddes 1990; Walker and Thoms 1993; Blanch *et al.* 2000; Roberts and Marston 2000; Clavero *et al*. 2004; Jensen *et al*. 2008; Gehrig 2010; Bice *et al.* 2011)

Flow regulation along longitudinal gradients (in conjunction with upstream water diversions) also reduces lateral, river-floodplain connectivity (Maheshwari *et al.* 1995). For instance, the River Murray is now constrained within its channel for prolonged periods and subsequently floodplain vegetation health has severely declined (Roberts 2003; Overton *et al.* 2006; Cunningham *et al.* 2009; Mac Nally *et al.* 2011). This decline is primarily attributed to soil salinisation as a result of altered surface water regimes and changes in groundwater–surface water interactions between the River Murray and its floodplain (Jolly *et al.* 1993; Slavich *et al.* 1999; Overton *et al.* 2006).

Prevention of further channel, wetland and floodplain decline along the River Murray may be possible by using existing flow control structures to manage water levels (see Galat *et al*. 1998; Jenkins *et al.* 2008). Weir pool surcharge is one method of increasing river channel water level variability and delivering water to the floodplain, independently of elevated discharge, and provides promise as a method of enhancing floodplain vegetation health. In 2000, Lock 5 water levels were raised to 50 cm above the normal operating level (herein referred to as full supply level: FSL), for a period of two weeks, inundating a small area of low lying floodplain and temporary wetlands and resulting in significant recruitment of flood dependent species and a decrease in abundance of terrestrial species (Siebentritt *et al.* 2004). Similarly, in 2005–2006 a combination of weir pool surcharge and increased flow was used to raise water levels of the Lower River Murray's Chowilla anabranch system (Souter *et al.* 2014). As a result of increased water levels in anabranch creeks on the Chowilla floodplain and through horizontal recharge freshening of the adjacent groundwater, there was a significant improvement in the condition of river red gums (*Eucalyptus camaldulensis*) trees (Souter *et al.* 2014).

A weir pool raising event was undertaken in the River Murray (weir pools 1 and 2) in spring 2014 and this report details the monitoring and assessment of vegetation response to this event. The following hypotheses were considered:

- H1: weir pool raising of +50 cm would inundate wetland and low lying floodplain areas (which would have otherwise remained dry for a comparable flow level without weir pool raising) and increase the establishment of taxa from floodplain and amphibious plant functional groups.
- H2: A weir pool raising of +50 cm would lead to increased abundance of riverbank, emergent vegetation due to increase water availability,
- H3: A weir pool raising of +50 cm would improve the crown condition of river red gums adjacent to riverbanks and wetlands due to increased water availability

1.2. Objectives

The over-arching aims of this project were to monitor and assess the response of littoral and floodplain vegetation (including river red gum condition) including:

- the response of littoral understory plant communities of the river channel and adjacent wetlands in response to weir pool raising,
- the condition of river red gums (*Eucalyptus camaldulensis*) in response to weir pool raising, and
- the germination of red gum seeds in areas inundated by weir pool raising.

2. METHODS

2.1. Weir pool raising overview

Weir pool raising occurred in Lock 1 and Lock 2 of the River Murray, the planned weir pool raising was to raise water levels in both weir pools a maximum of 50 cm above normal pool level. Water levels in both weir pools were raised 30 cm above normal pool level in late August 2014 and held until October, when levels were raised another 10 cm and held for two weeks (Figure 1). Water levels were raised another 10 cm in November and held for two weeks in Weir Pool 2, but only one week in Weir Pool 1 due to structural issues with the weir (Figure 1). Water levels were returned to normal pool level in Weir Pool 2 by mid-December (Figure 1). Due to the structural issues in Weir Pool 1, water levels were returned to pool level in early-December but fell to 10 cm below normal pool level where they remained (Figure 1). The weir pool raising event is described in detail in the draft Riverine Recovery Lock 1 spring 2014 Weir Pool Raising Event Plan and Riverine Recovery Lock 2 spring 2014 weir pool raising event plan.

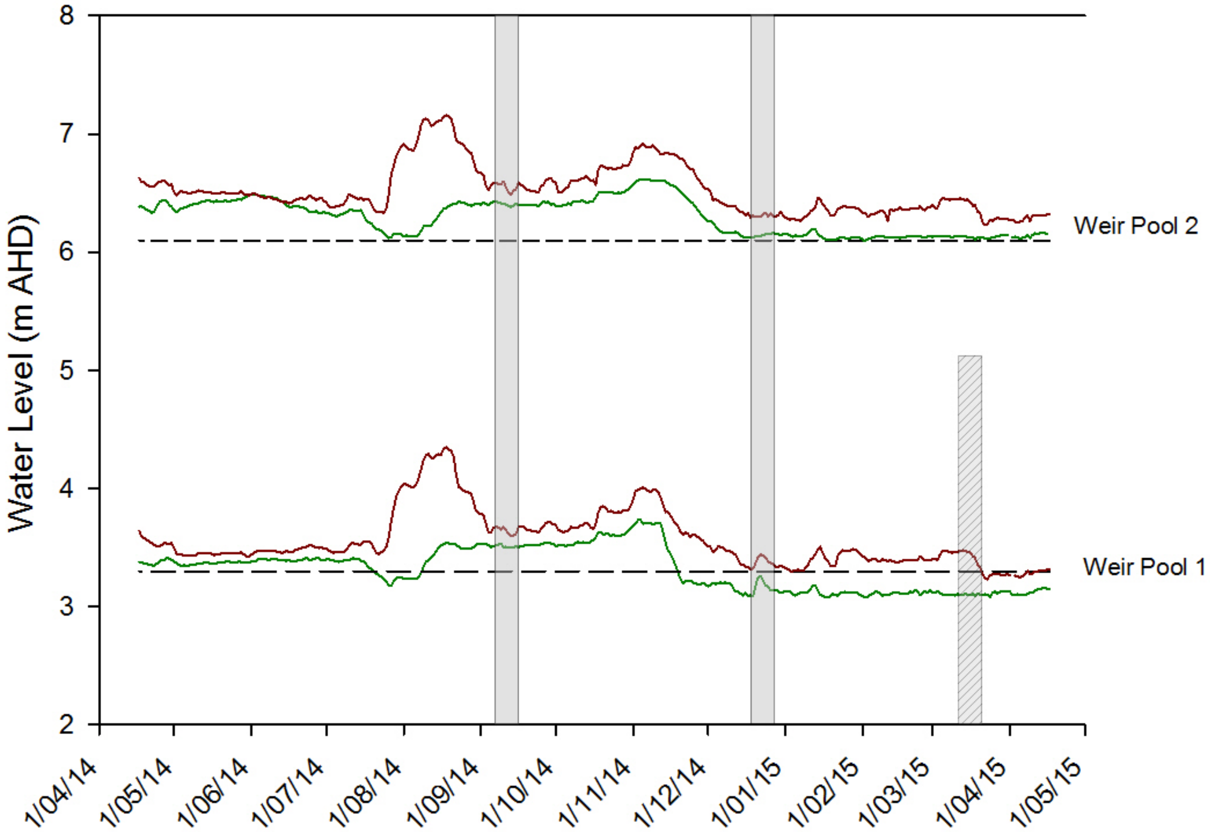

Figure 1: Daily surface water levels (m AHD) for Weir Pool 1 and 2 from April 2014 – May 2015 recorded upstream of the controlling (downstream) Lock and Weir (green lines) and downstream of the antecedent (upstream) Lock and Weir (red lines), relative to normal pool level (dashed, black lines). Grey bars represent sampling times for littoral understorey and tree condition surveys in weir pools 1 and 2; hashed grey bar represents follow-up tree condition surveys undertaken (Weir Pool 1 only).

2.2. Study region

Longitudinal water regime gradients exist along the length of the weir pools of the lower River Murray, such that during entitlement flows water levels (river stage) in the zone above each weir exhibit little variation (e.g. ±50 mm, lower pool zone), but the tailwater zones are subject to daily variations of ±200–500 mm (Maheshwari *et al*. 1995; Blanch *et al*. 2000; Walker 2001) (see Figure 1; Figure 2). Hence, increasing distances downstream from a lock correspond to decreasing amplitudes in water level variability (Blanch *et al.* 1999).

In regards to weir pool surcharge, changes to water level variability are likely to be greater within the lower pool zone (immediately upstream of the weir), but will decrease with increasing distance upstream. Accordingly, sites were selected within these weir pool zones (tailwater excluded) with the upper pool (zone likely to be least impacted by the weir pool surcharge) representing an unmanaged treatment.

Weir and Lock 1 (Blanchetown) are located 274 km (middle thread distance, MTD) upstream from the Murray Mouth, and normal pool level is 3.2 m AHD (Australian Height Datum) with a typical head difference of 2.1 m AHD. Weir and Lock 2 (Taylorville) are located 362 river km upstream from the Murray Mouth and normal pool level is 6.1 m AHD with a typical head difference of 2.8 m.

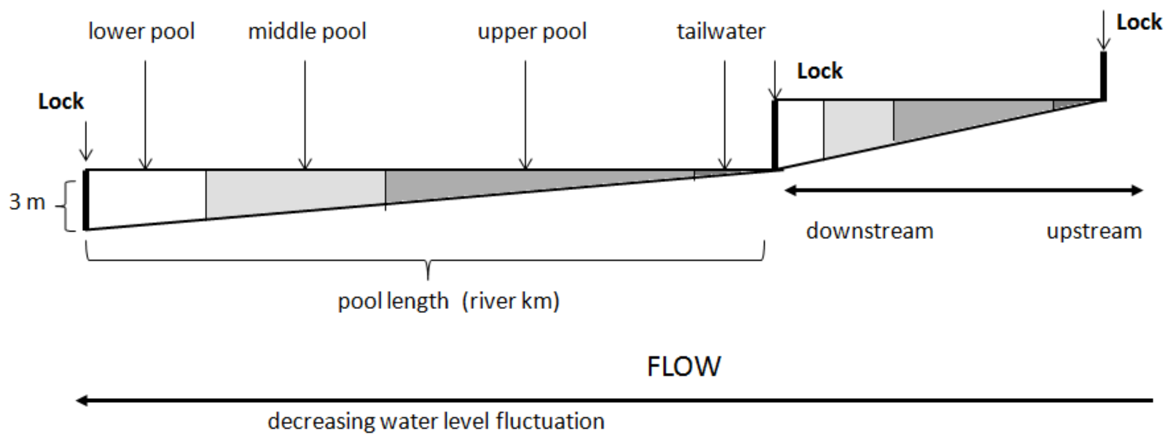

Figure 2: Schematic diagram characterising the nature of daily water level variability within weir pools of the Lower River Murray, South Australia. When the river is within channel, distinct weir pools zones form, where lower pool zones are characterised by minimal water level variability, while water levels in tailwater zones are highly variable (modified from Walker 2001).

2.3. Vegetation surveys and red gum condition

The response of the littoral understorey plant communities and the monitoring of river red gum condition were analysed using two different methodologies in each of the manipulated weir pools. For the Lock 1 weir pool, a method was adopted the first of which intensively surveyed an indicator site within each of the weir pool zones to maximise sampling effort (Figure 2). For the Lock 2 weir pool, an alternative method was adopted that focused on greater replication and spatial coverage along the reaches of the weir pool, with less sampling effort at individual sites. Locations of quadrats, tree canopy photographs and river red gums used for condition assessment are presented in Appendix 1.

2.3.1 Weir Pool 1

For Weir Pool 1 (between Lock 1 and 2), an indicator wetland was selected within each weir pool zone to assess the benefits of weir pool raising (Figure 3; Figure 4). For each wetland selected within the a) lower, b) middle, and c) upper river reaches of the weir pool (Table 1); six paired river-wetland sites were established (*n* = 12 sites; 6 river and 6 wetland) (Figure 3) for monitoring of littoral understorey communities. There were a total of 36 littoral understorey sites surveyed in Weir Pool 1.

Littoral understorey vegetation and tree condition assessment surveys were undertaken in September 2014, when weir pool water levels were raised to 3.5 m AHD (+0.3 m above pool level), before a further raising to 3.7 m AHD in early November. A second survey was undertaken in January 2015; eight weeks after water levels had returned to normal pool level (or slightly below due to structural issues arising from Weir and Lock 1) (Figure 1). An additional follow-up assessment of tree condition was undertaken in the Lock 1 weir pool in April 2015, a further 13 weeks following weir pool raising, when weir pool levels were approximately 3.15 m AHD (-0.05 m below pool level) (Figure 1).

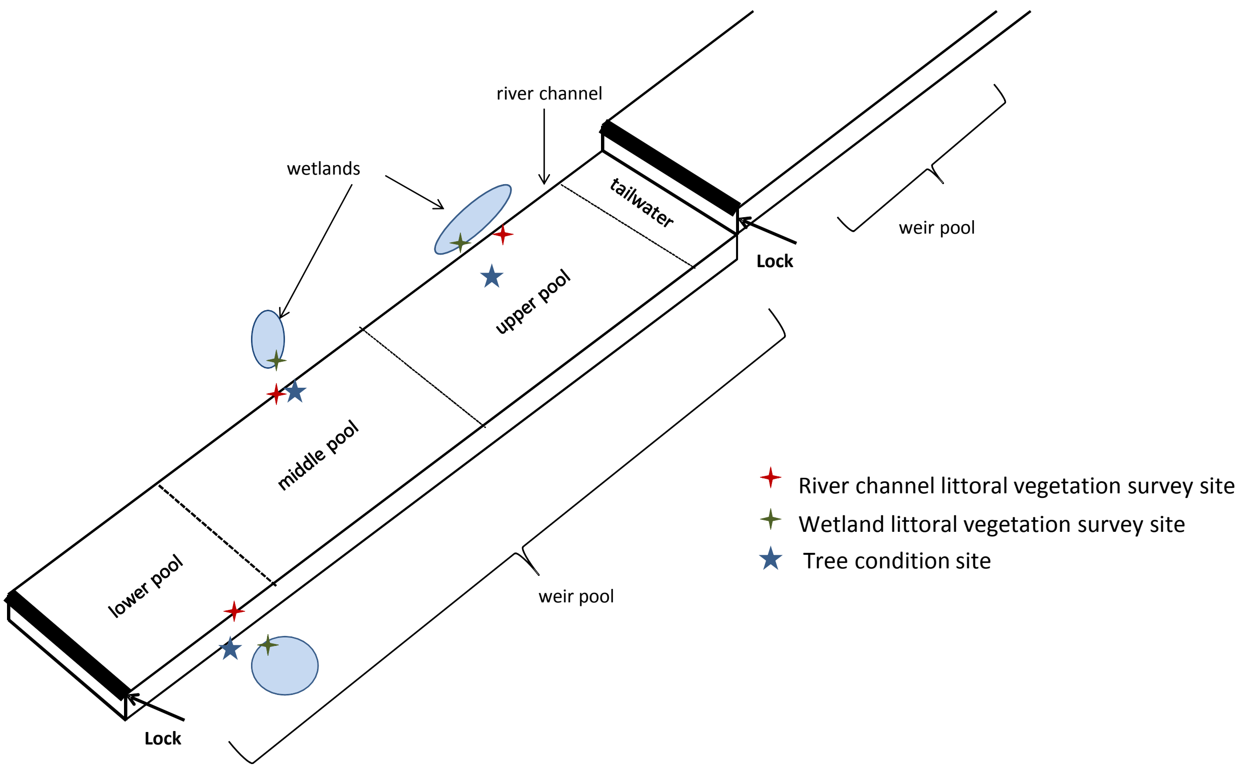

Figure 3: Site selection for Weir Pool 1 (between Locks 1 and 2) using a method based upon intensively surveying an indicator site within zones (lower, middle, upper) of a weir pool.

Table 1: Location of selected wetlands within Weir Pool 1, their respective weir pool zones and the corresponding number of paired river-wetland littoral vegetation transects and *Eucalyptus camaldulensis* condition monitoring sites, in response to weir pool raising in spring 2014.

Weir pool	**Zone**	**Wetland**	**Total number of paired river-wetland transects**	**Total number *Eucalyptus camaldulensis* trees per site**
1	Lower	Arlunga	12 (6 – 6)	45
1	Middle	Murbko Flat Complex	12 (6 – 6)	50
1	Upper	Weston Flat Lagoon	12 (6 – 6)	50

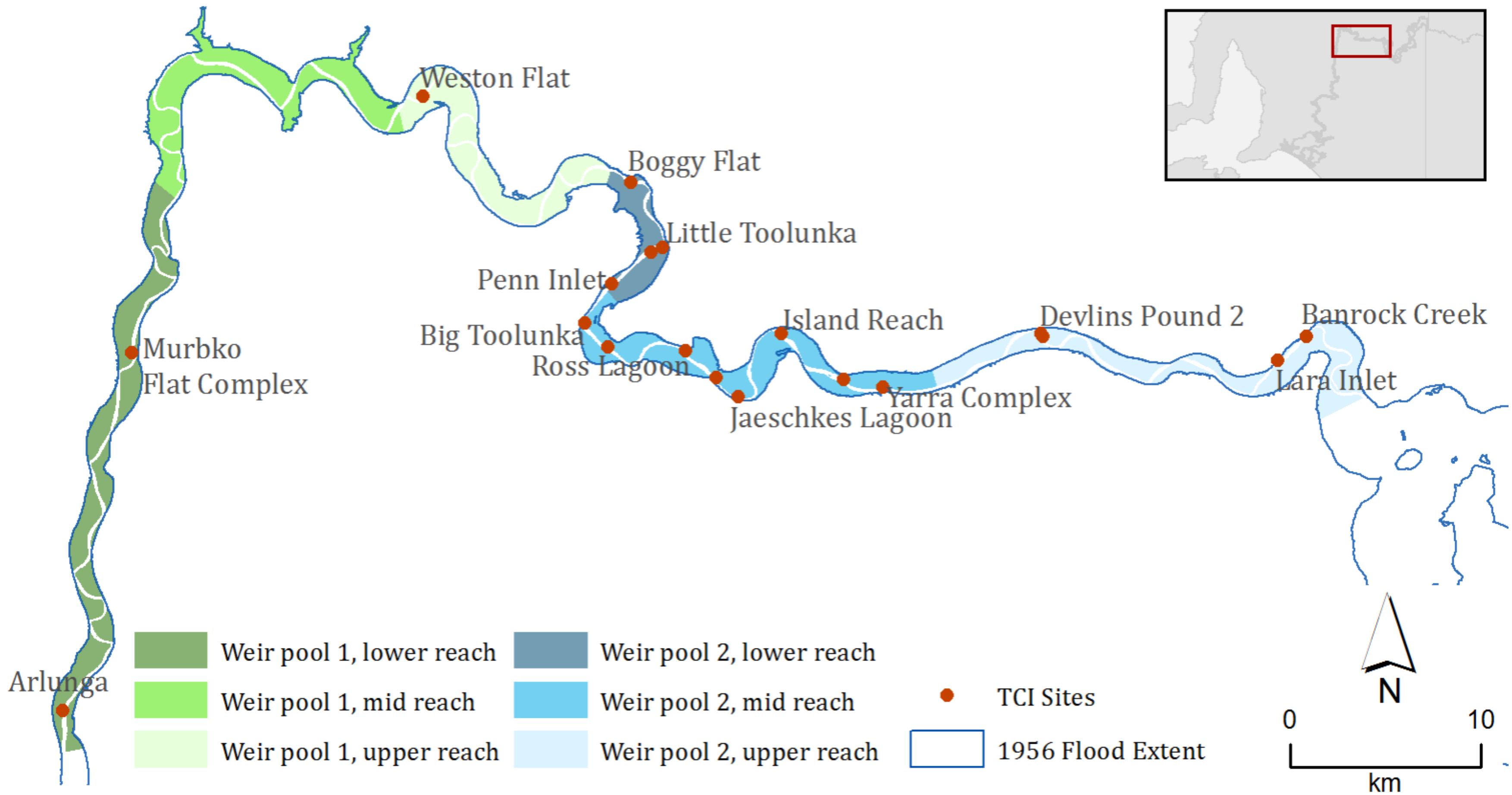

Figure 4: Map of Weir Pool 1 and Weir Pool 2 showing the study wetlands.

2.3.1.1 Littoral vegetation surveys

Where the six paired river-wetland sites were established within a wetland, a littoral vegetation transect was established perpendicular to the waterline (*n* =12 transects) (Figure 5). Quadrats (1 x 15 m) were established on each transect at 0 cm (River Murray pool level), and then at 10 cm elevation intervals from +0.1 m to +0.6 m (inclusive), then +0.8 m and +1.0 m above pool (measured using a laser level) parallel to the shoreline or bank (Figure 5). Species abundance was measured by frequencies; where the quadrat was split into fifteen, 1 x 1 m cells and plants present in each cell recorded. Therefore, a species has a score of between 0 (not present) and 15 (present in each cell) for a quadrat. A cell with no live plants present was given a score of one for bare soil. The aforementioned methods have been used successfully by a number of vegetation monitoring projects in South Australia upstream of Wellington (Weedon and Nicol 2006; Weedon e*t al.* 2007; Marsland *et al.* 2008; 2009; Gehrig *et al.* 2010; Nicol 2010; Nicol *et al.* 2010), at Markaranka (Marsland and Nicol 2009) and the Lindsay Mullaroo system and Hattah Lakes (C. Campbell *pers. comm.*). Plants were identified to species (where possible) using keys in Jessop and Tolken (1986), Jessop *et al.* (2006), Cunningham *et al.* (1981), Dashorst and Jessop (1998), Sainty and Jacobs (1981; 2003), Prescott (1988) and Romanowski (1998). Nomenclature follows the Centre for Australian National Biodiversity Research and Council of Heads of Australasian Herbaria (2015).

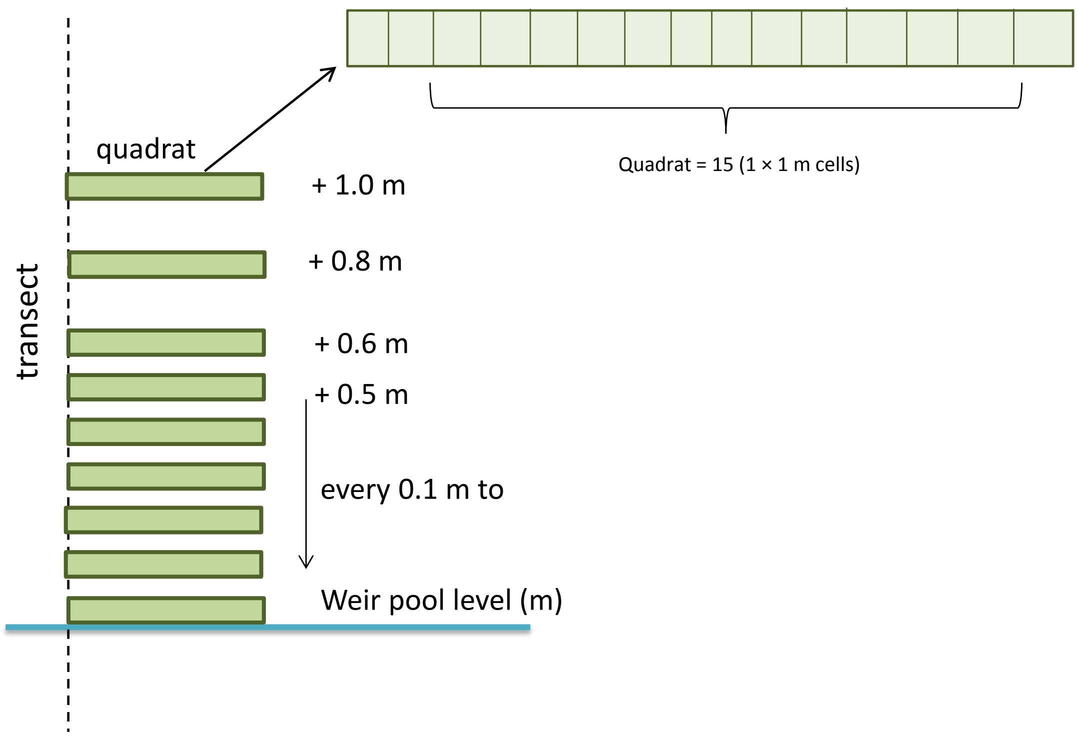

Figure 5: Littoral vegetation transect: plan view showing placement of quadrats relative to waterline.

2.3.1.2 River red gum condition

At each wetland surveyed in Weir Pool 1, a tree condition site was established (Figure 3), with up to 50 river red gum trees selected for condition assessment. Individual trees were marked (using yellow cattle tags), numbered and their position recorded with GPS (Garmin® GPSMap62s). Tree condition assessment used the technique developed by Souter et al (2008; 2010) for assessment of *Eucalyptus camaldulensis*. This method takes into consideration: crown extent and density, bark form, epicormic growth and state, reproduction, crown growth, leaf die off and damage, and mistletoe (Appendix 2; Souter *et al.* 2009; Souter *et al.* 2010). Therefore, condition and trajectory (whether condition is improving or declining) are assessed (Souter *et al.* 2009; 2010).

Measurements of diameter at breast height (DBH) were recorded at 1.3 m above ground for trees with DBH ≥10 cm, following the technique described by Souter *et al.* (2009). Where there were multiple stems, the DBH of each stem was recorded. Where swelling or a limb occurred at 1.3 m, two unaffected points, equally spaced above or below, were measured and averaged to give an estimate of DBH. Trees considered long-term dead (i.e. no bark, or severe cracks present) were excluded, but trees were no foliage was visible, but bark was still intact were tagged and measured.

Changes in Plant Area Index (PAI) were also recorded to assess changes in tree canopy. PAI is the area of leaves and stems per unit ground area without adjustment for clumping of canopy components. PAI is determined from hemispherical photographs taken using a digital camera and fisheye lens with full 180° field of view. Within each tree condition monitoring site, four randomly selected, permanent locations were marked with a wooden stake and position recorded using a handheld GPS (GARMIN® GPSMap62s). For each survey period, the tripod and digital camera (CANON EOS 700D; Sigma 4.5 mm F2.8 circular fisheye lens adapter) were positioned at 1.3 m height and once levelled, three upward facing (i.e. lens pointing 90° to the horizontal plane) images were taken using the following settings:

- AV mode
- F-value = >9.0
- ISO = > 800
- Exposure/AEB: 0 (normal), +1 (overexposure) and -1 (underexposure).
- Picture style: standard
- One shot, continuous file numbering
- RAW + JPEG file type

The presence and location of any germinated *Eucalyptus camaldulensis* seedlings observed during the field surveys (if any) were also recorded (and marked with GPS).

2.3.2 Weir Pool 2

For Weir Pool 2 (between Lock 2 and 3) a range of wetlands were selected along each river reach within the weir pool (Figure 4; Figure 6). For each wetland selected within the a) lower, b) middle, and c) upper river reaches of the weir pool (Table 2); one or two paired river-wetland sites were established (*n* = 12 sites per reach; 6 river and 6 wetland) (Figure 4; Figure 6). There were therefore a total of 36 littoral understorey sites surveyed in Weir Pool 2. Littoral understorey vegetation and tree condition assessment surveys were undertaken in September 2014, when weir pool water levels were raised to 6.4 m AHD (+0.3 m above normal pool level). Weir pool levels were raised a further 0.2 m in early-November and held for approximately 2 week duration before returning to normal pool level. A second survey was undertaken in January 2015; five weeks after water levels had returned to pool level (Figure 1).

