CENTRAL LAND COUNCIL

Submission to the Northern Territory Environmental Protection Agency

SINGLETON HORTICULTURE PROJECT

Referral of proposed action submitted by Fortune Agribusiness Funds Management Pty Ltd and published by the NTEPA on 23 November 2022

PART 2

ATTACHMENT F:

REVIEW OF THE SALINITY IMPACT ASSESSMENT REPORT

Report prepared by the CLC based on advice from Peter Cook, Flinders University. The report has been sighted and approved by Peter Cook.

Review of the GHD Salinity Impact Assessment Report (Appendix L) based on advice from Professor Peter Cook, Flinders University

This report was prepared by Evie Rose (Central Land Council) based on expert advice and reviewed by Peter Cook (Professor of Hydrogeology at Flinders University and Director of the National Centre for Groundwater Research and Training (NCGRT)). One of Australia's foremost groundwater scientists, Professor Cook has more than 20 years' experience in groundwater research, spanning the fields of groundwater hydrology, ecohydrology, isotope hydrology, unsaturated zone flow process, and surface water – groundwater interaction.

Review of GHD's 2022 Salinity Impact Assessment Report (**Salinity Report**) found that it **does not:**

1. Adequately model or report maximum potential salinity increases in the water table and groundwater. The model inappropriately and arbitrarily assumes a maximum of 1500mg/L salinity.
    - Due to this arbitrary figure, it does not calculate salinity drainage based on the assumed initial level of 900mg/L and an assumed leaching fraction. If it had done so, the maximum salinity increases would be magnitudes higher than predicted.
2. Consider original soil salinity below 3m, which could greatly increase salinity levels above predictions
3. Report on or model environmental impacts of salinity beyond changes in the groundwater extracted from the pumping bores.

These gaps leave critical questions unanswered and mean the risks of increased salinity are likely much higher than predicted. The Salinity Report does not answer the fundamental concerns raised in Cook and Keane's 2021 report which considered these factors and found that the region is high-risk for salinity impacts after 30 years, especially in areas with shallow groundwater depths. This report, despite being the only previous work on salinity impacts in the region, was not referenced at all by GHD.

1. GHD's Salinity Report fails to calculate and model for the potential maximum increases in salinity levels because it inappropriately and arbitrarily assumes a maximum of 1500mg/L.

The scale GHD uses to model solute transport is misleading and based on inappropriate parameters for the region. The scale goes from 900mg/L TDS[1] to an assumed maximum of 1500mg/L (2022, 15) GHD note they have chosen to cap the salinity increase at 1500mg/L: 'based on the information available, *a salinity of 1500mg/L TDS has been assumed* for the modelling' (2022, 15). This assumed cap is based on an inappropriate and unrelated comparison. While GHD acknowledge that 'the salinity of recharge water is likely to depend on site-specific factors that are difficult to estimate at this stage', they 'deferred to previous experience from projects elsewhere is [sic] regional Australia were the salinity of irrigation drainage has been monitored and data is publicly available' to decide on the maximum of 1500mg/L (2022, 15). The 'projects' referenced are in fact based on one region: the Mallee Catchment Management Authority (north-western Victoria). It is likely that the salinity of water used for irrigation in these areas is much lower than 900 mg/L, were a maximum of 1500mg/L might be more likely. Parameters have been drawn from very different hydrogeological parameters to the Western Davenport region.

[1] 900 mg/L TDS is the initial assumed salinity of groundwater 'based on the limited information currently available' (2022, 16).

This assumed maximum fails to accurately represent potential maximum increases: if the initial level is 900mg/L maximum increases are likely to be magnitudes higher than 1500mg/L. GHD should have calculated what the likely level of salinity of drainage would be based on irrigation with water at 900mg/L, and an assumed leaching fraction (the water that passes through the root zone and carries concentrated salts). Given an initial level of 900mg/L, the salts infiltrating the groundwater would be much more concentrated than 1500mg/L: from at least two to potentially many more thousands of mg/L.

It can be inferred from the modelling (Figure 15, 53) that after 1 year salinity at the water table is already at the maximum level reported on the scale, however there are no figures provided and there is no way of knowing how much higher than 1500mg/L the salts could actually be.

The scale is based on illogical assumptions and inappropriate comparisons, and the resulting modelling suggests salinity impacts far lower than what is likely for the Singleton region.

2. The GHD report only considers the impacts of pumping, and does not consider the naturally occurring levels of salinity in the soils within the unsaturated zone below 3m.

There is no data in the Western Davenports of soil salinity below 2-3m, however Cook and Keane (2021) found that there is likely to be high concentrations of salt below this depth. They found chloride profiles of 6 – 8,000mg/L in soil 5-20m below ground at nearby Rocky Hill and high levels at Ti Tree. Cook and Keane report that the major uncertainty over original soil salinity is 'the greatest concern' for determining impacts of irrigated agriculture as some areas contain very high salt stores that could threaten the underlying groundwater system. If there are high levels in the soil, salinity increases could be much greater than predicted. Further sampling and monitoring is required to fill this critical gap in determining the impacts of salinity.

3. GHD's Salinity Report does not provide a holistic environmental impact assessment, it only models for changes in the salinity of groundwater extracted from the pumping bores.

GHD *identifies* the environmental risks of changes to soil quality, GDE and vegetation 'loss or death' (63-64) and 'damage to cultural heritage' due to salinity (67), however it rates these risks as low, and fails to provide any modelling on environmental indicators including potential impacts to soil quality, salinity increases at the water table (capped at 1500mg/L) and impacts on the groundwater more broadly.

GHD acknowledges that increases in salinity are likely to be quickest and highest at the water table, yet models changes in salinity of the groundwater drawn from bores 60-140m below ground level (2022, 54). At this depth increases in salinity are likely to occur at a much slower rate, given the time-lag for salts in the recharge front to travel through the aquifer. Salinity increases in this shallow groundwater are critical to understand impacts on the health of aquatic and terrestrial GDEs. The report therefore only models for how salinity increases may impact the Singleton horticultural development, not the environment.

Based on these limitations, the critical questions that remain unanswered by GHD's salinity report are:

- What is the salinity at the top of the water table?
- What are the potential maximum salinity levels due to the development?
- Why is a salinity concentration of 1500mg/L assumed as the maximum when initial salinity levels are assumed to be 900mg/L?

- What are the soil salinity levels below 2-3m and how might they impact on increased salinity risks?

ATTACHMENT G:

CHANGES IN RICHNESS AND ABUNDANCE OF RODENTS AND NATIVE PREDATORS IN RESPONSE TO EXTREME RAINFALL IN ARID AUSTRALIA

Pavey C.R. and Nano C.E.M.

Austral Ecology (2013) 38, 777–785

REDACTED

ATTACHMENT H:

THE BREEDING AND FORAGING ECOLOGY AND ABUNDANCE OF THE PRINCESS PARROT (*POLYTELIS ALEXANDRAE*) DURING A POPULATION IRRUPTION

Pavey C.R., Nano, C.E.M., Cole J.R., McDonald P.J., Nunn P., Silcocks A. and Clarke R.H.

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The breeding and foraging ecology and abundance of the Princess Parrot (*Polytelis alexandrae*) during a population irruption

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Abstract. The Princess Parrot (*Polytelis alexandrae*) is an Australian endemic that displays irruptive population dynamics. We studied a breeding event in the southern Northern Territory in 2010–11, which followed a peak in primary productivity stimulated by extended above average rainfall. Birds were present from mid-July 2010 to February 2011, with highest numbers in August–November 2010. The maximum count was 172 birds. Multiple nests, all in mature Marble Gum (*Eucalyptus gongylocarpa*), were detected monthly from August to November 2010 and a single nest in January 2011. Birds fed on flowers, seeds and other material of 11 plant species, both on the ground and within foliage. The decrease in abundance of Parrots over time coincided with a decrease in plant species richness and flower abundance and an increase in availability of seeds and fruit. The area had not been burnt since 2002 indicating that fire-stimulated primary production does not trigger breeding. Despite the time since fire there was evidence of severe effects of past fires. Management of the area now involves efforts to reduce the incidence of high-intensity fires, control of buffel grass (*Cenchrus ciliaris*) and annual monitoring for the presence of Princess Parrots. Our research highlights the importance of ecological information for making effective conservation management recommendations.

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Introduction

A significant proportion of arid Australian bird species have irruptive population dynamics (e.g. Burbidge and Fuller 2007). These species typically retract to, or move between, small, discrete portions of their geographical range – core areas – during extended dry periods, then breed rapidly in response to pulses in the availability of resources. As numbers increase in response to higher resource availability, individuals disperse from core areas into other parts of their range and there is a resultant, often dramatic, increase in population size and area of occupancy (Blyth and Burbidge 1997). The distribution and population dynamics of most of these irruptive species are poorly known and the limits of their core ranges are not well understood. This lack of information makes it difficult to estimate population size accurately during non-irruptive periods and, therefore, to assess conservation status (e.g. Garnett *et al*. 2011). This lack of information has highlighted the importance of understanding the role of population irruptions in the persistence of species. A corollary of this is the importance of researchers being able to respond opportunistically to population irruptions to collect data on ecological and life-history variables.

The Princess Parrot (*Polytelis alexandrae*), is an endemic Australian species restricted to the arid zone of Western Australia, the Northern Territory and South Australia (Fig. 1; Johnstone and Storr 1998; Higgins 1999; Barrett *et al*. 2003). Previously, the pattern of occurrence of the species was referred to as nomadic or migratory (e.g. Johnstone and Storr 1998; Higgins 1999; Pavey 2007). However, there is now general consensus that the Princess Parrot has irruptive population dynamics (Blyth and Burbidge 1997; Baxter and Henderson 2000; Garnett *et al*. 2011). The species is often not present for long periods and then large numbers of birds are seen in an area for a short period of time (e.g. North 1896; Higgins 1999; Cowle in Mulvaney *et al*. 2000). The location of the core range of the Princess Parrot is not well understood (Fig. 1). Some authors suggest that it is centred on the eastern Great Sandy Desert (e.g. Blyth and Burbidge 1997), although recent expeditions suggest that it may be the eastern Gibson Desert and western Great Victoria Desert (Atlas of Australian Birds database (Birdata), 1998–2013, BirdLife Australia, Melbourne, see http://www.birdata.com.au/about_atlas.vm, accessed 15 October 2013). The species is enigmatic and little is known of its biology or ecology (Higgins 1999).

Here we report on a breeding event of the Princess Parrot near Glen Edith on Haasts Bluff Aboriginal Land Trust (ALT) in 2010–11. Our study aimed to collect information on aspects of the ecology and occurrence of Princess Parrots, specifically, the

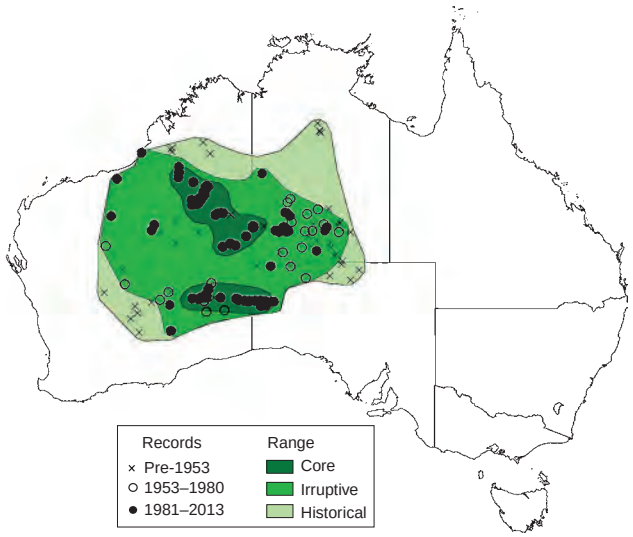

Fig. 1. A map of the geographical range of the Princess Parrot, based on the Atlas of Australian Birds databases showing a division of the range into core, irruptive and historical components. The core range has been derived from records collected between 1981 and 2012 and based on frequency of occurrence. Data were analysed within 1° grids with core attributes being if Princess Parrots were recorded over 2 or more years within the period. To overcome bias from differing survey effort across the area, grids with reporting rates (percentage of sightings compared to number of surveys) of <2% were removed from core range.

period of occurrence in the area, breeding, foraging, group size and overall local population size. A second aim was to understand the components of the environment used for nesting and feeding and to assess whether there were management actions needed to ensure the retention and persistence of important habitat.

Methods

The study was undertaken from August 2010 to August 2011 within the Haasts Bluff ALT (exact location withheld). The vegetation of the area consists of open woodland or woodland of Marble Gum (*Eucalyptus gongylocarpa*) and Desert Oak (*Allocasuarina decaisneana*). The first reports of Princess Parrot in the area came in late July 2010 (I. May, pers. comm.) and our initial field trip (August 2010) was within 4 weeks of this report. During the initial trip observers searched a wide area by driving along 90 km of an access track and searching areas adjacent to the track on foot. Most Princess Parrots located during this search were along a 3-km length of the track that traversed a band of Marble Gum woodland south of Glen Edith. As a consequence of this concentration of Princess Parrots, all subsequent field trips focussed on an area of ~5.0 × 2.0 km (1000 ha) centred on these initial records. This area is hereafter referred to as the main study area.

Eight field trips were made to the location during the study (Table 1), including six trips when nesting was ongoing, one to search for non-breeding birds, and a final trip 12 months after intense breeding had begun (in 2010). The purpose of the final trip was to assess whether the 2010 breeding activity was a singular event or indicative of a more extended irruption (or more regular, previously undetected, breeding) in the region. Field trips were for a minimum of 2 days and included at least two observers, though usually more (Table 1).

Table 1. A summary of field trips to the study area to observe Princess Parrots, including length of visit (in 24-h days), number of observers (dedicated full-time to searching for Princess Parrots and recording data) and observer-days (one observer day is an observer active for a full day)

Dates	Number of days (24-h periods)	Number of observers	Observer days
21–23 Aug. 2010	2	3	6
21–24 Sep. 2010	3	4[A]	12
26–28 Oct. 2010	2	4[A]	8
22–23 Nov. 2010	1	2	2
20–21 Jan. 2011	1	2	2
16–17 Feb. 2011	1	2	2
12–13 May 2011	1	3	3
24–25 Aug. 2011	1	4	4

[A]In addition to full-time observers there was active participation in searches by the Anangu Luritjiku Rangers and their co-ordinator (J. Hulcombe): four rangers in September and three in October.

Annual rainfall at the nearest weather station at Watarrka National Park (Bureau of Meteorology weather station number 015652; 24°17′29.62″S, 131°32′56.00″E, 614 m above sea level, ~50 km from the site) in the year before the irruption and the years of the study was 116.9 mm (2009), 810.3 mm (2010) and 326.5 mm (2011). The annual average for the location is 328.5 mm ($n = 19$ years). The year 2010 featured 4 months with monthly totals of >100 mm in January (114.4 mm), March (139.7 mm), September (104.9 mm) and October (123.7 mm). This was one of only two events of well above-average mean annual rainfall in the area in the past 20 years.

Abundance, group size and behaviour

During the initial field trip, in August 2010, a series of twelve 2-ha searches (a 20-min survey of a 2-ha area using the BirdLife Australia Atlas of Australian Birds methodology, http://www.birdlife.org.au/projects/atlas-and-birdata/become-an-atlasser, accessed 6 November 2013) was undertaken: six in Marble Gum woodland and six in other vegetation associations. These sites were spaced widely along the access track. In September 2010, five 2-ha searches were undertaken within the main study area, each in Marble Gum woodland. These five sites were resurveyed in January 2011.

Another five sites within the main study area were selected for a more detailed assessment of abundance in September 2010. The five sites were each ~1.0 × 0.5 km (50 ha) and were chosen to encompass variation in quality of Marble Gum as potential nesting habitat. The sites ranged from one dominated by large hollow-bearing trees to one consisting mostly of juvenile trees, with the other three sites being intermediate between these two extremes. Each site was surveyed by two observers for 60 min. Observers walked through the site searching for birds, recording the number of Parrots present, and evidence of occupation of hollows.

In addition to the above surveys, observers searched more widely for Princess Parrots within the main study area. Any birds seen were observed and notes taken of behaviour. For each

discrete bout of behaviour observers noted: location, time, duration of activity, number of birds including sex and age (if views permitted separation) and activity (separated into flying, perched or feeding). If a bird was observed in flight and perched during a bout, it was scored as 'perched'. For feeding bouts, observers recorded the location as either ground or foliage and the plant species was identified by a botanist (C. Nano) in the field. A feeding bout was defined as an observation of a single bird feeding on a single plant species. Therefore, two birds feeding on the same shrub were classified as two bouts and if a single bird fed on two plant species during an observation this was also classified as two bouts. Observers also noted interactions between two or more birds including the occurrence of calling, preening, begging and feeding.

Habitat and vegetation assessment

Within each of the five 2-ha search sites (described above), we established a 70 × 70-m habitat monitoring plot. These plots were surveyed for vegetation and other habitat variables on three occasions (September 2010, January 2011, May 2011) and for data on Marble Gum demography in September 2010.

In each plot we measured a range of abiotic variables including landform pattern and element, slope (as a percentage), aspect and substrate type. The type and intensity of major disturbances (fire, weeds, introduced herbivores) were also recorded. We characterised vegetation structure (description of dominant species and cover in each stratum: tree layer, upper shrub layer, lower shrub layer and ground layer) and vegetation profile (amount of plant biomass across six different height intervals from 0 to >10 m above the ground). We recorded every plant species and estimated its cover abundance using the classes: 1 (<5% cover, 1–5 individuals), 2 (<5% cover, 6–50 individuals), 3 (<5% cover, >50 individuals), 4 (5–9% cover), 5 (10–30% cover) and 6 (>30% cover). For each species present in the plot we recorded population-level fruiting and flowering using the classes: 0, population sterile; 1, low (<20% of individuals of each species with low levels of flowering or fruiting); 2, moderate (20–100% with low levels of flowering or fruiting or <20% with high levels of flowering or fruiting); and 3, high (20–100% with flowering or fruiting at capacity). For each plot we then multiplied the species cover-class scores by (1) the flower-class score and (2) the fruiting-class score to give a coarse estimate of changes in the abundance of potential food resources over time. This was done to explore patterns of availability of food resources over the monitoring period. For each of the three sample times we calculated plant species richness (averaged over the five plots).

Marble Gum trees were classified into five classes that reflected their age and the availability of hollows: large (diameter at breast height (DBH) usually ≥0.5 m), old trees with multiple apparent hollows (>2 hollows); medium-sized trees (DBH usually <0.5 m) with low availability of hollows (0–1 hollows); saplings (no hollows, pre-reproductive young plant, ≥1 m tall); fire-regrowth (main stem killed, no hollows); and juveniles (pre-reproductive young plant, <1 m tall). We recorded the number of individuals in each class for each of the five plots. For each plot, we obtained height and girth data for one representative individual in each class. We used these data to examine availability of hollows, fire effects, and age structure of Marble Gums across the main study area.

Analysis of data

We carried out analysis on bouts of behaviour. To ensure independence of observations we reviewed the time and location of records to avoid using data from the same birds on the same day more than once. We used a similarity percentage analysis SIMPER (Clarke and Gorley 2006) to identify the plant species that distinguished the September sample period (high Parrot abundance) from the remaining two sample times on the basis of the multiplied species cover by flowering and fruiting scores. This procedure ranks taxa according to their contributions to within-group similarity and between-group dissimilarity.

Data are presented as means ± standard error.

Results

Occurrence and abundance

Princess Parrots were first detected on 23 July 2010 (I. May, pers. comm.; Atlas of Australian Birds database (Birdata), BirdLife Australia) and by mid-August 2010 birds were concentrated in a small area of Marble Gum woodland. This area was used from August 2010 to January 2011 (Table 2). A single bird was heard, but not seen, in February 2011 whereas no individuals were recorded in May 2011 or August 2011. The number of birds present peaked in August–November 2010, with a high sighting rate in September (71 independent observations over 12 observer-days), October (77 observations over 8 observer-days) and November 2010 (34 observations over 2 observer-days). By January 2011 the number of birds had declined dramatically with 14 observations (11 in flight) completed over 2 observer-days.

The population estimate across the 1000-ha main study area, assuming the data in Table 2 represent independent observations, was a minimum of 137 birds in September 2010 and 172 birds in October 2010. In August 2010, a minimum of 36 breeding adults was estimated from within a 200-ha area within the 1000-ha main study area. The maximum flock size observed during the study period was 20 birds on 27 October 2010 (Table 2).

In August 2010, when surveys were covering a wide area of Haasts Bluff ALT, Princess Parrots were recorded at four of six

Table 2. Group size of Princess Parrots in the south-western Northern Territory from September 2010 to January 2011

Group size data are given separately for perched (including feeding) birds and those in flight

Month	Activity	Mean size of groups (birds)	Median size of groups (birds)	Maximum size of groups (birds)	*n* (groups)
September	Flight	1.58	1	4	25
	Perch	2.13	2	7	46
October	Flight	2.30	1	20	40
	Perch	2.16	2	5	37
November	Flight	1.74	1	7	12
	Perch	2.64	2.5	6	22
January	Flight	1.55	2	2	11
	Perch	1.67	2	2	3

2-ha search sites in Marble Gum woodland (14 birds, estimated density of 1.17 individuals ha^{-1}) and one of six 2-ha search sites in other vegetation associations (3 birds, estimated density of 0.25 individuals ha^{-1}). Princess Parrots were present on each of the five 2-ha search sites established within the main study area in September 2010 (34 birds, estimated density of 3.4 individuals ha^{-1}). However, when the five sites were resurveyed in January 2011, Princess Parrots were present at only two of the sites (3 birds, estimated density of 0.3 individuals ha^{-1}).

Princess Parrots were present on each of the five 50-ha sites, representing a gradation in habitat quality of Marble Gum woodland, in September 2010. The minimum estimate for the five sites combined was 38 adult birds (mean 7.6 ± 5.12, range 1–14). If these data are used to extrapolate to the 1000-ha main study area then the minimum estimate is 152 birds in September 2010.

Reproduction

Active nests were detected in August (15 nests), September (8), October (7) and November 2010 (3) and January 2011 (1) (Table 3). No more than one active nest was detected in a single tree, although at several sites nests were located in adjacent trees. In these instances, nest-trees were 40–60 m apart. The nest-hollow used in January was also occupied in September 2010 indicating the possibility that some pairs laid two clutches.

The first evidence of fledglings came in September 2010 (Table 3), when one juvenile bird was positively identified, and the number of fledglings peaked in October–November 2010. No fledglings were detected in August 2010 or January 2011. The last observation of fledglings at the site was on 3 December 2010 (A. Stafford, pers. comm.).

Table 3. The breeding phenology of Princess Parrots in the south-western Northern Territory from August 2010 to August 2011

	August 2010	September 2010	October 2010	November 2010	January 2011
Courtship feeding	✓	✓		✓	✓
Inspection of nests	✓	✓			
Incubation or brooding	✓	✓	✓	✓	✓
Fledgling being fed		✓	✓	✓	✓

Our observations on group size in October and November suggest that the average pair fledged one or two young with a maximum of five (Fig. 2*a*). Not all groups, especially those in flight, could be inspected for the presence of young. However, most groups that were observed closely contained juvenile birds. When considering all sightings, the percentage of groups that had three or more birds (i.e. potentially consisting of a pair and offspring) increased substantially from September (14%) through October (27%) to November (38%). This pattern indicates an increase in the presence of fledglings from September to November and suggests that group size in October and November is a reliable indicator of the number of young fledged.

Characteristics of nests

At least 22 active Princess Parrot nests were observed, although there may have been more nests. All nesting took place in hollows in large Marble Gums. The mean height of 15 nesting trees in August 2010 was 14.06 ± 0.70 m (range 7.85–18.06 m) and the mean height of entrances to the nesting hollow 6.76 ± 0.37 m (range 4.40–9.88 m). The mean height of entrances to the nesting hollows of six nests in October 2010 was 6.52 ± 0.64 m (range 4.40–8.35 m).

Feeding

We observed foraging Princess Parrots in August ($n = 14$), September ($n = 15$), October ($n = 7$) and November ($n = 2$). A total of 38 independent foraging records were obtained, of which five were birds flushed from the ground, in which case feeding was not observed but inferred. The longest continuous observation of a foraging bird was 35 min. Princess Parrots frequently foraged on the ground and in the foliage of shrubs and trees (Fig. 2*b*).

Princess Parrots were observed feeding on at least 11 plant species. Parrots were observed feeding on grass seeds (2 observations: *Digitaria ammophila*, *Eragrostis eriopoda*), Acacia seed pods (2 observations: *Acacia maitlandii*), flowers (21 observations: Mulga (*Acacia aneura*), *Grevillea juncifolia*, *Leptosema*

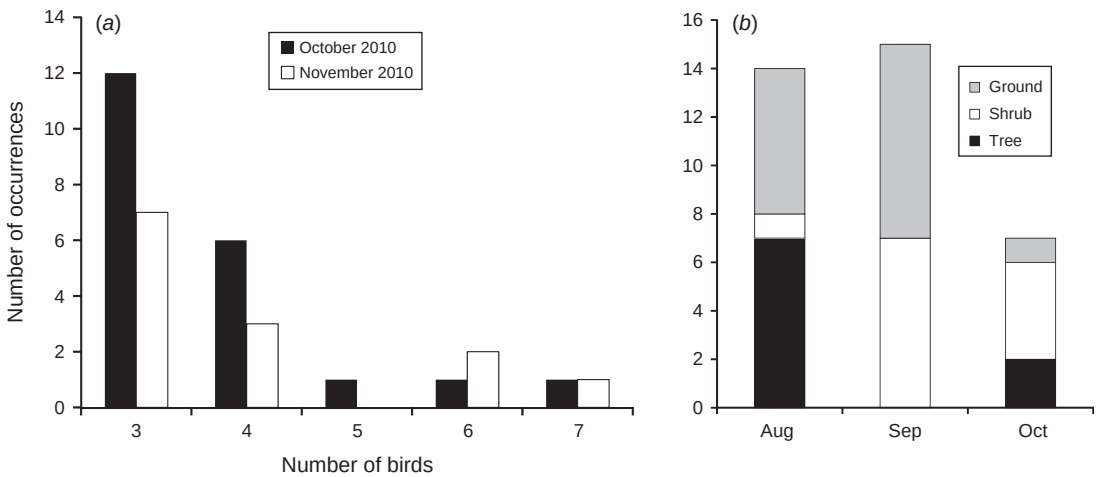

Fig. 2. (*a*) Summary of group size (perched and flight combined) for all groups of three or more Princess Parrots in October and November 2010; and (*b*) strata occupied by foraging Princess Parrots over 3 months in 2010.

chambersii, *Hakea lorea*, *Eremophila* spp.), leaf stems (2 observations: *Euphorbia ferdinandii*, *Amyema miquelii*), lerps (2 observations: *Eucalyptus* sp.) and unidentified plant material (four observations: *Ptilotus polystachyus*). The composition of feeding records changed across the 3 months of intensive sampling from August to October 2010. The red-flowering subshrub, *L. chambersii* was important in August ($n = 5$ feeding records) but was seen to be eaten only once in September and not at all in October. In contrast, flowers of the shrub *Grevillea juncifolia* were observed to be eaten during only one observation in August whereas these were the main food source in September ($n = 7$) and October ($n = 3$). Although birds frequently fed on flowers we have no direct evidence that nectar was consumed.

Habitat and vegetation assessment

The Marble Gum woodland in which the Princess Parrots nested was located on an undulating sandplain (aeolian sand) with sandy loam soil. Plant species richness in September 2010 ranged from 48 to 69 species (mean 60.6 ± 8.08) across the five habitat plots and 59% of the plant-species records ($n = 300$) included some level of flowering, with 27% of these being scored as high (class 3). Further, all plots had 50% or more species with some level of flowering (range 50–65%). By contrast, the incidence of fruiting at this time was 20% and none of the species was given a high fruiting score. In January 2011, plant species richness was marginally lower than the previous sample, ranging from 44 to 66 species (mean 55 ± 8.4). The incidence of flowering at this time was also lower (50.5%) whereas that of fruiting had increased to 56% ($n = 275$ total species records across the plots). No species was recorded as having high flowering or fruiting (class 3) in January 2011. Finally, by May 2011, species richness was at its lowest, ranging from 40 to 51 species (mean 45.6 ± 5.0) across the five plots. At this time, flowering incidence was at its lowest (28%), and fruiting was intermediate at 46% ($n = 228$ species records across the plots). Again, no species had high fruiting or flowering levels in this last sample.

The September sample period was characterised by higher flowering in more shrub (9 species) and subshrub species (3 species) compared with the January sample (0 shrub species; 0 subshrub species) (SIMPER analysis: 70% cumulative between-group dissimilarity). The same pattern was apparent in the comparison of the September (6 shrub species, 3 subshrub species) and May samples (0 shrub species, 0 subshrub species). Abundance of flowers was notably higher in the September sample for *Grevillea juncifolia*, *Leptosema chambersii*, *Acacia murrayana*, *Bonamia erecta* and *Aluta maisonneuvei* subsp. *maisonneuvei* (Appendix 1).

The September sample period was not characterised by high availability of fruit or seeds compared with the following two sample periods. Only four species – *Euphorbia ferdinandii*, *Bonamia erecta, Ptilotus polystachyus* and *Lawrencella davenportii* – had a comparatively high fruiting index in September *v.* January (22 species) and May (14 species) (SIMPER analysis: 70% cumulative between-group dissimilarity).

The site was last burnt in 2002. The presence of One-humped Camel (*Camelus dromedarius*) was detected in two of the five plots and there was moderate indications of presence of Camels throughout the main study area. We did not detect indications of any other introduced herbivores. No weeds were detected on the plots, although we noted several small patches of the introduced and invasive buffel grass *Cenchrus ciliaris* within the study area.

The average height of the Marble Gum overstory ranged from 12 to 17 m. The mid-layer of the Marble Gum woodland consisted of mallee eucalypts (*Eucalyptus gamophylla*, *E. mannensis*, *E. oxymitra*), shrubs (*Eremophila longifolia*, *Eremophila glabra*, *Senna artemisioides*, *Acacia maitlandii*) and Marble Gum saplings. The ground cover was dominated by hummock grass (*Triodia schinzii*) and short-lived tussock grasses (*Aristida holathera*, *Enneapogon polyphyllus*) with the subshrub, *Leptosema chambersii* subdominant on one plot. Across all plots, the bulk of the live vegetation biomass was concentrated in the upper and lower height-classes: >10 m (range of biomass across the five plots 5–12%), 0.5–1 m (range 6–12%) and 0–0.5 m (range 30–40%). Thus, medium to tall shrubs were found to contribute relatively little to the biomass of the sites.

The distribution of size-classes of Marble Gums in the 70×70-m plots varied (Fig. 3). Three of the plots (at sites 1, 3 and 5) had three or more large old trees with multiple apparent hollows and it was at these sites that Princess Parrot activity was concentrated. The number of large trees per plot in the five sites ranged from 6 (site 3) to 1 (site 4). Medium-sized trees (no or few hollows available) formed the dominant component of the plots at sites 1 and 2. The occurrence and density of Princess Parrots was relatively low at site 2 compared to other sites. Site 4 differed most in that it was the only site with juvenile Marble Gums, and it also had the lowest number of mature adult Marble Gums ($n = 1$) across the site. Activity of Parrots was similarly relatively low here compared with other sites. Like the distribution of juvenile Marble Gums, the distribution of sapling Marble Gums was not uniform across the study area, with individuals occurring in only two of the five plots. Resprouting adults were recorded from two sites that otherwise had a good representation of large and

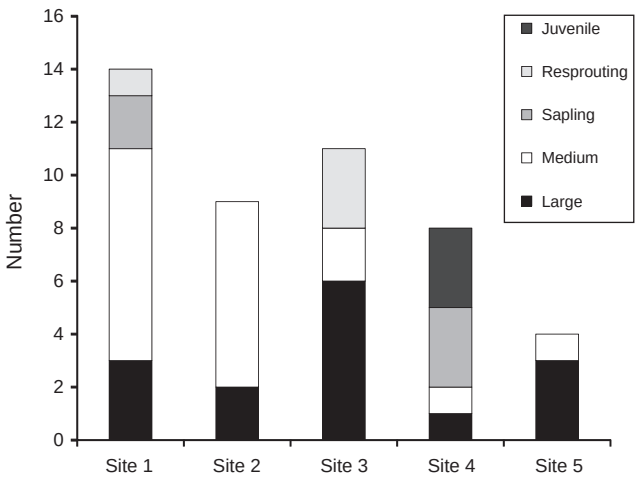

Fig. 3. Frequency distribution of size-classes of Marble Gums in five vegetation monitoring plots (70×70 m) in the study area. Classes were: large old trees with multiple apparent hollows (>2 hollows); medium trees with low availability of hollows (0–1 hollows); saplings (no hollows, no roosting sites); fire-resprouting (main stem killed, no hollows, no roosting sites); and juveniles (small trees <1 m tall).

medium trees (sites 1 and 3). Thus, there was no evidence that fire was resulting in a decline in the availability of key resources under the present fire regime.

Discussion

The pulse in primary productivity that likely triggered the Princess Parrot breeding event was driven by high rainfall early in 2010. Specifically, at Watarrka National Park, 50 km from the study site, monthly rainfall events of 100 mm or more occurred in January and March 2010, following a dry year in 2009 (annual rainfall of 116.9 mm). This spike in rainfall was widespread across the southern Northern Territory and adjacent areas of arid Australia (Pavey and Nano 2013; Wardle *et al*. 2013). The response time of Princess Parrots to the summer rainfall seems to have been rather brief; significant numbers were present by the time of the first visit to the site in late July 2010. During the Princess Parrot breeding event other parrots present in the study area were Major Mitchell's Cockatoo (*Lophochroa leadbeateri*), Cockatiel (*Nymphicus hollandicus*), Australian Ringneck (*Barnardius zonarius*), Mulga Parrot (*Psephotus varius*) and Budgerigar (*Melopsittacus undulatus*) (C. R. Pavey, C. E. M. Nano, J. R. Cole, P. J. McDonald, P. Nunn, A. Silcocks and R. H. Clarke, unpubl. data). Follow-up monthly rainfall events of >100 mm also occurred during the peak of breeding activity in September and October 2010. This resulted in temporary pools of water being present in the study area, although the nearest permanent water is likely to be >50 km from the study area.

The study area had remained unburnt for 8 years at the time of the vegetation and habitat assessments in September 2010. However, all five habitat monitoring plots had evidence of severe effects of fire. Fine-scale fire-scar mapping of the study area (Northern Territory Government, unpubl. data) together with broader satellite imagery analysis (Turner *et al*. 2008) reveal that Haasts Bluff ALT is subject to large wildfires following wet years. These fires can damage or kill Marble Gums thus reducing breeding habitat quality for Princess Parrots. The last such fire event was in 2002. The fire threat in the area may increase in future if invasive buffel grass, which we located in several small patches, becomes established. Buffel grass is known to alter fuel-load characteristics, increasing the frequency and intensity of fires and negatively affecting native trees and shrubs (Miller *et al*. 2010). Establishment of buffel grass in the study area is highly likely to lead to increased mortality of hollow-bearing Marble Gums as is happening with River Red Gums (*Eucalyptus camuldensis*) after buffel grass invasion of river channels in the MacDonnell Ranges bioregion (C. R. Pavey, pers. obs.).

Occupancy of the site and the breeding event of Princess Parrots was prolonged in comparison with previous records based on the limited existing information available. Specifically, the breeding event continued for 6 months, with active nests observed from August to November 2010 and in January 2011, although the peak in nesting activity was from August to November. As recently fledged juvenile Parrots were present from September and Princess Parrot incubation and nestling stages average a total of ~56 days (Higgins 1999), some Princess Parrot breeding must have begun in July 2010 at this site. The breeding period is usually given as September–November or September–December in the wild (Higgins 1999) and September–December in captivity (Shephard 1989). We recorded a peak of fledglings in the population in October and November 2010. Our data on group size indicate that most pairs fledged one or two young with a maximum of five (Fig. 2*a*). These data match estimates of clutch-size of 3–6 eggs for wild birds (Higgins 1999) and typical clutch-sizes of 4–5 eggs in captivity (Shephard 1989).

We have several sources of data to estimate the minimum number of Princess Parrots present within the ~1000-ha main study area (see Methods). The data on group size (Table 2) indicate a minimum number of 137 birds in September 2010 and 172 in October 2010. The alternative method of estimating abundance, based on the five 50-ha search areas, minimised the likelihood of re-counting birds because two observers spent 60 min in the area familiarising themselves with the movements and activities of all Princess Parrots. If the September 2010 data (38 adult birds with a mean of 7.6 per site) are used to extrapolate to the 1000-ha study area then the minimum estimate is 152 birds. As an alternative, searches for nests in August 2010 in an area of ~200 ha within the study area located a minimum of 36 breeding adults. If extrapolated to the 1000-ha study area this gives a total of 180 adults. That these estimates are congruent is encouraging.

Whether the number of birds present at Haast's Bluff ALT in late 2010 is a significant portion of the global population of the Princess Parrot is not clear. However, if the estimate of 1200 mature individuals given, albeit with low confidence, by Garnett *et al*. (2011) as a potential population size at its lowest point is accepted, then the estimate of a minimum of 172 birds in our study area in October 2010 is almost 15% of the global population of the species.

The current knowledge of the geographical distribution of the Princess Parrot indicates that Haasts Bluff ALT does not form part of its core range (Fig. 1). The species does not appear to be resident there (or in the general area) as no individuals were present in May or August 2011 despite food and nesting resources being available. However, four birds were sighted on 23 May 2012 (C. Nano and P. Hodgens, unpubl. data) indicating that the area may not be unoccupied for long during wet periods. A potential explanation of the use of the area by Princess Parrots is that it is significant for breeding during population irruptions and, therefore, is occupied only periodically. Before 2010 the area was infrequently visited by observers so the pattern of occupation by Princess Parrots is not clear. Nevertheless, large numbers were observed in this general vicinity in 1894 (North 1896) with 15 specimens taken (Spencer 1896, p. 101). The site of North's observation is given as 'between Glen Edith and Deering Creek'. Although this description does not enable an exact location to be specified, the furthest of the two locations is within 30 km of our study area. Further, the stand of Marble Gums in which breeding occurred during our study was previously identified as being significant on a regional scale and a survey for Princess Parrots was done in the area in the early 1980s, albeit without detecting Parrots (Fleming and Piercey 1982). Our work showed that the stand is characterised by a high proportion of medium-sized and large hollow-bearing trees, a feature which makes it a high-quality breeding location for parrots and other hollow-nesting fauna.

Our observations provide new insights into, and clarify other aspects of, the diet and foraging behaviour of the Princess Parrot.

Specifically, we show that the species feeds on flowers, seeds and other material of a wide range of plants and that it frequently forages on both the ground and in foliage. At the species level, most food plants that we observed being consumed by Princess Parrots have not been recorded previously (Higgins 1999). However, all the food plants were common in the study area during our observations (C. Nano, unpubl. data) and a significant portion of plants were flowering. Further, many of the species are common and widely distributed throughout the arid zone. The study area had remained unburnt since 2002, demonstrating that fire-stimulated primary production is not a trigger and is not necessary for reproduction in this species.

The decrease in numbers of Parrots over time coincided with a gradual decrease in plant species richness and in abundance of flowers. By contrast, the results did not indicate that the birds have a strong reliance on overall high seed availability for breeding or persistence at a site, given that population numbers were dramatically reduced by January when the availability of seeds and fruit was at its highest level.

All confirmed nesting observed during this breeding event was in mature Marble Gums, which was the dominant tree within the main study area. Although Marble Gum has previously been identified as a nesting tree for the Princess Parrot (Johnstone and Storr 1998; Garnett *et al.* 2011), most reports of nesting are from River Red Gums and other eucalypts along drainage lines (Higgins 1999). Although Desert Oak has been listed as a nesting tree (Higgins 1999), it does not readily form hollows and Princess Parrots were not recorded nesting in Desert Oak despite it being common in the study area. Marble Gum typically grows on sandy substrates, often at considerable distance from watercourses, so it may have been overlooked as a nesting tree in the past. It is a tree that readily forms hollows (Fleming and Piercey 1982) and is distributed across the eastern and southern portions of the range of the Princess Parrot (Brooker and Kleinig 1994; Garnett *et al.* 2011). Although its distribution in the southern Northern Territory is patchy (Fleming and Piercey 1982) it appears likely to be an important nesting tree for Princess Parrots in these parts of its range.

Management issues and actions

Several important management issues have emerged from this Princess Parrot breeding event. The first set of issues relate to the logistics of carrying out this type of opportunistic study. The project would not have been possible without the positive attitude and approach of the organisation responsible for management of the land, the Central Land Council, and the traditional owners of the land who facilitated access to the area and enabled the study to proceed collaboratively. Specifically, the Anangu Luritjiku Rangers responsible for management of this area assisted with collection of data for the duration of the two longest and most intense field trips in September and October 2012. The value of such collaboration for obtaining information on Princess Parrots has been noted previously (Brennan *et al.* 2012). The Anangu Luritjiku Rangers have subsequently undertaken fire management (see below) and control of buffel grass in the study area. Further, the ability of the organisations involved in the study (Northern Territory Government, Monash University, BirdLife Australia (Birds Australia at the time), Central Land Council) to dedicate staff to the project at short notice was vital to its successful completion. Without this ability the work could not have been undertaken.

In terms of on-ground management, the protection of stands of Marble Gum as a critical nesting resource has emerged as the key management focus. Although the frequency of use of the area by Princess Parrots is not known, the occurrence of two significant known irruptions (1894, 2010–11) and the reappearance of birds in May 2012 suggest that the Glen Edith area is an important location for the species. Because the years including and immediately following significant rainfall have a heightened risk of large-scale wildfires (Letnic and Dickman 2006), particular attention was given to the risk of fire affecting the stand of Marble Gums in mid- to late 2011. This period encompassed a series of significant fire events in the southern Northern Territory (Bastin and Allan 2012), affecting several bioregions: MacDonnell Ranges, 34.9% of the bioregion burnt; Burt Plain, 31.6%; Finke, 25.1%; and Great Sandy Desert, 35.4% (Australian Collaborative Rangelands Information System (ACRIS), unpubl. data). A fire burnt the periphery of our 1000-ha study area in August 2011, but the effect on individual Marble Gums was negligible. As a consequence of the fire risk, a fuel-reduction burn to mitigate any potential effect from wildfire was undertaken by the Central Land Council in spring 2011 (B. Kaethner, pers. comm.).

