Attachment 1 Revised Calculations

Lot 11 and 74 Beenyup Road, Banjup

Response to Submissions

EPA Assessment Number: 2255

Aigle Royal Developments

SLR Project No.: 675.072616.00001

23 July 2025

Table 1: Environmental Values in Development Area

Environmental Value	Description	Area (Ha)
Vegetation Condition	Completely Degraded	0.40
	Good	2.42
	Very Good	0.22
Vegetation Type	Cleared	0.40
	AfBaBmKg	2.24
	AfBiKg	0.40
Fauna Habitat	Disturbed area	0.28
	Mixed Banksia and Eucalypt woodland	2.76
Banksia Woodlands TEC		2.24
FCT SCP21c		2.64
Black Cockatoo Breeding Trees	3 breeding trees, none of which were observed to have hollows	N/A
Black Cockatoo foraging habitat		2.85

Table 3: Environmental Values in Wetland Buffer Area

Environmental Value	Description	Area (Ha)
Vegetation Condition	Completely Degraded	0.12
	Degraded	0.11
	Good	0.84
	Very Good	0.51
Vegetation Type	Cleared	0.12
	AlKg	0.11
	AfBaBmKg	0.28
	AfBiKg	1.07
Fauna Habitat	Disturbed area	0.10
	Melaleuca woodland	0.63
	Mixed Banksia and Eucalypt woodland	0.86
Banksia Woodlands TEC		0.28
FCT SCP21c		1.35
Black Cockatoo Breeding Trees	5 breeding trees, none of which were observed to have hollows	N/A
Black Cockatoo foraging habitat		1.51

Table 2: Environmental Values in Conservation Area

Environmental Value	Description	Area (Ha)
Vegetation Condition	Completely Degraded	1.99
	Degraded	0.14
	Good – Degraded	0.01
	Good	1.38
	Very Good – Good	0.40
	Very Good	8.77
	Excellent – Very Good	8.74
	Excellent	0.11
Vegetation Type	BaBm (A)	0.43
	BaBm (B)	0.00
	Cleared	1.32
	Ec	0.23
	ErMp	1.14
	Garden and Orchard	0.00
	Ha	4.06
	KgHa	3.38
	MpKg	2.89
	Mr	0.47
	MrBa	2.83
	MrMl	3.13
	MtMr	1.24
	Non-endemic Eucalypt species	0.38
	Open Water	0.04
	Planted non-endemic and endemic species	0.01
Fauna Habitat	Disturbed area	1.89
	Melaleuca woodland	5.98
	Mixed Banksia and Eucalypt woodland	0.41
	Mixed shrubs on dampland	9.99
	Wetlands	3.27
Banksia Woodlands TEC		0.64
FCT SCP23a		2.39
Black Cockatoo Breeding Trees	14 breeding trees, one of which was observed to have a hollow	N/A
Black Cockatoo foraging habitat		20.87

Attachment 2 Proposed Environmental Offset

Lot 11 and 74 Beenyup Road, Banjup

Response to Submissions

EPA Assessment Number: 2255

Aigle Royal Developments

SLR Project No.: 675.072616.00001

23 July 2025

Monday, 10 March 2025

Our Ref: e.g. A24.213_MEM-OS_0_FINAL

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Proposed Environmental Offset – Lots 11 and 74 Beenyup Road, Banjup (EPBC 2017/7923)

Aigle Royal Developments (herein referred to as the Proponent) have obtained approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to develop Lots 11 and 74 Beenyup Road, Banjup (the Site) for residential purposes (EPBC 2017/7923). The Site and proposed development is shown inFigure 1. The proposed development is currently undergoing assessment by the WA Environmental Protection Authority (EPA) under section 38 of the *Environmental Protection Act 1986* (EP Act).

This memorandum has been prepared to describe the combined residual impacts of both Stage 1 and 2 of the proposed development and detail proposed on- and off-site environmental offsets to satisfy conditions of EPBC Act approval (EPBC 2017/7923). It is considered that these offsets will also satisfy State requirements.

Stage 1 and 2 Impacts

The proposed development will have significant residual impacts to Matters of National Environmental Significance (MNES), namely the Endangered Carnaby's black cockatoo (CBC) and Banksia woodlands of the Swan Coastal Plain Threatened ecological community (Banksia TEC). The combined residual impact to MNES from both Stage 1 and 2 is as follows:

- 6.02 ha foraging habitat for CBC with a weighted average quality of 6 (out of 10; low to moderate). Habitat is described as predominantly banksia woodland with an average of 20% foliage cover (Figure 2).
- 5.70 ha of Banksia TEC with a habitat quality score of 5 (out of 10) due to being primarily comprised of vegetation in average Very Good condition, having low species richness, representing a state Priority Ecological Community (PEC), and having a small patch size (Figure 3).

On-Site Offsets

On-site offsets are proposed during both Stage 1 and Stage 2 of the proposed development, as follows:

- Overall, approximately 26.08 ha of land will be designated for retention and protection. A 2.48 ha Conservation Area will be transferred into Jandakot Regional Park for management by the City of

Cockburn as part of Stage 1, and 23.48 ha will be zoned as Parks and Recreation under the Metropolitan Region Scheme (MRS) as part of Stage 2. Additionally, 0.12 ha of the Stage 1 Public Open Space (POS) area will be retained, as it is within the 50 m buffer of Conservation Category Wetland (CCW) UFI 12984.

Areas where MNES will be retained are shown on Figure 1.

Conservation Area

The Stage 1 Conservation Area (2.48 ha) comprises entirely CBC foraging habitat and Banksia TEC, summarised as follows:

- Weighted average CBC foraging habitat quality was assessed as 7 (out of 10; moderate) due to being comprised of a banksia woodland vegetation type with an average 20% foliage cover.

- Weighted average Banksia TEC habitat quality was assessed as 5 (out of 10) due to being primarily comprised of vegetation in average Very Good condition, having low species richness, representing a state PEC, and having a small patch size.

Parks and Recreation

The area to be zoned as Parks and Recreation under the MRS during Stage 2 contains 3.18 ha of CBC foraging habitat and 1.96 ha of Banksia TEC, summarised as follows:

- Weighted average CBC foraging habitat quality was assessed as 6 (out of 10; low to moderate) due to being comprised of a banksia woodland vegetation type with an average 10-20% foliage cover.

- Weighted average Banksia TEC habitat quality was assessed as 5 (out of 10) due to being primarily comprised of vegetation in average Very Good condition, having low species richness, representing a State PEC, and having a small patch size.

Total On-Site Offsets

Carnaby's Black Cockatoo

- A total of 5.77 ha (extent of CBC foraging habitat currently in moderate or low to moderate quality) will be increased to a weighted average habitat quality of 8 (moderate to high) by increasing average foliage cover to 30-40%. This will be achieved through a combination of infill planting, weed management, fence maintenance, and access controls.

- Additionally, 1.50 ha of CBC foraging habitat will be established within currently cleared land, with a final HQS of at least 7 (moderate). To achieve this end goal, foraging species will be planted to achieve at least 20% foliage cover.

- A breakdown of current and future habitat quality scores (HQS) for CBC foraging habitat within the Conservation Area and Parks and Recreation is provided below:

Current HQS (out of 10)	Future HQS (out of 10)	Area (ha)	Current weighted HQS	Future weighted HQS
10 (very high)	10 (very high)	0.76	1.04	1.04
7 (moderate)	9 (high)	0.55	0.55	0.68
6 (low to moderate)	8 (moderate to high)	4.46	3.68	4.91
0 (none)	6 (low to moderate)	1.50	0.00	1.24
Total		**7.27**	**5.25 (5)**	**7.87 (8)**

Banksia Woodlands of the Swan Coastal Plain

- Scenario 1: 1.50 ha of currently cleared land will be revegetated to Banksia TEC with a similar quality to that which already occurs within the on-site offsets (5 out of 10). This will require revegetation of banksia woodland vegetation type to Very Good condition.

- Scenario 2: Alternatively, if required, the existing extent of Banksia TEC within the Conservation, POS, and Parks and Recreation area (4.55 ha with current weighted average HQS of 5) may be managed to prevent any potential degradation from adjacent residential development and manage edge effects such that there are no consequential negative impacts. This scenario also includes the creation of 1.50 ha of Banksia TEC within currently cleared land, as detailed above, as well as the restoration of 0.1 ha vegetation in Good to Degraded condition that does not currently meet the diagnostic criteria as Banksia TEC.

Current HQS	Area (ha)	Future HQS without offset	Future HQS without offset (weighted)	Future HQS with offset	Future HQS with offset (weighted)
5	4.55	4	3.70	5	3.70
0	1.60	0	0	5	1.30
Total	**6.15**		**3.70 (4)**		**5.00 (5)**

- The offset calculator demonstrates that on-site retention and revegetation/restoration can contribute to the following proportion of total offset requirements for Stage 1 and 2:

MNES	Proposed offset	Start quality (weighted average)	End Quality (weighted average)	Proportion of total offset (%)
Carnaby's black cockatoo	Revegetation of 1.50 ha of cleared land, and restoration of 6.77 ha (total offset: 7.29).	5	8	31.00%
Banksia woodlands of the Swan Coastal Plain	Scenario 1: Revegetation of 1.50 ha of cleared land.	0	5	13.47%
	Scenario 2:	4	5	22.10%[1]

[1] Offset quantum assumes a reduction in Banksia TEC habitat quality in the absence of the offset and associated management due to the increased risk of edge effects and disturbance from adjacent residential development. It is expected that this could reduce quality of existing Banksia TEC (4.55 ha) by one point (5 to 4), and weighted average habitat quality across the entire on-site offset area (6.15 ha) by one point (4 to 3). With the offset applied, habitat

MNES	Proposed offset	Start quality (weighted average)	End Quality (weighted average)	Proportion of total offset (%)
	Management of 4.55 ha existing Banksia TEC, revegetation of 1.50 ha of cleared land, and restoration of 0.1 ha.			

- Throughout the remainder of this report, total combined on-site and off-site offsets assume Scenario 1 for on-site offsets (revegetation of 1.50 ha of currently cleared land providing an offset equating to 13.47% of residual impacts).

- The offset calculators are provided as attachments to this memo.

Offset Site – Portion of Rose Shanks Reserve

- A 16.16 ha portion of Rose Shanks Reserve is proposed to compensate for the remaining residual impact of proposed development (Stages 1 and 2). This area is shown in Figure 3 and is hereafter referred to as the 'Proposed Offset Site'.

- Rose Shanks Reserve is vested in the City of Cockburn for conservation. Nevertheless, advice has confirmed that this is not a positive obligation that the City instigate rehabilitation of the land like that proposed.

Vegetation Types and Condition within the Proposed Offset Site

- The Proposed Offset Site contains the following vegetation types and conditions:

Vegetation type	Area (ha)	% of Total
Cleared	0.46	2.8
Planted 01	0.60	3.7
Planted 02	1.13	7.0
REVEG	12.02	74.4
VT01	1.58	9.8
VT02	0.37	2.3
Total	16.16	**100**

Vegetation condition	Area (ha)	% of Total
Cleared	0.46	2.8
Completely degraded	5.14	31.8
Degraded	7.29	45.1
Good	1.73	10.7
Very good	1.30	8.1

quality would be maintained within the existing Banksia TEC (i.e. remain at 5), revegetation within 1.50 ha (0 to 5), and restoration of 0.1 ha would increase the weighted average quality across the 6.15 ha area from 4 to 5.

Vegetation condition	Area (ha)	% of Total
Excellent	0.23	1.5
Total	**16.16**	**100**

CBC Foraging Habitat within the Proposed Offset Site

- The Proposed Offset Site currently contains 16.16 ha of land containing CBC foraging habitat ranging from 0 (none) to 7 (very high). Habitat quality was assessed under the DCCEEW (n.d.) HQS tool for black cockatoo foraging habitat. According to the HQS tool, habitat with a site condition score of 2 or less is highly unlikely to constitute suitable habitat for black cockatoos, therefore the adjusted current extent of suitable foraging habitat within the Proposed Offset Site is 5.11 ha.

- The current weighted average site condition score for the entire Proposed Offset Site (16.16 ha) is 3 (out of 10), as detailed below:

CBC foraging quality[2] (out of 10)	Area (ha)	% of Site	Weighted quality
0 - none	2.65	16.4	0.00
1 - negligible to low	2.59	16.1	0.16
2 - low	5.81	35.9	0.72
6 - low to moderate	0.23	1.4	0.09
7 - moderate	2.21	13.7	0.96
8 - moderate to high	0.83	5.2	0.41
9 - high	0.05	0.3	0.03
10 - very high	1.79	11.1	1.11
Total	**16.16**	**100.0**	**3.47 (3)**

- Site context was assigned a score of 3 (out of 3) for habitat of low to moderate quality or higher (i.e. site condition score of between 3 and 7) given the presence of suitable foraging habitat (with a site condition score of at least 3) within the surrounding 12 km.

- CBC foraging habitat within the Proposed Offset Site is shown on Figure 4.

- Revegetation and restoration of CBC foraging habitat is proposed to be undertaken over a 20-year time period to establish low to moderate quality habitat within areas that currently contain low (or worse) quality habitat (11.05 ha). Elsewhere, habitat will be improved by a maximum of 2 HQS points, except where habitat is currently of high to very high quality (1.84 ha) where habitat quality will be maintained.

- Final habitat quality to be created and improved by the proposed offset is provided below:

[2] Note: The DCCEEW (n.d.) HQS Tool identifies that foraging habitat with a score of 2 (low) or lower is highly unlikely to constitute suitable foraging habitat. Therefore, a site context score is not applied for habitat that scores between 0 and 2.

CBC foraging quality		Area (ha)	Weighted quality (final)
Start quality (out of 10)	Final quality (out of 10)		
0 - none	**6 – low to moderate**	2.65	0.98
1 - negligible to low	**6 – low to moderate**	2.59	0.96
2 - low	**6 – low to moderate**	5.81	2.16
6 - low to moderate	**8 – moderate to high**	0.23	0.11
7 - moderate	**8 – moderate to high**	2.21	1.09
8 - moderate to high	**9 - high**	0.83	0.46
9 - high	**9 - high**	0.05	0.03
10 - very high	**10 – very high**	1.79	1.11
Total		**16.16**	**6.91 (7)**

- As shown above, the proposed offset will result in 16.16 ha of CBC foraging habitat with a weighted quality of 7 (out of 10) will be delivered within the Proposed Offset Site.

- Site context will remain at a score of 3 (out of 3) given the presence of suitable foraging habitat (with a site condition score of at least 3) within the surrounding 12 km. Given that all habitat will be improved to have a final site condition score of at least 3 (out of 7), the site context score of 3 will apply to all habitat within the Proposed Offset Site.

Banksia TEC within the Proposed Offset Site

- The Proposed Offset Site currently contains 1.84 ha of Banksia TEC, which forms part of a larger patch to the east within Rose Shanks Reserve. Banksia TEC within the Proposed Offset Site was assessed under the DCCEEW (n.d.) HQS tool for Banksia TEC and has a current quality of 6 (out of 10).

- A summary of Banksia TEC HQS for the patch that intersects the Proposed Offset Site is provided below:

Component	Sub-component	Possible	Actual	Rationale
Site Condition (70%)	Vegetation condition	100	60	Average vegetation condition: Very Good
	Species richness	10	0	Below average species richness
	Presence of threatened taxa	10	0	No threatened taxa present
	State TEC/PEC	20	10	State PEC
	Dieback	10	0	None identified
Condition total		150	70	
Condition out of 70 (total/150*70)		**70**	**32.67**	
Site Context (30%)	Connectivity	30	20	Forms a medium to large local remnant
	Patch size	50	50	Total patch size is 24.86 ha
	Site location and risk	10	10	The TEC has been extensively cleared throughout its range
	Site location and risk	10	0	The patch is not at the edge of the community's geographic extent
Context total		**100**	**80**	
Context out of 30 (total/100*30)		30	24	
Quality total (out of 100)		30	56.67	

Component	Sub-component	Possible	Actual	Rationale
Final score (out of 10)		**10**	**5.67 (6)**	

- The balance of the Proposed Offset Site (14.32 ha) does not contain Banksia TEC.
- Banksia TEC within the Proposed Offset Site is shown on Figure 5.
- Revegetation of Banksia TEC is proposed to be undertaken over a 20-year time period to establish the TEC within areas not currently representative of the TEC, and that are not covered by limestone roads (total of approximately 13.86 ha).
- The proposed offset will result in Banksia TEC with a HQS of 5 (out of 10) through revegetation to average 'Good' condition across 13.86 ha. Inputs to the HQS are detailed below:

Component	Sub-component	Possible	Actual	Rationale
Site Condition (70%)	Vegetation condition	100	40	Average vegetation condition: Good
	Species richness	10	0	Below average species richness
	Presence of threatened taxa	10	0	No threatened taxa present
	State TEC/PEC	20	10	State PEC
	Dieback	10	0	None identified
Condition total		150	70	
Condition out of 70 (total/150*70)		**70**	**23.33**	
Site Context (30%)	Connectivity	30	20	Forms a medium to large local remnant
	Patch size	50	50	Total patch size is 24.86 ha
	Site location and risk	10	10	The TEC has been extensively cleared throughout its range
	Site location and risk	10	0	The patch is not at the edge of the community's geographic extent
Context total		**100**	**80**	
Context out of 30 (total/100*30)		30	24	
Quality total (out of 100)		30	47.33	
Final score (out of 10)		**10**	**4.73 (5)**	

Offset Calculator Results

- Offset calculator demonstrates that revegetation of the Proposed Offset Site will contribute the following proportion of total offset requirements for Stage 1 and 2:

MNES	Proposed offset	Start quality	End Quality	Proportion of total offset (%)
Carnaby's black cockatoo	Revegetation and restoration of 16.16 ha to increase weighted site HQS from 3 to 8.	3	7	91.63%
Banksia woodlands of the Swan Coastal Plain	Establishment, through revegetation, of 13.86 ha of Banksia TEC within currently Degraded to	0	5	114.93%

MNES	Proposed offset	Start quality	End Quality	Proportion of total offset (%)
	Completely Degraded land.			