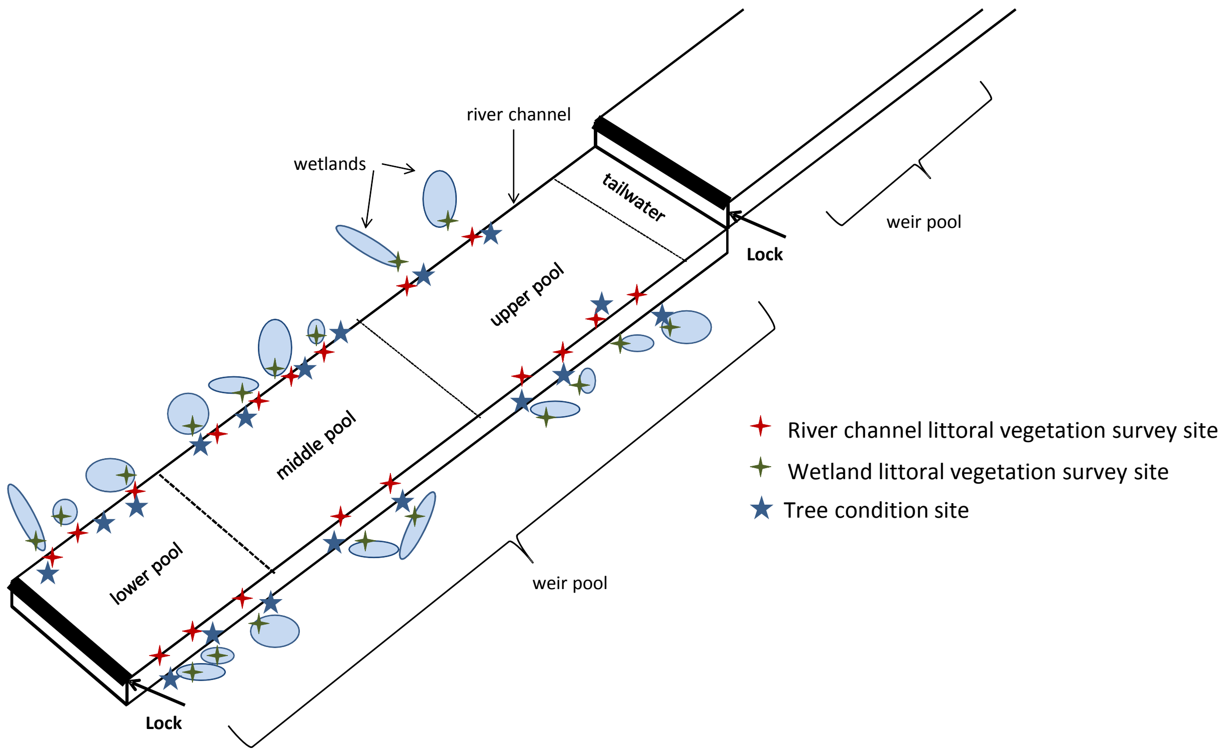

Figure 6: Site selection for Weir Pool 2 (between Locks 2 and 3) using a method based upon extensive spatial coverage within zones (lower, middle, upper) of a weir pool.

Table 2: Location of selected wetlands within Weir Pool 2, their respective weir pool zones and the corresponding number of paired river-wetland littoral vegetation transects and *Eucalyptus camaldulensis* condition monitoring sites, in response to weir pool raising in spring 2014 (tree numbers varied between sites due to there not being 30 trees with DBH>10 cm at some sites).

Weir pool	Zone	Wetland	Total number of paired river-wetland transects	Total number *Eucalyptus camaldulensis* trees per site
2	Lower	Boggy Flat	2 (1 – 1)	30
2	Lower	Little Toolunka	4 (2 – 2)	60 (30, 30)
2	Lower	Penn Inlet	2 (1 – 1)	30
2	Lower	Big Toolunka	4 (2 – 2)	60 (30, 30)
2	Middle	Island Reach	2 (1 – 1)	24
2	Middle	Ross Lagoon	2 (1 – 1)	30
2	Middle	Jaeschke Lagoon	4 (2 – 2)	30 (18, 12)
2	Middle	Yarra Complex	4 (2 – 2)	60 (30, 30)
2	Upper	Devlins Pound	2 (2 – 2)	60 (30, 30)
2	Upper	Lara Inlet	2 (2 – 2)	48 (30, 18)
2	Upper	Banrock Creek	4 (2 – 2)	52 (30, 22)

2.3.2.1 Littoral vegetation surveys

For Weir Pool 2 (between Lock 2 and 3), a number of wetlands were selected within each weir pool zone (Figure 1; Table 2) to increase spatial coverage within the river reach (Figure 6). At each wetland, one to two paired river-wetland littoral vegetation sites were established (Figure

5) and within each of these, one transect was established perpendicular to the waterline (*n* = 36 transects within Weir Pool 2; representing the same number established in weir pool 1) (Figure 3). Quadrats were established on each transect at 0 cm (River Murray pool level), and then every 10 cm from +0.1 m to +0.6 m (inclusive), then +0.8 m and +1.0 m above pool (measured using a laser level) parallel to the waterline (Figure 5). Abundance was measured by frequencies; where the quadrat was split into fifteen 1 x 1 m cells and plants present in each cell listed. Therefore, a species has a score of between 0 (not present) and 15 (present in each cell) for a quadrat. A cell with no live plants present was given a score of one for bare soil.

2.3.2.2 Red gum condition

In Weir Pool 2, up to 30 *Eucalyptus camaldulensis* trees were selected at each paired river-wetland site (adjacent to the understorey survey sites; Figure 6). Each tree was marked with a cattle ear tag and position recorded by GPS. Tree condition assessment used the technique described in Section 2.3.1.2 above.

2.4. Data Analysis

The changes in littoral understorey floristic composition before and after weir pool raising were analysed with PERMANOVA (Anderson 2001; Anderson and Ter Braak 2003) and Indicator Species Analysis (Dufrene and Legendre 1997) using the software packages PCOrd version 5.12 (McCune and Mefford 2006) and PRIMER version 6.1.12 (Clarke and Gorley 2006). Bray-Curtis (1957) similarities were used to calculate the similarity matrices for PERMANOVA analyses and NMS ordinations.

River red gum crown extent and density were assigned categorical scores for each tree within each site, zone and weir pool. A tree condition index score was also determined as the product of crown extent and crown density per cent scores producing a range of values between 0 – 1 (modified from Harper and Shemmield 2012; Department of Environment, Water and Natural Resources 2012). Equation 2 was then used to standardise scores to a range between 0 – 1 to determine a Tree Condition Index (TCI).

Equation 1:

$$TCI\ score\ (y') = \frac{y_{extent} \times y_{density}}{1000}$$

Where y' is the standardised value for the TCI score (between 0 and 1), y_{extent} is the raw percentage score for crown extent divided and $y_{density}$ is the raw percentage score for crown density.

Plant Area Index (PAI) was determined from the digital hemispherical photographs of the canopy. To improve the contrast between vegetation and sky, images were first classified using image analysis (MultiSpec Application Version 3.1, Purdue University) and PAI was then calculated using WINPHOT 5.00 (ter Steege 1996, as described by Hale *et al.* (2013)).

To compare changes in river red gum condition between surveys, the TCI and PAI scores were compared between surveys times (September 2012 and January 2015) and zones (lower, middle and upper) within weir pools using a univariate two-factor PERMANOVA in PRIMER (Anderson 2001; Anderson and Ter Braak 2003). Euclidean distances were used to calculate the similarity matrices for PERMANOVA analyses and α = 0.05 for all analyses. When significant differences occurred, Mmultiple comparisons (where appropriate) were conducted using thea Bonferroni correction of significance was applied (Bonferroni corrected α = 0.05/ncomparisons) (Quinn and Keogh 2002).

3. RESULTS

3.1. Littoral understorey

Weir Pool 1

A total of 122 taxa (48 exotics, including three proclaimed pest plants in South Australia; one species listed as rare and one species listed as endangered in South Australia) were recorded from both surveys on the river bank and in wetlands in Weir Pool 1 (Appendix 3a and b). On the river bank 93 taxa (39 exotics) were recorded from both surveys with 75 recorded in September 2014 (before the weir was raised) and 63 in January 2015 (after the weir was raised and water levels returned to normal pool level). In wetlands, a total of 102 taxa (40 exotics) were recorded from both surveys with 83 recorded in September 2014 (before the weir was raised) and 77 in January 2015 (after the weir was raised and water levels returned to normal pool level). The reduction in taxon richness between the two surveys was primarily due to winter annuals, which were present at high elevations in September 2014, but absent in January 2015 (Appendix 3a and b).

In Weir Pool 1, there were no significant differences in the river channel littoral understorey vegetation between surveys for elevations from 0 to +0.8 m. However, there were significant differences between zones and the significant indicators characterising each elevation within each weir pool zone are presented in Table 4. A significant Survey × Zone interaction for the +1.0 m elevation indicated that littoral vegetation varied across surveys, but patterns of variation were not consistent among zones and survey times (Table 3). In particular, at the +1.0 m elevation, winter annuals such as, *Sonchus oleraceus* and *Medicago* spp. were more abundant during September 2014, but by January 2015, *Paspalum distichum* increased in abundance, particularly in the lower zone.

For the wetlands in Weir Pool 1, there were significant Survey × Zone interactions for the 0 m and +0.1 m elevations, indicating variation in littoral vegetation that littoral vegetation varied across surveys, but patterns of variation were not consistent among zones and survey times. In particular, at the 0 m elevation, open water and *Aster subulatus* were abundant during September 2014, but by January 2015 *Ludwigia peploides*, *Mimulus repens* and *Bolboschoenus caldwellii* occurred more frequently; but open water and *Mimulus repens* were more characteristic of the upper zone throughout the study period (Table 4; Table 5). At +0.1 m, a number of species increased in abundance following inundation (Table 5), however most of these changes occurred in the lower zone (Table 4). For the remaining elevations there were significant differences between zones and survey times (Table 3) as presented in Table 4 and Table 5.

Table 3: Two-factor PERMANOVA results comparing frequency of occurrence of littoral understorey at different elevations between survey times (trips) and weir pool zones within Weir Pool 1 (df = degrees of freedom; *p*-value = probability value; α = 0.05).

			River		Wetland	
Elevation (m)	**Factors**	**df**	***Pseudo-F***	***P-value***	***Pseudo-F***	***P-value***
0	Zone	2, 35	7.12	0.001	9.42	0.001
	Survey	1, 35	1.75	0.11	8.58	0.001
	Survey x Zone	2, 35	1.45	0.12	2.61	0.003
+0.1	Zone	2, 35	7.02	0.001	7.86	0.001
	Survey	1, 35	1.38	0.22	8.43	0.001
	Survey x Zone	2, 35	1.07	0.38	1.92	0.04
+0.2	Zone	2, 35	8.14	0.001	8.88	0.001
	Survey	1, 35	0.93	0.42	7.58	0.001
	Survey x Zone	2, 35	1.13	0.31	1.51	0.14
+0..3	Zone	2, 35	9.69	0.001	5.42	0.001
	Survey	1, 35	0.89	0.47	4.88	0.001
	Survey x Zone	2, 35	0.89	0.52	1.62	0.06
+0.4	Zone	2, 35	9.98	0.001	4.42	0.001
	Survey	1, 35	1.27	0.27	3.16	0.003
	Survey x Zone	2, 35	0.52	0.52	1.18	0.23
+0.5	Zone	2, 35	8.82	0.001	4.2	0.001
	Survey	1, 35	1.15	0.31	2.77	0.006
	Survey x Zone	2, 35	0.94	0.47	1.04	0.42
+0.6	Zone	2, 35	7.59	0.001	3.07	0.001
	Survey	1, 35	1.14	0.28	2.63	0.006
	Survey x Zone	2, 35	0.91	0.52	0.93	0.57
+0.8	Zone	2, 35	3.93	0.001	3.30	0.001
	Survey	1, 35	2.06	0.04	3.18	0.001
	Survey x Zone	2, 35	1.06	0.36	1.43	0.083
+1.0	Zone	2, 34	2.81	0.001	4.08	0.001
	Survey	1, 34	1.96	0.03	2.39	0.006
	Survey x Zone	2, 35	0.83	0.65	1.20	0.246

Table 4: Indicator Species Analysis (Dufrene and Legendre 1997) based on unpooled data for river channel data and wetland data in Weir Pool 1 only. Maximum Group indicates the zone in which a particular taxon had the highest indicator value. P-values were derived from Monte-Carlo test of significance (permutations = 10, 000). Only significant species are shown and species were considered significant if $p<0.05$.

Elevation (m)	River Channel Maximum Group			Wetland Max. Group		
	Lower Zone	**Middle Zone**	**Upper Zone**	**Lower Zone**	**Middle Zone**	**Upper Zone**
0	*Typha domingensis*, *Medicago* sp., *Azolla filiculoides*, *Juncus usitatus,* *Paspalum distichum*, *Schoenoplectus validus*	*Phragmites australis*		*Typha domingensis* *Paspalum distichum* *Centella asiatica* *Azolla filiculoides* *Juncus usitatus* *Schoenoplectus validus*	*Phragmites australis*	*Open water* *Mimulus repens* *Malvella leprosa*
+0.1	*Medicago* sp., *Typha domingensis*, *Juncus usitatus,* *Paspalum distichum,* *Azolla filiculoides,* *Polypogon monspeliensis*	*Phragmites australis*		*Duma florulenta* *Juncus usitatus* *Typha domingensis* *Paspalum distichum* *Sonchus oleraceus* *Centella asiatica* *Schoenoplectus validus* *Aster subulatus* *Lachnagrostis filiformis* *Wahlenbergia fluminalis*	*Phragmites australis*	Open water *Mimulus repens* *Bolboschoenus caldwellii*
+0.2	*Medicago* sp., *Typha domingensis*, *Juncus usitatus,* *Paspalum distichum,* *Azolla filiculoides,* *Cyperus gymnocaulos*	*Phragmites australis*		*Duma florulenta* *Paspalum distichum* *Mimulus repens* *Sonchus oleraceus* *Typha domingensis* *Juncus usitatus* *Aster subulatus* *Eucalyptus camaldulensis*	*Phragmites australis*	Open water *Malvella leprosa*
+0.3	*Medicago* sp., *Typha domingensis*, *Paspalum distichum,* *Cyperus gymnocaulos*	*Phragmites australis*	*Centaurea calcitrapa,* bare soil	*Duma florulenta* *Paspalum distichum* *Lactuca saligna* *Eucalyptus camaldulensis* *Typha domingensis*	*Phragmites australis*	*Mimulus repens* *Malvella leprosa*
+0.4	*Medicago* sp., *Paspalum distichum,* and *Cyperus gymnocaulos*	*Phragmites australis*	*Centaurea calcitrapa,* bare soil	*Paspalum distichum* *Cotula coronopifolia* *Tecticornia pergranulata* *Duma florulenta* *Lactuca saligna* *Atriplex* spp. *Spergularia marina*	*Phragmites australis*	*Senecio runcinifolius* *Sporobolus mitchellii* *Centaurea calcitrapa* *Mimulus repens* *Malvella leprosa*

Elevation (m)	**River Channel Maximum Group**			**Wetland Max. Group**		
	Lower Zone	**Middle Zone**	**Upper Zone**	**Lower Zone**	**Middle Zone**	**Upper Zone**
+0.5	*Medicago* sp., *Paspalum distichum,* *Cyperus gymnocaulos*	*Phragmites australis*	*Centaurea calcitrapa,* bare soil	*Atriplex* spp. *Paspalum distichum* *Spergularia marina* *Tecticornia pergranulata* *Lactuca saligna* *Duma florulenta*	*Phragmites australis*	*Centaurea calcitrapa* *Senecio runcinifolius* *Onopordum acanthium* Bare soil *Sporobolus mitchellii*
+0.6	*Medicago* sp., *Cyperus gymnocaulos,* *Atriplex prostrata*	*Phragmites australis* and *Duma florulenta*	*Centaurea calcitrapa,* bare soil	*Spergularia marina* *Tecticornia pergranulata* *Wahlenbergia fluminalis* *Atriplex* spp. *Lactuca saligna* *Paspalum distichum*	*Phragmites australis*	*Centaurea calcitrapa* *Senecio runcinifolius* *Onopordum acanthium* *Euphorbia drummondii* *Marrubium vulgare*
+0.8	*Paspalum distichum*, *Atriplex prostrata* *Atriplex* spp.	*Phragmites australis,* *Duma florulenta,* *Haloragis aspera,* *Aster subulatus,* *Rumex bidens*		*Tecticornia pergranulata* *Wahlenbergia fluminalis* *Spergularia marina* *Atriplex prostrata* *Sonchus asper*	*Myoporum montanum* *Duma florulenta* *Sporobolus mitchellii*	*Marrubium vulgare* *Centaurea calcitrapa* *Onopordum acanthium* *Callitriche stagnalis* *Euphorbia drummondii* *Mimulus repens* *Senecio runcinifolius* *Malvella leprosa*
+1.0	*Tecticornia pergranulata*, *Eragrostis curvula* and *Paspalum distichum*	*Phragmites australis,* *Rumex bidens,* *Wahlenbergia fluminalis*	*Centaurea calcitrapa* , bare soil	*Tecticornia pergranulata* *Enneapogon nigricans*	*Myoporum montanum* *Sporobolus mitchellii* *Teucrium racemosum* *Duma florulenta*	*Marrubium vulgare* *Centaurea calcitrapa* *Senecio runcinifolius* *Onopordum acanthium* *Mimulus repens* *Euphorbia drummondii* *Malvella leprosa* *Callitriche stagnalis*

Table 5: Indicator Species Analysis (Dufrene and Legendre 1997) based on unpooled data for wetland littoral data in Weir Pool 1 only. Maximum Group indicates the survey period in which a particular taxon had the highest indicator value. P-values were derived from Monte-Carlo test of significance (permutations = 10, 000). Only significant species are shown and species were considered significant if $p<0.05$.

Elevation (m)	**Wetland Maximum Group**	
	September 2015	**January 2015**
0	Open water *Aster subulatus*	*Ludwigia peploides* *Mimulus repens* *Bolboschoenus caldwellii*
+0.1	Open water *Aster subulatus* *Azolla filiculoides* *Cotula coronopifolia* *Eucalyptus camaldulensis* *Helichrysum luteo-album* *Juncus usitatus* *Lachnagrostis filiformis* *Lemna minor* *Medicago* spp. *Polypogon monspeliensis* *Senecio runcinifolius*	*Alternanthera denticulata* Bare soil *Bolboschoenus caldwellii* *Brachyscome* sp. *Heliotropium curassavicum* *Heliotropium europaeum* *Ludwigia peploides* *Malva parviflora* *Malvella leprosa* *Mimulus repens* *Myriophyllum papillosum* *Paspalum distichum* *Persicaria lapathifolia* *Schoenoplectus validus* *Senecio cunninghamii*
+0.2	*Azolla filiculoides* *Lachnagrostis filiformis* *Polypogon monspeliensis*	*Aster subulatus* *Heliotropium europaeum* *Mimulus repens* *Paspalum distichum*
+0.3	*Aster subulatus* *Azolla filiculoides* Bare Soil *Eucalyptus camaldulensis* *Helichrysum luteo-album* *Lachnagrostis filiformis* *Rorippa palustris* *Senecio runcinifolius* *Sonchus oleraceus* *Spergularia marina*	*Heliotropium europaeum*
+0.4	*Eucalyptus camaldulensis* *Helichrysum luteo-album* *Hypochaeris glabra* *Lachnagrostis filiformis* *Rorippa palustris* *Sonchus oleraceus* *Spergularia marina*	*Heliotropium europaeum* *Paspalum distichum*
+0.5	*Helichrysum luteo-album* *Lachnagrostis filiformis* *Rorippa palustris* *Sonchus oleraceus*	*Heliotropium europaeum* *Paspalum distichum* *Senecio cunninghamii*
+0.6	*Centaurea calcitrapa* *Helichrysum luteo-album* *Lachnagrostis filiformis* *Lactuca saligna* *Mesembryanthemum crystallinum* *Rorippa palustris* *Sonchus oleraceus* *Spergularia marina*	*Heliotropium europaeum* *Paspalum distichum*
+0.8	*Lachnagrostis filiformis* *Rorippa palustris* *Sonchus oleraceus* *Spergularia marina* *Plantago turrifera*	*Paspalum distichum* *Senecio cunninghamii*

	Aster subulatus *Lactuca saligna* *Sporobolus mitchelli*	
+1.0	*Atriplex suberecta* *Centaurea calcitrapa* *Enneapogon nigricans* *Helichrysum luteo-album* *Lachnagrostis filiformis* *Rorippa palustris* *Sonchus oleraceus*	Paspalum distichum *Onopordum acanthium* *Senecio cunninghamii*

Weir Pool 2

A total of 127 taxa (46 exotics, including three proclaimed pest plants in South Australia; one species listed as rare and one species listed as endangered in South Australia) were recorded from both surveys on the river bank and in wetlands in Weir Pool 2 (Appendix 3c and d). On the river bank 93 taxa (36 exotics) were recorded from both surveys with 72 recorded in September 2014 (before the weir was raised) and 62 in January 2015 (after the weir was raised and water levels returned to normal pool level). In wetlands, a total of 110 taxa (38 exotics) were recorded from both surveys with 93 recorded in September 2014 (before the weir was raised) and 64 in January 2015 (after the weir was raised and water levels returned to normal pool level). Similar to the Lock 1 weir pool, the reduction in taxon richness between the two surveys was primarily due to winter annuals, which were present at high elevations in September 2014, but absent in January 2015 (Appendix 3c and d).

Along the riverbanks in Weir Pool 2, there was a significant difference between surveys for the 0 m elevation, but not at any other elevation. At the 0 m elevation, open water was most abundant in September 2014, but by January 2015 *Paspalum distichum* and *Cyperus gymnocaulos* were more abundant (Table 6). There were significant differences between zones for all elevations (Table 6) and the significant indicators characterising each elevation within each weir pool zone are presented in (Table 7).

Alternatively, within the wetlands of Weir Pool 2 there were significant differences between survey periods (Table 6). In particular at the 0 m elevation, open water and *Atriplex subulatus* were significant in September 2014, but *Bolboschoenus caldwellii* was a significant indicator in January 2015. At +0.1 m, *Azolla filiculoides*, *Aster subulatus* and open water were significant indicators in September 2014, but there were no significant indicators in January 2015 (Table 8).

Within wetlands of Weir Pool 2 there were significant differences between zones and survey times (Table 6). In particular, within the elevations between 0 and +0.6 m, the lower zones of

Weir Pool 2 tended to have a higher number of significant indicators compared to the middle and upper zones (Table 7). In September 2014, there was a greater abundance of grasses and winter annuals compared to January 2015 when more amphibious and floodplain taxa were present (Table 8).

Table 6: Multivariate two-factor PERMANOVA results comparing frequency of occurrence of littoral understorey at different elevations between survey times (trips) and weir pool zones within Weir Pool 2, for both riverbank and wetland sites (df = degrees of freedom; *p*-value = probability value; α = 0.05).

			River		**Wetland**	
Elevation	**Factors**	**df**	***Pseudo-F***	***P-value***	***Pseudo-F***	***P-value***
0	Zone	2, 35	3.35	<0.001	2.65	0.004
	Survey	1, 35	2.43	0.03	3.15	0.002
	Survey x Zone	2, 35	1.18	0.29	0.88	0.58
+0.1	Zone	2, 35	3.28	0.005	2.6	0.006
	Survey	1, 35	0.31	0.31	3.24	0.005
	Survey x Zone	2, 35	0.45	0.47	1.05	0.37
+0.2	Zone	2, 35	3.56	<0.001	2.31	0.002
	Survey	1, 35	1.74	0.11	2.49	0.02
	Survey x Zone	2, 35	1.67	0.08	0.87	0.59
+0..3	Zone	2, 35	3.46	<0.001	2.06	0.006
	Survey	1, 35	0.82	0.54	2.28	0.018
	Survey x Zone	2, 35	1.04	0.37	1.04	0.41
+0.4	Zone	2, 35	3.85	0.002	1.52	0.087
	Survey	1, 35	0.36	0.93	1.62	0.11
	Survey x Zone	2, 35	0.68	0.73	0.51	0.96
+0.5	Zone	2, 35	3.65	0.001	1.80	0.03
	Survey	1, 35	0.25	0.95	1.60	0.12
	Survey x Zone	2, 35	0.51	0.87	0.96	0.49
+0.6	Zone	2, 35	3.82	<0.001	2.36	0.003
	Survey	1, 35	0.61	0.66	2.11	0.03
	Survey x Zone	2, 35	0.58	0.83	0.76	0.78
+0.8	Zone	2, 35	4.46	0.001	1.83	0.02
	Survey	1, 35	1.5	0.15	2.23	0.03
	Survey x Zone	2, 35	0.76	0.65	0.49	0.99
+1.0	Zone	2, 35	3.52	<0.001	2.49	<0.001
	Survey	1, 35	1.14	0.28	2.65	0.007
	Survey x Zone	2, 35	0.83	0.65	0.85	0.66

Table 7: Indicator Species Analysis (Dufrene and Legendre 1997) based on unpooled data for river channel data and wetland data in Weir Pool 2 only. Maximum Group indicates the zone in which a particular taxon had the highest indicator value. P-values were derived from Monte-Carlo test of significance (permutations = 10,000). Only significant species are shown and species were considered significant if p<0.05.

Elevation (m	**River Channel Maximum Group**			**Wetland Max. Group**		
	Lower Zone	**Middle Zone**	**Upper Zone**	**Lower Zone**	**Middle Zone**	**Upper Zone**
0	*Schoenoplectus validus, Juncus usitatus, Duma florulenta, Phragmites australis, Typha domingensis*		*Stemodia florulenta Heliotropium europaeum, Bolboschoenus caldwellii*	*Duma florulenta, Aster subulatus, Phragmites australis, Schoenoplectus validus, Paspalum distichum,*		
+0.1		*Wahlenbergia fluminalis, Cyperus gymnocaulos*	*Bolboschoenus caldwellii, Limosella australis*	*Duma florulenta, Aster subulatus, Phragmites australis, Schoenoplectus validus, Paspalum distichum,*		
+0.2	*Phragmites australis*	*Wahlenbergia fluminalis, Cyperus gymnocaulos*	*Stemodia florulenta, Heliotropium europaeum*	*Phragmites australis, Duma florulenta, Aster subulatus, Paspalum distichum,*		
+0.3	*Duma florulenta, Phragmites australis*		*Heliotropium europaeum*	*Duma florulenta. Phragmites australis, Lactuca saligna, Aster subulatus*	*Heliotropium curassavicum, Spergularia marina*	
+0.4	*Duma florulenta, Phragmites australis*		*Heliotropium europaeum, Cyperus gymnocaulos*			
+0.5	*Phragmites australis*	*Lachnagrostis filiformis*	*Heliotropium europaeum*	*Lactuca saligna,*		*Sporobolus mitchellii, Heliotropium europaeum*
+0.6				*Wahlenbergia fluminalis Lactuca saligna*		*Eucalyptus camaldulensis, Euphorbia drummondii, Senecio runcinifolius,*
+0.8	*Phragmites australis*		*Cyperus gymnocaulos*	*Wahlenbergia fluminalis, Atriplex prostrata*	*Duma horrida, Sporobolus mitchellii*	*Centaurea calcitrapa*
+1.0	*Phragmites australis, Asperula gemella, Sonchus asper*	*Euphorbia terracina*	*Cyperus gymnocaulos*		*Duma horrida, Glycyrrhiza acanthocarpa*	*Mimulus repens, Euphorbia drummondii, Senecio runcinifolius, Rorippa palustris*

Table 8: Indicator Species Analysis (Dufrene and Legendre 1997) based on unpooled data for wetland littoral data in Weir Pool 2 only. Maximum Group indicates the survey period in which a particular taxon had the highest indicator value. P-values were derived from Monte-Carlo test of significance (permutations = 10,000). Only significant species are shown and species were considered significant if $p<0.05$.