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Appendix 1. Diagnostic species for the September 2010 sample period and species contributing up to 70% of the average Bray–Curtis between-sample–time dissimilarity (defined by SIMPER analysis) based on the generated flowering and fruiting indices (cover class × flowering ÷ fruiting class)

Numbers in bold indicate diagnostic species for the September sample. Italicised numbers indicate discriminating species for pairwise comparisons between the September and the January and May 2011 sample times. Growth-form codes: f, forb; ss, subshrub; s, shrub; t, tree; tg, tussock grass; ms, mallee shrub; hg, hummock grass

Species	Growth-form	Flowering			Fruiting		
		Sep	Jan	May	Sep	Jan	May
Abutilon fraseri subsp. *fraseri*	f	0	0.2	0	0	0.2	0.2
Abutilon otocarpum	ss	0	0.6	1			
Acacia kempeana	s	0	0.2	0			
Acacia maitlandii	s	0.4	0	1.2	*0*	*1.2*	0
Acacia murrayana	s	***2.4***	*0*	0			
Allocasuarina decaisneana	t	0	0.2	0			
Aluta maisonneuvei subsp. *maisonneuvei*	s	***4.2***	*1.2*	2.4			
Amphipogon caricinus	tg	***4.6***	*0.4*	0	*1*	*2*	*1.6*
Aristida holathera	tg	***3***	*4.6*	*1.4*	***1.2***	*3.2*	*3.8*
Aristida inaequiglumis	tg	0	0.6	1.6	***1.2***	1.2	*3.8*
Bonamia erecta	ss	***5.4***	*0*	*0*	***1.8***	*0*	*0*
Brachyscome ciliaris var. indeterminate	f	0.2	0.4	0	0	0.4	0
Brunonia australis	f	1	1.4	0.8	*0*	*1.8*	*1.2*
Calandrinia balonensis	f	*1.4*	1.2	*0*	*0*	*1.2*	0
Calandrinia remota	f	0	0.8	0	0	0.4	0
Calandrinia reticulata	f	***1.6***	*3.2*	1.6	*0*	*1.8*	*1.2*
Calotis hispidula	f	0.2	0	0			
Calytrix carinata	s	0.6	0.2	0			
Chenopodium desertorum	ss	0.2	0.4	1.2	0	0.4	0.4
Chrysocephalum apiculatum	f	*0*	*3.4*	*5.2*	*0*	*1.8*	*2.6*
Chrysocephalum eremaeum	ss	0.6	1.4	0.8	0.2	1	0.8
Cymbopogon obtectus	tg	0.6	2	1.4	*0.2*	*2*	*2.8*
Digitaria ammophila	tg	1.4	1.8	1.2	*1*	*3.6*	*4.2*
Digitaria brownii	tg	0.4	0.8	0.4	*0.4*	*1.6*	0.8
Einadia nutans subsp. *eremaea*	f				0	0	0.4
Enneapogon polyphyllus	tg	***4.2***	*5.4*	*2.4*	***3.2***	*5.6*	*4.4*
Eragrostis eriopoda	tg	*0*	0.4	*2.2*	***1.2***	2	*2.8*
Eremophila glabra subsp. *glabra*	s	***1.8***	*0.2*	*0*	*0*	*1.2*	0
Eremophila latrobei subsp. *latrobei*	s	0.2	0	0			
Eremophila longifolia	s	0	1.2	0.4	*0*	*1.2*	1
Eremophila platythamnos	s	**1.4**	1.2	0	0	1	0.8
Eriachne aristidea	tg	0	0.4	0	*0*	*1.2*	0
Eriachne helmsii	tg	0.2	0	0	0.2	0.4	0.4
Eucalyptus gongylocarpa	t	0	1.6	0			
Eucalyptus oxymitra	ms	0	0.4	0	0	0	0.4
Euphorbia ferdinandii	f	***4***	*0.8*	*0*	***1.2***	*1*	*0*
Euphorbia tannensis	f	0.8	0.4	0	0.4	0.2	0
Exocarpos sparteus	s	0.6	0	0			
Glischrocaryon aureum	ss	0.2	0.2	0.2			
Gompholobium simplicifolium	s	0	0.2	0			
Goodenia glabra	f	***2.4***	*1.4*	*0*	0	0.4	0
Goodenia mueckeana	f	***2***	*0.6*	*0*	0	0.6	0
Grevillea juncifolia subsp. *juncifolia*	s	***3.6***	*1.6*	*0.4*	*0*	*2*	0.6
Jasminum calcareum	s	0	0.2	0			
Lawrencella davenportii	f	***3***	*0*	*0*	***1.6***	*0*	*0*
Lepidium phlebopetalum	f	0.2	0	0	0.4	0	0
Leptosema chambersii	ss	***3.6***	*0*	*0.6*	0	0	0.6
Leucochrysum sp.	f	0.4	0	0			
Leucochrysum stipitatum	f	***3***	*1*	*0*	0	0.8	0
Lobelia heterophylla subsp. *centralis*	f	0	1.2	0	*0*	*3.2*	0.4
Logania centralis	ss	0.2	0	0			
Micromyrtus flaviflora	s	***2.4***	*0*	*0*			
Minuria leptophylla	f	***2.8***	*1.8*	*0.4*	*0.8*	*1.6*	*2.2*
Monachather paradoxus	tg	1.2	0	0	0.8	0.4	0.2

Appendix 1. (*continued*)

Species	Growth-form	Flowering			Fruiting		
		Sep	Jan	May	Sep	Jan	May
Olearia subspicata	s	*1.8*	*0*	0	0.2	0.2	0
Panicum effusum	tg	*0.6*	*1.6*	0.4	*0.2*	*1.6*	0.8
Paraneurachne muelleri	tg	**1.4**	0.2	0.4	**1**	0.6	1.2
Paspalidium reflexum	tg	*0.6*	*2.2*	0.8	*1*	*2.8*	*3*
Pimelea trichostachya	f	1.2	0.8	0			
Podolepis canescens	f	***2.8***	*2.2*	*0.2*	*0*	*2.2*	0.2
Prostanthera althoferi subsp. *longifolia*	s	0.4	0	0	0	0.2	0.4
Prostanthera striatiflora	s	***2.2***	*0*	*0*	*0*	*1.4*	0
Ptilotus nobilis subsp. *nobilis*	f	0.6	0	0			
Ptilotus obovatus var. indeterminate	ss	1.2	0	0.4	0.4	0	0
Ptilotus polystachyus	f	***5.6***	*1.6*	*0.2*	***3.4***	*1.6*	*0.2*
Ptilotus sessilifolius	ss	***2.4***	*1.6*	*0.8*	**0.8**	1.2	0.6
Salsola tragus subsp. *tragus*	f	0	0.6	0.2	0	0.2	0.2
Scaevola basedowii	ss	0	0.8	0.4	0	0.4	0
Sclerolaena johnsonii	f	**1.8**	2	1.2	***1.6***	*3*	*2.6*
Senecio gregorii[A]	f	0.2	0	0			
Senna artemisioides subsp. *artemisioides*	s	1.6	0	0	0	0	0.4
Senna artemisioides subsp. *petiolaris*	s	***2.2***	*1.2*	*0*	0	0.2	0
Senna pleurocarpa var. *pleurocarpa*	s	***2.2***	*0*	*0*	0	0.6	0
Sida sp. Pindan	ss				0	0.4	0
Sida ammophila	f	0	0.4	0	0.2	0.8	0
Solanum centrale	ss	0.6	0	0			
Solanum coactiliferum	ss	0	0	0.4			
Solanum ferocissimum	ss	0.2	0	0	0	0	0.8
Solanum orbiculatum subsp. *orbiculatum*	ss	0.2	0	0			
Solanum quadriloculatum	ss	0.4	0	0			
Stackhousia megaloptera	ss	0.2	0.6	0	0	0.6	0
Stenopetalum lineare var. *lineare*	f	0.2	0	0	0.2	0	0
Swainsona affinis	f	*2.2*	*0.4*	*0*	0.6	0.4	0
Synaptantha tillaeacea var. indeterminate	f	0.2	0	0			
Triodia schinzii	hg	*0*	*6.4*	0	*0*	0.8	*4.8*
Vittadinia sp.	f	0	0	0.2	0	0.8	0.4
Wahlenbergia tumidifructa	f	0	0.2	0	0	0.2	0
Xerochrysum bracteatum	f	0.6	0.6	0	0	1	0

[A]Note: this taxon was previously recognised as *Othonna gregorii*; that name is no longer current.

ATTACHMENT I:

POPULATION DYNAMICS OF DASYURID MARSUPIALS IN DRYLAND AUSTRALIA: VARIATION ACROSS HABITAT AND TIME

Pavey C.R., Nano, C.E.M. and Waltert M.

Austral Ecology (2020) 45, 283–290

REDACTED

ATTACHMENT J:

THE ROLE OF REFUGES IN THE PERSISTENCE OF AUSTRALIAN DRYLAND MAMMALS

Pavey, C.R., Addison J., Brandle R., Dickman C.R., McDonald P.J., Moseby K.E. and Young L.I.

Biological Reviews (2017), 92, pp. 647–664.

REDACTED

ATTACHMENT K:

REDACTED

ATTACHMENT L:

SINGLETON WATER LICENCE ABORIGINAL CULTURAL VALUES ASSESSMENT – PUBLIC REPORT

Prepared by Susan Dale Donaldson, Anthropologist
1 September 2021

Singleton Water Licence
Aboriginal Cultural Values Assessment

PUBLIC REPORT TO THE CENTRAL LAND COUNCIL

Singleton Pastoral Lease, Neutral Junction Pastoral Lease, Warrabri Aboriginal Land Trust and Iliyarne Aboriginal Land Trust, Northern Territory, Australia.

SUSAN DALE DONALDSON (ANTHROPOLOGIST)

Environmental & Cultural Services

1 September 2021

WARNING: THIS REPORT CONTAINS REFERENCE TO ABORIGINAL PEOPLE WHO HAVE DIED

Front cover: First Trip to Grandfather's Country with Rangers © Lindy Brodie 2021

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ACRONYMS

AAPA	Aboriginal Areas Protection Authority
AC	Authority Certificate
AIATSIS	Australian Institute of Aboriginal and Torres Strait Islander Studies
ALT	Aboriginal Land Trust
CLC	Central Land Council
DA	Drawdown Area
FPIC	Free, Prior and Informed Consent
GDE	Groundwater dependent ecosystem
GL	Gigalitre
ha	Hectare
ICN	Indigenous Corporation Number
ICOMOS	International Council on Monuments and Sites
km	kilometre
km^2	square kilometres
ML	Megalitre
NOI	Notice of intention
NTG	Northern Territory Government
PL	Pastoral Lease
PPL	Perpetual Pastoral Lease
RNTBC	Registered Native Title Body Corporate
RWA	Restricted Work Area
SWL	Singleton Water Licence
UNESCO	United Nations Educational, Scientific and Cultural Organization
WDWAP	Western Davenport Water Allocation Plan

Executive summary

In September 2020, Fortune Agribusiness Funds Management Pty Ltd (Fortune Agribusiness) applied for a water licence over Singleton Pastoral Lease (PL) located within the Central Plains management zone of the Western Davenport Water Allocation Plan (WDWAP), near Wycliffe Well in the Northern Territory. Whilst the proposed water extraction zone (development wells / bores) is located on Singleton PL, the groundwater drawdown area is estimated by Fortune Agribusiness as extending beyond the water extraction zone to other parts of Singleton PL, and across Neutral Junction PL, Warrabri Aboriginal Land Trust (ALT) and Iliyarne ALT.

In May 2021, the Central Land Council (CLC) was instructed by Aboriginal owners to identify the cultural values associated with the Singleton Water Licence (SWL) area and to consider how these values might be impacted by the granting of the water licence. Anthropological consultant Susan Dale Donaldson was engaged by the CLC to undertake the cultural values assessment.

The cultural values assessment involved a literature review and consultations with 80 Aboriginal owners in June 2021 which identified a complex Aboriginal cultural landscape across the SWL groundwater drawdown area including important cultural values directly associated with groundwater dependent ecosystems (GDEs). The assessment found the SWL area to be situated on the traditional lands for four *Kaytetye* speaking groups (*Anerre, Waake-Akwerlpe, Iliyarne* and *Arlpwe)*. An additional 23 Aboriginal groups were also identified across the broader Western Davenport District as holding kinship and ritual ties to these Kaytetye groups and to the drawdown area.

Traditional Owners' belief in the *Altyerre* (Dreaming) Law and the need to follow the Law is the cornerstone cultural value arising from this assessment and the foundation of all other identified cultural values. Taking care of country into the future according to ancient laws and customs appeases the creator spirits residing at important places. If traditional roles and responsibilities are not carried out by Traditional Owners, and if country is damaged as a result of the actions of Traditional Owners or others, punishment is imposed on senior Traditional Owners by *Altyerre* forces resulting in sickness, injury and even death. Spiritual punishment can lead to psychological stress and guilt linked to people's sense of internal moral failure associated with being responsible for damaging the country belonging to their spiritual ancestors, their actual ancestors, the current generation of kin and their descendants. Social sanctions may also result; Traditional Owners can be forced into temporary or permanent isolation from their traditional group. This was a major theme expressed during this assessment, as described below:

> ‘Aboriginal law is strong. If I do the wrong thing and my trees dies, I’ll be gone. If Dreaming trees get lost, we be gone too. We got to tell them this. Someone will be in trouble, the bloke not listening to us, he will get sick. That’s our law. Our law is in the ground and will not change. When I’m gone my family got him (The Law). Our main word to them is “please take it easy on the water all around the world”.’ *Frankie Holmes Akemarre*

This assessment also revealed the strong spiritual connection between Traditional Owners and sacred sites, the places embodying the *Altyerre* (Dreaming). Background research combined with consultations with Traditional Owners identified 40 sacred sites associated with 20 *Altyerre* mythologies within the drawdown area. Considering not all of the identified sites were visited during the assessment combined with the cultural complexities of the region, it is possible that one or two of the sites identified are actually the same place known by different names. It is also possible that other sites exist within the drawdown area that were not identified during this assessment.

Many of the *Altyerre* tracks traversing the drawdown area interlink with places across the broader cultural landscape. Whilst all of the mythologies across the drawdown area relate to the *Altyerre* creation of the land and water, a number of mythologies specifically relate to water such as ancestors carrying and digging for water, ancestors teaching others how to sing for rain, and groups attending large rain ceremonies. These mythological episodes continue to be re-enacted by Traditional Owners today in ritual, through song, dance, paint, story-telling and by visiting the spiritual ancestors residing at sacred places. Damage to sacred sites can impact Traditional Owners’ spiritual connection to country.

> ‘If we Iliyarne people let our land go dry, other people will growl at us. We need to keep the water until we die so that it can jump over to our children and their children all the way like that. The spirit people will get upset if we let that country go dry. They will make us sick, especially Rodger Tommy the main *kirda* (owner through father), and his sons and daughters. We are his *kwertengerl* (owner through mother) and we watch over that country for him.’ *Heather Anderson Narrurlu*

Each of the 40 sacred sites identified within the drawdown area were beyond the extraction zone and all have features associated with GDE: soakages, bean trees, orange trees, coolibah trees, creeks, swamps, supplejack trees, ghost gum trees, and bloodwood trees. It is understood that sandhills and mulga patches associated with sacred soakages are not GDE features.

The Aboriginal Areas Protection Authority issued the company with a sacred sites Authority Certificate (AC) for the proposed work; the subject land covers an area larger than the extraction zone but less than the estimated groundwater drawdown area (C2019/083). The current assessment identified 5 sacred sites within the AC subject land, not included in the AC. Moreover, a further 32 sacred sites were identified outside the AC subject land within the drawdown zone.

The assessment found that the spiritual connection Traditional Owners have with their country is strengthened by ritual activity which is also linked to the powerful forces of the *Altyerre*. There are a number of ceremonial grounds close to the drawdown area, used in the past, as well as today. Whilst there is a strong belief held by Traditional Owners in the power of ritual, for instance for rainmakers to make rain to increase water supply regardless of secular activities and impacts, many Kaytetye rituals require specific flora and fauna species obtained across the drawdown area. The current proposal to reduce groundwater has the potential to adversely impact GDE species which Traditional Owners customarily require for ritual activity. These potential changes concern the current generation of Traditional Owners, they fear the consequences of not following their ancient Law.

The extraction and drawdown areas have been identified as prime hunting ground by Traditional Owners. A vast array of flora and fauna species utilised by Traditional Owners were documented during this assessment, many of which depend on groundwater. The Wakurlpu and Alekarenge communities in particular utilise their 'back yard', within the drawdown area, to collect natural resources. Continuing to 'go hunting' is vital to the maintenance of good mental, physical and spiritual health for Aboriginal people and an important way to transmit cultural knowledge and practices to younger generations.

The importance of soakage water to Aboriginal people in the region was first documented by Stuart in 1862 when in the vicinity of the Crawford Range and Taylor Creek he recorded 'soakages dug in the Creek by the natives. There is no surface water, but apparently plenty by digging in the bed of the creek'.[1] Aboriginal people's reliance upon and valuing of water and other natural resources in this dry region continued throughout the 1900s (see Bell 1983; Koch & Koch 1993; Olney 1999; Turpin 2000; CLC 2008). The establishment of Warrabri settlement in 1956, now known as Alekarenge (Ali Curung), enabled Kaytetye families and their neighbours to remain on or close to their traditional lands. Others worked and lived on nearby Singleton and Neutral Junction Stations. Historical accounts in the 1960s reveal how the Aboriginal people who call this region 'home' in a traditional sense, were 'apparently prepared to stay at Singleton no matter how bad the conditions'.[2] Oral histories reveal

[1] Stuart 1865:79.
[2] Singleton Station CENSUS F133/22 (65/32); 1967.

that Traditional Owners and their ancestors have never ceased hunting and gathering on their traditional lands which includes collecting water from soaks, springs, swamps and creeks.

There is concern that this culturally important activity will be impacted by a reduction in groundwater and there will be a subsequent loss of associated cultural knowledge. Traditional Owners fear that the bigger animals will go to other areas to find water, and the smaller species will die out. People will feel a sense of shame and loss if they allow species to die out or find a 'new home'.

Traditional Owners have roles and responsibilities to maintain and protect their country including the plants and animals; in Aboriginal thinking, everything is connected and especially to water. Looking after country in a broad sense relates to sustaining the biodiversity through regular burns, cleaning out/covering up soakages and other activities. These cultural activities relate to preserving all aspects of the cultural landscape, including water sources, for future generations so that culturally valued natural resources can be sustained. The potential for Traditional Owners to get sick or die as a result of the believed consequences of non-compliance with the Law, by not looking after the water upon which the plants and animals living on their country rely, was a key theme expressed during this assessment.

As evidenced by existing literature and consultations with Traditional Owners, it is apparent there was much historical seasonal movement between soaks and living areas and ceremonial grounds across the drawdown area and beyond. Seasonal movement was previously a matter of ongoing residence, subsistence and ritual obligation, whereas nowadays seasonal movement to water sources is on a visiting/camping/hunting/ritual basis. Whilst country continues to be accessed for cultural purposes, movement between water sources has reduced. The continued cultural pattern being expressed links people to their past and provides promise for the future of their important cultural practices.

Today there are hundreds of Aboriginal people living close to the drawdown area and or regularly accessing the land for cultural purposes. There is a fear amongst Traditional Owners that their families will not attempt to travel lengthy distances for fear of getting thirsty and dying. Similarly, they fear that people will 'stay in town' if there is no available water on country. Concerns have also been raised by Traditional Owners that if people breakdown in their motor vehicles when out hunting in remote areas, they might not be able to rely on their traditional ecological knowledge to survive because the landscape and its resources may be altered.

> 'Don't they see that there are people living on this land? Living off this land? It's like when the British tested rockets at Maralinga they were blind and didn't see that people were living there. Then they made

the people sick and blind. The birds fell out of the sky. Their country was ruined. Yami Lester was blinded and he had no idea what was happening. Today we know what's about to happen, there is about to be a water crisis. We have to stop it before it happens.' *Maureen O'Keefe Nampijinpa*

Based on in-depth discussions with Traditional Owners when undertaking this assessment, it is clear that Traditional Owners would prefer to sustain the current health of their country and maintain their custodial responsibilities to it by opposing the Singleton Water Licence, rather than the alternative scenario of seeing their country get sick, having their traditional rights and interests eroded, and holding the psychological stress and guilt associated with knowing their descendants may lose important cultural values which have been sustained by Kaytetye people for thousands of years.

Traditional Owners desire to continue their active role in managing their traditional lands and waters for the future benefit of their society and culture. They want to guard the foundation of their ancient religion by defending their cultural values. To enable this to occur, it is recommended that the broad range of cultural values identified be sustained and safeguarded in accordance with national and international cultural heritage management practice (UNESCO 2003; ICOMOS 2017).

Good practice in the field of cultural heritage management includes working in cooperation with Traditional Owners to develop and apply an approach to cultural heritage management inclusive of a broad range of tangible and intangible cultural values. Traditional Owners' cultural values should not only be documented, Traditional Owners themselves should be empowered as active stakeholders and decision makers in matters that affect their land and waters.

1.0 INTRODUCTION

1.1 Background

On 2 September 2020, the Central Land Council (CLC) received a notice of intention (NOI) to make a groundwater extraction licence (water licence) decision. Fortune Agribusiness Funds Management Pty Ltd (Fortune Agribusiness) applied for the water licence over Singleton Station (see Figure 1). The application volume is 39,800 ML (megalitres)/year for agricultural purposes and 200 ML/year for public water supply purposes, a total volume of 40,000 ML/year.

Figure 1 Singleton Water Licence drawdown area and surrounding Aboriginal communities

Source: CLC 2021 [based on Fortune Agribusiness data][3]

[3] Georeferenced from Singleton Horticulture Project Summary Report (August 24:2020) and Groundwater Dependent Ecosystem Mapping and Borefield Design prepared by GHD (Sheet 8 of 12 from Figure 4-9: July 2020).

Singleton Station is situated within the Central Plains management zone of the Western Davenport Water Allocation Plan (WDWAP) (Northern Territory Government (NTG) 2018) and is located in the Central Australia region of the Northern Territory, 100 kilometres (km) south of Tennant Creek and 300 km north of Alice Springs.

According to the WDWAP, the NTG has committed to the long-term sustainable management of the Territory's water resources.[4] The WDWAP applies to the Western Davenport Water Control District (the District), which covers an area of almost 24,500 square kilometres located approximately 150 km south of Tennant Creek. The purpose of the plan is to ensure that water resources are managed in a way that protects and maintains environmental and cultural values while allowing water to be sustainably used for productive consumptive beneficial uses.[5] The objectives of the WDWAP are to:

1. Meet the environmental water requirements of water dependent ecosystems.
2. Protect Aboriginal cultural values associated with water and provide access to water resources to support local Aboriginal economic development.
3. Allocate water for future public water supply and rural stock and domestic purposes.
4. Provide equitable access to water to support ecologically sustainable regional economic development.

Three management zones have been recognised within the WDWAP district based on hydro-geologically distinct environments: the Davenport Ranges, the Southern Ranges and the Central Plains (Figure 2). The major groundwater resource occurs within the Central Plains Management Zone which is the subject of the Fortune Agribusiness water licence over Singleton Station. The WDWAP also acknowledges that a range of important tangible and intangible Aboriginal cultural values exist across the district:

> 'Aboriginal people within the District have a strong connection to country. The cultural landscape of this area includes physical (e.g., sacred sites, ancestor trees and other features such as stone arrangements) and non-physical (e.g. knowledge, practices, songs, ceremony) cultural values. All water sources such as soaks, rock holes, springs and rivers play a major role in the social, spiritual and customary values of the Traditional Owners of the District…the use of a water resource is not only physical and extends to other cultural values through activities such as visiting and maintaining sites, sharing and teaching cultural knowledge, conducting ceremony, or participating in management decisions. The significance of water for Traditional Owners is not limited to surface water and GDEs as it is found throughout the country and in all living things. Water availability also affects many activities, like hunting and harvesting for bush tucker, bush medicine, tool and craft making.' (WDWAP) (NTG 2018:28)

[4] NTG 2018:6.
[5] NTG 2018:6.

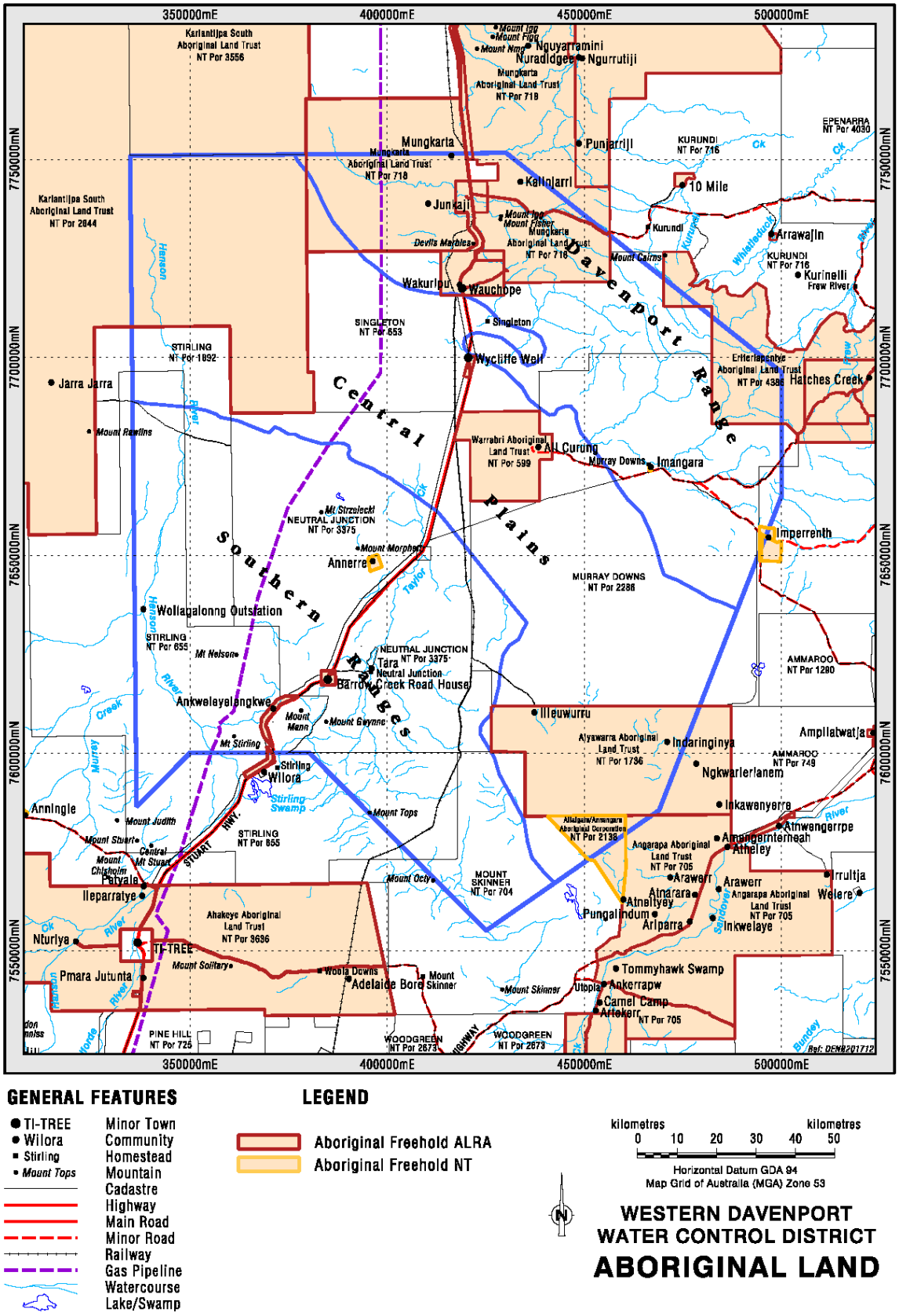

Figure 2 Western Davenport Water Control District

Source: NTG 2018.

Whilst the proposed water extraction zone (the proposed development wells / bores) is located on Singleton PL (see Figure 3), the projected groundwater drawdown area, as estimated by Fortune Agribusiness, extends beyond the water extraction zone to other parts of Singleton PL, and across Neutral Junction PL, Warrabri Aboriginal Land Trust (ALT) and Iliyarne ALT.

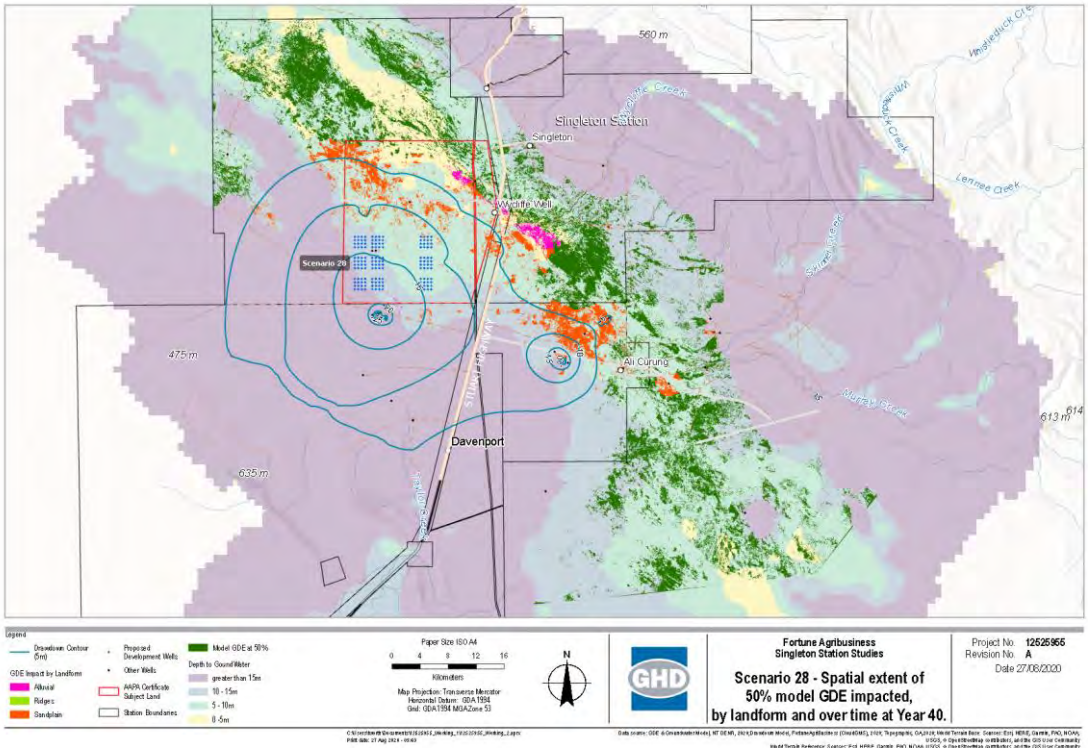

Figure 3 Spatial extent of Development Wells, Drawdown Contours, GDE impact by Landform and AAPA Certificate Subject Land

Source: Fortune Agribusiness 2020:28.

The definition of the drawdown area used in this report is the area identified by Fortune Agribusiness where impacts to GDEs will occur which include the area covered by the drawdown contours and GDE impacts by landforms (see Figure 3). This area was digitised by CLC geospatial staff (see Figure 4) using georeferenced map images submitted by Fortune Agribusiness in its application for the water licence.[6] The "Outer extent of drawdown area" (in Figure 4) is inclusive of GDE impact to alluvial and sandplain landforms described in the project documentation.[7]

[6] Singleton Horticulture Project Summary Report (August 24:2020) and Groundwater Dependent Ecosystem Mapping and Borefield Design prepared by GHD (Sheet 8 of 12 from Figure 4-9: July 2020).
[7] GHD (Sheet 8 of 12 from Figure 4-11: July 2020).

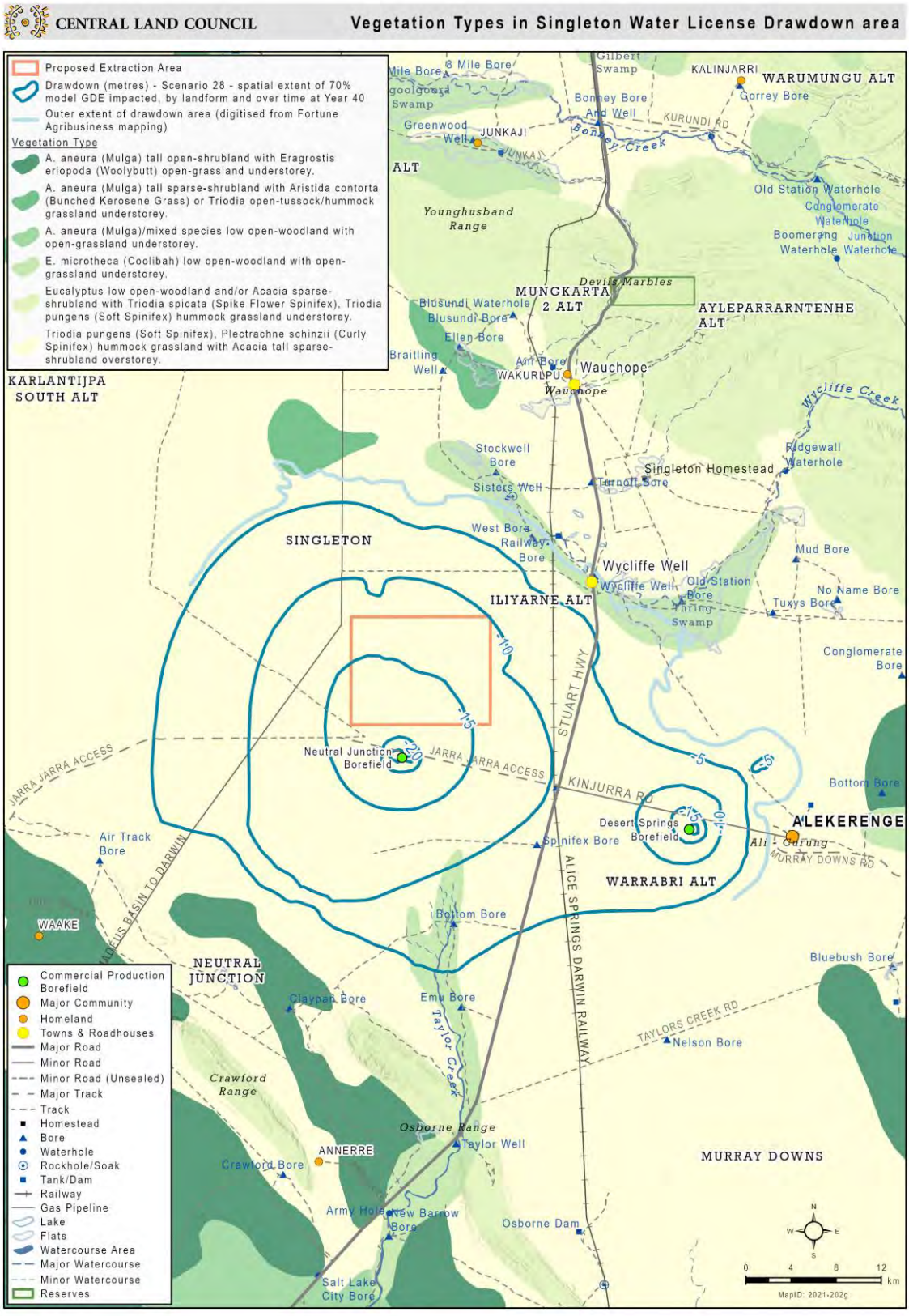

Figure 4 SWL drawdown area and vegetation map

The focus of this assessment, 'the study area', is the drawdown area (see Figure 4) which is predominantly sandplains containing termite mounds, sparse shrubs and low trees including *Acacia anuera* (Mulga), *Triodia basedowii* (Spinifex), *Triodia pungens* (Spinifex*), Triodia bitextura* (Spinifex) and *Eragrostis eriopoda* (Woollybutt).[8] A landform known as 'ghost gum rise' is located in the west of the study area in sandplain country. Alluvial plains are also found in the south of the study area where Taylor Creek forms a floodout, and in the north east of the study area which includes part of Thring Swamp and Wycliffe Creek and associated floodout. This vegetation type has a mixture of a small amounts of *Eragrostis eriopoda* (Woollybutt grass), *Aristida browniana* (Kerosene grass) and *Eucalyptus victrix* (Coolibah) over short grasses and forbs.[9] Both the alluvial plains and sandplains contain soakage water.

This assessment considers the study area in the context of the surrounding cultural landscape affected by the SWL including Wycliffe Sandhill immediately northeast of the drawdown area, the Crawford Ranges to the south, the Hanson River to the west and to the east the Davenport Range. This broader area encompasses Murray Downs PPL to the southeast, the Davenport Range National Park to the east, Kurundi PPL to the northeast, Mungkarta ALT and Devils Marbles (KARLU KARLU) Conservation Reserve to the north, and Karlantijpa South ALT to the west.

Singleton PL and Neutral Junction PL are subject to native title determinations; Mpwerempwer Aboriginal Corporation is the Registered Native Title Body Corporate (RNTBC) managing native title for Singleton PL and the Kaytetye Tywerate Arenge Aboriginal Corporation RNTBC and the Eynewantheyne Aboriginal Corporation RNTBC manage native title across Neutral Junction PL. The Traditional Owners across these determination areas have legal rights to access and travel over any part of the land and waters; live on the land; hunt, gather, take and use the natural resources of the land and waters; access, maintain and protect places and areas of importance on or in the land and waters; engage in cultural activities; conduct ceremonies; hold meetings; teach the physical and spiritual attributes of places and areas of importance; participate in cultural practices relating to birth and death including burial rites; regulate the presence of others at any of these activities on the land and waters; make decisions about the use and enjoyment of the land and waters by Aboriginal people; share and exchange natural resources obtained on or from the land and waters, including traditional items made from the natural resources.[10] The cultural values identified in this assessment are generally reflected in these legal rights.

[8] Pers. comm. Jessica Burdon 27.07.2021.
[9] Pers. comm. Jessica Burdon 27.07.2021.
[10] In Rex on behalf of the Akwerlpe-Waake, Iliyarne, Lyentyawel Ileparranem and Arrawatyen People v Northern Territory of Australia (2010) FCA 911 (Singleton PL).

Fortune Agribusiness obtained a sacred sites Authority Certificate (AC) from the Aboriginal Areas Protection Authority (AAPA) for the proposed works. The AC subject land includes and extends beyond the water extraction zone but does not cover the entire estimated drawdown area (see Figure 3 and section 3.2).

On 8 April 2021, the Controller made its decision on Fortune Agribusiness's water licence application and decided on a staged approach; each stage is two years from the completion of the preceding stage; the final stage will continue until the end of the licence (i.e., from years 7–30 if Fortune Agribusiness proceed through the stages at full pace).

On 7 May 2021, CLC put in a submission seeking a ministerial review of the Water Controller's decision to grant the Singleton Water Licence (SWL). Of note is CLC's position that the Water Controller fails to take into account the impact that the SWL will have on Aboriginal cultural values in the Western Davenport District. Concurrently, the CLC was instructed by Aboriginal owners to further identify the cultural values associated with the SWL area and to consider how these values might be impacted by the granting of the water licence.

Anthropological consultant Susan Dale Donaldson was then engaged by the CLC to undertake the cultural values assessment. Donaldson was requested to prepare a report regarding the cultural landscape of the area affected by the SWL and the extent of the native title holders and traditional owners' rights and interests and their cultural beliefs and practices. The report is to be culturally non-restricted and requires free, prior and informed consent (FPIC) by informants for use in the public domain.

1.2 Methodology

The methodology for this assessment involved reviewing literature; engaging with Aboriginal owners who hold knowledge of the area; analysing all the available evidence and considering how the identified values may be impacted by the proposed work. The approach was based on the Australian Burra Charter Practice Note on Intangible Cultural Heritage and Place (ICOMOS 2017).

LITERATURE REVIEW

The literature review covered a broad range of published and unpublished sources relating to Aboriginal traditional and contemporary life, as well as key project documents, land claim materials, archaeological and historical materials and ecological papers relating to groundwater dependent ecosystems.

Specific project reports reviewed include the WDWAP (NTG 2018); the AAPA Certificate C2019/083 (NTG 2019); the Singleton Horticulture Project summary report (Fortune Agribusiness 2020); and the recent NTG report on the ecological characteristics of potential groundwater dependent vegetation in the Western Davenport Water Control District (Nano et al. 2021).

Historical materials reviewed include Stuart 1865 (1975); Spencer & Gillen (1904); Davidson (1905); Aboriginal Land Commissioner (1982); Flood (1983); Petrick (1983); Bell (1983); Nash (1984); Smith (1987); Aboriginal Land Commissioner (1988); Koch & Koch (1993); Horton (1994); Courto (1996); Mulvaney & Kamminga (1999); records from the National Archives of Australia (NAA); Federal Court of Australia (*FCA 472* 2004); and personal communication with past and present Aboriginal owners.

Anthropological and ecological materials reviewed include The Rainbow-serpent in South-east Australia by Radcliffe-Brown, A. R. (1930); 'Aboriginal Territorial Organization: Estate, Range, Domain and Regime' Stanner, W. E. H. (1965); The Australian Aborigines: A portrait of their Society by Maddock, K. (1972); Tribes and Boundaries in Australia by Peterson N. (ed.) (1976); *The Nutrition of Aborigines in Relation to the Ecosystem of Central Australia* Hetzel, B. & H. Frith 1978 (eds.); The World of the First Australians by Berndt, R. M. & Berndt, C. H. (1988); Bushfires & Bush tucker: Aboriginal Plant Use in Central Australia by Latz, P. (1995); *Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness* by Rose, D. (1996); 'Freshwater' in ATSIC Background Briefing Papers- Water Rights Project by Langton, M. (2002); Ngapa Kunangkul: Living Water. Report on the Aboriginal Cultural Values of Groundwater in the La Grange Sub-basin by Yu, S. (2002); United Nations Educational, Scientific and Cultural Organization (UNESCO) *Convention for the Safeguarding of the Intangible Cultural Heritage* (2003); The National Water Initiative and Acknowledging Indigenous Interests in Planning by McFarlane, B. (2004); 'Fresh Water Rights and Biophillia: Indigenous Australian Perspectives' by Rose, D. (2004); Study of Groundwater-Related Aboriginal Cultural Values on the Gnangara Mound, Western Australia by McDonald, E., B. Coldrick & L. Villiers (2005); 'Water Ways in Aboriginal Australia: An Interconnected Analysis' by Touissant, S., Sullivan, P. and Yu, S. (2005); 'Compartmentalising Culture: The Articulation and Consideration of Indigenous Values in Water Resource Management' by Jackson, S. (2006); Cultural Values Associated with Alice Springs Water by Kimber, R. G. (2011); *The Kalpurtu Water Cycle: Bringing Life to the Desert of the South West Kimberley in Country, Native Title and Ecology* by Sullivan, P., H. Boxer (Pampila), W. Bujiman (Pajiman) & D. Moor

(Kordidi) (2012); Burra Charter Practice Note on Intangible Cultural Heritage and Place (ICOMOS 2017); and Framing the Loss of Solace: Issues and Challenges in Researching Indigenous Compensation claims by Pannell, S. (2018).

ENGAGING WITH TRADITIONAL OWNERS

Engagement with Traditional Owners was undertaken according to current Australian best practice in cultural heritage management. This includes consideration of the following documents: Working with Indigenous communities leading practice Sustainable Development Program for the Mining Industry (Australia Government 2016); Guide to Free, Prior and Informed Consent (Oxfam Australia 2010); Ask First: A Guide to Respecting Indigenous Heritage Places and Values (Australian Heritage Commission 2002); and Guidelines for Ethical Research in Australian Indigenous Studies (Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) 2012).

Qualitative ethnographic research methods were undertaken including participant observation, physical inspection of sites with the Traditional Owners, community meetings, mapping workshops, in-depth one on one interviews and small semi-structured, focus group sessions. The consultant was assisted by CLC staff members to consult 80 Aboriginal people including:

- Kaytetye Traditional Owners from the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe groups associated with the drawdown area across Singleton PL, Neutral Junction PL, Warrabri ALT and Iliyarne ALT
- members of neighbouring groups Anterrengeny (Alyawarr), Jarra Jarra and Warlapanpa (Kaytetye), Kelantjerrang, Karlu Karlu, Jalyjirra, Miyikampi and Kanturrpa (Warumungu/Warlpiri)
- members of other groups across the region Warupunju and Kunapa (Warumungu); Thankgenerang and Etwerrpe (Kaytetye) and Ngappa (Jingilli/Mudburra), and
- residents of affected communities including Alekarenge, Wauchope, Barrow Creek, Tara, Wilora, Anerre, Waake, Mungkarta, Kalinjarri and Imangara.

Consultations took place within and beyond the drawdown area over the period 8–27 June 2021. Twenty-two sacred sites were visited with Traditional Owners across Warrabri ALT, Singleton PL and Neutral Junction PL; of these 11 were within the drawdown area and 11 beyond it. Many more sites within and beyond the drawdown area were identified through desktop research and / or discussed with Traditional Owners during the consultation period, but not visited. All of the sites visited have features dependent on groundwater.

Background research combined with consultations with Traditional Owners identified 40 sacred sites associated with 20 *Altyerre* [Dreaming] mythologies within the drawdown area. Considering not all of the identified sites were visited during the assessment combined with the cultural complexities of the region, it is possible that one or two of the sites identified are actually the same place known by different names. It is also possible that other sites exist within the drawdown area that were not identified during this assessment. More time on the ground with Traditional Owners would provide further clarity on the cultural landscape in terms of the presence and significance of sacred sites.

Following the identification of current cultural values and how native title rights and interests are exercised today, potential material and non-material loss was investigated. This enabled an understanding of potential impact to native title rights and other cultural values.

ANALYSING AVAILABLE EVIDENCE

Following community engagement, the documented evidence was analysed to determine the cultural values and the relationship between the elements across the cultural landscape. A landscape or a feature may be associated with a number of different heritage themes and cultural activities and the feature's physical form may have been altered over time.

In determining the significance of intangible values across a cultural landscape, its features, and the relationships between them, consideration was also given to how well the themes and historic periods are represented and how the important characteristics of the cultural landscape compare with those of other places. The scale of the significance needs to be determined, i.e., whether the place is of local, regional, state, national or international significance.

IDENTIFYING IMPACTS

The Burra Charter Practice Note on Intangible Cultural Heritage and Place (ICOMOS 2017) does not directly define how intangible values can be harmed or damaged nor does it provide a framework for assessing impacts to intangible values. It does however outline how change to a place may impact on a cultural practice and equally changes to a cultural practice may impact on the cultural significance of a place. Possible changes that might impact on cultural practices include:

- changes to use or access
- changes to the form, fabric or layout of the place
- restrictions on the spaces available for cultural practices.

Generally, impacts can be both positive and negative and may result in the need for management, whether broad landscape processes or small-scale actions. If the existing condition of certain individual features are in poor condition, it may be the case that the proposed works will improve the situation. Processes likely to degrade the values and condition of the landscape and its features also need to be identified. Threats include an increase in usage or the potential to pollute waterways, for instance. Different components of the cultural values across the landscape will almost certainly require different treatments or impact mitigation measures in order to safeguard the identified values. Whilst impact mitigation is not addressed in this assessment, it is worthwhile outlining current best practice framework around ways to sustain and safeguard intangible cultural values nationally and internationally.