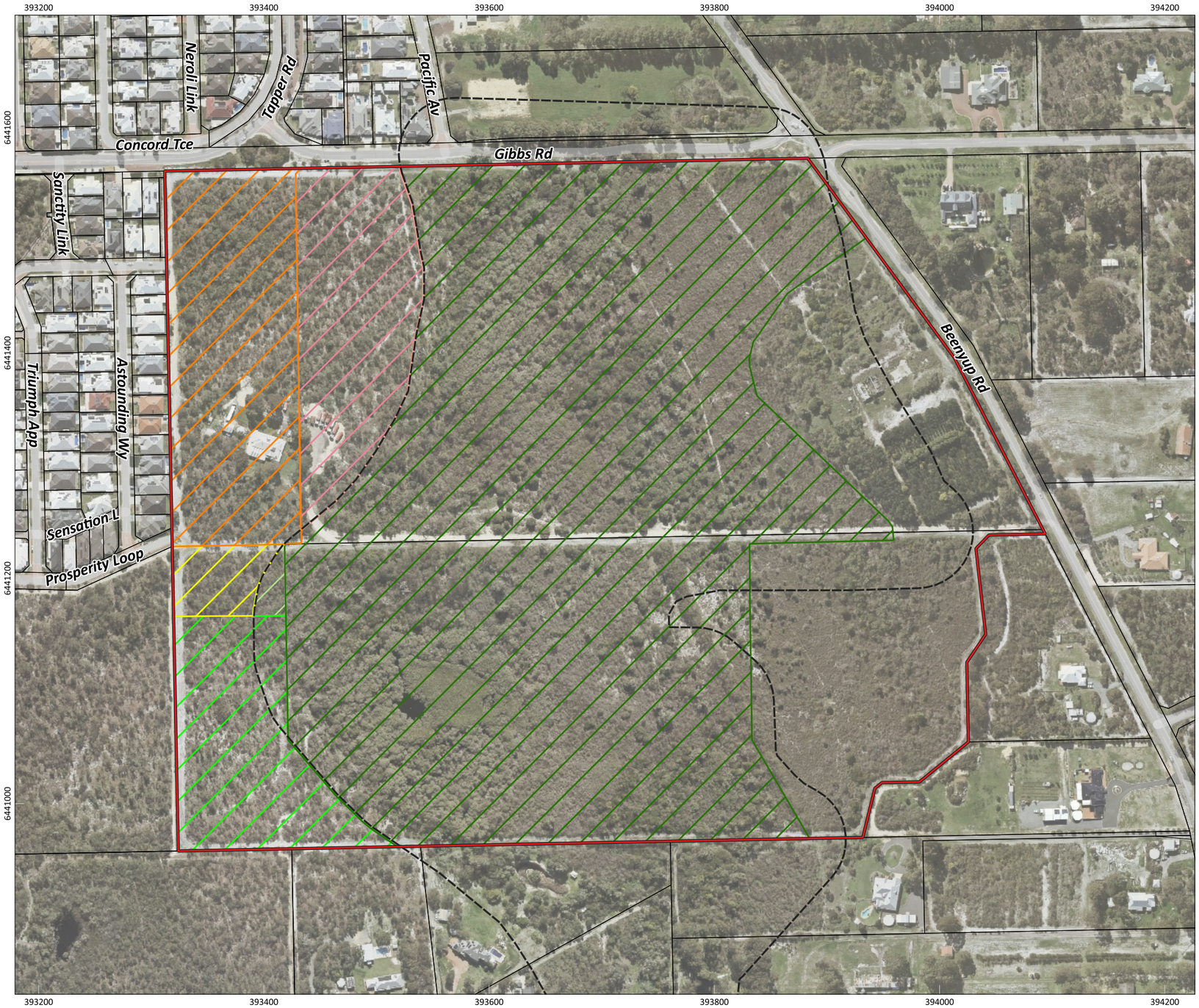
- Offset calculators are provided as attachments to this memo.

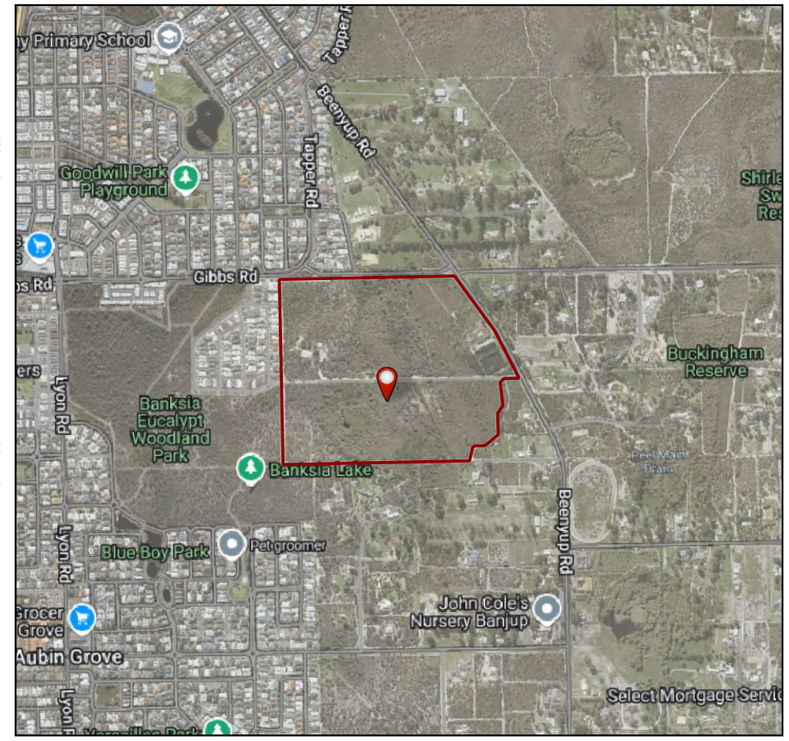
Combined Outcome of On-Site and Off-Site Offsets

- The combined outcome of proposed on-site and off-site offsets is provided below:

MNES	Outcome of proposed on-site offset	Outcome of proposed off-site offset	Combined offset
Carnaby's black cockatoo	31.00%	91.63%	**122.63%**
Banksia woodlands of the Swan Coastal Plain	13.47%	114.93%	**128.4%**

- Well over the minimum 100% direct offset for Stage 1 and 2 of the proposed development is achieved by the on-site and off-site offsets detailed in this memo for CBC and Banksia TEC.





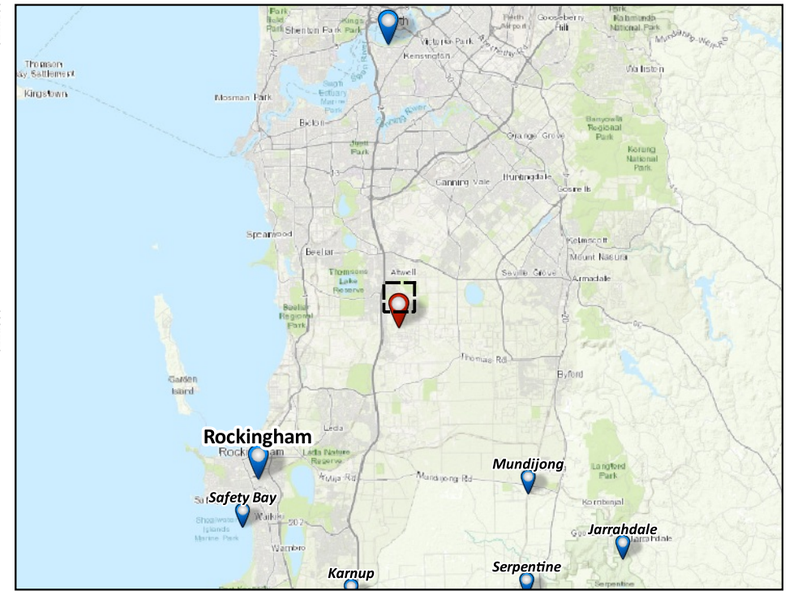


Figure 1: The Site (EPBC 2017/7923)

N

0 60 120 180 240 m

SCALE 1:4,000	SHEET SIZE A3 COLOUR
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50	
DATA SOURCE Landgate	

PROJECT/REPORT NAME
EPBC 2017/7923
Offset Strategy

CLIENT
Aigle Royal Developments

PROJECT NUMBER	VERSION
A24.213	0
DRAWN BY / REVIEWED BY	DATE
HS / DN	7/3/2025

Legend

- The Site
- Cadastre (No Attributes) (LGATE-001)
- 50 m buffer of CCW (UFI 12984)

Areas to be Impacted
- Stage 1
- Stage 2
- Public Open Space (recreation and amenity)

Areas to be Retained
- Conservation Area
- Parks and Recreation
- Public Open Space (within 50 m CCW buffer)

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary (LGATE-002). Base map ESRI Topo. Townsites (LGATE-248).

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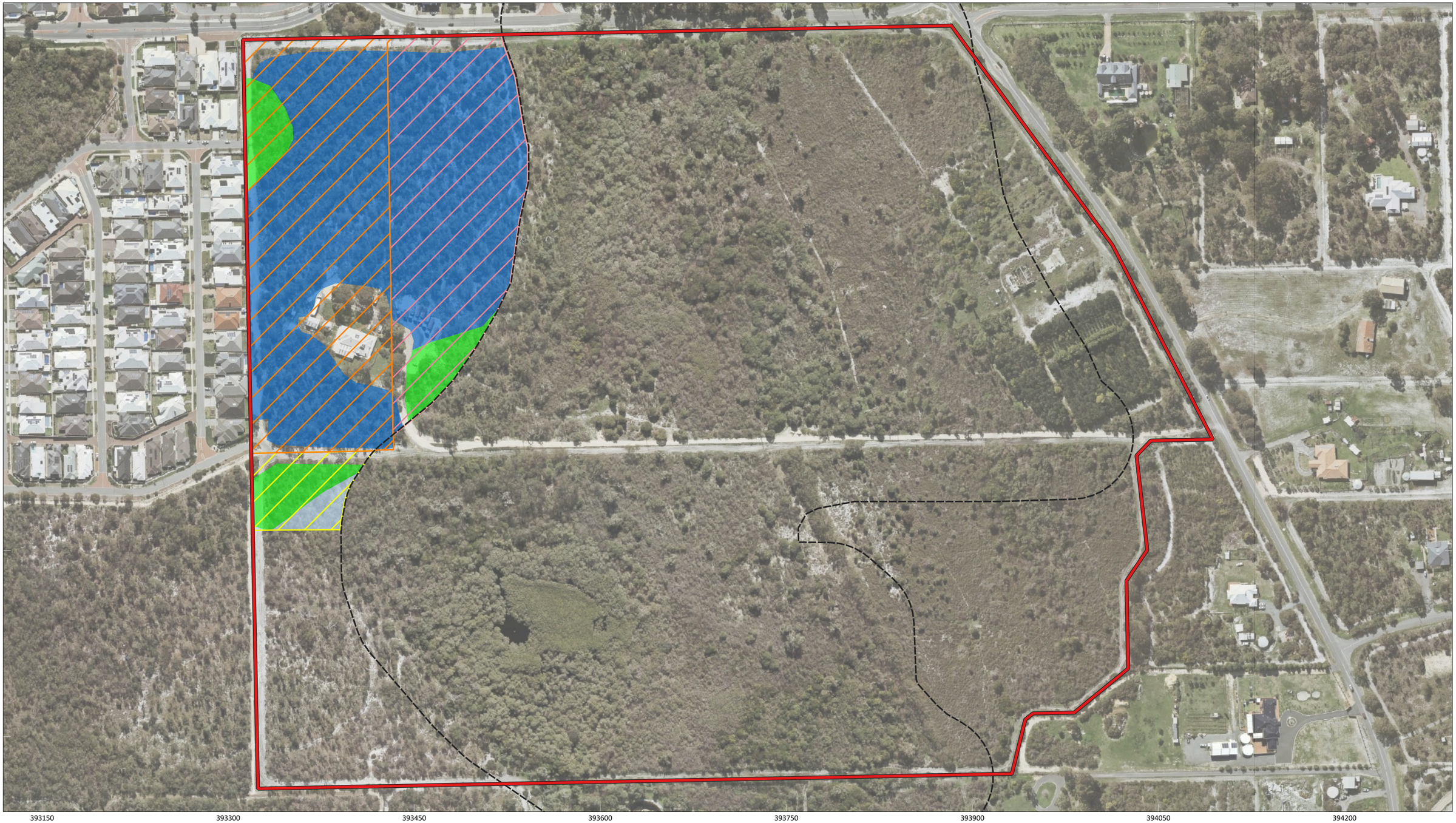

Figure 2: Carnaby's Black Cockatoo Habitat to be Impacted

N

0 90 180 m

PROJECT/REPORT NAME	EPBC 2017/7923 Offset Strategy
SCALE	1:3,000
SHEET SIZE	A3 COLOUR
CLIENT	Aigle Royal Developments
COORDINATE REFERENCE SYSTEM	GDA2020 / MGA zone 50
PROJECT NUMBER	A24.213
VERSION	0
DATA SOURCE	Landgate
DRAWN BY / REVIEWED BY	HS / DN
DATE	7/3/2025

Legend

- The Site
- 50 m buffer of CCW (UFI 12984)

Areas to be Impacted

- Stage 1
- Stage 2
- Public Open Space (recreation and amenity)

CBC Foraging Habitat Quality

- 6 - Low to moderate
- 7 - Moderate
- 10 - Very high

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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Figure 2: Banksia TEC to be Impacted

N

0 90 180 m

SCALE 1:3,000	SHEET SIZE A3 COLOUR	PROJECT/REPORT NAME EPBC 2017/7923 Offset Strategy	
		CLIENT Aigle Royal Developments	
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50		PROJECT NUMBER A24.213	VERSION 0
DATA SOURCE Landgate		DRAWN BY / REVIEWED BY HS / DN	DATE 7/3/2025

Legend

- The Site
- 50 m buffer of CCW (UFI 12984)

Areas to be Impacted

- Stage 1
- Stage 2
- Public Open Space (recreation and amenity)

Banksia TEC HQS

- 5 (out of 10)

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

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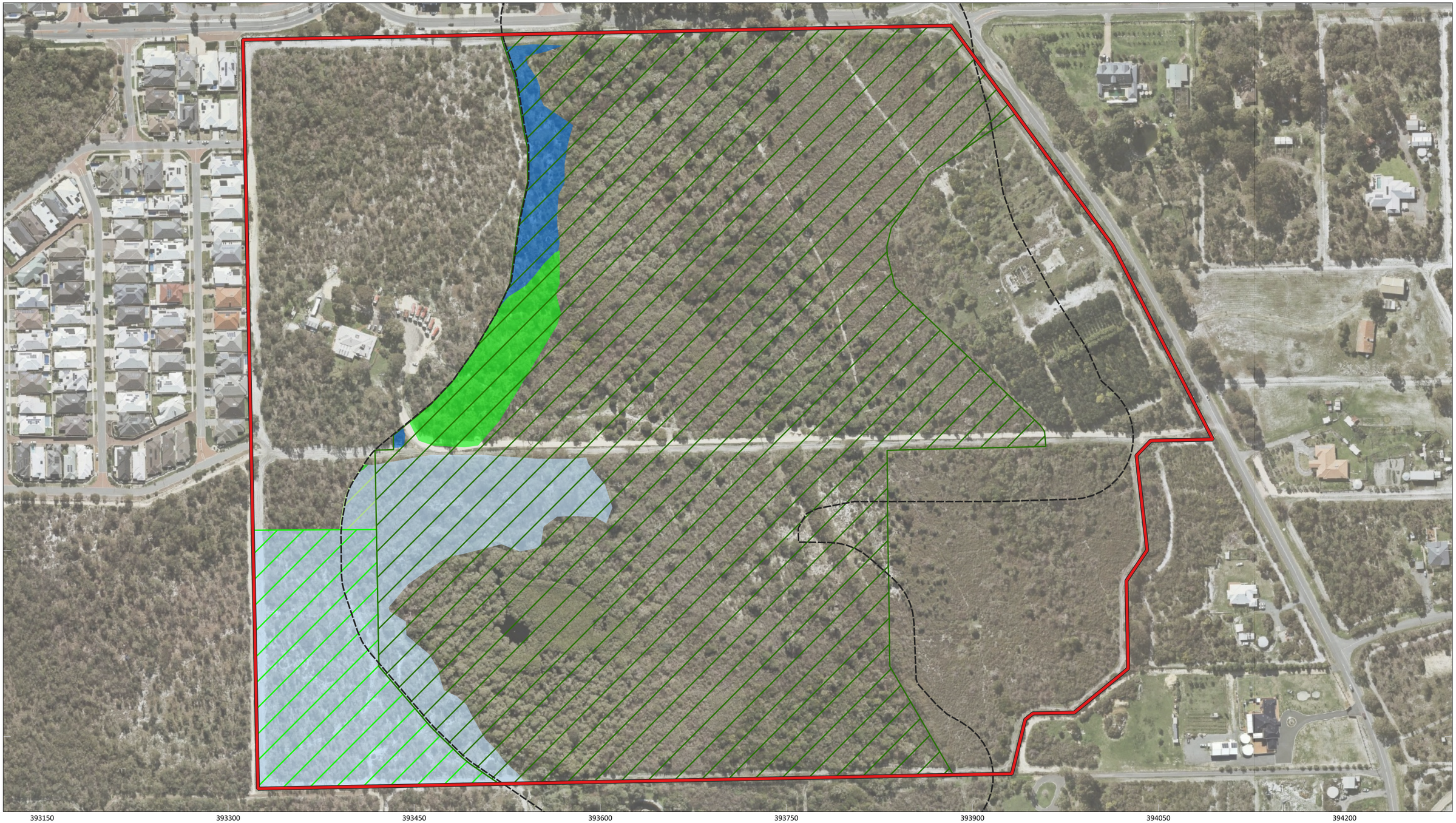