Elevation (m)	**Wetland Maximum Group**	
	September 2015	**January 2015**
0	Open water *Aster subulatus*	*Bolboschoenus caldwellii*
+0.1	Open water *Azolla filiculoides* *Aster subulatus*	
+0.2	*Azolla filiculoides* *Aster subulatus* *Lachnagrostis filiformis*	*Mimulus repens* *Heliotropium europaeum*
+0.3	*Lachnagrostis filiformis* *Azolla filiculoides* *Aster subulatus*	*Heliotropium europaeum*
+0.4		
+0.5		
+0.6	*Lachnagrostis filiformis* *Spergularia marina*	*Heliotropium europaeum* *Paspalum distichum*
+0.8	*Sonchus oleraceus* *Lachnagrostis filiformis* *Spergularia marina* *Lactuca saligna* *Rorippa palustris*	*Paspalum distichum* *Heliotropium europaeum* *Senecio cunninghamii*
+1.0	*Lachnagrostis filiformis* *Rorippa palustris* *Sonchus oleraceus* *Atriplex* spp.	*Paspalum distichum* *Senecio cunninghamii*

3.2. Tree condition assessments

3.2.1 Crown extent and density condition within weir pools

In Weir Pool 1, river red gums were generally in a moderate condition in September 2014 (Table 9; Figure 7; Figure 8). By January 2015, however, the number of trees with moderate crown extent (3–5) increased to 129 (out of 145, 89%) and dropped back slightly by April 2015 (Figure 7). Similarly, the proportion of trees with medium (4) to medium-major (5) crown densities scores in September 2014, increased slightly to 89% in January 2015, with a more marked decrease to 80% in April 2015 (Figure 8).

Despite the site by site variability (Appendix 4), a similar pattern was observed in Weir Pool 2, with the majority of trees in moderate condition in September 2014 (Figure 8). By January 2015, the number of trees with medium (4) to medium-major (5) crown extent increased to 411 (out of 484, 85%) and one tree recorded major (6) extent (Figure 7). Similarly, the proportion of trees with medium-major crown density (score 5) increased from 41% to 60% in Weir Pool 2, so that the majority of trees measured had visibly improved canopies (Figure 8).

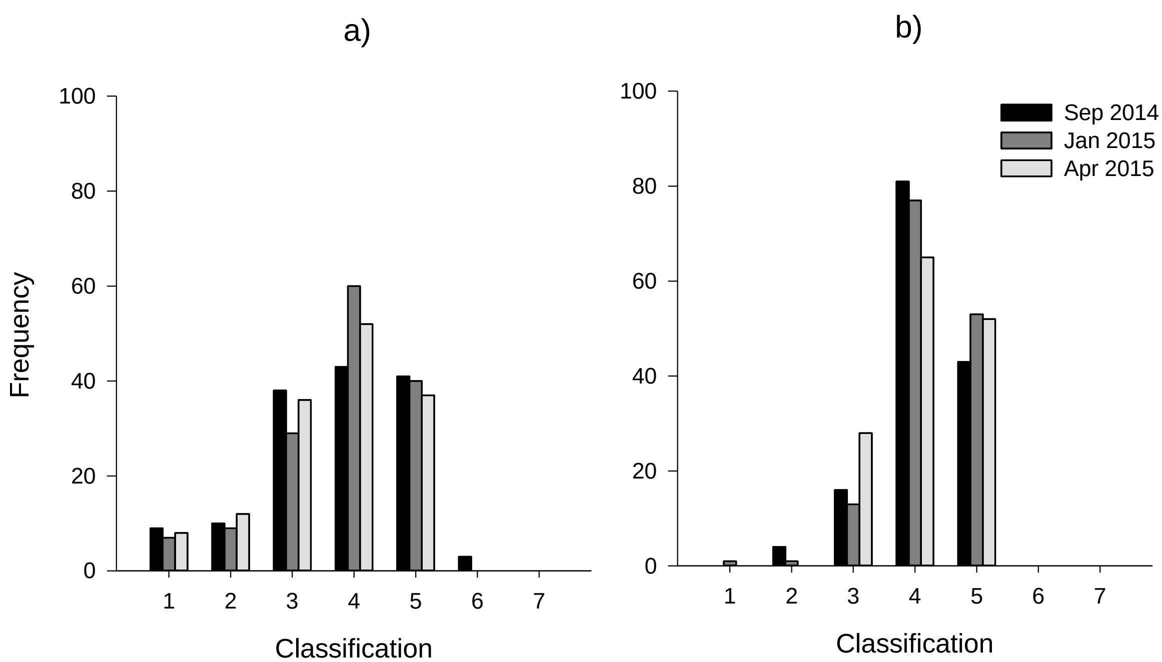

Figure 7: Comparison of the number of *Eucalyptus camaldulensis* trees (n = 145) in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, in September 2014, January 2015 and April 2015, in Weir Pool 1.

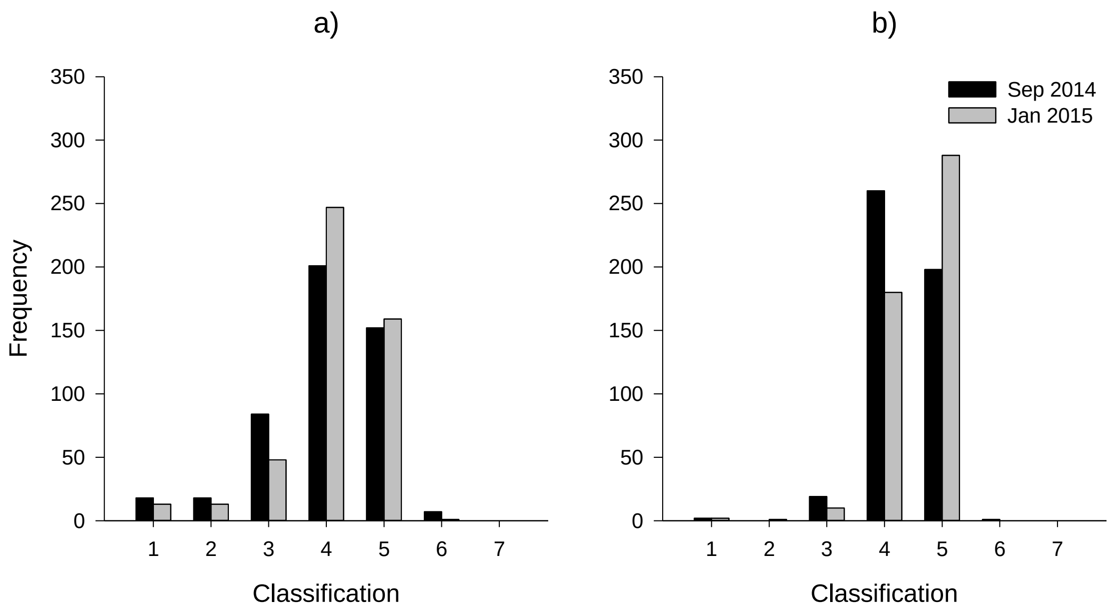

Figure 8: Comparison of the number of *Eucalyptus camaldulensis* trees (*n* = 484) in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, in September 2014 and January 2015, in Weir Pool 2.

3.2.2 Crown extent and density condition within zones

The greatest observed increase in both crown extent and density occurred in the upper zone of Weir Pool 1 across the survey period (Table 9; Figure 9; Figure 10). In September 2014, 74% of trees in the upper zone were distributed across two crown extent categories: sparse-medium to medium (3 – 4), but by January and April 2015 a greater percentage of trees shifted into medium to medium-major (4 – 5) crown extent scores (Figure 8). In contrast, the majority of trees in the lower zone had greater crown extent in September 2014 compared to the upper zone (i.e. 71% with medium to medium-major (4 – 5) scores), and this proportion further increased to 87% by January 2015, then returned to 71% in April 2015 (Figure 9). In the middle zone, the majority of trees were distributed across three crown extent categories (i.e. 78% of trees in sparse-medium to medium-major (3 – 5) categories) in September 2014, increasing to 80% by January 2015 and to 86% by April 2015 (Figure 9). In regards to crown densities, trees in the lower zone were also in moderate to good condition with 98% of trees recording medium to medium-major (4 – 5) scores in September 2014, which remained largely unchanged in January 2015 (98%) and April 2015 (100%) (Figure 11). In the middle zone, 96% of trees were more broadly distributed across three categories (sparse-medium to medium-major (3 – 5) in September 2014, but by January 2015, most trees had improved, shifting to medium to medium-major (4 – 5) scores (Figure 9); however by April 2015, the majority of trees with medium-major (5) crown densities decreased again from 26% to 16% (Figure 9). In the upper zone, 94% of trees were distributed across three crown density categories (sparse-medium to medium-major (3 – 5) scores), increasing to 96% in January 2015 and 100% in April 2015 indicating overall improvement to moderate condition (Figure 9).

Similarly in Weir Pool 2, the upper zone showed the greatest increase in crown extent and density (Table 10; Figure 11; Figure 12). In all zones, the greatest proportion of trees (91%) fell into three main categories for crown extent: sparse-medium to medium major (3 – 5) scores in September 2014, only increasing slightly to 94% by January 2015 (Figure 11). In terms of crown density, most trees in the lower zone and upper zone were in slightly better condition in September 2014, with 95% and 92%, respectively of trees with medium to medium-major scores (4 – 5). This proportion increased to 98% in January 2015, with a pronounced shift in the proportion of trees increasing to medium-major crown densities (score 5) in January 2015 (Figure 12). For the middle zone, 99% of trees measured medium to medium-major (4 – 5) crown density scores in September 2014 and remained largely unchanged by January (Figure 11).

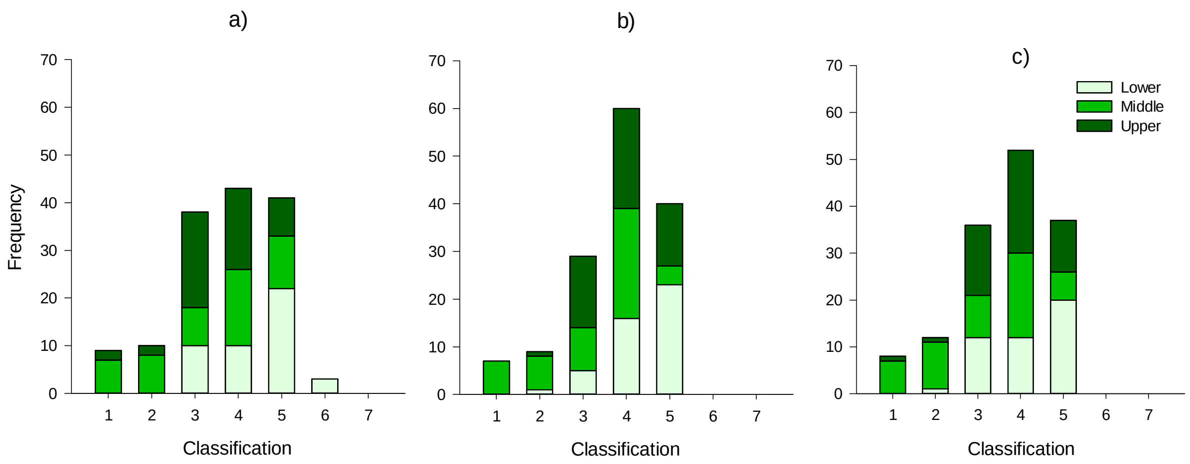

Figure 9: Comparison of the number of *Eucalyptus camaldulensis* trees (*n* = 145) extent crown condition category using The Living Murray (TLM) classification, in a) September 2014 b) January 2015 and c) April 2015, between zones in Weir Pool 1.

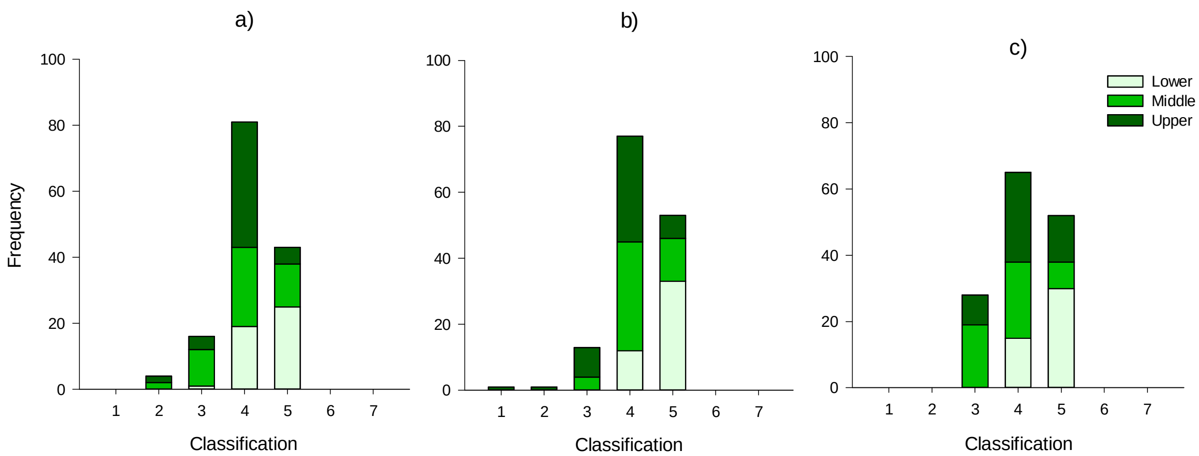

Figure 10: Comparison of the number of *Eucalyptus camaldulensis* trees (*n* = 145) density crown condition category using The Living Murray (TLM) classification, in a) September 2014 b) January 2015 and c) April 2015, between zones in Weir Pool 1.

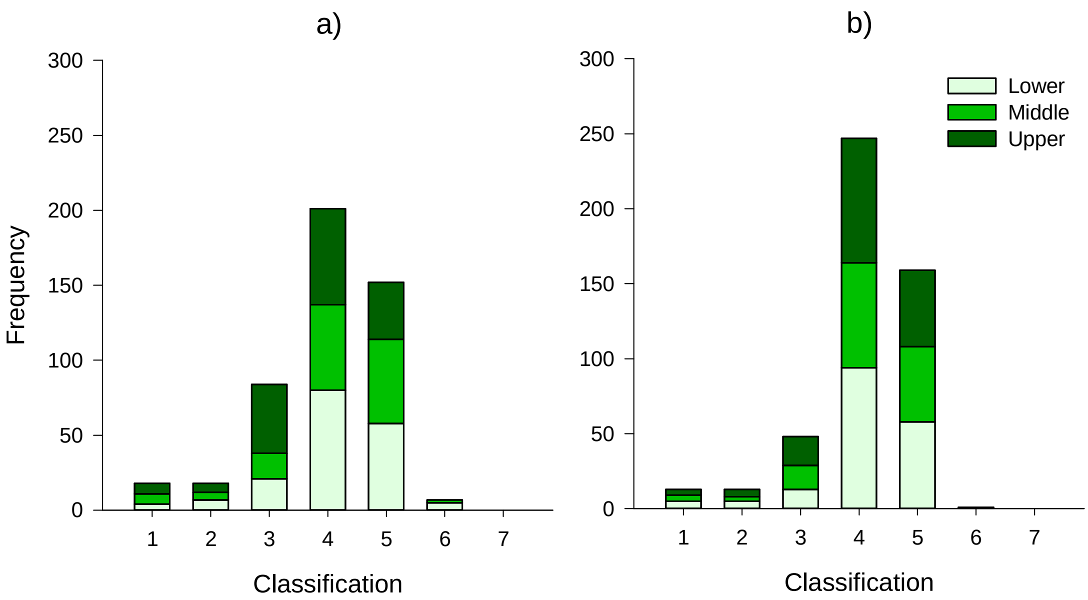

Figure 11: Comparison of the number of *Eucalyptus camaldulensis* trees (*n* = 481) extent crown condition category using The Living Murray (TLM) classification, in a) September 2014 and b) January 2015, between zones in Weir Pool 2.

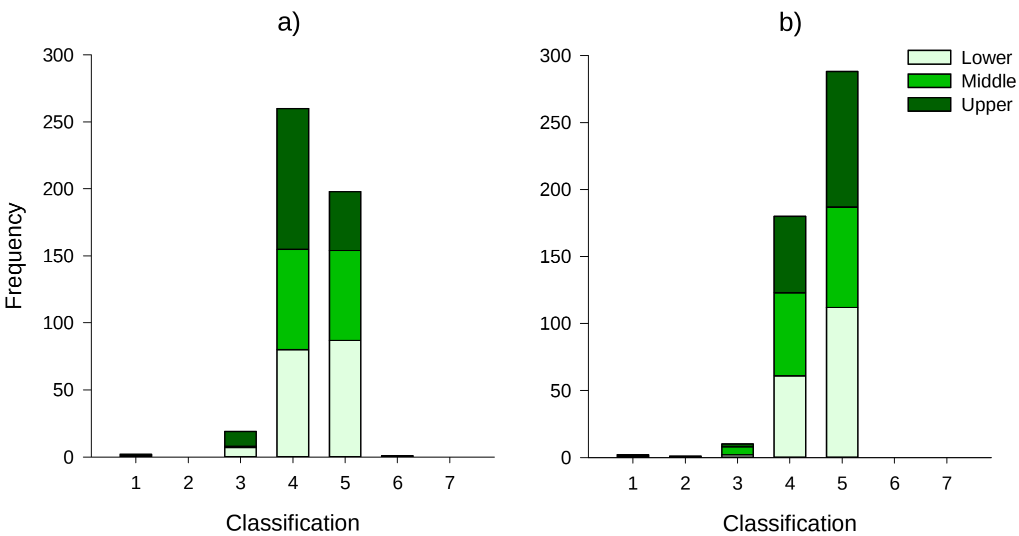

Figure 12: Comparison of the number of *Eucalyptus camaldulensis* trees (*n* = 481) density crown condition category using The Living Murray (TLM) classification, in a) September 2014 and b) January 2015, between zones in Weir Pool 2.

Table 9: Summary of mean extent and density crown percentage scores (using The Living Murray classification), Tree Condition Index scores (Harper and Shemmield 2012) and Plant Area Index (PAI) scores in Weir Pool 1. Red values indicate a decline and blue values indicate an improvement.

Weir Pool 1	# of trees	Mean crown extent (%)				Mean Crown Density (%)				TCI scores				Plant Area index			
		Jan-15	% change from Sep-14	Apr-15	% change from Sep-14	Jan-15	% change from Sep-14	Apr-15	% change from Sep-14	Jan-15	Change from Sep-14	Apr-15	Change from Sep-14	Jan-15	% change from Sep-14	Apr-15	% change from Sep-14
ALL	145	49.13	**+1.43**	47.72	**+0.02**	58.07	**+2.76**	56.03	**+0.72**	0.300	**+0.014**	0.284	**-0.002**	0.764	**+0.005**	0.760	**-0.004**
Lower	45	58.1	**-1.22**	55.78	**-3.55**	66.00	**+4.88**	65.00	**+3.89**	0.417	**+0.020**	0.368	**-0.028**	0.853	**+0.060**	1.020	**+0.230**
Middle	50	38.8	**-2.30**	38.00	**-3.1**	52.90	**+5.20**	49.3	**-3.60**	0.230	**-0.015**	0.205	**-0.040**	0.753	**-0.075**	0.610	**-0.220**
Upper	50	51.4	**+7.62**	50.20	**+6.42**	43.77	**+7.12**	54.7	**+10.92**	0.265	**+0.044**	0.286	**+0.065**	0.688	**+0.033**	0.620	**-0.040**

Table 10: Summary of change in mean extent and density crown percentage scores (using The Living Murray classification), Tree Condition Index scores (Harper and Shemmield 2012) and Plant Area Index (PAI) scores in Weir Pool 2. Red values indicate a decline and blue values indicate an improvement.

Weir Pool 2	# of trees	Mean crown extent (%)		Mean Crown Density (%)		TCI scores		Plant Area index	
		Jan-15	% change from Sep-14	Jan-15	% change from Sep-14	Jan-15	Change from Sep-14	Jan-15	% change from Sep-14
ALL	481	55.01	**+2.04**	63.35	**+4.33**	0.365	**+0.037**	0.756	**+0.261**
Lower	175	55.29	**+0.60**	64.40	**+3.63**	0.369	**+0.016**	0.578	**+0.358**
Middle	144	54.93	**+0.35**	61.81	**+1.60**	0.361	**+0.010**	0.703	**+0.062**
Upper	162	54.79	**+6.41**	63.58	**+7.52**	0.364	**+0.085**	1.008	**-0.020**

3.2.3 Tree condition Index (TCI) scores

Weir pool 1

Within Weir Pool 1 there were no significant differences in TCI scores between survey trips, but there were significant differences between zones (Table 11). Pairwise comparisons highlight that the TCI scores (mean = 0.397 – 0.417) in the lower zone (mean = 0.397 – 0.417) were different from both the middle (t = 6.87, p < 0.001) and upper zones (t = 6.81, p < 0.001); whereas the middle and upper zones were not significantly different from each other (t = 0.78, p = 0.44; mean = 0.222 – 0.257) (Table 9). In particular, trees within the lower zone recorded significantly greater TCI scores (indicative of better crown condition) than the middle and upper zones (Table 11).

Within Weir Pool 2 there was a significant Survey × Zone interaction, indicating that TCI scores for river red gums varied between survey trips and zones (Table 12). Unlike Weir Pool 1, pairwise comparisons highlight that the upper zone in Weir Pool 2 was different from both the lower (t = 3.65, p < 0.001) and middle zones (t = 2.55, p = 0.012); whereas the lower and middle zones were not significantly different from each other (t = 89, p = 0.38). In particular, although trees in the lower and middle zones initially had greater TCI scores in September 2014, there was a marked increase in TCI scores for trees in the upper zone between surveys in Weir Pool 2 (+0.085) by January 2015 (Table 10).

Table 11: Multivariate two-factor PERMANOVA results for comparing Tree Condition Index (TCI) scores for river red gums (*Eucalyptus camaldulensis)* between survey times (trips) and weir pool zones within Weir Pool 1 (df = degrees of freedom; *p*-value = probability value; α = 0.05)

Factor	**df**	***Pseudo-F* statistic**	***P*-value**
Survey	2, 434	0.61	0.52
Zone	2, 434	52.36	0.001
Survey × Zone	4, 434	1.71	0.15

Table 12: Multivariate two-factor PERMANOVA results for comparing Tree Condition Index (TCI) scores for river red gums (*Eucalyptus camaldulensis)* between survey times (trips) and weir pool zones within Weir Pool 2 (df = degrees of freedom; p-value = probability value; α = 0.05)

Factor	**df**	**Pseudo-F statistic**	**P-value**
Survey	1, 961	18.6	0.001
Zone	2, 961	6.87	0.003
Survey × Zone	2, 961	6.87	0.002

3.2.4 Plant Area Index (PAI) scores

Within Weir Pool 1 there were significant differences in PAI between both zones and survey trips (Table 13). Pairwise comparisons highlight that the PAI scores in September 2014 were all significantly different between zones and that PAI was generally higher in the lower and middle zones compared to the upper zone (Table 9). By January 2015, PAI for trees in the middle zone had decreased slightly, but had improved in both the lower and upper zones (Table 9). By April 2015, PAI for trees in the lower zones increased further, but there was a decrease in trees within the middle and upper zones (Table 9).

Within Weir Pool 2 there were no significant differences between survey times, but there were significant differences between zones (Table 14). Pairwise comparisons highlight that the PAI scores in the upper zone (mean = 0.98 – 1.008) were significantly higher from both the middle (t = 4.18, p < 0.001) and lower zones (t = 4.89, p < 0.001); whereas the middle and upper zones were not significantly different from each other (t = 0.24, p = 0.83; mean = 0.543 – 0.703) (Table 10).

Table 13: Multivariate two-factor PERMANOVA results for comparing Plant Area Index (PAI) scores for river red gums (*Eucalyptus camaldulensis)* between survey times (trips) and weir pool zones within Weir Pool 1 (df = degrees of freedom; *p*-value = probability value; α = 0.05)

Factor	**df**	***Pseudo-F* statistic**	***P*-value**
Survey	2, 35	3429.7	0.002
Zone	2, 35	993.19	<0.001
Survey × Zone	2, 35	0.032	0.997

Table 14: Multivariate two-factor PERMANOVA results for comparing Plant Area Index (PAI) scores for river red gums (*Eucalyptus camaldulensis)* between survey times (trips) and weir pool zones within Weir Pool 2 (df = degrees of freedom; *p*-value = probability value; α = 0.05).

Factor	**df**	***Pseudo-F* statistic**	***P*-value**
Survey	1, 79	0.12	0.73
Zone	2, 79	13.52	<0.001
Survey × Zone	2, 79	0.02	0.98

3.2.5 Red gum seedling recruitment

Red gum seedlings were not observed at any sites in areas inundated by the weir pool raising event in Weir Pool 1 or 2 after water levels had returned to pool level.

4. DISCUSSION

Littoral understorey vegetation

Few significant changes in the plant community occurred between surveys that could be attributed to weir pool manipulation, particularly in the river channel. Riverbanks within Weir Pool 1 were often steep and densely vegetated with emergent species such as *Cyperus gymnocaulos*, *Typha domingensis* and/or *Phragmites australis*. Plant communities between the 0 to +0.8 m elevations did not change significantly, although it was anticipated abundances of dominant species such as the aforementioned clonal taxa would increase up the elevation gradient in response to raised water levels and increased soil moisture (DEWNR 2012). Changes in riverbank plant communities between surveys only occurred at the +1.0 m elevation but as a result of the presence of terrestrial winter annuals in September 2014 and not as a response to changes in water levels. As this elevation was outside of the influence of the weir pool manipulation this was not unexpected. Along the riverbanks in Weir Pool 2, littoral understorey vegetation also remained largely unchanged between surveys, although there was a difference detected at the 0 m elevation (normal pool level), where open water was abundant in September 2014, but terrestrial damp and amphibious taxa abundances increased by January 2015. While there were observed changes at this lowest elevation, these changes were slight and not likely to have been biologically significant. However, if weir pool manipulations were to occur more frequently, and for longer, then opportunities for increasing diversity and re-distribution of taxa at these lower elevations would increase (DEWNR 2012).

Wetlands were more species rich than riverbanks and there were also more significant changes in littoral understorey plant communities at most elevations. At the lowest elevations (0 to +0.1 m), differences between surveys were largely driven by where there was an increase in the abundances of a range of amphibious, floodplain and emergent taxa following inundation. At intermediate elevations (between +0.2 to + 0.5 m), the changes were predominantly driven by increased abundances of exotics, such as *Heliotropium europaeum* or *Paspalum distichum*, while at the highest elevations (>+0.6 m) the changes were driven by the seasonal presence of terrestrial winter annuals in September 2014. While the observed increases in species diversity and functional groups were more pronounced at the lower elevations, the areas influenced by these changes were not as great as originally anticipated. Again, if weir pool manipulations were to occur more frequently and/or for longer durations it would provide more opportunities to increase the diversity and area of re-distribution (DEWNR 2012). Furthermore, a natural flood, where the duration and magnitude of higher water levels is greater may be required to significantly change the plant community on the river banks (*sensu* Bice *et al*. 2014).

There were distinct differences between weir pool zones in regards to littoral understorey vegetation. Typically the lower zones had higher abundances of emergent taxa adapted to stable water levels compared to the middle and upper zones (*sensu* Blanch *et al.* 1999; 2000), hence the observed changes in plant communities at the lowest elevations following inundation were often more pronounced in the lower river reaches.

In regards to littoral understorey vegetation, monitoring would ideally focus on wetlands since weir pool manipulations of this magnitude height and duration appear unlikely to have much influence on riverbank plant communities. Monitoring of wetland littoral understorey could be designed to compare responses between different wetland types (i.e. permanent versus temporary wetlands). Also monitoring could target the response of key indicator taxa (and/or functional groups) as opposed to whole plant communities, similar to work undertaken by Siebentritt *et al.* (2004) in Weir Pool 5. Monitoring may also be targeted to assess potential impacts of particular pest species that may be encouraged through weir pool manipulations. For instance, a few proclaimed pest plant species (e.g. *Malvella leprosa)* were found to increase in abundance as a result of this particular weir pool manipulation and while this may be an unavoidable outcome, closer monitoring of these species may help to develop and refine management actions that minimise harmful impacts.