The Australian ICOMOS Burra Charter Practice Note on intangible values outlines ways to 'sustain cultural practices' involving collaboration between the associated communities and the place manager/land owner. Suggested management policies and actions may be needed to help sustain the cultural practices including:

- protection of any fabric or parts of the place which are integral to the cultural practices
- introducing cultural protocols such as restrictions on access or activities undertaken in parts of the place
- checking that the circumstances at the place support continuation of the cultural practices.

Similarly, the United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention for the Safeguarding of the Intangible Cultural Heritage (2003) focuses on 'safeguarding' the processes from which the intangible values arise. This approach aims to ensure intangible cultural heritage is continuously recreated and transmitted. For UNESCO safeguarding intangible cultural heritage is about the processes involved in transferring of knowledge, skills and meaning from generation to generation, rather than on the production of its concrete manifestations, such as dance performances, songs, music instruments or crafts. As with the ICOMOS approach above, safeguarding measures must be developed and applied, with the consent and involvement of the community itself. Moreover, safeguarding measures must always respect the customary practices governing the access to heritage, which might, for instance be the case when dealing with sacred or secret intangible cultural heritage manifestations (UNESCO 2003).

2.0 IDENTIFIED ABORIGINAL CULTURAL VALUES

The cultural values assessment identified a complex Aboriginal cultural landscape across the SWL groundwater drawdown area including important cultural values directly associated with groundwater dependent ecosystems (GDEs).[11] The assessment found the SWL area to be situated on the traditional lands for four *Kaytetye* speaking groups (*Anerre, Waake-Akwerlpe, Iliyarne* and *Arlpwe)*. An additional 23 Aboriginal groups, from *Kaytetye, Alyawarr, Warumungu* and *Warlpiri* language regions were also identified across the broader Western Davenport District as being culturally associated with the SWL drawdown area.

2.1 Following the *Altyerre* Law & cultural obligations

Kaytetye people believe that the traditional laws and customs by which they are connected to the land and waters were created in a mythological era known in Kaytetye as *Altyerre* and in English as 'The Dreaming'.[12] The term *Altyerre* covers a range of interconnected concepts including ancestry, mythological beings and their creative journeys when the landscape was given form, religious laws and ritual objects, sacred designs and songs, important places, and codes of social order. Natural features across the landscape are believed to be an embodiment of *Altyerre* power and are thus revered, and cared for so they can be handed onto succeeding generations intact. Whilst the *Altyerre* is the basis of the Kaytetye religious system and directs Kaytetye ritual life, the concept extends across the continent.[13]

> 'When the wild spirit men flew over Iliyarne country they saw no water. Then when the country men, the Iliyarne men flew over they saw the water shining in the sun light. The country showed them the water. The spirit people who live there are tricky ones.' *Heather Anders*on

Traditional Owners' belief in the *Altyerre* is the cornerstone cultural value arising from this assessment and the foundation of all other identified cultural values. 'Sacred sites' (*Ihangkele*) are places where mythological *Altyerre* ancestors reside and, in this region, primarily relates to reliable sources of water (*arntwe*) including *artnwep* (swamps), *ngentye* (soakages) and *elpaye* (creeks), and *ilinjera* (floodouts).

Undertaking cultural obligations such as visiting sacred sites, speaking to the spiritual ancestors and re-enacting mythological stories in song and dance, according to *Altyerre* laws and customs, appeases the creator spirits residing in country (*apmere*).

[11] GDE as defined in Cook and Eamus 2018:1; also pers. comm Ryan Vogwill and Jessica Burton 10.08.2021.
[12] Spencer & Gillen 1904:13–14; Kaytetye orthography in this assessment was developed by Turpin 2000.
[13] See Maddock 1972; Berndt & Berndt 1988; Rose 1996.

The beliefs of present-day Traditional Owners reflect observations made by Spencer and Gillen in 1904. They found that:[14]

> From time immemorial, that is, as far back as ever native traditions go, the boundaries of the tribes have been where they are now fixed. Within them their ancestors roamed about, hunting performing their ceremonies just as their living descendants do at the present day. Very probably this is associated with the fundamental belief that his alcheringa (=*Altyerre*) ancestors occupied precisely the same country which he does now. The spirit parts of these ancestors are still there…The spirit individuals would not permanently leave their old home, and where they are there must he stay.

This observation is significant in the present context as it emphasises how Kaytetye people's traditional connection to the drawdown area is based on religious associations to particular ancestral lands in accordance with an acknowledged system of traditional land ownership. Moreover, permanent waterholes are usually associated with highly restricted *Altyerre* activities and rituals. Whilst no permanent springs were identified within the drawdown area there are many nearby that are associated with highly significant water dreaming mythologies and rituals as Mr Jones explained:

> 'The springs are important places and each have a story. In Warumungu we say *Junjunpartin* for water bubbling up, springing up. We don't really have a word for underground water. Under is *kantangara* and water is *Ngappa*. There is a spring between Karlinjarri and Kurundi. There is a spring at Old Elkedra station where the underground snake scared the station manager away, they were forced to relocate. Another story, Ngappa came underground from the west all the way to KELLY WELL, near the tower, then travelled to a spring where the lightning struck. It then travelled to the east.' *Michael Jones*

Turpin recorded the story about the establishment and subsequent failure of Old Elkedra Station, mentioned by Michael Jones. According to Tommy Thompson (dec.) the station managers built their cattle yards and house near the water edge at NKWARRENY:

> …where the snake lives in the water…the rainbow snake was left alone because he was underwater in a cave, like a well. A big rain came and fell on them; it was huge…It was still the rainy season; the snake rose up from there, from that waterhole, it rose up really high and soon there was a big wind and they

[14] Spencer & Gillen 1904:13–14.

saw lightning and rain. The old men were looking at it while it was standing. First, they woke up the bosses, Bill Riley and Kennedy, then the others…The whitefellas saw the snake, grabbed their rifles and shot at the eye of the huge snake coming out of the waterhole. The snake went down then, during the night time. It was the power of the snake that made the rain flatten the trees and the creek flood. It was the snake that let that water out. The old people who knew about the rainbow snake said 'that's the rainbow snake all right…'…the old people knew the song to sing the snake down. After the snake went down, a rainbow shone there. A rainbow was in the sky…the people left because of the snake…they were heading to ARRTYELER.[15]

An example of the intersection between groundwater dependent ecosystems and the Traditional Owners' obligations under traditional laws and customs relates to a highly significant, ancient coolibah tree at MPWEREMPWER-ANGE swamp close to Wycliffe Creek (see Figures 5 and 6). The Coolibah tree is the home, the main place of residence for the *Altyerre* beings that created MPWEREMPWER-ANGE. The coolibah tree is the subject of Iliyarne family stories, ritual songs and paintings. Iliyarne people also visit the tree and at such times, speak to their spiritual ancestors residing in and around the tree. These ritual acts appease the spiritual ancestors who in turn provide ample lilies for Iliyarne people to collect and consume. An increase in lilies indicates to Traditional Owners that the ancestors are pleased that the Law is being followed and traditional culture is being maintained. These ritual acts also maintain the health of the tree into the future, in accordance with customary law. This in turn leads to a sense of wellness amongst the Iliyarne Traditional Owners.

Figure 5 Mature Coolibah tree in MPWEREMPWER-ANGE swamp, Iliyarne ALT

Source: Photograph by Susan Dale Donaldson.

[15] Turpin 2003:38–52; see also Elkin 1930.

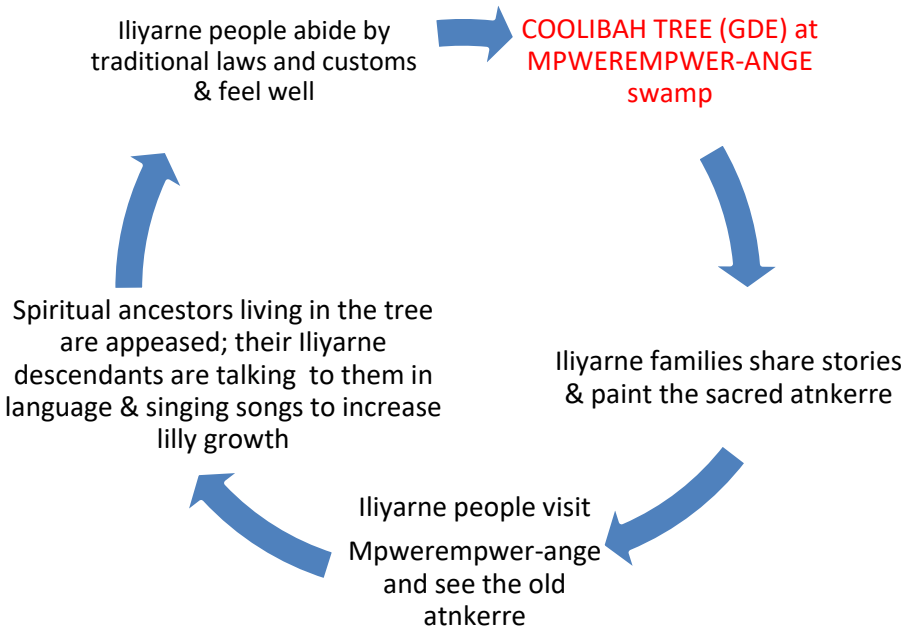

Figure 6 The intersection between the importance of following the Law and groundwater dependent ecosystems

If the *Altyerre* Law is not followed as a result of the actions of Traditional Owners or others, senior Traditional Owners and non-Indigenous people may be punished by *Altyerre* forces resulting in sickness, injury and even death (see Section 3.1).

> 'We know the *Nguramulla* (Spirit people) live in the land and if we don't look after our land, they will feel sad and get sick and so will Traditional Owners. That's why we always look after our country.' *Michael Jones*

> '*Kwertengerl* need to start talking to protect that big coolibah tree at MPWEREMPWER-ANGE. That Dreaming Tree is the Kwerrimpe [ceremonial women] digging lilies. If that tree is touched or injured sickness will come and blindness for Aboriginal people and white people too. That lily wasn't a traveller, it just belongs to this one place. People need to say no to this water or go blind.' *Ned Kelly*

Overall, it is believed that the powerful forces of the *Altyerre* will remain in the land and waters for eternity, but the current generation of Traditional Owners responsible for looking after the land and water will be punished if cultural obligations are not undertaken in their lifetime. All Kaytetye families hold stories about individuals who broke the Law and were punished because they didn't exercise their custodial responsibilities and look after their country.

2.2 Maintaining spiritual connections and protecting sacred sites

Traditional Owners maintain that they have descended from *Altyerre* (Dreaming) ancestors and that their *etnwenge* (a person's spirit) is deeply connected to one's country (*apmere*) and especially to water (*arntwe*).[16] In the *Altyerre* the landscape was given form by the activities of mythical beings, the spiritual ancestors of Kaytetye people today. Across the SWL area, these spiritual ancestral beings were in the form of animals such as possums, kangaroos, dingos, frogs and birds; plants such as the lily, bush plum and orange tree; and natural phenomena such as the wind and rain. The routes taken by ancestral beings and the places where they camped, danced and hunted were transformed into natural features such as rivers and valleys, waterholes and trees. Traditional Owners consider these places associated with ancestral creation, sacred sites.

This assessment revealed a strong spiritual connection between Traditional Owners and 40 sacred sites identified within the drawdown area.[17] Each of the 40 sacred sites were beyond the immediate extraction zone and all have features associated with GDE as outlined below. These sites all have unique Kaytetye names and are associated with at least 20 *Altyerre* mythological episodes as depicted in the dynamic cultural landscape diagram (see Figure 7). Due to sensitivities surrounding cultural knowledge and information the specific name of each *Altyerre* Dreaming track and each sacred site is not described in the diagram (Figure 7); the coloured lines relate to the many *Altyerre* tracks and the 40 dots each represent a sacred site within the drawdown area. It is clear from this image that the SWL drawdown area contains specific cultural values and is concurrently integrated into a broader cultural landscape from which it draws significance.

Most of the identified *Altyerre* tracks traverse the drawdown area and interlink with places across the broader cultural landscape. Some *Altyerre* creation stories cover vast distances whilst others are more localised, marking discrete territories. Across the drawdown area for instance, the *Ankerratye* (Coolibah grub) waited at a soakage on Taylor Creek, and was integral in making rain there. Similarly, the *Aterre* (Cicada) story wasn't a traveller, it always resides at a particular soakage in the Taylor Creek floodout and the *Mpwerempwer* (Lily) resides within a sacred coolibah tree at Thring Swamp [also known as 'Lily Swamp']. These places are within the drawdown area.

Travelling mythologies can relate to vast areas and multiple sacred sites. The *Atherre Aleke* (=Two Dingos) Dreaming for instance is associated with a stretch of country between Western Australia and Alekarenge, traversing close to the drawdown area. The *Ahakeye* (Bush Plum) Dreaming is another extensive traveller and is associated with two important soakages within the drawdown area, close to the extraction zone.

[16] Spencer and Gillen noted 'alcheringa' (1904:11–14,161). In this region, the Dreaming is also known as *Altyerr* (Alyawarr), *Wirnkarra* (Warumungu), and *Jukurrpa* (Warlpiri). See also Sullivan et al. (2012).
[17] 29 sacred sites were identified within the drawdown contour zone and a further 11 sacred sites within the GDE impact by landform zone [total 40 sacred sites across drawdown zone].

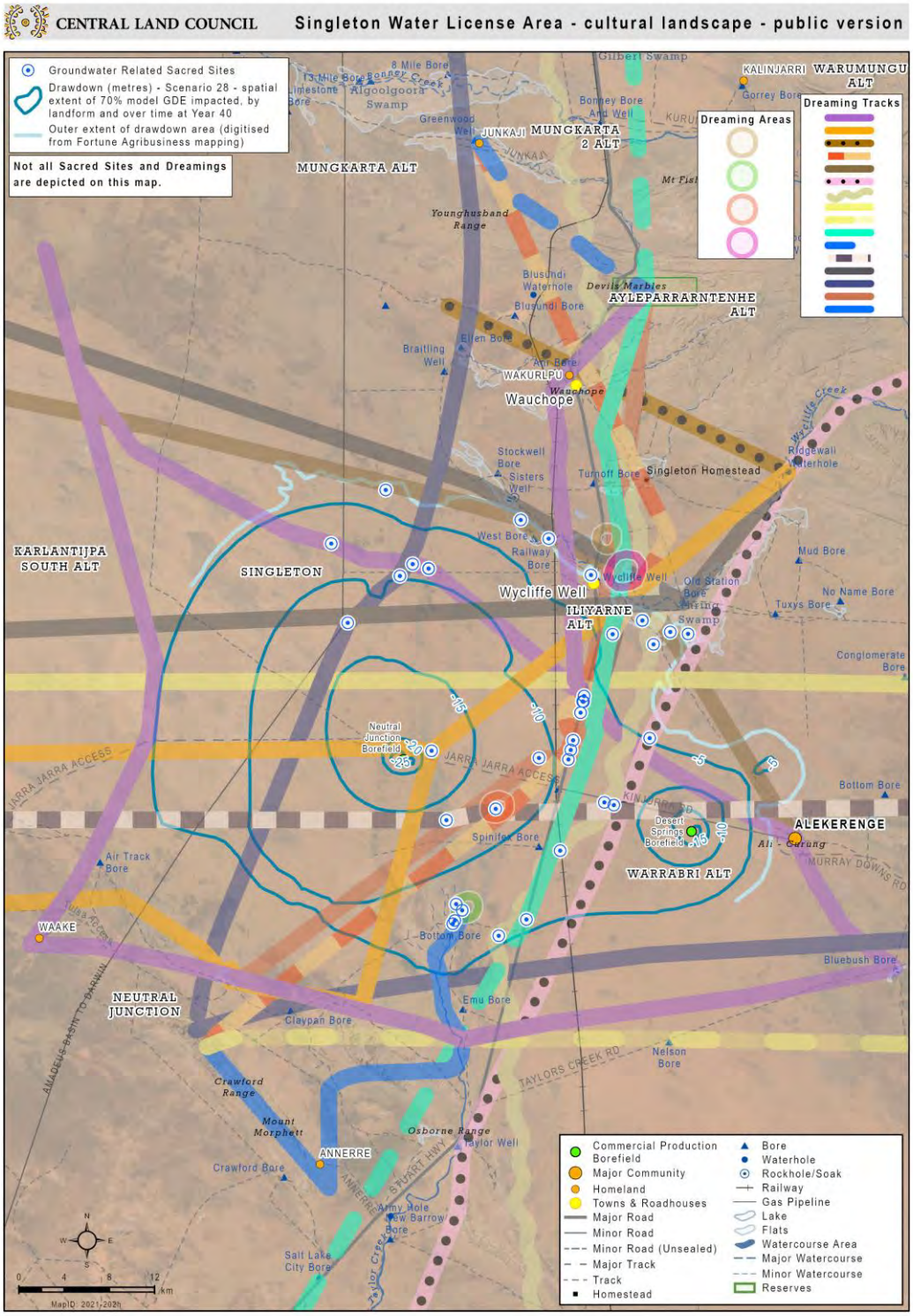

Figure 7 Cultural landscape diagram: Altyerre (Dreaming) activity across the SWL area

Source: CLC 2021 (based on data collected by Donaldson).

Other extensive travellers associated with sacred soakages within the drawdown area include the *Awentyerrenge* (Whirliwind) Dreaming; *Therre Antywempe* (Two Taipans); *Therre Atyewtere* (Two bandicoots); *Anatye* (Yam Dreaming); and the *Atnhelengkwe* (Emu). Whilst the *Ilperalke* (Sugar Bag) Dreaming travelled across the extraction zone and drawdown area, no sacred sites associated with this tradition were identified within the extraction zone or drawdown area. The *Ilperalke* (Sugar Bag) travelled underground close to the drawdown area and rituals associated with this tradition are believed to increase sugar bag (= honey from native bees) supplies across the drawdown area to *Anerre, Waake-Akwerlpe, Iliyarne* and *Arlpwe people* as well as to the people with whom they share their country.

Whilst all of the mythologies across the drawdown area relate to the *Altyerre* creation of the land and water generally, a number of mythologies specifically relate to water. For instance, *Arnkerrthe* (Thorny Devil Lizard) ancestor carried water on his back in preparation for a rain ceremony as he travelled making soakages across the drawdown area*; Kwerrimpe* (Ceremonial Women) dug for water as they travelled and in doing so made a stand of Coolibah trees within the drawdown area; *Therre Arinenge* (Two euro rainmakers) travelled far and wide, including to two soakages within the drawdown area, teaching their neighbours how to make rain and lightning and collecting people for a regional rain ceremony; and the *Akwelye* (Rain) Dreaming specifically travelled around Anerre country, defining the boundaries of that country and creating three important *Akwelye* (Rain) soakages along Taylors Creek within the drawdown area.

Other dreamings have been identified immediately beyond the drawdown area including the travelling *Arinenge* (Euro) Dreaming and the localised *Anemarranenke* (Sand Frog). These two traditions are associated with GDE and form important connections across the cultural landscape, but they were not found to be associated with sacred sites within the drawdown area. Another important Dreaming found within the cultural landscape but beyond the drawdown area, is associated with culturally restricted information and is not outlined in this assessment.

One particular sacred site, a soakage close to the extraction zone and within the drawdown area, is an important yam dreaming site owned by the Anerre group (Figure 14). Anerre people visit the place to clean the soak, to talk to their spiritual ancestors and to teach younger Anerre people about the sacred site. The soakage has been protected by Traditional Owners over the years through these customary actions and by participating in sacred site clearances associated with roadworks. The water collected from the soak embodies *Altyerre* power and is highly valued and therefore protected by Traditional Owners in accordance with their traditional laws and customs.

As noted above, participants also hold linguistic connections to sacred sites and their ongoing use of unique Kaytetye terms and place names to describe the importance of groundwater across the drawdown area was apparent. In 1901 when Spencer and Gillen camped at Wycliffe Well, Gillen recorded the Aboriginal name for Wycliffe Well as 'Nan-pu-lunga' (=INYANPULUNGKU) and noted the presence of one Kaytetye man, his three wives and a child.[18] INYANPULUNGKU is sacred soakage within the drawdown area. Given the cultural sensitivities an exhaustive list of sacred site names is not outlined here. A collation of site types within the drawdown area, described in Kaytetye, has however been produced as a way for the reader to better understand the cultural landscape in relation to GDE and sacred sites (see Table 1). Over half of the sacred sites identified are soakages which continue to be valued by Traditional Owners today as an important source of water as well as spiritual sustenance.

Table 1 Kaytetye GDE terms by known sacred sites within drawdown area

Dominant feature	Number of sites within DA	Other associated sacred features
ngentye (soakage)	28	*Atwerety* (bean tree), *artetye* (mulga tree), *akerleye* (bush orange).
elpaye (creek)	3	Ghost gums and *aylpele* (river red gum).
ilinjera (floodout)	2	-
artnwep (swamp)	1	*Mpwerempwer* (lily)
arrkarakw (bloodwood)	3	-
atnkerre (coolibah tree)	1	*artnwep* (swamp)
Supplejack tree	1	-
Ghost gum tree	1	*elpaye* (creek)
TOTAL	40	-

[18] Gillen 1968:171–172. Gillen named the Aboriginal man 'Spencer'.

In 2003, linguist Myfany Turpin recorded a story told by senior Kaytetye man Tommy Kngwarraye Thompson (now dec.), relating to a spring and the origins of the Kaytetye language.[19] Thompson tells of how the source of the Kaytetye language is associated with a spring called ELKEREMPELKERE, at Barrow Creek:[20]

> …they (the *Kwerrimpe* women) spoke their language; it was Kaytetye…they told each other Dreamtime stories, special stories that had the power to create. From these stories the Kaytetye language and people were born. The *Kwerrimpe* women were talking Kaytetye, laughing, having fun and eating bush onions…From just one bush onion shoot the Kaytetye language and people spread out…The Dreaming at ELKEREMPELKERE is the origin of the Kaytetye language and people.

Today, Kaytetye people expressed a desire to ensure their Kaytetye place names are maintained into the future, and in particular the Kaytetye names of the water sources including the drawdown area. Intergenerational visits to country are one way that Kaytetye people pass on cultural and linguistic knowledge sustaining this important value, which also relates to spiritual connections to country given the places names were allocated in the *Altyerre* past.

Whilst the facts about the extent of groundwater deduction and the groundwater dependence of vegetation are not known at present, it is assumed that at some point of groundwater reduction there will be effects on GDEs and cultural values related to shallow groundwater.[21]

Of the identified 40 sacred sites within the drawdown area, 11 were visited during this assessment between 22 and 24 June 2021. These site features were all groundwater dependent including such as soakages, bean trees, orange trees, coolibah trees, creeks, swamps, ghost gum trees and bloodwood trees.

Figure 8 Kaytetye men at a sacred soakage, Warrabri ALT

Source: Photograph by Susan Dale Donaldson.

[19] Turpin 2003.
[20] Turpin 2003:2–5.
[21] See Nano (Appendix 4: 2021) for a listing of species which are "closely associated with sandplain and alluvial potential GDV". These species are more likely to be affected by groundwater drawdown.

Each of these sites are sacred to Kaytetye people, and in particular to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. Each of these sites are interlinked with the broader cultural landscape. A few examples are shown in Figures 8–10.

Figure 9 Kaytetye women at a sacred soak and red river gum on Taylor Creek, Neutral Junction PL

Source: Photograph by Susan Dale Donaldson.

Figure 10 A sacred soakage and bean tree, Singleton PL

Source: Photograph by Susan Dale Donaldson.

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A further 11 important sacred sites were visited across the broader cultural landscape beyond the drawdown area between 22 and 24 June 2021.

Most of the sites were within 5–10 km from the drawdown area and three significant sites 15–20 km away from the drawdown area were also visited for cultural context.

The site features visited beyond the drawdown area were all groundwater dependent and include soakages, springs, bean trees, fig trees, red river gum trees, coolibah trees, creeks, swamps, and ghost gum trees (see Figures 11–13).

Figure 11 A sacred bloodwood, Warrabri ALT

Source: Photograph by Susan Dale Donaldson.

Figure 12 Kaytetye men at a sacred creek, Iliyarne ALT

Source: Photograph by Susan Dale Donaldson.

As with the sites visited within the drawdown area noted above, each of the sites visited beyond the drawdown area are sacred to Kaytetye people, and in particular to the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe groups and interlink with the broader cultural landscape including places within the drawdown area.

Figure 13 Kaytetye group at sacred swamp, Iliyarne ALT

Source: Photograph by Susan Dale Donaldson.

The spiritual connection Kaytetye people have to sacred sites, that is the intangible link between a person and a sacred place, is directly associated with the condition of sacred sites (Figure 14).[22] If the state of a sacred site is diminished, the spiritual connection people have to that place is also diminished. Maintaining spiritual connections to country also occurs when mythological episodes are re-enacted by Traditional Owners in ritual, through song, dance, paint, story-telling and by visiting the spiritual ancestors residing at sacred places.

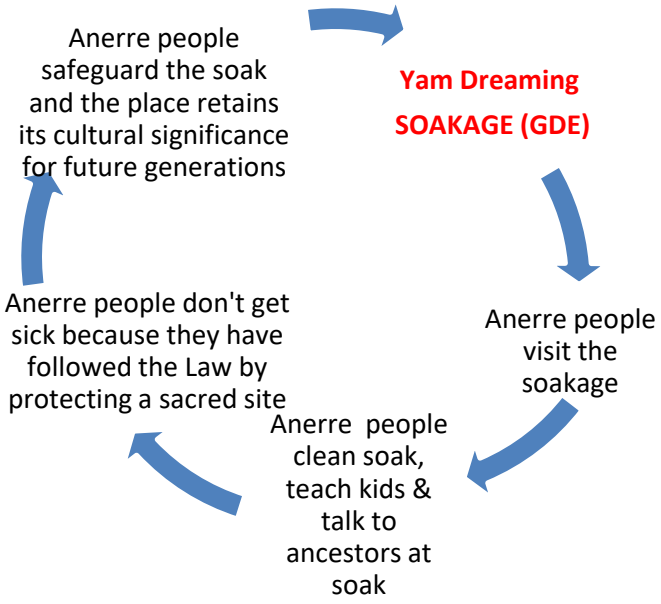


Figure 14 The intersection between the importance of protecting sacred sites and groundwater dependent ecosystems

[22] See also McDonald et al. 2005:2.

2.3 Undertaking rituals associated with groundwater and GDE

The assessment also found that the spiritual connection Traditional Owners have with their *apmere* (country) is strengthened by ritual activity which is also linked to the powerful forces of the *Altyerre*. Kaytetye ceremonies undertaken by men are called *etnherrantye* and women's ceremonies are called *erntweyane.* There are a number of ceremonial grounds close to the drawdown area, used by Traditional Owners or their ancestors in the past. These ritual grounds retain ritual significance and cultural associations and are hoped to be used by Traditional Owners again in the future. The rainmakers undertake rituals to make rain and other ritual leaders undertake rituals to increase species across the drawdown area such as lilies, frogs and bees.

> 'The songs and the ceremonies will be alive forever; nothing can touch them. The rainmakers have powers. In the early days they (stations) not use too much water now they want more, too much. Each one (Aboriginal group) has *Ngappa* (water) dreaming, they follow their line and hand it over.' *Donald Thompson Akemarre*

> 'My grandmother Molly O'Keefe used to dance and sing on Singleton Station at Stockwell Bore. They used to walk from there to the sandhill to get water on the north side.' *Evangeline Presley*

> 'We do ceremony to liven up the bees' wings to make them strong, so they make more honey. We know the different types of honey, from the different flowers. The white gum flowers make sweeter honey than bloodwood flowers. We take the honey and leave the bee house because that's where he lives. That's his place. We call water *Arntwe* in Kaytetye and *Kwaty* in Alyawarr and *Ngappa* in Warumungu and Warlpiri. That's the water that falls from the sky and the water that's in the ground. It's all water. It's all from the Dreaming. It's all precious.' *Frankie Holmes Akemarre*

> 'My *tyatye* (mother's fathers) country is Warlapunpa. They have rain makers too. When people dance and paint, they think about their *apmere* (country) and sometimes they cry for that country. When I visit soakages around Warlapunpa I put leaves over the soaks to keep them wet. We danced all night at a bush camp, this side of the railway. The painted designs belonged to Anerre, Kaytetye country.' *Selma Thompson*

> ‘When we do the *Kwaty Awely* (water ceremony for women) the rain comes. My mother taught Selma how to collect white clay for the dancers. The rain is made when the *kwertengerl* chuck the white clay onto the ground. The rain will come quick all over Kaytetye country.’ *Hilda Pwerle*

> ‘I am teaching Selma the *Kwaty Awely* (water ceremony for women) from Warlapunpa country, that’s Kaytetye too. Water Dreaming. They knocked down that *Kwaty* tree on the highway (=KWATY TREES) and that made us sad. It brings us worry because that tree has a spirit and a name. It is Pwerle like me. That story holds the country alive. Pwerle sings for the *Kwaty Awely* and is the main teacher. *Ngampeyarte* are the *kwertengerl*, they are the dancers.’ *Lena Pwerle*

The results of Kaytetye ritual activity were acknowledged by the early pastoralists in the region as described by a senior Kaytetye man:

> ‘If station managers needed rain in the early days, they would ask the rainmakers to make rain and would pay them in food. Birchmore at Kurundi Station, Harris at Murray Downs, Hayes at Neutral Junction, they all did this. They knew Aboriginal law was strong. If the land dried up the rainmakers would sing and the rain would come. After that there would be more water in the soakages and more food around the place. The station managers used to pay the rainmakers to sing for rain. True.’ *Ned Kelly*

While in the region in 1901 Spencer and Gillen witnessed the performance of 88 ‘sacred totemic ceremonies’ some of which related to sacred sites within the drawdown area. They were impressed by how elaborate and enduring were ceremonies concerning initiation, marriage, the increase of species, the maintenance of the ‘alcheringa’ (=*Altyerre*), tree burial and mourning practices. In relation to what is now the broader Western Davenport Water Control District, Spencer and Gillen recorded ‘Aneara which is the great rain making site in the Kaitish tribe’ and ‘the great centre of the rain people’.[23] Details about the Kaytetye *kwerrenarr* (rainbow serpent) are highly restricted and not discussed in this report.

[23] Gillen 1968:147; Spencer & Gillen 1968(1904):158; see also Stanner 1934.

In her 1970s ethnographic study at Alekarenge on women's ritual, Bell discusses a number of characteristics applicable to Kaytetye land and society, including ritual obligation to kin and country, roles and responsibilities in relation to land and the maintenance of the landscape through ceremonial activity.[24] Bell recorded many traditional mythologies including that associated with the *Ahakeye* (=Wild Plum) Dreaming belonging to the Akwerlpe-Waake group.[25] See Figure 15.

Figure 15 Bush plum *Ahakeye* (*Canthium attenuatum*), Warrabri ALT

Source: Photograph by Jessica Burdon (CLC).

Many of these ritual activities require specific flora and fauna species obtained across the drawdown area as observed by Gillen in 1901 who recorded his Aboriginal guides capturing galahs and a duck, and keeping the feathers 'for future ceremonies'.[26] See Figure 16.

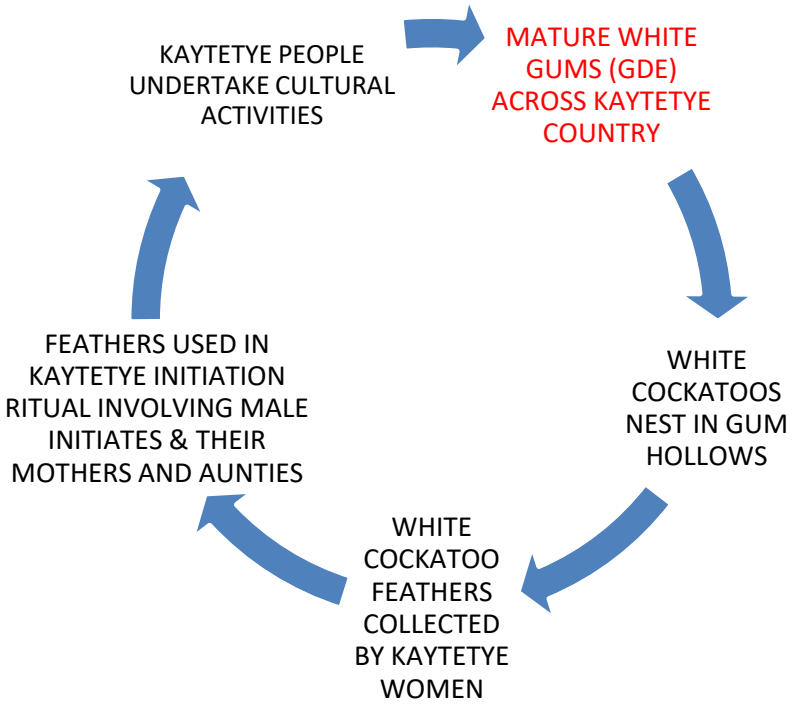


Figure 16 The cyclical interdependence of groundwater dependent ecosystems and ritual activities

[24] Bell 1983 (1993). The research for this work was carried out between 1975 and 1978.
[25] Bell 1983 (1993):131–132.
[26] Gillen 1968:242–247.

Records reveal that many Kaytetye people were born on Neutral Junction and Singleton Stations including Zigfreid Nelson Kemarre, Billy Dobbs Kngwarraye (dec.), Lena Thangale, Joe Murphy Kngwarraye (dec.), Carol Thompson and Cyril Jabangardi. In accordance with Kaytetye customs Lena Thangale's bush name is *Mpwerempwer-ange* (=Lily) after the site on Singleton Station near where she was born in 1930.[27]

> 'My sister Carol was born at a soakage on Taylor Creek called ARWENGANENYE near Emu bore. My mother and father were living in the bush, moving from soak to soak.' *Selma Thompson*

A number of Kaytetye people are known to have died and were buried in the drawdown area. Ritual activities associated with dying on country strengthens spiritual connections to important places and is reinforced by the Kaytetye land tenure model which ensures country is inherited in a systematic way, enabling intergenerational occupation of the same terrain and religious teachings about places and within it.

> 'Bill Crook put down that well at Stockwell (Stockwell Bore Singleton Station). People lived there for a long time, all the Aboriginal families, Kaytetye, Alyawarr…Warumungu. People are buried there. My father worked at Old Singleton. Bill Crook was a good manager. Barry Donahue was cheeky. He took too many Aboriginal wives. The Aboriginal men were stockmen and the women looked after the nanny goats. They all lived across the creek. There are people buried all around Old Singleton. Polly Napaljarri, my aunty, and one Nakamarra, Louise Fitz grandmother…and others, but we don't know who.' *Ned Kelly*

Of great cultural importance to the participants is the belief that the spirits of their deceased [actual] ancestors, their parents, grandparents, great grandparents and so on, have returned to the land and reside in their country in perpetuity. As such, when Traditional Owners visit their country, they feel the spiritual presence of their forebears and through that intangible connection attain a sense of inner comfort. An intangible cultural connection is formed between Traditional Owners and places associated with the spirits of their deceased kin; visiting these places and treating them with respect is another way Traditional Owners maintain kinship connections to past ancestors. An integral aspect of the Kaytetye religion is how the actions of Traditional Owners cause happiness amongst the spirits and strengthen Traditional Owners' connection to country; this is a life-sustaining spiritual force for Traditional Owners.

[27] Pers. comm. 24.3.2006 Mary Kemarre; pers. comm. 01.09.2005 Johnny Nelson Pwerle and Zigfried Nelson Kemarre; CENSUS F133/22 (65/32). Letter dated 04.04.1996 Lovegrove to Welfare in Tennant Creek.

'We remember the old people when we visit places. Somehow, they are still there. If the country dries up, they all finish up, we all finish up'. *Sonny Curtis*

'My mother's spirit came back to this land. She'd be happy that we are here, that we came to look around. The country welcomes we home. This is home. If we lose our home, we would be too sad. If it changes, we feel sick and the old people will feel bad. The spirits in the land feel the same.' *Karen Morrison*

Another Kaytetye ritual is for family members to be given Aboriginal names or 'bush names' (based on the names of sacred sites / natural phenomena) providing another link between people and country. These names were often also the names given to their grandfathers and have been used for countless generations. When sacred sites associated with people's bush names are damaged the intangible link between the person and the place is also impacted; people feel a sense of loss that they will not be allocating these names to future group members if the site is gone. Generations and generation of their ancestors have allocated these names to past kin; Traditional Owners understand the future allocation of this name may be redundant forever.

'*Mpwerempwer-ange* [lily] is Lindy's mother's bush name. We paint that one to tell the story, to teach the kids. I tell the kids stories about coming here with my mother and about their grandfather. We tell them the stories then show them the places so that the story gets fixed in their minds.' *Karen Morrison*

An important value associated with Kaytetye ritual and spirituality is simply being on country and enjoying it with family forging strong bonds between generations of kin. The availability of water and shade trees are linked to this value:

'We love to swim in the creek and hunt for bush turkey and collect ducks. We sit in the shade next to the creek and cook the turkey and duck, have a swim, have a feed.' *Lindy Brodie*

'My father brought me here to THANKWE and we will bring our kids here too. I can't believe this tree is still standing. It is so old. This is the main tree connecting me to my grandpa and to my grandkids. I will feel no good if it dies.' *Brian Jakarra*

The cultural values outlined in section 2.3 are entwined; having fun on country isn't just about fun, it's also about reinforcing and experiencing spiritual connection, transferring knowledge, caring for country and fulfilling ritual obligation. Traditional Owners don't separate these concepts.

2.4 Upholding ecological knowledge associated with collecting natural resources

Another important element in Kaytetye society is the cultural knowledge and practices associated with collecting natural resources; hunting, gathering, sharing, consuming and trading. Upholding cultural knowledge and practices associated with ecological processes is very important to Traditional Owners. Whilst this research did not identify any sacred sites within the immediate extraction area, the extraction area has been identified by Traditional Owners as prime hunting grounds regularly used by Traditional Owners and members of nearby communities.

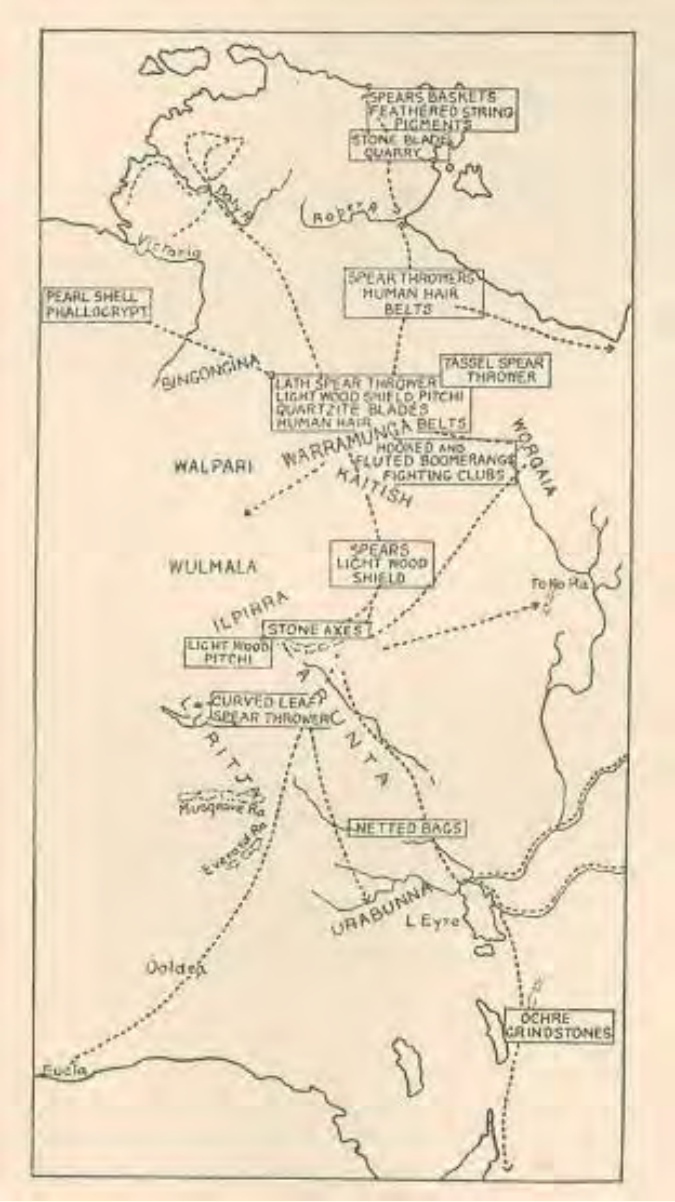
Additionally, the broader drawdown area and the surrounding cultural landscape including Taylor Creek and the sand dune/floodout systems associated with Wycliffe Creek are regionally significant resource rich areas utilised across a range of seasons. A vast array of flora and fauna species utilised by Traditional Owners across the extraction zone and drawdown area were documented during this assessment, many of which are dependent on groundwater. A similar study by McDonald found that water is central to Aboriginal culture and way of life and that groundwater dependent environmental features and ecological processes are themselves Aboriginal cultural values (2005:16).

The importance of soakage water to Aboriginal people in the region was first documented by Stuart in 1862 when in the vicinity of the Crawford Range and Taylor Creek he recorded 'soakages dug in the Creek by the natives. There is no surface water, but apparently plenty by digging in the bed of the creek'.[28] Half a century later Gillen observed a 'very fine and nutritious yam weighing 1–3 lbs of which the blacks are especially fond' growing between Kelly Well and Wycliffe Well.[29]

Aboriginal people's reliance upon and valuing of water and other natural resources in this dry region continued throughout the 1900s (see Bell 1983; Koch & Koch 1993; Olney 1999; Turpin 2000; CLC 2008). The establishment of Warrabri settlement in 1956, now known as Alekarenge (Ali Curung), enabled Kaytetye families and their neighbours to remain on or close to their traditional lands.

[28] Stuart 1865:79.
[29] Gillen 1968:171.

For Aboriginal people living at Wakurlpu and Alekarenge communities in particular the drawdown area is their 'back yard' where they regularly collect natural resources. Continuing to 'go hunting' is vital to the maintenance of good mental, physical and spiritual health for Aboriginal people and an important way to transmit cultural knowledge and practices to younger generations. Being based at Alekarenge in the 1970s, Bell observed Aboriginal people finding frogs in 'cool damp sand' and water sources in 'wide, dry creek beds'.[30] She also found that 'land was a living resource from which people drew sustenance – both physically and spiritually'.[31]



In his investigation into Aboriginal trade relations Frederick McCarthy found that the 'Warramunga–Kaitish tribes' were an important 'distributing group across north Australia'.[32] Hooked boomerangs were traded along what McCarthy termed the 'Central Route' (see Figure 17), which traversed vast distances, including through Kaytetye country. Spencer and Gillen had also noted how boomerangs were 'constantly being traded from one part of the country to another and from one tribe to the other' in the region between Alice Springs and north of Tennant Creek.[33]

Participants in this assessment continue to collect natural resources across the region to make boomerangs and other items to sell and exchange. Many of these items are derived from GDEs present across the extraction and drawdown area including bloodwood trees.

Figure 17 Central Trunk Trading Route

Source: McCarthy 1939:429.

[30] Bell 1983 (1993):22.
[31] Bell 1983 (1993):48.
[32] McCarthy 1939 (Part 1): 405–438; (Part 2):81–104.
[33] Spencer & Gillen 1904:12.

The following quotes were gathered during recent fieldwork for this assessment. They are representative of a wider body of evidence of continuing and contemporary Aboriginal use of country and ecological interconnections (see Figure 19).

'The land of honey that Singleton, and frogs. The land of plenty, our own big garden, that's how I look at it. It is everyone's hunting ground, especially from Alekarenge.' *Maureen O'Keefe Nampijinpa*

'We know what we are looking for because we have been taught. We love sugarbag and if my kids can't taste it, that will make me sad.' *Renele Aplin*

'There are a lot of bush potatoes and bananas in the [site name redacted] area, near Neutral Junction bore fields. We go hunting in that area often.' *Selma Thompson*

Figure 18 Bush potato *Anatye* (*Ipomoea costata*), Neutral Junction Station

Source: Photograph by Jessica Burdon (CLC).