Figure 4: On-Site Offsets - Carnaby's Black Cockatoo

N

0 90 180 m

SCALE 1:3,000	SHEET SIZE A3 COLOUR	PROJECT/REPORT NAME EPBC 2017/7923 Offset Strategy	
		CLIENT Aigle Royal Developments	
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50		PROJECT NUMBER A24.213	VERSION 0
DATA SOURCE Landgate		DRAWN BY / REVIEWED BY HS / DN	DATE 7/3/2025

Legend

- The Site
- 50 m buffer of CCW (UFI 12984)

Areas to be Retained

- Conservation Area
- Parks and Recreation
- Public Open Space (within 50 m CCW buffer)

CBC Foraging Habitat Quality

- 6 - Low to moderate
- 7 - Moderate
- 10 - Very high

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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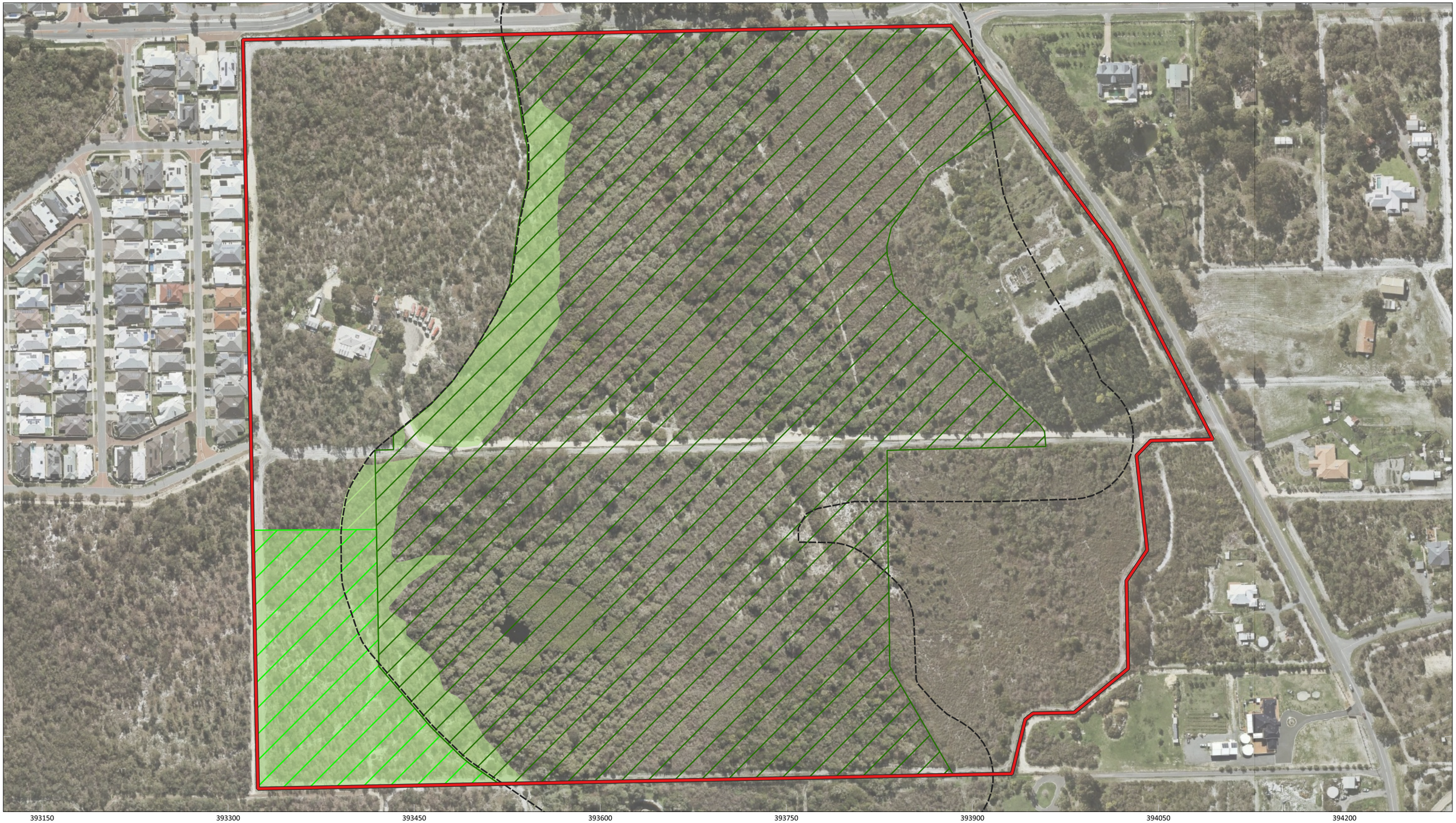

Figure 4: On-Site Offsets - Banksia TEC

N

0 90 180 m

SCALE 1:3,000	SHEET SIZE A3 COLOUR
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50	PROJECT NUMBER A24.213
DATA SOURCE Landgate	DRAWN BY / REVIEWED BY HS / DN

PROJECT/REPORT NAME
EPBC 2017/7923
Offset Strategy

CLIENT
Aigle Royal Developments

VERSION 0

DATE 7/3/2025

Legend

- The Site
- 50 m buffer of CCW (UFI 12984)

Areas to be Retained

- Conservation Area
- Parks and Recreation
- Public Open Space (within 50 m CCW buffer)

Banksia TEC HQS

- 5 (out of 10)

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

WESTERN ENVIRONMENTAL
Western Environmental Pty Ltd
08 6244 2310 |
enquiries@westenv.com.au
Level 3/25 Prowse St, West Perth WA 6005
westenv.com.au

Designed and Automated by AC

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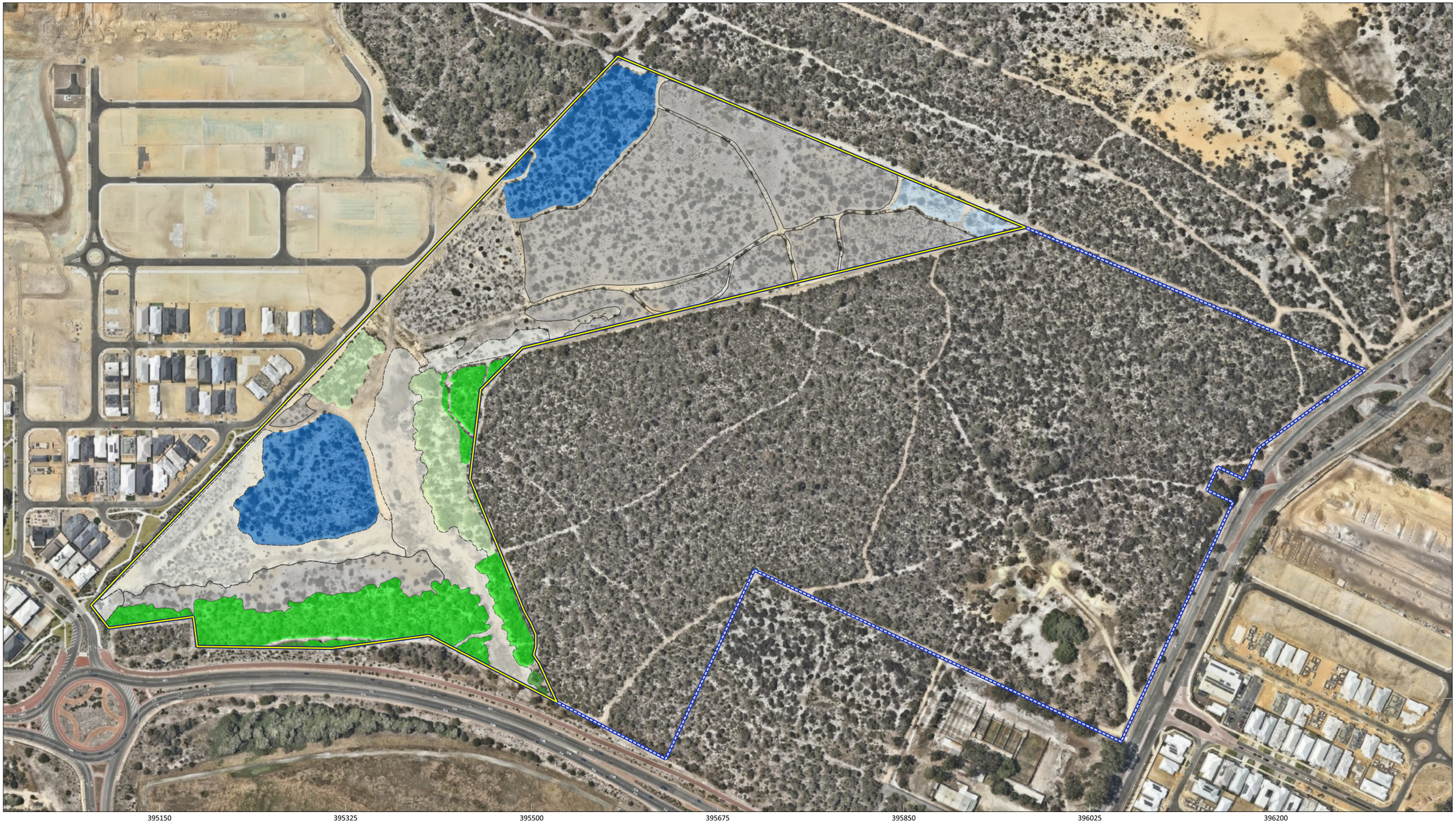

Figure 6: Proposed Offset Site - CBC Foraging Habitat

N

0 100 200 m

PROJECT/REPORT NAME: EPBC 2017/7923 Offset Strategy		
SCALE: 1:3,500	SHEET SIZE: A3 COLOUR	CLIENT: Aigle Royal Developments
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 50	PROJECT NUMBER: A24.213	VERSION: 0
DATA SOURCE: Landgate	DRAWN BY / REVIEWED BY: HS / DN	DATE: 7/3/2025

Legend

- Proposed Offset Site
- Rose Shanks Reserve

Current CBC Foraging Habitat Quality

- 1 - Negligible
- 2 - Low
- 6 - Low to moderate
- 7 - Moderate
- 8 - Moderate to high
- 9 - High
- 10 - Very high

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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Designed and Automated by AC

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Figure 6: Proposed Offset Site - Banksia TEC

N 0 100 200 m		PROJECT/REPORT NAME EPBC 2017/7923 Offset Strategy	
SCALE 1:3,500	SHEET SIZE A3 COLOUR	CLIENT Aigle Royal Developments	
COORDINATE REFERENCE SYSTEM GDA2020 / MGA zone 50		PROJECT NUMBER A24.213	VERSION 0
DATA SOURCE Landgate		DRAWN BY / REVIEWED BY HS / DN	DATE 7/3/2025

Legend

- Proposed Offset Site
- Rose Shanks Reserve
- Area to be Revegetated to Banksia TEC

Existing Banksia TEC HQS
- 6 (out of 10)

No	Description	Drawn	Approved	Date
A	Original issue	JP	TC	7/3/2025

NOTES:

Cadastral boundary from LANDGATE 2022. Label corresponds to the vegetation association number.

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Designed and Automated by AC

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Appendix A
Carnaby's Black Cockatoo – Onsite Offset

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	CBC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	6.02	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	3.61	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	3.61	Adjusted hectares	7.27 ha onsite offset - transfer and revegetation	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	7.29	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	90%	0.00	0.00	1.12	31.00%	No		
									Future area without offset (adjusted hectares)	7.3	**Future area with offset (adjusted hectares)**	7.3									
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**5**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**8**	3.00	65%	1.95	1.54					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	3.612	1.12	31.00%	**No**	$0.00	#DIV/0!	#DIV/0!
					$0.00	**#DIV/0!**	**#DIV/0!**

Appendix B
Banksia TEC – Onsite Offset (Scenario 1)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Banksia TEC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	5.7	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	2.85	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	Yes	2.85	Adjusted hectares	Scenario 1: Revegation of 1.42 ha cleared land to Banksia TEC	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	1.5	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	90%	0.00	0.00	0.38	13.47%	No		
									Future area without offset (adjusted hectares)	1.5	**Future area with offset (adjusted hectares)**	1.5								
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**5**	5.00	65%	3.25	2.56				
Threatened species habitat																				
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	2.85	0.38	13.47%	**No**	$0.00	#DIV/0!	#DIV/0!
					$0.00	**#DIV/0!**	**#DIV/0!**

Appendix C
Banksia TEC – Onsite Offset (Scenario 2)

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Banksia TEC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	5.7	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	2.85	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	2.85	Adjusted hectares	Scenario 2: Management of 4.55 ha, revegetation of 0.5 ha cleared land, improvement of 0.1 ha G-D vegetation	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	6.15	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	90%	0.00	0.00	0.63	22.10%	No		
									Future area without offset (adjusted hectares)	6.2	**Future area with offset (adjusted hectares)**	6.2									
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**4**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**5**	2.00	65%	1.30	1.02					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	2.85	0.63	22.10%	**No**	$0.00	#DIV/0!	#DIV/0!
					$0.00	**#DIV/0!**	**#DIV/0!**

Appendix D
Carnaby's Black Cockatoo – Proposed Offset Site

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	CBC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	6.02	Hectares	
			Quality	**6**	Scale 0-10	
			Total quantum of impact	3.61	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	3.61	Adjusted hectares	Revegetation and restoration of 16.16 ha within rose shanks reserve	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	16.16	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	90%	0.00	0.00	3.31	91.63%	Yes		
									Future area without offset (adjusted hectares)	16.2	**Future area with offset (adjusted hectares)**	16.2									
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**3**	**Future quality without offset (scale of 0-10)**	**3**	**Future quality with offset (scale of 0-10)**	**7**	4.00	65%	2.60	2.05					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	3.612	3.31	91.63%	**Yes**	$0.00	#DIV/0!	#DIV/0!
					$0.00	**#DIV/0!**	**#DIV/0!**

Appendix E
Banksia TEC – Proposed Offset Site

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Banksia TEC
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	**1.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	Yes		**Area**	5.7	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	2.85	Adjusted hectares	
Threatened species habitat						
Area of habitat	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)		% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																					
Area of community	Yes	2.85	Adjusted hectares	13.86 ha of Banksia TEC creation. Balance of site (1.85 ha) currently Banksia TEC.	**Risk-related time horizon (max. 20 years)**	20	**Start area (hectares)**	13.86	**Risk of loss (%) without offset**	0%	**Risk of loss (%) with offset**	0%	0.00	90%	0.00	0.00	3.28	114.93%	Yes		
									Future area without offset (adjusted hectares)	13.9	**Future area with offset (adjusted hectares)**	13.9									
					Time until ecological benefit	20	**Start quality (scale of 0-10)**	**0**	**Future quality without offset (scale of 0-10)**	**0**	**Future quality with offset (scale of 0-10)**	**5**	5.00	60%	3.00	2.36					
Threatened species habitat																					
Area of habitat	No				**Time over which loss is averted (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**										
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0									
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**										
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**		**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																				
Condition of habitat Change in habitat condition, but no change in extent	No																				
Threatened species																					
Birth rate e.g. Change in nest success	No																				
Mortality rate e.g Change in number of road kills per year	No																				
Number of individuals e.g. Individual plants/animals	No																				

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	0				$0.00		$0.00
Area of community	2.85	3.28	114.93%	**Yes**	$0.00	N/A	$0.00
					$0.00	**$0.00**	**$0.00**

Attachment 3 Aubin Grove and Banjup Monitoring Programme 2021/2022

Lot 11 and 74 Beenyup Road, Banjup

Response to Submissions

EPA Assessment Number: 2255

Aigle Royal Developments

SLR Project No.: 675.072616.00001

23 July 2025

01 September 2022

Your Ref:
Our Ref: H21089Av1

Kris Kennedy

Aigle Royal Developments
Level 8, 336 St Georges Tcs
Perth WA 6000
ATTENTION: Kris Kennedy

Dear Kris,

AUBIN GROVE AND BANJUP MONITORING PROGRAMME 2021/2022

Hyd2o was commissioned by Aigle Royal in October 2021 to undertake a predevelopment groundwater monitoring programme for Lots 11 & 9046 Gibbs Road, and Lot 74 Beenyup Road in Aubin Grove and Banjup (herein referred to as the site).

The monitoring programme was undertaken to complement previous data collected by Bioscience from September 2011 to September 2014 (Bioscience, 2014). The monitoring programme includes monitoring of groundwater quality in four of the existing bores and groundwater levels in all 12 on a quarterly basis over a 12-month period to support the future water management reporting for the site.

1. MONITORING PROGRAMME

Groundwater monitoring was conducted at the 12 onsite bores previously installed by Bioscience which provided coverage across the site and in the wetland area. Monitoring bore locations are shown in Figure 1 and bore logs are included in Attachment 1.

Groundwater level monitoring was undertaken during the sampling occasions across all twelve onsite bores and three nearby DWER bores, totalling four occasions over 12 months (Table 1). The monitoring of long term DWER bores allows onsite groundwater measurements to be referenced to long term local groundwater records.

Groundwater sampling was undertaken quarterly in four bores over 12 months, totalling four occasions. All samples were measured in situ for physical parameters (Temp, EC, pH, DO%), with samples sent to a NATA approved laboratory for analysis of nutrient levels (Total N, NOx-N, Ammonia, Total P, FRP), and metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn).

Table 1: Monitoring Program

Monitoring	Parameter	Location	Method	Frequency and Timing
Groundwater level	Water Level (mAHD)	12 bores within site area and 3 DWER bores	Electrical probe or similar	Quarterly (4 occasions)
Groundwater quality	Physical parameters, Nutrients, Heavy Metals	4 bores within site area	Pumped bore sample	

2. MONITORING RESULTS

2.1. Groundwater Levels

Groundwater levels for the site were monitored quarterly from October 2021 through to August 2022 at the twelve site bores and three DWER bores. A summary of recorded water levels for the monitoring programme are shown in Table 2 and Attachment 2.

Minimum groundwater levels for the site bores were recorded in April 2022 and ranged from 24.05 mAHD at G10 to 25.20 mAHD at G1. Maximum groundwater levels were recorded in October 2021 ranging from 25.55 mAHD at G6 to 26.24 mAHD at G1.