Tree condition

In general, the changes in river red gum condition across weir pools and between surveys were highly variable and difficult to directly attribute to weir pool manipulation because there were no significant changes in tree condition index scores or PAI between surveys. There were, however, noticeable changes in tree crown condition between zones, with a general shift in the condition of the majority of trees from moderate condition to moderate–good. Increases in crown extent and density raw percentage scores for individual trees between surveys were observed in the field, but were often slight (+5 – 10%). Nevertheless, this slight improvement for an individual tree was often enough to see a tree shift from one crown condition category to the next. When tree condition index scores and PAI, however, were averaged across the zones, improvements in tree condition were less discernible and in some instances there was a negative change in crown condition at the river reach scale. The observed decreases in tree condition in some zones are most likely attributed to limb loss and/or fallen trees that occurred at some sites across the survey period. Negative responses could also be attributed to site-specific variability and if so, this might warrant further monitoring to confirm. In addition, the authors noted some limitations to the use of the PAI methodology recommended for The Living Murray (TLM) and CEWO long term intervention Monitoring Projects (Souter *et al.* 2010; Hale *et al.* 2013), where some resolution is most likely lost when the raw image files are converted to a file size that current software programs require to classify an image for analysis. The loss of resolution during this procedure would be enough to mask the minor, visible changes that were observed on-ground as a result of new crown tip and epicormic growth between surveys.

The most unexpected result was the marked improvement in tree crown condition in the upper zones of both weir pools between surveys (particularly Weir Pool 2), compared to the lower and middle zones. This particular river reach zone was anticipated to be the least likely affected by weir pool manipulations; however, prior to the weir pool manipulation, there was a small, unregulated flow that led to increased water levels of up to +1.05 m in the tailwater and upper zones (below locks 2 and 3) during July and August 2014 (Figure 1). Hence trees within the upper zones were potentially exposed to a longer (although interrupted) duration and greater magnitude of water level increase prior to sampling than trees within the lower and middle zones. For future, reference sites are best selected from other unmanaged weir pools to provide evidence for causal relationships as a result of these unanticipated occurrences (Downes *et al.* 2012).

Lateral bank recharge is an important mechanism for maintaining vegetation condition along the River Murray channel and in-channel flow pulses have been specifically beneficial to river red gum maintenance (Doody *et al.* 2014). In the Lower River Murray, river red gums are commonly found growing in low lying regions along the fringes of riverbanks and in areas that are more frequently flooded (George *et al.* 2005) whereas black box (*Eucalyptus largiflorens*) and river cooba (*Acacia stenophylla*) are found at higher elevations and the outer parts of the floodplain (Mensforth *et al.* 1994). Future monitoring of riparian tree response would ideally include all floodplain tree taxa along the river-floodplain gradient as this would potentially help to define the extent of inundation and/or lateral bank recharge, which may exceed the areas occupied by river red gums. Furthermore, for future weir pool manipulations, physiological measurements of the changes in water status of long-lived vegetation in response are recommended. Changes in tree water availability (or an improvement in water source quality), may cause rapid responses (hours – days) in physiological parameters, such as increased stomatal conductance, transpiration, photosynthetic rates and water status (Gehrig 2010; Doody *et al.* 2014). In contrast, the lag time for detecting improvements in crown extent/condition are typically longer (weeks to months) (George *et al.* 2005; Gehrig 2013; 2014). Changes in crown extent are often attributed to increased epicormic growth, while improvements in crown density are often related to improvements in crown tip growth. Follow up surveys of tree condition in Weir Pool 1 undertaken in April 2015, three months after the initial surveys indicate that improvements in crown extent/density were starting to decline from measurements made in January 2015, also suggesting a relatively short-lived persistence in improvements. More refined estimations of the duration of tree condition improvements could be better delineated through physiological measurements. In addition, measurements of the changes in soil moisture and salinity across the monitoring period would help to elucidate the magnitude and extent of lateral bank recharge and help determine causal relationships.

Methodology comparisons

The most significant changes observed in littoral understorey and riparian tree condition were observed in Weir Pool 2. This was most likely an artefact of the methodology adopted in this weir pool, which was designed to provide greater spatial coverage across a zone compared to the method used in Weir Pool 1, which was designed to intensively survey an indicator site within each zone. Under the Murray-Darling Basin Authority's The Living Murray Program, a series of six Icon Sites were chosen based upon their high ecological, economic and cultural value, to be the subject of intensive and ongoing monitoring to assess how river regulation and other human-induced perturbations may impact the ecological health of the system. The vast size of the Murray-Darling Basin dictates that a monitoring program could not incorporate extensive spatial and temporal true random sampling, if it were to be practical or cost-effective (Downes *et al.* 2002). Hence reducing the number of sampling units to a set of indicator sites has clear advantages, but runs the risk that changes from site to site may be asynchronous (Downes *et al.* 2002), which is evident in the degree of site by site variability observed in this study. Overall, increasing the spatial coverage of plant communities assessed in Weir Pool 2, increased the statistical power and helped to detect responses that were not as adequately detected in Weir Pool 1, although this specific method was more time consuming and resource dependent.

Red gum seedling recruitment

The absence of red gum seedlings in the areas inundated by the weir pool raising was not unexpected. The relatively short duration of the raising event (especially for Weir Pool 1) probably did not provide sufficient time to build up reserves of soil moisture and remove existing competing vegetation. Furthermore, evidence from watering trials and observations after the 2010-11 flood suggests that flooding is required for red gum recruitment (trees reaching at least sapling stage) (Nicol *et al.* 2010; Nicol 2012). Nicol *et al.* (2010; 2012) monitored understorey vegetation in 18 temporary wetlands that received environmental water on the Chowilla Floodplain and red gum seedlings were observed in only eight. Of those eight wetlands, seedlings survived to saplings at only one wetland. In contrast there was significant widespread recruitment of red gums after the 2010-11 flood (SARDI, unpublished). Nevertheless, the weir pool raising was conducted in spring at a time when floods would naturally occur, which was synchronous with seed production in red gums (Jensen 2008) and if raised levels were maintained for longer seedlings may have been observed.

5. CONCLUSIONS

Despite some inconclusive results regarding the benefits of weir pool raising to the understorey plant community and tree condition, it remains an important management action to reinstate water level variability during periods of entitlement flow or small in-channel flow pulses. The inconclusive results (particularly for red gum condition) were probably due to the small unregulated event in late winter, which raised water levels in upper weir pools significantly higher than the weir pool raising event and confounded the results. Furthermore, structural problems in Lock and Weir Pool 1 resulted in a shorter than planned raising in this weir pool.

The monitoring program was based around biota that took time to respond to the weir pool raising. For example, understorey vegetation required time to germinate and grow to a stage when it could be identified after water levels returned to normal pool level and there is a lag in the growth response of red gums. Future monitoring should concentrate on processes that respond rapidly to weir pool raising; such as changes in soil moisture, soil water potential, soil salinity and tree water status. Monitoring the aforementioned variables will give a clearer picture into the benefits that weir pool raisings have for the plant community.

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Appendix 1: GPS coordinates of understorey transects, trees assessed for tree condition and tree canopy photographs (map datum WGS 84)

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
1	AR HP01	Arlunga	Canopy photo	Photo 1	-34.329957	139.616136
1	AR HP02	Arlunga	Canopy photo	Photo 2	-34.329554	139.616293
1	AR HP03	Arlunga	Canopy photo	Photo 3	-34.329065	139.616995
1	AR HP04	Arlunga	Canopy photo	Photo 4	-34.328627	139.617171
1	AR R01	Arlunga	Understorey survey	River 1	-34.307506	139.638871
1	AR R02	Arlunga	Understorey survey	River 2	-34.311448	139.63388
1	AR R03	Arlunga	Understorey survey	River 3	-34.316169	139.627305
1	AR R04	Arlunga	Understorey survey	River 4	-34.327992	139.617425
1	AR R05	Arlunga	Understorey survey	River 5	-34.329442	139.616972
1	AR R06	Arlunga	Understorey survey	River 6	-34.3323	139.616238
1	AR W01	Arlunga	Understorey survey	Wetland 1	-34.307354	139.638197
1	AR W02	Arlunga	Understorey survey	Wetland 2	-34.311062	139.633244
1	AR W03	Arlunga	Understorey survey	Wetland 3	-34.315271	139.625241
1	AR W04	Arlunga	Understorey survey	Wetland 4	-34.328083	139.616448
1	AR W05	Arlunga	Understorey survey	Wetland 5	-34.329402	139.61619
1	AR W06	Arlunga	Understorey survey	Wetland 6	-34.332288	139.615013
1	AR01	Arlunga	Tree health	Tree 01	-34.330053	139.616176
1	AR02	Arlunga	Tree health	Tree 02	-34.330059	139.616039
1	AR03	Arlunga	Tree health	Tree 03	-34.329997	139.616229
1	AR04	Arlunga	Tree health	Tree 04	-34.329864	139.616219
1	AR05	Arlunga	Tree health	Tree 05	-34.32978	139.61627
1	AR06	Arlunga	Tree health	Tree 06	-34.329695	139.616236
1	AR07	Arlunga	Tree health	Tree 07	-34.329592	139.61629
1	AR08	Arlunga	Tree health	Tree 08	-34.329604	139.616215
1	AR09	Arlunga	Tree health	Tree 09	-34.329575	139.616242
1	AR10	Arlunga	Tree health	Tree 10	-34.329562	139.616312
1	AR11	Arlunga	Tree health	Tree 11	-34.329534	139.616306
1	AR12	Arlunga	Tree health	Tree 12	-34.329537	139.616246
1	AR13	Arlunga	Tree health	Tree 13	-34.329501	139.61624
1	AR14	Arlunga	Tree health	Tree 14	-34.329518	139.616308
1	AR15	Arlunga	Tree health	Tree 15	-34.3295	139.616295
1	AR16	Arlunga	Tree health	Tree 16	-34.329517	139.616304
1	AR17	Arlunga	Tree health	Tree 17	-34.329513	139.616302
1	AR18	Arlunga	Tree health	Tree 18	-34.328953	139.616617
1	AR19	Arlunga	Tree health	Tree 19	-34.328716	139.616396
1	AR20	Arlunga	Tree health	Tree 20	-34.328672	139.616353
1	AR21	Arlunga	Tree health	Tree 21	-34.328676	139.616306
1	AR22	Arlunga	Tree health	Tree 22	-34.328606	139.61658
1	AR23	Arlunga	Tree health	Tree 23	-34.326688	139.617328
1	AR24	Arlunga	Tree health	Tree 24	-34.326542	139.617471
1	AR25	Arlunga	Tree health	Tree 25	-34.326627	139.617868
1	AR26	Arlunga	Tree health	Tree 26	-34.326848	139.617921
1	AR27	Arlunga	Tree health	Tree 27	-34.326947	139.617897
1	AR28	Arlunga	Tree health	Tree 28	-34.326999	139.617794
1	AR29	Arlunga	Tree health	Tree 29	-34.328108	139.616503
1	AR30	Arlunga	Tree health	Tree 30	-34.328911	139.616604
1	AR31	Arlunga	Tree health	Tree 31	-34.329133	139.616417
1	AR32	Arlunga	Tree health	Tree 32	-34.329921	139.616313
1	AR33	Arlunga	Tree health	Tree 33	-34.329948	139.61637
1	AR34	Arlunga	Tree health	Tree 34	-34.327086	139.617825
1	AR35	Arlunga	Tree health	Tree 35	-34.327113	139.617634
1	AR36	Arlunga	Tree health	Tree 36	-34.327402	139.617591
1	AR37	Arlunga	Tree health	Tree 37	-34.328142	139.617324
1	AR38	Arlunga	Tree health	Tree 38	-34.32822	139.617325
1	AR39	Arlunga	Tree health	Tree 39	-34.328369	139.617284

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
1	AR40	Arlunga	Tree health	Tree 40	-34.32854	139.617121
1	AR41	Arlunga	Tree health	Tree 41	-34.328565	139.617131
1	AR42	Arlunga	Tree health	Tree 42	-34.329035	139.617011
1	AR43	Arlunga	Tree health	Tree 43	-34.329107	139.617048
1	AR44	Arlunga	Tree health	Tree 44	-34.329193	139.616952
1	AR45	Arlunga	Tree health	Tree 45	-34.329434	139.616886
1	MU HP01	Murbko Flat Complex	Canopy photo	Photo 1	-34.16165	139.657565
1	MU HP02	Murbko Flat Complex	Canopy photo	Photo 2	-34.161316	139.657732
1	MU HP03	Murbko Flat Complex	Canopy photo	Photo 3	-34.161524	139.657608
1	MU HP04	Murbko Flat Complex	Canopy photo	Photo 4	-34.161364	139.658493
1	MU R01	Murbko Flat Complex	Understorey survey	River 1	-34.168358	139.654174
1	MU R02	Murbko Flat Complex	Understorey survey	River 2	-34.16403	139.659013
1	MU R03	Murbko Flat Complex	Understorey survey	River 3	-34.160769	139.658518
1	MU R04	Murbko Flat Complex	Understorey survey	River 4	-34.15896	139.658275
1	MU R05	Murbko Flat Complex	Understorey survey	River 5	-34.151121	139.659604
1	MU R06	Murbko Flat Complex	Understorey survey	River 6	-34.148292	139.660735
1	MU W01	Murbko Flat Complex	Understorey survey	Wetland 1	-34.167965	139.653943
1	MU W02	Murbko Flat Complex	Understorey survey	Wetland 2	-34.162932	139.654768
1	MU W03	Murbko Flat Complex	Understorey survey	Wetland 3	-34.160276	139.656606
1	MU W04	Murbko Flat Complex	Understorey survey	Wetland 4	-34.158756	139.657087
1	MU W05	Murbko Flat Complex	Understorey survey	Wetland 5	-34.150004	139.655555
1	MU W06	Murbko Flat Complex	Understorey survey	Wetland 6	-34.148113	139.659008
1	MU01	Murbko Flat Complex	Tree health	Tree 01	-34.161372	139.658499
1	MU02	Murbko Flat Complex	Tree health	Tree 02	-34.161418	139.658508
1	MU03	Murbko Flat Complex	Tree health	Tree 03	-34.161402	139.65856
1	MU04	Murbko Flat Complex	Tree health	Tree 04	-34.161456	139.658569
1	MU05	Murbko Flat Complex	Tree health	Tree 05	-34.161514	139.658599
1	MU06	Murbko Flat Complex	Tree health	Tree 06	-34.16152	139.658624
1	MU07	Murbko Flat Complex	Tree health	Tree 07	-34.161543	139.658644
1	MU08	Murbko Flat Complex	Tree health	Tree 08	-34.161553	139.658605
1	MU09	Murbko Flat Complex	Tree health	Tree 09	-34.161579	139.658658
1	MU10	Murbko Flat Complex	Tree health	Tree 10	-34.161609	139.658658
1	MU11	Murbko Flat Complex	Tree health	Tree 11	-34.161619	139.65869
1	MU12	Murbko Flat Complex	Tree health	Tree 12	-34.161637	139.658675
1	MU13	Murbko Flat Complex	Tree health	Tree 13	-34.161675	139.658699
1	MU14	Murbko Flat Complex	Tree health	Tree 14	-34.161679	139.658688
1	MU15	Murbko Flat Complex	Tree health	Tree 15	-34.161789	139.658707
1	MU16	Murbko Flat Complex	Tree health	Tree 16	-34.161779	139.658661
1	MU17	Murbko Flat Complex	Tree health	Tree 17	-34.16182	139.658675
1	MU18	Murbko Flat Complex	Tree health	Tree 18	-34.161826	139.658698
1	MU19	Murbko Flat Complex	Tree health	Tree 19	-34.16179	139.658613
1	MU20	Murbko Flat Complex	Tree health	Tree 20	-34.161849	139.658685
1	MU21	Murbko Flat Complex	Tree health	Tree 21	-34.161914	139.658611
1	MU22	Murbko Flat Complex	Tree health	Tree 22	-34.161902	139.657808
1	MU23	Murbko Flat Complex	Tree health	Tree 23	-34.161693	139.657592
1	MU24	Murbko Flat Complex	Tree health	Tree 24	-34.161676	139.65751
1	MU25	Murbko Flat Complex	Tree health	Tree 25	-34.161599	139.657566
1	MU26	Murbko Flat Complex	Tree health	Tree 26	-34.161615	139.657594
1	MU27	Murbko Flat Complex	Tree health	Tree 27	-34.161577	139.657549
1	MU28	Murbko Flat Complex	Tree health	Tree 28	-34.161577	139.657685
1	MU29	Murbko Flat Complex	Tree health	Tree 29	-34.161588	139.65769
1	MU30	Murbko Flat Complex	Tree health	Tree 30	-34.161493	139.657711
1	MU31	Murbko Flat Complex	Tree health	Tree 31	-34.161484	139.657637
1	MU32	Murbko Flat Complex	Tree health	Tree 32	-34.16149	139.657582
1	MU33	Murbko Flat Complex	Tree health	Tree 33	-34.161482	139.657512
1	MU34	Murbko Flat Complex	Tree health	Tree 34	-34.161461	139.657446
1	MU35	Murbko Flat Complex	Tree health	Tree 35	-34.161413	139.657471
1	MU36	Murbko Flat Complex	Tree health	Tree 36	-34.161282	139.657529

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
1	MU37	Murbko Flat Complex	Tree health	Tree 37	-34.161316	139.657656
1	MU38	Murbko Flat Complex	Tree health	Tree 38	-34.16129	139.657642
1	MU39	Murbko Flat Complex	Tree health	Tree 39	-34.161272	139.65769
1	MU40	Murbko Flat Complex	Tree health	Tree 40	-34.16125	139.657648
1	MU41	Murbko Flat Complex	Tree health	Tree 41	-34.16129	139.657713
1	MU42	Murbko Flat Complex	Tree health	Tree 42	-34.161362	139.65772
1	MU43	Murbko Flat Complex	Tree health	Tree 43	-34.161342	139.657772
1	MU44	Murbko Flat Complex	Tree health	Tree 44	-34.161361	139.657786
1	MU45	Murbko Flat Complex	Tree health	Tree 45	-34.161407	139.657866
1	MU46	Murbko Flat Complex	Tree health	Tree 46	-34.161016	139.657879
1	MU47	Murbko Flat Complex	Tree health	Tree 47	-34.160725	139.658352
1	MU48	Murbko Flat Complex	Tree health	Tree 48	-34.160754	139.65846
1	MU49	Murbko Flat Complex	Tree health	Tree 49	-34.160781	139.658417
1	MU50	Murbko Flat Complex	Tree health	Tree 50	-34.160805	139.658476
1	WF HP01	Weston Flat	Canopy photo	Photo 1	-34.042027	139.82512
1	WF HP02	Weston Flat	Canopy photo	Photo 2	-34.042658	139.823637
1	WF HP03	Weston Flat	Canopy photo	Photo 3	-34.04194	139.823308
1	WF HP04	Weston Flat	Canopy photo	Photo 4	-34.0411	139.823782
1	WF R01	Weston Flat	Understorey survey	River 1	-34.042744	139.824861
1	WF R02	Weston Flat	Understorey survey	River 2	-34.03944	139.826963
1	WF R03	Weston Flat	Understorey survey	River 3	-34.037012	139.828854
1	WF R04	Weston Flat	Understorey survey	River 4	-34.034706	139.831234
1	WF R05	Weston Flat	Understorey survey	River 5	-34.033286	139.832524
1	WF R06	Weston Flat	Understorey survey	River 6	-34.033826	139.831774
1	WF W01	Weston Flat	Understorey survey	Wetland 1	-34.034156	139.831097
1	WF W02	Weston Flat	Understorey survey	Wetland 2	-34.038032	139.821684
1	WF W03	Weston Flat	Understorey survey	Wetland 3	-34.032534	139.823484
1	WF W04	Weston Flat	Understorey survey	Wetland 4	-34.033967	139.830981
1	WF W05	Weston Flat	Understorey survey	Wetland 5	-34.034092	139.821579
1	WF W06	Weston Flat	Understorey survey	Wetland 6	-34.039412	139.820654
1	WF01	Weston Flat	Tree health	Tree 01	-34.041726	139.825613
1	WF02	Weston Flat	Tree health	Tree 02	-34.041871	139.82547
1	WF03	Weston Flat	Tree health	Tree 03	-34.041873	139.825516
1	WF04	Weston Flat	Tree health	Tree 04	-34.042094	139.825262
1	WF05	Weston Flat	Tree health	Tree 05	-34.042257	139.825115
1	WF06	Weston Flat	Tree health	Tree 06	-34.042279	139.825044
1	WF07	Weston Flat	Tree health	Tree 07	-34.042431	139.824887
1	WF08	Weston Flat	Tree health	Tree 08	-34.042467	139.824909
1	WF09	Weston Flat	Tree health	Tree 09	-34.042893	139.823999
1	WF10	Weston Flat	Tree health	Tree 10	-34.042872	139.823879
1	WF11	Weston Flat	Tree health	Tree 11	-34.042717	139.823766
1	WF12	Weston Flat	Tree health	Tree 12	-34.042683	139.823548
1	WF13	Weston Flat	Tree health	Tree 13	-34.042503	139.823525
1	WF14	Weston Flat	Tree health	Tree 14	-34.042424	139.823541
1	WF15	Weston Flat	Tree health	Tree 15	-34.042087	139.823428
1	WF16	Weston Flat	Tree health	Tree 16	-34.042035	139.823439
1	WF17	Weston Flat	Tree health	Tree 17	-34.042015	139.823455
1	WF18	Weston Flat	Tree health	Tree 18	-34.042008	139.823465
1	WF19	Weston Flat	Tree health	Tree 19	-34.042011	139.823383
1	WF20	Weston Flat	Tree health	Tree 20	-34.04203	139.823338
1	WF21	Weston Flat	Tree health	Tree 21	-34.042008	139.823331
1	WF22	Weston Flat	Tree health	Tree 22	-34.041962	139.823367
1	WF23	Weston Flat	Tree health	Tree 23	-34.041968	139.823433
1	WF24	Weston Flat	Tree health	Tree 24	-34.041911	139.823406
1	WF25	Weston Flat	Tree health	Tree 25	-34.041874	139.823392
1	WF26	Weston Flat	Tree health	Tree 26	-34.041856	139.823346
1	WF27	Weston Flat	Tree health	Tree 27	-34.041894	139.82322
1	WF28	Weston Flat	Tree health	Tree 28	-34.041888	139.823272

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
1	WF29	Weston Flat	Tree health	Tree 29	-34.042009	139.823335
1	WF30	Weston Flat	Tree health	Tree 30	-34.042003	139.823264
1	WF31	Weston Flat	Tree health	Tree 31	-34.042006	139.823252
1	WF32	Weston Flat	Tree health	Tree 32	-34.042015	139.823298
1	WF33	Weston Flat	Tree health	Tree 33	-34.042089	139.823291
1	WF34	Weston Flat	Tree health	Tree 34	-34.04199	139.823294
1	WF35	Weston Flat	Tree health	Tree 35	-34.0418	139.823349
1	WF36	Weston Flat	Tree health	Tree 36	-34.04177	139.823314
1	WF37	Weston Flat	Tree health	Tree 37	-34.041727	139.823439
1	WF38	Weston Flat	Tree health	Tree 38	-34.041696	139.82341
1	WF39	Weston Flat	Tree health	Tree 39	-34.041605	139.823477
1	WF40	Weston Flat	Tree health	Tree 40	-34.041353	139.823429
1	WF41	Weston Flat	Tree health	Tree 41	-34.041359	139.823264
1	WF42	Weston Flat	Tree health	Tree 42	-34.0413	139.823389
1	WF43	Weston Flat	Tree health	Tree 43	-34.041135	139.823695
1	WF44	Weston Flat	Tree health	Tree 44	-34.041167	139.823779
1	WF45	Weston Flat	Tree health	Tree 45	-34.041062	139.823757
1	WF46	Weston Flat	Tree health	Tree 46	-34.041024	139.823754
1	WF47	Weston Flat	Tree health	Tree 47	-34.04109	139.823951
1	WF48	Weston Flat	Tree health	Tree 48	-34.041065	139.823954
1	WF49	Weston Flat	Tree health	Tree 49	-34.040847	139.82406
1	WF50	Weston Flat	Tree health	Tree 50	-34.040917	139.824206
2	BC1 HP01	Banrock Creek 1	Canopy photo	Photo 101	-34.162998	140.325239
2	BC1 HP02	Banrock Creek 1	Canopy photo	Photo 102	-34.15923	140.325934
2	BC1 R	Banrock Creek 1	Understorey survey	River 1	-34.159004	140.326057
2	BC1 W	Banrock Creek 1	Understorey survey	Wetland 1	-34.163193	140.325819
2	BC101	Banrock Creek 1	Tree health	Tree 101	-34.15937	140.325755
2	BC102	Banrock Creek 1	Tree health	Tree 102	-34.159321	140.325851
2	BC103	Banrock Creek 1	Tree health	Tree 103	-34.15932	140.325893
2	BC104	Banrock Creek 1	Tree health	Tree 104	-34.159287	140.325888
2	BC105	Banrock Creek 1	Tree health	Tree 105	-34.159289	140.325913
2	BC106	Banrock Creek 1	Tree health	Tree 106	-34.159226	140.325934
2	BC107	Banrock Creek 1	Tree health	Tree 107	-34.159225	140.325977
2	BC108	Banrock Creek 1	Tree health	Tree 108	-34.159169	140.326107
2	BC109	Banrock Creek 1	Tree health	Tree 109	-34.159147	140.326072
2	BC110	Banrock Creek 1	Tree health	Tree 110	-34.158801	140.326547
2	BC111	Banrock Creek 1	Tree health	Tree 111	-34.15877	140.326553
2	BC112	Banrock Creek 1	Tree health	Tree 112	-34.158769	140.326636
2	BC113	Banrock Creek 1	Tree health	Tree 113	-34.158749	140.326633
2	BC114	Banrock Creek 1	Tree health	Tree 114	-34.158774	140.326918
2	BC115	Banrock Creek 1	Tree health	Tree 115	-34.158868	140.326922
2	BC116	Banrock Creek 1	Tree health	Tree 116	-34.158969	140.326562
2	BC117	Banrock Creek 1	Tree health	Tree 117	-34.158989	140.326539
2	BC118	Banrock Creek 1	Tree health	Tree 118	-34.159219	140.326501
2	BC119	Banrock Creek 1	Tree health	Tree 119	-34.159224	140.326486
2	BC120	Banrock Creek 1	Tree health	Tree 120	-34.15939	140.326297
2	BC121	Banrock Creek 1	Tree health	Tree 121	-34.159458	140.32616
2	BC122	Banrock Creek 1	Tree health	Tree 122	-34.159456	140.326061
2	BC123	Banrock Creek 1	Tree health	Tree 123	-34.159643	140.325976
2	BC124	Banrock Creek 1	Tree health	Tree 124	-34.159827	140.325259
2	BC125	Banrock Creek 1	Tree health	Tree 125	-34.15987	140.325166
2	BC126	Banrock Creek 1	Tree health	Tree 126	-34.162613	140.324737
2	BC127	Banrock Creek 1	Tree health	Tree 127	-34.162955	140.325237
2	BC128	Banrock Creek 1	Tree health	Tree 128	-34.162939	140.325314
2	BC129	Banrock Creek 1	Tree health	Tree 129	-34.162898	140.325492
2	BC130	Banrock Creek 1	Tree health	Tree 130	-34.162931	140.325604
2	BC1HP01	Banrock Creek 2	Canopy photo	Photo 201	-34.169035	140.312203
2	BC2 HP02	Banrock Creek 2	Canopy photo	Photo 202	-34.162277	140.322767