'

'There is good hunting ground west of Wauchope. We collect beans from the bean tree to make jewellery. The bloodwood has everything, it is like a supermarket, it even collects water.' *Maureen O'Keefe*

'We share our country with the Alekarenge mob. They come here to collect sugarbag and water lilies and frogs.' *Karen Morrison*

'The Taylor Creek floodout comes out to the ALYERERNYE area. There are plenty of potatoes here after the rain. It is good open country. People come hunting here all the time from Alekarenge.' *John Duggie*

'We used to camp at the swamp when we were kids and collect ducks and yams. We'd also collect frogs from the Wycliffe sandhill. We would dig down up to 2 metres. I remember jumping into the hole. It was moist at the bottom of the hole where the frogs were.' *David Curtis*

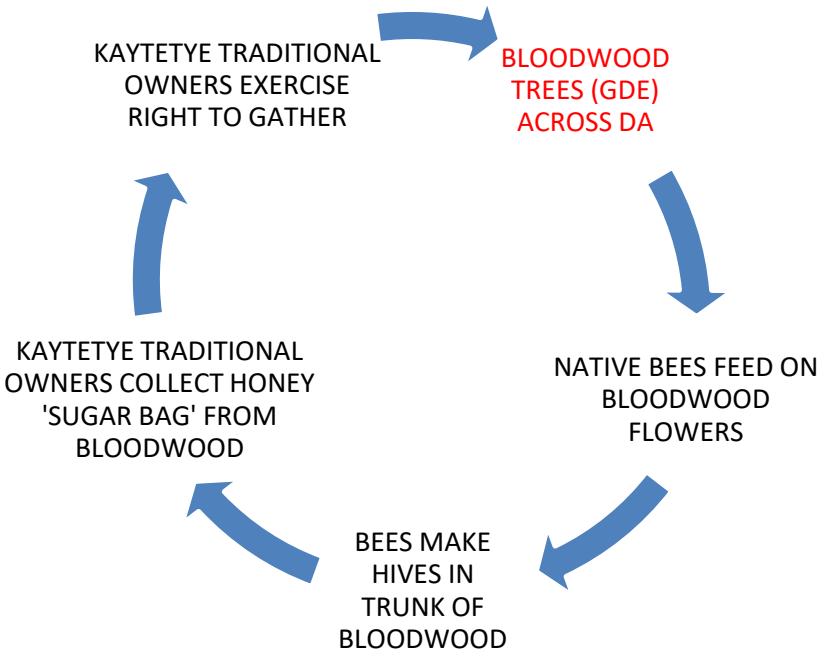


Figure 19 The intersection between the right to use natural resources and groundwater dependent ecosystems

A list of culturally important plant and fungus species observed or discussed within the drawdown area and their indigenous names was collated by Jessica Burdon (CLC) (see Attachment 1). The information is based on field observations, discussions with Traditional Owners and Latz (1995 & 2018). The listed plants are also referenced in Nano et al. (2021) as closely associated with sandplain and alluvial potential Ground Dependent Vegetation (GDV) in the Western Davenport study area.[34]

[34] Pers. comm. Jessica Burdon 27.07.2021.

Food resources obtained from the drawdown area, recorded during this assessment, include roots from the *Mpwerempwer* (Lily), fruit from the *ahakeye* (Bush Plum or Currant/*Canthium latifolium*), fruit from the *nkwerleye* (Bush Plum/*Santalum lanceolatum*), fruit from the *akerleye* (Bush Orange/*Capparis umbonata*), seeds from the *artetye/ntang* (Mulga/*Acacia aneura*) which are ground for making bread, *kayte* (Grub), and *kwardenge* (wild duck eggs),

Figure 20 Bush tomato *anemangkerr* (*Solanum chipendalei*), Warrabri ALT

Source: Photograph by Susan Dale Donaldson.

Figure 21 Cole's Wattle/Soap wattle *Alarrey* (*Acacia colei*), Neutral Junction Station

Source: Photograph by Susan Dale Donaldson.

Tungkarne (Bush Beans), *anatye* (Bush Potato/Ipomea costata), *arlatyeye/arpetye* (Pencil Yam/*Vigna lanceolata*), *ikwarreye* (Wild Banana/*Leichardtia australis*), honey from the *ilperalke* (Sugar Bag), *kartepa* (Bush Coconut from the bloodwood tree), *tharrkarre* (honey from the Grevillea Holly), desert raisin (*Solanum centrale*), *arlkerre* (Bush Tomato/*Solanum chipendalei*), *mpwelengk* (Desert Spadefoot Toad/Notaden nichollsi), *atnhelengkwe* (emu), *atweynterl* (Sand Frog), *kalyeyampe* (another type of frog), *arelwatyerre* (sand goanna), *aherre* (kangaroo), *arwengerrpe* (Bush turkey), *atnhelengkwe* (emu), *enewaylenge* (echidna), *arwengerrpe* (bush turkey), *arnewetye* (Conkerberries/*Carissa lanceolata*), *kungkarte* (Sweet Bush tea leaf), *alarrey* (Cole's Wattle/*Acacia colei*), *atywenpe* (Perentie lizard) and *tyanywenge* (Bush Tobacco) were also found across the drawdown area. See also species list in Attachment 1.

There are also many Kaytetye terms associated with ecological knowledge and use of groundwater across the drawdown area including *aherbe* (ground), *ahepetewe* (hot weather), *arrertame* (permanent), *kwene* (under), *etwerrpe (*Sandhill/sand), *elye (shade), ahepetewe* (summer), *aherrke* (sun)*, arntweng-areye* (rainy season), *aynterrke* (dry), *arntwe* (fresh water and rain), *angenke* (dig), *kartawerre* (root), *arne* (water vessel), *kwathenke* (drink), *anerre* (rockhole), *artnwep* (swamps), *ngentye* (soakages)*, elpaye* (creeks), *and ilinjera* (floodouts), and *irrigkudu* (green, grassy flatlands). Maintaining the Kaytetye language is linked to Kaytetye people sustaining traditional ecological knowledge into the future.

> 'We say *Kantangara* for under and *Ngappa* for water…so for the underground water in Warumungu we say *ngappa kantangara kuna*.' *Heather Anderson*

Interconnections between water, traditional ecological knowledge, spirituality, survival and GDE was expressed by Traditional Owners throughout the assessment:

> 'The bean trees at the soaks are part of the story and can't be cut. They are Dreaming trees and can't be cut. They were planted in the *Altyerre*; they show us where the soakages are when we are travelling. The trees need the soakages and we need the trees to find the soakages to get water.' *Ned Kelly*

'At ALKETALKERREY we would dig a long way down to get a drink. After we finished there, we would walk to ATYEWANTEYE and stay there for a while. The bean trees at ALKETALKERREY and the orange tree at ATYEWANTEYE can't be touched. We can use the ones away from the soakages, the ones that aren't sacred.' *Donald Thompson*

'We see the large trees and know there is underground water. The old men used to dig for water near the old trees. We don't know what is going to happen if they take that water and what are they using it for? We have to think about it more'. *Brian Tennison*

Figure 22 Northern wild orange *akarley* (*Capparis umbonate*)

Source: Photograph by Jessica Burdon (CLC).

'The *Kwerrimpe* were bush onion ladies, they were Kaytetye and travelled around Kaytetye country. They left onions for us and we still find them along Taylor Creek even when there is no rain. We also get bush plums, bush potatoes, tomatoes, banana, honey ants, sugar bag, coconuts, goanna, turkeys, kangaroos, echidnas, grass seeds, and beans. We use the root of the acacia to make boomerangs and the best sugar bag is in winter from the bloodwood, it is stored in the trunk of the tree like a fridge.' *Selma Thompson*

Figure 23 Woolybutt grass *antyer* (*Eragrotis eriopoda*)

Source: Photograph by Susan Dale Donaldson

'Not all soaks hold water all year around. They can be good after rain but then dry up. There are springs that always have water. I've never thought about where the water comes from, it is just always there. I don't know how the springs will be affected. If the water is taken it's gone forever and we can't get it back. Once it's gone, it's gone.' *Michael Jones*

'I dug for sand frogs in the sand hills at Wycliffe with my grandmother Molly O'Keefe. We used a stick and a crowbar. I was carrying my son in a coolimon at the time. He is now 32! We dug about one metre down, not far and the sand was dry around the frog, but the frog carried water in him.' *Evangeline Presley*

'Our old people originally found water; we can find water too in the same places. Water is precious. We can't give away our water, we have to think of our family and future. We will hold the money in our pocket only a little while.' *Michael Wilson*

'The insects live in the trees and they eat the leaves and flowers from the trees. The flying ants make ant beds and we collect the spinifex wax. The bees make sugar bag. So, the insects need the big trees to survive and we need the insects to make us wax and honey. It is all connected.' *Michael Jones*

'We used the wood from the bloodwood to make boomerangs. The bees also like the bloodwood trees to make sugarbag and we also get bush coconuts from bloodwoods. We can't lose the bloodwoods, they are important for lots of things, even the ones that aren't sacred.' *Michael Jones*

Figure 25 Spinifex wax Atnkere, Warrabri ALT

Source: Photograph by Susan Dale Donaldson.

'Bloodwood sap is used to make a medicine drink. We also get sugar bag from bloodwoods and coconuts.' *Selma Thompson*

Figure 26 Collecting sap Arrkiper from bloodwood tree (*Corymbia opaca*) on Warrabri ALT

Source: Photograph by Susan Dale Donaldson.

Historically Kaytetye people shared important ecological knowledge with early European explorers in good faith.

'The old people at Singleton knew where the water was and showed it to the white explorers. They had a map in their memory from a long time ago.' *Derick Walker*

Figure 24 Bush coconuts (kathip) from bloodwood (*Corymbia opaca*), Singleton Station

Source: Photograph by Jessica Burdon (CLC).

2.5 Continuing customary roles and responsibilities

In 1901 Spencer and Gillen identified 'Kaitish' (=Kaytetye) territory as extending from Barrow Creek in the south to the Davenport Range/Bonney Creek area in the north, and extending either side of the Overland Telegraph Line (see Figure 27).[35]

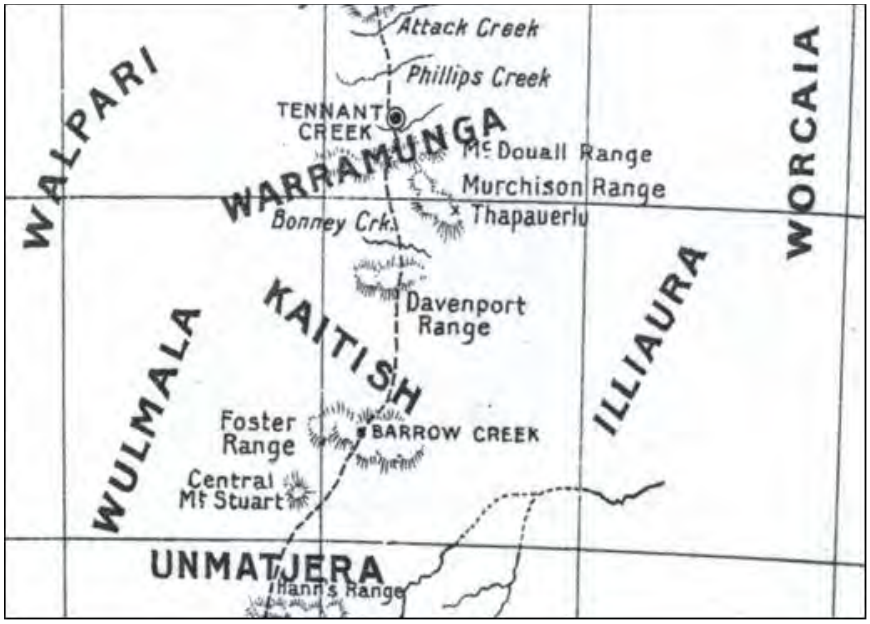


Figure 27 Spencer and Gillen tribal map

Source: Spencer and Gillen 1904.

In the Kaytetye belief system Traditional Owners see themselves as custodians of their land and waters and they have customary roles and responsibilities to maintain and protect their country and the things that live there; in Aboriginal thinking, everything is connected and especially to water. Looking after country in a broad sense relates to sustaining the biodiversity through regular burns, cleaning out/covering up soakages and other activities. These cultural activities relate to preserving all aspects of the cultural landscape, including water sources, for future generations so that culturally valued natural resources can be sustained and sacred sites protected.[36]

[35] Spencer & Gillen 1904: endpaper.
[36] Stanner 1935.

For Traditional Owners, managing country 'proper way' requires being part of making decisions about how country is used and accessed according to ancient laws and customs based on specific land tenure systems. Within each landholding group, people inherit certain roles in relation to land depending on their genealogical link to it. Those people affiliated with land through their father's father (FF) are called *apmerek-artwey (mangaya* in Warumungu and *kirda* in Warlpiri*)* and those affiliated with land through their mother's father (MF) are called *kwertengerl* (*kurdungurlu* in Warumungu and Warlpiri). Those affiliated with the estate through their father's mother (FM) and mother's mother (MM) also hold important connections to country.[37]

Apmerek-artwey are required to pass on the ritual and corporate property of their country to their patrilineal descendants, perform as actors in ceremony and together with their *kwertengerl* make decisions about access to their country's economic and spiritual resources. The role of *kwertengerl* usually involves painting their *apmerek-artwey* for dances and ensuring performances unfold in accordance with Law. *Kwertengerl* are required to ensure sites are protected. Today these complementary roles are also transferred into contemporary non-ritual decision-making processes involving Traditional Owners and their land.

In the 1970s Bell observed rituals associated with the *Ngapa* (=rain) mythology which involved rainbows, rain, lightning and waterholes around the Devils Marbles area.[38] She found that the patrilineal descent-based roles and responsibilities pertaining to country, as outlined above, were defined in the Dreaming and aim to ensure 'the proper management of country – that is, to see the nexus between the use of the land and the maintenance of the land is not threatened'.[39] The link between maintaining areas of importance and GDE was often expressed by Traditional Owners during this assessment (Figure 28).

[37] Bell 1993; Sutton 1993.
[38] Bell 1983 (1993):167.
[39] Bell 1983 (1993):139.

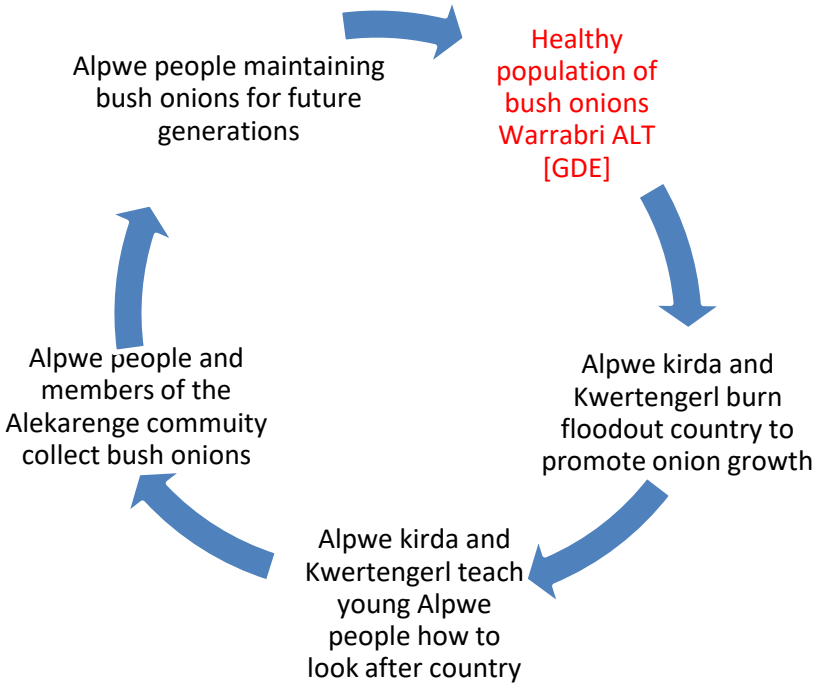


Figure 28 The cyclical interdependence of maintaining areas of importance and groundwater dependent ecosystems

Looking after precious water sources and the range of interconnected species is an important part of Kaytetye people's customary roles and responsibilities, and in particular for *kwertengerl.*

> 'We cover up soakages after they have been dug to protect them from getting damaged by Kangaroo poo, camels, bullocks. We cover them with leaves and branches and logs after the hole has been levelled. We don't want animals falling in the holes and getting trapped either. Anyone passing by can use the soak and cover it up before they leave, ready for the next family. We share our water in the desert with all the families, not just for one person. We keep that water cool for the next family passing by. Some soakages we dig after rain; others are good all year around like ATYEWANTEYE. People lived there because there was water in cold weather and hot weather. We dig that one in from the side, we sit on the side and as we dig, we keep moving in, deeper and deeper. There is a bush orange tree there too.' *Selma Thompson*

> 'There are plenty of bilbies on the Hanson River. They eat witchetty grubs. When the grubs are eaten out, they move on, the whole family moves on. Witchetty grubs grow up in the yellow wattle trees, the turpentine and acacias. Jarra Jarra side they make more witchetty grubs; they sing them up.' *Donald Thompson*

For a Kaytetye person to not be part of decision making in matters that affect their country, then affects their relationship with their country and kin. Today, as in the past, traditional decision-making takes time because it considers complex religious elements, an array of social networks and detailed traditional ecological knowledge systems.

2.6 Being able to live and travel on country

As evidenced by existing literature and consultations with Traditional Owners, it is apparent there was much historical seasonal movement between soaks and living areas and ceremonial grounds across the drawdown area and beyond (see Figure 29). Seasonal movement was previously a matter of ongoing residence, subsistence and ritual obligation, whereas nowadays seasonal movement to water sources is on a visiting/camping/hunting/ritual basis. Whilst country continues to be accessed for cultural purposes, movement between water sources has reduced. The continued cultural pattern being expressed links people to their past and provides promise for the future of their important cultural practices.

As noted earlier in this assessment, the drawdown area traditionally belongs to Kaytetye people associated with four Aboriginal land-owning groups: *Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe*. These four country groups have determined native title rights and interests to the drawdown area in accordance with traditional laws and customs and are deeply intertwined with their neighbouring groups through ritual, mythology, kinship, trade, economic activity, language and shared historical experience.

The broader cultural landscape including the Western Davenport District includes an additional 23 Aboriginal land-owning groups who have kinship and ritual ties to the four immediate groups: Miyikampi, Kanturrpa, Kelantyerrang, Lyentyawel Ileparranem, Arrawajin, Errene, Wurulju, Kwerrkepentye, Pwerrk, Antarrengeny, Rtwerrpe, Arlekwarr, Akalperre, Amakweng, Ahalper, Tyarre Tyarre, Alhalker, Anangker, Atnerlelengk, Akweranty/Anwerret, Akaneng, Ngkwarlerlanem, Arnkawenyerr, Mitartu and Arnapwenty/Imangker.[40]

[40] CLC 2016:4; Kaytej, Warlpiri and Warlmanpa Land Claim 1981. Transcript of Proceedings. Aboriginal Land Commissioner; McLaren Creek Land Claim 1988. Transcript of Proceedings. Aboriginal Land Commissioner; Alyawarr, Kaytetye, Warumungu and Wakay Native Title Claim 2000. Transcript of Proceedings. Transcript Australia; pers. comm. Andrew Fahey 09.08.2021.

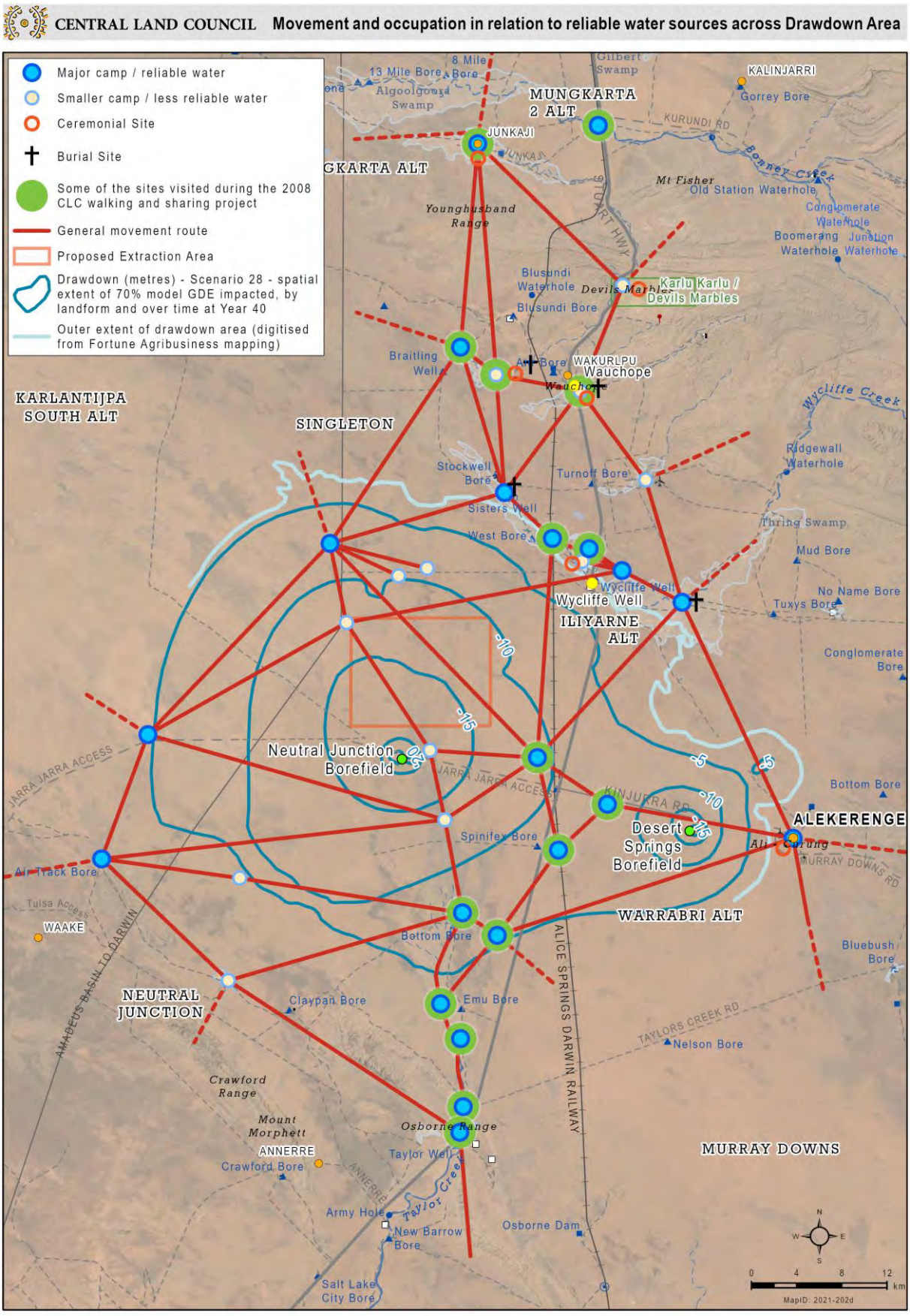


Figure 29 Movement and occupation diagram in relation to reliable water sources across the study area

Source: CLC 2021 (based on data collected by Donaldson).

Human colonisation in Australia's arid zone took place 20,000–30,000 years ago with varying levels of migration and depopulation taking place during the last glacial era followed by a reclamation of rangeland areas.[41] Archaeological excavations at Ingaladdi rock shelter, near Katherine, 800 km north of the study area, indicates human occupation of the area more than 7,000 years ago.[42] Archaeological investigations in the Davenport Ranges National Park immediately to the east of the study area, dated rock engravings as being at least several thousand years old – providing clear evidence of pre-historic Aboriginal use of the region.[43]

Observations of Aboriginal people living within the drawdown area extend back to John McDouall Stuart's 1862 expedition when he documented people hunting and gathering of food and was presented with opossums and birds.[44] Stuart and his party came across 'a beautiful pond of water, and about a mile along the pond the ground was sufficiently firm to allow of the horses going to drink; this is a beautiful sheet of water, 50 yards wide, and seems to be permanent; some of the horses had a swim in it. This I have named Thring's Pond.'[45] Thring Swamp is an important site belonging to the Iliyarne group located on the southern side of Wycliffe Creek on Singleton Station.[46]

While in the vicinity of the Crawford Range and Taylor Creek, Stuart saw 'several natives' and recorded 'soakages dug in the Creek by the natives. There is no surface water, but apparently plenty by digging in the bed of the creek, judging by the number of native wells that he saw with water in them'.[47]

Aboriginal people were observed at Taylor Creek by Renner and his party in 1872, where 'blacks annoyed him very much after he left the Taylor, by constantly setting fire to the grass along the road.' [48] In 1874, during a time of severe drought across the region there was an increase in pressure on water resources. These difficult conditions together with an incident involving ration distribution at Barrow Creek led Kaytetye men to attack and kill two European men who were stationed there. Settlers responded by mounting a reprisal expedition which resulted in a number of Kaytetye people being killed in the region, including at Taylor Creek.[49]

[41] Mulvaney & Kamminga 1999:190–191; Smith 1987:710–711.
[42] Flood 1983:126. See also Horton 1994:493.
[43] Federal Court of Australia (2004) *The Alyawarr, Kaytetye, Warumungu, Wakay Native Title Claim Group v Northern Territory of Australia (2004) FCA 472*:33.
[44] Stuart 1865 (1975):198–215.
[45] Stuart 1863:13.
[46] Stuart 1865:79.
[47] Stuart 1865:79.
[48] Petrick 1983:20.
[49] Aboriginal Land Commissioner 1982:4; Koch & Koch 1993:xiv; Bell 1983 62–65.

In 1896 Eylmann was travelling through Kaytetye territory 19 miles west of Taylor Creek and observed the remains of a living area and 'cave paintings'.[50] After passing through Wycliffe Well where he noted an abundance of food and water Eylmann visited Kelly Well where he found 'an Aboriginal camping place' comprising 'rough huts built from gum tree twigs, and wind breaks' as well as:

> …yam sticks, feathers from emus and galahs, remains of the native pear, broken weapons, ochre and chalk used for painting, small bones, trough-shaped pieces of bark…a hand-sized flat stone…covered on one side with a reddish, easily crushed resin, and a piece of bark that contained this resin in a liquid form…a long heavy club, painted red, decorated with carnelian rings and short diagonal incisions.[51]

In 1899 Spencer and Gillen passed through the region and documented Kaytetye society. They found Palaeolithic and Neolithic objects including spears with stone-flaked heads attached by resin and string; flint/flakes were used like a chisel for decorating coolamons and adze with flints. Knives, specially designed by Kaytetye women, were also documented.[52] Tree burials were also recorded across Kaytetye country.

The initial exploration of Kaytetye territory by Stuart and others was promptly followed by the development of the overland telegraph line and the pastoral and mining industries. Kelly and Wycliffe Wells were constructed in 1875 and the first pastoral lease in the region was at Barrow Creek, granted in 1877.[53] In the 1880s Murray Downs, Elkedra and Frew River stations were established, only to be abandoned a short time later, due to violent clashes between the newcomers and local Aboriginal people. In 1888, George Hayes leased Neutral Junction and Frank Scott, Stirling Station. In 1930, Greenwood Station was established at Bonney Creek (now Mungkarta ALT) and around the same time a grazing licence existed over what is now Singleton Station.[54]

The correlation between permanent (*arrertame)* water (a*rntwe)*, sacred sites and social organisation has been widely documented across Australia.[55] Treating important water sources with reverence and respect, an aspect of Kaytetye laws and customs, ensures future generations of Kaytetye people can survive as a society on the land as well as enjoy spiritual satisfaction. The Kaytetye ideal is to ensure springs, soaks and swamps remain in the original condition provided to them in the past *Altyerre* era, when they were created, so that future generations can enjoy the same qualities. When country changes or is damaged, Traditional Owners feel this is a direct reflection that they haven't followed the Law.

[50] Courto 1996:77.
[51] Courto 1996:78.
[52] Spencer & Gillen 1904:635–641.
[53] Aboriginal Land Commissioner 1982:5–6.
[54] Koch & Koch 1993:xv–xix
[55] Bell 1983 (1993); Rose (2004).

Latz discusses the importance of water in an arid environment. He found that:

> …the locality of water is the most important factor governing the movement of people in the central deserts. Not only must every adult member of a community know exactly where every water source is located, but they must also have a good idea of how much water will be available to them when they arrive. The knowledge is obtained by careful observation of previous rains coupled with many years of experience on the hydrology of the area, evaporation rates and so on. Lack of water is, however, rarely a serious problem in the central desert, at least in normal years. Although large pools of permanent water are scarce the many and varied sources of underground water are relatively plentiful, much more than is generally realised… (Latz 1995:18).

Latz highlights that during droughts a lack of food around permanent water causes people to relocate rather than the depletion of water (1995:18). He identifies a number of plants obtaining water (*Brachychiton*) as well as plants that indicate the presence of underground water (sedge *Cyperus gymnocaulos*) (Latz 1995:65) and plants that are usually found near permanent water sources (wild orange) (1995:140). The later was identified in the current assessment close to a sacred soak as were bean trees.

'There was a big camp at ALKETALKERREY for Kaytetye, Warlpiri and Alyawarr and Warumungu. The soakage was made by the whirly wind from ATWERPE. Anerre come here too. This place is the bush name for Bundy Thompson. People walked here from ATARA in the olden days. If they take the water away or come too close, the bean tree will die and the soak will dry up.' *Ned Kelly*

Figure 30 Bats-wing coral bean tree *atywerety* (*Erythrina vespertilio*)

Source: Photograph by Jessica Burdon (CLC).

Kimber (2011) highlights how 'precious permanent' water sources in the arid region were relied on during times of droughts until 'good rains fell elsewhere in their country' (2011:13). He notes that 'as a consequence of these fluctuations in availability of water to Arrernte people (and indeed all desert peoples), they had learnt to pulse with the seasonal and also drought availability of water' (Kimber 2011:13). He also highlights how 'the key' to each Aboriginal country area 'was a reliable as possible water supply, normally requiring a spring, or very good long-lasting soakages and rock-holes, but could involve a known temporary water.' (Kimber 2011:28).

> ‘Iliyarne people used to live at MPWEREMPWER-ANGE and near ANEMARRANENKE it is good open country with plenty of food and good water. They would go between here and ALYERERNYE.’ *Donald Thompson*

Drought conditions across the region in the 1920s and the growing practice of European men taking Aboriginal women as wives led to the 1928 violence at Coniston Station on the Lander River. Frederick Brooks was killed by Aboriginal people and this led to the killing of many innocent Aboriginal people.[56] Perry analysed the relationship between groundwater, land use and landforms and found that the dependence of both European and Aborigines on the same small portion of the land in central Australia is one reason for the strength of the land use conflict in the region (Perry 1978:74). Koch and Koch documented how families fleeing the Coniston conflict in 1928 camped at Stockwell Bore JAMPALJARN on Singleton Station on their way to Greenwood where mourners painted themselves white as part of Kaytetye mortuary ritual.[57] Speaking of the reprisals that followed, or a related incident, Johnny Nelson (now deceased) recalled:[58]

> …poor old my old fella, they bin make big business…they didn’t know the trouble there. They ran in, they grab them there, make it prisoner they bin have big business, you know…they ran into Murray then. Grab ’em them. Two of them bin shot in the Hanson Creek…(after) showing them all (rock holes and water).

Strong connections were formed to a number of places used to evade conflict at Coniston and Barrow Creek as noted by Bell who found that people’s memories were strongly tied to a history of fleeing conflict and seeking refuge at Barrow Creek, Singleton Bore, Wauchope, and Greenwood where rations were distributed in the early 1900s. Traditional Owners today recall the soakages visited by their ancestors fleeing the conflict. One soakage in the drawdown area used for this purpose was ALYERERNYE where people stopped on route to Greenwood [now on McLaren ALT].

Koch and Koch recorded oral histories about Kaytetye people working at the Wauchope wolfram mine, camping and collecting bush tucker at JAMPALJARN (Stockwell Bore) on Singleton Station, and buying melons at the Wycliffe Well farm.[59]

[56] Koch & Koch 1993:xvii.
[57] Koch & Koch 1993:67–70.
[58] Aboriginal Land Commissioner 1982:6 (Exhibit 2).
[59] Koch & Koch 1993:113–114.

'We use to camp here at ALYERERNYE. Husband and wives would dig together, until they found water. First, they'd clear the grass, maybe burn it. The wife would be digging down in the hole, in the soak, and would pass water up to her husband sitting on top. We use a bucket now but they used coolamons they made from the bean tree. Not the sacred ones though. That is an old law and it's still there today. Maureen's mother and aunty were here and Ned Kelly. There is good tucker around here and in the sandhills to the west are plenty potatoes. West of here is Waake and to the east Wakurlpu.' *Donald Thompson*

'Sonny Jakarra can tell you about the old people living along Taylor Creek. My father and grandfather lived there too. People walked all around that area hunting. They would move around the area on foot in those days.' *Selma Thompson*

'People used to travel between ALKETALKERREY and ARLEPWARTE and ATYEWANTEYE. People were living at these places and would dig for water with their coolamons. There was plenty of tucker around, potatoes, conkerberries. People would stay at each place for a month so until the food ran out then move to the next soak. So, if there was plenty of food around people would stay longer before moving on. People couldn't live without food or water.' *Ned Kelly*

Participants in this assessment, and or their ancestors, have direct historical experience with a shortage of water. In 1945 a shortage of water led to the closure of Tennant Creek's 'Six Mile' Aboriginal Reserve resulting in Aboriginal families being relocated to Phillip Creek Native Settlement to the north of Tennant Creek.[60] However, the Phillip Creek site also lacked permanent water and Aboriginal people were moved to 'Warrabri' (now called Alekarenge) in 1956; according to Cliff Williams '…all the bosses decided to move us from Phillip Creek because the water made lots of people get sick'. [61]

Many Kaytetye families also lived and worked on the stations in the vicinity of Alekarenge, including on Singleton and Neutral Junction.[62] In 1961 Pitman wrote that 'Singleton appears to be coming a colony of aged wards…they are unwilling to live at Warrabri…several of the wards have been transported on a number of occasions back to Warrabri, only to return.'[63] The May 1966 census recorded 10 Aboriginal people residing on Singleton Station in 'humpies a quarter of a mile from the Homestead' with people regularly visiting Warrabri and other centres

[60] Aboriginal Land Commissioner 1988:48.
[61] NAA 1959/1897. Warrabri Corroboree Ed. 9/1959. See also Meggitt 1962:28 'The Story of my life', Cliff Williams: See also Aboriginal Land Commissioner 1988:49. NAA 1954/953.
[62] NAA 1957/122. CENSUS 1964.
[63] NAAE 155/20 (1960/86) inspection report, 1961.

around the station.[64] In June 1967 Pederson reported 19 people 'all living as Aboriginal' on Singleton Station. The Aboriginal residents lived in 'whirlies' and all the cooking was done individually over open fires around the whirlies. The Aboriginals 'presented as a reticent, shy group who are apparently prepared to stay at Singleton no matter how bad the conditions'.[65] Station life allowed for the continuation of a traditional lifestyle during that time of the year when people were not undertaking station work.[66]

When Traditional Owners visit a soak today, memories of how the place was visited in the past is recollected and new memories are made. Historical stories about places and the people who lived at particular soakages is an important way for their descendants to connect to their ancestor's country. Family connections were historically formed as men and women worked on Singleton and Neutral Junction Stations.

> 'My father brought me here and we will bring our kids here too. I can't believe this tree is still standing. It is so old. This is the main tree connecting me to my grandpa and to my grandkids. I will feel no good if it dies.' *Brian Jakarra*

> 'I came to THANKWE as a child with my mother and other families from Alekarenge. We camped at THANKWE and collected lots of yams, bush tobacco and ashes from the snappy gums.' *Maureen O'Keefe*

According to the WDWAP, approximately 1,000 people currently live in the District, including around 500 people in the major community of Alekarenge. The District also includes three smaller communities (Imangara, Mungkarta and Tara) and nine outstations (Ankweleyelengkwe, Annerre, Greenwood, Illeuwurru, Imperrenth, Indaringinya, Kalinjarri, Tjuperle and Wakurlpu).[67] The Aboriginal people residing in the district are either Traditional Owners or Aboriginal people with whom Traditional Owners share their land, water and resources including across the drawdown area.

> 'I enjoy being here at Wakurlpu. I can relax here and be with family. It is good for my health and I feel a lot happier being on country.' *Glenis Curtis*

> 'Home is home for Aboriginal people. Wakurlpu is our home, our country. When the country is green, we are happy. Water is like gold to our people.' *Jeffery Curtis*

[64] CENSUS F133/22 (65/32). Inspection report dated 01.09.1966 Cooke. Census 1966.
[65] CENSUS F133/22 (65/32). Census 1967 and 1968.
[66] E155/20, 57/25. Hamilton 1958 and 1960.
[67] NTG 2018:11.

> ‘We have a farm here too at Alekarenge. We need water to keep local jobs. Wages for the locals. What about our children? If we lose water at Alekarenge what will happen to the people in the community? We can’t move people away. This is their country. This is my home, my land. The families hunt around the community and across Singleton Station and Neutral. If the country is damaged, we will keep the law, our law. The law came from the past, we have it now, and it will keep going into the future. We will stay here and the story will stay here too and the names (of places). It will be sad if the animals go and the birds fly to another country. Maybe the rainmakers will make the country green again and the animals will come back. They can make a smoky fire to make clouds to bring on the rain.’ *Michael Williams*

In 2008 the CLC undertook a mammoth cultural teaching project ‘Walking and Sharing Stories from Bonney Creek to Barrow Creek’ which involved 65 Kaytetye, Warumungu, Warlpiri and Alyawarr people walking 140 km over 15 days (see Figure 29). The participants visited 30 soakages along the way and shared cultural and historical stories and undertook cultural practices such as digging soaks to collect water.[68]

After participating in the walk, Ellen Haywood said she enjoyed visiting the soakages because ‘we think back for the old people’. She also found that it was:

> important to learn about their history and to know the knowledge of everywhere where the waterholes are so that they can know whenever their car run out of fuel, they know where to get water and bush tucker as well. How to find food, how to find water and to know which direction we travelling which land, whose land. Sometimes some lands have boundaries that certain people have to carry on and if you’re travelling from another place then they’re the person-owner that has to take the lead.[69]

Ellen also felt:

> …excited and good to see the land that we travelling through and enjoying every walk and every place, every soakage…The best thing is the knowledge to be carried on by young people, handed down from old people to us young people and the stories need to be told about this walk and our history.[70]

[68] CLC September 2008. Walking and Sharing Stories from Bonney Creek to Barrow Creek. *Land Rights News*, p.7.
[69] 20.06.2008 ABC Stateline transcript.
[70] 20.06.2008 ABC Stateline transcript.

Another participant Maureen O'Keefe recalled how her aunty used to:

> travel from each soak until the next one until they reach Barrow Creek. She spent most of her childhood wandering around these hills and these soaks with the Kaytetye people. She brought us back, she revisited them old soaks that she used to go to as a child with these Kaytetye people. She used to tell us stories about it before. Then she thought about it maybe one day we could do a walk and visit those soaks again. It was lovely you know walking all these soaks, visiting. Made me realise then how hard it was then for those people to travel. They had no cars back then and they travelled this dry Australian desert. I thought it was just a desert, I didn't know there were soaks there you know. I didn't know about it until she told me story about it. I was wondering, how did they get water? How did they travel this long distance from Wauchope to Barrow Creek and I was wondering, where did they get water when they were travelling through this land? But I didn't know there were soaks along the way until she told me a story…and I seen it all now, them soaks. I visit a few when I was a little girl, maybe three but now we visit a lot, some in creeks, some in plain country and water floodouts you know.[71]

Sheila Braeden felt that the walk was a good way to teach the next generation about the soakages and other resources. She said:

> …we decided to have this project going for our children so we can teach them and pass the knowledge down to them. So, this project is all about teaching their children so in the future that our great, great grandchildren will teach their children and tell them stories about what we did for them. It's just passing the knowledge on see if we passed away well there is something for them to see…they can learn the knowledge from them as well in different languages and in them days they used to share the land and the resources that were there that used from other different languages, teach the other languages. Different languages have done all same thing, like the same soakages, bush tucker that they had and they're passing it on to their children from different languages. So that's why we got together as Warlpiri, Alyawarr, Warumungu and Kaytetye.[72]

In the words of Tommy Thompson (dec.), who was an integral member of the walk, as a teacher:

> …we got our culture live in our mind, and a map in our mind, and a ceremony on our mind. Everything got all in the mind, no map, that's why you have to remember this country. What people took around when we were kids, mum and dad used to move around looking for food, find food, meat, water, to live, to give

[71] 20.06.2008 ABC Stateline transcript.
[72] 20.06.2008 ABC Stateline transcript.

> us life. Wherever you live in town you have to come back and visit this grandpa's country. You got it free. Everyone can come. You have to find this, it's a different history.[73]

According to Brian Jakarra who also participated in the walk:

> I've learnt a lot about these soakages, what he taught me and told me all the way by listening to him and him telling me all the stories, the stories about the land and the people, how our people, Kaytetye people used to live off the land and how he, as a kid, used to walk around with his mother and father and even mum, Mona, it was their idea to get all the families together, sons and daughters and grandchildren and take them on this walk. Show these soakages and how they used to live. It changed a bit. The soakage never changed the landscape has, mostly by erosions. The soakages some of them I recognise yep since I was a kid…these old people. They really want to pass on their knowledge and the stories, pass it on to the younger kids, the younger generation like to us, to me and so I can pass it on to these other little ones then, when these old people gone, so we can carry 'em on, see? We still got our old people alive. Some of these soakages, I haven't seen them in my life. Only a few that I know of we came past. These other ones just seem to spring up. It's really good so everyone can see it. Around Australia hopefully so people can get to know that we're the smallest tribe in the northern territory, the Kaytetye tribe and setting an example how these other larger language groups can do it. They might do one of these projects one day.

Some of the participants in the current study were involved in the 2008 walk and remember the time fondly. A number of water sites visited in 2008 were visited again in 2021 for the current research, further embedding cultural knowledge and practice associated with important water sources.

> 'We walked to Barrow Creek from Bonney Well stopping at soakages on the way. It was good to listen to the old people's stories and to find the old soaks. I have rain dreaming for the Helen Springs area. Other people have rain dreaming for this area. We all need water. We needed water on the walk.' *Louise Fitz*

[73] 20.06.2008 ABC Stateline transcript.

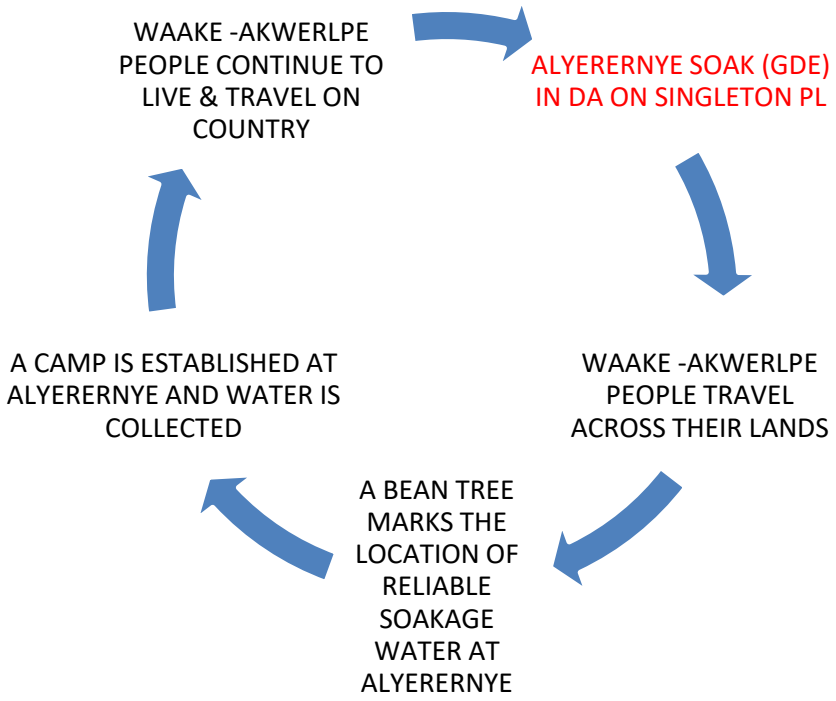


Figure 31 The intersection between the living & travelling and groundwater dependent ecosystems

In a similar study Sullivan found that:

> …fresh water sources are still important for their food resources and recreation. They may be vital from time to time, since an individual's survival can still depend on finding water when vehicles break down, bog in sand, or when people scout around on foot from the base of a bush camp. Just as the importance of water in this arid area has not diminished, the belief system and practices that surround it remain strong also… (Sullivan et al. 2012:47).

3.0 POTENTIAL IMPACTS TO ABORIGINAL CULTURAL VALUES

The following section outlines the impact that the SWL may have on cultural values in relation to the drawdown area, particularly those values affected by groundwater depth. The basis of opinion is the scientific premise that a reduction in groundwater can have 'severe negative impacts on GDEs' as outlined in the technical report specifically relating to the current study area (Nano et al. 2021:1):

> Globally, groundwater dependent ecosystems (GDEs) are recognised for their value as ecological refuges, specialised habitat and areas of high indigenous cultural importance. Particularly in the world's drylands, GDEs are often threatened as human water use increasingly exceeds aquifer recharge rates…Globally, overexploitation of groundwater represents a major threat to GDEs...Drawdown impacts are most pronounced in arid regions, especially following prolonged and severe drought, and in the context of climate change…Lowering water tables have been shown to have severe negative impacts on GDEs…

What Kaytetye cultural values are reliant upon GDEs and how will they be negatively impacted by a reduction in groundwater? The data reviewed has shown that there is a direct and obvious link between Kaytetye cultural values, groundwater and GDEs; they are cyclically interdependent and as such vulnerable to impacts caused by a reduction in groundwater. Moreover, there is a direct link between Traditional Owners exercising many of their determined native title rights, how they use their freehold land, the presence of groundwater and healthy ground dependent ecological systems.