The recorded groundwater levels were broadly consistent with the Perth Groundwater Map. The online DWER Perth Groundwater Map shows May 2003 groundwater levels ranging from 24.0 mAHD through the site to 23.0 mAHD west of the site, which represent a typical minimum groundwater level at the end of summer. The Map also provides groundwater contours showing the historical maximum groundwater levels across the site being between 26.0 mAHD and 26.5, approximately 2.5 m above the May 2003 summer minimum.

DWER bores monitored show a historical annual variation of between 1.5 m – 2.5 m at JM29, and between 0.5 m – 1.5 m at JE20C and the Beenyup Swamp Bore between winter and summer levels. DWER long-term hydrographs are included in Attachment 3.

An Average Annual Maximum Groundwater Level (AAMGL) and maximum groundwater levels (MGL) was calculated by Hyd2o for the DWER bores (Table 3) based on its long term record, with this value then used to adjust site bores to AAMGL (Table 4).

AAMGLs were calculated using groundwater levels from 2000 onwards, however DWER bores, JM29 and Beenyup Swamp Bore, indicate groundwater levels may be rising locally This rise may potentially be a result of recent land use change. Hyd2o recommend further analysis of groundwater trends be conducted in future to determine design levels for the site.

The AAMGL for site bores is estimated to range from a maximum of 25.81 mAHD in the north western corner, to a minimum of 25.12 mAHD in the south eastern border. Groundwater flow across the site differs from the which long term DWER groundwater mapping which flows in a north west direction.

AAMGL mapping is provided in Figure 2.

Table 2: Monitored Groundwater Bore Levels

	Easting	Northing	Natural Surface (mAHD)	Water Levels (mAHD)			
				29/10/2021	27/01/2022	22/04/2022	3/08/2022
Site Bores							
G1	393321	6441531	28.41	26.24	25.56	25.20	25.87
G2	393374	6441240	31.72	25.74	25.10	24.86	25.23
G3	393331	6440975	30.29	25.65	25.04	24.53	25.10
G4	393863	6441559	26.50	25.70	24.92	24.32	25.31
G5	393948	6441260	26.23	25.63	24.75	24.22	25.2
G6	393912	6440980	26.48	25.55	24.70	24.25	25.11
G7	393649	6441246	25.85	25.58	24.55	24.48	25.15
G8	393451	6441065	27.15	25.57	24.95	24.57	25.05
G9	393479	6441361	30.82	25.88	25.21	24.92	25.39
G10	393811	6441092	25.99	25.56	24.48	24.05	25.17
G11	393783	6441372	26.37	25.67	24.58	24.10	25.23
G12	393587	6441479	25.75	25.76	25.07	24.21	25.4
DWER Bores							
BRSB	393453	6441068	26.90	25.63	24.97	24.54	25.12
JE20C	694172	6441123	27.79	25.83	25.24	24.74	25.38
JM29	393812	6441696	26.90	25.61	23.94	23.76	25.34

Table 3: AAMGL and MGL – DWER Bores

Bore	Period of Record	GWL on 29/10/21 (mAHD)	MGL (mAHD)	AAMGL (mAHD)	Correction Factor (m)
JM29	2000 - 2022	25.61	25.95	25.33	-0.28
JE20C	2000 - 2022	25.83	25.87	25.39	-0.44
BSB	2000 - 2022	25.63	25.63	25.06	-0.57
Correction Factors for Site Bores					**-0.43**

Table 4: AAMGL - Site Bores

Bore	Natural Surface (mAHD)	GWL on 29/10/21 (mAHD)	AAMGL (mAHD)	Depth to AAMGL (m)
G1	28.41	26.24	25.81	2.60
G2	31.72	25.74	25.31	6.41
G3	30.29	25.65	25.22	5.07
G4	26.50	25.70	25.27	1.23
G5	26.23	25.63	25.20	1.03
G6	26.48	25.55	25.12	1.36
G7	25.85	25.58	25.15	0.70
G8	27.15	25.57	25.14	2.01
G9	30.82	25.88	25.45	5.37
G10	25.99	25.56	25.13	0.86
G11	26.37	25.67	25.24	1.13
G12	25.75	25.76	25.33	0.42

2.2. Groundwater Quality

Groundwater quality samples were taken from four site bores (G1, G5, G7, and G12) on four occasions across the twelve-month period.

Groundwater quality results are summarised in Table 5 with detailed results and laboratory reports provided in Attachments 4 and 5. Results are evaluated against ANZECC (2000) guidelines for highly coloured wetland ecosystems in South-west Australia and the protection of freshwater species.

Key results are summarised as follows:

- Mean EC ranged from 0.380 mS/cm at G1 to 1.481 mS/cm at G12, remaining within ANZECC guidelines (0.300 - 1.500 mS/cm).
- Mean pH was recorded as 6.45, 4.20, 5.56, and 4.30, at G1, G5, G7 and G12 respectively. Suggesting groundwater across the site is slightly acidic and within the ANZECC (2000) guideline range of 4.50 - 6.50 pH.
- Mean TN exceeded the ANZECC guidelines (1.5 mg/L) at all sites except G1. G1, G5, G7 and G12 were recorded as 1.00 mg/L, 5.60 mg/L, 3.33 mg/L, and 5.40 mg/L respectively.
- Mean NOx-N (mg/L) ranged from 0.018 mg/L at G12 to 0.104 mg/L at G5, with all bores except G5 within the ANZECC guideline of 1.5 mg/L.
- Mean NH_3-N (mg/L) across the site ranged from 0.005 mg/L at G1 to 0.393 mg/L at G5, remaining within the 95% level of protection for freshwater species (0.900 mg/L).
- Mean TP remained within the 0.060 mg/L ANZECC guideline at G1 and G7, recording values of 0.060 mg/L and 0.053 mg/L, respectively. G5 and G12 recorded TP concentrations of 0.938 mg/L and 3.038 mg/L, exceeding the ANZECC guideline.
- Mean FRP exceeded the ANZECC guideline of 0.03 mg/L at all bores except G7, Recording 0.04 mg/L at G1, 0.32 mg/L at G5, 0.01 mg/L at G7, and 0.10 mg/L at G12.
- Mean values for As, Pb, Ni, and Zn fell within their respective ANZECC trigger values for the 95% protection of freshwater species.
- Mean Cr fell within the 80% protection of freshwater species.
- Mean Cu was below detectable limits at all bores except G7, which slightly exceeded the 80% trigger value for the protection of freshwater species.
- Cd and Hg were below detectable limits on all monitoring occasions across all site bores, remaining within the 99% protection for freshwater species.

These results represent readings taken prior to development and would likely represent baseline site groundwater quality of existing conditions.

Table 5: Groundwater Quality Summary

Parameter	ANZECC Guidelines (2000)	G1	G5	G7	G12
EC (mS/cm)	0.300 - 1.500[1]	0.380	0.763	0.546	1.481
pH	4.50 - 6.50[1]	6.45	4.20	5.56	4.30
TN (mg/L)	1.50[1]	1.00	5.60	3.33	5.40
NOx-N (mg/L)	0.100[1]	0.028	0.104	0.035	0.018
NH_3-N (mg/L)	0.3200 – 2.300[2]	0.005	0.393	0.031	0.136
TP (mg/L)	0.060[1]	0.060	0.938	0.053	3.038
FRP (mg/L)	0.03[1]	0.04	0.32	0.01	0.10
As (mg/L)	0.001- 0.360[2]	<0.001	<0.001	0.002	0.003
Cd (mg/L)	0.0001 - 0.0008[2]	<0.0001	<0.0001	<0.0001	<0.0001
Cr (mg/L)	0.00001 - 0.0400[2]	<0.0010	0.0010	0.0030	0.0140
Cu (mg/L)	0.0010 - 0.0025[2]	<0.0010	<0.0010	0.0029	<0.0010
Pb (mg/L)	0.0010 - 0.0094[2]	<0.001	<0.001	<0.001	0.003
Ni (mg/L)	0.008 – 0.017[2]	<0.001	<0.001	0.005	0.011
Zn (mg/L)	0.0024 – 0.031[2]	<0.001	0.004	0.003	0.002
Hg (mg/L)	0.00006 – 0.0054[2]	<0.00005	<0.00005	<0.00005	<0.00005

1. ANZECC (2000) guidelines default trigger values for highly coloured wetland ecosystems in South-west Australia.

2. Trigger values for 99th – 80th percentile protection of freshwater species.

3. CONCLUSION AND RECOMMENDATIONS

- Groundwater level across the site were broadly consistent with regional groundwater levels. Groundwater levels across all bores exceeded previous monitoring values (Bioscience, 2011) and winter peak readings were above calculated AAMGL's. The increased water table compared to Bioscience (2011) monitoring data and long term DWER bore hydrographs are expected given the increased winter rainfall experienced during 2021.
- Groundwater flow across the site flows in a south easterly direction, towards the southern site border. Groundwater flow across the site differs from the which long term DWER groundwater mapping which flows in a north west direction.
- The rising trend in groundwater levels at nearby DWER bores (JM29 and BSB) may indicate increasing local groundwater levels due to recent land use change. Hyd2o recommend further analysis of groundwater trends be conducted in future to determine design levels for the site.
- Groundwater quality at all site bores fell within ANZECC (2000) guidelines for all physical parameters (EC and pH).
- In regards nutrient levels, groundwater quality across all site bores except G1, generally fluctuated above the ANZECC (2000) guidelines. G1 remained within guideline values across all parameters. Recorded nutrient levels are in the typical range for the Swan Coastal Plain and are representative of historical land use in the area.
- The majority of heavy metals were within their respective ANZECC trigger values for the 80% to 99% protection of freshwater species.

4. REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZECC), 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, October 2000.

Environmental Protection Authority, 2008. Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System - Phosphorus Management, November 2008.

Bioscience, 2011. Lots 252 & 268 Beenyup Rd, Banjup. Geotechnical Report.

Should you have any queries regarding this report, please do not hesitate to contact Georgia Ross or Sasha Martens of this office.

Yours sincerely,

Georgia Ross

Engineering Hydrologist

Attachments

Figure 1: Monitoring Locations

Figure 2: AAMGL Mapping

Attachment 1: Geotechnical Report (Bioscience, 2011)

Attachment 2: Water Level Monitoring Data

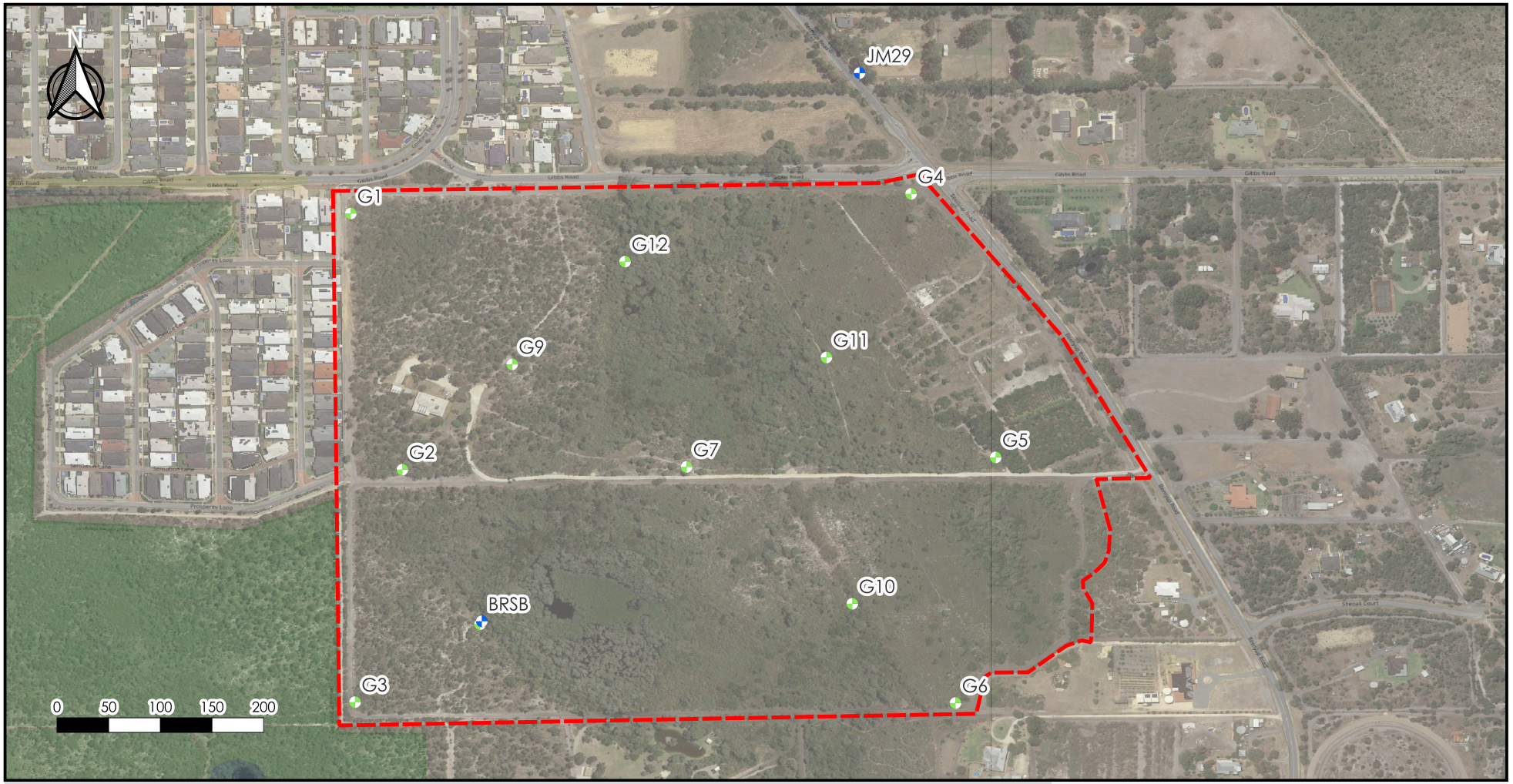
Attachment 3: Long Term DWER Hydrographs

Attachment 4: Water Quality Monitoring Data

Attachment 5: Laboratory Reports

FIGURES

Date: 21/06/2022 Job No. H21089



Site
DWER Bores
Site Bores

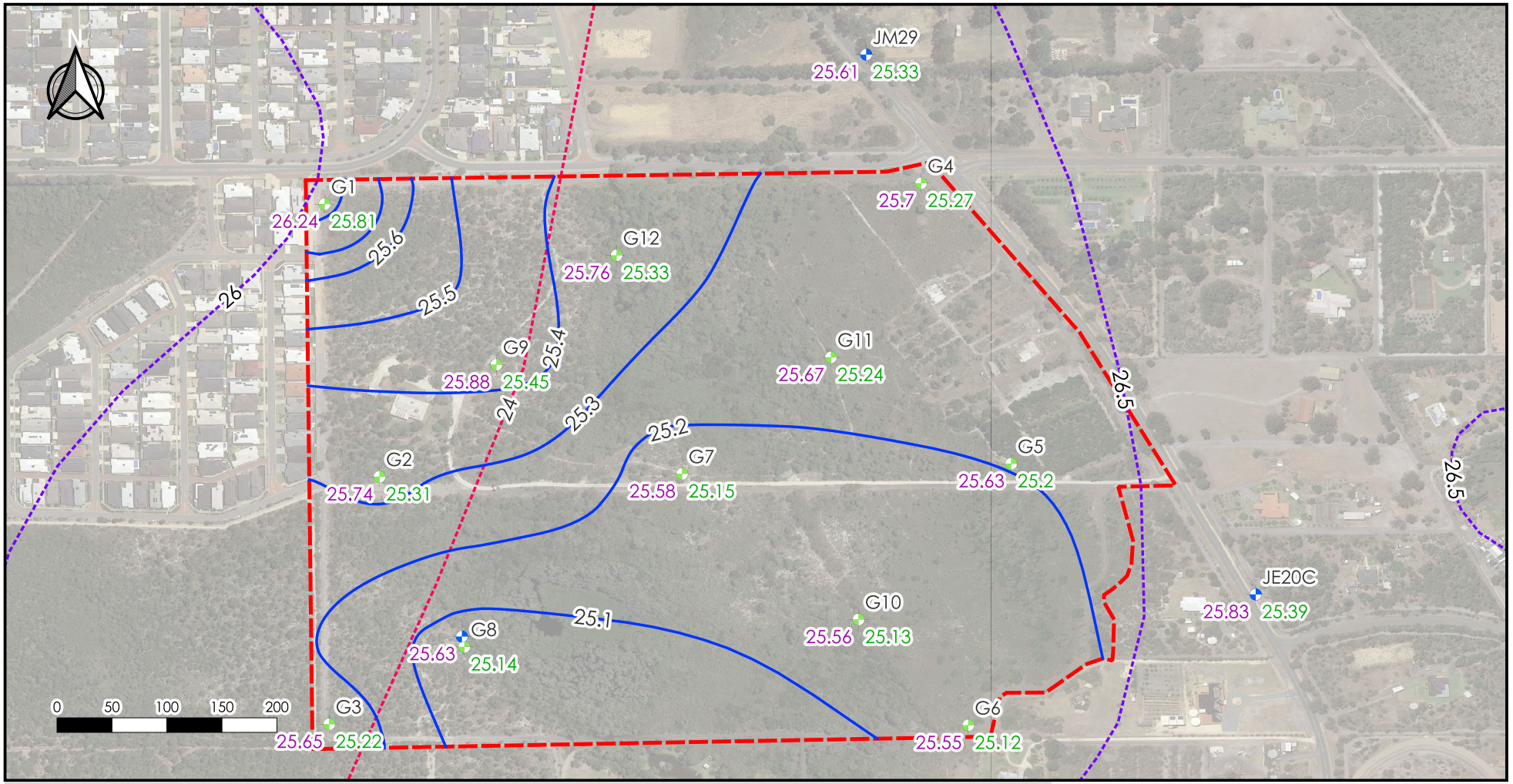
hyd2o

Aubin Grove & Banjup Monitoring

Monitoring Locations

Figure 1

Date: 08/08/2022 Job No. H21089



Site

DWER Bores

Site Bores

October 2022 Max GWL (mAHD)

AAMGL (mAHD)

DWER Maximum Groundwater Levels (mAHD)

DWER Minimum Groundwater Levels (mAHD)

AAMGL (mAHD)

hyd2o

Aubin Grove & Banjup Monitoring

Groundwater Mapping

Figure 2

Attachment 1
Geotechnical Report
(Bioscience, 2011)

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488 Nicholson Rd Forrestdale WA 6112
TELEPHONE (08) 93972446
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GEOTECHNICAL REPORT
Lots 252 & 268 Beenyup Rd
Banjup

This report describes the geotechnical investigations undertaken by Bioscience Pty Ltd for a proposed residential development at Lots 252 and 268 Beenyup Road, Banjup, WA.
The aim of the investigation was to assess the subsurface soil, groundwater level, permeability and acid sulfate of soil across the site and thus:

- Determine the suitability of the site to support the proposed development.
- Provide recommendations on site preparation and earthworks, so as to allow the proposed development.
- Assess the groundwater level beneath the site at the time of the field work, if encountered.
- Assess the permeability of the soils across the site and provide comments on suitable stormwater disposal and site drainage.
- Assess the risk of acid sulphate soils beneath the site based upon readily available desktop information and sampling and analysis.