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	BC2 R	Banrock Creek 2	Understorey survey	River 2	-34.162153	140.322623
2	BC2 W	Banrock Creek 2	Understorey survey	Wetland 2	-34.162932	140.322584
2	BC201	Banrock Creek 2	Tree health	Tree 201	-34.162384	140.322741
2	BC202	Banrock Creek 2	Tree health	Tree 202	-34.162439	140.322587
2	BC203	Banrock Creek 2	Tree health	Tree 203	-34.162469	140.322535
2	BC204	Banrock Creek 2	Tree health	Tree 204	-34.162502	140.322579
2	BC205	Banrock Creek 2	Tree health	Tree 205	-34.162552	140.322337
2	BC206	Banrock Creek 2	Tree health	Tree 206	-34.162604	140.322381
2	BC207	Banrock Creek 2	Tree health	Tree 207	-34.162669	140.322401
2	BC208	Banrock Creek 2	Tree health	Tree 208	-34.162583	140.322299
2	BC209	Banrock Creek 2	Tree health	Tree 209	-34.162622	140.322272
2	BC210	Banrock Creek 2	Tree health	Tree 210	-34.162712	140.32227
2	BC211	Banrock Creek 2	Tree health	Tree 211	-34.162719	140.32217
2	BC212	Banrock Creek 2	Tree health	Tree 212	-34.163213	140.321808
2	BC213	Banrock Creek 2	Tree health	Tree 213	-34.162914	140.322253
2	BC214	Banrock Creek 2	Tree health	Tree 214	-34.162929	140.322308
2	BC215	Banrock Creek 2	Tree health	Tree 215	-34.162704	140.322397
2	BC216	Banrock Creek 2	Tree health	Tree 216	-34.162739	140.322448
2	BC217	Banrock Creek 2	Tree health	Tree 217	-34.162664	140.322568
2	BC218	Banrock Creek 2	Tree health	Tree 218	-34.162762	140.322593
2	BC219	Banrock Creek 2	Tree health	Tree 219	-34.162831	140.322586
2	BC220	Banrock Creek 2	Tree health	Tree 220	-34.162856	140.322901
2	BC221	Banrock Creek 2	Tree health	Tree 221	-34.162873	140.322924
2	BC222	Banrock Creek 2	Tree health	Tree 222	-34.163078	140.323121
2	BT1 HP01	Big Toolunka 1	Canopy photo	Photo 101	-34.149763	139.916033
2	BT1 HP02	Big Toolunka 1	Canopy photo	Photo 102	-34.149318	139.919059
2	BT1 R	Big Toolunka 1	Understorey survey	River 1	-34.150367	139.916063
2	BT1 W	Big Toolunka 1	Understorey survey	Wetland 1	-34.14937	139.919178
2	BT101	Big Toolunka 1	Tree health	Tree 101	-34.149858	139.916044
2	BT102	Big Toolunka 1	Tree health	Tree 102	-34.149815	139.915999
2	BT103	Big Toolunka 1	Tree health	Tree 103	-34.149782	139.916006
2	BT104	Big Toolunka 1	Tree health	Tree 104	-34.149769	139.915991
2	BT105	Big Toolunka 1	Tree health	Tree 105	-34.14972	139.915957
2	BT106	Big Toolunka 1	Tree health	Tree 106	-34.149697	139.915958
2	BT107	Big Toolunka 1	Tree health	Tree 107	-34.149532	139.916324
2	BT108	Big Toolunka 1	Tree health	Tree 108	-34.149732	139.916408
2	BT109	Big Toolunka 1	Tree health	Tree 109	-34.149799	139.916441
2	BT110	Big Toolunka 1	Tree health	Tree 110	-34.149613	139.916486
2	BT111	Big Toolunka 1	Tree health	Tree 111	-34.149498	139.916584
2	BT112	Big Toolunka 1	Tree health	Tree 112	-34.149408	139.916892
2	BT113	Big Toolunka 1	Tree health	Tree 113	-34.14934	139.916887
2	BT114	Big Toolunka 1	Tree health	Tree 114	-34.14938	139.916928
2	BT115	Big Toolunka 1	Tree health	Tree 115	-34.149485	139.917014
2	BT116	Big Toolunka 1	Tree health	Tree 116	-34.14948	139.917095
2	BT117	Big Toolunka 1	Tree health	Tree 117	-34.149723	139.917145
2	BT118	Big Toolunka 1	Tree health	Tree 118	-34.149807	139.917173
2	BT119	Big Toolunka 1	Tree health	Tree 119	-34.15006	139.91735
2	BT120	Big Toolunka 1	Tree health	Tree 120	-34.14961	139.91764
2	BT121	Big Toolunka 1	Tree health	Tree 121	-34.14943	139.918914
2	BT122	Big Toolunka 1	Tree health	Tree 122	-34.14931	139.919079
2	BT123	Big Toolunka 1	Tree health	Tree 123	-34.149272	139.91903
2	BT124	Big Toolunka 1	Tree health	Tree 124	-34.149085	139.91895
2	BT125	Big Toolunka 1	Tree health	Tree 125	-34.148947	139.918965
2	BT126	Big Toolunka 1	Tree health	Tree 126	-34.150358	139.916217
2	BT127	Big Toolunka 1	Tree health	Tree 127	-34.150365	139.916251
2	BT128	Big Toolunka 1	Tree health	Tree 128	-34.150373	139.916301
2	BT129	Big Toolunka 1	Tree health	Tree 129	-34.150406	139.91632
2	BT130	Big Toolunka 1	Tree health	Tree 130	-34.150471	139.916267

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	BT2 HP01	Big Toolunka 2	Canopy photo	Photo 201	-34.16054	139.927435
2	BT2 HP02	Big Toolunka 2	Canopy photo	Photo 202	-34.157293	139.928914
2	BT2 R	Big Toolunka 2	Understorey survey	River 2	-34.160891	139.928008
2	BT2 W	Big Toolunka 2	Understorey survey	Wetland 2	-34.15767	139.929357
2	BT201	Big Toolunka 2	Tree health	Tree 201	-34.16117	139.928729
2	BT202	Big Toolunka 2	Tree health	Tree 202	-34.16117	139.9286
2	BT203	Big Toolunka 2	Tree health	Tree 203	-34.161096	139.928564
2	BT204	Big Toolunka 2	Tree health	Tree 204	-34.161121	139.928509
2	BT205	Big Toolunka 2	Tree health	Tree 205	-34.161121	139.92847
2	BT206	Big Toolunka 2	Tree health	Tree 206	-34.161081	139.928446
2	BT207	Big Toolunka 2	Tree health	Tree 207	-34.161095	139.928401
2	BT208	Big Toolunka 2	Tree health	Tree 208	-34.161044	139.928369
2	BT209	Big Toolunka 2	Tree health	Tree 209	-34.161012	139.928309
2	BT210	Big Toolunka 2	Tree health	Tree 210	-34.161003	139.928263
2	BT211	Big Toolunka 2	Tree health	Tree 211	-34.161006	139.928289
2	BT212	Big Toolunka 2	Tree health	Tree 212	-34.160981	139.928246
2	BT213	Big Toolunka 2	Tree health	Tree 213	-34.160515	139.927428
2	BT214	Big Toolunka 2	Tree health	Tree 214	-34.160304	139.927535
2	BT215	Big Toolunka 2	Tree health	Tree 215	-34.157834	139.929533
2	BT215	Big Toolunka 2	Tree health	Tree 216	-34.157835	139.929513
2	BT216	Big Toolunka 2	Tree health	Tree 217	-34.157602	139.929247
2	BT217	Big Toolunka 2	Tree health	Tree 218	-34.157701	139.929091
2	BT218	Big Toolunka 2	Tree health	Tree 219	-34.157642	139.929069
2	BT219	Big Toolunka 2	Tree health	Tree 220	-34.157486	139.929027
2	BT220	Big Toolunka 2	Tree health	Tree 221	-34.157398	139.928962
2	BT221	Big Toolunka 2	Tree health	Tree 222	-34.157351	139.928904
2	BT222	Big Toolunka 2	Tree health	Tree 222	-34.157401	139.928531
2	BT223	Big Toolunka 2	Tree health	Tree 223	-34.15736	139.928332
2	BT224	Big Toolunka 2	Tree health	Tree 224	-34.157312	139.928268
2	BT225	Big Toolunka 2	Tree health	Tree 225	-34.157315	139.928254
2	BT226	Big Toolunka 2	Tree health	Tree 226	-34.157292	139.928253
2	BT227	Big Toolunka 2	Tree health	Tree 227	-34.157289	139.928259
2	BT228	Big Toolunka 2	Tree health	Tree 228	-34.15723	139.928154
2	BT229	Big Toolunka 2	Tree health	Tree 229	-34.157221	139.928212
2	BT230	Big Toolunka 2	Tree health	Tree 230	-34.157121	139.928208
2	BFHP01	Boggy Flat	Canopy photo	Photo 1	-34.08367	139.942678
2	BFHP02	Boggy Flat	Canopy photo	Photo 2	-34.082836	139.9426
2	BF R	Boggy Flat	Understorey survey	River 1	-34.082862	139.940997
2	BF W	Boggy Flat	Understorey survey	Wetland 1	-34.082573	139.941252
2	BF01	Boggy Flat	Tree health	Tree 01	-34.08374	139.9427
2	BF02	Boggy Flat	Tree health	Tree 02	-34.083755	139.942797
2	BF03	Boggy Flat	Tree health	Tree 03	-34.083757	139.942777
2	BF04	Boggy Flat	Tree health	Tree 04	-34.083675	139.942636
2	BF05	Boggy Flat	Tree health	Tree 05	-34.0836	139.942666
2	BF06	Boggy Flat	Tree health	Tree 06	-34.083571	139.942512
2	BF07	Boggy Flat	Tree health	Tree 07	-34.083266	139.94248
2	BF08	Boggy Flat	Tree health	Tree 08	-34.083196	139.942377
2	BF09	Boggy Flat	Tree health	Tree 09	-34.083166	139.942358
2	BF10	Boggy Flat	Tree health	Tree 10	-34.083153	139.942373
2	BF11	Boggy Flat	Tree health	Tree 11	-34.083156	139.942259
2	BF12	Boggy Flat	Tree health	Tree 12	-34.08315	139.94214
2	BF13	Boggy Flat	Tree health	Tree 13	-34.08293	139.942259
2	BF14	Boggy Flat	Tree health	Tree 14	-34.08293	139.942196
2	BF15	Boggy Flat	Tree health	Tree 15	-34.082834	139.942314
2	BF16	Boggy Flat	Tree health	Tree 16	-34.082892	139.942595
2	BF17	Boggy Flat	Tree health	Tree 17	-34.082877	139.942591
2	BF18	Boggy Flat	Tree health	Tree 18	-34.08288	139.942616
2	BF19	Boggy Flat	Tree health	Tree 19	-34.082795	139.942697

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	BF20	Boggy Flat	Tree health	Tree 20	-34.082993	139.942891
2	BF21	Boggy Flat	Tree health	Tree 21	-34.083241	139.942782
2	BF22	Boggy Flat	Tree health	Tree 22	-34.083203	139.94278
2	BF23	Boggy Flat	Tree health	Tree 23	-34.083204	139.942857
2	BF24	Boggy Flat	Tree health	Tree 24	-34.083236	139.942749
2	BF25	Boggy Flat	Tree health	Tree 25	-34.083252	139.942832
2	BF26	Boggy Flat	Tree health	Tree 26	-34.083293	139.942729
2	BF27	Boggy Flat	Tree health	Tree 27	-34.083355	139.94272
2	BF28	Boggy Flat	Tree health	Tree 28	-34.083311	139.942939
2	BF29	Boggy Flat	Tree health	Tree 29	-34.083354	139.942976
2	BF38	Boggy Flat	Tree health	Tree 30	-34.083405	139.943072
2	DP1 HP01	Devlins Pound 1	Canopy photo	Photo 101	-34.15698	140.174582
2	DP2 HP02	Devlins Pound 1	Canopy photo	Photo 102	-34.15876	140.17583
2	DP1 R	Devlins Pound 1	Understorey survey	River 1	-34.157077	140.174551
2	DP1 W	Devlins Pound 1	Understorey survey	Wetland 1	-34.156223	140.175372
2	DP101	Devlins Pound 1	Tree health	Tree 101	-34.156907	140.174524
2	DP102	Devlins Pound 1	Tree health	Tree 102	-34.156865	140.174652
2	DP103	Devlins Pound 1	Tree health	Tree 103	-34.156918	140.174661
2	DP104	Devlins Pound 1	Tree health	Tree 104	-34.156922	140.174686
2	DP105	Devlins Pound 1	Tree health	Tree 105	-34.156966	140.174603
2	DP106	Devlins Pound 1	Tree health	Tree 106	-34.156978	140.174594
2	DP107	Devlins Pound 1	Tree health	Tree 107	-34.157001	140.174549
2	DP108	Devlins Pound 1	Tree health	Tree 108	-34.156996	140.174606
2	DP109	Devlins Pound 1	Tree health	Tree 109	-34.156952	140.174624
2	DP110	Devlins Pound 1	Tree health	Tree 110	-34.157038	140.174673
2	DP111	Devlins Pound 1	Tree health	Tree 111	-34.157056	140.174645
2	DP112	Devlins Pound 1	Tree health	Tree 112	-34.157098	140.174557
2	DP113	Devlins Pound 1	Tree health	Tree 113	-34.157139	140.174626
2	DP114	Devlins Pound 1	Tree health	Tree 114	-34.157117	140.174612
2	DP115	Devlins Pound 1	Tree health	Tree 115	-34.157128	140.174711
2	DP116	Devlins Pound 1	Tree health	Tree 116	-34.157129	140.174704
2	DP117	Devlins Pound 1	Tree health	Tree 117	-34.157133	140.174718
2	DP118	Devlins Pound 1	Tree health	Tree 118	-34.157164	140.174721
2	DP119	Devlins Pound 1	Tree health	Tree 119	-34.15715	140.174676
2	DP120	Devlins Pound 1	Tree health	Tree 120	-34.157155	140.17465
2	DP121	Devlins Pound 1	Tree health	Tree 121	-34.157165	140.174673
2	DP122	Devlins Pound 1	Tree health	Tree 122	-34.15723	140.174619
2	DP123	Devlins Pound 1	Tree health	Tree 123	-34.157246	140.174651
2	DP124	Devlins Pound 1	Tree health	Tree 124	-34.157225	140.174726
2	DP125	Devlins Pound 1	Tree health	Tree 125	-34.157232	140.174704
2	DP126	Devlins Pound 1	Tree health	Tree 126	-34.157223	140.17474
2	DP127	Devlins Pound 1	Tree health	Tree 127	-34.157333	140.174692
2	DP128	Devlins Pound 1	Tree health	Tree 128	-34.157357	140.175096
2	DP129	Devlins Pound 1	Tree health	Tree 129	-34.157194	140.175251
2	DP130	Devlins Pound 1	Tree health	Tree 130	-34.157053	140.175018
2	DP2HP01	Devlins Pound 2	Canopy photo	Photo 201	-34.159454	140.176109
2	DPHP02	Devlins Pound 2	Canopy photo	Photo 202	-34.157331	140.175067
2	DP2 R	Devlins Pound 2	Understorey survey	River 2	-34.159517	140.176014
2	DP2 W	Devlins Pound 2	Understorey survey	Wetland 2	-34.155205	140.176446
2	DP201	Devlins Pound 2	Tree health	Tree 201	-34.1584	140.175694
2	DP202	Devlins Pound 2	Tree health	Tree 202	-34.158702	140.175826
2	DP203	Devlins Pound 2	Tree health	Tree 203	-34.158736	140.175822
2	DP204	Devlins Pound 2	Tree health	Tree 204	-34.158812	140.175834
2	DP205	Devlins Pound 2	Tree health	Tree 205	-34.159193	140.175904
2	DP206	Devlins Pound 2	Tree health	Tree 206	-34.159198	140.175938
2	DP207	Devlins Pound 2	Tree health	Tree 207	-34.15921	140.175898
2	DP208	Devlins Pound 2	Tree health	Tree 208	-34.159217	140.175919
2	DP209	Devlins Pound 2	Tree health	Tree 209	-34.159234	140.175939

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	DP210	Devlins Pound 2	Tree health	Tree 210	-34.159269	140.175963
2	DP211	Devlins Pound 2	Tree health	Tree 211	-34.159376	140.176095
2	DP212	Devlins Pound 2	Tree health	Tree 212	-34.159421	140.176101
2	DP213	Devlins Pound 2	Tree health	Tree 213	-34.159461	140.176085
2	DP214	Devlins Pound 2	Tree health	Tree 214	-34.159464	140.176073
2	DP215	Devlins Pound 2	Tree health	Tree 215	-34.159454	140.176135
2	DP216	Devlins Pound 2	Tree health	Tree 216	-34.159476	140.17613
2	DP217	Devlins Pound 2	Tree health	Tree 217	-34.159504	140.176115
2	DP218	Devlins Pound 2	Tree health	Tree 218	-34.159501	140.176156
2	DP219	Devlins Pound 2	Tree health	Tree 219	-34.159516	140.176132
2	DP220	Devlins Pound 2	Tree health	Tree 220	-34.159513	140.176207
2	DP221	Devlins Pound 2	Tree health	Tree 221	-34.159601	140.176232
2	DP222	Devlins Pound 2	Tree health	Tree 222	-34.159675	140.176283
2	DP223	Devlins Pound 2	Tree health	Tree 223	-34.159696	140.176277
2	DP224	Devlins Pound 2	Tree health	Tree 224	-34.15972	140.176274
2	DP225	Devlins Pound 2	Tree health	Tree 225	-34.159727	140.176327
2	DP226	Devlins Pound 2	Tree health	Tree 226	-34.159753	140.176374
2	DP227	Devlins Pound 2	Tree health	Tree 227	-34.159831	140.176378
2	DP228	Devlins Pound 2	Tree health	Tree 228	-34.159831	140.176413
2	DP229	Devlins Pound 2	Tree health	Tree 229	-34.159812	140.17643
2	DP230	Devlins Pound 2	Tree health	Tree 230	-34.159874	140.176437
2	IR HP01	Island Reach	Canopy photo	Photo 1	-34.155965	140.027514
2	IR HP02	Island Reach	Canopy photo	Photo 2	-34.154267	140.025075
2	IR R01	Island Reach	Understorey survey	River 1	-34.155694	140.02688
2	IR W	Island Reach	Understorey survey	Wetland 1	-34.153773	140.025716
2	IR01	Island Reach	Tree health	Tree 01	-34.156025	140.027413
2	IR02	Island Reach	Tree health	Tree 02	-34.155995	140.027411
2	IR03	Island Reach	Tree health	Tree 03	-34.155974	140.027344
2	IR04	Island Reach	Tree health	Tree 04	-34.155882	140.027256
2	IR05	Island Reach	Tree health	Tree 05	-34.155861	140.02712
2	IR06	Island Reach	Tree health	Tree 06	-34.155845	140.027098
2	IR07	Island Reach	Tree health	Tree 07	-34.155767	140.027042
2	IR08	Island Reach	Tree health	Tree 08	-34.155744	140.026973
2	IR09	Island Reach	Tree health	Tree 09	-34.155717	140.026943
2	IR10	Island Reach	Tree health	Tree 10	-34.155719	140.026914
2	IR11	Island Reach	Tree health	Tree 11	-34.15568	140.026881
2	IR12	Island Reach	Tree health	Tree 12	-34.155615	140.026784
2	IR13	Island Reach	Tree health	Tree 13	-34.155629	140.026783
2	IR14	Island Reach	Tree health	Tree 14	-34.155579	140.026722
2	IR15	Island Reach	Tree health	Tree 15	-34.155571	140.026717
2	IR16	Island Reach	Tree health	Tree 16	-34.155498	140.026735
2	IR17	Island Reach	Tree health	Tree 17	-34.155485	140.026626
2	IR18	Island Reach	Tree health	Tree 18	-34.155453	140.026582
2	IR19	Island Reach	Tree health	Tree 19	-34.155427	140.026568
2	IR20	Island Reach	Tree health	Tree 20	-34.154271	140.025101
2	IR21	Island Reach	Tree health	Tree 21	-34.154084	140.02522
2	IR22	Island Reach	Tree health	Tree 22	-34.154104	140.025259
2	IR23	Island Reach	Tree health	Tree 23	-34.154081	140.025237
2	IR24	Island Reach	Tree health	Tree 24	-34.154091	140.025222
2	JL1 HP01	Jaeschkes Lagoon 1	Canopy photo	Photo 101	-34.185688	140.002205
2	JL1 HP02	Jaeschkes Lagoon 1	Canopy photo	Photo 102	-34.185331	140.002233
2	JL1 R	Jaeschkes Lagoon 1	Understorey survey	River 1	-34.185954	140.002941
2	JL1 W	Jaeschkes Lagoon 1	Understorey survey	Wetland 1	-34.181922	140.000657
2	JL101	Jaeschkes Lagoon 1	Tree health	Tree 101	-34.185661	140.002364
2	JL102	Jaeschkes Lagoon 1	Tree health	Tree 102	-34.185676	140.002193
2	JL103	Jaeschkes Lagoon 1	Tree health	Tree 103	-34.185737	140.002221
2	JL104	Jaeschkes Lagoon 1	Tree health	Tree 104	-34.185758	140.002202
2	JL105	Jaeschkes Lagoon 1	Tree health	Tree 105	-34.185727	140.002075

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	JL106	Jaeschkes Lagoon 1	Tree health	Tree 106	-34.185747	140.002056
2	JL107	Jaeschkes Lagoon 1	Tree health	Tree 107	-34.185712	140.002074
2	JL108	Jaeschkes Lagoon 1	Tree health	Tree 108	-34.185684	140.001935
2	JL109	Jaeschkes Lagoon 1	Tree health	Tree 109	-34.1856	140.002029
2	JL110	Jaeschkes Lagoon 1	Tree health	Tree 110	-34.18557	140.00198
2	JL111	Jaeschkes Lagoon 1	Tree health	Tree 111	-34.185536	140.001589
2	JL112	Jaeschkes Lagoon 1	Tree health	Tree 112	-34.185326	140.000719
2	JL113	Jaeschkes Lagoon 1	Tree health	Tree 113	-34.185123	140.00052
2	JL114	Jaeschkes Lagoon 1	Tree health	Tree 114	-34.185024	140.00004
2	JL115	Jaeschkes Lagoon 1	Tree health	Tree 115	-34.18522	140.001485
2	JL116	Jaeschkes Lagoon 1	Tree health	Tree 116	-34.185207	140.00156
2	JL117	Jaeschkes Lagoon 1	Tree health	Tree 117	-34.185358	140.00228
2	JL118	Jaeschkes Lagoon 1	Tree health	Tree 118	-34.185285	140.002542
2	JL2 HP01	Jaeschkes Lagoon 2	Canopy photo	Photo 201	-34.176508	139.989883
2	JL2 HP02	Jaeschkes Lagoon 2	Canopy photo	Photo 202	-34.176086	139.989263
2	JL R2	Jaeschkes Lagoon 2	Understorey survey	River 2	-34.176595	139.989436
2	JL201	Jaeschkes Lagoon 2	Tree health	Tree 201	-34.176445	139.99
2	JL202	Jaeschkes Lagoon 2	Tree health	Tree 202	-34.176485	139.990018
2	JL203	Jaeschkes Lagoon 2	Tree health	Tree 203	-34.176567	139.98977
2	JL204	Jaeschkes Lagoon 2	Tree health	Tree 204	-34.176344	139.989341
2	JL205	Jaeschkes Lagoon 2	Tree health	Tree 205	-34.176324	139.989334
2	JL206	Jaeschkes Lagoon 2	Tree health	Tree 206	-34.176104	139.989277
2	JL207	Jaeschkes Lagoon 2	Tree health	Tree 207	-34.176052	139.989179
2	JL208	Jaeschkes Lagoon 2	Tree health	Tree 208	-34.175562	139.988708
2	JL209	Jaeschkes Lagoon 2	Tree health	Tree 209	-34.175384	139.988626
2	JL210	Jaeschkes Lagoon 2	Tree health	Tree 210	-34.17506	139.98837
2	JL211	Jaeschkes Lagoon 2	Tree health	Tree 211	-34.174938	139.98826
2	JL212	Jaeschkes Lagoon 2	Tree health	Tree 212	-34.175163	139.988757
2	LI HP101	Lara Inlet 1	Canopy photo	Photo 101	-34.170309	140.309226
2	LI1 HP02	Lara Inlet 1	Canopy photo	Photo 102	-34.170211	140.309343
2	LI R01	Lara Inlet 1	Understorey survey	River 1	-34.169767	140.310727
2	LI1 W	Lara Inlet 1	Understorey survey	Wetland 1	-34.168912	140.310594
2	LI101	Lara Inlet 1	Tree health	Tree 101	-34.170342	140.30915
2	LI102	Lara Inlet 1	Tree health	Tree 102	-34.170315	140.309164
2	LI103	Lara Inlet 1	Tree health	Tree 103	-34.170326	140.309217
2	LI104	Lara Inlet 1	Tree health	Tree 104	-34.170316	140.30923
2	LI105	Lara Inlet 1	Tree health	Tree 105	-34.170316	140.309243
2	LI106	Lara Inlet 1	Tree health	Tree 106	-34.170299	140.309239
2	LI107	Lara Inlet 1	Tree health	Tree 107	-34.1703	140.309229
2	LI108	Lara Inlet 1	Tree health	Tree 108	-34.170296	140.309264
2	LI109	Lara Inlet 1	Tree health	Tree 109	-34.170225	140.309236
2	LI110	Lara Inlet 1	Tree health	Tree 110	-34.170256	140.30919
2	LI111	Lara Inlet 1	Tree health	Tree 111	-34.170237	140.309233
2	LI112	Lara Inlet 1	Tree health	Tree 112	-34.170265	140.309237
2	LI113	Lara Inlet 1	Tree health	Tree 113	-34.170256	140.309285
2	LI114	Lara Inlet 1	Tree health	Tree 114	-34.170271	140.309304
2	LI115	Lara Inlet 1	Tree health	Tree 115	-34.170287	140.309317
2	LI116	Lara Inlet 1	Tree health	Tree 116	-34.170279	140.309321
2	LI117	Lara Inlet 1	Tree health	Tree 117	-34.170294	140.309341
2	LI118	Lara Inlet 1	Tree health	Tree 118	-34.170269	140.309328
2	LI119	Lara Inlet 1	Tree health	Tree 119	-34.170263	140.309363
2	LI120	Lara Inlet 1	Tree health	Tree 120	-34.170273	140.309339
2	LI121	Lara Inlet 1	Tree health	Tree 121	-34.170262	140.30939
2	LI122	Lara Inlet 1	Tree health	Tree 122	-34.170231	140.309362
2	LI123	Lara Inlet 1	Tree health	Tree 123	-34.170239	140.309333
2	LI124	Lara Inlet 1	Tree health	Tree 124	-34.170199	140.309311
2	LI125	Lara Inlet 1	Tree health	Tree 125	-34.170199	140.309281
2	LI126	Lara Inlet 1	Tree health	Tree 126	-34.170224	140.309298