3.1 Emotional and physical responses

This assessment has found a direct cyclical interrelationship between groundwater dependent ecosystems and Traditional Owners' ability to fulfill their cultural obligations in accordance with traditional laws and customs. Because the current proposal may have the effect of dramatically reducing groundwater which will subsequently damage GDEs, the proposal has the potential to undermine and adversely impact Traditional Owners' ability to fulfill customary responsibilities relating to appeasing ancestral spirit beings living in the landscape and at particular sacred sites. Traditional Owners will feel responsible for any damage caused to sacred sites associated with GDE as a result of reduced groundwater, causing cultural and spiritual pain and anxiety.[74] As a result, Traditional Owners believe they may get sick or die as a result of offending ancestral spirit beings and allowing sacred sites to be damaged whilst in their custodial care.

[74] See Mansfield in Pannell 2018: 257.

Traditional Owners' spiritual ancestors living in the land and waters can express their anger when the traditional system is not operating as it should – for example, when rituals are not undertaken according to the rules set down long ago. People can get sick and die if the law is not abided by. Moreover, there is a real fear held by Traditional Owners that the *Altyerre* powers residing in the land and water, across the region, will adversely react to the widespread demise of the biodiversity relying on their groundwater.

The cultural consequences for failing to fulfill the customary responsibilities (often described by Traditional Owners as 'breaking the law') are targeted at individuals whose traditional role it is to appease ancestral spirits; *apmerek–artwey* (*kirda*) and *kwertengerl (kurdungurlu*). All Kaytetye families hold stories about individuals who broke the law and were punished resulting in sickness, injury and even death. These ill-fated outcomes are more powerful, in the eyes of Traditional Owners, than the hard work of the ritual rainmakers, who will continue to make rain. The question is being asked by Traditional Owners, can they make enough rain to fill up the underground water supply? What if the rain makers die as punishment because the land dries out?

Whilst there is a strong belief held by Traditional Owners in the power of ritual, for instance for rainmakers (*angkethemwey*) to make rain *(arntwe)* to increase water supply, and a firm belief in the ongoing force of the *Altyerre* regardless of external activities, it is also apparent that the current generation of Traditional Owners fear the consequences of upsetting the creator spirits by not following the *Altyerre* Law. With a reduction in groundwater, Traditional Owners predict they will see sacred trees 'falling over', soakages drying up, animals finding a new home, bees making less honey, and in turn they may be directly blamed if their country (*apmere*) dries up *(errpatye)*. Emotional responses to breaching cultural rules has been documented and discussed elsewhere (see Pannell 2018). This was a major theme expressed during this assessment, as described below.

Participants in this assessment expressed a range of likely emotional responses if their important cultural values are negatively impacted by a decline in groundwater levels as a result of the SWL. These predictions are based on their previous experience relating to sacred site damage. Traditional Owners believe that their spiritual ancestors residing in the land also have emotions and will be emotionally impacted if country gets sick.[75] There are many Kaytetye terms to describe emotional responses to life events including *arlatnarrerane* (cry), *ampwarrenke* (die), *althere* (homesick), *amperrnge* (sad/unhappy), *nyerre* (shame), *arntetye* (sick), *athamarrerange* (worried), and *atere* (scared).

[75] See Pannell's (2018:263) discussion on the different ways Aboriginal people talk about their emotions and how the mythological beings in the landscape are also believed to have emotions.

Social sanctions may also result; Traditional Owners can be forced into temporary or permanent isolation from their traditional group which can lead to psychological stress and guilt associated with being responsible for damaging the country belonging to their spiritual ancestors, their actual ancestors, their current generation of kin and their descendants.

'I came to this place as a child with my father. This is a water dreaming place. The *Aylpele* (River Red Gum) and soak is the main place in the creek. The Murphy family are related in here too. If this tree dies the owners will go with it but another tree might grow. The story stays the same.' *Brian Jakarra*

Figure 32 Sacred River Red Gum and soakage in Taylor Creek, Neutral Junction PL

Source: Photograph by Susan Dale Donaldson.

With regard to the cyclical concepts described in Figure 6, if the sacred coolibah tree is damaged as a result of a reduction in groundwater on which it depends, Iliyarne Traditional Owners will be unable to fulfill their customary role in accordance with their traditional laws, and as a direct consequence, they believe senior Iliyarne *kirda* will be punished by *Altyerre* forces; they are likely to get sick, suffer ongoing 'bad luck' and potentially die. These forms of punishment are an important aspect of Kaytetye religion and cultural phenomenon. The cultural values associated with sacred trees in particular is of utmost importance to Kaytetye people and are usually diminished as a result of cultural obligations not being undertaken, as described by assessment participants:

‘We got to look out for the owners, they will get sick if they don’t do their job and look after their country.’ *Donald Thompson Akemarre*

‘Aboriginal law is strong. If I do the wrong thing and my trees dies, I’ll be gone. If Dreaming trees get lost, we be gone too. We got to tell them this. Someone will be in trouble, the bloke not listening to us, he will get sick. That’s our law. Our law is in the ground and will not change. When I’m gone my family got him. Our main word to them is “please take it easy on the water all around the world”.’ *Frankie Holmes Akemarre*

‘Country is happy when we talk to it and look after it. I did a painting about how lovely Wycliffe Creek is, with the ducks and the shade trees. Our old people might get sick and *kirda* might die if the shade trees fall. We would be sad as *kwertengerl* for Iliyarne if we lost our shade and our water and if the ducks flew away to find water. We would be sad and feel shame because Iliyarne wouldn’t be their home anymore, they can’t live without water. If the trees die the witchetty grubs die too, they can’t fly away like a duck can…We would feel sad for them too.’ *Lindy Brodie Nungarrayi*

Figure 33 ILIYARNE ILPAIYE, Wycliffe Creek

Source: Photograph by Susan Dale Donaldson.

3.2 Damage to sacred sites

The current research identified 40 sacred sites within the drawdown area, all beyond the extraction zone, associated with over 20 *Altyerre* (Dreaming) mythologies (see Figure 7). The proposal to reduce groundwater has the potential to adversely impact groundwater dependent sacred sites, which Traditional Owners are traditionally responsible for maintaining. As noted above, if a sacred site is damaged or destroyed there is a belief that *apmerek–artwey (kirda)* may get sick or die and *kwertengerl (kurdungurlu)* who inherit the customary role of protecting sites may feel responsible for the damage, which may lead to feelings of hurt and shame, as well as mental illness and social isolation.

Fortune Agribusiness received an Authority Certificate (AC) from AAPA in 2019 for work associated with the Singleton Horticulture Project including water extraction, the use of dams, bores and watercourses and the planting of crops.[76] The AC subject land extends from the southern boundary of Singleton Station north to the Stockwell Bore area, and between the Stuart Highway and the gas pipeline (see Figure 3). This area is larger than the extraction area and much smaller, but not completely overlapped by, the drawdown area.

The current research, as well as that undertaken by AAPA for the project AC, identified no sacred sites within the immediate extraction area. C2019/083 defines ten (10) Restricted Work Areas (RWAs) covering eleven sacred sites. Within these 10 RWA:

- Seven [RWA 1, RWA 2, RWA 3, RWA 4, RWA 6, RWA7 and RWA 8] are beyond the drawdown area in the Wycliffe Creek–Swamp area associated with eight sacred sites featuring ghost gums, bloodwoods, soakages, a 'depression hollow', two sand ridges, creeks, waterholes and swamps[77]; and
- Three [RWA 5, RWA 9 and RWA 10] are within the drawdown area associated with three sacred sites featuring a creek, ghost gums, a waterhole, soakages and bean trees. RWA 10 (AAPA AC 2019/083) is very close to the western extent of the extraction area and consists of GDE features (soak and bean tree).

Of these 11 sacred sites, 10 correlate with research undertaken for the current assessment; the cluster of bloodwood trees within RWA 1 were not recorded, probably because the focus of the current research was the drawdown area and this site lies beyond it.

[76] AAPA AC 2019/083.
[77] There are two sites within RWA 1

Critically, the current assessment identified 5 sacred sites within the AC subject land, not identified in the AC or overlapped by any of the RWAs. These sites are all within the drawdown area and are all associated with GDE features; all are soakages. An additional 32 sacred sites were identified outside the AC subject land and within the drawdown zone.

This assessment also highlighted a potential duplication within the AAPA C2019/083. The status of ten of the sacred sites is described as 'recorded' whilst one is listed as 'other site'. None are 'registered'. The site listed as 'other site' [5756-32] in the AC Appendix and on the AC map is described as a site of cultural significance to Aboriginal people but not one that meets the definition of a sacred site in the NT Sacred Sites Act. The site is described in the AC Appendix as 'a small waterhole / soakage in the main channel of Wycliffe Creek'. A site with the same number is also described in the certificate as 'a small soakage and water hole' subject to RWA 6 [AC para 10]. Research for this assessment found that the soakage, waterhole and creek associated with 5756-32 are associated with the *Atherre Artweye* [=Two Men] and *Aherre* [=Kangaroo] Dreamings and are indeed sacred.

It is notable that AAPA request that the applicant 'should engage an arborist to consider the long-term health of sacred trees both within and outside of the subject land, and in particular trees located within the railway corridor.'[78] Whilst the request is not a condition of the AAPA Certificate, it indicates that AAPA are concerned about sacred sites beyond the subject land into the drawdown area, and in particular sacred features associated with trees.

Given people are spiritually connected to country, if a sacred site is damaged or destroyed the spiritual connection between Traditional Owners and the site is also damaged or destroyed. There would also be a loss or decline in the cultural connection held by the Traditional Owners to the places that are impacted. There is a strong belief that rituals and songs and stories will continue even if sites and species of cultural value are damaged or destroyed, for instance, Possum Dreaming across the region continues to be valued by Aboriginal people, despite the extinction of possums. Another example is when Traditional Owners continue to recite place names in ritual songs relating to sites that are destroyed or their location has been forgotten. Similarly, a sacred bloodwood tree on the highway within the drawdown area has died, however, Traditional Owners believe that a new one will 'spring up' nearby soon to represent the story for that place. However, songs and associated place names are more accurately etched into the minds of the next generation through visitation, by Traditional Owners hearing and feeling and smelling and seeing the site. By remembering the journey to the site and knowing the places before and after.

[78] AAPA AC 2019/083.

Whilst Aboriginal traditions are known to adapt over time to cater for ecological and demographic changes, concerns have been expressed by Traditional Owners about incremental loss. They are well aware of cultural values already lost as a result of colonisation and fear further loss into the future. The ability of Traditional Owners to maintain traditions becomes harder if paralleled to ecological destruction and site damage. Will new trees 'spring up' to replace the ones that have 'fallen'? Will the soakages be recharged with enough rainfall or will they dry out in the long term? Yes, the rainmakers can make rain and the rangers can rehabilitate the natural environment, but how sustainable is this? Kaytetye people's spiritual connections and cultural practices associated with particular sacred sites, which have endured for thousands of years, could be gradually diminished or lost forever with a reduction in groundwater.

Below is a collation of Traditional Owners' comments relevant to an expression of how this cultural value might be impacted and the extent to which site damage preys on people's minds:

> 'I get sad when I know that my uncle and father called the names of soaks they knew and they knew how to find them. I know the names they called but don't know where the sites are. It makes me sad that I'll never find these places again. What story can we leave for Wycliffe country if the sites are gone. We will know the stories and the names but there will be no sites.' *Michael Jones*

> 'Frogs live in the Wycliffe sandhill. There is a big tree standing there. A Dreamtime tree. If the frogs die, we might get sick. If the country goes down, we go down too. If they kill our country, the feeling we have for that country, for the spirits, might makes us sick.' *Karen Morrison*

> 'We are connected to country through the dreaming law. When that Ngapa tree at PANJIRRIJI got damaged the owner, Old Black Hat, he died because that tree got damaged. This happens to our people. Our Law is strong. When they took that devil's pebble away from KUNJARRA Mr Taylor died. We can get sick because the spirit in the tree is connected to our spirit, if the tree dies part of our spirit dies too. So, we try and do our best to look after country and fear the consequences if we don't. *Kirda* might die or get sick and *Kwertengerl* might feel guilty because they haven't done their job, they might get mental health no good.' *Michael Jones*

> 'When they took that KARLU KARLU rock away people got sick. The land went dry and people were having car crashes all the time. When the rock was returned people were happy. My grandmother Molly waited

for that rock to be returned before she died. She died happy. If all the water goes, forever, first we will lose our old people, then other Traditional Owners. We can't let that happen. We need to save our water forever, not lose it forever. We are not interested in money, we want our water to save our lives forever, for all the future generations. They can enjoy swimming in Wycliffe Creek too.' *Evangeline Presley*

'There is spring water at Barrow Creek at ELKEREMPELKERE. They graded too close to it so the water got shut down. The little people, the spirits living at the spring shut that water off because they were angry. They get angry if people do the wrong thing at a sacred site. We have to talk to the spirits for days so that the soil gets wet and then there will be puddles everywhere.' *Hilda Pwerle*

'If we have no soakage water, the story will still be sitting there in the country. Another tree might come up. Our Dreaming is strong and survives. We can still pass on the *Altyerre* and share the stories. That's the same for the ladies too.' *John Duggie*

'The country has spirit. It is alive. The country will get sad and sick and Traditional Owners will get sad and sick if the country dries up. We don't want to see the old people worry. We like to see our country green and the birds will be happy and the old people will be happy. I saw dad talk to the spirits at ELKEREMPELKERE. They are there. He spoke to them in Kaytetye. We belong to that place too. If kids break trees around the spring to make a humpy, they will get sick and we'd have to take them to see a witch doctor to get better.' *Selma Thompson*

Damage to sacred sites can impact Traditional Owners' spiritual connection to country as well as their social relationships. As such, protecting sacred sites is one way for Kaytetye people to maintain their spiritual identity and wellbeing.

'If we Iliyarne people let our land go dry, other people will growl at us. We need to keep the water until we die so that it can jump over to our children and their children all the way like that. The spirit people will get upset if we let that country go dry. They will make us sick, especially Rodger Tommy the main *kirda* (owner through father), and his sons and daughters. We are his *kwertengerl* (owner through mother) and we watch over that country for him.' *Heather Anderson Narrurlu*

'If the land dries up, we will not recognise it. We will not be able to find our sacred sites and soaks. The big sacred trees will fall. If water goes, country gets lost and people die. We die. Where will the animals

go? Big shade trees are important too in summer for people and animals. The coolibah on the highway is called [name redacted], it represents ladies travelling when they were making rain. They were Napurrulas from Anerre country. We have to look after that tree.' *Selma Thompson*

'There is a lot of *Ngappa Wirnkara* (rain dreaming) around the Singleton area. KARLU KARLU, Wakurlpu, Warlaparnpa, all these places were made by *Ngappa Wirnkarra*. Cowboy Sandy had Ngappa Wirnkarra too and the mob at Renner Springs and Anerre in the south. All these places will be affected if there is no water. The story will still be there, still alive, the song will still be there and still be sung, but we will be sad when we get to that place all dead. The story will be weaker for younger people, it will not be as strong as it was for the people before because the places will be ruined. We take them to soakages that are gone and to country that is sick. We have lost other soakages when they put in bores. It is sad to visit these places that are lost, but we keep the story going.' *Michael Jones*

'We need to keep that big tree alive on the sandhill. That tree has a story for Iliyarne country. I paint that tree and sandhill. That's my mother's country. The spirit people are holding the tree roots underneath, they are holding on tight to keep that tree alive.' *Heather Anderson*

When sacred sites associated with people's bush names are damaged the intangible link between the person and the place is also impacted. People feel sad that they will not be allocating these names to future group members if the site is gone.

'Mpwerempwer-ange [lily] is Lindy's mother's bush name. If the land dries up, our lilies will dry out too. We want our kids to see the lilies. It is part of their country. If the lilies all die, it will just be a story from the past about how we collected lilies.' *Karen Morrison*

Figure 34 The importance of sacred sites to Kaytetye people

In summary, the importance of sacred sites to Kaytetye people are multilayered and include being a focal point for mythology and ritual; central to one's inheritance and to the inheritance of one's descendants; a source of spiritual connections and access to the powerful forces of the *Altyerre*; and an important element in the way Traditional Owners exercise their repositionability to their country and to their ancestors (Figure 34). Conversely, if a sacred soakage for instance permanently dries as a result of a reduction in groundwater on which it depends, the Kaytetye Traditional Owners are unable to fulfill their customary role in accordance with their traditional laws, and as a direct consequence senior *kirda* will be punished by *Altyerre* forces; they are likely to get sick, suffer ongoing 'bad luck' and potentially die. The group may also suffer long term and intergenerational emotional and spiritual loss.

3.3 Reduction in species required for ritual activity

A reduction in groundwater has the potential to adversely impact GDE species which Traditional Owners customarily require for ritual activity. Specific items required for ritual (e.g., bird feathers/water) may become scarce and in turn undermine ritual activity. Some ritual items are interchangeable (turkey down feathers > nappy fluff) others are not (water required from specific sacred sites). A reduction in groundwater will undoubtedly have a multitude of negative impacts on this important cultural value including altering and diminishing ritual activities into the future.

> 'We use bird feathers for ceremony; bush turkey (down) feathers, black feathers from the eagle, emu tail feathers. If these birds die or fly away, we would have to seek permission from Warlmanpa, Jingili, Mudburra and Warlpiri mob to get these things from their country. We would have to travel to this which means more work. It would make things harder because we would have to drive a long way.' *Michael Jones Jampin*

> 'We use the white cockatoo feathers for young fella business. We collect the ones that have fallen on the ground. The sons and nephews pass feathers onto their mothers and aunties. We need to look after the white gum trees where the cockatoos nest. If these trees die then the birds will have no nests for their babies and we will have no feathers for our ceremony. We need water to keep the trees and the cockies and our business alive.' *Evangeline Presley*

In regards to sacred water senior Ngappa (water) Dreaming man noted:

> 'My rain dreaming is further north. If they took the water away from my country, I'd have to close down that ceremony; it might not work. We can't let this happen. We can't live without water. Maybe they are trying to kill us.' *Dick Foster*

3.4 Diminishing natural resources required for hunting, gathering and other activities

This assessment identified the extraction area as prime hunting land. The broader drawdown area is also highly valued as a natural resource collection place. The assessment found, like other previous studies across central Australia, that Kaytetye people utilise natural resources for a variety of reasons including for sustenance, medicine, implements, ritual, and trade and exchange.

The Western Davenport Water Allocation Plan (WDWAP) acknowledges this:

> The floodouts and associated vegetation are culturally important to the Traditional Owners, particularly in relation to large trees they support (such as Eucalyptus sp. and Corymbia sp.) and the high importance of these areas to Aboriginal cultural practices and land use. Floodout are generally important hunting areas and also often have ceremonial importance…Soaks are considered one of the most important sources of water in the desert…Significant drying or lowering of the water table could adversely affect the availability of water in soaks and the health of important GDEs… (NTG 2018).

A reduction in groundwater will undoubtedly have a multitude of negative impacts on this important cultural value. Traditional Owners expressed serious concerns about the SWL potential impact to a range of cyclical ecological process which in turn are likely to negatively impact their important hunting and gathering grounds:

> 'We have to speak on behalf of the insects and animals. The insects are working hard, they all have a job to do. You are not going to see all the ants marching along with protest signs, we have to do it for them. You look at the honey bee giving life to others by pollinating flowers. There will be nothing without the bees, and no honey for us. The bees need the gum flowers to make the honey. If our bloodwoods and other gums die, the bees will have no food and can't make honey. We love our sugar bag. It makes me cry when I think of not having any more honey.' *Maureen O'Keefe*

> 'I remember seeing bilby scratching east of Neutral Junction Station and a speckled hare wallaby dead on the Alekarenge road. There should be a flora and fauna survey done across Singleton, Neutral and Warrabri ALT.' *Gladys Brown*

> 'Frogs are vulnerable to change; they might be affected by a loss of groundwater or climate change.' *David Curtis*

Because of the cyclical interrelationship between certain GDE species and places required for the native title right to hunt, gather, take and use the natural resources of the land and waters, if the current proposal reduces groundwater, there is the potential for the proposal to adversely impact GDE species and places which Traditional Owners rely on for sustenance, gaining goods and other items (see Figure 19).

Not a lot of data was collected on trade, however, there is an obvious link between a reduction in resources and people's ability to access resources for trade. Having said that, Aboriginal society has proven to be adaptable to change in regards to economic opportunities and a reduction in certain species currently valued as tradable items may lead to other items becoming more valuable in their absence.

The drawdown area, including Taylor Creek and the sand dune/floodout systems associated with Wycliffe Creek are regionally significant resource rich areas across a range of seasons. The Wauchope and Alekarenge communities in particular utilised their 'back yard' to collect natural resources and to maintain spiritual well-being. Traditional Owners take and use the natural resources across the drawdown area on a seasonal basis. There is concern that this culturally important activity will be impacted and associated knowledge lost. It is feared that the bigger animals will go to another Country to find water, and the smaller species will die out. People will feel a sense of shame and loss if they allow species to die out or find a 'new home'.

'Water is precious for life. If we have no water, we will die. Our pencil yams and bush bananas will die and the animals that can travel will go to green country.' John Duggie

Figure 35 Snail shell at MPWEREMPWER-ANGE swamp, Iliyarne ALT

Source: Photograph by Susan Dale Donaldson.

There is concern that this culturally important activity will be impacted by a reduction in groundwater and a subsequent loss of associated cultural knowledge and practice. The wellbeing of the local community who regularly access the drawdown area will also be negatively impacted given hunting and associated activities promotes a healthy lifestyle both physically and mentally. Moreover, Traditional Owners fear that the bigger animals will go to another Country to find water, and the smaller species will die out. People will feel a sense of concern, loss, sadness and shame if they allow some species to die out and others to find a 'new home'.

'When the wind blows from the east animals from the west can smell the water and come to the swamp for a drink and a rest. We worry about all the birds and animals, kangaroo and goanna, if the swamp dried up. We love collecting conkerberries, passionfruit, sugarbag, lilies, frogs and witchetty grub around MPWEREMPWER-ANGE.' *Heather Anderson*

Figure 36 Bush banana *alkwarre* (*Marsdenia australis*), Neutral Junction Station

Source: Photograph by Susan Dale Donaldson.

'In the early days spring water was drunk with grass straws. The zebra finches will take you to water. We would cover up the soak with clay so that the water didn't evaporate. The sun would suck the water up if we didn't cover it over. Old people will tell you, if there is no water in the ground, certain trees will hold water in dry times. When the water is all gone, special trees will get killed off, we are seeing this already. The animals that can't escape to find water will die. The crabs in the mud might die and the bilbies. There used to be bilbies at Greenwood when I was growing up. They live in small groups and eat witchety grubs. How will they survive without water? If there are no roos, we won't go hunting. If there is no water, it will be hard to hunt.' *Sonny Curtis Jappanangka*

'It makes me feel sad for country if country has no water. We live in a desert. We need that water.' *Cedric Tennison*

Figure 36 Conkerberry anwekety (Carissa lanceolata)

Source: Photograph by Jessica Burdon (CLC).

Kaytetye people also expressed a contextual view of the current proposal and potential impacts, with an obvious understanding of broader environmental processes:

> 'We already have cattle messing up our creeks, so now we can't drink from them. That makes our underground water coming up into our soaks and springs even more important. They picked the place where we need our water for the swamps and springs, it will be all sucked dry. We are going to have a water crisis. If we lose our water forever, we suffer forever, for generations to come. We are fighting for their future now. This water belongs to everyone, the plants and human beings. How cruel can the government be? You wouldn't let your child get thirsty; they are meant to be the big daddy looking after us.' *Maureen O'Keefe*

> 'We have noticed some of our landmark trees drying out and dying in the hot weather. The climate is getting hotter and it will continue to get hotter into the future so we will need more water for our plants and reduce evaporation. I am not against farming or irrigation, but this water allocation is too much. The government isn't taking into consideration climate change and the concerns of our people. Our springs and soaks will be affected, they are already being affected by the change in weather. Once the water table starts dropping, given the connections underground, all the water will head to Singleton and other current bore fields will be affected too. Our yams, bush potatoes they are in certain areas all year around, they have to depend on the groundwater. How will they be affected? Our trees in swampy areas, the witchety grubs live in them. Without the trees our food source is lost. I'd be upset to lose our bush foods. The allocation is excessive. I am against it.' *David Curtis*

'If we have no water, we will be very concerned about the things that can't travel too far, like the crabs, witchetty grubs and mussels. They will die. A bird can fly away but a little crab can't go far.' *Michael Jones Jampin*

Figure 37 Crab (*Austrothelphusa transversa*) holes in the bank of the Wycliffe Creek

Source: Photograph by Jessica Burdon (CLC).

3.5 A loss for future generations of Kaytetye people

Because of the cyclical interrelationship between certain GDE species and the Traditional Owners' right to maintain areas of importance for future generations, if the current proposal will have the effect of dramatically reducing groundwater, there is potential for adverse impacts to GDE species which Traditional Owners are traditionally responsible for looking after (see Figure 28).

Traditional Owners expressed that a reduction in underground water will make it very difficult for *apmerek-artwey* and *kwertengerl* to fulfill their customary obligations in relation to ensuring there is a future water supply and good hunting ground and for their descendants, just as their ancestors did:

> 'When you add it all up, all the water they want to take out of the ground across the region, it is too much. What about our future? What about the future of our grandkids? We need to look after our water.' *Rodger Tommy Jungarrayi*

> 'The old people, including my father, dug water out of the soaks with coolamons and then covered them up to keep the water cool and to save the water from being ruined from kangaroos, dust and grass. They lived around Taylors Creek. That's all Anerre country. A little bird called *Ngeymarre* lives along that creek. It is a little zebra finch. There is a story about that *Ngeymarre*.' *Selma Thompson*

The potential for Traditional Owners to feel shamed as a result of not looking after the water upon which the plants and animals living on their country rely, was a key theme expressed during this assessment. Traditional Owners feel that a reduction in underground water will make it very difficult for *apmerek-artwey* and *kwertengerl* to fulfil their customary obligations in relation to water and the life that water sustains. What will they pass onto their grandchildren?

> 'The old people before us looked after the country proper way. They had to look after their country for us, that was their job. Things are getting harder and harder. If they take the water, how are we going to look after our country?' *Sonny Curtis Jappanangka*

> 'The rangers have a focus on prevention where wildlife and plants are concerned. This water licence isn't going to help them in the job they do. It all comes down to water. We have to preserve underground water. People can use it but not to this level. It is very irresponsible of the Northern Territory Government to do that. Small scale is not too bad. This is awful. Sucking water out of an arid zone makes no sense. We can't be certain it can be recharged and rain is not as reliable as it used to be. I can't believe the government did this. Aboriginal people should have control over water, it is part of our country. Water is for all people; no-one can live without water. Also, it is a real worry that if the underground water is removed, the ground might fall in. Sink holes. Not having control over the use of water will cause people stress and stress kills people. It will be a huge problem.' *David Curtis*

> 'It will be hard for Aboriginal people to care for their country because having no underground water is a hard problem to fix. The rangers work hard, but this will be a big problem for them. We might need water monitors so that the problem doesn't get bad. We worry about our future and the future of our grandchildren.' *Jorna Murphy Nappangarti*

Wakurlpu *kirda* Billy Boy Foster (dec.) highlighted the important role *kwertengerl* plays in looking after sacred sites and the repercussions of not:[79]

> …young men are being taught the *Ahakeye* Dreaming, they are being taught by the *kirda* and *kwertengerl, kirda* is doing the dancing, but *kwertengerl* got to do his job because that's Aboriginal Law…if *kirda* do wrong…*kwertengerl* go crook on him…The marbles are the plums…if they are damaged there would be

[79] Warumungu Land Claim, Transcript 1985:3413, 3416–17, 3441–2, 3415–8.

> big trouble for the *kwertengerl*… look after the sacred *ahakeye* objects stored at [site name redacted].

Visiting country with children to teach laws and customs will also be undermined if species are reduced and sites are damaged. Summer teaching including learning how to swim, requires shade trees and water, both may be reduced.

> 'Allocating this much water will weaken our native title and dry up our land rights land. If certain bush tucker depends on that water, like sugar bag, the people responsible for that dreaming will be upset. My dreaming is sugar bag. I can eat sugar bag, but I wouldn't eat the last one. If the sugar bag disappears, I will still have my totem, but no sugar bag to eat and share.' *David Curtis*

> 'Certain people have responsibilities for the country, caring for it. If this happens, no-one has control and they can't care for their country. If they can't care for their country, they get stressed. We thought we had land rights but what good is land without water? Aboriginal people still are not safe. We are forever fighting.' *David Curtis*

> 'We need to look after our country, but it's like a small hose fighting a fierce bush fire…what if the rainmakers get sick and die too?' *Michael Jones*

3.6 Decline in ability to live on and travel on the land

Because of the cyclical interrelationship between certain GDE species and places and Traditional Owners' desire to continue to travel over their land and waters and to live on the land, if the current proposal will have the effect of dramatically reducing groundwater, there is the potential to adversely impact GDE species and places which Traditional Owners traditionally rely on when undertaking these important activities which they value (see Figure 31).

There is a fear that people will not attempt to travel lengthy distances in fear of getting thirsty and dying. It is thought that this right would be less enjoyable to exercise if the land is dry, and country would be accessed less often. There is a fear that people will 'stay in town' if there is no available water on country.

'We are worried about how taking so much groundwater and how that will affect our water supply at Kalinjarri Outstation where our family lives. Not only Kalinjarri, but McLaren Creek, Alekarenge and Wakurlpu also. There are people living in all these places. They also go hunting around their areas and if there is not water then there will be no animals to hunt.' *Sandra Morrison*

'We have a community outstation at Wakurlpu. If the water levels drop our water goes salty and if that happens, we will not be able to live there. We would have no drinking water and wouldn't be able to grow anything. If the water drops at Singleton, the water levels under the surrounding communities will get pulled to Singleton and reduce the water in the communities.' *David Curtis Jungarrayi*

'How can we survive without water at our outstation here at Wakurlpu. This is our country. More of our family is moving back. How can the country survive without water? We are very worried about losing our water. Our water. If we have less water our Wakurlpu community water pressure will be even less. It is already very low. Some days we have to wait half a day to get any pressure. If there is no water, it doesn't look as though we could live there, on our country.' *Sonny Curtis*

'Don't they see that there are people living on this land? Living off this land? It's like when the British tested rockets at Maralinga they were blind and didn't see that people were living there. Then they made the people sick and blind. The birds fell out of the sky. Their country was ruined. Yami Lester was blinded and he had no idea what was happening. Today we know what's about to happen, there is about to be a water crisis. We have to stop it before it happens.' *Maureen O'Keefe Nampijinpa*

Concerns have also been raised by Traditional Owners that if people break down in their motor vehicles when out hunting in remote areas, they might not be able to rely on their traditional ecological knowledge to survive because the landscape and its resources may be altered.

'When I was eight years old, three men walked from Warrabri to Wauchope and they couldn't find any water. One of them died of thirst. They never found the body. People need water to travel or they might die.' *Michael Jones*

'When we had no motor car, we used to walk from soak to soak, if they take the water away, we will die half way.' *Sonny Curtis*

4.0 CONCLUSION

The drawdown area extends across Singleton PL, Neutral Junction PL, Warrabri ALT and Iliyarne ALT. These lands have been through either the Aboriginal land rights or native title process which found and/or determined that the drawdown area traditionally belongs to Kaytetye people associated with the Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe groups. These four country groups have rights and responsibilities to the drawdown area in accordance with traditional laws and customs and are deeply intertwined with their neighbouring groups through ritual, mythology, kinship, trade, economic activity, language and shared historical experience.

Traditional Owners' belief in the *Altyerre* Law and the associated spiritual power imbued in the cultural landscape is the cornerstone cultural value arising from this assessment and the foundation of all other identified cultural values. Key cultural values for Traditional Owners identified in this assessment are following the *Altyerre* Law; maintaining spiritual connections and protecting sacred sites; undertaking ritual activity; upholding ecological knowledge associated with collecting natural resources; continuing customary roles and responsibilities; and being able to live on country and travel across country.

Background research combined with consultations with Traditional Owners identified 40 sacred sites associated with 20 *Altyerre* [Dreaming] mythologies within the drawdown area. Considering not all of the identified sites were visited during the assessment combined with the cultural complexities of the region, it is possible that one or two of the sites identified are actually the same place known by different names. It is also possible that other sites exist within the drawdown area that were not identified during this assessment. More time on the ground with Traditional Owners would provide further clarity on the cultural landscape in terms of the presence and significance of sacred sites.

Many of the *Altyerre* tracks traversing the drawdown area interlink with places across the broader cultural landscape. All of the sites are located beyond the immediate water extraction zone and all have features associated with GDE including *ngentye* (soakages), *elpaye* (creeks), *ilinjera* (floodouts), *artnwep* (swamps), *arrkarakw* (bloodwoods) and *atnkerre* (coolibah trees).

If there is a reduction in groundwater, Traditional Owners' feel that these important places may change forever and their ability to maintain their cultural values in accordance with their traditional laws and customs will be hindered because many culturally relevant species, sacred places and cultural practices rely on groundwater, directly and indirectly. Of particular concern to Traditional Owners are the consequences associated with breaking the Law if sacred sites are damaged; they hold a strong belief that *apmerek–artwey (kirda)* who hold the

customary role of passing country onto the next generation, may get *arntetye* (sick) or *ampwarrenke* (die). Similarly, spiritual consequences for *kwertengerl (kurdungurlu)* who hold the customary role of protecting sites may feel responsible leading to feelings of *amperrnge* (sadness/unhappy) and *nyerre* (shame), and potential mental illness and social isolation or *althere* (homesickness).

The subject land for the Aboriginal Areas Protection Authority sacred sites Authority Certificate for the proposed work covers an area larger than the extraction zone but less than the estimated groundwater drawdown area (C2019/083). The current assessment identified 5 sacred sites within the AC subject land, not included in the AC. A further 32 sacred sites were identified outside the AC subject land and within the drawdown zone.

Based on in-depth discussions with Traditional Owners when undertaking this assessment, it is clear that Traditional Owners would prefer to sustain the current health of their country and maintain their custodial responsibilities to it by opposing the Singleton Water Licence, rather than the alternative scenario of seeing their country get sick, having their traditional rights and interests eroded, and holding the psychological stress and guilt associated with knowing their descendants may lose important cultural values which have been sustained by Kaytetye people for thousands of years.

Traditional Owners desire to continue their active role in managing their traditional lands and waters for the future benefit of their society and culture. They want to defend their cultural values and guard the foundation of their ancient religion. To enable this to occur, it is recommended that the broad range of cultural values identified be sustained and safeguarded in accordance with national and international cultural heritage management practice (UNESCO 2003; ICOMOS 2017).

In relation to the protection of 'cultural uses' of water, the WDWAP recognises that there are cultural values which relate to GDEs and will have additional requirements for cultural use protection such as soaks, ceremonial areas and hunting grounds, and that further work is required to ensure that these requirements are understood including ongoing monitoring to identify any changes or threats to these values being protected.[80] The plan also recognises Aboriginal people are custodians for water places and places relying on water.[81]

Good practice in the field of cultural heritage management includes working in cooperation with Traditional Owners to develop and apply an approach to cultural heritage management inclusive of a broad range of tangible and intangible cultural values. Traditional Owners' cultural values should not only be documented, Traditional Owners themselves should be empowered as active stakeholders and decision makers in matters that affect their land and waters.

[80] NTG 2018:28.
[81] NTG 2018:29.

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ATTACHMENT 1
List of plant and fungus species associated with the SWL Drawdown Area

List of plant and fungus species associated with the SWL drawdown area

This list of culturally important plant and fungus species observed or discussed within the Singleton Water Licence District and their indigenous names were collated by Jessica Burdon (CLC). The information is based on field observations, discussions with Traditional Owners, and Latz (1995 & 2018). The listed plants are referenced in Nano et al. (2021) as closely associated with sandplain and alluvial potential GDV in the Western Davenport study area. **Plants not referenced in Nano et al. (2021) are shown with an asterisk *.**

Genus	species	Family	Common name	Kaytetye	Alyawarra
Abutilon	otocarpum	MALVACEAE	lantern flower		*akeley-akeley*
Acacia	aneura	MIMOSACEAE	mulga	*artetye*	*artety*
Acacia	colei	MIMOSACEAE	Cole's Wattle, Soap wattle	*elkerte*	*alarrey*
Acacia	cowleana	MIMOSACEAE	sickle-leaved wattle	*elkerte*	*alerrey*
Boerhavia	coccinea	NYCTAGINACEAE	Tar vine		*ayep*
Capparis	umbonata	CAPPARACEAE	northern wild orange		*akerley*
Canthium	attenuatum	RUBIACEAE	native currant/bush plum		*ahakeye*
Carissa	lanceolata	APOCYNACEAE	conkerberry	*arnewetye/ perlape*	*arnwekty*

Chrysopogon	fallax	POACEAE	goldenbeard grass		*iylayemp-iylay, iylenty, lyayepelyay*
Corymbia	aparrerinja	MYRTACEAE			*Ilwemp*
Orymbia	opaca	MYRTACEAE	bloodwood		*arrkarakw*
Cymbopogon	ambiguus	POACEAE	native lemon grass	*arineng-arinenge*	*aherr-aherr/Apmwerr*
Cyperus	bulbosus	CYPERACEAE	bush onion	*erreyakwerre/ yerrakwerre*	*irreyakwerr*
Dactyloctenium	radulans	POACEAE	button grass		*apwert-arlkwenh*
Eragrostis	leptocarpa	POACEAE	love grass		*awertaw*
Eragrostis	eriopoda	POACEAE	woollybutt		*alyatywereng, antyer*
Eremophila	longifolia	MYOPORACEAE	Emu bush		*arlarterr, itnwerreng*
Eremophila	latrobei	MYOPORACEAE	Native fuchsia		*akwenthey, therrpeyt*
Erythrina	vespertilio	FABACEAE	bean tree, bats wing coral tree		*atwerety, Atjuritj*
Eucalyptus	camaldulensis	MYRTACEAE	river red gum	*aylpele*	*alperr*
Eucalyptus	victrix	MYRTACEAE			*ankerru*
Grevillea	striata	PROTEACEAE	beefwood		*irltenty*
Hakea	chordophylla	PROTEACEAE	northern corkwood	*ntyweyampe*	*ntyweyamp*
Hakea *	*macrocarpa*	*PROTEACEAE*	*Dogwood Hakea*		*andrreum*

Ipomoea	muelleri	CONVOLVULACEAE			*anaytapaytap*
Ipomoea*	*costata*	*CONVOLVULACEAE*	*Bush potato*		*anajara*
Melaleuca	lasiandra	MYRTACEAE			*dunkwerrk*
Muehlenbeckia	florulenta	POLYGONACEAE			*Inculdj*
Marsdenia*	*australis*	*ASCLEPIADACEAE*			*alkwarrer*
Pisolithus*	*tinctorius*	*SCLERODERMATACEAE*			*arrank-arrank, irrkweng*
Podaxis *	*pistillaris*	*TULOSTOMATACEAE*			*pwenkapw, pwengapweng*
Pterocaulon	serrulatum	ASTERACEAE			*inteng*
Rhyncharrhena	linearis	APOCYNACEAE	bush bean	*werrpe*	
Santalum	lanceolatum	SANTALACEAE			*alkwa*
Senna	artemisioides	FABACEAE			*apwen, arey-arey, areyawarr*
Solanum	chipendalei	SOLANACEAE			*akatyerr*
Streptoglossa	bubakii	ASTERACEAE			*inteng*
Tinospora	smilacina	MENISPERMACEAE			*atnwerl*
Triodia	pungens	POACEAE	soft spinifex	*alatyite*	*alatyeyt*
Ventilago	viminalis	RHAMNACEAE			
Yakirra	*australiensis*		Bunch Panic, Bilby grass		*alwepenh, yakerr*

ATTACHMENT M:

ADDENDUM: ABORIGINAL CULTURAL VALUES
SINGLETON WATER LICENCE

Prepared by Susan Dale Donaldson, Anthropologist
7 February 2023

ADDENDUM

Aboriginal cultural values impact assessment

Singleton Water Licence Drawdown Area

Singleton Pastoral Lease, Neutral Junction Pastoral Lease, Warrabri Aboriginal Land Trust and Iliyarne Aboriginal Land Trust, Northern Territory, Australia.

SUSAN DALE DONALDSON

ANTHROPOLOGIST

Environmental & Cultural Services

7 Feb 2023

WARNING: THIS REPORT CONTAINS REFERENCE TO ABORIGINAL PEOPLE WHO HAVE DIED

Contents

Executive summary

The Singleton Horticultural Project proposal has been referred to the Northern Territory Environment Protection Authority (NT EPA) for consideration as a 'proposed action' under section 48 of the NT *Environment Protection Act 2019* (NT EP Act). The Singleton Horticultural Project relies on the Singleton Water Licence (SWL). The Central Land Council (CLC) requested Susan Donaldson prepare an addendum to the Aboriginal Cultural Values Assessment report (Donaldson 2021) to specifically address whether the Singleton Water Licence will have a *significant impact* on Aboriginal cultural values identified across the Singleton Water Licence Drawdown Area (SWLDA).

The Singleton Water Licence Drawdown Area (SWLDA) extends across Singleton Pastoral Lease (PL), Neutral Junction PL, Warrabri Aboriginal Land Trust (ALT) and Iliyarne ALT. These lands traditionally belong to four Kaytetye speaking landholding groups, Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe, who have recognised native title rights to the SWLDA. These four Aboriginal groups have localised rights and responsibilities to the drawdown area in accordance with traditional laws and customs which give rise to their cultural values which are of high significance. Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe people are structurally interrelated with the other Kaytetye landholding groups and their Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa speaking neighbours all of whom culturally connect to the SWLDA and share many of the identified cultural values.

Traditional Owners' belief in the *Altyerre* Law is the cornerstone value arising from the cultural values assessment and the foundation of all other values including maintaining spiritual connections and protecting sacred sites; undertaking ritual activity; upholding ecological knowledge associated with natural resources; continuing customary roles and responsibilities; and being able to live and travel on country (Donaldson 2021).

These values primarily relate to social and spiritual themes linked to surface water, groundwater dependent ecosystems (GDEs) and other features across the SWLDA. The values relate to cultural places within the SWDLA, as well as cultural practises and traditions directly associated with the SWDLA. The cultural values across the SLWDA are maintained by the Traditional Owners today and are deeply rooted in their heritage and form the framework for their future.

Additional analysis has shown that the likely consequences (the 'impact') to each of the identified Aboriginal cultural values (the cultural aspects of 'environment' present on the selected site) caused by a reduction of groundwater (the 'action' and major 'impact source') will be significant.

A massive reduction in groundwater across the SWLDA will trigger major negative consequences to cultural places and values held by Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe people and their neighbouring tribal groups impacting culture and heritage; human health; community and economy; aquatic ecosystems; hydrological processes; and terrestrial ecosystems.

The potential impacts will likely or almost certainly result in highly significant cultural values to be lost, degraded and damaged, as well as notably altered, modified, obscured or diminished. The planned action, in my view, is likely to alter the existing use of a number of cultural and ceremonial sites, causing their values to notably diminish over time. The action is also likely to permanently diminish the cultural value of places for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people to which its values relate and permanently damage ceremonial features with cultural value. It is my view that the likely impact that this proposal may have on the identified cultural places values as linked to Groundwater Dependant Ecosystems (GDEs) across the SWLDA is significant.

Whilst Aboriginal Areas Protection Authority (AAPA) approval has been granted and aims to avoid harm to a number of identified sacred sites, the substantive risk of damage to, or interference with sacred sites on or in the vicinity of the AAPA subject land is highly likely (even if they are covered by Restricted Work Areas). Another highly likely consequence of harming sacred site in this matter is the distress caused to the Traditional Owners. In my view both of these potential impacts are significant and not adequately addressed by approvals received under the Northern Territory Aboriginal Sacred Sites Act 1989.

I am not aware of impact management measures aimed at avoiding, mitigating or reducing the potential adverse impacts to the identified cultural values beyond the AAPA Authority Certificate process. Accordingly, the duration and extent of the significant impact to the cultural values is unknown at this stage. Significant cumulative impacts of the proposal are also uncertain but likely given the changes to the climate, the existing and historical use of the site for agricultural activity, and the proposal to remove a large quantity of groundwater. Similarly, the 'end of life' plan for the proposal is undefined, so the ongoing or residual impacts to the cultural values is also uncertain.