The investigation included the drilling of twelve piezometers, and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

The site comprises a rectangular shaped area of approximately 44.8 ha, identified as Lots 252 and 268 Beenyap Street in Banjup, Western Australia. It is bounded by Gibbs Rd to the north, Beenyup Rd to the east and neighbouring properties to the west and south.
At the time of investigation, the site was mostly covered by native bush and trees. There was a wetland area in middle of the both lots, covered by shallow water. There were three empty

sheds in the east side, and a residual house in the west side of lot 252. A gravel road in the middle of the site separates lot 252 and 268.

The geology at the site as per the Geological Survey of Western Australia 1:50000 Environmental Geological Series FREMANTLE Map Sheets 2033 I and 2033 IV are either:

- S8 – SAND – Very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin. (Bassendean Sand).
- S10 – SAND – as S8 as relatively thin veneer over strong, blocky, brown silts and clay (Bassendean Sand over Guildford Formation).
- Ms_5 - SANDY SILT-dark brownish grey silt, with disseminated fine-grained quartz sand, firm, variable clay content, of lacustrine origin (Swamp deposits)

The Perth Groundwater Atlas (2004) shows the site has a natural surface contour of 26 - 28 m AHD and groundwater contour of 24 - 25 m AHD (May 2003).

In September 2011 twelve piezometers (G1 to G12) were installed in the site by Edge Drilling to monitor groundwater level fluctuation and its flow regime, as well as investigating the sub-soil characteristics and collect representative samples for laboratory testing.
The test pits (G1 to G12) were excavated to a maximum depth of 9 m using a mechanical Hollow Stem auger. Test pit locations are shown in Figure 1. Each test pit was logged in general accordance with test procedure AS 1726–1993 by a suitably experienced representative from Bioscience. Soil samples were recovered from selected locations for Particle Size Distribution and acid sulfate testing in laboratory. These soil samples were placed in air tight sample bags and chilled in insulated coolers. Soil samples remained in cooled storage during transport to the laboratory.

In general, the sub-ground strata in the site are, sandy black topsoil overlaying a white/grey/brown, medium, sub-angular sand layer, down to a depth of 9 m below ground level. In some bores a dark brown, non-cemented coffee rock was observed.
In the bore 12, a dark brown loamy sand layer (1.5 - 3 m bGL) overlying a brown silty/clay sand layer (3 - 4 m bGL).

Particle Size Distribution test

PSD test was conducted on 16 selected samples from different bores and depth in the area. Almost all the samples are in medium sand fraction range on the graph (Figure 2).

Permeability value

Although neither field or laboratory test was conducted to determine permeability values directly, however PSD test results can provide a reliable indirect permeability value for the area. Generally medium sand fraction soils have a permeability value of 10^{-4} to 10^{-2} (m/s). Such soils are suitable for stormwater infiltration and open drains. In further stage of the project more detailed analysis might be required to verify more accurate permeability values.

Acid Sulfate

Perth Groundwater Atlas classified the area as high to moderate risk of ASS, that means ASS might be occur at a depth lower than 3 m.

Soils recovered from test pits were subjected to analysis to determine the likelihood of acid sulfate soils being present, and thus any requirement for more detailed investigations as and when development plans are advanced to the point of specifying excavation location and depths. The work involved undertaking "Field pH testing" which is considered a useful, but not completely reliable indicator of PASS and AASS, and laboratory analysis of total sulfur present. The rationale for Total S testing is that DEC guidance set an action threshold which triggers the requirement for management plans when oxidisable sulfur exceeds 0.03%. Bioscience uses a LECO CS200 sulfur analyser to rapidly and reliable determine whether this threshold could be exceeded, which thereby triggers the need for further testing.

A total of 16 soil samples were tested. The results (Figure 3) show that, the reaction with peroxide is very low in 14 samples and moderate in two samples (G12, 2-3 m & 4-5 m). Also the reduction in peroxide pH is very minor. The 0.03% sulfur threshold was exceeded in half of the samples, G3,G5, G10 (0-1 m &1-2m), G11 (0-1m & 1-2m), G12 (2-3m & 4-5m).

Results:

The majority of soils encountered were sands of the Bassendean Formation (see PSD graph).

The results of this assessment indicate that the site can be classified as 'Class A' in accordance with AS 2870-1996, provided site preparation is carried out as detailed in Section 8.2. It is emphasised that the given classification will need reassessment if bulk earthworks for the proposed development include cutting the site.

According the geotechnical investigation results the following site preparation procedure is recommended:

- Identification and diversion or protection of any buried services within the work areas.
- Removal of topsoil, organics, roots, old services, rubbish and any other deleterious material from the site.
- Any clay layer underlying the top soil in the Lots should be removed and refilled by suitable fill material.
- Proof compact the exposed surface using a suitable compaction plant.
- Where the surface deforms excessively during compaction or wet and/or week material is exposed, over-excavation and replacement with compacted few draining sand fill may be required.
- Confirm that adequate compaction is achieved as outlined below.
- Place and compact approved clean free draining fill material in layers of no greater than 0.3m thickness, up to the level required.

Limitations

Bioscience Pty Ltd has prepared this report for a project at Lots 252 & 268 Beenyup Road, in Banjup, WA. The work was carried out under Bioscience's Conditions of Engagement. This report is provided for the exclusive use of Miluc Pty Ltd for this project only and for the purposes described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report Bioscience has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after Bioscience's field testing has been completed.

Bioscience's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Bioscience in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. Bioscience cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Bioscience. This is because this report has been written as advice and opinion rather than instructions for construction.

Azin Kusari BE(civil) MEng.St

13 October 201

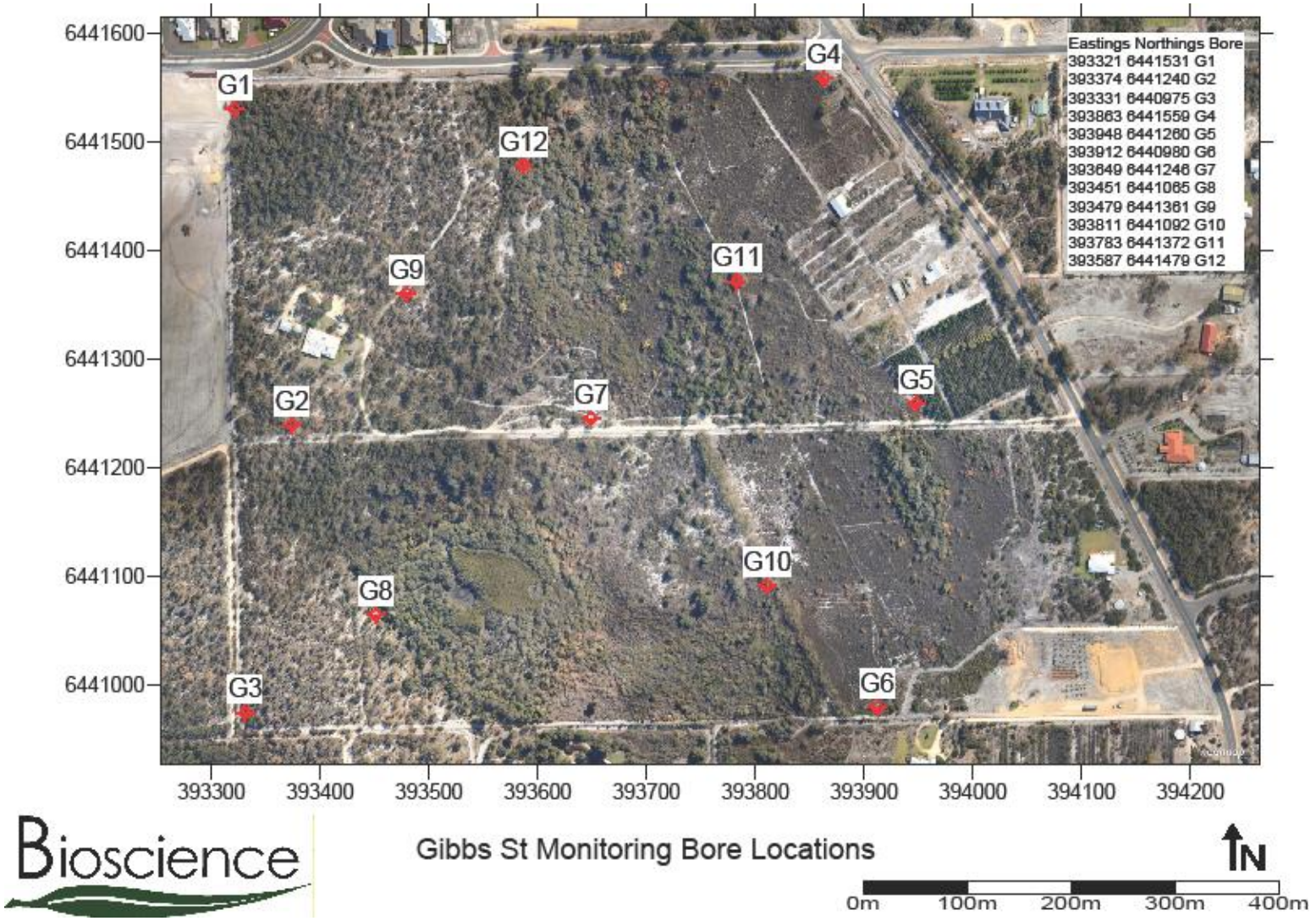


Figure 1: Lots 252 &268

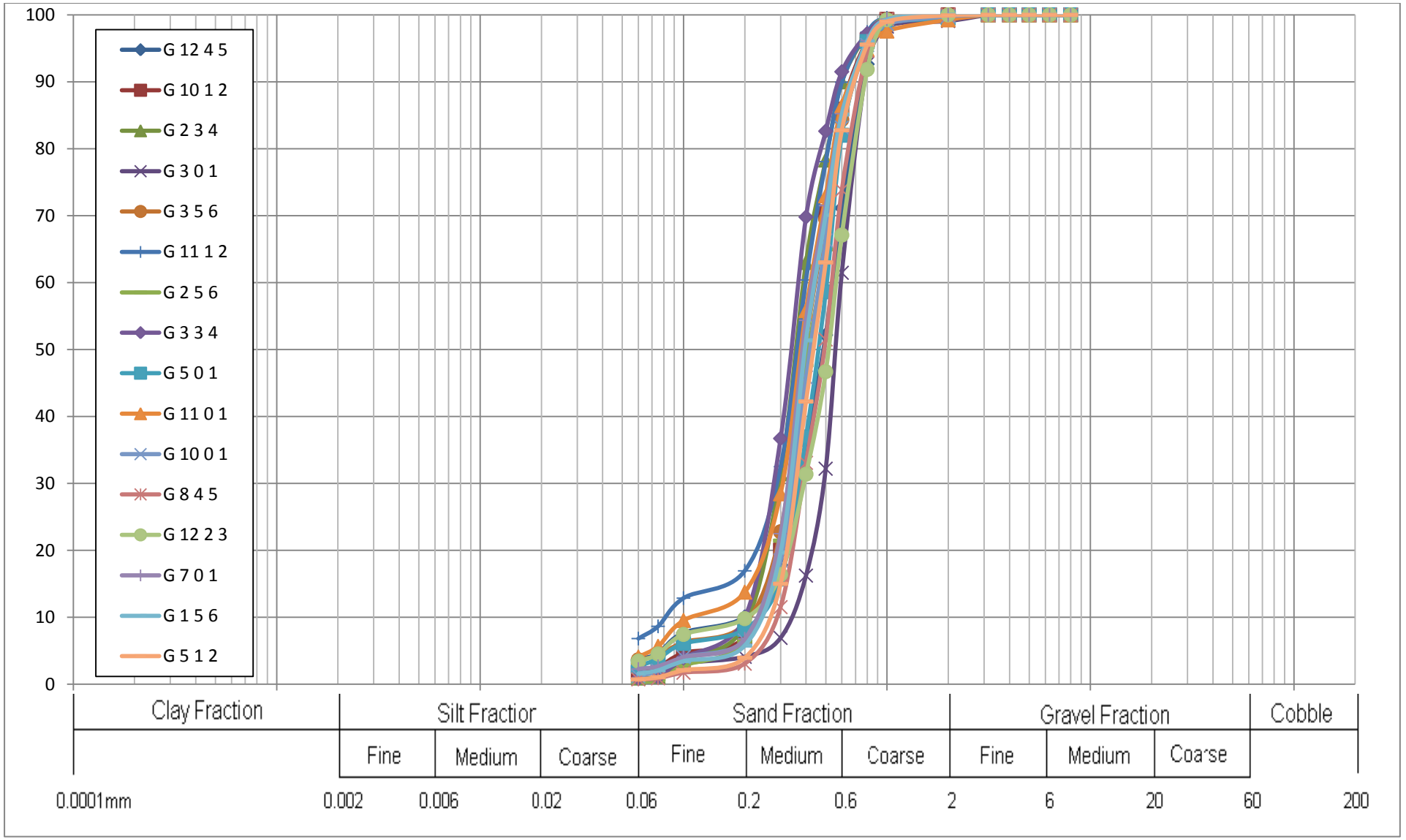


Figure 2: Particle Size Distribution graph for selected locations and depths

Sample	Depth (m)	pH (H_2O)	pH (H_2O_2)	ΔpH	Reactivity	Carbon (%)	Sulphur (%)	Soil Profile Description
G1	5-6	4.30	3.85	0.45	Low	0.3275	0.00616	Dark brown SM
G2	5-6	4.97	3.97	1.00	Low	0.00781	-0.00495	White SP
G3	0-1	4.07	3.11	0.96	Low	6.088	0.03993	Dark Pt
G3	5-6	4.06	3.21	0.85	Low	1.124	0.00141	Dark Pt
G4	3-4	5.45	4.88	0.57	Low	0.09266	-0.00321	Light brown SP
G5	0-1	3.93	3.05	0.88	Low	2.936	0.00473	Dark Pt
G5	1-2	4.44	2.91	1.53	Low	7.161	0.06979	Brown ML
G6	3-4	4.46	3.74	0.72	Low	0.1080	-0.00435	Brown ML
G7	0-1	3.05	1.62	1.43	Low	0.1847	0.00311	Dark brown SM
G8	4-5	5.27	3.81	1.46	Low	0.05981	-0.000339	Light brown SP
G10	0-1	4.33	3.03	1.3	Low	2.043	0.08251	Brown SP
G10	1-2	4.29	3.55	0.74	Low	1.149	0.04552	Dark brown SM
G11	0-1	3.52	2.96	0.56	Low	10.56	0.1915	Dark Pt
G11	1-2	3.47	2.86	0.61	Low	10.04	0.1512	Brown OL
G12	2-3	4.00	2.89	1.11	Medium	0.3488	0.04274	Dark brown SC
G12	4-5	5.08	3.57	1.51	Medium	0.2479	0.06008	Dark brown SC

Figure 3: Hydrogen peroxide test for acid sulphate soils

Appendix A: Bore Profiles

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT between 3 to 3.75 m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393321		
Site No:	G 1	**Northings/Lat:**	6441531		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	750	Sandy top soil	Grey/Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer	-				
1500	3750	Sand	White	Medium		Moist	Non-cohesive	Layer	-				
3750	6000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer	-				

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 6.75m
Client:		**Photo No:**			bGL
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393374		
Site No:	G 2	**Northings/Lat:**	6441240		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1000	Sand	Grey/black	Medium		Moist	Non-cohesive	Layer					
1000	8000	Sand	white	Medium		Moist	Non-cohesive	Layer					
8000	9000	Sand	Yellow	Medium		Moist	Non-cohesive	Layer					

Investigator/s: AK **Date:** 12/09/2011 **Notes:** WT at 5.6m Coffee rock is not

Client: **Photo No:** bGL cemented

Location: Gibbs Rd, Banjup **Eastings/Long:** 393331

Site No: G3 **Northings/Lat:** 6440975

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1200	Peaty top soil	black			Moist	Non-cohesive	Layer	Organic mat.				
1200	2000	Sand	White mottled grey	Medium		Moist	Non-cohesive	Layer					
2000	5000	Sand	White	Medium		Moist	Non-cohesive	Layer					
5000	8000	Sandy coffee rock	Dark brown	Medium		Moist	Non-cemented	Layer					

Investigator/s: AK **Date:** 09/09/2011 **Notes:** WT at 1.5 m

Client: **Photo No:** bGL

Location: Gibbs Rd, Banjup **Eastings/Long:** 393863

Site No: G4 **Northings/Lat:** 6441559

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	100	Sandy top soil	Grey/ black	Medium		Moist	Non-cohesive	Layer	-				
100	750	Sand	Black	Medium		Moist	Non-cohesive	Layer	-				
750	1500	Sand	Black/white	Medium		Moist	Non-cohesive	Layer	-				
1500	2250	Sand	White/Grey	Medium		Moist	Non-cohesive	Layer	-				
2250	4000	Sand	White/Grey	Medium		Wet	Non-cohesive	Layer	-				