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	LI127	Lara Inlet 1	Tree health	Tree 127	-34.170191	140.309298
2	LI128	Lara Inlet 1	Tree health	Tree 128	-34.170209	140.309281
2	LI129	Lara Inlet 1	Tree health	Tree 129	-34.170218	140.3093
2	LI130	Lara Inlet 1	Tree health	Tree 130	-34.170225	140.309351
2	LI2 HP01	Lara Inlet 2	Canopy photo	Photo 201	-34.169666	140.310613
2	LI2 HP02	Lara Inlet 2	Canopy photo	Photo 202	-34.169311	140.310574
2	LI2 R	Lara Inlet 2	Understorey survey	River 2	-34.169329	140.311728
2	LI2 W	Lara Inlet 2	Understorey survey	Wetland 2	-34.167778	140.3121
2	LI201	Lara Inlet 2	Tree health	Tree 201	-34.16974	140.310641
2	LI202	Lara Inlet 2	Tree health	Tree 202	-34.169602	140.310897
2	LI203	Lara Inlet 2	Tree health	Tree 203	-34.16958	140.310897
2	LI204	Lara Inlet 2	Tree health	Tree 204	-34.16957	140.310693
2	LI205	Lara Inlet 2	Tree health	Tree 205	-34.169604	140.310681
2	LI206	Lara Inlet 2	Tree health	Tree 206	-34.169374	140.310474
2	LI207	Lara Inlet 2	Tree health	Tree 207	-34.169386	140.310655
2	LI208	Lara Inlet 2	Tree health	Tree 208	-34.169326	140.310659
2	LI209	Lara Inlet 2	Tree health	Tree 209	-34.169305	140.310598
2	LI210	Lara Inlet 2	Tree health	Tree 210	-34.169256	140.310561
2	LI211	Lara Inlet 2	Tree health	Tree 211	-34.169	140.310646
2	LI212	Lara Inlet 2	Tree health	Tree 212	-34.168974	140.311092
2	LI213	Lara Inlet 2	Tree health	Tree 213	-34.168858	140.311207
2	LI214	Lara Inlet 2	Tree health	Tree 214	-34.168929	140.311386
2	LI215	Lara Inlet 2	Tree health	Tree 215	-34.168763	140.311505
2	LI216	Lara Inlet 2	Tree health	Tree 216	-34.169207	140.31156
2	LI217	Lara Inlet 2	Tree health	Tree 217	-34.169099	140.311809
2	LI218	Lara Inlet 2	Tree health	Tree 218	-34.168877	140.312373
2	LI219	Lara Inlet 2	Tree health	Tree 219	-34.168704	140.312151
2	LI220	Lara Inlet 2	Tree health	Tree 220	-34.168745	140.311833
2	LT HP101	Little Toolunka 1	Canopy photo	Photo 101	-34.114876	139.959628
2	LTHP102	Little Toolunka 1	Canopy photo	Photo 102	-34.115196	139.960035
2	LT R01	Little Toolunka 1	Understorey survey	River 1	-34.114907	139.956691
2	LT W01	Little Toolunka 1	Understorey survey	Wetland 1	-34.115325	139.960028
2	LT101	Little Toolunka 1	Tree health	Tree 101	-34.114585	139.960392
2	LT102	Little Toolunka 1	Tree health	Tree 102	-34.114523	139.960387
2	LT103	Little Toolunka 1	Tree health	Tree 103	-34.114526	139.960362
2	LT104	Little Toolunka 1	Tree health	Tree 104	-34.114586	139.960285
2	LT105	Little Toolunka 1	Tree health	Tree 105	-34.114589	139.960235
2	LT106	Little Toolunka 1	Tree health	Tree 106	-34.114581	139.960211
2	LT107	Little Toolunka 1	Tree health	Tree 107	-34.114591	139.960168
2	LT108	Little Toolunka 1	Tree health	Tree 108	-34.114668	139.959998
2	LT109	Little Toolunka 1	Tree health	Tree 109	-34.114733	139.959969
2	LT110	Little Toolunka 1	Tree health	Tree 110	-34.11482	139.959822
2	LT111	Little Toolunka 1	Tree health	Tree 111	-34.114818	139.95981
2	LT112	Little Toolunka 1	Tree health	Tree 112	-34.114878	139.959718
2	LT113	Little Toolunka 1	Tree health	Tree 113	-34.114913	139.959665
2	LT114	Little Toolunka 1	Tree health	Tree 114	-34.114896	139.959645
2	LT115	Little Toolunka 1	Tree health	Tree 115	-34.114867	139.959593
2	LT116	Little Toolunka 1	Tree health	Tree 116	-34.114865	139.959593
2	LT117	Little Toolunka 1	Tree health	Tree 117	-34.114883	139.959553
2	LT118	Little Toolunka 1	Tree health	Tree 118	-34.114878	139.959577
2	LT119	Little Toolunka 1	Tree health	Tree 119	-34.114826	139.959567
2	LT120	Little Toolunka 1	Tree health	Tree 120	-34.114835	139.95959
2	LT121	Little Toolunka 1	Tree health	Tree 121	-34.11543	139.95984
2	LT122	Little Toolunka 1	Tree health	Tree 122	-34.115352	139.959925
2	LT123	Little Toolunka 1	Tree health	Tree 123	-34.115224	139.960006
2	LT124	Little Toolunka 1	Tree health	Tree 124	-34.115205	139.960011
2	LT125	Little Toolunka 1	Tree health	Tree 125	-34.115201	139.960011
2	LT126	Little Toolunka 1	Tree health	Tree 126	-34.115193	139.960043

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	LT127	Little Toolunka 1	Tree health	Tree 127	-34.115215	139.960034
2	LT128	Little Toolunka 1	Tree health	Tree 128	-34.115217	139.959999
2	LT129	Little Toolunka 1	Tree health	Tree 129	-34.115223	139.960014
2	LT130	Little Toolunka 1	Tree health	Tree 130	-34.115222	139.960006
2	LT HP201	Little Toolunka 2	Canopy photo	Photo 201	-34.116663	139.953553
2	LT HP202	Little Toolunka 2	Canopy photo	Photo 202	-34.115777	139.954814
2	LT R02	Little Toolunka 2	Understorey survey	River 2	-34.116568	139.953557
2	LT W02	Little Toolunka 2	Understorey survey	Wetland 2	-34.117082	139.959011
2	LT201	Little Toolunka 2	Tree health	Tree 201	-34.116636	139.953483
2	LT202	Little Toolunka 2	Tree health	Tree 202	-34.116637	139.953594
2	LT203	Little Toolunka 2	Tree health	Tree 203	-34.116485	139.953716
2	LT204	Little Toolunka 2	Tree health	Tree 204	-34.117819	139.958482
2	LT205	Little Toolunka 2	Tree health	Tree 205	-34.117814	139.958517
2	LT206	Little Toolunka 2	Tree health	Tree 206	-34.117855	139.95853
2	LT207	Little Toolunka 2	Tree health	Tree 207	-34.117863	139.958563
2	LT208	Little Toolunka 2	Tree health	Tree 208	-34.117924	139.958599
2	LT209	Little Toolunka 2	Tree health	Tree 209	-34.117867	139.958637
2	LT210	Little Toolunka 2	Tree health	Tree 210	-34.117871	139.958631
2	LT211	Little Toolunka 2	Tree health	Tree 211	-34.117881	139.95868
2	LT212	Little Toolunka 2	Tree health	Tree 212	-34.117892	139.958702
2	LT213	Little Toolunka 2	Tree health	Tree 213	-34.117901	139.958734
2	LT214	Little Toolunka 2	Tree health	Tree 214	-34.117061	139.958991
2	LT215	Little Toolunka 2	Tree health	Tree 215	-34.116225	139.954098
2	LT216	Little Toolunka 2	Tree health	Tree 216	-34.116187	139.954129
2	LT217	Little Toolunka 2	Tree health	Tree 217	-34.116196	139.954171
2	LT218	Little Toolunka 2	Tree health	Tree 218	-34.116179	139.954193
2	LT219	Little Toolunka 2	Tree health	Tree 219	-34.11616	139.954213
2	LT220	Little Toolunka 2	Tree health	Tree 220	-34.116145	139.954219
2	LT221	Little Toolunka 2	Tree health	Tree 221	-34.116115	139.95436
2	LT222	Little Toolunka 2	Tree health	Tree 222	-34.115757	139.954808
2	LT223	Little Toolunka 2	Tree health	Tree 223	-34.115686	139.954913
2	LT224	Little Toolunka 2	Tree health	Tree 224	-34.115754	139.954738
2	LT225	Little Toolunka 2	Tree health	Tree 225	-34.115786	139.954787
2	LT226	Little Toolunka 2	Tree health	Tree 226	-34.115679	139.955205
2	LT227	Little Toolunka 2	Tree health	Tree 227	-34.115403	139.955832
2	LT228	Little Toolunka 2	Tree health	Tree 228	-34.115235	139.956101
2	LT229	Little Toolunka 2	Tree health	Tree 229	-34.115136	139.956378
2	LT230	Little Toolunka 2	Tree health	Tree 230	-34.115157	139.956446
2	P HP01	Penn Inlet	Canopy photo	Photo 1	-34.131399	139.930881
2	P HP02	Penn Inlet	Canopy photo	Photo 2	-34.131568	139.931256
2	P R	Penn Inlet	Understorey survey	River 1	-34.131809	139.931516
2	P W	Penn Inlet	Understorey survey	Wetland 1	-34.131365	139.930923
2	P01	Penn Inlet	Tree health	Tree 01	-34.13164	139.931328
2	P02	Penn Inlet	Tree health	Tree 02	-34.131505	139.931381
2	P03	Penn Inlet	Tree health	Tree 03	-34.131476	139.931218
2	P04	Penn Inlet	Tree health	Tree 04	-34.131386	139.930923
2	P05	Penn Inlet	Tree health	Tree 05	-34.131362	139.930897
2	P06	Penn Inlet	Tree health	Tree 06	-34.131368	139.930891
2	P07	Penn Inlet	Tree health	Tree 07	-34.131362	139.930858
2	P08	Penn Inlet	Tree health	Tree 08	-34.131354	139.930844
2	P09	Penn Inlet	Tree health	Tree 09	-34.131352	139.930798
2	P10	Penn Inlet	Tree health	Tree 10	-34.131331	139.9308
2	P11	Penn Inlet	Tree health	Tree 11	-34.131339	139.93079
2	P12	Penn Inlet	Tree health	Tree 12	-34.131357	139.930786
2	P13	Penn Inlet	Tree health	Tree 13	-34.131546	139.930565
2	P14	Penn Inlet	Tree health	Tree 14	-34.131526	139.930456
2	P15	Penn Inlet	Tree health	Tree 15	-34.131552	139.930391
2	P16	Penn Inlet	Tree health	Tree 16	-34.131618	139.930485

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	P17	Penn Inlet	Tree health	Tree 17	-34.131638	139.930492
2	P18	Penn Inlet	Tree health	Tree 18	-34.131629	139.930409
2	P19	Penn Inlet	Tree health	Tree 19	-34.131839	139.93026
2	P20	Penn Inlet	Tree health	Tree 20	-34.132229	139.930546
2	P21	Penn Inlet	Tree health	Tree 21	-34.131978	139.930791
2	P22	Penn Inlet	Tree health	Tree 22	-34.131536	139.931801
2	P23	Penn Inlet	Tree health	Tree 23	-34.13151	139.931814
2	P24	Penn Inlet	Tree health	Tree 24	-34.131354	139.931756
2	P25	Penn Inlet	Tree health	Tree 25	-34.131388	139.932001
2	RL HP01	Ross Lagoon	Canopy photo	Photo 1	-34.163847	139.973113
2	RL HP02	Ross Lagoon	Canopy photo	Photo 2	-34.164996	139.974324
2	RL R1	Ross Lagoon	Understorey survey	River 1	-34.164024	139.973003
2	RL W	Ross Lagoon	Understorey survey	Wetland 1	-34.163091	139.974786
2	RL01	Ross Lagoon	Tree health	Tree 01	-34.163344	139.972589
2	RL02	Ross Lagoon	Tree health	Tree 02	-34.163527	139.972662
2	RL03	Ross Lagoon	Tree health	Tree 03	-34.163545	139.972689
2	RL04	Ross Lagoon	Tree health	Tree 04	-34.163567	139.972679
2	RL05	Ross Lagoon	Tree health	Tree 05	-34.163589	139.972701
2	RL06	Ross Lagoon	Tree health	Tree 06	-34.163578	139.972804
2	RL07	Ross Lagoon	Tree health	Tree 07	-34.163555	139.972776
2	RL08	Ross Lagoon	Tree health	Tree 08	-34.163646	139.972685
2	RL09	Ross Lagoon	Tree health	Tree 09	-34.163638	139.972694
2	RL10	Ross Lagoon	Tree health	Tree 10	-34.163665	139.972743
2	RL11	Ross Lagoon	Tree health	Tree 11	-34.163672	139.97275
2	RL12	Ross Lagoon	Tree health	Tree 12	-34.16379	139.973028
2	RL13	Ross Lagoon	Tree health	Tree 13	-34.163795	139.973081
2	RL14	Ross Lagoon	Tree health	Tree 14	-34.16386	139.973104
2	RL15	Ross Lagoon	Tree health	Tree 15	-34.164109	139.973108
2	RL16	Ross Lagoon	Tree health	Tree 16	-34.164089	139.973139
2	RL17	Ross Lagoon	Tree health	Tree 17	-34.164084	139.973165
2	RL18	Ross Lagoon	Tree health	Tree 18	-34.164126	139.973222
2	RL19	Ross Lagoon	Tree health	Tree 19	-34.164296	139.973242
2	RL20	Ross Lagoon	Tree health	Tree 20	-34.164437	139.973757
2	RL21	Ross Lagoon	Tree health	Tree 21	-34.164495	139.97384
2	RL22	Ross Lagoon	Tree health	Tree 22	-34.164798	139.973807
2	RL23	Ross Lagoon	Tree health	Tree 23	-34.164907	139.973874
2	RL24	Ross Lagoon	Tree health	Tree 24	-34.164999	139.97398
2	RL25	Ross Lagoon	Tree health	Tree 25	-34.164897	139.974215
2	RL26	Ross Lagoon	Tree health	Tree 26	-34.164805	139.9744
2	RL27	Ross Lagoon	Tree health	Tree 27	-34.164987	139.974287
2	RL28	Ross Lagoon	Tree health	Tree 28	-34.165023	139.974346
2	RL29	Ross Lagoon	Tree health	Tree 29	-34.165189	139.974406
2	RL30	Ross Lagoon	Tree health	Tree 30	-34.165171	139.97459
2	YC1 HP01	Yarra Complex 1	Canopy photo	Photo 101	-34.17713	140.061669
2	YC1 HP02	Yarra Complex 1	Canopy photo	Photo 102	-34.177517	140.062251
2	YC R01	Yarra Complex 1	Understorey survey	River 1	-34.177379	140.061937
2	YC1 W	Yarra Complex 1	Understorey survey	Wetland 1	-34.176412	140.062633
2	YC101	Yarra Complex 1	Tree health	Tree 101	-34.177689	140.062619
2	YC102	Yarra Complex 1	Tree health	Tree 102	-34.177653	140.062593
2	YC103	Yarra Complex 1	Tree health	Tree 103	-34.177649	140.062474
2	YC104	Yarra Complex 1	Tree health	Tree 104	-34.177545	140.062239
2	YC105	Yarra Complex 1	Tree health	Tree 105	-34.177545	140.062199
2	YC106	Yarra Complex 1	Tree health	Tree 106	-34.177528	140.062216
2	YC107	Yarra Complex 1	Tree health	Tree 107	-34.177516	140.062199
2	YC108	Yarra Complex 1	Tree health	Tree 108	-34.177488	140.062191
2	YC109	Yarra Complex 1	Tree health	Tree 109	-34.177498	140.062154
2	YC110	Yarra Complex 1	Tree health	Tree 110	-34.177516	140.062136
2	YC111	Yarra Complex 1	Tree health	Tree 111	-34.177487	140.062123

Weir Pool	Identifier	Site	Survey type	Location Description	Latitude	Longitude
2	YC112	Yarra Complex 1	Tree health	Tree 112	-34.177432	140.06213
2	YC113	Yarra Complex 1	Tree health	Tree 113	-34.177378	140.062084
2	YC114	Yarra Complex 1	Tree health	Tree 114	-34.177325	140.062031
2	YC115	Yarra Complex 1	Tree health	Tree 115	-34.177349	140.062005
2	YC116	Yarra Complex 1	Tree health	Tree 116	-34.177354	140.062003
2	YC117	Yarra Complex 1	Tree health	Tree 117	-34.177316	140.061964
2	YC118	Yarra Complex 1	Tree health	Tree 118	-34.177284	140.061989
2	YC119	Yarra Complex 1	Tree health	Tree 119	-34.17733	140.061957
2	YC120	Yarra Complex 1	Tree health	Tree 120	-34.177317	140.061962
2	YC121	Yarra Complex 1	Tree health	Tree 121	-34.177302	140.061946
2	YC122	Yarra Complex 1	Tree health	Tree 122	-34.177302	140.061916
2	YC123	Yarra Complex 1	Tree health	Tree 123	-34.177269	140.061908
2	YC124	Yarra Complex 1	Tree health	Tree 124	-34.177256	140.06189
2	YC125	Yarra Complex 1	Tree health	Tree 125	-34.177263	140.061896
2	YC126	Yarra Complex 1	Tree health	Tree 126	-34.177268	140.061853
2	YC127	Yarra Complex 1	Tree health	Tree 127	-34.177148	140.061734
2	YC128	Yarra Complex 1	Tree health	Tree 128	-34.177109	140.061672
2	YC129	Yarra Complex 1	Tree health	Tree 129	-34.177109	140.06165
2	YC130	Yarra Complex 1	Tree health	Tree 130	-34.177031	140.061569
2	YC2 HP01	Yarra Complex 2	Canopy photo	Photo 201	-34.181814	140.085273
2	YC2 HP02	Yarra Complex 2	Canopy photo	Photo 202	-34.182068	140.088226
2	YC R02	Yarra Complex 2	Understorey survey	River 2	-34.181816	140.085609
2	YC2 W	Yarra Complex 2	Understorey survey	Wetland 2	-34.180311	140.085567
2	YC201	Yarra Complex 2	Tree health	Tree 201	-34.18172	140.084562
2	YC202	Yarra Complex 2	Tree health	Tree 202	-34.181785	140.084831
2	YC203	Yarra Complex 2	Tree health	Tree 203	-34.181773	140.085146
2	YC204	Yarra Complex 2	Tree health	Tree 204	-34.181798	140.085237
2	YC205	Yarra Complex 2	Tree health	Tree 205	-34.181814	140.085279
2	YC206	Yarra Complex 2	Tree health	Tree 206	-34.181654	140.085721
2	YC207	Yarra Complex 2	Tree health	Tree 207	-34.18177	140.085732
2	YC208	Yarra Complex 2	Tree health	Tree 208	-34.181735	140.085861
2	YC209	Yarra Complex 2	Tree health	Tree 209	-34.181866	140.086152
2	YC210	Yarra Complex 2	Tree health	Tree 210	-34.181806	140.086199
2	YC211	Yarra Complex 2	Tree health	Tree 211	-34.181881	140.086243
2	YC212	Yarra Complex 2	Tree health	Tree 212	-34.181869	140.086558
2	YC213	Yarra Complex 2	Tree health	Tree 213	-34.181906	140.086868
2	YC214	Yarra Complex 2	Tree health	Tree 214	-34.181895	140.086946
2	YC215	Yarra Complex 2	Tree health	Tree 215	-34.181903	140.08697
2	YC216	Yarra Complex 2	Tree health	Tree 216	-34.181952	140.087443
2	YC217	Yarra Complex 2	Tree health	Tree 217	-34.181936	140.087538
2	YC218	Yarra Complex 2	Tree health	Tree 218	-34.182054	140.087576
2	YC219	Yarra Complex 2	Tree health	Tree 219	-34.18191	140.087652
2	YC220	Yarra Complex 2	Tree health	Tree 220	-34.181906	140.087683
2	YC221	Yarra Complex 2	Tree health	Tree 221	-34.181941	140.087686
2	YC222	Yarra Complex 2	Tree health	Tree 222	-34.181996	140.087905
2	YC223	Yarra Complex 2	Tree health	Tree 223	-34.182038	140.088167
2	YC224	Yarra Complex 2	Tree health	Tree 224	-34.182093	140.088241
2	YC225	Yarra Complex 2	Tree health	Tree 225	-34.18028	140.085456
2	YC226	Yarra Complex 2	Tree health	Tree 226	-34.180284	140.085372
2	YC227	Yarra Complex 2	Tree health	Tree 227	-34.180271	140.085369
2	YC228	Yarra Complex 2	Tree health	Tree 228	-34.180306	140.085321
2	YC229	Yarra Complex 2	Tree health	Tree 229	-34.180285	140.085299
2	YC230	Yarra Complex 2	Tree health	Tree 230	-34.180265	140.085277

Appendix 2: Description of *Eucalyptus camaldulensis* assessment (*crown density represents the potential original crown and crown density represents the actual crown i.e. the maximum density cannot be higher than the extent score) (Souter *et al.* 2009; Souter *et al.* 2010).

Condition Measurement	Score	Condition Rating	Comments
Crown extent*	5	Maximum	>90% original canopy present
	4	Major	75-90% original canopy present
	3	Moderate	26-75% original canopy present
	2	Sparse	10-25% original canopy present
	1	Minimal	<10% original canopy present
	0	None	No original canopy present
Crown density*	5	Maximum	>90% original canopy present
	4	Major	75-90% original canopy present
	3	Moderate	50-75% original canopy present
	2	Sparse	25-50% original canopy present
	1	Minimal	<25% original canopy present
	0	None	No original canopy present
Bark condition	I or C	Intact or Cracked	A tree is not classed as dead unless there are deep cracks in the bark
Epicormic growth	3	Abundant	Dominates appearance of tree
	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present
Epicormic state	A or IA	Active or Inactive	Whether the epicormic growth is actively growing or not
Reproduction	3	Abundant	Dominates appearance of tree
(flowering and fruiting)	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present
Crown growth	3	Abundant	Dominates appearance of tree
(active tip growth)	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present
Leaf die off	3	Abundant	Dominates appearance of tree
	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present
Leaf damage	3	Abundant	Dominates appearance of tree
	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present
Mistletoe	3	Abundant	Dominates appearance of tree
	2	Common	Obvious but does not dominate appearance of tree
	1	Scarce	Present but not obvious, requires close inspection
	0	Absent	Not present

APPENDICES

Appendix 3: Plant species list for the September 2014 and January 2015 in a. Lock 1 riverbanks, b. Lock 1 wetlands, c. Lock 2 riverbanks and d. Lock 2 wetlands (*denotes exotic species; **denotes proclaimed pest plant in South Australia; #denotes listed as rare in South Australia; ###denotes listed as endangered in South Australia).

a.

Zone	Lower																		Middle																		Upper																	
Survey Number	**1**									**2**									**1**									**2**									**1**									**2**								
Elevation	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**80**	**100**
Taxon																																																						
Acacia stenophylla (seedling)																																					X	X	X	X	X	X	X	X	X									
Acacia stenophylla																										X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Alternanthera denticulata										X			X	X	X																																							
Alternanthera nana																												X	X	X	X	X	X	X	X	X																		
*Arctotheca calendula**					X		X	X	X																																													
Asperula gemella																										X	X																											
*Aster subulatus**			X	X	X														X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							X														
*Atriplex prostrata**	X	X	X				X	X	X					X	X	X	X	X									X	X	X	X	X	X			X	X																		
Atriplex spp.						X	X	X	X						X	X	X	X									X									X									X									
Atriplex suberecta																											X															X	X	X	X									
*Avena barbata**					X	X	X	X	X																	X	X																											
Azolla filiculoides	X	X	X							X	X	X	X	X	X	X	X	X																				X	X															
Bolboschoenus caldwellii																																					X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	
Brachyscome basaltica																										X																												
Brassica spp.*																																											X	X										
*Bromus mollis**					X	X	X	X	X																																													
*Bromus rubens**			X		X	X	X	X	X																																													
Bromus spp.*													X	X	X																									X	X	X	X											
Bulbine bulbosa				X	X	X	X	X	X																																	X	X		X									
*Callitriche stagnalis**			X		X	X	X	X	X																															X		X	X	X										
Centella asiatica		X	X							X																																												
*Centaurea calcitrapa**										X	X															X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Centipeda minima										X																																												
*Conyza bonariensis**													X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X																		
Cotula australis																																										X												
Cotula coronopifolia			X	X	X	X	X																																															
Crassula helmsii										X	X					X																				X																		
Crassula sieberana###								X	X																																													
*Cynodon dactylon**									X				X	X	X																																							
Cyperus gymnocaulos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Daucus glochidiatus				X	X	X	X		X																		X																											
Distichlis distichophylla																	X																																					
Duma florulenta									X										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									X
Enchylaena tomentosa									X								X	X																										X	X									X
*Enneapogon nigricans**			X	X	X	X	X	X	X																																													
*Eragrostis curvula**		X	X	X	X	X	X	X	X																																													
Eucalyptus camaldulensis (sapling)						X			X									X																																				
Chamaesyce drummondii																	X	X																							X					X	X	X	X	X	X	X	X	X
Euphorbia maculata																										X																												
*Euphorbia terracina***																			X	X	X	X	X	X	X	X	X																											
Glycyrrhiza acanthocarpa																												X	X	X	X	X																						
Haloragis aspera																			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
*Heliotropium curassavicum**																																																		X	X			
*Heliotropium europaeaum**											X			X		X																																						
Helichrysum luteo-album		X					X																			X	X												X	X	X	X	X											
*Hordeum vulgare**						X	X	X	X																																													
*Hypochaeris glabra**				X	X	X	X	X	X									X							X	X	X																											
*Hypochaeris radicata**								X	X																																													
Iris sp.*			X	X																																																		
Juncus usitatus	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X	X																				
Lachnagrostis filiformis									X																											X			X	X	X	X	X	X	X									
Lemna minor	X	X	X																																																			
Lobelia alata			X																																																			
Ludwigia peploides										X	X	X																										X								X								
Maireana sp.							X	X	X								X																																					
*Malvella leprosa***																																														X	X	X	X	X	X	X	X	X
*Marrubium vulgare***																																								X	X	X	X	X	X								X	X
Medicago spp.*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								X	X										X	X	X	X	X	X	X	X	X									
*Melilotus indicus**					X	X	X																														X	X	X	X	X	X	X	X	X									
*Mesembryanthemum crystallinum**																																											X											
Stemodia florulenta																																					X									X	X	X	X	X	X	X	X	X

Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																																																						
Myoporum montanum																			X	X	X	X	X	X	X		X																											
Myriophyllum papillosum#										X	X	X																																										
*Nothoscordum gracile**															X																																							
*Onopordum acanthium**																	X											X	X	X	X	X	X	X	X	X										X	X	X	X	X	X	X	X	X
*Paspalum distichum**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Pennisetum clandestinum**										X	X	X																																										
Persicaria lapathifolia																																			X	X																		
Phragmites australis	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Phyla canescens**									X					X	X	X	X	X								X	X																											
Picris hieracioides																												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									
*Plantago coronopus**				X	X	X	X	X	X																																													
Plantago turrifera																																										X				X	X	X	X	X	X	X	X	X
*Polypogon monspeliensis**	X	X	X	X	X	X	X				X																																											
*Riechardia tingitana**			X	X	X	X	X	X	X									X								X	X																											
*Rorippa palustris**							X	X	X																	X	X													X	X	X	X	X										
Rumex bidens	X	X	X	X	X					X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
Samolus repens																		X																																				
Schoenoplectus validus	X	X	X	X						X	X	X																																										
Sclerolaena divaricata																		X																																				
Senecio cunninghamii											X	X	X	X	X	X	X	X																	X	X																		
Senecio runcinifolius																																								X	X	X	X	X	X									
Solanum lacunarium																																								X														
*Sonchus asper**			X	X	X	X	X	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													X	X													X
*Sonchus oleraceus**	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Spergularia marina**		X	X	X	X	X	X	X						X	X	X																																						
Sporobolus mitchellii																	X	X																																				
Tecticornia pergranulata						X	X	X	X					X	X	X	X	X																																				
Teucrium racemosum																										X	X									X																		
Trachymene cyanopetata																										X	X																											
Trifolium spp.*			X																																											X	X	X	X	X	X	X	X	X
Typha domingensis	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																					X	X	X	X					
*Urtica urens**										X																																												
Wahlenbergia fluminalis					X	X	X			X	X	X	X	X	X	X	X	X								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									

b.

Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																																																						
Acacia stenophylla (seedling)															X	X																													X									
Acacia stenophylla																																			X																			
Alternanthera denticulata																												X	X			X	X	X	X	X																		
*Anagallis arvensis**																										X	X					X		X																				
*Asphodelus fistulosus**																																																					X	
Asperula gemella																																													X									
*Aster subulatus**																			X		X	X	X	X	X	X	X							X			X	X	X	X	X	X	X											
*Atriplex prostrata**			X	X				X	X				X	X	X	X	X							X		X	X							X	X	X																		
Atriplex spp.				X	X	X	X	X	X			X	X	X	X	X	X	X						X	X	X	X					X	X	X	X	X				X		X	X	X	X									
Atriplex suberecta															X	X	X								X	X	X													X	X	X	X	X	X							X	X	X
Azolla filiculoides	X	X	X	X						X	X	X	X						X	X	X	X						X	X	X							X	X	X	X	X					X								
Bolboschoenus caldwellii																																					X	X	X	X	X					X								
Brachyscome basaltica																																										X		X										
Brassica spp.*																		X																																				
*Bromus rubens**																																								X	X	X			X									
Bromus spp.*														X	X																						X	X	X	X	X	X												
Bulbine bulbosa					X	X	X	X	X																	X																												
*Callitriche stagnalis**				X		X																					X															X	X	X	X									
Centella asiatica	X	X	X							X	X	X		X																																								
*Centaurea calcitrapa**				X	X								X	X								X												X			X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		
Centipeda minima							X	X																																				X	X									
*Chenopodium glaucum**												X	X																																									
Dysphania pumilio																	X																																					
*Conyza bonariensis**																								X			X	X	X	X																								
Cotula australis																																										X		X							X			X
Cotula coronopifolia		X	X	X	X	X		X		X		X			X													X	X	X																								
Crassula helmsii										X	X	X	X	X	X																																							
Crassula sieberana###					X	X	X	X		X																																												
Cyperus gymnocaulos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Daucus glochidiatus				X	X	X	X	X	X			X			X							X	X	X	X	X	X															X												
*Dittrichia graveolens**																																										X					X	X	X					
Duma florulenta		X	X	X	X	X	X		X		X	X	X	X	X	X	X		X		X	X	X	X	X	X	X				X	X	X	X	X	X							X	X	X					X	X			X
Duma horrida						X		X	X								X	X					X																															

Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																																																						
Einadia nutans				X	X	X		X										X																											X									
Enchylaena tomentosa					X	X	X		X						X	X	X	X						X									X		X	X						X	X	X	X									
*Enneapogon nigricans**				X	X	X	X	X	X																																													
Eragrostis australasica																									X	X	X																											
*Eragrostis curvula**						X	X	X	X																																													
Eremophila divaricata								X																																													
Eucalyptus camaldulensis		X	X	X	X	X	X				X												X	X	X	X																												
Eucalyptus camaldulensis (sapling)		X								X	X	X		X	X	X	X	X									X	X	X	X				X	X	X						X				X								
Euchiton involucratus																																											X	X										
Chamaesyce drummondii																		X																									X	X	X	X	X	X						
*Euphorbia terracina***									X																																												
Glycyrrhiza acanthocarpa																																											X	X	X									
Haloragis aspera																									X	X																												
*Heliotropium curassavicum**																																								X	X	X	X				X	X	X	X	X	X			X
*Heliotropium europaeum**												X	X	X	X	X																X		X																				
Helichrysum luteo-album	X	X	X	X	X		X															X	X	X		X	X					X								X	X	X	X					X	X						
*Hordeum vulgare**				X	X	X	X	X		X												X																		X	X	X		X	X									
*Hypochaeris glabra**					X	X	X												X	X	X	X	X	X	X		X																											
*Hypochaeris radicata**				X		X			X																																												
Juncus usitatus	X	X	X	X						X	X	X	X	X					X							X	X	X	X	X	X	X		X	X	X		X									X							
*Lactuca saligna**																																											X										
Lachnagrostis filiformis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X					X		X	X	X	X	X	X	X	X	X	X	X	X									
Lemna minor	X	X	X	X																X																																		
Lobelia alata						X		X																																													
Ludwigia peploides										X	X	X	X						X									X	X	X	X						X	X								X	X							
Lythrum salicaria													X	X																																						
Maireana sp.							X	X	X						X												X								X	X																		
*Malvella leprosa***																																													X	X	X	X	X	X	X	X	X
*Malva parviflora**																																													X	X	X	X	X	X		X	X
*Marrubium vulgare***																																								X	X	X	X	X	X					X		X	X	X
Medicago spp.*	X	X	X	X	X	X	X	X		X	X											X	X	X	X	X	X					X	X		X																			
*Melilotus indicus**				X	X	X	X			X	X	X	X				X									X	X			X	X	X	X									X		X										
*Mesembryanthemum crystallinum**						X	X	X	X															X	X							X											X	X										
Mimulus repens																																								X						X	X	X	X	X	X	X	X	X
Stemodia florulenta																																				X										X								
Myoporum montanum				X	X	X		X														X	X	X	X	X	X						X	X	X	X																	
Myosurus australis					X																																															
Myriophyllum papillosum#	X									X	X	X																X	X																								
*Onopordum acanthium**																																													X	X	X	X	X	X	X	X	X
*Paspalum distichum**	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	
*Pennisetum clandestinum**											X																																									
Persicaria lapathifolia																												X	X	X					X																			
Phragmites australis	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
*Phyla canescens**																X											X								X	X																	
Picris hieracioides																																X	X	X	X	X								X									
*Plantago coronopus**				X	X	X	X	X	X																																												
Plantago turrifera					X			X																		X																X	X	X										
*Polypogon monspeliensis**	X	X	X	X	X	X	X						X	X	X						X																																
*Riechardia tingitana**		X			X	X									X										X	X	X									X																		
Rhodanthe pygmaea																																												X										
*Rorippa palustris**			X	X	X	X	X	X	X															X	X	X	X	X													X	X	X	X	X	X									
Samolus repens																X	X	X																		X																		
Schoenoplectus validus	X	X								X	X	X							X									X	X	X																								
Sclerolaena brachyptera						X	X	X	X									X																																			
Sclerolaena divaricata																							X				X							X	X	X									X							X	X	X
Sclerolaena stelligera																																	X																			
Senecio cunninghamii													X	X	X		X															X	X	X	X	X																		
Senecio runcinifolius																											X										X	X	X	X	X	X	X	X	X									
*Solanum nigrum**																								X		X	X																		X									
*Sonchus asper**													X	X	X	X	X	X								X	X					X		X		X	X	X	X	X	X	X	X			X	X	X	X				X	
*Sonchus oleraceus**	X	X	X	X	X	X	X	X	X	X	X	X				X						X	X	X	X	X	X								X		X	X	X	X	X	X	X	X										
*Spergularia marina**				X	X	X	X	X	X			X	X	X	X	X	X	X				X	X	X	X	X	X	X				X		X																				
Sporobolus mitchellii								X	X														X	X		X	X						X	X	X	X			X	X	X	X	X	X	X									
Tecticornia pergranulata					X	X	X	X	X					X	X	X	X	X								X	X																											
Teucrium racemosum																									X	X						X		X	X																		
Trachymene cyanopetula				X																		X	X			X	X																										
Trifolium spp.*						X																																														
Typha domingensis	X	X	X	X						X	X	X	X	X					X									X	X	X	X	X	X													X								
*Vicia sativa**																																																			X	X	X
Wahlenbergia fluminalis										X	X	X			X	X								X	X		X					X	X	X		X	X	X	X	X	X					X			X	X	X	X		

c.

Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	##	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	##	0	10	20	30	40	50	60	80	100
Taxon																																																						
Acacia stenophylla (seedling)	X	X	X	X	X	X	X		X																																													
Acacia stenophylla										X	X	X	X	X	X	X	X				X	X	X	X				X	X	X	X	X	X	X	X	X																		
Alternanthera denticulata											X																					X							X					X	X	X	X	X	X	X				X
Ammania multiflora																																														X	X							
Asperula gemella					X	X		X	X									X																																				
*Aster subulatus**	X	X	X	X	X	X	X	X								X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X			X				X		X	X			X	X	X	X						
*Atriplex prostrata**									X																X		X																		X								X	
Atriplex spp.									X							X	X	X						X	X	X	X					X	X	X	X											X	X	X	X	X	X	X	X	X
Atriplex suberecta								X																																														
Azolla filiculoides																																														X	X							
Bolboschoenus caldwellii																																					X	X	X	X	X					X	X							
Brachyscome basaltica																					X	X	X	X	X	X	X		X		X	X	X	X	X	X							X	X	X									
Brachyscome dentata								X	X																																													
Brachyscome melanocarpa																																														X	X							
Brassica spp.*																																																						X
*Bromus mollis**																										X	X																											
*Bromus rubens**				X	X	X	X													X	X	X	X	X																														
Bulbine bulbosa																						X	X	X	X	X	X																											
*Centaurea calcitrapa**									X																																				X									
Centipeda minima										X																																												
*Chenopodium glaucum**																X	X	X							X										X										X			X				X		
*Conyza bonariensis**																				X	X	X	X	X	X	X	X																											
Cotula australis																								X	X	X	X													X						X	X	X						
Crassula sieberana###					X				X																																													
*Cynodon dactylon**																					X	X	X	X	X	X	X																											
Cyperus gymnocaulos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Daucus glochidiatus										X	X																																											
Distichlis distichophylla																																				X																		X
Duma florulenta	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								X	X					X		X		
Einadia nutans															X																														X									
Enchylaena tomentosa								X	X									X						X	X																			X	X	X	X	X	X	X	X	X	X	X
*Enneapogon nigricans**																									X	X	X																											
Epaltes australis																													X	X																X	X	X	X	X				
*Eragrostis curvula**																	X	X										X	X	X	X	X	X	X	X	X																		
Eucalyptus camaldulensis				X														X																											X									
Eucalyptus camaldulensis (sapling)					X			X	X	X	X	X	X	X	X	X	X	X									X									X	X	X	X	X		X	X	X		X	X	X			X	X		
Chamaesyce drummondii									X																		X			X	X	X	X	X	X	X											X	X	X	X	X		X	X
*Euphorbia terracina***																		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
*Gazania rigens**			X	X	X	X	X													X	X	X	X	X	X	X								X																				
Glycyrrhiza acanthocarpa																																X	X	X	X	X																		
Haloragis aspera															X		X																													X	X	X	X	X	X			
*Heliotropium curassavicum**																									X										X	X			X	X	X	X	X	X	X	X	X	X	X	X				
*Heliotropium europaeum**															X		X															X														X	X	X	X	X	X	X	X	X
Helichrysum luteo-album									X										X	X	X	X	X	X	X	X	X								X	X							X	X	X	X	X							
*Hordeum vulgare**																				X	X	X	X	X		X	X																											
*Hypochaeris glabra**								X										X							X	X	X																	X		X	X	X	X	X	X	X	X	
*Hypochaeris radicata**				X	X	X	X																				X																											
Isolepis hookeriana																												X	X																									
Juncus aridicola			X																																																			
Juncus usitatus	X	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X			X		X	X	X	X	X	X	X			X	X							
*Lactuca saligna**			X	X	X	X	X	X	X									X							X	X																				X		X						
*Lactuca serriola**																																												X										
Lachnagrostis filiformis																			X	X	X	X	X	X	X	X	X												X	X	X	X	X	X	X									
Limosella australis																					X	X						X									X	X	X	X						X	X							
Ludwigia peploides										X	X								X	X	X	X	X															X	X	X	X					X	X	X	X	X	X			
*Lupinus cosentinii**				X	X	X	X	X																																														
Medicago spp.*			X	X	X	X	X	X	X												X	X	X	X	X	X	X																											
*Mesembryanthemum crystallinum**									X																																													
Mimulus repens																																														X	X							
Minuria integerrima																																		X		X																		
Stemodia florulenta														X	X	X		X		X	X	X	X	X	X	X	X										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Myriophyllum papillosum#																																														X	X							
Myriophyllum verrucosum ,																				X																	X	X	X	X														
*Nicotiana glauca**								X	X																																													
Nitella sp.																					X	X															X	X	X															
*Paspalum distichum**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Persicaria lapathifolia																																														X	X							
Phragmites australis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Phyla canescens**																									X																													
Picris hieracioides											X					X	X	X																											X									
Plantago turrifera									X																	X	X																											
*Polypogon monspeliensis**																																							X	X	X	X	X	X	X									
Potamogeton crispus																																					X	X																
*Riechardia tingitana**							X	X														X	X	X	X	X	X																											
*Ricinis communis**																																X		X													X	X	X	X	X			

Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	##	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	##	0	10	20	30	40	50	60	80	100
Taxon																																																						
*Rorippa palustris**									X													X	X	X	X	X	X													X					X	X	X							
Rumex bidens																										X	X																											
Samolus repens																X	X																																					
Schoenoplectus validus	X									X																																												
Senecio cunninghamii													X	X	X	X	X	X					X	X	X	X		X	X	X	X	X	X	X	X	X										X	X	X	X	X				
Senecio runcinifolius				X	X	X	X	X	X							X					X	X	X	X	X	X	X								X	X							X	X			X							
*Solanum nigrum**																									X				X			X		X																				
*Sonchus asper**						X		X	X			X	X	X		X	X	X				X	X	X	X	X	X																	X		X	X	X	X	X	X	X	X	X
*Sonchus oleraceus**			X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X		X	X					X	X	X	X	X				X	X				
*Spergularia marina**																X																																	X			X	X	X
Sporobolus mitchellii																										X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X									
Swainsona greyana																					X	X	X	X	X	X	X																											
Tecticornia pergranulata									X																																													
Teucrium racemosum																		X							X								X	X		X										X	X	X	X	X	X	X	X	X
Trachymene cyanopetula									X																																X	X		X	X									
Typha domingensis										X	X																																											
Vallisneria australis																																					X	X	X	X														
*Vicia sativa**			X	X	X	X	X	X	X											X	X	X	X	X																														
Wahlenbergia fluminalis				X	X	X	X	X	X				X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X		X	X									

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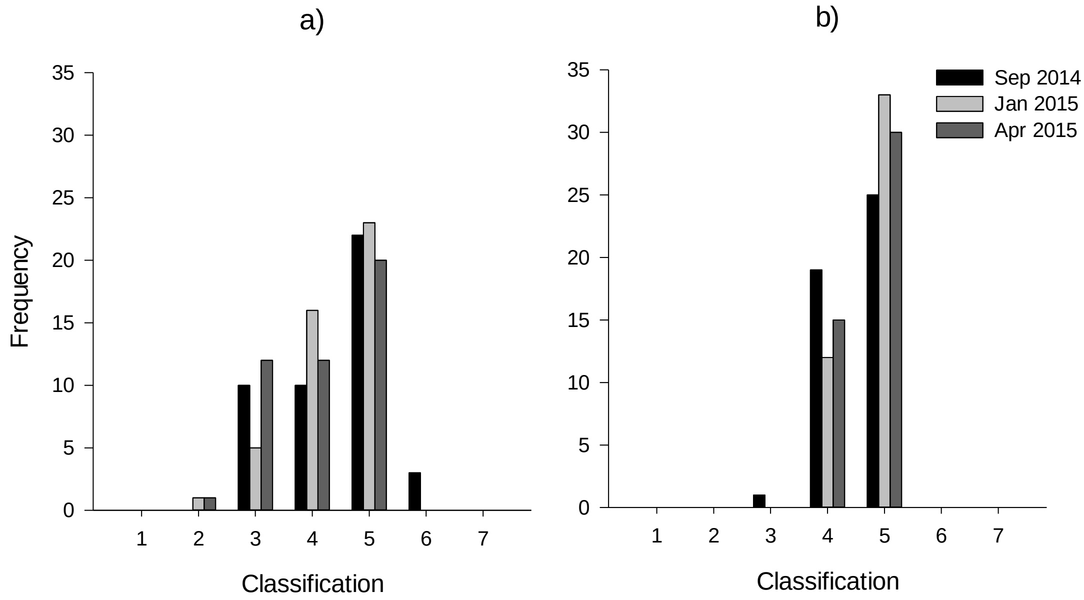
Zone	Lower																		Middle																		Upper																	
Survey Number	1									2									1									2									1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																																																						
Acacia stenophylla (seedling)	X	X	X	X	X	X	X															X	X	X	X	X	X																											
Alternanthera denticulata									X																																			X	X	X	X	X						
*Anagallis arvensis**																																												X										
*Arctotheca calendula**																										X																												
*Aster subulatus**	X	X	X	X	X	X	X	X	X		X	X	X	X	X					X	X	X				X						X		X		X			X	X	X	X	X							X	X			
*Atriplex prostrata**					X	X	X	X	X				X	X			X	X									X					X	X	X		X						X		X							X			
Atriplex spp.					X	X	X	X	X					X	X	X	X	X					X	X	X	X	X				X	X	X	X	X	X					X			X							X		X	X
Atriplex suberecta					X	X	X		X														X		X	X									X							X	X	X	X							X		
Azolla filiculoides	X	X	X	X	X	X	X			X									X	X	X	X						X									X	X	X							X	X							
Bolboschoenus caldwellii	X	X								X	X										X	X						X	X	X	X						X	X								X	X	X	X					
Brachyscome basaltica																					X	X	X	X	X	X	X																X	X	X									
Brachyscome dentata																																							X	X	X	X	X	X	X									
Brachyscome melanocarpa																																																						X
*Bromus rubens**																										X	X																		X									
Bromus spp.*																								X	X																				X									
Calotis cuneifolia																										X																												
Calotis hispidula									X																		X																		X									
*Callitriche stagnalis**																																											X	X										
*Centaurea calcitrapa**																																								X	X	X	X	X	X								X	
Centipeda minima				X																																			X	X														
*Chenopodium glaucum**								X				X	X	X	X	X	X	X																X	X										X									
*Conyza bonariensis**																																									X	X	X	X	X									
Cotula australis									X												X	X																								X	X	X	X	X	X			X
Cotula coronopifolia	X	X		X	X		X	X																																														
Crassula sieberana###								X	X																	X																												
Cyperus gymnocaulos	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Daucus glochidiatus										X																																												
Disphyma crassifolium								X	X						X																																							
Distichlis distichophylla																													X	X																								
*Dittrichia graveolens**																																												X										
Duma florulenta	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X			X		X	X	X	X	X
Duma horrida																								X	X	X	X						X	X	X	X																		
Einadia nutans								X																																			X											
Enchylaena tomentosa								X	X		X	X	X	X	X		X							X	X		X					X			X	X					X												X	X
*Enneapogon nigricans**									X													X	X	X			X																											
Epaltes australis			X	X	X	X							X																					X					X	X						X								
*Eragrostis curvula**										X			X																					X	X	X																		
Eragrostis dielsii																										X	X																											
Eucalyptus camaldulensis			X	X	X	X														X																				X	X		X											X
Eucalyptus camaldulensis (sapling)	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X									X								X	X					X	X	X	X	X					X	X	X	X	X
Eucalyptus largiflorens (sapling)																										X	X																											
Euchiton involucratus																										X																												
Chamaesyce drummondii															X																X	X			X								X	X	X	X		X	X	X	X	X	X	X
*Euphorbia terracina***																												X			X														X									
Frankenia pauciflora								X																									X	X																				
*Gazania rigens**																											X																											
Glycyrrhiza acanthocarpa	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X				X	X	X	X	X	X														X				
Haloragis aspera								X																																							X	X	X	X	X	X	X	
*Heliotropium amplexicaule**																																											X											
*Heliotropium curassavicum**																					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X		X			X	X	X		

Zone	Lower																	
Survey Number	1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																		
*Heliotropium europaeaum**											X	X	X	X	X	X	X	X
Helichrysum luteo-album	X	X	X	X	X	X	X	X	X									
*Hordeum vulgare**																		
*Hypochaeris glabra**			X	X	X	X	X		X				X					
*Hypochaeris radicata**																		
Juncus usitatus	X	X	X						X	X	X		X		X	X	X	X
*Lactuca saligna**	X	X	X	X	X	X	X	X	X				X			X		
*Lactuca serriola**																		
Lachnagrostis filiformis	X	X	X	X	X	X	X	X	X									
Lobelia alata											X							
Ludwigia peploides	X	X	X							X	X							
Maireana sp.																		
*Marrubium vulgare***																		
Medicago spp.*					X													
*Melilotos indicus**								X	X									
*Mesembryanthemum crystallinum**																		
Mimulus repens											X	X	X		X			
Mollugo cerviana																		
Stemodia florulenta																		
Myriophyllum papillosum#			X															
Myriophyllum verrucosum ,											X							
*Nicotiana glauca**																		
Oesteocarpum acropterum																		
*Onopordum acanthium**																		
*Paspalum distichum**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
*Pennisetum clandestinum**																		
Phragmites australis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Picris hieracioides					X			X	X									
Pimelea penicillaris#												X	X	X	X	X	X	X
Plantago turrifera	X	X	X	X	X	X	X	X	X									
Polygonum plebeium																		
*Polypogon monspeliensis**																		
Portulaca oleracea																		
Stuckenia pectinata																X		
*Riechardia tingitana**																		
*Rorippa palustris**							X	X	X								X	X
Rumex bidens																		
Samolus repens												X			X			
Schoenoplectus validus	X	X								X	X							
Sclerolaena brachyptera																		
Sclerolaena divaricata																	X	X
Sclerolaena stelligera																		
Senecio cunninghamii								X		X	X	X	X	X	X	X	X	X
Senecio runcinifolius	X	X	X	X	X	X	X	X										
*Solanum nigrum**																		
Solanum lacunarium																		
*Sonchus asper**								X	X								X	X
*Sonchus oleraceus**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
*Spergularia marina**				X	X		X	X						X				
Sporobolus mitchellii						X	X	X										
Suaeda australis																		
Swainsona greyana																		
Tecticornia pergranulata					X	X	X	X	X			X	X	X	X	X		
Teucrium racemosum										X					X	X	X	
Trachymene cyanopetula																		
Trifolium spp.*																		
Typha domingensis	X	X	X	X	X	X	X			X	X	X	X	X				
*Urtica urens**																		
Vallisneria australis																		
Wahlenbergia fluminalis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

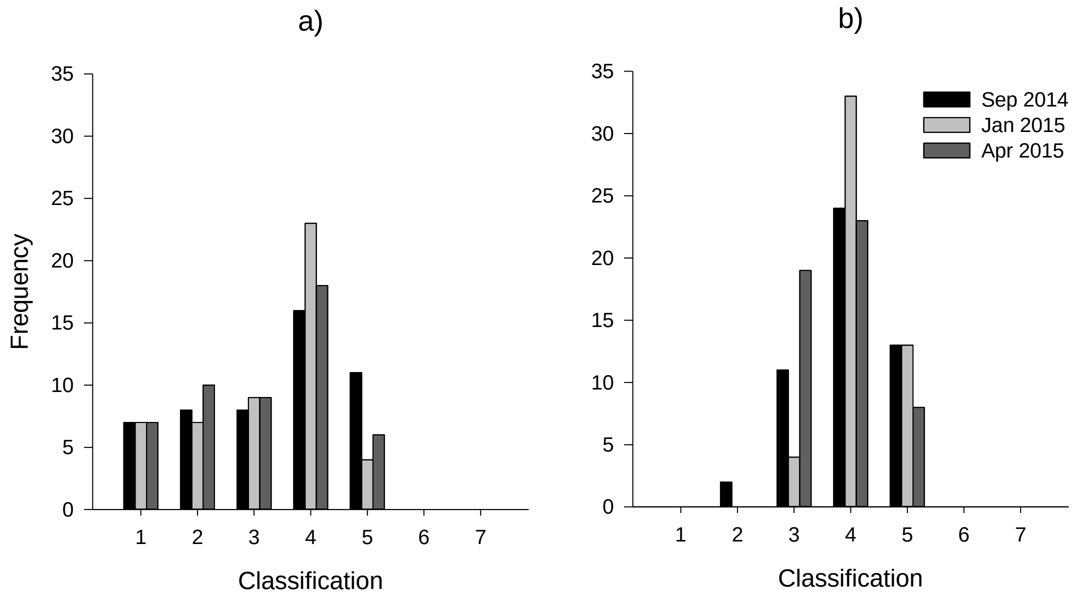
Zone	Middle																	
Survey Number	1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																		
*Heliotropium europaeaum**										X	X	X	X	X				
Helichrysum luteo-album					X	X	X		X									
*Hordeum vulgare**			X	X	X	X	X	X	X									
*Hypochaeris glabra**					X	X	X	X	X				X		X			
*Hypochaeris radicata**					X	X	X		X									
Juncus usitatus	X	X								X								
*Lactuca saligna**			X	X	X	X	X	X										
*Lactuca serriola**								X	X									
Lachnagrostis filiformis		X	X	X	X	X	X	X	X		X	X						
Lobelia alata																		
Ludwigia peploides																		
Maireana sp.						X											X	
*Marrubium vulgare***																		
Medicago spp.*					X	X	X	X	X									
*Melilotos indicus**																		
*Mesembryanthemum crystallinum**					X	X	X	X	X									
Mimulus repens							X			X	X	X	X	X	X	X	X	
Mollugo cerviana							X											
Stemodia florulenta																		
Myriophyllum papillosum#																		
Myriophyllum verrucosum ,																		
*Nicotiana glauca**																		
Oesteocarpum acropterum					X													
*Onopordum acanthium**																		
*Paspalum distichum**			X	X						X	X	X	X	X	X	X	X	X
*Pennisetum clandestinum**										X								
Phragmites australis	X	X	X	X	X	X	X			X	X	X	X	X	X	X		
Picris hieracioides																		
Pimelea penicillaris#																		
Plantago turrifera					X	X	X	X	X									
Polygonum plebeium																		
*Polypogon monspeliensis**			X	X	X	X	X	X										
Portulaca oleracea					X	X			X									
Stuckenia pectinata																		
*Riechardia tingitana**							X		X									
*Rorippa palustris**						X	X	X	X									
Rumex bidens																		
Samolus repens													X	X	X	X	X	X
Schoenoplectus validus																		
Sclerolaena brachyptera									X									
Sclerolaena divaricata											X	X	X	X		X	X	X
Sclerolaena stelligera								X	X									
Senecio cunninghamii										X	X	X					X	
Senecio runcinifolius			X						X									
*Solanum nigrum**																		
Solanum lacunarium																		
*Sonchus asper**																		X
*Sonchus oleraceus**			X	X	X	X	X	X	X				X	X	X	X	X	
*Spergularia marina**			X	X	X	X	X	X	X				X					
Sporobolus mitchellii							X	X	X	X	X	X				X	X	X
Suaeda australis																	X	
Swainsona greyana			X	X	X	X	X	X										
Tecticornia pergranulata			X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Teucrium racemosum																		X
Trachymene cyanopetula																		
Trifolium spp.*																		
Typha domingensis	X	X								X	X	X						
*Urtica urens**																		
Vallisneria australis	X																	
Wahlenbergia fluminalis								X	X									

Zone	Upper																	
Survey Number	1									2								
Elevation	0	10	20	30	40	50	60	80	100	0	10	20	30	40	50	60	80	100
Taxon																		
*Heliotropium europaeaum**												X	X	X	X	X	X	X
Helichrysum luteo-album					X	X	X	X	X									
*Hordeum vulgare**								X	X									
*Hypochaeris glabra**								X	X	X	X	X		X		X		
*Hypochaeris radicata**																		
Juncus usitatus	X													X			X	
*Lactuca saligna**							X		X									
*Lactuca serriola**																		
Lachnagrostis filiformis			X		X	X	X	X	X									
Lobelia alata																		
Ludwigia peploides			X	X	X					X	X	X	X	X				
Maireana sp.																		
*Marrubium vulgare***													X	X	X	X		X
Medicago spp.*								X	X									
*Melilotos indicus**							X	X										
*Mesembryanthemum crystallinum**																		
Mimulus repens				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mollugo cerviana																		
Stemodia florulenta						X												
Myriophyllum papillosum#																		
Myriophyllum verrucosum ,	X																	
*Nicotiana glauca**																	X	
Oesteocarpum acropterum																		
*Onopordum acanthium**														X	X	X	X	X
*Paspalum distichum**				X				X	X	X	X	X	X	X	X	X	X	X
*Pennisetum clandestinum**						X			X									
Phragmites australis										X								
Picris hieracioides									X									
Pimelea penicillaris#																		
Plantago turrifera																		
Polygonum plebeium					X										X			
*Polypogon monspeliensis**																		
Portulaca oleracea																		
Stuckenia pectinata																		
*Riechardia tingitana**							X											
*Rorippa palustris**			X	X	X	X	X	X	X									
Rumex bidens							X						X	X				
Samolus repens																		
Schoenoplectus validus																		
Sclerolaena brachyptera																		
Sclerolaena divaricata																		
Sclerolaena stelligera						X												
Senecio cunninghamii														X	X	X	X	X
Senecio runcinifolius			X	X	X	X	X	X	X					X	X	X	X	X
*Solanum nigrum**								X	X									X
Solanum lacunarium						X	X		X									
*Sonchus asper**																X		
*Sonchus oleraceus**						X	X	X	X						X	X		X
*Spergularia marina**															X			
Sporobolus mitchellii				X	X	X	X	X	X			X		X	X	X	X	X
Suaeda australis																		
Swainsona greyana																		
Tecticornia pergranulata																		
Teucrium racemosum																	X	X
Trachymene cyanopetula								X	X									
Trifolium spp.*																		
Typha domingensis																		
*Urtica urens**							X											
Vallisneria australis	X																	
Wahlenbergia fluminalis							X		X						X			X

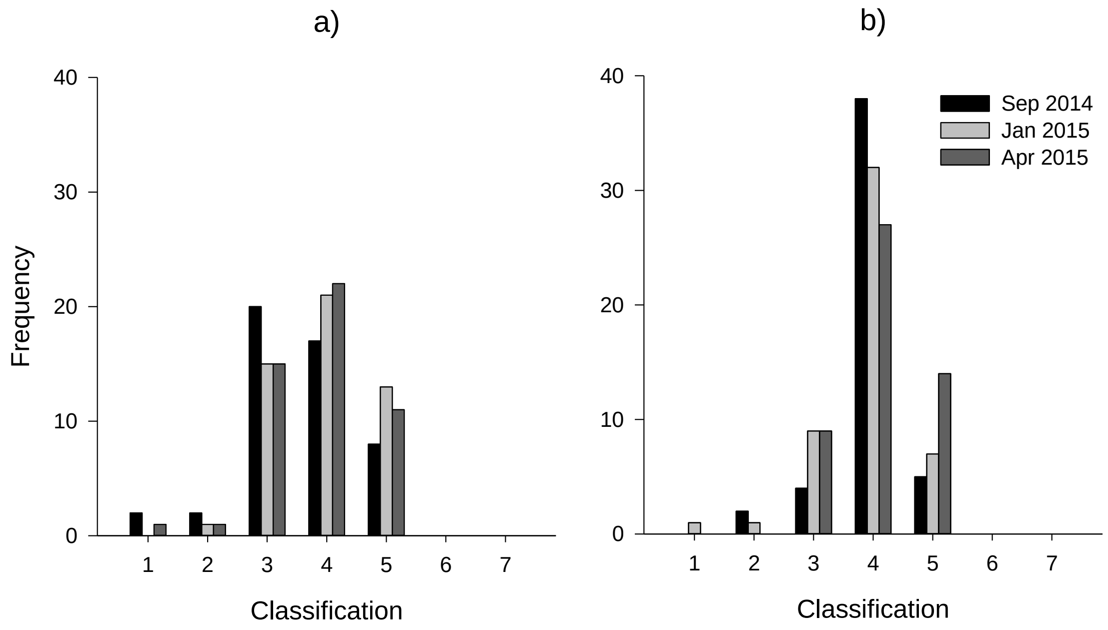
Appendix 4: Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification per site in September 2014 and January 2015.