1.0 INTRODUCTION

The Singleton Horticultural Project proposal has been referred to the Northern Territory Environment Protection Authority (NT EPA) for consideration as a 'proposed action' under section 48 of the NT Environment Protection Act 2019 (NT EP Act). The Singleton Horticultural Project relies on the Singleton Water Licence (SWL).

The Central Land Council (CLC) requested Susan Donaldson prepare an addendum to the Aboriginal Cultural Values Assessment report (Donaldson 2021) to specifically address whether the Singleton Water Licence will have a significant impact on Aboriginal cultural values identified across the Singleton Water Licence Drawdown Area (SWLDA).

A deeper analysis of the existing consultation data was carried out and considered in relation to the project's potential 'significant impact' as defined by the Northern Territory's *Environment Protection Act 2019* (NT EP Act), with consideration of the *Environment Protection Biodiversity Conservation Act 1999* (Cth) (EPBC Act), the Burra Charter (Australia ICOMOS 2013) and the Burra Charter Practice Note on Intangible Cultural Heritage and Place (Australia ICOMOS 2017).

In preparing this addendum, further engagement with Traditional Owners did not occur.

1.1 Definitions

The SWL proposal has been referred to the NT EPA for consideration as a 'proposed action' under section 48 of the NT EP Act because the proposed action has the potential to have a 'significant impact' on the environment.

> The meaning of 'action' under the NT EP Act includes a project; a development; an undertaking; an activity or series of activities; works, and a material alteration of any of these things.

The meaning of 'impact' (of an action) under the NT EP Act is an event or circumstance that is a direct consequence of the action; or an event or circumstance that is an indirect consequence of the action and the action is a substantial cause of that event or circumstance. An impact may be a cumulative impact and may occur over time.

The NT EP Act defines 'significant impact' as an impact of major consequence having regard to the context and intensity of the impact; the sensitivity, value and quality of the environment impacted on, and the duration, magnitude and geographic extent of the impact.

The meaning of 'environment' under the NT EP Act is all aspects of the surroundings of humans including physical, biological, economic, cultural and social aspects.

The meaning of 'environmental values' under the NT EP Act is aspects of the environment that are important or serve an important function, such as a river that provides beneficial uses to ecological and human communities, a site that is sacred to Aboriginal people, or an animal or plant species that is threatened.

Further to the criteria outlined in the NT EP Act, in determining whether a proposal is capable of having a 'significant impact' on the environment the NT EP Act may have regard to various matters including (NT 2021: 19):

1. objects of the NT EP Act or other NT environmental legislation
2. value (e.g., effects on environmental factors and objectives), sensitivity and quality of the environment which is likely to be impacted
3. extent (intensity, duration, magnitude, frequency and geographic footprint) of likely impacts
4. consequence of likely impacts (or change)
5. resilience of the environment to cope with the impacts or change
6. cumulative impact with other proposals
7. connections and interactions between parts of the environment to inform a holistic view of impacts to the environment

8. level of confidence in the prediction of impacts and the success of proposed mitigation.

The decision about whether a potential impact is considered 'significant', for the purpose of the NT EP Act, is one for the Northern Territory Environmental Protection Authority.

The term 'significant impact' has been adopted in other jurisdictions, and most notably in relation to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), which requires Ministerial approval if an action will have a significant impact on matters of national environmental significance (MNES). Although the EPBC Act Significant Impact Guideline (2013) (EPBC Guideline) is not directly relevant to Singleton Station as it deals with MNES, there is useful information in relation to how proposals with potential impacts on Indigenous heritage values are considered against the significant impact test.

Under the EPBC Act a 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. Most of the national criteria are incorporated into the NT EP Act criteria listed above.

The EPBC Guideline contains useful information in relation to how proposals with the actions likely to cause impacts on Indigenous heritage values associated with World Heritage properties and National Heritage places are considered against significant impact criteria.

<u>Significant impact criteria for World Heritage properties and National Heritage places with Indigenous heritage values</u>

An action is likely to have a significant impact on the Indigenous heritage values of a place if there is a real chance or possibility that it will cause (EPBC Guideline 2013:16, 19):

- one or more of the values to be lost
- one or more of the values to be degraded or damaged, or
- one or more of the values to be notably altered, modified, obscured or diminished.

Examples of actions likely to have significant impact on World Heritage properties and National Heritage places associated with Indigenous heritage values

Examples of how an action is likely to have significant impact on Indigenous heritage values of a place include if there is a real chance or possibility that the action will (EPBC Guideline 2013: 18, 22):

- restrict or inhibit the existing use of a place as a cultural or ceremonial site causing its values to notably diminish over time;
- permanently diminish the cultural value of a place for a community or group to which its values relate;
- alter the setting of a place in a manner which is inconsistent with relevant values;
- remove, damage, or substantially disturb cultural artefacts, or ceremonial objects, in a place, and
- permanently damage or obscure rock art or other cultural or ceremonial features with heritage value.

The EPBC Guideline notes that the above are general examples and their application will depend on the individual values of each place, and that an alteration or disturbance which is small in scale may have a significant impact if a feature or component of a place embodies values that are particularly sensitive or important (2013:18).

Moreover, the EPBC Guideline also notes that to have a significant impact on Indigenous heritage values, it is not necessary for an action to impact upon the whole of the place, all of the values of a place, or a whole value of a place (2013: 18). It is sufficient if an action is likely to have a significant impact on a part, element, or feature of a place which embodies, manifests, shows, or contributes to the values of that place.

Identifying places with 'Indigenous heritage values' and levels of cultural significance is required in order to determine the level of any impacts. The concept of cultural significance is used in Australian heritage practice and legislation to encompass all of the cultural values and meanings that might be recognised in a place. Cultural significance is the sum of the qualities or values that a place has, including the five values—aesthetic, historic, scientific, social and spiritual, for past, present and future generations (Article

1.2 of the Burra Charter 2013). Of particular relevance to this matter are the social and spiritual values which form cultural significance for Traditional Owners.

Social value refers to the associations that a place has for a particular community or cultural group and the social or cultural meanings that it holds for them (Burra Charter 2013). Examples include places that are:

- important as a local marker or symbol
- important as part of community identity or the identity of a particular cultural group
- important to a community or cultural group because of associations and meanings developed from long use and association

Spiritual value refers to the intangible values and meanings embodied in or evoked by a place which give it importance in the spiritual identity, or the traditional knowledge, art and practices of a cultural group (Burra Charter 2013). Spiritual value may also be reflected in the intensity of aesthetic and emotional responses or community associations, and be expressed through cultural practices and related places. The qualities of the place may inspire a strong and/or spontaneous emotional or metaphysical response in people, expanding their understanding of their place, purpose and obligations in the world, particularly in relation to the spiritual realm. Spiritual values can include:

- places that contribute to the spiritual identity or belief system of a cultural group
- places that are a repository of knowledge, traditional art or lore related to spiritual practice of a cultural group
- places that are important in maintaining the spiritual health and wellbeing of a culture or group
- the physical attributes of a place which play a role in recalling or awakening an understanding of an individual or a group's relationship with the spiritual realm
- spiritual values of the place that find expression in cultural practices or human-made structures, or inspire creative works

1.2 Summary of the Aboriginal cultural values

Donaldson (2021) identified six Aboriginal cultural values associated with surface expressions of groundwater as well as groundwater dependent ecosystems (GDEs) across the SWDLA[1]. These Aboriginal cultural values are:

- Following the Altyerre Law and cultural obligations
- Maintaining spiritual connections and protecting sacred sites
- Undertaking rituals
- Upholding ecological knowledge associated with natural resources
- Continuing customary roles and responsibilities
- Being able to live and travel on country

These tangible and intangible cultural values are held by the members of four Kaytetye speaking landholding groups; the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe. Whilst these values are found in various forms across Aboriginal Australia, it is the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people who observe these values in the specific, localised context of the SWLDA. Accordingly, these six cultural values are highly significant to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. Aspects of these cultural values are also shared by members of other Kaytetye speaking landholding groups as well as the members of the neighbouring Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa language groups.

For further details about these cultural values and the groups to which they relate refer to Donaldson (2021).

[1] A groundwater dependant ecosystem (GDE) is the natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis so as to maintain their communities of plants and animals, ecological processes and ecosystem services. More specifically, aquatic GDE (Type 2) are ecosystems dependent on the surface expression of groundwater (wetlands, springs, soaks) and terrestrial GDE (Type 3) are ecosystems dependent on subsurface presence of groundwater (groundwater is not visible from the earth surface and the water table is within the root zone of the plants, either permanently or episodically) (Richardson et al., 2011).

2.0 ANALYSIS OF CULTURAL VALUES

This section provides a deeper analysis of the data presented by Donaldson (2021) in order to present a more detailed description of the identified cultural values and to determine the level of impact the proposed action may have to those values and associated places (as presented in section 3).

As noted above the Kaytetye speaking Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people observe each of the six identified values (listed in section 1.4) in the specific, localised context of the SWLDA. The critical point here is that the connection to the SWLDA held by these people are unique. Accordingly, these cultural values are highly significant to the members of the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe groups. Additionally, aspects of these six cultural values are also shared by members of other Kaytetye groups as well as the members of the neighbouring Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa language groups.

2.1 Types of sacred sites and their inherent cultural value

Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours maintain these six key cultural values across the SWLDA in relation to 40 sacred sites (Ihangkele) associated with surface expressions of groundwater, aquatic GDEs and terrestrial GDEs. Whilst there are additional sacred sites across the SWLDA that do not depend on groundwater (e.g., a few rocky outcrops and other rock formations), approximately 95% of sacred sites present across the SWLDA are groundwater dependant. Accordingly, the majority of sacred sites across the SWLDA are vulnerable or sensitive to changes to groundwater levels.

Sacred sites featuring surface expressions of groundwater (soakages, springs, wetlands including swamps) are highly valued by Aboriginal people in the desert region where it is common for Ancestral activity to indicate water sources and the pathways between them (Berndt 1976:141).

Soakages dominate the cultural environment across the SWDLA; over half of the sacred sites identified across SWLDA are soakages which continue to be highly significant to the Traditional Owners as critical

source of water and a guide for travelling through country. Across the SWLDA 28 sacred soakages (ngentye) have been identified[2].

According to Peterson, soakage waters are the most important water sources under all but the worst conditions and are relied upon by Aboriginal people when other surface water sources diminish (Peterson 1976: 26). Across the SWLDA, soakages are the spiritual embodiment of Ancestral activity and direct subsistence patterns relative to environmental conditions across the region (Peterson 1976:25). Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people are culturally obliged to protect soakages, as well as undertake rituals and maintain spiritual connection to them. In doing so the Altyerre Law is followed. It is also critical that they uphold ecological knowledge associated with soakages in order to live and travel on country (Bell 2002:92).

One sacred swamp (artnwep) was also identified within SWLDA[3]. The presence of swamps in a desert environment supports an abundance of life forms. Swamps are often the focus for Aboriginal ritual activity because they can sustain large gatherings of people over an extended period of time. The swamp supports the growth of multiple aquatic GDEs including water lilies. The swamp is the foci of an important Iliyarne increase ritual aimed at generating an abundance of lilies to feed the people and appease the Ancestors dwelling at the site. Lilies are highly culturally significant and are specifically associated with this locality and in this region specifically associated with Iliyarne country. Water lilies growing at this swamp are the cornerstone identification feature for Iliyarne people and country. Lilies are the Iliyarne 'trade mark' celebrated by Ileyarne people through traditional songs, dance and painting.

For these reasons, the sacred soakages and the sacred swamp within the SWLDA are highly significant to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours.

Additionally, the interrelationship between these sites and places in the surrounding landscape is very important. For instance, WILYANINYE is a permanent spring on Wakurlpu country, 5km to the north of the SWLDA on Singleton Station. WILYANINYE is sacred due to its association with bush plum and baby dreaming[4]. The place is also highly valued as a place to live in the hot dry months when other water sources are depleted. According to Nungarrayi, 'in the olden days we lived off the spring water. When all

[2] A soakage is a location where shallow groundwater can be accessed by digging (Box et al 2008:1399).
[3] A swamp is a shallow waterbody with emergent vegetation or a vegetated area with saturated soil (Box et al 2008:1399).
[4] Koch, K., G. Koch, P. Wafer and J. Wafer (1981: 35).

the soakages dried up that was where we lived, at Wilyaninye, because of the permanent spring water…' (Bell 2022:121).

Sacred sites with root systems dependant on groundwater are also highly significant to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. Six sacred sites classified as terrestrial GDEs have been identified across the SWLDA; three bloodwood trees (arrkarakw), one coolibah tree (atnkerre), one supplejack tree and one ghost gum tree. Each of these groundwater dependant trees is highly significant to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people because, like soakages, they are the spiritual embodiment of Ancestral activity and the basis for specific ritual activity. These trees dominate the cultural landscape due to their longevity and offer a seemingly everlasting array of reliable natural assets; medicine, good shade, food, habitat for fauna. Whilst the sacred tree species within the SWLDA individually offer specific natural resources (sap, bark, food etc), the high significance of these trees is primarily due to their intangible religious associations.

The three sacred creeks (elpaye) and two sacred floodouts (ilinjera) identified across the SWLDA are also highly significant to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people[5]. These features represent spiritual Ancestral activity and also attract an abundance of natural resources associated with important cultural practices undertaken by Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. The sacred creeks are highly significant because they are a source of water and are a place to gather for cultural teachings. The sacred floodout is highly significant because it is an important hunting ground at certain times of the year.

Each of the 40 sacred sites within the SWLDA, regardless of their natural features, are the foci for Kaytetye people following the Altyerre Law and undertaking cultural obligations including activities associated with protecting them. These places enable Kaytetye people to maintain spiritual connections and undertake rituals associated with groundwater and GDEs. Each of the 40 sacred sites within the SWLDA, regardless of their natural or physical form, are deeply valued by Kaytetye people because they are the source of spiritual essence and ongoing religious sustenance. The cultural significance of each of these 40 sacred sites is high; these places are highly valued. The majority of sacred sites across the SWLDA serve important functions for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe and their tribal neighbours.

[5] Whilst their dependence on groundwater can vary both between sites and for an individual site throughout the year or longer periods, creeks and floodouts are a mixture of Type 2 and Type 3 GDEs, depending on how the water table interacts with them (pers. comm. Ryan Vogwill 25.01.2023).

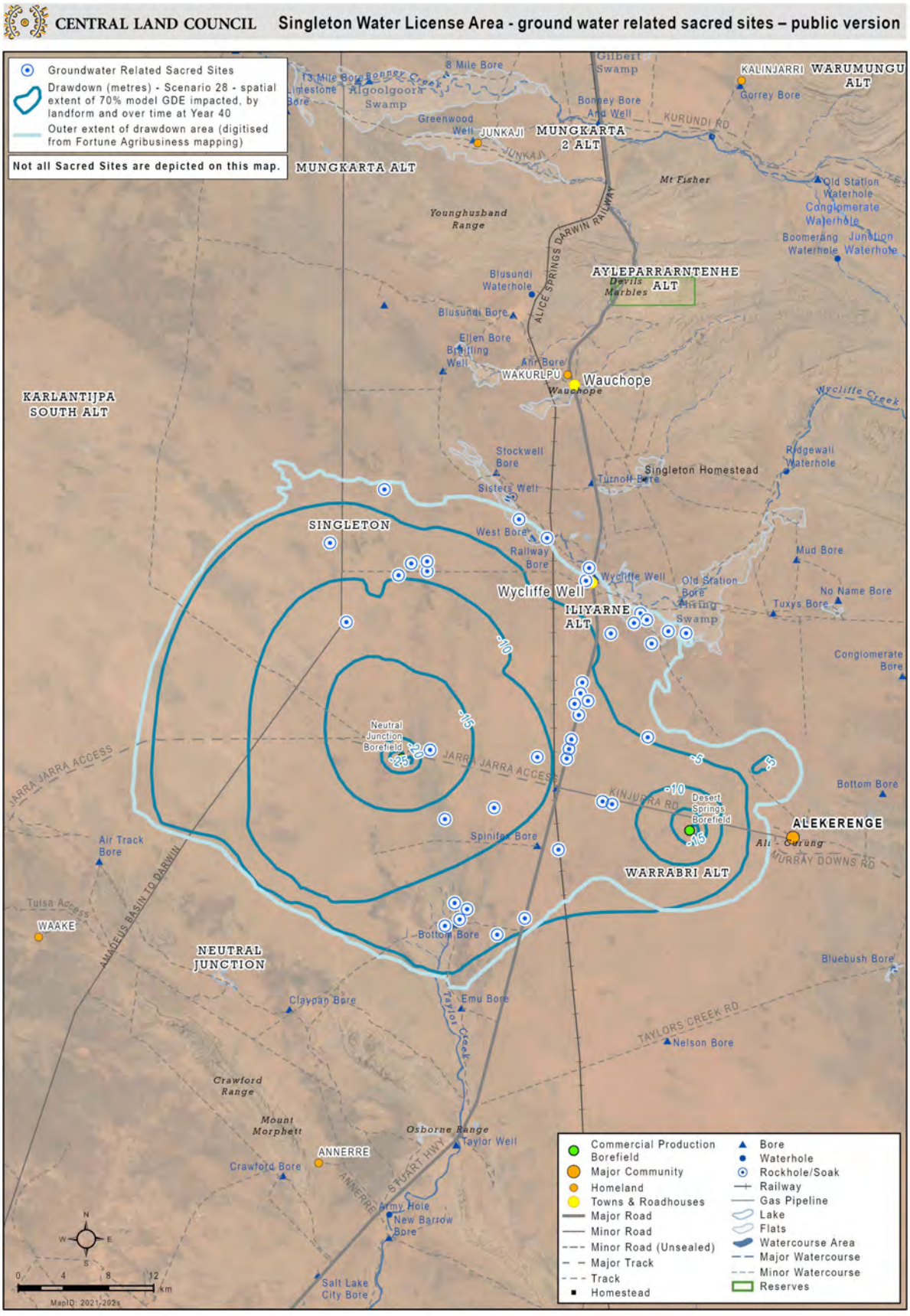

Figure 1 Groundwater related sacred sites SWLDA (CLC 2022)

2.2 The present condition of the sacred sites and their relative value

Traditional Owners are part of a dynamic and complex system designed to sustain their physical, biological, economic, cultural and social environment. Whilst the overarching Dreamtime Law is a constant, the system enables changes within it. For instance, lost cultural knowledge can be regained through dreams and replaced back into the country, for future generations (Bell 2022: 92 – 93); a sacred tree may be re-established by a sapling of the same species at the same location; a person inadvertently entering a sacred place can be punished by internal systems of controlling order (Berndt 1996: 348); and a group may have to temporarily rely on a neighbour's permanent water source in times of serve drought.

These are examples of how Aboriginal society perpetuates and adapts when faced with isolated incidents of change and disorder. Berndt argues that deviations (as distinct from minor variations) by Aboriginal people from their own social norms attract sanctions implemented by senior members of the group which can lead to the death of perpetrators (Berndt 1996: 338 – 344).

What happens today when a sacred site is lost or degraded as a result of major external influences?

Changes to the Aboriginal social system caused by more severe activities have been documented across the region over the past century and a half and include the depletion of critical waterholes by explorers and their stock, massacres of people whose detailed knowledge of country was lost forever, and the raping of women (Bell 2022:62-63). According to Bell the impact caused by these types of actions were 'dramatic' and led to 'carefully managed resources destroyed by persons with whom they couldn't communicate and to whom the Law did not apply…. their ability to care for their country and their dependants was immediately jeopardised, no longer was knowledge of country enough for survival' (2022:62).

As alluded to by Bell, punishment can be difficult if the perpetrator or perpetrators are not part of Aboriginal society, that is, they are beyond the control or influence of the senior members of the group who make decisions about the punishment.

Whilst some sacred sites across the SWLDA have already suffered partial damage as a result of agricultural activity (use of bore water, construction of fences) and environmental factors (drought, fires), the

majority of sacred sites surveyed for this assessment were intact and ranged from moderately healthy to very healthy. Some of the soakages visited were dug out by hand and water was collected.

The few sacred sites observed in poor condition were considered by the Traditional Owners to have the ability to regain good health by way of human or spiritual action (regrowth or replanting). One bloodwood tree which had been burnt to the ground, seemingly in poor condition, was survived by fresh shoots rising from its base. One Bean Tree (*Bauhinia cunninghamii*) marking a soakage appeared very dry and possibly dead. Traditional Owners maintained that the bean tree was planted by their human Ancestors as a land mark to assist people to locate the soakage and that it is now the customary role of the present generation to replant another bean tree to serve the same function.

Traditional Owners have maintained these cultural practices and beliefs for generations but now fear that a reduction in the groundwater, for the duration and magnitude proposed, will undermine these cultural and environmental management techniques.

Does the cultural value of a sacred site alter if a site is harmed (by any action) or the quality (environmental condition) of the site is poor?

Yes and no. The value of the place remains significant to Aboriginal people because the spiritual essence endures in the country, waiting to remerge at some point in the future in the same location. The songs, designs and dances are also retained in Aboriginal people's repertoire of cultural practices. The loss occurs at the point of cultural connection between Traditional Owners and the place; given the place may no longer be evident or visible, the intangible cultural values of cultural connection are broken. The loss is felt in the sphere of cultural obligation between Traditional Owners, the place and their Laws; the intangible cultural values invoked when fulfilling customary roles and responsibilities are absent. The consequences of the loss also impact ritual activity, being able to live and travel on country and being able to protect sacred sites; the intangible and tangible cultural values associated with these activities are severely undermined.

Does a reduction in the number of sacred sites in one's country mean that the remaining sites become more precious?

Each sacred site is important for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours. A scarcity in water resources would trigger a reliance on the remaining water resources, consequently increasing the significance of the remaining resource. In this context the remaining sacred sites have an increased cultural value.

A reduction in the quantity of sacred sites over time over the geographical extent of one's country will result in severe sanctions within Aboriginal society aimed at the senior members of the group responsible for maintaining a healthy country. So, whilst the remaining sites increase in value, the Traditional Owners will likely undertake death and mourning rituals in response to seeing country dry out and sacred sites suffering permanent harm. Whilst the remaining sites might become the focus for cultural and ritual activity, the places that are lost will never be forgotten and the trauma associated with the loss will endure.

2.3 Geographical extent and the Kaytetye land tenure system

In the present matter, to understand how the geographical extent of the proposed works might impact the identified cultural values, it is essential to understand the localised way in which Kaytetye people connect to the land according to their traditional laws and customs.

The SWLDA lies in the mid north western extent of land owned by Kaytetye speaking people (Figure 2). Kaytetye country comprises at least 15 landholding or estate groups, each group being responsible for all aspects of their respective traditional lands. Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe country is within the SWLDA, with Jarra Jarra to the west, Arrawatyen to the north east, Lyentyawel Ileparranem to the east, Warlekerlange to the south west, and Alapanpe, Akalperre, Arlekwarr, Ertwerrpe, Thangkenharenge, Kwerrkepentye and Entengele to the south[6]. A large portion of Kaytetye country is affected by this proposal.

[6] Turpin and Ross 2004: 20

Figure 2 Kaytetye country (Tindale 1940).

Each group holds the traditional responsibility to appease and maintain connections with the spiritual Ancestors residing in their respective lands; Anerre people, for instance, hold the traditional responsibility to appease and maintain connections with the spiritual Ancestors residing in Anerre land and to protect the sacred sites on their country. Similarly, the Waake-Akwerlpe, Iliyarne and Arlpwe people are charged with upholding the same laws and customs on their respective lands. Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people have recognised native title rights under Australia law across the SWLDA, specifically:

- Iliyarne people have associations to the north east extent of the SWLDA in relation to 19 sacred sites (nine of which they share responsibility for with other groups);
- Arlpwe people have associations to the central and eastern extent of the SWLDA in relation to six sacred sites (three of which they share responsibility for with other groups);
- Anerre people have associations to the north central and southern extent of the SWLDA in relation to 23 sacred sites (12 of which they share responsibility for with other groups); and the
- Waake-Akwerlpe people have associations to the western and northern extent of the SWLDA in relation to five sacred sites (two of which they share responsibility for with other groups).

Viewing each group's connection to the SWLDA at a localised level allows us to understand the potential impact, from a Kaytetye perspective, in relation to the cultural value associated with following the Altyerre Law by undertaking certain rituals, fulfilling cultural obligations including the protection of sacred sites, and maintaining spiritual connections. Each sacred site is important to each of these groups, in particular, and serve an important function for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours. A large and important extent of Iliyarne country and Anerre country will be affected by the proposal (and in turn the identified cultural values), and important parts of Waake-Akwerlpe country and Arlpwe country (and their cultural values) will also be affected.

2.4 Context in relation to focal sacred sites

In relation to context of the proposal and the value of places (sacred sites), it is critical to understand how most desert groups relate to a focal sacred site or cluster of sites, being the loci of religious powers for their particular group and the basis for the group's name. Whilst all sacred sites are important, focal sites hold another layer of import by virtue of their high religious significance and point of group identification. Focal sacred sites are particularly sensitive and culturally important for the associated Traditional Owning group.

Within the SLWDA a focal complex of sacred sites exists for the Iliyarne group; ILIYARNE ILPAIYE, a creek and associated ghost gum trees interlinked with the highly significant MPWEREMPWER-ANGE, a swamp and large coolibah tree. This highly significant site complex, within the SWLDA, is the foundation of Iliyarne people's cultural identity as the basis of the group's name, as the focal mythological place for this group and as the primary food source for the group. It is irreplaceable. This focal site complex is the basis for Iliyarne Law, physical wellness, ritual and spiritual wellbeing. Thus, in the context of the local cultural landscape, compared with the other groups whose focal sacred sites lay beyond the SWLDA, the SWLDA has additional layers of cultural meaning to Iliyarne people and commensurately greater sensitivity to impact. The Iliyarne focal sacred sites across the SWLDA serve an important function for Iliyarne people and how they relate to their tribal neighbours.

2.5 Context and sacred sites as boundary markers

In accordance with the traditional Kaytetye land tenure system, there are multiple sacred sites within the SWLDA where two or more of the traditional Aboriginal landholding groups converge, that is, their respective countries share boundary zones. Traditional boundaries in this region are usually marked by sacred sites, which are often shared by the neighbouring groups. Whilst all sacred sites are important due to their spiritual value, sacred sites that are also boundary markers hold an additional value to the respective groups because of their function to organise how people are located within the cultural landscape. These boundary sites act as navigational markers and are integral to cultural educational practices and intergroup relations. It is understood that these boundaries were established in the Altyerre and Kaytetye people today are obliged to abide by them.

The anthropological research for this investigation identified 12 sacred sites within the SWLDA that are important boundary markers and of high cultural value to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. Two of these boundary markers indicate locations where three landholding groups come together (both large ghost gum trees). The other 10 sacred sites indicate boundaries for two neighbouring groups (nine soakages and one large ghost gum tree). The sacred sites on Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe country which indicate tribal boundaries between each of the groups are deeply important and particularly sensitive to change. Negative impacts to these culturally prominent sites could lead to long-term problems in terms of how Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people relate to themselves and each other, and may affect their ability to undertake cultural obligations according to traditional laws and customs. Sacred sites that indicate tribal boundaries serve an important function for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours.

2.6 Connections and interactions across the landscape

Consideration of the connections and interactions between parts of the environment needs to be considered in the context of the Kaytetye land tenure system. According to traditional laws and customs this system of land tenure is fundamentally localised whilst concurrently deeply interconnected with the broader cultural landscape associated with the neighbouring Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa speaking people.

Another way to inform a holistic view of the environmental and cultural landscape is to consider connections and interactions between the land and people directly associated with the SWLDA in relation to the surrounding land and people. So, whilst the Kaytetye groups Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe are the Traditional Owners of the area covered by the SWLDA, other Kaytetye landholding groups as well as Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa speaking people, maintain a different type of association to the SWLDA involving kinship, trade, historical experiences, social obligation, resource collection and ritual co-operation.

In particular, those parts of the SWLDA where there are no identified sacred sites are highly valued by Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa people as hunting grounds and as sources of natural resources of cultural value. In these areas multiple groups maintain ecological knowledge associated with collecting natural resources, continuing customary roles and responsibilities and undertaking rituals, and are able to live and travel on country. The natural environment, including the seasons, dictates Aboriginal land use practises. Many Aboriginal residents of nearby communities and outstations, including Alicurung, regularly visit the SWLDA on a seasonal basis, to 'go hunting' in their 'back yard'. These activities are valued and are an integral part of what it means to be an Aboriginal person in Central Australia.

Understanding these regional connections and seasonal interactions allows a greater appreciation of how the SWLDA contains important cultural values for Aboriginal people well beyond the immediate SWLDA. Lands rich in natural resources in a desert environment serve an important function for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours. Changes to the cultural landscape directly within the SWLDA will potentially impact people and country across the region.

2.7 Geographical extent of each value

The geographical extent of each cultural value needs to be considered from an Aboriginal ontological perspective where all living things are interconnected and interact with the spiritual world.

Whilst the deep and powerful spiritual essence is found at 'sacred sites' which are treated with respect and reverence, spiritual Ancestors are also located across the broader landscape and are part of everyday activities such as hunting and swimming and preparing a camping place.

The 40 sacred sites across the SWLDA do not exist in isolation from each other, but rather they are interconnected to form the core of the Aboriginal cultural landscape held together by the identified cultural values. There are no unimportant spaces or places not associated with Aboriginal laws and customs or the recognised native title rights and interests[7]. All aspects of Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe country are important to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people and their tribal neighbours.

[7] The recognised native title rights across the SWLDA include the right to access and travel over any part of the land and waters; the right to live on the land, and for that purpose, to camp, erect shelters and other structures; the right to hunt, gather, take and use the natural resources of the land and waters, including the right to access, take and use natural water resources on or in the land; the right to access, maintain and protect places and areas of importance on or in the land and waters; and the right to engage in cultural activities.

3.0 ANALYSIS OF DATA CONSIDERING LEVEL OF IMPACT

This section aims to determine the likely consequences (the 'impact') to the identified Aboriginal cultural values (the cultural aspects of 'environment' present on the selected site) caused by a reduction of groundwater (the 'action' and major impact source). Consideration is then given to the level of impact (major/ minor) in terms of the context and intensity of the impact, the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.

3.1 The action – available data and existing opinions

It is acknowledged that whilst there is a current lack of region-specific groundwater drawdown impact criteria (and data) and an absence in the assessment of the risks to aquatic GDEs (Hydro Geo Enviro 2021:7), it is understood that 'water drawdown presents a potential risk to sacred sites that include features dependent on groundwater (i.e., soaks and culturally significant trees)' (GHD 2022:92). It has been argued that a reduction in groundwater can have 'severe negative impacts on GDEs' (Nano et al. 2021:1).

GHD also highlighted that groundwater pumping will lower the water table beneath and surrounding the bore field and because some sacred sites including trees are dependent on access to the groundwater, lowering the water table may reduce the trees' access to water which in turn could impact their health (2022: 126). GHD recognise that 'some soaks are part of sacred sites' and that depending on the connection between the soaks and the groundwater being pumped for irrigation, it is possible that pumping could reduce the water available to soaks (2022: 126). GHD also acknowledge the relationship between the health and wellbeing of Aboriginal people and the health of country (GHD 2022: 126).

Despite recognising these key factors, GHD found that there was only a *medium* residual risk associated with the proposal in relation potential impacts to sacred sites or Aboriginal cultural values from water drawdown and a *low* residual risk associated with direct impacts to sacred sites (GHD 2022:129).

Impacts to Aboriginal cultural values caused by actions undertaken during the course of a development project are usually considered as either direct or indirect. The NT Environmental Impact Guidance for proponents (NT Guide 2021) defines 'impact of an action' as an event or circumstance that is:

- a direct consequence of the action; or
- an indirect consequence of the action and the action is a substantial cause of that event or circumstance.

According to this definition an action is quite broad in that it can include a project, a development, an undertaking, an activity or series of activities or works (NT 2021). According to GHD, direct impacts to Aboriginal cultural values are not anticipated as part of the proposal (2022: 126).

Utilising the available albeit limited data concerning standard consequences relating to a reduction in groundwater, Donaldson (2021) identified a number of likely impacts to Aboriginal cultural values associated surface water, groundwater dependent ecosystems (GDEs) and other features within the SWLDA:

- Aboriginal people's sacred sites will be harmed
- Aboriginal people will suffer from emotional and physical stress
- Flora and fauna species required by Aboriginal people for ritual activity will be eradicated or diminished
- Natural resources required by Aboriginal people for hunting and gathering will be eradicated or diminished
- Aboriginal people's ability to live on and travel across their traditional lands will be hindered
- Future generations of Aboriginal people will suffer from a loss of cultural practices and cultural identity

The next sections outline the severity of these consequences against NT guidelines and other relevant criteria, to assess whether or not the impacts should be considered 'significant'.

3.2 NT EPA environmental factors

It is clear that a range of important tangible and intangible Aboriginal values relating to cultural aspects of the environment are present across the proposed development area (Donaldson 2021; GHD 2022; Bell 2002; CLC 2008; Koch & Koch 1993; Turpin 2003).

The NT EPA's pre-referral screening tool outlines the NTG's environmental factors and objectives and the indicative values associated with them. The framework is useful for the present assessment in that it provides a thematized structure within which to consider areas where the proposal may have the potential to have a significant impact on the environment (limited here to factors relating to cultural aspects of the environment).

The relevant factors that relate to the identified cultural values across the SWLDA are culture and heritage, human health, community and economy, aquatic ecosystems, hydrological processes, and terrestrial ecosystems, as detailed below.

Potential effects on NT EPA's environmental factors, objectives and indicative values (NT 2021: 25 – 30)		
NT EPA Factor	**Objective**	**Indicative environmental value**
Culture and heritage	Protect sacred sites, culture and heritage.	Sacred sites
Human health	Protect the health of the Northern Territory population.	Drinking water Recreational water Bush tucker
Community and economy	Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians	Dwellings, homelands, communities, towns and suburbs where people live Livable environment (access to natural resources including bush food, recreational use of the natural or built environment e.g. fishing, cycling, sports, picnics)

		Healthy lifestyles (sense of wellbeing and good mental health) Vulnerable sectors of the community Connections to culture and community (Aboriginal rights and interests, including right of access; cultural practices; sense of belonging, inclusion, connectedness and cohesion; healthy social relationships).
Aquatic ecosystems	Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Groundwater dependent ecosystems Species of social, cultural, livelihood and/or economic significance Biological and functional diversity
Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	Culturally important water features or other features affected by water level Present and future uses, and users of water
Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	Species of social, cultural, livelihood and/or economic significance

These factors and associated objectives and indicative (environmental / cultural) values have been incorporated into this impact assessment (3.3).

3.3 Impact assessment

3.3.1 AAPA

As outlined by GHD the Authority Certificate C2019/083 covers portions of property parcel NT Por 653 (Singleton Station) and most of, but not all of, the groundwater extraction drawdown area (2022:126). GHD note that harm to sacred sites is not permitted under C2019/083, including due to water extraction, and the proposal is being planned to avoid harm. Similarly, harm to sacred sites outside of the C2019/083 subject land must also be avoided, according to GHD (2022:126).

The project AAPA Authority Certificate (AC) (2019/083) stipulates work restrictions aimed at protecting three sacred sites within the drawdown area (RWA 5, RWA 9 and RWA 10 associated with a creek, ghost gums, a waterhole, soakages and bean trees) and eight sacred sites beyond the drawdown area (RWA 1, RWA 2, RWA 3, RWA 4, RWA 6, RWA7 and RWA associated with ghost gums, bloodwoods, soakages, a 'depression hollow', two sand ridges, creeks, waterholes and swamps).

Unfortunately, not all of the 40 sacred sites identified by Donaldson (2021) were identified by AAPA as being present in the AC subject land and are thus not covered by any of the 10 RWAs in the AAPA Authority Certificate (AC 2019/083) outlined above. Additionally, a large number of sacred sites were identified by Donaldson within the drawdown area beyond the AC subject land, as described below:

> '…Critically, the current assessment identified five sacred sites within the AC subject land not identified in the AC or overlapped by any of the RWAs. These sites are all within the drawdown area and are all associated with GDE features; all are soakages. An additional 32 sacred sites were identified outside the AC subject land and within the drawdown zone…' (Donaldson 2021:70).

A direct impact to a sacred site is often thought of as occurring as a result of a physical and highly visible disturbance, such as when a grader knocks down a sacred tree or backfills a sacred soakage. These forms of direct impact causing harm to sacred sites are usually avoided by ensuring the AAPA Restricted Works Area (RWA) process is applied.

Drilling multiple bores to extract groundwater is proposed as a key activity in the current development. In my view activities that are critical to the proposed development with likely negative consequences to the identified cultural values should be considered within the 'direct impact' framework. Having said that, it is my view that even if the extraction of groundwater is classified as causing an 'indirect impact', the removal of groundwater will still be the substantial cause of events that follow, that is, harm to sacred sites and distress for the Traditional Owners.

In my view whilst a RWA may protect a sacred site from the direct impact of a drilling rig, for example, but it will not protect a sacred sites from the impact of a reduction in groundwater on which the existence of the sacred site depends. Accordingly, all of the identified GDE sacred sites, be they covered by a RWA or not, have the potential to be harmed by a reduction in groundwater which in my opinion equates to significant impact. The consequences of significant impact to sacred sites are outlined in the table below.

3.3.2 IMPACT SUMMARY TABLE

SWL ABORIGINAL CULTURAL VALUES IMPACT ASSESSMENT (NT EP Act 2019 criteria)				
ABORIGINAL CULTURAL VALUES PRESENT ON SWLDA	CULTURAL SIGNFICANCE	IMPACT CAUSED BY REMOVAL OF GROUNDWATER	POTENTIAL FOR IMPACT	LEVEL OF IMPACT
Maintaining spiritual connections and protecting sacred sites, specifically in relation to the 40 identified GDE sacred sites (Ihangkele) within the SWLDA.[8]	High	Within the SWLDA Iliyarne people have the localised responsibility in accordance with their traditional laws and customs to protect 19 sacred sites (nine of which they share responsibility for with other groups); Arlpwe people have the same local responsibility to protect six sacred sites (three of which they share responsibility for with other groups); Anerre people have the same local responsibility to protect 23 sacred sites (12 of which they share responsibility for with other groups); and the Waake-Akwerlpe people have the same local responsibility to protect five sacred sites (two of which they share responsibility for with other groups). The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect sacred sites, culture and heritage* in the following ways: • Harm to sacred sites (Ihangkele) will lead to the punishment of the senior Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people, by	Likely	Significant

[8] See pages 29 - 36 of Donaldson (2021) for identification of these cultural values and pages 69 -74 of Donaldson (2021) for the impact of disruption to them.

		Ancestral Spirit beings, for not protecting the sacred sites within their respective countries. • Harm to sacred sites (Ihangkele) will cause major negative consequences to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people's spiritual connection to country because they maintain that their etnwenge (a person's spirit) is deeply connected to one's country (apmere), sacred sites (Ihangkele) especially to water (arntwe). • Harm to sacred sites will subsequently cause distress to the Aboriginal custodians of the sacred sites that have been damaged or destroyed. • Given the identified sacred sites are the source of spirituality and ongoing religious sustenance, harm to the sacred sites will have enduring and sever consequences to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people's spiritual health and well-being. • Harm to a sacred site could interrupt the spiritual connection Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people have to that place and inhibit the spiritual connections if the place no longer exists or is permanently damaged.		

		• Harm to sacred sites is an offence under the *Northern Territory Aboriginal Sacred Sites Act 1989* According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will: • restrict or inhibit the existing use of cultural or ceremonial sites causing the values to notably diminish over time • permanently diminish the cultural value of places for Traditional Owners		
Following the Altyerre Law and cultural obligations across the SWLDA	High	For Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people, abiding by the Altyerre Law and undertaking important cultural obligations for kin and country appeases the creator spirits and is a deeply important societal foundation. The system is balanced to ensure the environment sustains future generations who in turn will maintain the Altyerre Law and undertake cultural obligations to perpetuate society. On a regional scale, a large portion of Kaytetye country is affected by this proposal. Locally (within the SWLDA), large portions of Iliyarne country and Anerre country, will be affected by the proposal. Important parts of Waake-Akwerlpe country and Arlpwe country will also be affected.	Likely	Significant

		12 sacred sites within the SWLDA are important tribal boundary markers and of high cultural value to Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people. Two of these boundary markers indicate locations where three land holding groups come together (both large ghost gum trees), the other 10 indicate boundaries for two neighbouring groups (nine soakages and one large ghost gum tree). These tribal boundary sites act as navigational markers and are integral to cultural educational practices and intergroup relations. It is understood that these boundaries were established in the Altyerre and Kaytetye people today are obliged to abide by them. Sacred sites that represent tribal boundaries are deeply important and particularly sensitive to change. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective *to enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians* in the following ways: • The desertification of country and in particular homelands and communities where people live, will have major negative consequence for senior Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people who are responsible for sustaining country for the future. They will suffer shame and blame which will affect their		

		emotional and physical state, potentially including, the Kaytetye believe, severe illness resulting in death. • The liveability of the environment including access to natural resources, access to bush food, the recreational use of the natural environment will be diminished. • The ability to maintain a healthy lifestyle for an already vulnerable sector of the community, including attaining a sense of wellbeing and good mental health will be diminished. • Connections to culture and community including exercising Aboriginal rights and interests associated with access, cultural practices, sense of belonging, connectedness and healthy social relationships will be negatively altered if not permanently damaged. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning* in the following ways: • Damage to Groundwater dependent ecosystems (GDEs)		

		• Species of social, cultural, livelihood and/or economic significance will be disturbed including culturally important localised species (lilies). The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained* in the following ways: • Culturally important water features or other features will likely be affected by a reduction in water level including culturally prominent boundary marking sites. Permanent damage to these landmarks could lead to major consequences including long-term problems for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people in terms of how they relate to themselves and each other, and their ability to undertake cultural obligations according to traditional laws and customs. • Species of social, cultural, livelihood and/or economic significance will be diminished.		

		According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will: • permanently diminish the cultural value of places for Traditional Owners • inhibit the existing use of cultural sites causing the values to notably diminish over time		
Undertaking rituals requiring GDE species sourced from within the SWLDA across the SWLDA[9]	High	The spiritual connection Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe have with their apmere (country) is strengthened by ritual activity which is also linked to the powerful forces of the Altyerre. Many of these ritual activities require specific flora and fauna species obtained across the drawdown area, some of which directly or indirectly relate to GDE. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning* in the following ways:	Likely	Significant

[9] See pages 37 - 42 of Donaldson (2021) for identification of these cultural values and pages 75 of Donaldson (2021) for the impact of disruption to them.

		• A reduction in species of social, cultural, and economic significance required by Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people for ritual activity. This will lead to the need for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people to seek permission from neighbouring tribal groups to obtain the required ritual items from them. Having to seek permission from neighbours for resources that used to be obtained on their own country may cause Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe to feel shamed about their degraded country and cultural loss. • A reduction in shade trees and water sources, which in turn may hinder Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people's ability to the gather in large groups to undertake ritual activities that require shade and water on their land across the SWLDA. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained* in the following ways: • Culturally important water features or other features affected by water level		

		• Present and future uses, and users of water for ritual activity • the cultural practices associated with ritual activity are diminished if site visitation is not possible, that is, if the site is permanently destroyed and over time locationally lost or forgotten. This is another major consequence indirectly related to the act of removing groundwater. According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will: • permanently diminish the cultural value of places for Traditional Owners • inhibit the existing use of ceremonial sites causing the values to notably diminish over time		
Upholding ecological knowledge associated with collecting natural	High	The geographical extent of impacts to this value is to be understood with a consideration of the seasonal way in which Kaytetye, Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa people exploit the SWLDA.	Likely	Significant

resources across the SWLDA.[10]		Upholding cultural knowledge and practices associated with ecological processes linked to the collection of natural resources for sustenance and trade is an important cultural value associated with the entire SWLDA. The SWLDA is prime hunting ground used by Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people, as well as other Kaytetye people and their Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa neighbours, at different times of the year. Many Aboriginal residents of the nearby Alicurung community regularly visit the SWLDA on a seasonal basis, as their 'backyard'. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect the health of the Northern Territory population* in the following ways: . • A reduction in drinking water • Damage to recreational water • A reduction in bush tucker and medicines The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning* in the following ways:		

[10] See pages 42-49 of Donaldson (2021) for identification of these cultural values and pages 76-80 of Donaldson (2021) for the impact of disruption to them.