Investigator/s:	PK	**Date:**	10/09/2011	**Notes:**	WT at 1.5 m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393948		
Site No:	G5	**Northings/Lat:**	6441260		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	310	Silty top soil	Black	Medium		Dry	cohesive	Layer					
310	1500	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
1500	3000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					
3000	4000	Sand	Grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 1.5 m bGL Coffee rock is not cemented
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393912		
Site No:	G6	**Northings/Lat:**	6440980		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	900	Sandy Top soil	black	Medium		Moist	Non-cohesive	Layer					
900	2000	Sand	White	Medium		Moist	Non-cohesive	Layer					
2000	4000	Sandy coffee rock	Dark Brown	Medium		Moist	Non-cohesive	Layer					

Investigator/s: PK **Date:** 10/09/2011 **Notes:** WT at 1.3m

Client: **Photo No:** bGL

Location: Gibbs Rd, Banjup **Eastings/Long:** 393649

Site No: G7 **Northings/Lat:** 6441246

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	2800	Sand	Brown	Medium		Moist	Non-cohesive	Layer					
2800	4100	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s: AK **Date:** 12/09/2011 **Notes:** WT at 2.7m bGL

Client: **Photo No:**

Location: Gibbs Rd, Banjup **Eastings/Long:** 393451

Site No: G8 **Northings/Lat:** 6441065

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	5500	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s: AK | **Date:** 12/09/2011 | **Notes:** WT at 5.8 m bGL

Client: | **Photo No:**

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393479

Site No: G9 | **Northings/Lat:** 6441361

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	800	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
800	8000	Sand	White	Medium		Moist	Non-cohesive	Layer					

Investigator/s: PK | **Date:** 10/09/2011 | **Notes:** WT at 1.3 m bGL

Client: | **Photo No:**

Location: Gibbs Rd, Banjup | **Eastings/Long:** 393811 | Ferrous sand is not

Site No: G10 | **Northings/Lat:** 6441097 | cemented

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	200	Peaty top soil	Black	Medium		Moist	Non-cohesive	Layer					
200	610	Sand	White	Medium		Moist	Non-cohesive	Layer					
610	750	Ferrous	Brown	Medium		Moist	Non-cohesive	Layer					
750	4000	Sand	Brown	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	PK	**Date:**	10/08/2011	**Notes:**	WT at 1.2m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393783		
Site No:	G11	**Northings/Lat:**	6441372		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	220	Sandy Top soil	Black	Medium		Moist	Non-cohesive	Layer					
220	600	Sand	White/brown	Medium		Moist	Non-cohesive	Layer					
600	1100	Sand	Brown/ black	Medium		Moist	Non-cohesive	Layer					
1100	1500	Ironstone	Brown	Medium		Dry	Firm	Layer					
1500	4000	Sand	White/grey	Medium		Wet	Non-cohesive	Layer					

Investigator/s:	AK	**Date:**	12/09/2011	**Notes:**	WT at 0.6m bGL
Client:		**Photo No:**			
Location:	Gibbs Rd, Banjup	**Eastings/Long:**	393587		
Site No:	G12	**Northings/Lat:**	6441479		

Depth (mm)		Type	Colour	Grade	Shape	Condition	Consistency	Structure	Organic / Fill / Waste	Cobble (%)	Gravel (%)	Sand (%)	Silt/Clay (%)
To	From									>6.3mm	>2mm	<2mm	<0.075
0	1500	Sand Top soil	Black	Medium		Moist	Non-cohesive	Layer					
1500	3000	Loamy Sand	Dark brown	Medium		Wet	Cohesive	Layer					
3000	4000	Silty Sand	Brown	Medium		Wet	Cohesive	Layer					

Bore	Easting	Northing	Upstick	Surface elevation (mAHD)	Total Depth
G1	393321	6441531	0.79	28.405	6.4
G2	393374	6441240	0.38	31.72	9.1
G3	393331	6440975	0.685	30.293	8.47
G4	393863	6441559	0.59	26.496	4.4
G5	393948	6441260	0.665	26.232	4.6
G6	393912	6440980	0.37	26.48	4.3
G7	393649	6441246	0.55	25.845	4.45
G8	393451	6441065	0.7	27.152	5.1
G9	393479	6441361	0.49	30.818	8.4
G10	393811	6441092	0.535	25.987	4.5
G11	393783	6441372	0.65	26.366	4.5
G12	393587	6441479	0.63	25.752	4.45

mBTOC

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	3.62	3.417	3.712	4.016	4.036	3.797	3.517	3.478	3.729	3.815	3.973	4.197	4.044	4.075	3.471	3.101	3.129	3.322	3.972	4.124	3.815	3.267	3.19
G2	7.02	6.794	7.097	7.428	7.516	7.281	7.003	6.928	7.155	7.325	7.415	7.626	7.562	7.467	6.957	6.503	6.512	6.744	7.379	7.507	7.33	6.745	6.598
G3	5.972	5.756	6.09	6.437	6.477	6.278	6.013	5.935	6.166	6.315	6.445	6.638	6.566	6.457	6.008	5.502	5.512	5.743	6.392	6.514	6.348	5.769	5.602
G4	1.743	1.758	2.122	2.59	2.508	2.125	1.837	1.86	2.21	2.43	2.698	2.895	2.525	2.653	1.842	1.611	1.637	1.883	2.664	2.8	2.149	1.65	1.546
G5	1.54	1.599	2.03	2.528	2.455	2.066	1.745	1.781	2.14	2.398	2.627	2.816	2.553	2.54	1.72	1.5	1.512	1.762	2.612	2.733	2.182	1.543	1.476
G6	1.653	1.633	2.07	2.49	2.38	2.113	1.81	1.859	2.226	2.418	2.592	2.761	2.507	2.534	1.822	1.55	1.571	1.831	2.553	2.651	2.175	1.661	1.576
G7	1.12	1.205	1.63	2.18	2.164	1.756	1.295	1.374	1.768	2.027	2.238	2.479	2.245	2.142	1.272	1.06	1.097	1.365	2.285	2.43	1.947	1.196	1.14
G8	2.853	2.695	3.014	3.37	3.391	3.186	2.913	2.86	3.1	3.249	3.388	3.562	3.465	3.364	2.916	2.452	2.473	2.676	3.34	3.453	3.251	2.706	2.549
G9	6.065	5.846	6.151	6.469	6.543	6.306	6.027	5.955	6.201	6.335	6.47	6.674	6.601	6.518	5.979	5.55	5.576	5.796	6.433	6.565	6.635	5.75	5.631
G10	1.229	1.315	1.862	2.355	2.187	1.832	1.452	1.52	1.981	2.237	2.432	2.59	2.313	2.243	1.436	1.22	1.244	1.567	2.437	2.532	1.972	1.319	1.264
G11	1.631	1.729	2.233	2.786	2.671	2.207	1.842	1.902	2.328	2.64	2.865	3.05	2.747	2.689	1.82	1.603	1.63	1.941	2.873	2.985	2.325	1.687	1.616
G12	0.995	0.924	1.257	1.7	1.672	1.364	1.041	1.041	1.3	1.438	1.798	2.227	1.72	1.699	1.053	0.662	0.681	0.92	1.729	2.137	1.414	0.809	0.712

mBGL

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	2.83	2.627	2.922	3.226	3.246	3.007	2.727	2.688	2.939	3.025	3.183	3.407	3.254	3.285	2.681	2.311	2.339	2.532	3.182	3.334	3.025	2.477	2.4
G2	6.64	6.414	6.717	7.048	7.136	6.901	6.623	6.548	6.775	6.945	7.035	7.246	7.182	7.087	6.577	6.123	6.132	6.364	6.999	7.127	6.95	6.365	6.218
G3	5.287	5.071	5.405	5.752	5.792	5.593	5.328	5.25	5.481	5.63	5.76	5.953	5.881	5.772	5.323	4.817	4.827	5.058	5.707	5.829	5.663	5.084	4.917
G4	1.153	1.168	1.532	2	1.918	1.535	1.247	1.27	1.62	1.84	2.108	2.305	1.935	2.063	1.252	1.021	1.047	1.293	2.074	2.21	1.559	1.06	0.956
G5	0.875	0.934	1.365	1.863	1.79	1.401	1.08	1.116	1.475	1.733	1.962	2.151	1.888	1.875	1.055	0.835	0.847	1.097	1.947	2.068	1.517	0.878	0.811
G6	1.283	1.263	1.7	2.12	2.01	1.743	1.44	1.489	1.856	2.048	2.222	2.391	2.137	2.164	1.452	1.18	1.201	1.461	2.183	2.281	1.805	1.291	1.206
G7	0.57	0.655	1.08	1.63	1.614	1.206	0.745	0.824	1.218	1.477	1.688	1.929	1.695	1.592	0.722	0.51	0.547	0.815	1.735	1.88	1.397	0.646	0.59
G8	2.153	1.995	2.314	2.67	2.691	2.486	2.213	2.16	2.4	2.549	2.688	2.862	2.765	2.664	2.216	1.752	1.773	1.976	2.64	2.753	2.551	2.006	1.849
G9	5.575	5.356	5.661	5.979	6.053	5.816	5.537	5.465	5.711	5.845	5.98	6.184	6.111	6.028	5.489	5.06	5.086	5.306	5.943	6.075	6.145	5.26	5.141
G10	0.694	0.78	1.327	1.82	1.652	1.297	0.917	0.985	1.446	1.702	1.897	2.055	1.778	1.708	0.901	0.685	0.709	1.032	1.902	1.997	1.437	0.784	0.729
G11	0.981	1.079	1.583	2.136	2.021	1.557	1.192	1.252	1.678	1.99	2.215	2.4	2.097	2.039	1.17	0.953	0.98	1.291	2.223	2.335	1.675	1.037	0.966
G12	0.365	0.294	0.627	1.07	1.042	0.734	0.411	0.411	0.67	0.808	1.168	1.597	1.09	1.069	0.423	0.032	0.051	0.29	1.099	1.507	0.784	0.179	0.082

mAHD

Bore	16/09/2011	1/11/2011	4/01/2012	7/03/2012	16/05/2012	5/07/2012	7/09/2012	5/10/2012	4/12/2012	9/01/2013	4/02/2013	22/03/2013	15/05/2013	2/07/2013	21/08/2013	20/09/2013	25/10/2013	21/11/2013	28/02/2014	24/03/2014	30/05/2014	8/08/2014	19/09/2014
G1	25.575	25.778	25.483	25.179	25.159	25.398	25.678	25.717	25.466	25.38	25.222	24.998	25.151	25.12	25.724	26.094	26.066	25.873	25.223	25.071	25.38	25.928	26.005
G2	25.08	25.306	25.003	24.672	24.584	24.819	25.097	25.172	24.945	24.775	24.685	24.474	24.538	24.633	25.143	25.597	25.588	25.356	24.721	24.593	24.77	25.355	25.502
G3	25.006	25.222	24.888	24.541	24.501	24.7	24.965	25.043	24.812	24.663	24.533	24.34	24.412	24.521	24.97	25.476	25.466	25.235	24.586	24.464	24.63	25.209	25.376
G4	25.343	25.328	24.964	24.496	24.578	24.961	25.249	25.226	24.876	24.656	24.388	24.191	24.561	24.433	25.244	25.475	25.449	25.203	24.422	24.286	24.937	25.436	25.54
G5	25.357	25.298	24.867	24.369	24.442	24.831	25.152	25.116	24.757	24.499	24.27	24.081	24.344	24.357	25.177	25.397	25.385	25.135	24.285	24.164	24.715	25.354	25.421
G6	25.197	25.217	24.78	24.36	24.47	24.737	25.04	24.991	24.624	24.432	24.258	24.089	24.343	24.316	25.028	25.3	25.279	25.019	24.297	24.199	24.675	25.189	25.274
G7	25.275	25.19	24.765	24.215	24.231	24.639	25.1	25.021	24.627	24.368	24.157	23.916	24.15	24.253	25.123	25.335	25.298	25.03	24.11	23.965	24.448	25.199	25.255
G8	24.999	25.157	24.838	24.482	24.461	24.666	24.939	24.992	24.752	24.603	24.464	24.29	24.387	24.488	24.936	25.4	25.379	25.176	24.512	24.399	24.601	25.146	25.303
G9	25.243	25.462	25.157	24.839	24.765	25.002	25.281	25.353	25.107	24.973	24.838	24.634	24.707	24.79	25.329	25.758	25.732	25.512	24.875	24.743	24.673	25.558	25.677
G10	25.293	25.207	24.66	24.167	24.335	24.69	25.07	25.002	24.541	24.285	24.09	23.932	24.209	24.279	25.086	25.302	25.278	24.955	24.085	23.99	24.55	25.203	25.258
G11	25.385	25.287	24.783	24.23	24.345	24.809	25.174	25.114	24.688	24.376	24.151	23.966	24.269	24.327	25.196	25.413	25.386	25.075	24.143	24.031	24.691	25.329	25.4
G12	25.387	25.458	25.125	24.682	24.71	25.018	25.341	25.341	25.082	24.944	24.584	24.155	24.662	24.683	25.329	25.72	25.701	25.462	24.653	24.245	24.968	25.573	25.67

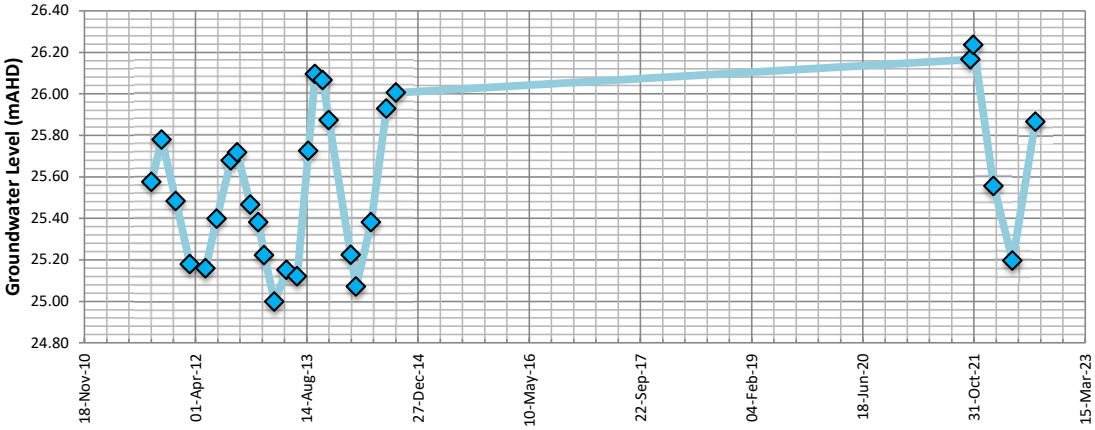
Attachment 2
Groundwater Level Monitoring Data

H21089 Aubin Grove & Banjup

G1 Bioscience Bore 1

				Natural Surface (mAHD)	28.41
Data Analysis Period Start Date	1/01/2010	Easting	393321	Top of Casing (m AHD)	29.20
Data Analysis Period End Date	8/08/2022	Northing	6441531	End of Hole (mAHD)	22.01

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	3.62	25.58	2.83
1/11/2011	3.42	25.78	2.63
4/01/2012	3.71	25.48	2.92
7/03/2012	4.02	25.18	3.23
16/05/2012	4.04	25.16	3.25
5/07/2012	3.80	25.40	3.01
7/09/2012	3.52	25.68	2.73
5/10/2012	3.48	25.72	2.69
4/12/2012	3.73	25.47	2.94
9/01/2013	3.82	25.38	3.03
4/02/2013	3.97	25.22	3.18
22/03/2013	4.20	25.00	3.41
15/05/2013	4.04	25.15	3.25
2/07/2013	4.08	25.12	3.29
21/08/2013	3.47	25.72	2.68
20/09/2013	3.10	26.09	2.31
25/10/2013	3.13	26.07	2.34
21/11/2013	3.32	25.87	2.53
28/02/2014	3.97	25.22	3.18
24/03/2014	4.12	25.07	3.33
30/05/2014	3.82	25.38	3.03
8/08/2014	3.27	25.93	2.48
19/09/2014	3.19	26.01	2.40
15/10/2021	3.03	26.17	2.24
29/10/2021	2.96	26.24	2.17
27/01/2022	3.64	25.56	2.85
22/04/2022	4.00	25.20	3.21
3/08/2022	3.33	25.87	2.54

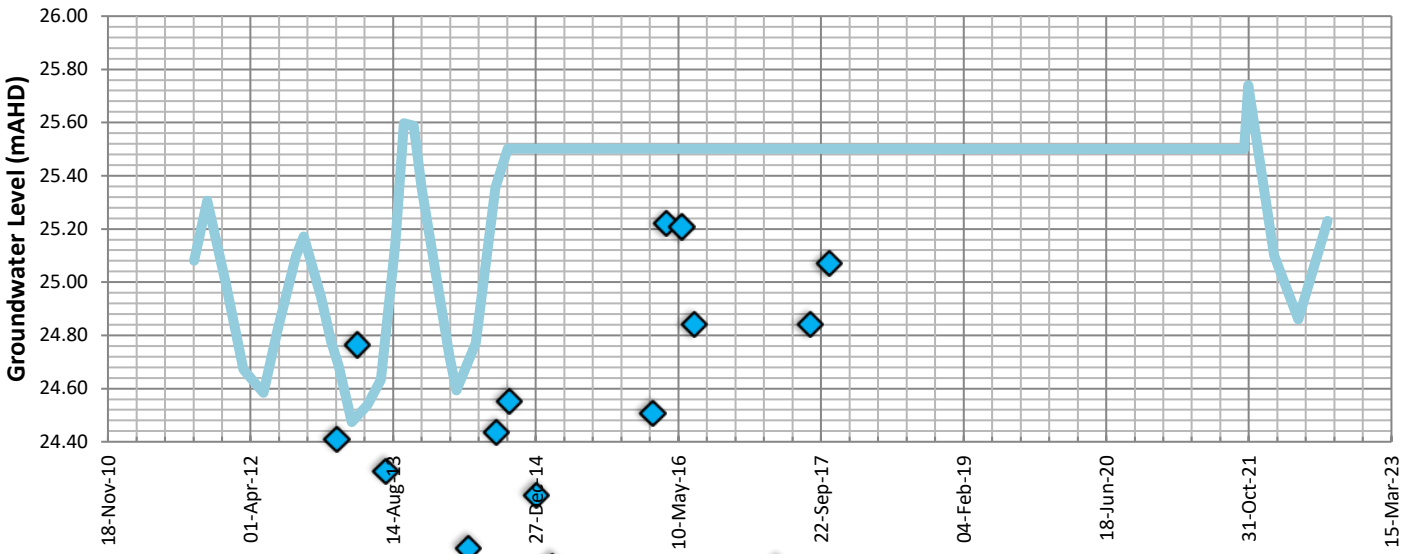
Minimum Recorded Level (mAHD)	24.998
Maximum Recorded Level (mAHD)	26.235