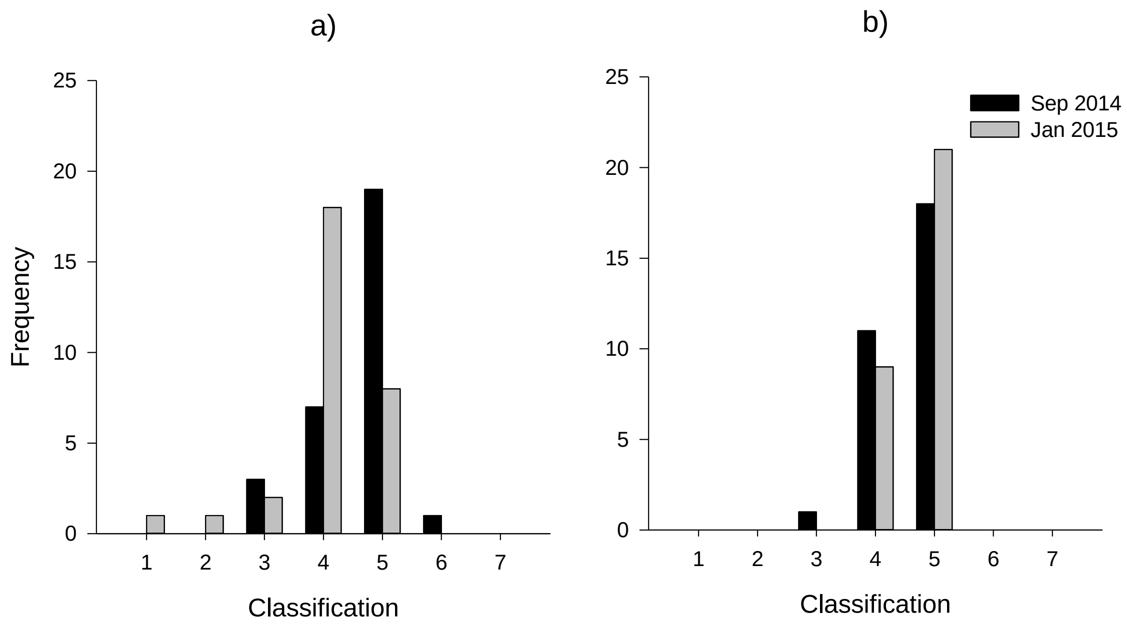
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Arlunga in September 2014, January 2015 and April 2015.



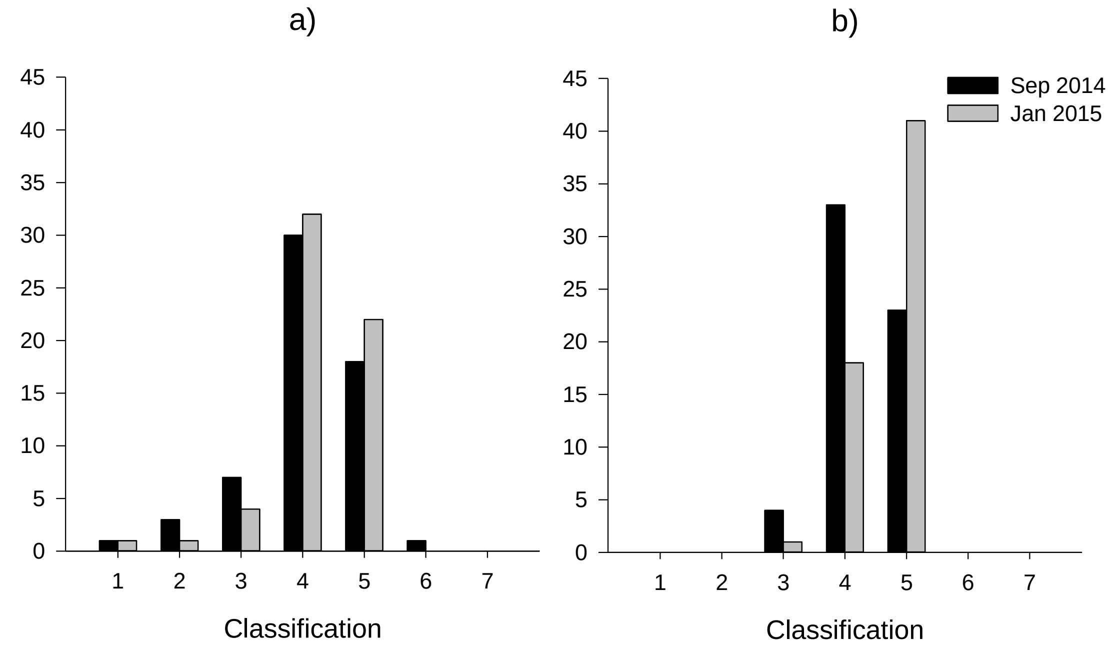
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Murbko in September 2014, January 2015 and April 2015.



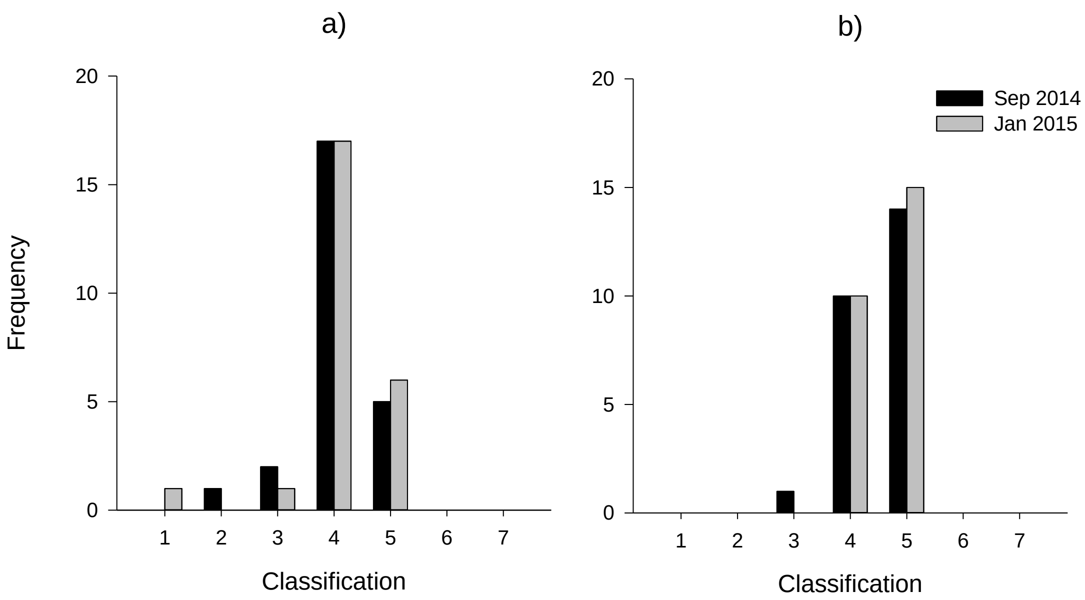
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Weston Flat in September 2014, January 2015 and April 2015.



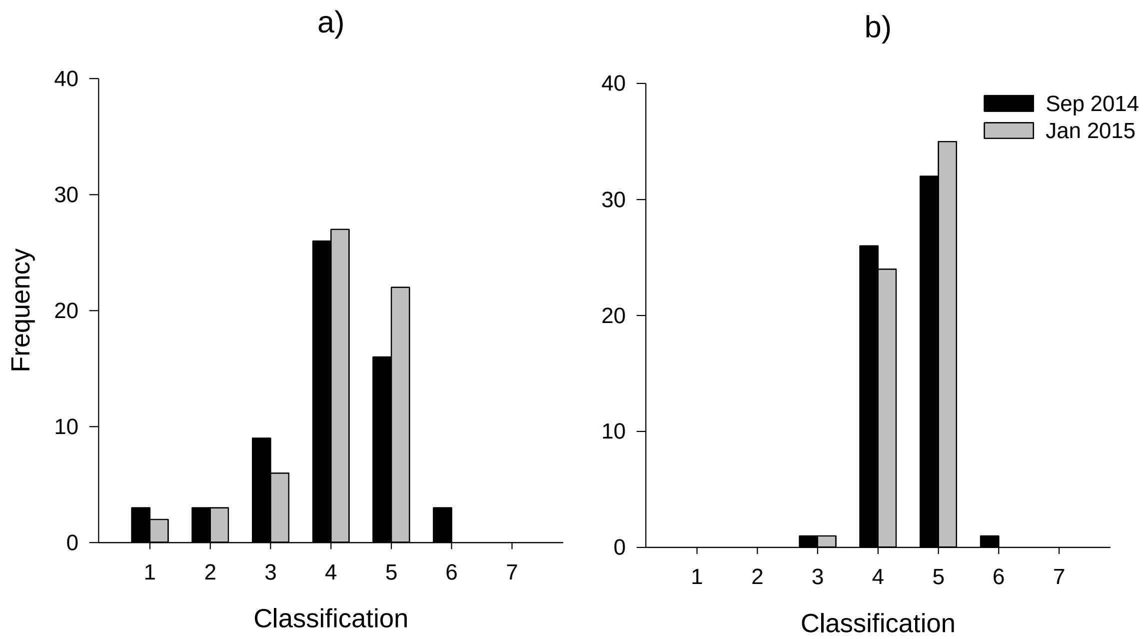
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Boggy Flat in September 2014, January 2015.



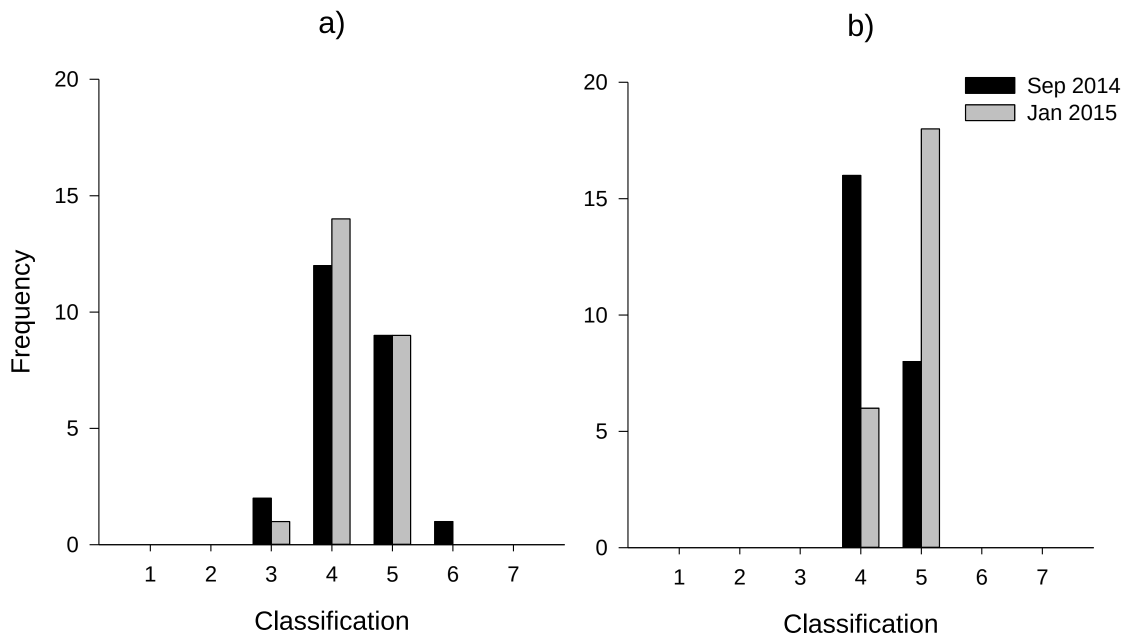
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Little Toolunka in September 2014, January 2015.



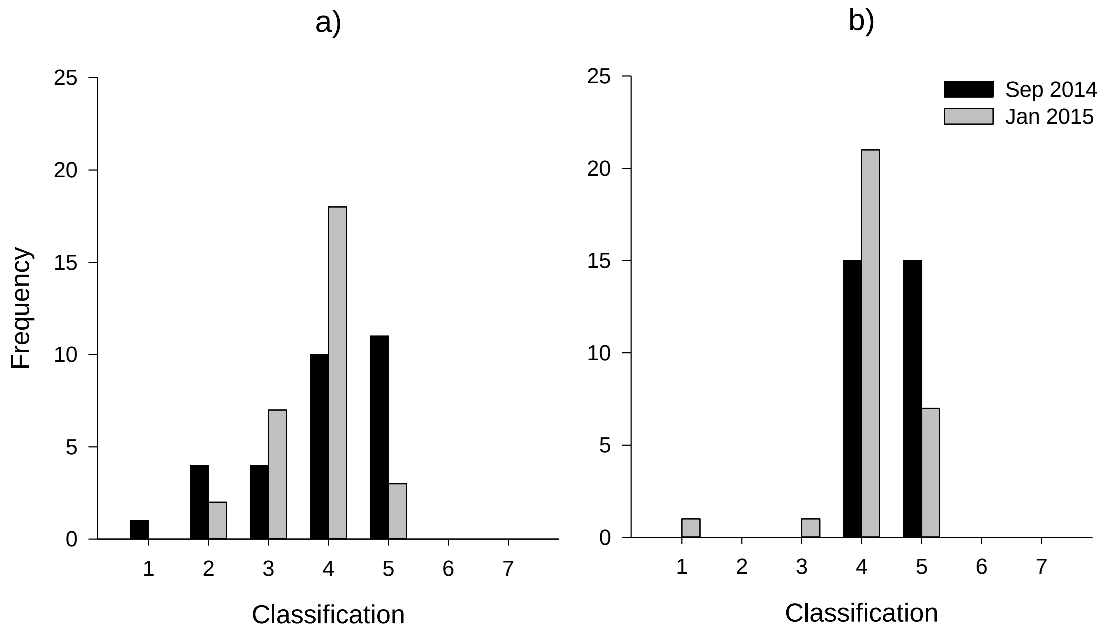
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Penn inlet in September 2014, January 2015.



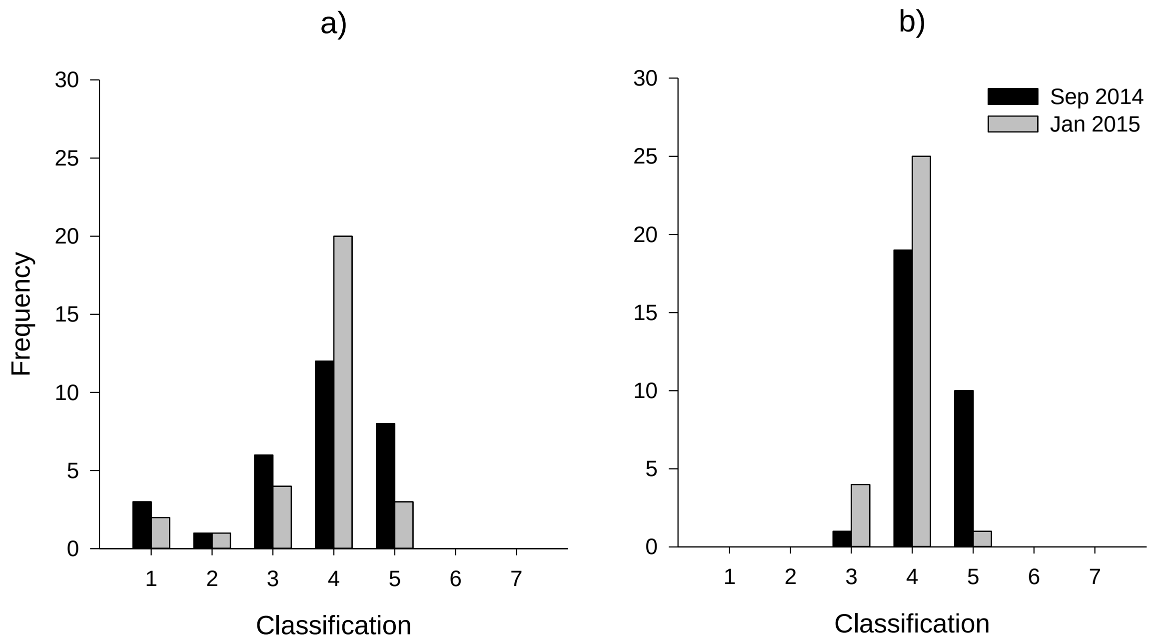
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Big Toolunka in September 2014, January 2015.



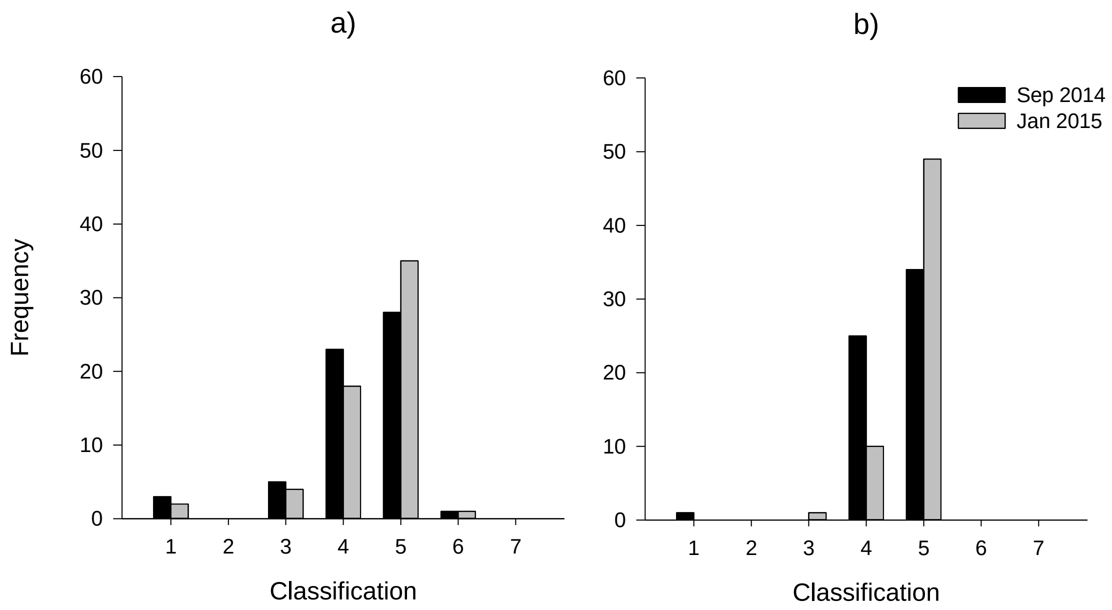
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Island Reach in September 2014, January 2015.



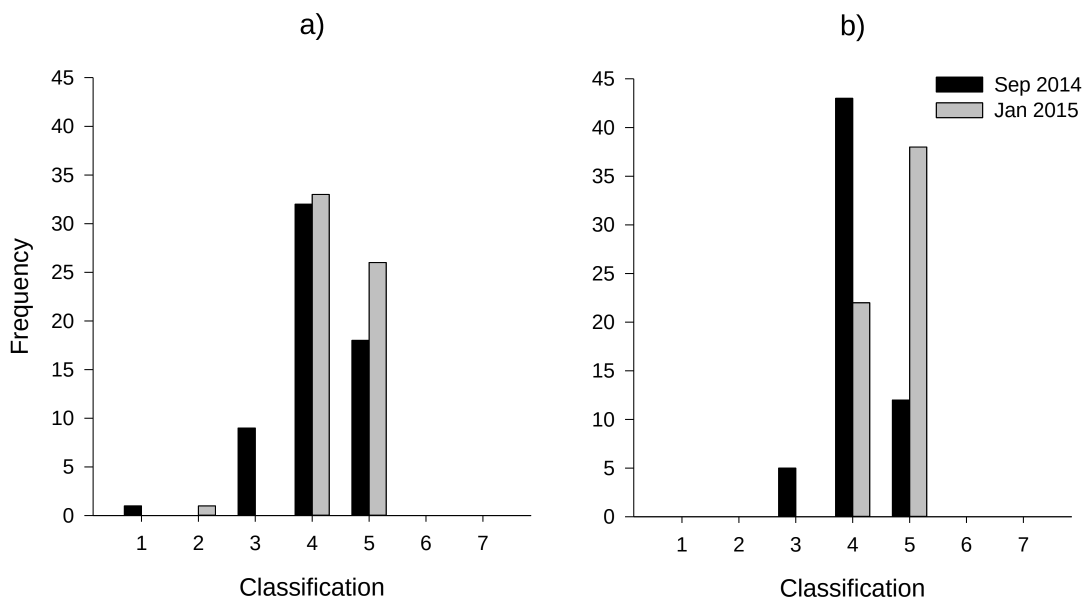
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Ross Lagoon in September 2014, January 2015.



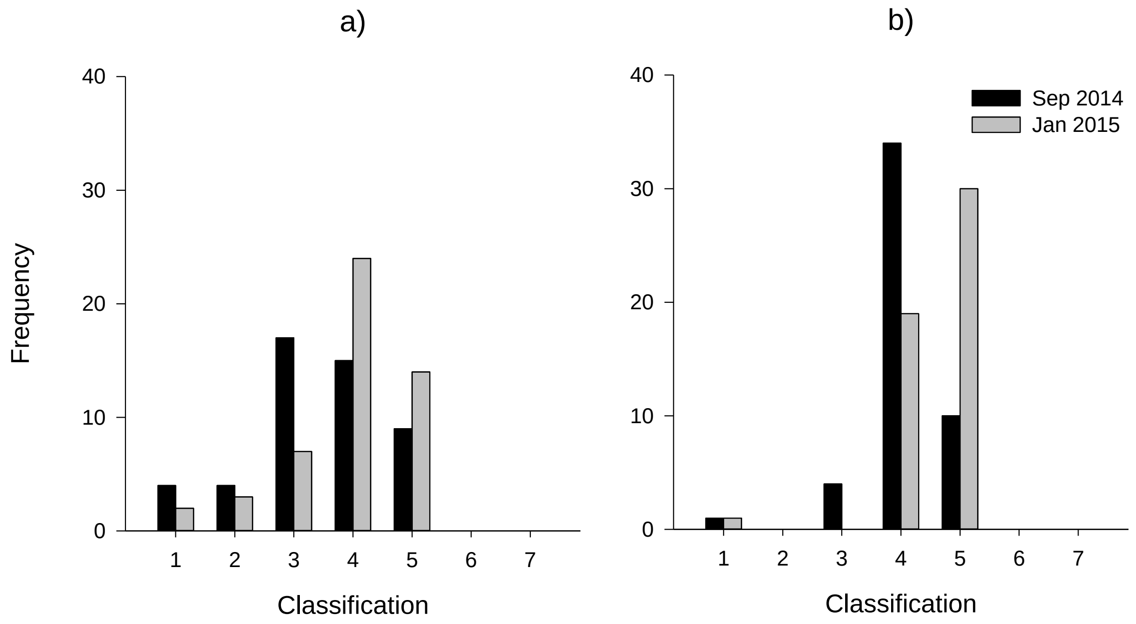
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Jaeschke Lagoon in September 2014, January 2015.



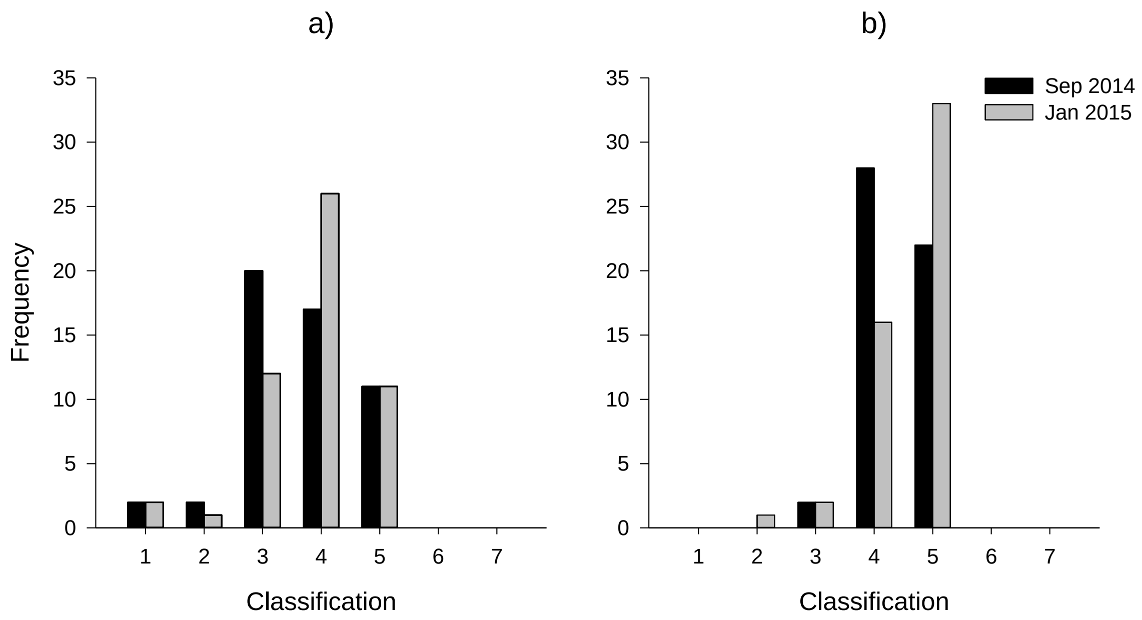
Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Yarra Complex in September 2014, January 2015.



Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Devlins Pound in September 2014, January 2015.



Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Lara Inlet in September 2014, January 2015.



Comparison of the number of *Eucalyptus camaldulensis* trees in each a) extent and b) density crown condition category using The Living Murray (TLM) classification, at Banrock Creek in September 2014, January 2015.