		• Species of social, cultural, livelihood and/or economic significance including the altering of cyclical ecological process which may indirectly diminish important natural resources utilised for hunting, gathering and other activities across the SWLDA for Aboriginal people across the region who value and utilise the area. • loss of associated cultural knowledge and practice associated with soakage water. • The wellbeing of the local community who regularly access the drawdown area will also be negatively impacted, given hunting and associated activities promote a healthy lifestyle both physically and mentally. • Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people fear that the bigger animals will leave Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe country to find a better, well-watered home, and that the smaller species unable to travel far will die out. Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe will feel a sense of concern, loss, sadness and shame if they allow some species to die out and others to find a 'new home'. According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will:		

		• permanently diminish the cultural value of places for Traditional Owners • restrict the existing use of cultural sites causing the values to notably diminish over time		
Continuing customary roles and responsibilities across the SWLDA[11]	High	According to traditional laws and customs, Traditional Owners see themselves as custodians of their land and waters (on behalf of all others) and they have customary roles and responsibilities to maintain and protect their country and the things that live there. Looking after country in a broad sense relates to sustaining the biodiversity through regular burns, cleaning out/covering up soakages and other activities. These cultural activities relate to preserving all aspects of the cultural landscape, including water sources, for future generations so that culturally valued natural resources can be sustained and sacred sites protected. The geographical extent of impacts to this value is to be understood with a consideration of the Kaytetye land tenure system which, according to traditional laws and customs, is fundamentally localised whilst concurrently deeply interconnected with the broader cultural landscape associated with Warumungu, Alyawarr, Warlpiri, Anmatyerre and Warlmanpa people	Likely	Significant

[11] See pages 50 - 53 of Donaldson (2021) for identification of these cultural values and pages 80 -82 of Donaldson (2021) for the impact of disruption to them.

		Within the SLWDA a focal complex of sacred sites exists for the Iliyarne group; ILIYARNE ILPAIYE, a creek and associated ghost gum trees interlinked with MPWEREMPWER-ANGE, a swamp and large coolibah tree. This highly significant site complex is the foundation of Iliyarne people's cultural identity (as the basis of the group's name, contains the primary food source for the group, and is the focal mythological place for this group) and is irreplaceable. This focal site complex is the basis for Iliyarne customary practices guiding their roles and responsibilities. Thus, in the context of the local cultural landscape, compared with the other groups whose focal sacred sites lay beyond the SWLDA, the SWLDA has additional layers of cultural meaning to Iliyarne people and commensurately greater sensitivity to impact. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained* in the following ways: • Culturally important water features or other features affected by water level may cause Iliyarne to feel shamed, leading to social isolation and physiological ill health.		

		• Members of the group may suffer long term, intergenerational emotional and spiritual loss and even death. For Ileyarne people, these consequences are catastrophic. • the unleashing of power (punishment) held by the Ancestral spirits residing at these places can have long lasting negative emotional and physical effects, mainly for the senior Iliyarne people. • If Iliyarne people are seen by other Kaytetye groups as allowing their 'main country' to get sick, Iliyarne people will also suffer the consequences of societal shame which can lead to psychological ill health. Kaytetye people have terms for these particular consequences including arlatnarrerane (crying), ampwarrenke (dying), amperrnge (sad/unhappy), nyerre (shame), arntetye (sick), athamarrerange (worried), and atere (scared). • A reduction in groundwater will make it very difficult for Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people to fulfil their customary obligations in relation to looking after water and the life that the water sustains. If GDE species diminish, the impact may be experienced by future generations of Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people.		

		According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will: • permanently diminish the cultural value of places for Traditional Owners		
Being able to live and travel on country across the SWLDA.[12]	High	The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians* in the following ways: • Dwellings, homelands, communities, towns and suburbs where people live • Liveable environment (access to natural resources including bush food, recreational use of the natural or built environment e.g. fishing, picnics) • Healthy lifestyles (sense of wellbeing and good mental health) • Vulnerable sectors of the community	Likely	Significant

[12] See pages 53-64 of Donaldson (2021) for identification of these cultural values and pages 82 - 83 of Donaldson (2021) for the impact of disruption to them.

		The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained* in the following ways: • Damage to the 28 soakages (ngentye) which are critical sources of water and are relied upon when travelling through country. • Culturally important water features or other features affected by water level will be reduced thus hindering Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe people's ability to live and travel across their lands. • Present and future uses, and users of water will also be diminished if not permanently destroyed. A decline in available water in soakages will hinder Aboriginal people's ability to live on and travel across their traditional lands. Without the availability of water, travel is more difficult and even dangerous for people's lives. There is a concern that people will not attempt to travel lengthy distances in fear of getting thirsty and dying. • Traditional Owners feel responsible for looking after their Kaytetye kin and Warumungu, Alyawarr, Warlpiri, Anmatyerre and		

		Warlmanpa neighbours and the residents of nearby communities and outstations who utilise the area and rely on the natural resources across the SLWDA. The removal of groundwater during the operation of the project has the potential to transgress the NT EPA's objective to *protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning* in the following ways: • Species of social, cultural, livelihood and/or economic significance According to the significant impact criteria for places with Indigenous heritage values (EPBC Act), there is a real possibility that the removal of groundwater under the SWL will: • permanently diminish the cultural value of places for Traditional Owners • restrict the existing use of cultural sites causing the values to notably diminish over time		

3.4 Managing significant impacts

3.4.1 AAPA

Whilst Aboriginal Areas Protection Authority (AAPA) approval has been granted and aims to avoid harm to a number of identified sacred sites, the substantive risk of damage to, or interference with other sacred sites on or in the vicinity of the AAPA subject land is highly likely or almost certain. Another highly likely consequence of harming sacred site in this matter is the distress caused to the Traditional Owners of the sacred sites.

In my view both of these impacts are significant and not adequately addressed by approvals received under the *Northern Territory Aboriginal Sacred Sites Act 1989*.

3.4.2 Other measures and uncertainties

There has been extensive community engagement with Traditional Owners and other affected Aboriginal community members in relation to the proposal. The overwhelming community response is one of concern for future generations given the unknowns in relation to how the significant impacts will be managed in order to avoid catastrophic consequences (for people and country).

Impact management measures beyond the AAPA Authority Certificate process (3.3.1) aimed at avoiding, mitigating or reducing the potential adverse impacts to the identified cultural values have not been identified by the proponent. Accordingly, the duration and extent of the significant impact to the identified cultural values is unknown at this stage and the level of community confidence in predicting potential significant impacts of the proposal is low due to the absence of relevant (local and current) information, which fosters uncertainty.

Cumulative impacts of the proposal are also uncertain but likely given the changes to the climate, the existing and historical use of the site for agricultural activity, and the proposal to remove a large quantity of groundwater. The culmination of historical impacts and project driven impacts lead to significant

impact to the identified cultural values. Similarly, the 'end of life' plan for the proposal is undefined, so the ongoing or residual impacts to the cultural values is uncertain.

The capacity of affected community members to access and understand information about the proposal and the management of potential significant impacts is hindered by a lack of information required to enable informed decision making. As such, the level of community confidence in predicting and managing potential significant impacts to sacred sites and other important cultural values is low.

4.0 CONCLUSION

The proposed reduction in groundwater relating to the Singleton Water Licence for the Singleton Horticultural Project has the potential to cause significant impact to Aboriginal cultural values across the Singleton Water Licence Drawdown Area (SWLDA) which extends across Singleton Pastoral Lease (PL), Neutral Junction PL, Warrabri Aboriginal Lands Trust (ALT) and Iliyarne ALT.

This analysis has shown that the proposed reduction in groundwater across the SWLDA will trigger major negative consequences to cultural places and values held by Akwerlpe-Waake, Iliyarne, Anerre and Arlpwe people and their neighbouring tribal groups including factors associated with culture and heritage; human health; community and economy; aquatic ecosystems; hydrological processes; and terrestrial ecosystems. The potential impacts will likely or almost certainly result in highly significant cultural values to be lost, degraded and damaged, as well as notably altered, modified, obscured or diminished.

Whilst Aboriginal Areas Protection Authority (AAPA) approval has been granted and aims to avoid harm to a number of identified sacred sites, the substantive risk of damage to, or interference with sacred sites on or in the vicinity of the AAPA subject land is highly likely (even if the sacred sites are covered by Restricted Work Areas). Another highly likely consequence of harming sacred site in this matter is the distress caused to the Traditional Owners. In my view both of these potential impacts are significant and not adequately addressed by approvals received under the Northern Territory Aboriginal Sacred Sites Act 1989.

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ATTACHMENT N:

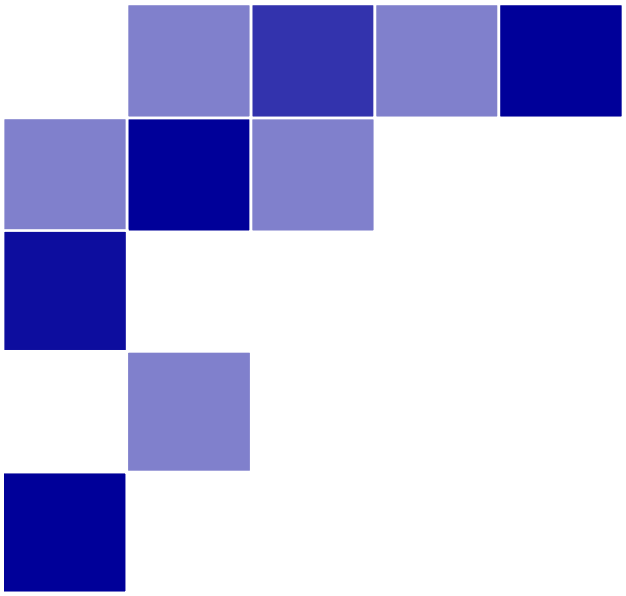
REVIEW OF THE SINGLETON HORTICULTURE PROJECT'S WATER ENTITLEMENT PROVISION COSTS, BENEFITS AND EMPLOYMENT IMPACTS

Released 12 July 2022

Prepared by Professor Jeffrey Connor, Daniel Hill, Dr Daniel Gregg and Dr Kamaljit Sangha

University of South Australia,
Centre for Markets, Values and Inclusion

Review of the Singleton Horticulture Project's water entitlement provision costs, benefits and employment impacts.



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Executive Summary

The Singleton Horticulture Project (henceforth 'Singleton') proposed south of Tennant Creek in the Northern Territory by Fortune Agribusiness has published a business case outline in publicly available form. The case outlines an ambition to develop 3,500 hectares of 'high value irrigated horticulture', primarily comprised of permanent crops (e.g. mandarins, grapes, avocados) with the remainder as annual horticulture (e.g. melons, onions and fodder). **To support the development, the Northern Territory Government has agreed to provide an entitlement to 40,000 megalitres of groundwater to be drawn annually for 30 years, free of charge.**

Whilst, the proponents have put forward a business case, it is short on publicly available detail. Additional rigour would be required to validate the claims in that business case that very large regional economic and employment benefits will result. This review challenges the business case and implicit assumptions that the project would provide net benefit to the NT by applying "reference case" analysis, (reference to similar past and ongoing projects) to realistically forecast potential performance of Singleton with respect to outcomes that count for the NT. The objectives are to:

1. Assesses the true economic costs of Singleton by considering the value of natural resources (namely water) that are currently not included in the business case for this project. This publicly owned asset has been allocated at no charge to Singleton.
2. Considers assumptions around employment and value generation for Singleton using data on agricultural employment and real-world business performance statistics from similar projects/cases.
3. Describe a range of other economic, social, environmental, and cultural impacts that may be substantial but are not considered within the Singleton business case.

Summary of findings

The key findings with respect to the Singleton business case are that:

1. The business case includes a large, unstated, subsidy in the form of a transfer of water owned by the NT public to Fortune Agribusiness, with a value of between $70 million to more than $300 million.

2. The economic benefit claims by Singleton seem overstated compared with reported industry performance in similar enterprises, especially when likely local and NT as opposed to outside of NT distribution of benefit is considered. The nature of this overstatement relative to best available real world reference data is summarised in the table below.

Economic benefit from Singleton.	**Claims made by Fortune Agribusiness and NT Government**	**Findings from our analysis.**
Value of the water entitlement.	Provided free of charge by the NT Government.	The entitlement is worth between $70 million and over $300 million.
Employment for local communities and Northern Territory residents.	110 permanent jobs and 1350 seasonal jobs, with opportunities for local employment.	A large proportion of NT agricultural jobs go to overseas workers and interstate fly-ins. Seasonal jobs are only available for short contracts over a few weeks or months. We estimate that only 26-36 full time equivalent jobs will likely be filled by residents of the Northern Territory, of which only 5-8 full-time equivalent jobs are expected to be from proximate Aboriginal communities in the Barkly region.
Economic activity through operating expenditures.	$110 million a year, much of this spent within the Northern Territory.	Operating costs appear to be inflated by between 10%-35%. The true expenditure figure is likely to be only between $70-$100 million per year, of which only $13-$28 million is expected to be spent in the Northern Territory.

The proposed project is also likely to generate large social and ecological costs that will result from substantial impacts on other users of the resources including groundwater-dependent ecosystems. Yet, social or environmental costs have not been accounted for in any publicly available Singleton business case reporting.

We conclude that the gift of water, valued at between $70 million and more than $300 million, from the NT public to a private enterprise headquartered outside of the NT is extraordinary. Especially given the lack of detail on the case for this transfer, and the potential for major social and environmental impacts associated with this water allocation. There is no evidence of a clear social benefit-cost analysis to justify a transfer of such value from the public to a private enterprise. Indeed, considering that as few as 26-36 full time equivalent jobs could be filled by Northern Territory residents and only $13-$26 million per year will be spent within the Northern Territory, if performance is similar to reference projects, the public value of this project appears to be highly questionable.

Also concerning is that, despite the NT Government's stated focus on development processes that are inclusive of Aboriginal people and communities, the Singleton project approval process has provided no substantive opportunity for Aboriginal communities with a clear stake in this project to participate in the water allocation decisions related to Singleton.

Recommendations

This review raises serious concerns about the process of approving water entitlements in the NT. A lack of publicly available information demonstrating thorough and creditable assessment of project benefits and costs suggests that the Northern Territory Government (NTG) is unlikely to have robustly assessed the high social and economic costs involved in the Singleton water entitlement or the return on the large gift of publicly owned water. In the absence of publicly available assessment demonstrating otherwise, we can only conclude that the NT Government appears to have decided to gift a public asset worth between $70 and more than $300 million for a project likely to create very limited NT employment and likely adverse impacts on the social and economic wellbeing of Aboriginal traditional owners, residents of neighbouring remote communities and the environment.

The main recommendation arising is that the NT Government should reform the processes of water entitlement application review, evaluation and charging. A revised process backed by legislation and regulatory frameworks should:

a) Require Commonwealth and State water infrastructure and dam investments and private proponent proposals for water allocations such as the Singleton water allocation to include an independent and peer-reviewed social benefit cost analysis process;

c) Strengthen processes and policy that support Aboriginal participation in water entitlement applications in order to make resource allocation decisions that are consistent with Aboriginal cultural practices, cultural values protection, and employment and development objectives; and

d) Introduce an appropriate charging regime for transfer of public water assets to private interests.

About this report

The Central Land Council (CLC) is a Commonwealth corporate entity established under the *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA). It is also a native title representative body under the *Native Title Act 1993*. It is led by a representative body of 90 Aboriginal people elected from communities in the southern half of the Northern Territory, which covers almost 777,000 square kilometres and has as Aboriginal population of more than 24,000.

The CLC has statutory responsibilities to ascertain, represent, and protect the rights and interests of Aboriginal people living in the CLC region. It also has specific statutory functions with respect to Aboriginal land. One of the CLC's central roles is to protect the interests of Aboriginal people with an interest in Aboriginal land, by assisting constituents to make land claims, negotiate agreements with third parties, protect sacred sites and use land and other financial resources for the benefit of their communities. Many Indigenous communities and outstations are located on Aboriginal land owned under the ALRA, and thus the CLC had a direct interest in, and responsibility for, the administration of land in those communities and outstations.

In addition to these functions, the CLC administers a range of programs for the benefit of constituents in relation to environmental management, community development, governance, cultural heritage, and customary practices. The CLC also plays a strong role in advocating for the interests of our constituents, the majority of which reside in remote communities.

The CLC, on behalf of local traditional owners and native title groups, requested a team of economists led by University of South Australia Business School Professor Jeff Connor to review the economic case put forward by Fortune Agribusiness in their Singleton Water Licence application for a 3500 hectare irrigation development south of Tennant Creek in the NT.

1. Introduction

The Singleton Horticulture Project proposed by Fortune Agribusiness on Singleton pastoral station south of Tennant Creek in the Northern Territory has published a business case in publicly available form. The case outlines an ambition to develop 3,500 hectares of 'high value irrigated horticulture', primarily comprised of permanent crops (e.g. mandarins, grapes, avocados) with the remainder as annual horticulture (e.g. melons, onions and fodder). **To support the development, the Northern Territory Government has agreed to provide an entitlement to 40,000 megalitres of groundwater to be drawn annually for 30 years, free of charge.**

The proponent's business case, whilst short on publicly available detail, claims that very large regional economic and employment benefits will result. Good governance would require transparent review of costs, and benefits from the perspective of the NT public including accounting for large implicit subsidy and high costs from groundwater level decline.

Taking a public good benefit cost perspective the analysis considers the costs and benefits likely to accrue to the people of the Northern Territory who will implicitly subsidise the project. This review applies a "reference class analysis" approach where performance of documented similar projects is used to estimate performance, cost and benefit assumptions.[1] The approach is particularly important in evaluation of large irrigation and water resource projects because it can correct for the enduring optimism bias around performance and costs typical in large project evaluations.[2]

[1] Ansar, A., Flyvbjerg, B., Budzier, A., Lunn, D., 2014. Should we build more large dams? The actual costs of hydropower megaproject development. Energy policy 69, 43-56. Flyvbjerg, B., Bester, D.W., 2021. The cost-benefit fallacy: Why cost-benefit analysis is broken and how to fix it. Journal of Benefit-Cost Analysis 12, 395-419.

[2] Higginbottom, T.P., Adhikari, R., Dimova, R., Redicker, S., Foster, T., 2021. Performance of large-scale irrigation projects in sub-Saharan Africa. Nature Sustainability 4, 501-508. Petheram, C., McMahon, T., 2019. Dams, dam costs and damnable cost overruns. Journal of Hydrology X 3, 100026.

Objectives

The objective of this review was to test assumptions about benefits and costs in the Singleton business case published by Fortune Agribusiness (henceforth 'the Singleton Project Report') against published data on comparable projects and contexts with a view to:

i. Consider the validity of business case assumptions and the case for possible adjustments to more accurately reflect experience with projects facing similar circumstances to Singleton.
ii. Consider implicit assumptions about subsidy, true economic costs and values at risk for the NT from the Singleton proposal that are not stated in the Singleton business case.
iii. Provide a recalibration of the skeletal business case detail made publicly available for Singleton including evaluation of distribution of benefits and costs within and outside of the NT using data on actual outcomes from a range of cases that are comparable in at least one dimension to Singleton.

Three key aspects of the business case from the NT public perspective examined analysis were:

1. The value of natural resources (namely water) that are currently not included in the business case or charged to the project proponent and yet should be counted as cost to the citizens of the NT.
2. Assumptions about employment and value generation from Singleton for the NT. These are tested with data on agricultural employment and business performance statistics from similar projects/cases.
3. The range of other economic, social, environmental, and cultural impacts that are likely substantial, but are not considered in the Singleton business case.

Report structure

The report begins (Section 2) with a brief review of key facts that can be discerned from the publicly available Singleton business case reporting. Section 3 provides an analysis of the value of water provided to Singleton. Section 4 considers explicit and implicit assumptions in the Singleton business case and how calibration using reference case analysis leads to different conclusions about outcomes. Additional economic, environmental and social values that are

likely to be impacted upon by Singleton but could not be quantified in dollar terms in this study are provided in Section 5. Finally, a brief set of conclusions are provided in Section 6.

2. Key facts of the Singleton business case

Key facts underpinning the business case provided publicly by the project proponent and the NT Government are minimal. They state only that:

- Up to 40,000 megalitres of water is proposed to be allocated to the project on a 30 year basis.
    - The groundwater for this project comes from the Lake Surprise Sandstone, Arrinthunga Formation, Chabalowie Formation, and Dulcie Sandstone aquifer types of the Wiso and Georgina basins underlying the Central Plains Management Zone.
    - This allocation of water is, by far, the biggest groundwater allocation license ever given to any development project in the NT.
    - This allocation also represents a very large allocation in comparison to other horticultural operations in Australia.
    - The 30 year period of the lease is three times longer than the normally granted 10 years.
- The proposed area for the development is 3,500 hectares.
    - While irrigation is to be entirely on the Singleton property, water table drawdown from this project is expected to substantially and adversely impact very large areas where groundwater levels will decline. The impacted area extends well beyond the Singleton property boundaries and into the lands of four independent estate groups (the Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe).
    - The drawdown area includes a range of ecologically and culturally significant sites that are likely to be negatively impacted by the project with little hope of recovery if water levels are lowered.

Additionally, the Singleton business case includes assumptions about project costs and employment levels, but it doesn't describe NT based employment including Aboriginal employment expected for nearby communities. Ecological and cultural impacts are mostly ignored in Fortune Agribusiness' own statements. Section 4 provides insights into expectations for these outcomes.

3. The value of water provided for Singleton

Natural water bodies and waterways that have not yet been allocated to individual users, are public assets. The allocation of water owned in common to individual users comes at an opportunity cost (see text box below) to others who are no longer able to access the resource or the benefits that derive from its non-extractive management. In recognising this opportunity cost, unallocated water is typically only made available for individuals through tenders or water markets. Charging for the water ensures that the resource is allocated to the highest value use, with reserve prices set to reflect the opportunity cost to the public of no longer owning the water entitlement.

Opportunity Cost

Opportunity cost is the forgone benefit that would have been derived from an alternative option (that was not actually chosen). To properly evaluate economic costs, the costs and benefits of the next best available option should be compared to a proposed course of action. In many cases, market prices or other equivalent values are used to provide a basis of comparison for the 'next best available option'. Opportunity costs that are positive (i.e. when the alternative option is more valuable) should typically be justified on the basis of other benefits.

3.1. How valuable is the ground water provided to Singleton by the NT public?

The NTG has not undertaken a tender process for the water allocated to Singleton. It allocated Singleton an entitlement to extract up to 40 gigalitres of groundwater *each year* for 30 years from the Central Plains Management Zone. No price has been applied against this water even though a groundwater resource in the arid zone is unlikely to be renewable on any normal economic timeframe. As a comparison, the 40 gigalitres allocated to Singleton is more water than what is consumed in Darwin annually, and over 30 years the project will extract the equivalent of 2.4 times the volume of water contained in Sydney Harbour. **In providing this entitlement free of charge, the NT Government is providing an implicit subsidy to Singleton.**

Whilst there is a lack of a tender process, or water sales data for the NT, the water resource allocated to Singleton can be valued by applying water entitlement market values from other jurisdictions in Australia. A range of potential comparison values can be used. For example, Class 3 SA River Murray (high security) entitlements are traded in a mature water market and are typically used for high value tree crops like those proposed for Singleton. The volume-weighted average price (VWAP)[3] for Class 3 SA River Murray (high security) for the 2020/21 water year was $6,710/megalitres.[4] At this price the entitlement gifted to Singleton implies a subsidy of up to $268 million.

For groundwater systems, water entitlement prices from other states that allocate and trade Great Artesian Basin water represent appropriate proxies for Central Plains Management Zone groundwater resource. Across 466 trades in the Great Artesian Basin groundwater system between 2008 and 2021 the volume weighted average price was $7,878/megalitres.[5] The *minimum* groundwater volume weighted average price across *all* groundwater resources in Queensland over this period was $2,216/megalitres. This includes groundwater resources where secure surface water is also available and is made available for lower value irrigation. At this price, a minimum or lower bound implicit subsidy for groundwater for the Singleton proposal is valued at $89 million for 40GL of high-security groundwater.

The table below summarises the implied values of the groundwater resource made available to Singleton. The table also includes the volume-weighted average price for all water traded in Australia since 2007 (where prices are available), and recent successful bids for unallocated groundwater in the Great Artesian Basin (in Western Queensland).

[3] The volume weighted average price is the average value (dollars per megalitre) of the water traded where each trade is weighted proportionally by the volume of water (in megalitre) involved in the sale. This provides a more accurate representation of the price (i.e. high-volume trades generally attract a 'bulk discount').
[4] Available from the BOM interactive dashboard - http://www.bom.gov.au/water/dashboards/#/water-markets/map
[5] Also available from the BOM interactive dashboard - http://www.bom.gov.au/water/dashboards/#/water-markets/map

Table 1 – Value of entitlements for different water resources across Australia, and implied value for the Singleton Horticulture Project water entitlement

Water resource	Implied value per megalitre of entitlement	Opportunity cost for Singleton Horticulture Project 30-year lease (40 gigalitres)[6]
Price paid by Fortune Agribusiness for Singleton for water entitlement	$0	$0
All water traded in Australia since 2007/08 (where prices are available)	$1,772	$70.89 million
Class 3 SA River Murray (high security) water entitlements (Southern Connected Murray Darling Basin - 2020-21 VWAP)	$6,710	$268.40 million
Recent bids for Great Artesian Basin unallocated water (for horticulture)	$3,001	$120.04 million
Minimum VWAP across all groundwater resources in Queensland since 2007/08 (where prices are available)	$2,216	$88.64 million
Great Artesian Basin groundwater VWAP since 2007/08 (where prices are available)	$7,878	$315.12 million

[6] The Singleton Horticulture Project has been granted a 30-year lease, meaning that values of entitlements in perpetuity might overvalue the lease for Singleton Horticulture Project. However, it is likely that the lease would be renewed after 30 years.

The values in the table are a good indication of the value of the high security groundwater resource provided to Singleton. Using these prices, the opportunity cost of the water entitlement provided to Singleton ranges between $70.89 million and $315.12 million, with evidence to suggest that the value is towards the higher end of this range. **The subsidy provided as unpriced groundwater thus likely represents foregone revenue for the NT public of up to $300 million**. For context, the total major works budget for the 2020-21 NTG Budget in the Barkly Region was $200 million, and after excluding transport infrastructure was only $28.9 million[7]. In addition, the NTG has incurred significant expenses in conducting investigations on water availability and extraction in the region.

4. Comparing Singleton business case assumed costs, benefits and employment impact to reference cases

Singleton estimates a yearly operating cost of $110 million across the 3500 hectares of productive land. It is claimed that this expenditure and development will support 110 permanent staff and up to 1350 seasonal jobs.

4.1. Operating costs of production are likely overstated

Singleton reports that much of the estimated yearly operating cost of $110 million will be spent locally. There is evidence to suggest this is a substantially higher operating cost than similar horticulture systems in Australia. Using standard farm budgets published by Australian state governments, annual operating costs for the proposed crops on Singleton range from approximately $20,000 per hectare for mandarin to $28,500 per-hectare for table grapes. Using these per hectare estimates of operating costs, this would indicate that the total operating costs for 3500 hectares would be in the range of $70 million to $100 million. These values are documented in the table below.

[7] NT Government Budget Barkley fact sheet - https://budget.nt.gov.au/__data/assets/pdf_file/0008/1000412/Barkly.pdf

Table 2 – Estimated operating costs for the crops proposed under the Singleton Horticulture Project

Operating costs	Operating costs/Ha	Operating costs for 3500 Ha	Source
Avocado	$26,065	$91,225,955	Howard Hall and CDI Pinnacle Management Pty Ltd, 2015, *Australian Avocado Benchmarking Program Development*, a report prepared for Horticulture Innovation Australia.
Table grapes	$28,563	$99,971,574	Department of Agriculture and Fisheries (QLD), 1998, *Gross Margin for Table Grapes (inland under trickle irrigation) North QLD*.
Mandarin	$20,090	$70,315,614	Falivene S and Creek A, 2018, *NSW citrus farm budget handbook 2018*, A report prepared for the Department of Primary Industries (NSW).
Onion	$26,220	$91,768,424	Department of Primary Industries (NSW), 2013, *Gross margin budget – Onions.*
Rockmelon	$22,770	$79,694,413	Department of Primary Industries (NSW), 2013, *Gross margin budget – Rockmelon.*
Expected operating costs for Singleton	$24,803	$86,811,141	Based on the expected split of crops - 75% tree crops and 25% annual crops.

Whilst the reported operating costs for Singleton may include additional costs associated with new supply chains and for operating in a remote area, **the data presented above suggests that the operating costs are potentially inflated for the project by between approximately 10%-35%**. There is an absence of documentation on why Singleton expects superior performance to

similar past projects. These higher than 'reference class' cost estimates appear to be an optimistic forecast and thus likely to overestimate the true Singleton project contribution to economic activity and jobs. As this forecast has been used to gain support for the project from investors and the NTG, there have been strong incentives for the project proponent to overstate operating costs and the economic contribution of the project[8]. For example, there is evidence to suggest the royalty-free access of groundwater has been granted due to expectations around permanent and seasonal jobs that will be provided by the project.

Overstating operating costs has implications for the true distribution of benefits from the project. Holding revenue constant, lower actual operating costs would result in higher profits for Singleton. This would result in fewer jobs and benefits for the local community, and instead increase the profits and returns for interstate and overseas investors.

4.2. The majority of non-labour operating costs will not be spent in the Barkly region or in the NT

There is further evidence to suggest that a large proportion of non-labour operating costs will not be spent locally, and instead will be spent interstate or overseas. Using the same state government farm budgets from

Table 2, we are able to disaggregate operating costs for the different crops proposed for Singleton. For each crop, the annual operating costs per hectare are disaggregated between different categories of farm expenses and are summarised in *table 3*.

Large agribusinesses typically do not use local providers for non-labour inputs as local providers do not have the capacity to provide for production of this scale. While the Singleton business case provides no detail on how their operating costs have been calculated, for each cost item it is possible to make highly plausible assumptions about whether each cost will involve spending within the NT or more likely involve spending interstate and overseas:

[8] Denicol, J., Davies, A., Krystallis, I., 2020. What are the causes and cures of poor megaproject performance? A systematic literature review and research agenda. Project Management Journal 51, 328-345. Higginbottom, T.P., Adhikari, R., Dimova, R., Redicker, S., Foster, T., 2021. Performance of large-scale irrigation projects in sub-Saharan Africa. Nature Sustainability 4, 501-508.

- Fertiliser, chemical and packaging materials are typically sourced from interstate and overseas providers for large horticulture businesses.
- Fortune Agribusiness propose to use intermediaries for distribution. Expenditure for these intermediaries will primarily be in interstate and overseas export markets.
- Services such as administration and marketing are likely to be conducted at Fortune Agribusiness' head offices outside of the region, or through external providers in key domestic and overseas markets.
- It is assumed that the majority of freight, nursery, fuel, and electricity inputs will be spent in the NT although these are also likely to be largely sourced from interstate. For example fuel for a project the size of Singleton is more likely to be bought in bulk with dedicated tankers from bulk fuel sellers (interstate). Similarly, freight may be provided by interstate freight companies.

Table 3 – Operating costs per hectare for proposed crops (detailed breakdown)

Operating costs/Ha	Avocado	Table grapes	Mandarin	Onion	Rockmelon
Seeds and nursery inputs	$0 (0%)	$0 (0%)	$0 (0%)	$1,563 (6.0%)	$1,463 (5.6%)
Fertiliser and chemical inputs	$2,220 (8.5%)	$4,146 (15.9%)	$2,277 (8.7%)	$2,212 (8.5%)	$1,911 (7.3%)
Fuel & electricity	$585 (2.2%)	$0 (0%)	$0 (0%)	$719 (2.8%)	$480 (1.8%)
Water (pumping and treatment)	$0 (0%)	$0 (0%)	$554 (2.1%)	$334 (1.3%)	$267 (1.0%)
Fixed labour inputs	$7,488 (28.7%)	$3,449 (13.2%)	$3,985 (15.3%)	$645 (2.5%)	$970 (3.7%)
Seasonal labour inputs	$246 (9.5%)	$4,084 (15.7%)	$5,736 (22.0%)	$8,931 (34.3%)	$2,646 (10.2%)
Packaging materials	$3,004 (11.5%)	$2,360 (9.1%)	$836 (3.2%)	$1,004 (3.9%)	$4,521 (17.3%)
Freight	$2,514 (11.5%)	$7,261 (27.9%)	$4,079 (15.7%)	$5,359 (20.6%)	$4,127 (15.8%)
Other costs - marketing, admin etc.)	$7,785 (29.9%)	$7,261 (27.9%)	$2,620 (10.1%)	$5,448 (20.9%)	$6,381 (24.5%)
Total non-labour costs per Ha	**$18,331 (61.9%)**	**$21,030 (73.6%)**	**$10,370 (51.6%)**	**$16,644 (63.5%)**	**$19,154 (84.1%)**
Total labour costs per Ha	**$7,734 (38.1%)**	**$7,533 (26.4%)**	**$9,720 (48.4%)**	**$9,576 (36.5%)**	**$3,616 (15.9%)**
Total operating costs per Ha	**$26,065**	**$28,563**	**$20,090**	**$26,220**	**$22,770**

Table 4 provides a summary of the percentage of non-labour costs likely to generate activity in that NT or interstate/overseas. Depending on the final mix of crop types, Singleton will likely only spend between 19-45% of total non-labour costs in the NT. **Assuming an operating cost of $110 million a year, best available information suggests that in total only $13-28 million a year will be spent in the NT for non-labour inputs.**

Table 4 – Distribution of non-labour operating costs

Non labour costs	**Location majority of cost item likely to be spent**	**Percentage of non-labour operating costs**
Seeds and nursery inputs	Northern Territory	0% - 9.4%
Fertiliser and chemical inputs	Interstate and overseas	10.0% – 22.0%
Fuel & electricity	Northern Territory	0% - 4.3%
Water (pumping and treatment)	Northern Territory	0% - 5.4%
Packaging materials	Interstate and overseas	6.0% - 23.6%
Freight	Northern Territory	15.6% - 39.3%
Other costs - marketing, distribution, admin etc.)	Interstate and overseas	25.3% - 48.3%
Proportion of non-labour costs spent locally in the NT		**19-45%**
Proportion of non-labour costs spent interstate or overseas.		**55-81%**

4.3. Employment opportunities for NT residents

Singleton proponents claim the project will support 110 permanent jobs and up to 1350 seasonal jobs when at full production capacity. This employment relates to the primary production of horticultural products, with additional employment to support the labour force, freight, and administration. Much like the non-labour inputs costs, it is likely that a majority of labour costs and employment opportunities will not be available for the NT population overall, less so for Barkly region towns and Aboriginal communities.

A report by Ernst and Young[9] estimates labour shortages of over 25% during the high intensity harvest periods across Australia. These labour shortages are more severe in remote locations where living conditions are less attractive, where there is time-sensitive harvest, and harvest conditions are hotter. Larger producers in remote regions, such as Singleton, typically rely on overseas or interstate workers through labour hire companies as working holiday workers and Australian residents prefer locations closer to larger towns and cities.

The NT Farmers Association reported that in 2019 only 11% of total horticultural labour was supplied locally. Overseas workers represented 63% of total labour, particularly during the harvest season, and the remaining 28% was supplied from interstate workers.[10] Many producers find it difficult to attract Australian workers due to the seasonal nature of the roles offered, remote locations and lack of contract security. Evidence of this can be seen on mango plantations in the NT, where producers report nearly no local seasonal workers[11].

The above evidence raises serious doubts about the true employment impacts of Singleton for the NT and Barkly region economy. Given the significant labour shortages for horticulture in Australia, it is likely that a large proportion of the permanent and seasonal work will be from overseas or interstate. Seasonal workers will most likely be sourced from the existing pool of

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[9] Ernst and Young, 2020, Seasonal horticulture labour demand and workforce study, a report prepared for Horticulture Innovation Australia, https://ausveg.com.au/app/uploads/2020/10/20200928_Hort-Innovation_Workforce-study_Final-Report_Public-Extract_vF2.pdf

[10] NT Farmers Association, 2019, *NT Plant Industries Workforce Development Plan 2020-25,* https://ntrebound.nt.gov.au/__data/assets/pdf_file/0003/930027/5.-NT-Farmers-WorkforceDevelopmentPlan2020_Final_Small-compressed.pdf

[11] Ernst and Young, 2020, Seasonal horticulture labour demand and workforce study, a report prepared for Horticulture Innovation Australia, https://ausveg.com.au/app/uploads/2020/10/20200928_Hort-Innovation_Workforce-study_Final-Report_Public-Extract_vF2.pdf

employed seasonal workers in the NT economy. In the absence of Singleton, these workers would find alternative opportunities in the NT or elsewhere.

Using the farm budget information in *table 5*, we are able to derive expected labour costs for permanent and seasonal staff and derive our own estimates of employment for the project consistent with actual experience with similar businesses. To compare permanent jobs with seasonal jobs, we adjust seasonal jobs to *full time equivalents* (FTEs). Given Singleton expects 1350 seasonal workers to be used across the 3500 hectares, we calculate from the labour costs in the farm budgets that the average term of employment for these 1350 seasonal workers is 8.8 weeks. As each FTE involves 46 weeks of employment, we can expect only around 258 FTE jobs from seasonal work. This is in addition to the 110 FTE jobs for permanent positions in the Singleton Business case.

Table 5 – Estimated FTEs from the Singleton Horticulture Project

Calculation	Figure	Method and source
Estimated total seasonal labour cost per ha	$4,519	Farm budgets from Table X, based on the expected split of crops - 75% tree crops and 25% annual crops
Estimated seasonal labour cost for 3500 Ha	$15,816,742	Cost per Ha multiplied by 3500 Ha
Expected number of seasonal labour days for 3500 Ha	59,617 days	Total cost for seasonal work, divided by the minimum daily wage for seasonal work in NT (with 30% on-costs)
Expected number of labour days per worker	44 days	Number of labour days, divided by the 1350 seasonal workers expected by Fortune Agribusiness
Expected number of labour weeks for seasonal worker	8.8 weeks	Number of labour days divided by 5 working days a week
Expected number of FTEs from seasonal work	258 FTEs	1350 seasonal workers, working on average 8.8 weeks a year.
Expected number of FTEs for permanent positions	110 FTEs	Expected number of permanent positions by Fortune Agribusiness
Expected number of FTEs filled from the local population	41 FTEs	368 total season and permanent FTEs, multiplied by 11% (percentage local employees as reported by NT Farmers Association, 2019)
Expected number of FTEs filled by local Aboriginal people	8-9 FTEs	21% of local FTEs (from proportion in the Ord River Irrigation Project – WA Auditor General 2016)

When considering that only 11% of those employed in horticulture are NT residents, we can expect a total NT employment outcome of only 41 FTE jobs (including seasonal workers). Also important is the number of people employed from Barkly region Aboriginal Communities. For an appropriate benchmark we can use the total Aboriginal employment outcomes from the Ord River Irrigation Scheme near Kununurra, WA. Kununurra has a similar proportion of Aboriginal people as the Barkly region in NT, where the WA Auditor General found that 21% of Ord irrigation project labour was provided by Aboriginal people in the initial stages of irrigation development and production.[12] Assuming this proportion for Singleton, we can expect, optimistically, only around 8-9 FTE jobs to be available for the local Aboriginal communities. **Taking into account the apparent over-statement of operating costs of 10-35% and assuming a similar overstatement of labour demand (Section 4.1), the total employment of NT residents could be as little as 26-36 FTE jobs and as few as 5-8 full-time equivalent jobs for local Aboriginal people.**

4.4. Economic and employment benefits have been limited in other horticultural projects

The promised employment outcomes of Singleton have strong parallels with other major irrigation projects in Northern Australia. The most notable of these is the Ord River Irrigation Scheme. The WA Auditor General reported that employment relating to the recent Ord River Irrigation Scheme expansion was 61 people plus 10–15 seasonal workers.[13] This was for an additional 1,600 hectares of irrigated crops and was substantially fewer jobs than what was expected. More details on Ord River Irrigation Scheme are provided in Box 1.

Box 1 – Ord River Irrigation Expansion Project

The Ord River Irrigation Expansion Project is a large scale, publicly funded development that has sought to develop irrigated land for intensive horticulture. The first stage of the Ord River Irrigation Area was completed in 1971 and services 14,000 hectares of farming land. In 2011 the WA and Commonwealth Government committed $220 million to the Ord River Irrigation Expansion project to:

[12] WA Auditor General, 2016, *Ord-East Kimberley Development*, https://audit.wa.gov.au/reports-and-publications/reports/ord-east-kimberley-development/auditor-generals-overview/
[13] Ibid

- deliver water and road infrastructure to service about 8,000 hectares of land at Goomig
- subdivide and sell off the 8,000 hectares in up to 25 lots.
- scope for land at Mantinea (4,000 hectares), Ord West Bank (1,300 hectares) and Packsaddle (1,380 hectares), and work to consider land at Knox (8,000 hectares), Victoria Highway, Carlton Hill, Bonaparte Plain and the Keep River Plain (NT).

The economic case for Ord River and its later expansions have been debated for decades. The consensus is that while the irrigation has provided some economic benefits for the local community, the costs of the scheme have far outweighed the benefits. Kununurra comes closest to being a town created and sustained by a remote irrigation scheme in Australia, but its growth appears to have relied more on tourism and mining than agriculture.[14]

In 2015 The Western Australian Office of the Auditor General reviewed the Ord River Project. The review found that:

- The original time and cost to deliver the irrigation expansion was unrealistic. This was due to severe underestimation of the time and investment needed to develop the irrigated land.
- A result of this was significantly less land under crop than what was previously planned at the time of the review. Although the area with irrigated crops has increased since, governance and economic constraints still exist for irrigators.[15]
- Whilst employment for the local population increased during the development stages, total employment relating to the expansion since dropped to 61 people plus 10–15 seasonal workers. This number is substantially fewer than what was expected at this stage of the scheme expansion.

[14] Wittwer G and Banerjee O, 2014, *Investing in irrigation development in North West Queensland, Australia*, Australian Journal of Agricultural and Resource Economics, 59, pp. 189–207

[15] For example, see Australian Broadcasting Corporation, June 21 2019, *Ord River irrigators say bureaucracy stifling agricultural development in WA's far north*, Available from - https://www.abc.net.au/news/rural/2019-06-21/ord-river-irrigators-red-tape-stifling-agricultural-development/11222494

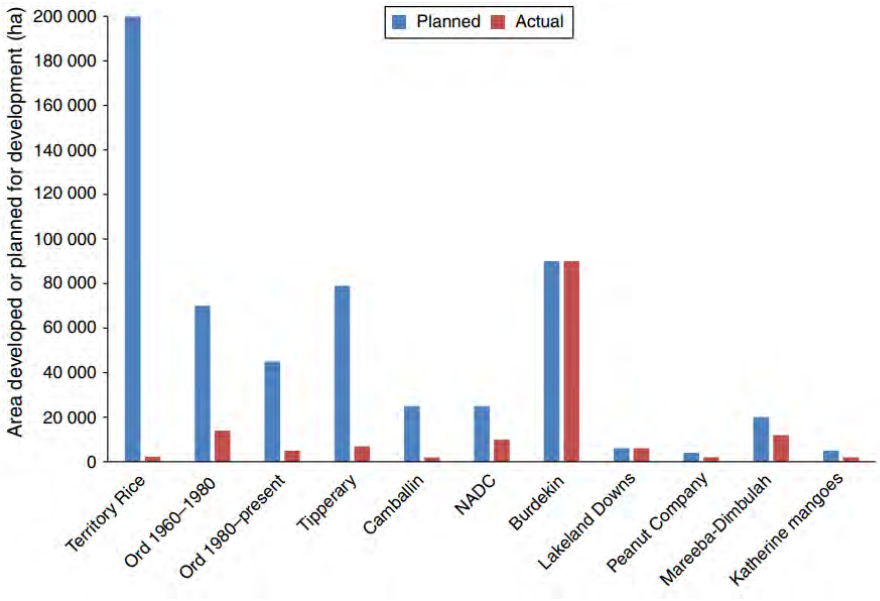
There have been several economic evaluations of irrigated developments in Northern Australia undertaken by the academic community. The consensus conclusion from this literature is that while agricultural production can be feasible from a technical perspective, significant economic and social barriers have often prevented large scale developments from being viable and providing welfare benefits for local communities.

For example, Wittwer and Banerjee[16] undertook a computable general equilibrium model of horticulture development in remote NW Queensland. They found that the irrigation development provided welfare losses for the Queensland community, even under different climate change, productivity, and demand scenarios. They concluded that there is limited evidence to suggest that irrigated agriculture has provided local jobs or made a substantial contribution to regional development.