H21089 Aubin Grove & Banjup

G2 Bioscience Bore 2

				Natural Surface (mAHD)	31.72
Data Analysis Period Start Date	1/01/2010	Easting	393374	Top of Casing (m AHD)	32.10
Data Analysis Period End Date	8/08/2022	Northing	6441240	End of Hole (mAHD)	22.62

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	7.02	25.08	6.64
1/11/2011	6.79	25.31	6.41
4/01/2012	7.10	25.00	6.72
7/03/2012	7.43	24.67	7.05
16/05/2012	7.52	24.58	7.14
5/07/2012	7.28	24.82	6.90
7/09/2012	7.00	25.10	6.62
5/10/2012	6.93	25.17	6.55
4/12/2012	7.16	24.95	6.78
9/01/2013	7.33	24.78	6.95
4/02/2013	7.42	24.69	7.04
22/03/2013	7.63	24.47	7.25
15/05/2013	7.56	24.54	7.18
2/07/2013	7.47	24.63	7.09
21/08/2013	6.96	25.14	6.58
20/09/2013	6.50	25.60	6.12
25/10/2013	6.51	25.59	6.13
21/11/2013	6.74	25.36	6.36
28/02/2014	7.38	24.72	7.00
24/03/2014	7.51	24.59	7.13
30/05/2014	7.33	24.77	6.95
8/08/2014	6.75	25.36	6.37
19/09/2014	6.60	25.50	6.22
15/10/2021	6.60	25.50	6.22
29/10/2021	6.36	25.74	5.98
27/01/2022	7.00	25.10	6.62
22/04/2022	7.24	24.86	6.86
3/08/2022	6.87	25.23	6.49

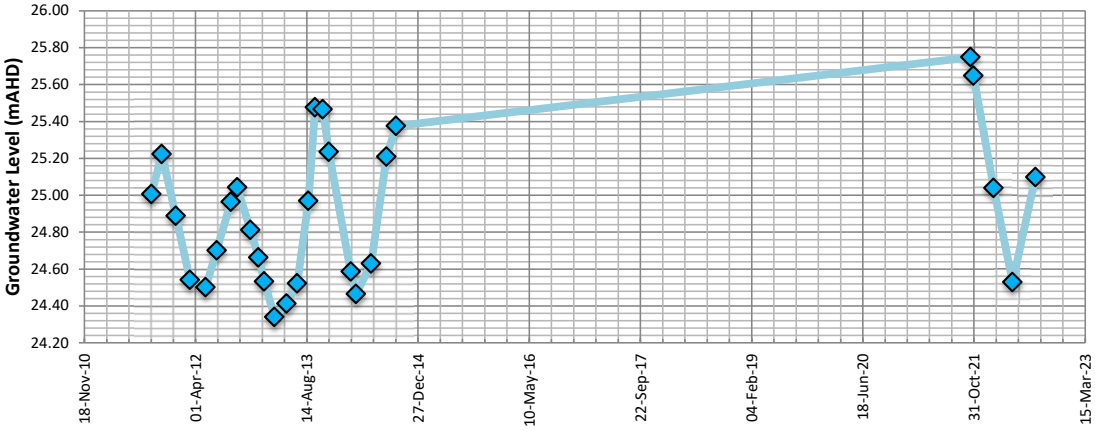
Minimum Recorded Level (mAHD)	24.474
Maximum Recorded Level (mAHD)	25.74

H21089 Aubin Grove & Banjup

G3 Bioscience Bore 3

				Natural Surface (mAHD)	30.29
Data Analysis Period Start Date	1/01/2010	Easting	393331	Top of Casing (m AHD)	30.98
Data Analysis Period End Date	8/08/2022	Northing	6440975	End of Hole (mAHD)	21.82

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	5.97	25.01	5.29
1/11/2011	5.76	25.22	5.07
4/01/2012	6.09	24.89	5.41
7/03/2012	6.44	24.54	5.75
16/05/2012	6.48	24.50	5.79
5/07/2012	6.28	24.70	5.59
7/09/2012	6.01	24.97	5.33
5/10/2012	5.94	25.04	5.25
4/12/2012	6.17	24.81	5.48
9/01/2013	6.32	24.66	5.63
4/02/2013	6.45	24.53	5.76
22/03/2013	6.64	24.34	5.95
15/05/2013	6.57	24.41	5.88
2/07/2013	6.46	24.52	5.77
21/08/2013	6.01	24.97	5.32
20/09/2013	5.50	25.48	4.82
25/10/2013	5.51	25.47	4.83
21/11/2013	5.74	25.24	5.06
28/02/2014	6.39	24.59	5.71
24/03/2014	6.51	24.46	5.83
30/05/2014	6.35	24.63	5.66
8/08/2014	5.77	25.21	5.08
19/09/2014	5.60	25.38	4.92
15/10/2021	5.23	25.75	4.55
29/10/2021	5.33	25.65	4.65
27/01/2022	5.94	25.04	5.26
22/04/2022	6.45	24.53	5.77
3/08/2022	5.88	25.10	5.20

Minimum Recorded Level (mAHD)	24.34
Maximum Recorded Level (mAHD)	25.748

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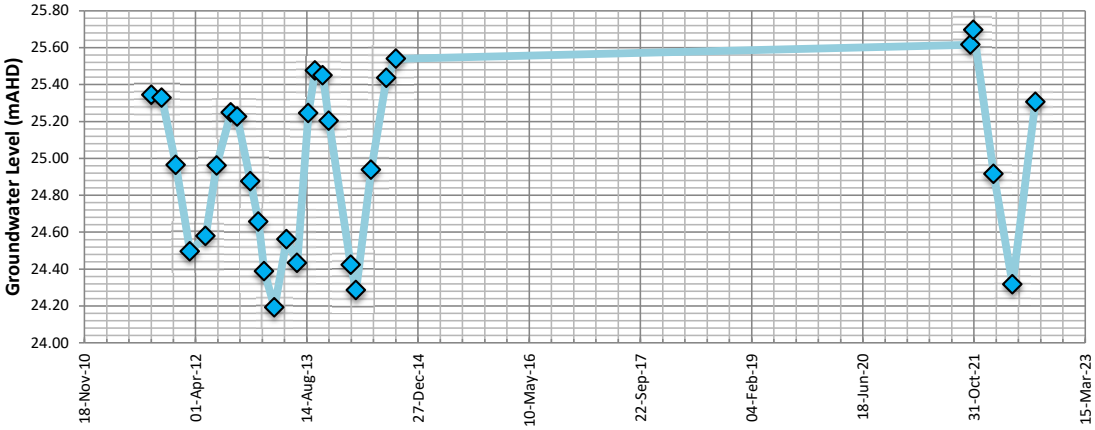
G4 Bioscience Bore 4

				Natural Surface (mAHD)	26.50
Data Analysis Period Start Date	1/01/2010	Easting	393863	Top of Casing (m AHD)	27.09
Data Analysis Period End Date	8/08/2022	Northing	6441559	End of Hole (mAHD)	22.10

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.74	25.34	1.15
1/11/2011	1.76	25.33	1.17
4/01/2012	2.12	24.96	1.53
7/03/2012	2.59	24.50	2.00
16/05/2012	2.51	24.58	1.92
5/07/2012	2.13	24.96	1.54
7/09/2012	1.84	25.25	1.25
5/10/2012	1.86	25.23	1.27
4/12/2012	2.21	24.88	1.62
9/01/2013	2.43	24.66	1.84
4/02/2013	2.70	24.39	2.11
22/03/2013	2.90	24.19	2.31
15/05/2013	2.53	24.56	1.94
2/07/2013	2.65	24.43	2.06
21/08/2013	1.84	25.24	1.25
20/09/2013	1.61	25.48	1.02
25/10/2013	1.64	25.45	1.05
21/11/2013	1.88	25.20	1.29
28/02/2014	2.66	24.42	2.07
24/03/2014	2.80	24.29	2.21
30/05/2014	2.15	24.94	1.56
8/08/2014	1.65	25.44	1.06
19/09/2014	1.55	25.54	0.96
15/10/2021	1.47	25.62	0.88
29/10/2021	1.39	25.70	0.80
27/01/2022	2.17	24.92	1.58
22/04/2022	2.77	24.32	2.18
3/08/2022	1.78	25.31	1.19

Minimum Recorded Level (mAHD)	24.191
Maximum Recorded Level (mAHD)	25.696

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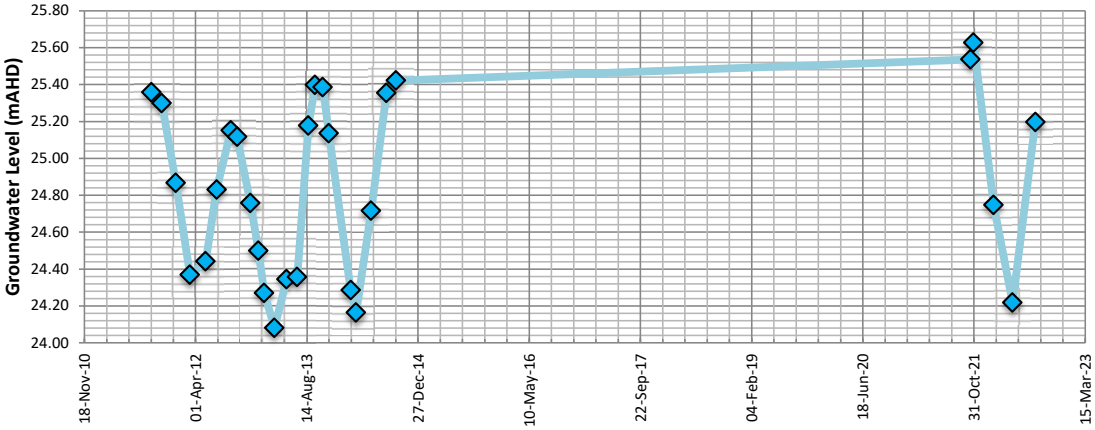
G5 Bioscience Bore 5

				Natural Surface (mAHD)	26.23
Data Analysis Period Start Date	1/01/2010	Easting	393948	Top of Casing (m AHD)	26.90
Data Analysis Period End Date	8/08/2022	Northing	6441260	End of Hole (mAHD)	21.63

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.54	25.36	0.88
1/11/2011	1.60	25.30	0.93
4/01/2012	2.03	24.87	1.37
7/03/2012	2.53	24.37	1.86
16/05/2012	2.46	24.44	1.79
5/07/2012	2.07	24.83	1.40
7/09/2012	1.75	25.15	1.08
5/10/2012	1.78	25.12	1.12
4/12/2012	2.14	24.76	1.48
9/01/2013	2.40	24.50	1.73
4/02/2013	2.63	24.27	1.96
22/03/2013	2.82	24.08	2.15
15/05/2013	2.55	24.34	1.89
2/07/2013	2.54	24.36	1.88
21/08/2013	1.72	25.18	1.06
20/09/2013	1.50	25.40	0.84
25/10/2013	1.51	25.39	0.85
21/11/2013	1.76	25.14	1.10
28/02/2014	2.61	24.29	1.95
24/03/2014	2.73	24.16	2.07
30/05/2014	2.18	24.72	1.52
8/08/2014	1.54	25.35	0.88
19/09/2014	1.48	25.42	0.81
15/10/2021	1.36	25.54	0.70
29/10/2021	1.27	25.63	0.61
27/01/2022	2.15	24.75	1.49
22/04/2022	2.68	24.22	2.02
3/08/2022	1.70	25.20	1.04

Minimum Recorded Level (mAHD)	24.081
Maximum Recorded Level (mAHD)	25.627

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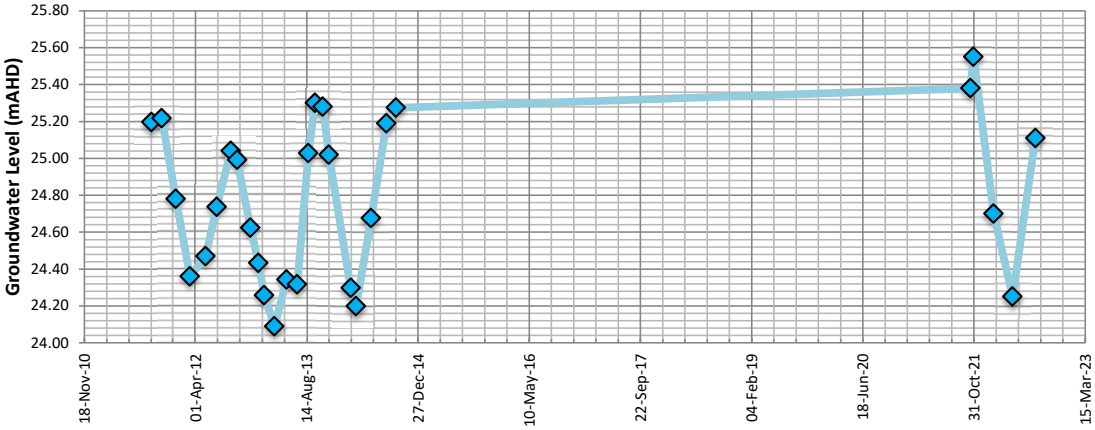
G6 Bioscience Bore 6

				Natural Surface (mAHD)	26.48
Data Analysis Period Start Date	1/01/2010	Easting	393912	Top of Casing (m AHD)	26.85
Data Analysis Period End Date	8/08/2022	Northing	6440980	End of Hole (mAHD)	22.18

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.65	25.20	1.28
1/11/2011	1.63	25.22	1.26
4/01/2012	2.07	24.78	1.70
7/03/2012	2.49	24.36	2.12
16/05/2012	2.38	24.47	2.01
5/07/2012	2.11	24.74	1.74
7/09/2012	1.81	25.04	1.44
5/10/2012	1.86	24.99	1.49
4/12/2012	2.23	24.62	1.86
9/01/2013	2.42	24.43	2.05
4/02/2013	2.59	24.26	2.22
22/03/2013	2.76	24.09	2.39
15/05/2013	2.51	24.34	2.14
2/07/2013	2.53	24.32	2.16
21/08/2013	1.82	25.03	1.45
20/09/2013	1.55	25.30	1.18
25/10/2013	1.57	25.28	1.20
21/11/2013	1.83	25.02	1.46
28/02/2014	2.55	24.30	2.18
24/03/2014	2.65	24.20	2.28
30/05/2014	2.18	24.68	1.81
8/08/2014	1.66	25.19	1.29
19/09/2014	1.58	25.27	1.21
15/10/2021	1.47	25.38	1.10
29/10/2021	1.30	25.55	0.93
27/01/2022	2.15	24.70	1.78
22/04/2022	2.60	24.25	2.23
3/08/2022	1.74	25.11	1.37

Minimum Recorded Level (mAHD)	24.089
Maximum Recorded Level (mAHD)	25.55

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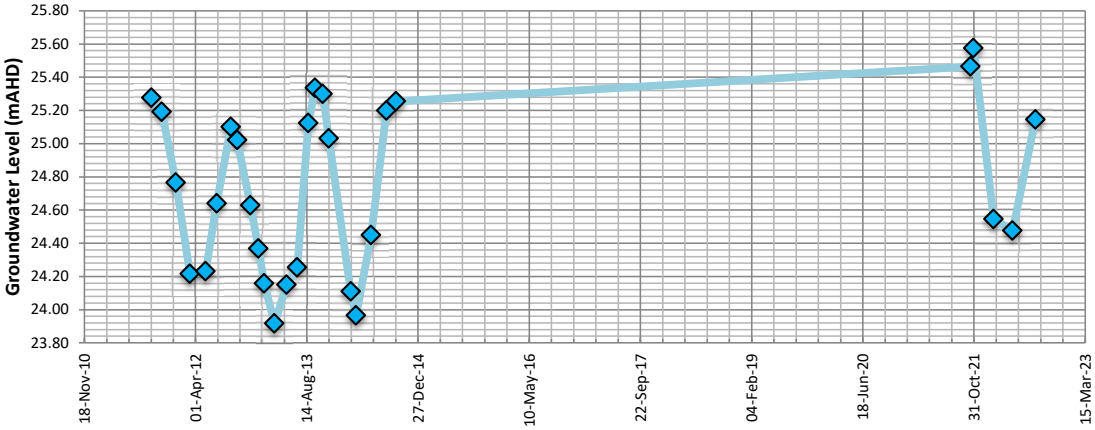
G7 Bioscience Bore 7

				Natural Surface (mAHD)	25.85
Data Analysis Period Start Date	1/01/2010	Easting	393649	Top of Casing (m AHD)	26.40
Data Analysis Period End Date	8/08/2022	Northing	6441246	End of Hole (mAHD)	21.40