In 2018, the CSIRO analysed a number of agricultural development schemes in Northern Australia.[17] The study found that nearly all large-scale developments have faced significant challenges in scaling up and providing the promised economic outcomes. A common factor across the schemes was the significant underestimation of the time required to expand irrigated production, and a lack of appreciation of input and output markets. Financial plans tended to overestimate early production, returns on capital and economies of scale. This typically resulted in severe cash flow problems for developers. **As a consequence, the areas of development and welfare outcomes for local communities were usually much less than the original expectations. Overstatement of the gains from private capture of public resources appears to be a common feature of large development projects in Northern Australia.** This can be seen in *Figure 1* from the CSIRO report, which contrasts the proposed area of development against the area actually developed.[18]

[16] Wittwer G and Banerjee O, 2014, *Investing in irrigation development in North West Queensland*, Australia, Australian Journal of Agricultural and Resource Economics, 59, pp. 189–207
[17] Ash A and Watson I, 2018, *Developing the north: learning from the past to guide future plans and policies,* The Rangeland Journal, 40, 301–314
[18] Ibid, pg. 310

Figure 1 - Areas (ha) of land planned for development, and actually developed



5. Environmental and cultural values

Whilst the proposed water extraction zone (development wells / bores) is located on the Singleton pastoral lease, the groundwater drawdown from the bores is expected to impact an area several orders of magnitude larger. Even the hydrology assessment by Fortune Agribusiness suggests that a drawdown area with a diameter in the order of 50 km will extend well beyond the water extraction points themselves to impact large areas of the lands of four Kaytetye speaking groups (Anerre, Waake-Akwerlpe, Iliyarne and Arlpwe). 23 additional Aboriginal groups across the broader Western Davenport District also hold kinship and ritual ties to the groups with traditional lands in the drawdown area.

5.1. Unquantified environmental values

A comprehensive cultural values assessment undertaken by anthropologist Susan Donaldson on behalf of Aboriginal land owners found that "if the current proposal reduces groundwater, there is the potential for the proposal to adversely impact GDE species and places which traditional Owners rely on for sustenance, gaining goods and other items."[19] The assessment found that,

[19] Dale-Donaldson, Susan (2021) *Singleton Water Licence Aboriginal Cultural Values Assessment*, PUBLIC REPORT TO THE CENTRAL LAND COUNCIL, 1 September 2021. p 77

many Kaytetye rituals require specific flora and fauna species that are currently obtained across the drawdown area but could be at risk of disappearing with the planned drawdown. These potential changes concern the current generation of Traditional Owners, they fear the consequences of not following their ancient Law. The extraction and drawdown areas have been identified as prime hunting ground by Traditional Owners. A vast array of flora and fauna species utilised by Traditional Owners were documented during this assessment, many of which depend on groundwater.[20]

5.2. A lack of consideration of cultural values

The Wakurlpa and Alekarenge communities in particular use their 'back yard', within the drawdown area, to collect natural resources. Hunting and collecting "are vital to the maintenance of good mental, physical and spiritual health for Aboriginal people and an important way to transmit cultural knowledge and practices to younger generations."[21]

Conceptually, economic measures of cost could be developed for the broad array of potential damages to cultural values, including costs of:

- emotional and physical responses;
- damage to sacred sites;
- reduction in species required for ritual activity;
- diminishing natural resources required for hunting, gathering and other activities;
- a loss for future generations of Kaytetye people; and
- a decline in the ability to live on and travel on the land.

While the work required to creditably assign economic values to such damages are beyond the scope of what is possible for this study, there is no good reason, a priori, to believe that they wouldn't involve values of similar or larger magnitude to direct benefits expected from irrigated production.

[20] Ibid, p. 80
[21] Ibid, p. 43

Further, significant losses of environmental values, that are in addition to cultural value losses, are likely as a result of groundwater table decline associated with Singleton. One potentially very large loss would be damaged potential to store carbon in perennial vegetation biomass, roots and soil. While this potential cost has not been assessed, the scientific basis for such assessment is available and considerable evidence demonstrates that once the groundwater level declines below key threshold levels, high carbon storage potential trees don't survive and potential for storage of hundreds to thousands of tonnes of carbon storage in biomass, roots and soil per hectare is lost[22]. Again, methods to value the cost to the Australian people and the Government in terms of increased costs compliance to meet Commonwealth emissions targets are available. **While the work required for such valuation is beyond the scope of this report, there is no reason, a priori, to believe that such cost might not be similar or greater than the direct benefits from horticultural production that the project would create.**

5.3. The process of approval of the Singleton Horticulture Project appears to be in contradiction to the NTGs own policy statements on Aboriginal development and inclusion

One common view expressed by traditional owners is that the drawdown that Singleton will cause will preclude fulfilling obligations required by Altyerre (Dreaming) law. The need to follow this law is a core of cultural identity and represents a failure to meet cultural obligations, even if the failure is a result of actions by others. This failure has severe consequences for traditional owners: "Taking care of country into the future according to ancient laws and customs appeases the creator spirits residing at important places. If traditional roles and responsibilities are not carried out by traditional owners, and if country is damaged as a result of the actions of traditional owners or others, punishment is imposed on senior traditional owners by Altyerre forces resulting in sickness, injury and even death. Spiritual punishment can lead to psychological stress and guilt linked to people's sense of internal moral failure associated with being responsible for damaging the country belonging to their spiritual ancestors, their actual ancestors, the current generation of kin and their descendants. Social sanctions may also result;

[22] Qiu, J., Zipper, S., Motew, M., Booth, E., Kucharik, C., Loheide, S., 2019. Nonlinear groundwater influence on biophysical indicators of ecosystem services. Nat Sustain 2: 475–483.

traditional owners can be forced into temporary or permanent isolation from their traditional group"[23].

There is no evidence to indicate that the NTG have adequately considered Traditional owners' perspectives despite statements that outline inclusivity as a core procedural element of NT Government decision making with respect to developments:

> *"Developing and strengthening structures [should be undertaken] to ensure the full involvement of Aboriginal and Torres Strait Islander peoples in shared decision making at the national, state and local or regional level and embedding their ownership, responsibility and expertise to close the gap."*
> *Priority Reform statement for the NT Government in their implementation plan for the Closing the Gap program*
> *(https://aboriginalaffairs.nt.gov.au/our-priorities/closing-the-gap)*

More recent policy development platforms, such as the Everyone Together 2019-2029 Strategy published by the NTG (NTG 2019) includes statements that clearly indicate a focus on integrating Aboriginal perspectives into policies about natural resource development, and explicitly placing Aboriginal people at the centre of decision-making:

> *"The NT Government accepts that decisions are best made closer to the communities affected and will lead a regional approach that places Aboriginal people and communities at the centre of decision making." (p7 NTG 2019)*

In addition, in 2008 the NT Government, along with all other states and territories, agreed to the National Water Initiative. Modules supporting the NWI outline a process to ensure "i) inclusion of Indigenous representation in water planning wherever possible; and ii) water plans will incorporate Indigenous social, spiritual and customary objectives and strategies for achieving these objectives wherever they can be developed (COAG 2017, p7).

The allocation of groundwater to Singleton represents incoherency in NT Government policy. Our analysis shows that the NT Government, in approving the Singleton water

[23] Ibid. p.67

licence, has not heeded their own commitments under Closing the Gap nor in the 'Everyone Together 2019-2029 Strategy'.

6. Conclusions

This report sought to consider:

1. the true economic costs of Singleton by considering the value of natural resources (namely water) that is currently not included in the business case for this project;
2. how assumptions around employment and value generation likely from the Singleton change based on data on agricultural employment and business performance statistics from similar projects/cases;
3. the range of other economic, social, environmental, and cultural impacts that may be substantial but are not considered within the Singleton Project Report.

In all cases we find substantial inconsistencies and omissions that indicate a substantial gap between the stated economic benefits of Singleton and those expected to be realised. Specifically, the review above indicates that, in all cases considered, economic benefits have likely been overstated (using reference case comparisons) and major known or potential costs have been omitted.

The key findings with respect to the Singleton business case are that:

1. The business case is critically dependent on an unstated subsidy associated with the transfer of water owned by the NT public to Fortune Agribusiness with a value of between $70 million and $300 million plus.
2. The stated economic benefits of Singleton are overstated:
    a. Operating costs appear to be inflated by between 10-35%.
    b. Local Aboriginal and non-Aboriginal employment levels implied within the project are much smaller than the forecast employment figures. Whilst exact employment outcomes can't be known ahead of project implementation we estimate that in the order of only between 26 and 36 FTE NT based jobs and as few as 5-8 jobs from neighbouring Aboriginal communities are likely if performance is like similar projects.

c. Implied expenditures are likely to be primarily outside of the NT. Our analysis suggests the likely amount to be in the vicinity of $13-28 million a year for non-labour input expenditures will be local if the project proceeds. This compares to an estimated operating cost figure in the Singleton business case of $110 million.

a. The proposed project is likely to generate substantial social and ecological costs that have not been accounted for. The resulting reductions in groundwater levels through extraction can best be considered as unsustainable and will generate substantial impacts on other users and groundwater-dependent ecosystems. The latter are considered to be at high risk.

In addition to these findings, the study identifies a concerning lack of detail around the business case that has led to the NTG approving the water licence for this project. The lack of detail extends to monitoring of environmental and cultural outcomes, and how any provision to curtail rights of withdrawal will be guaranteed should the project fail to substantively deliver on claimed benefits or cause unforeseen harm. It is concerning that there appears to be no formal social benefit cost assessment of the proposed project given the size of the public water resources allocated to this project, publicly-funded efforts to quantify water resources in the area and the potential associated environmental and cultural impacts.

ATTACHMENT O:

PEER REVIEW BY PROFESSOR R. QUENTIN GRAFTON OF UNISA'S ECONOMIC ANALYSIS REPORT OF THE SINGLETON HORTICULTURE PROJECT

March 1 (updated 7 July) 2022

Peer Review by Professor R. Quentin Grafton of UniSA's Economic Analysis Report of the Singleton Horticulture Project

March 1 (updated 7 July) 2022

The authors of the report have undertaken a hydrological-economic review of the costs and benefits of the proposed Singleton Horticultural Projects, south of Tennant Creek in the Northern Territory (NT). This planned development would be based on access to and extraction of up to 40,000 million litres per year of 'free' groundwater over a thirty-year period.

Business Case

The business case for the Singleton Horticultural Projects rests on access to the groundwater in the form of a licence from the NT government. The authors have used alternative water entitlement prices from other locations to estimate the implicit subsidy to the Singleton Horticultural Projects.

In my judgement, given the lack of any other water source for this project, a reasonable estimate of the market value of this water is likely to be in the higher end, or some $6,710 per million litres. At this market value, the implicit subsidy to Singleton Horticultural Projects could be in the order of $250 million. As a consequence of this subsidy, the NT government - the legal owner of the groundwater, will forgo this revenue that could be used for worthy purposes and, instead, it will accrue to a private enterprise rather than the 'public purse'.

Implicit Subsidy

It appears the primary justification for the large implicit subsidy to the Singleton Horticultural Projects is to generate local employment. Much of this employment would occur at harvest times. As the authors of the report note: "The Northern Territory Farmers Association report that in 2019 only 11% of total horticultural labour was supplied locally. Overseas workers represented 63% of total labour, particularly during the harvest season, and the remaining 28% was supplied from interstate workers." What the actual local additional employment with the development would be impossible to know with certainty in 2022 but it would seem highly unlikely to be more than a few dozen FTEs.

Accountability

In September 2021, the NT Department of Parks, Environment and Water Security prepared a public report entitled 'Northern Territory Strategic Water Plan: Directions Paper'. One of the espoused principles in the Directions paper is: "Fair and Accountable - Decisions will be based on clear roles, responsibilities and processes. Decisions will maximise public benefits, recognising that water has social, economic, cultural and environmental, as well as intrinsic values.". In my view, providing an implicit subsidy of the order of $250 million to a commercial enterprise in the form of 'free' water, does not satisfy this key principle.

Importantly, the NT Government is a signatory to the National Water Initiative (NWI). In paragraph 65 of the NWI, Australian governments (including the NT Government) agreed to; "full cost recovery for water services to ensure business viability and avoid monopoly rents, including recovery of environmental externalities, where feasible and practical" and in paragraph 66; "full cost recovery for all rural surface and groundwater based systems". In paragraph 72, the NWI further states that in the provision of unallocated water it should: "To the extent practicable, releases should occur through market-based mechanisms" The only exception to the 'user-pay principle' is in relation to community services obligations but that does *not* apply in this case as the benefits accrue to a commercial operation and is *not* the provision of water to a community.

Free, Prior and Informed Consent of First Nations

It would also seem that there has not been 'free, prior and informed consent' (FPIC) in relation to all the First Nations communities that may be affected by the development and the groundwater extractions. This is contrary to both the Aboriginal and Torres Strait Islander Studies (AIATSIS) Code of Ethics and the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). It is also contrary to a key finding of The Productivity Commission (2020, p. 13) 'National Water Reform Inquiry'

that: “Much more needs to be done to include Traditional Owners’ interests in water in jurisdictional planning and the management of water.”

Summary

I concur with the authors of the report that the business case of providing a large subsidy of ‘free’ water to Singleton Horticultural Projects is not justified from either a public interest or a cost-benefit perspective. Nor does it support water justice. These is because:

(1) An implicit subsidy in the order of $250 million in the form of ‘free’ groundwater to a commercial enterprise does *not* maximise public benefits, and is contrary to the National Water Initiative to which the NT Government is a signatory;

(2) It fails to adequately consider the consequences of social, economic, cultural and environmental values associated with large groundwater extractions over a thirty-year period. Thus, it also does not meet the NT government’s own guidelines in relation to water security; and

(3) It is inconsistent with free, prior and informed consent of First Nations communities in the vicinity of the proposed groundwater extraction. Thus, it is contrary to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

ATTACHMENT P:

SINGLETON PROJECT ECONOMIC IMPACT ANALYSIS: REVIEW IN REFERENCE TO THE *CONNOR ET AL. (2022)* CRITICAL REVIEW

Prepared by Professor Jeffrey Connor, Dr Daniel Gregg and Dr John Kandulu

Singleton Project Economic Impact Analysis: Review in reference to the Connor *et al*. (2022) critical review

Executive Summary

This document provides findings from a critical review of an Economic Impact Assessment (EIA) supporting the business case for the Singleton Horticulture Project conducted by GHD Pty Ltd (GHD) on behalf of Fortune Agribusiness Funds Management Pty Ltd (FAFM) on 25 October 2022. In an earlier report, Connor *et al.* (2022), provided an initial critical review of the proposed Singleton Horticulture Project business case based on information that FAFM made publicly available at that time.

The authors of this report have been requested by the Central Land Council to provide an updated review of the proposed Singleton Horticulture Project to inform a rigorous Environmental Impact Assessment process, considering that new reporting on the Singleton Business case has now been made available by FAFM. The questions guiding this additional review are:

1. What new information has been provided since we published Connor *et al.* (2022) specifically through the FAFM EIA and SIA referral documents?
2. Does the new material lead us to change the conclusions provided in Connor *et al.* (2022)?
3. Does the new material raise any additional concerns about the accuracy, methodology, assumption, data, or interpretation of data that warrant further investigation?
4. What tier of assessment is appropriate from an EIA perspective?

We found that GHD provided significant additional information and analysis, including further details on assumptions and methods used to estimate project costs and benefits. However, we also found that many of the assumptions used to estimate costs and benefits remain implausible, with minimal evidence provided to support the assumptions based on the performance of past similar enterprises. We also found that the EIA failed to satisfy a number of the NTG's own guidelines for benefit cost analysis for this type of project. We conclude that the bulk of additional information does not change the conclusions provided in Connor *et al*. (2022). Indeed, there are clear incentives for optimism bias in the EIA through implausible assumptions that bias project benefits upward, and this finding supports the key conclusion from Connor *et al*. (2022) that the project will provide substantially less benefit than FAFM contends and involve significant public costs that are not accounted for. We, therefore, submit that GHD's EIA does not meet the NT and Commonwealth governments' standards expressed in its benefit cost analysis guidelines for EIAs of proposed projects.

We found that costs to the environment and local Aboriginal wellbeing were not adequately accounted for, and a large, unstated, subsidy in the form of a transfer of water owned by the

NT public to Fortune Agribusiness was neither acknowledged nor quantified in the assessment. This leads us to believe that the FAFM EIA referral documents, in their current form, are not consistent with the NT's own guidelines for best practice in EIA.

Further, a major proposed benefit of the project is associated with job creation for Barkly Region residents. This claim is unrealistic and cannot be expected to be fulfilled if this project were to progress. This is primarily because the work force in the region is limited, with few appropriately skilled people currently unemployed or under-employed. All evidence indicates that regional labour shortages are generally not filled by regional residents as indicated by reporting on labour constraints by the NT Farmers' Association (2019). Furthermore, the Social Impact Assessment (SIA) for this project indicates a material likelihood that the project would displace employees from other businesses more than it would create new jobs in the region. This is likely to generate negative social and economic development outcomes by reducing the ability of locally-owned businesses to grow.

The reported data basis for the model is neither sufficient nor transparent enough to enable a critical review of the assumptions used. Unsubstantiated assumptions about unlimited labour supply in the region are likely to exaggerate job creation impacts. This deficiency should be addressed by using appropriate modelling methods that regional economics regularly uses to adjust for small region limited labour supply contexts. The EIA was also devoid of scenario analysis, probabilistic calculations and other widely applied tools typically employed when conducting a social benefit cost analysis of a proposed project. Most importantly, not all of the modelling assumptions and results seem to be available for public review.

Furthermore, whilst FAFM proposes that adaptive management will be used for this resource there is no provision for independent assessment of negative impacts over the course of the project. Nor is there provision for ensuring appropriate governance around that adaptive management. It is unlikely that self-regulation would work in this context where cost of sustainable management will be experienced by local NT citizens not FAFM, who stands to gain financially from the implicit subsidies. Therefore, self-regulation should be rejected as an option. Several corporate behavioural studies have showed that liability threats and pressures from consumers, investors and the public are more effective than self-regulation when it comes to adaptive environmental management, particularly when there is a significant financial disincentive (e.g. Anton *et al*. 2004). Therefore, if this project were to proceed, the adaptive management strategies proposed by FAFM should be enforced through an independent (not associated with FAFM or the NTG) body conducting annual impact reviews, making all impact results public, and retaining decision making power over continuation of the irrigation development plan for Singleton.

The concerns outlined in this report, similar to those outlined in the original Connor *et al*. (2022) review, lead us to question FAFM's seriousness about seeking to provide a clear, and unbiased, analysis of project impacts particularly regarding regional environmental, cultural, and economic development outcomes. Given these concerns, we can only conclude that the most detailed possible review for the Environmental Impact Assessment (i.e. a Tier 3 assessment) is required. To comply with the NT's own requirements, this would require accounting for the large public subsidy in the order of $70-$300 million dollars of the NT public's assets implicitly paid to FAFM, and a much more serious effort to value

environmental and social costs currently omitted in the EIA documents. In addition, further evidence is required to support assumptions, methods and input data used to forecast project costs and benefits to enable credible estimation of the net benefit of the project, including social and environmental impacts. Given repeated concerns around unrealistic assumptions applied to current FAFM project reviews, any future reviews for Environmental Impact Assessments should be undertaken by an entirely independent body with models and results provided for public review.

Key findings from our review of the GHG EIA are:

1. The EIA does not meet the NT and Commonwealth governments' standards, nor does it adhere to guidelines for EIAs of proposed projects
2. Optimistic assumptions were used in estimation of public benefits, leading to overstated public benefit forecasts
3. The assessment omits social costs, including potential loss of groundwater-dependent cultural and spiritual benefits, thereby effectively assigning them a value of 'zero'
4. The EIA did not account for the value of water entitlements that would be provided free of charge to FAFM
5. The EIA uses unsubstantiated assumptions about potential flow-on benefits, which suggests exaggerated flow-on impact estimates
6. The EIA overstates employment benefits, which questionably assumes that there is, currently, a large pool of available skilled labour in the Barkly Region
7. The assessment contains vague statements about the project's public service and benefit provision without providing any financial commitment to support the claims

Report overview

Organisation of reporting is as follows. First, key findings from Connor *et al.* (2022) are summarised, then a description of new material included in the EIA is provided. Next, key findings from a critical review of the EIA are outlined in reference to NT (and Commonwealth) Government economics assessment standards, particularly, the NTG Environmental Protection Authorities own Guidelines for the Preparation of an Economic and Social Impact Assessment V2.0 (2013)

Key findings from Connor *et al*. (2022)

Key findings provided by the Connor *et al.* (2022) review of the business case for the Singleton Horticulture Project show that first, there is a large implicit subsidy to FAFM who would extract groundwater for the project free of charge and second, estimates of economic benefits, operating costs of production and local expenditure and employment are overstated.

Nonadherence to the NTG Environmental Protection Authority's own Guidelines

It is evident that the assessment flouted the NTG Guidelines, which stipulates, for example, that:

"*investment* ***should provide the highest net benefit of all options available to increase access to water, taking into account economic, social and environmental impacts****; Projects should ..* ***provide a demonstrable public benefit and address a community need****; Projects should align with the National Water Initiative principles including appropriate* ***cost recovery*** *and, where full cost recovery is not deemed feasible,* ***any subsidies are fully transparent to the community****".*

Most notably, the EIA of the proposed Singleton Horticulture Project is inconsistent with NTG Guidelines, having significant implicit (in-kind water allocation) and a cash subsidy that is not counted as a cost despite the NT's own guidance indicating that it should be.

Large implicit subsidy to FAFM

The business case includes a large, unstated, subsidy in the form of a transfer of water owned by the NT public to Fortune Agribusiness, with a maximum value of over $300 million. In other states, consistent with NWI principles, the project proponent would have to incur this cost. In this case however, it is an implicit subsidy that should be represented as a cost in a social benefit cost analysis (BCA). Implications of public subsidisation of a private entity's groundwater extraction activities may include over extraction of scarce groundwater resource with multiple competing uses due to absence of an effective incentive to use water efficiently and a missed opportunity to recover costs for improved governance and resource management.

Overstated economic benefits

The claimed economic benefits of Singleton are overstated when compared with reported industry performance in similar enterprises. For example, the EIA found that the project would create 110 new permanent local jobs and 1,350 seasonal jobs (Pp 16 Section 2.3.2). Considering current labour market conditions in the Barkly region are characterised by a tight local skilled labour market, the project would more likely displace local labour from other competing sectors than create new jobs. Especially considering that the EIA does not provide a detailed plan for training the unemployed subpopulation, which is, in itself, limited.

Overstated operating costs of production

Based on comparisons with findings from assessments of similar horticultural enterprises in the region, it is likely that the project's operating costs of production are overstated by 10%-35% (Connor *et al*. 2022, p12)

Overstated local expenditure values

Expenditures on local and regional inputs are likely to be substantially overstated, noting that FAFM has not provided any new information, grounded in empirical evidence, to justify applying a greater than typical assumption in relation to local expenditure.

Overstated local employment forecasts

Local and regional employment estimates are likely to be grossly overstated. For example, the business case estimates that the project would employ 1,350 seasonal workers and create 110 FTE positions. These estimates are not consistent with calculations provided in Connor *et al*. (2022), which suggest that the expected contribution of the Singleton project, in terms of **local** job creation, would in-fact, be much lower than suggested in the business case, noting that Connor *et al*. (2022) based their calculations on data from the NT Farmers Association average proportions of local versus seasonal international and FIFO labour in the sector (2019).

Table 1 provides a summary of key findings from our review of the business case for the Singleton Horticulture Project.

Table 1. Omitted public cost and potentially overstated benefits identified in Connor *et al*. (2022)

Purported economic benefits from the Singleton Horticulture Project	Estimates from the GHD business case	Findings from our own analysis
1. Value of the water entitlement	Provided free of charge by the NT Government	The entitlement is worth between $70 million and over $300 million
2. Employment for local communities and Northern Territory residents	110 permanent jobs and 1,350 seasonal jobs, with opportunities for local employment	A large proportion of NT agricultural jobs go to overseas workers and interstate fly-ins. Seasonal jobs are only available through short-term contracts, ranging between one to three weeks and a few months. We estimate that only 26-36 full time equivalent (FTE) jobs will likely be filled by residents of the Northern Territory, of which only 5-8 FTE jobs would be expected to go to Aboriginal communities in the Barkly region.
3. Economic activity through operating expenditures	$110 million a year, much of this spent within the Northern Territory	Operating costs appear to be inflated by between 10%-35%. The true expenditure figure is likely to be between $70-$110 million per year, with $13-$28 million expected to be spent in the NT.

Based on the limited information available, and with plausible adjustment to reflect past performance in similar projects, we conclude that scaling up may be more difficult and limited than suggested and that:

Taking into account the apparent over-statement of operating costs of 10-35% as applying equally to the labour force (Section 4.1) the total employment of NT residents could reasonably be expected to be only 26-36 FTE jobs of which only 5-8 jobs are expected to include local Aboriginal people.
Connor et al. (2022, p21)

Updated information provided by FAFM

We note that since our original analysis, which was based on limited publicly available information, FAFM commissioned GHD to produce a detailed EIA on 25 October, 2022.

The EIA provides further detail and more clarity about calculations behind benefit and cost estimates than we had access to when we released Connor *et al*. (2022), including data and assumptions underpinning the business case as summarised in Table 2.

Table 2: New material included in the EIA of the Singleton Horticulture Project

Item	**Section**
EIA overview of methods, results, assumptions, limitations and the scope of evaluation. Details of accommodation, extraction staging, and development work steps	Section 1, Table 1
A profile of the regional economy	Section 2
indirect flow-on economic impact assessment with input-output (IO) modelling assumptions	Section 3
Indirect flow-on economic impact results	Section 4
Combined direct and indirect economic impact assessment results	Section 5
A crop attractiveness and market analysis selection, based on factors such as horticultural suitability, market capacity to take up more without adverse price collapse and returns per ha	Appendix D

Apparent contradictions, poorly validated assumption and other issues that require further attention

To judge the quality and adequacy of the information provided, we evaluated the EIA in reference to NTG Environmental Protection Authority's own Guidelines for the Preparation of an Economic and Social Impact Assessment V2.0 (2013) (hereafter, *NTG Guidelines*).

NT (and Commonwealth) governments' economics assessment standards

The objectives of the NTG Guidelines are to:

- *document the economic and social impacts of a proposed development on the locality and region;*
- *mitigate negative economic and social impacts on the locality and region;*
- *encourage development of new and/or expansion of existing businesses in the locality; and*

- *foster sustainable development and community wellbeing* (NTG, 2013).

The intent and content of this guidance is very similar and related to national guidelines such as the Commonwealth White Paper on Irrigation (2015), which states that agri-water "*investment* ***should provide the highest net benefit of all options available to increase access to water, taking into account economic, social and environmental impacts****; Projects should ..* ***provide a demonstrable public benefit and address a community need****; Projects should align with the National Water Initiative principles including appropriate* ***cost recovery*** *and, where full cost recovery is not deemed feasible,* ***any subsidies are fully transparent to the community****; If providing capital,* ***a consistent robust analysis of costs and benefits is used*** *and assessment is undertaken by Infrastructure Australia or similar experts."*

Similarly, the NTG Guidelines state that *Accelerated development places a premium on provision of accurate and comprehensive impact assessment and where appropriate mitigation of project specific economic and social risks.* (page 1). In addition, Section 5 of the NTG Guidelines provides specific requirements for what should be included in economic impact assessments including:

5.1.1 Contribution to the NT and Australian Economy

a) estimated total project revenue for the planned project duration (to provide the economic scale of the project)
b) expected project duration
c) value of any value-adding in the NT and Australia
d) estimated overall tax and royalty payments, showing the NT proportion, if available
e) expected value of exports and any imports
f) estimated capital expenditure for the whole project, identifying construction cap ex
g) expected annual operational expenditure, showing the proportion in the NT
h) impacts if any of neighbouring businesses or projects (costs and benefits)
i) any overall direct and indirect economic impact data if available
j) specific regional resources, constraints and opportunities
k) historical and current economic trends in the Territory/regional economy including projects being developed or to be developed in the near future
l) previous resources or other major development in the region and their effects including long and short term incomes and employment, business development, and estimates of lost and gained opportunities and landscape services e.g. reduction in the quality of the water supply.

5.1.2 Contribution to Business Development

a) expected value of NT/Australian business supply and service participation during construction and operations
b) Contribution through an agreed industry participation plan if required (usually required for all projects over $5m in value which receive 'substantial' NT government assistance).

5.1.3 Contribution to Employment and Training

a) expected direct and indirect project employment during construction and operations
b) estimated workforce/contractor numbers by occupational classification if available
c) overall employment training proposed during commencement, construction and operations

d) planned Indigenous employment, training and other project participation
e) expected level of overseas recruitment

5.1.4 Contribution to Regional Development

a) value of the proposed Community Benefit arrangements (already included)
b) estimated overall regional economic benefits
c) other contributions to local communities, including Indigenous traditional owners community value of any residuals infrastructure, such as roads, camps, lakes, etc
d) assessment of deficiencies / issues that require further attention in Economic impact

The highlighted text draws attention to the items that, in our assessment, do not meet the NT and Commonwealth governments' standards for economic impact assessments of proposed projects in the EIA prepared for FAFM by GHD. Most notably, the EIA of the proposed Singleton Horticulture Project is inconsistent with NTG Guidelines, having significant implicit (in-kind water allocation) and potentially other subsidy that is not counted as a cost despite the NT's own guidance indicating that it should be.

In the following sections, we provide further description of how the EIA is inconsistent with NTG Guidelines due to overstated public benefit estimates, arising from errors or purposeful misrepresentation of economic assessment methods, data and assumptions. The two main potential sources of error discussed include use of optimistic assumptions that overstate public benefit estimates and omission of social costs of the project.

1. *Optimistic assumptions that create overstated public benefit estimate remain*

The essence of points 2 and 3 in Table 1 from our original critique still hold. The new detailed EIA provides further detail on estimates of local input spending and employment. However, as in the previous publicly available information we based Connor *et al.* (2022) on, the proportion of highest value crops assumed in the business case's crop mix exceeds what has been achieved in similar past projects on a sustained basis. Input use expenditure also remain higher than is suggested by data for similar projects from publicly available information sources. This implies that the public is being asked to provide hidden cash subsidies for less public benefit than is stated and that the public benefit cost ratio for the project would likely be overstated based on this information.

The potential to create local employment seems particularly overstated as noted in Connor *et al*. (2022)

> *"The NT Farmers Association reported that in 2019 only 11% of total horticultural labour was supplied locally. Overseas workers represented 63% of total labour, particularly during the harvest season, and the remaining 28% was supplied from interstate workers. Many producers find it difficult to attract Australian workers due to the seasonal nature of the roles offered, remote locations and lack of contract security. Evidence of this can be seen on mango plantations in the NT, where producers report nearly no local seasonal workers.*
>
> *The above evidence raises serious doubts about the true employment impacts of Singleton for the NT and Barkly region economy. Given the significant labour shortages for horticulture in Australia, it is likely that a*

large proportion of the permanent and seasonal work will be from overseas or interstate. Seasonal workers will most likely be sourced from the existing pool of employed seasonal workers in the NT economy. In the absence of Singleton, these workers would find alternative opportunities in the NT or elsewhere."
Connor et al. (2022, p19)

The updated assessment assumes high proportions of local labour supply and input expenditures. This is contradictory with evidence showing low unemployment in the regions' small work forces, especially in appropriately skilled categories. This issue is evident in the GHD's EIA regional economic profile (Page 16), which provides graphs that contradict some of the reported numbers and census data. GHD's graph shows that 10.8% of the work force in the Barkly local government area (LGA) are technicians and trades workers, 16% are labourers in a total work force population of 2,700, with only a small fraction available for employment, or not fully employed. Further, there are significant contradictions between assumptions, data and comments by other concerned regional businesses in the SIA carried out by GHD about the potential for "crowding out" of local existing demand. Our submission is that a Tier 3 assessment is needed, including calibration of impact estimates such as expected local employment outcomes based on empirical evidence, to test/check forecasts provided in GHD (2022).

2. *Failure to include social cost despite purported public net benefit in assessment*

There is vague discussion/acknowledgement of potential loss of cultural and spiritual benefits for First Nations groups, but not serious effort to evaluate the scale of these values at risk, nor is there meaningful evaluation of investments required to mitigate or avoid these negative impacts on wellbeing of NT citizens. Though, as outlined in Connor *et al* (2022) Sections 5.1 and 5.2, estimating the value of potential losses in cultural, spiritual and environmental values of water is difficult, potential negative impacts of groundwater extraction on flow and flood-dependent cultural and spiritual values must still be recognised as a cost. Further, implications of omitting potential negative cultural and spiritual impacts should be made clear and transparent in discussion of EIA limitations and interpretation of EIA outcomes, consistent with best practice guidelines (DoFA, 2006; DTF, 2008) to ensure that limited water resources are distributed equitably and justly (Nikolakis & Grafton, 2022). Failure to acknowledge these values at risk from the project effectively assumes that they have a value of 'zero' in the EIA.

The plan suggests that an adaptive management approach will be taken, involving reduced water extraction and production scale (a traffic light approach), yet no probabilities of this kind of outcome or financial planning with contingencies for such eventualities is offered (e.g. how any potential risks of environmental damage from groundwater extraction will be mitigated). This leads us to question the robustness of the economic analysis and whether there is a serious intention to scale back should it prove environmentally and socially unsustainable.

3. *Failure to account for the value of water entitlements provided free of charge to FAFM*

This is a cost to the people of the Northern Territory. The Northern Territory does not charge when it allocates water because it assumes there will be significant economic development benefits and the "trade-off is worth it". However, the NT government's own BCA guidelines require that all public and implicit subsidy costs should be acknowledged.

4. *Unsubstantiated assumptions about flow-on benefits, suggesting exaggerated flow-on impact estimates*

GHD use the Input-Output (IO) methodology to estimate impacts of the project for the regional economy. As stated in the GHD report itself, IO analysis assumes:

"that the economy has no supply-side constraints. That is, it is assumed that extra output can be produced in an area without taking resources away from other activities, thus overstating economic impacts. The actual impact is typically dependent on the extent at which the economy is operating at or near capacity" (GHD 2023 p20)

Evidence from both the regional economy profile (EIA section 2) and the SIA provided by GHD illustrate that this assumption is not valid in the context of Barkly LGA, which is characterised by low unemployment rates (PP 16), particularly in the absence of a plan to offer training to the already limited unemployed subpopulation.

5. *Overstated employment benefits*

Despite a tight and small local skilled labour market in the Barkly LGA, the EIA claims that large job creation benefits are expected (Pp 16 Section 2.3.2). SIA comments by other local businesses, and empirical economic evidence from similar small local labour force settings, suggest displacement or poaching from other local employers is more likely than creation of new local jobs.

The following statement, which is the core basis for the use of the IO methodology to estimate economic impacts, is clearly contradicted by several sources, but most notably by the NT Farmers Association itself:

> *"The NT Farmers Association reported that in 2019 only 11% of total horticultural labour was supplied locally. Overseas workers represented 63% of total labour, particularly during the harvest season, and the remaining 28% was supplied from interstate workers. Many producers find it difficult to attract Australian workers due to the seasonal nature of the roles offered, remote locations and lack of contract security. Evidence of this can be seen on mango plantations in the NT, where producers report nearly no local seasonal workers.*
>
> *The above evidence raises serious doubts about the true employment impacts of Singleton for the NT and Barkly region economy. Given the significant labour shortages for horticulture in Australia, it is likely that a large proportion of the permanent and seasonal work will be from overseas*

or interstate. Seasonal workers will most likely be sourced from the existing pool of employed seasonal workers in the NT economy. In the absence of Singleton, these workers would find alternative opportunities in the NT or elsewhere."
Connor et al. (2022, p19)

This contradiction indicates that the application of the IO methodology in this case is deeply inappropriate and is highly likely to substantially overstate the value of the Singleton project given major and unavoidable supply chain constraints that characterise production in northern Australia, and more so in regional areas of northern Australia.

This concern is magnified by the fact that IO methodologies are not typically regarded as appropriate for 'small' regions – where 'small' refers to the size and scope of economic activity. The Barkly region, in this context, would typically be considered as falling in the 'very small' category, indicating that the IO methodology is not a valid method for estimating regional economic impacts in this case (ABS, 2023).

It is unclear how the IO is applied. It appears to be applied to the Barkly region based on IO specification appropriate to larger regions, and not to the Barkly region but this is not explicitly stated. Nor is there any explanation of how the issue of limited local respending opportunity and employable workforce in very small regions is treated methodologically. We suspect improper application of the model and resultant interpretation of results and suggest the issue should be further clarified in Tier 3 assessment.

6. *Vague statements without any commitment to public service and benefit provision*

In the information provided we see no budget items that focus on any form of social benefits, no committed funding to training or employee wellbeing. While infrastructure is vaguely discussed, there is no budgeted investment in broader public benefit. It seems to be implied that public subsidy should provide significant benefit to FAFM and that others will benefit as well. If there is a public subsidy provided to FAFM in any form it should be costed to determine true net public benefit in line with NT guidance.

7. *Inadequate consideration of climate liability*

Inadequate consideration of climate liability of the project as stipulated in Australian Prudential Regulation Authority (APRA)'s Prudential Practice Guide - CPG 229 Climate Change Financial Risk (APRA, 2021)

APRA has recently ruled that company directors and by extension ministers cannot plead ignorance of significant adverse greenhouse gas impacts of their business plans and risks that this creates. Carbon cost and liabilities for Australia in meeting its UN net emission reduction targets would likely arise from this project, as has been found in similar large horticultural operations for example Martin-Gorriz *et al*. (2020). The NT and FAFM are aware of these and should include, at a minimum, the cost of covering this liability with carbon credits if not the broader social cost of the emissions.

Table 3. R**eview details and comparisons**

Attribute	Original	Updated (GHD EIA)	Details	Significance
Operating costs	Operating costs were estimated at $110 million AUD per year.	Updated operating costs are estimated at 'over $94 million' AUD per year.	The lower end of the updated operating costs ($94 million) is ~15% lower than the original estimate. This accounts for the lower end of over-estimation of operating costs described by Connor *et al*. (2022) being estimated at 10%-35% over-estimation of operating costs. NT expenditures are broken down by category into percentage of expenditure within the NT in Table 15 (page 25 of GHD report) as follows (percentages reflect stated percent of all expenditure that will be spent in the NT). Bracketed [%] values indicate the percentage of all costs that each category is calculated to be (i.e the cost share): Crop variable costs: 70% [78%] Permanent employee costs: 80% [15%] Management fees: 50% [1.6%] General repairs and maintenance: 50% [<1%] Sundries/contingencies: 70% [<1%] Electricity: 100% [<1%] Insurance: 50% [<1%] Vehicle operating costs: 100% [<1%] Plant and equipment: 50% [1.7%] Overheads: 80% [1.7%]	Estimates for overall operating costs have been substantially reduced to be within a potentially reasonable range based on other farming activities. The new estimates remain at the upper end of expectations for operating costs, based on similar projects, and are likely to be lower than stated, possibly substantially lower. This indicates that there is a strong likelihood that the total operating cost of the project will be substantially lower than stated. Crop variable costs make up the highest proportion of operational costs of the project at 78% of all costs. This cost estimate includes seasonal labour for crop production activities. Average total expenditures estimates add up to over $75 million per year over 30 years. The percentage of crop variable costs forecast to be expended in the NT is estimated at 70%
Local procurement	No clear statement	Clear statement on locally-focused procurement: "procurement preference is clearly local Barkly region first, Territory second, elsewhere third. Where firms outside the Territory may be needed, FAFM will actively encourage these to function as close to the site as possible and to employ locally" (EIA page v)	There is no detail available on how this procurement preference will be applied. Given limitations facing local procurement there is no evidence that the Singleton project will be able to achieve substantial local, or even Territory, procurement for either the investment or operational phases.	There is no additional evidence that changes the results outlined by Connor *et al*. (2022).

Attribute	Original	Updated (GHD EIA)	Details	Significance
Revenues and gross margins	Not reviewed in Connor *et al*. (2022)	Stated to be an expected final revenue of $200 million AUD per year.	This represents a $100 million annual gross profit (EBITDA) on operating costs of approximately $100 million – or a margin of 50% on all costs.	This assumption represents an extraordinary divergence from any existing horticultural project known. For example the NSW DPI estimates that rockmelons have a 14% margin while seedless watermelons have a 9% margin not including interest, tax, depreciation and amortization. Taking out water costs only changes the margin by 1-2%. There is no detail on the source of these differences but some basic calculations indicate a very large over-estimation of expected revenues. For example, the expected revenue per hectare on the basis outlined within the GHD EIA report is equal to an average of over $57,000 revenue per hectare. Even taking a high estimate of gross margins from revenues at 20%, and retaining the high operating cost estimates for Singleton (at $100 million AUD) these values indicate a revenue expectation of $125 million AUD – an over 35% reduction in stated margins. If operating costs, and likely associated revenues, were strongly overstated (as indicated as a possibility) these values would be even lower at approximately $90 million AUD total revenue (or over 50% lower than stated in the GHD EIA documents). Given the extraordinary overstatement of expected revenues per hectare, combined with no evidence provided to justify such an expectation, there is a strong indication that total economic values would be substantially lower than stated – possibly half of what has been stated.
Employment (operating)	Connor *et al*. (2022) calculated that the project statements indicate that a total of 368 FTE positions would be created comprising of 110 true	The GHD EIA review indicates a substantial increase in expected employment levels to a total of 426 FTE positions	The GHD report uses FTEs as a measure instead of statements of seasonal and permanent positions making comparisons to standard farm models and data more direct.	This is a dramatic increase on estimated FTEs from the original proposal details (as calculated by Connor *et al.* 2022). It represents an increase of 15% on those original employment expectations – employment expectations that were shown to be likely to be inflated compared to labour usage

Attribute	Original	Updated (GHD EIA)	Details	Significance
	FTE positions and 1350 seasonal places (average employment length assumed at 8 weeks).		The composition of employment is described in the GHD EIA as: • 122 direct farm full time equivalent positions • 37 full time equivalent seasonal positions • 170 indirect full time equivalent positions • 97 indirect supply chain full time equivalent positions The IO analysis of GHD implies an employment multiplier of over 100% for operating activities – 159 FTEs generate 170 additional (indirect) FTE positions in the broader economy. For the construction phase the multiplier is lower, but still large (80%) for indirect jobs.	expectations for intensive horticulture in areas with greater labour availability, even with the original lower detail. These new estimates represent an inflation factor of over 50% compared to rockmelon labour use as estimated by the NSW Department of Primary Industries at 0.12 FTE per hectare (compared to 0.077 FTE per hectare for rockmelon in NSW). There is no detail to support these estimated labour usage data for Singleton whilst existing comparisons, in areas with high labour availability, indicate substantially lower labour usage (over 50% lower than stated per hectare for the Singleton project).
Construction estimates	Total construction value only provided	Detailed construction value across a number of activities provided along with a percentage allocation to expenditure within the NT. No detail provided that can support claims on % NT expenditures.	Total capital expenditure is estimated at ~ $252m AUD. Of this ~$167m is stated to be spent within the Northern Territory (66% of all capital expenditures).	It is not possible to consider the validity of the total expenditure estimates with available data. However, the proposed proportion of expenditure in the Northern Territory of 66% of total capital expenditures, amounting to $167 million appears highly optimistic. For each category, other than land clearing, the expectation that the Singleton project would seek to purchase capital inputs from the Northern Territory, a region with a small, and declining manufacturing sector, is unrealistic. Other indicators also raise questions over this assumption – for example the 3.3% unemployment rate in greater Darwin and 4.8% in regional areas of the Northern Territory are strongly indicative of an economy that is at capacity. In combination with the small size of the economy and population, this indicates substantial difficulties in the capacity of the NT economy to provision services/inputs to the construction phases of the Singleton project.

Authors' biographies

Professor Jeffery Connor

Jeff Connor specialises in quantitative economic, environmental and social integrated systems modelling often working closely with governments at local, state, national and international levels to provide economic policy advice based on rigorous economics. Jeff worked as an economist and group leader at CSIRO from 2001-2016 where he provided research and advise to the Murray Darling Basin Authority, natural resource management boards and state departments for water, agriculture and natural resource management in South Australia, Victoria, and Western Australia and in Bangladesh, Indonesia, China and Laos. He has secured and/or managed over $6 million worth of externally funded research and published over 60 peer reviewed articles and book chapters in water resource and environmental economics.

Dr Daniel Gregg

Daniel Gregg is Principal Economist at Heuris. Daniel has led several reports into farming systems risks and strategic initiatives, including a recent report for the OECD on agro-food systems resilience in which price and input risks were reviewed alongside market and other risks. This report focused on the importance of price risks in the COVID era and due to the emergence of geo-political tensions such as from the Russian invasion of Ukraine. Daniel has ongoing work with the OECD focusing on farm productivity measurement, leads the economic analysis of a large national sustainable farming initiative, and is an Associate Editor of the Australian Journal of Agriculture and Resource Economics focusing on farm analysis efforts.

Dr John Kandulu

John Kandulu is a Senior Research Economist at the School of Economics and Public Policy at the University of Adelaide. John has over 15 years of work experience as an applied economist in education, not-for-profit and government sectors focusing on natural resource management policy design and evaluation. He has contributed to projects addressing aid for development programs, policy-, program- and project impact evaluation, food and water security and water quality management. John applies various analytical techniques to inform policy- and investment decisions, including evaluating the effectiveness of new policy-, program- and project options, and the expected net return on prospective investment options. John's current research area of interest is design and evaluation of effective diversity and inclusion policies to inform inclusive natural resource management.