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.12	25.28	0.57
1/11/2011	1.21	25.19	0.66
4/01/2012	1.63	24.77	1.08
7/03/2012	2.18	24.22	1.63
16/05/2012	2.16	24.23	1.61
5/07/2012	1.76	24.64	1.21
7/09/2012	1.30	25.10	0.74
5/10/2012	1.37	25.02	0.82
4/12/2012	1.77	24.63	1.22
9/01/2013	2.03	24.37	1.48
4/02/2013	2.24	24.16	1.69
22/03/2013	2.48	23.92	1.93
15/05/2013	2.25	24.15	1.70
2/07/2013	2.14	24.25	1.59
21/08/2013	1.27	25.12	0.72
20/09/2013	1.06	25.34	0.51
25/10/2013	1.10	25.30	0.55
21/11/2013	1.37	25.03	0.81
28/02/2014	2.29	24.11	1.74
24/03/2014	2.43	23.97	1.88
30/05/2014	1.95	24.45	1.40
8/08/2014	1.20	25.20	0.65
19/09/2014	1.14	25.26	0.59
15/10/2021	0.93	25.47	0.38
29/10/2021	0.82	25.58	0.27
27/01/2022	1.85	24.55	1.30
22/04/2022	1.92	24.48	1.37
3/08/2022	1.25	25.15	0.70

Minimum Recorded Level (mAHD)	23.916
Maximum Recorded Level (mAHD)	25.575

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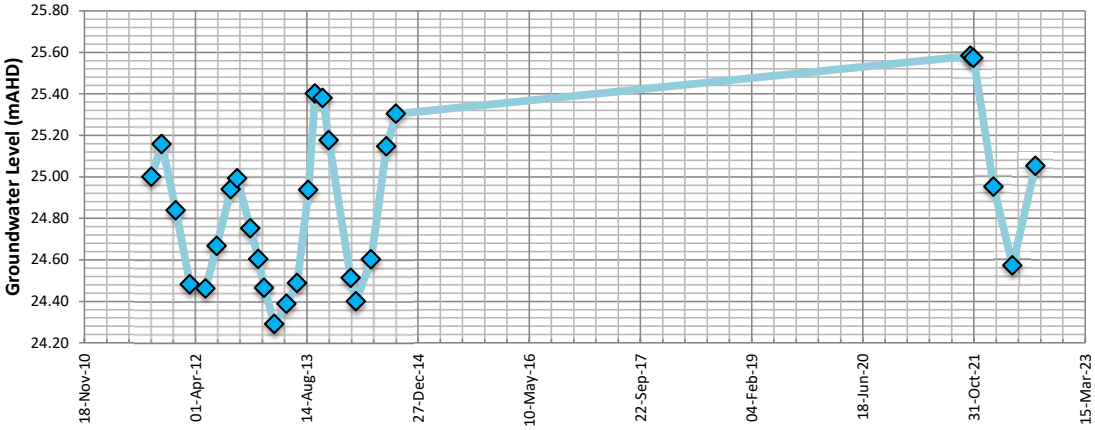
G8 Bioscience Bore 8

				Natural Surface (mAHD)	27.15
Data Analysis Period Start Date	1/01/2010	Easting	393451	Top of Casing (m AHD)	27.85
Data Analysis Period End Date	8/08/2022	Northing	6441065	End of Hole (mAHD)	22.05

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	2.85	25.00	2.15
1/11/2011	2.70	25.16	2.00
4/01/2012	3.01	24.84	2.31
7/03/2012	3.37	24.48	2.67
16/05/2012	3.39	24.46	2.69
5/07/2012	3.19	24.67	2.49
7/09/2012	2.91	24.94	2.21
5/10/2012	2.86	24.99	2.16
4/12/2012	3.10	24.75	2.40
9/01/2013	3.25	24.60	2.55
4/02/2013	3.39	24.46	2.69
22/03/2013	3.56	24.29	2.86
15/05/2013	3.47	24.39	2.77
2/07/2013	3.36	24.49	2.66
21/08/2013	2.92	24.94	2.22
20/09/2013	2.45	25.40	1.75
25/10/2013	2.47	25.38	1.77
21/11/2013	2.68	25.18	1.98
28/02/2014	3.34	24.51	2.64
24/03/2014	3.45	24.40	2.75
30/05/2014	3.25	24.60	2.55
8/08/2014	2.71	25.15	2.01
19/09/2014	2.55	25.30	1.85
15/10/2021	2.27	25.58	1.57
29/10/2021	2.28	25.57	1.58
27/01/2022	2.90	24.95	2.20
22/04/2022	3.28	24.57	2.58
3/08/2022	2.80	25.05	2.10

Minimum Recorded Level (mAHD)	24.29
Maximum Recorded Level (mAHD)	25.582

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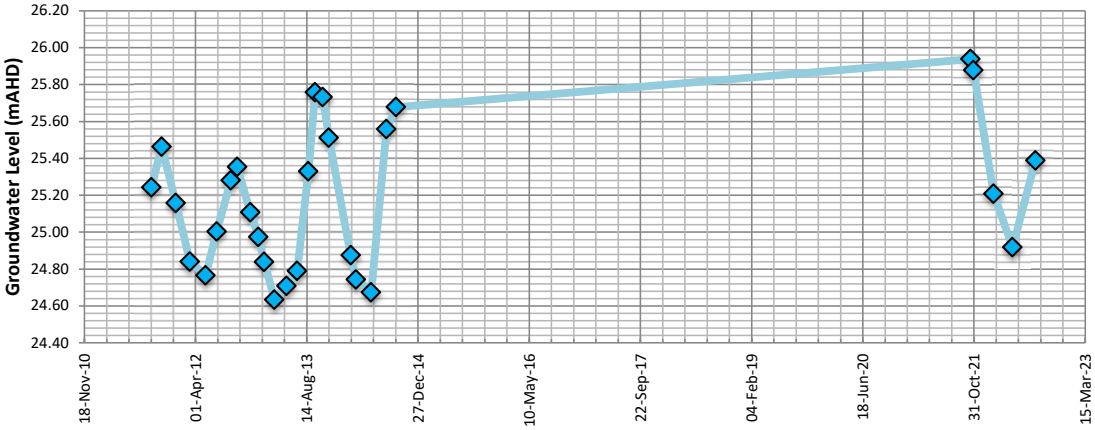
G9 Bioscience Bore 9

				Natural Surface (mAHD)	30.82
Data Analysis Period Start Date	1/01/2010	Easting	393479	Top of Casing (m AHD)	31.31
Data Analysis Period End Date	8/08/2022	Northing	6441361	End of Hole (mAHD)	22.42

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	6.07	25.24	5.58
1/11/2011	5.85	25.46	5.36
4/01/2012	6.15	25.16	5.66
7/03/2012	6.47	24.84	5.98
16/05/2012	6.54	24.77	6.05
5/07/2012	6.31	25.00	5.82
7/09/2012	6.03	25.28	5.54
5/10/2012	5.96	25.35	5.47
4/12/2012	6.20	25.11	5.71
9/01/2013	6.34	24.97	5.85
4/02/2013	6.47	24.84	5.98
22/03/2013	6.67	24.63	6.18
15/05/2013	6.60	24.71	6.11
2/07/2013	6.52	24.79	6.03
21/08/2013	5.98	25.33	5.49
20/09/2013	5.55	25.76	5.06
25/10/2013	5.58	25.73	5.09
21/11/2013	5.80	25.51	5.31
28/02/2014	6.43	24.88	5.94
24/03/2014	6.57	24.74	6.08
30/05/2014	6.64	24.67	6.15
8/08/2014	5.75	25.56	5.26
19/09/2014	5.63	25.68	5.14
15/10/2021	5.37	25.94	4.88
29/10/2021	5.43	25.88	4.94
27/01/2022	6.10	25.21	5.61
22/04/2022	6.39	24.92	5.90
3/08/2022	5.92	25.39	5.43

Minimum Recorded Level (mAHD)	24.634
Maximum Recorded Level (mAHD)	25.938

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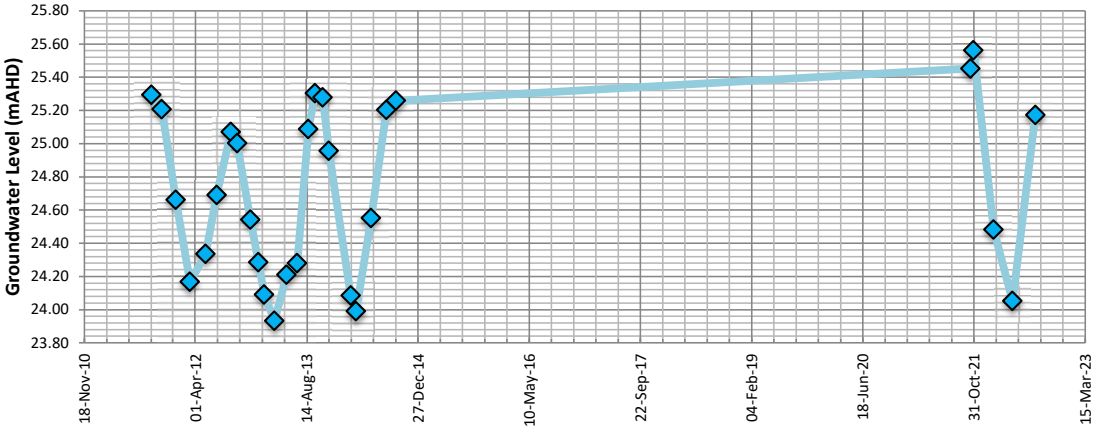
G10 Bioscience Bore 10

				Natural Surface (mAHD)	25.99
Data Analysis Period Start Date	1/01/2010	Easting	393811	Top of Casing (m AHD)	26.52
Data Analysis Period End Date	8/08/2022	Northing	6441092	End of Hole (mAHD)	21.49

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.23	25.29	0.69
1/11/2011	1.32	25.21	0.78
4/01/2012	1.86	24.66	1.33
7/03/2012	2.36	24.17	1.82
16/05/2012	2.19	24.34	1.65
5/07/2012	1.83	24.69	1.30
7/09/2012	1.45	25.07	0.92
5/10/2012	1.52	25.00	0.98
4/12/2012	1.98	24.54	1.45
9/01/2013	2.24	24.29	1.70
4/02/2013	2.43	24.09	1.90
22/03/2013	2.59	23.93	2.06
15/05/2013	2.31	24.21	1.78
2/07/2013	2.24	24.28	1.71
21/08/2013	1.44	25.09	0.90
20/09/2013	1.22	25.30	0.68
25/10/2013	1.24	25.28	0.71
21/11/2013	1.57	24.96	1.03
28/02/2014	2.44	24.09	1.90
24/03/2014	2.53	23.99	2.00
30/05/2014	1.97	24.55	1.44
8/08/2014	1.32	25.20	0.78
19/09/2014	1.26	25.26	0.73
15/10/2021	1.07	25.45	0.54
29/10/2021	0.96	25.56	0.43
27/01/2022	2.04	24.48	1.51
22/04/2022	2.47	24.05	1.94
3/08/2022	1.35	25.17	0.82

Minimum Recorded Level (mAHD)	23.932
Maximum Recorded Level (mAHD)	25.562

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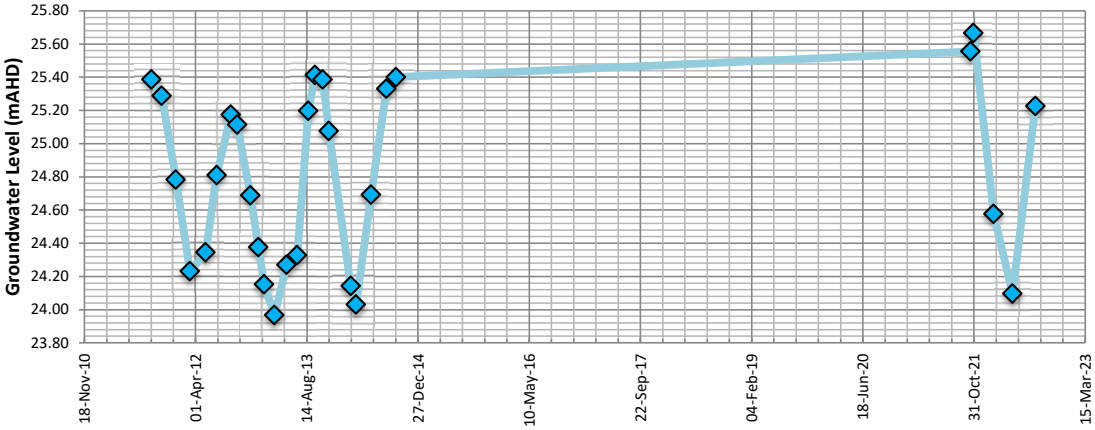
G11 Bioscience Bore 11

				Natural Surface (mAHD)	26.37
Data Analysis Period Start Date	1/01/2010	Easting	393783	Top of Casing (m AHD)	27.02
Data Analysis Period End Date	8/08/2022	Northing	6441372	End of Hole (mAHD)	21.87

Report Date : 8/08/2022



Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.63	25.39	0.98
1/11/2011	1.73	25.29	1.08
4/01/2012	2.23	24.78	1.58
7/03/2012	2.79	24.23	2.14
16/05/2012	2.67	24.35	2.02
5/07/2012	2.21	24.81	1.56
7/09/2012	1.84	25.17	1.19
5/10/2012	1.90	25.11	1.25
4/12/2012	2.33	24.69	1.68
9/01/2013	2.64	24.38	1.99
4/02/2013	2.87	24.15	2.22
22/03/2013	3.05	23.97	2.40
15/05/2013	2.75	24.27	2.10
2/07/2013	2.69	24.33	2.04
21/08/2013	1.82	25.20	1.17
20/09/2013	1.60	25.41	0.95
25/10/2013	1.63	25.39	0.98
21/11/2013	1.94	25.08	1.29
28/02/2014	2.87	24.14	2.22
24/03/2014	2.99	24.03	2.34
30/05/2014	2.33	24.69	1.68
8/08/2014	1.69	25.33	1.04
19/09/2014	1.62	25.40	0.97
15/10/2021	1.46	25.56	0.81
29/10/2021	1.35	25.67	0.70
27/01/2022	2.44	24.58	1.79
22/04/2022	2.92	24.10	2.27
3/08/2022	1.79	25.23	1.14

Minimum Recorded Level (mAHD)	23.966
Maximum Recorded Level (mAHD)	25.666

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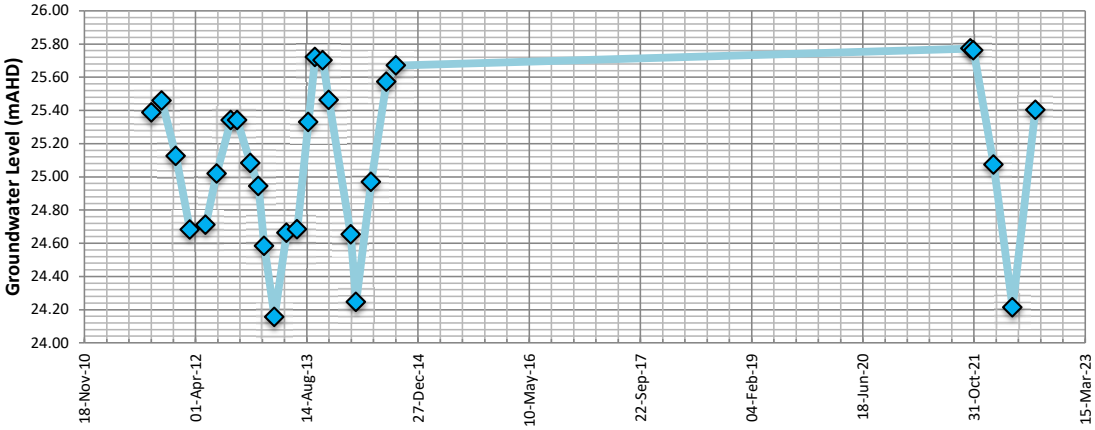
G12 Bioscience Bore 12

				Natural Surface (mAHD)	25.75
Data Analysis Period Start Date	1/01/2010	Easting	393587	Top of Casing (m AHD)	26.38
Data Analysis Period End Date	8/08/2022	Northing	6441479	End of Hole (mAHD)	21.30

Report Date : 8/08/2022

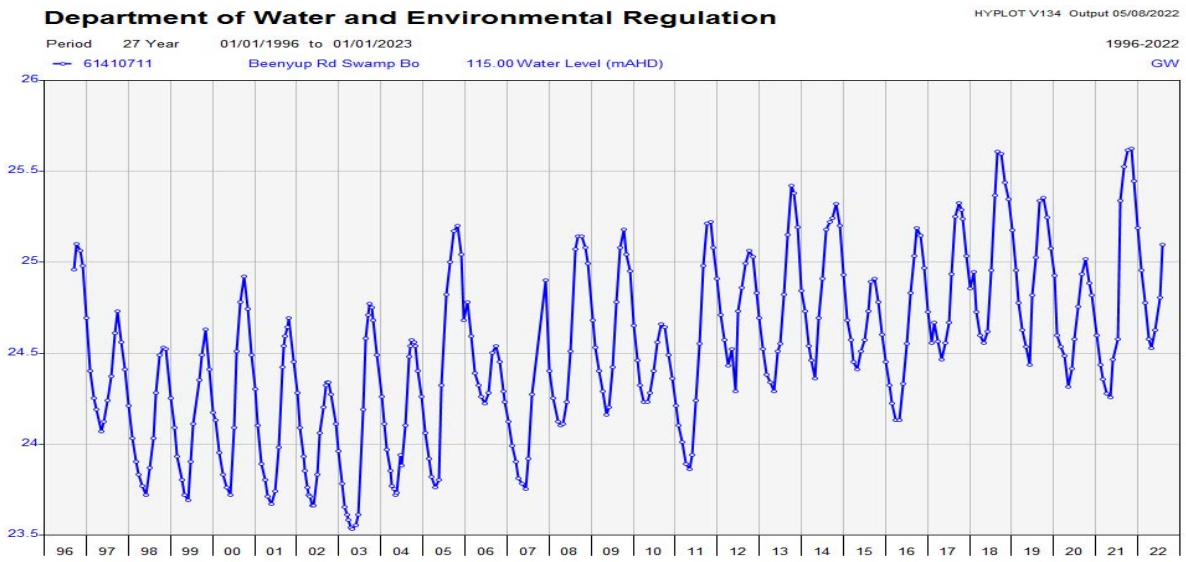


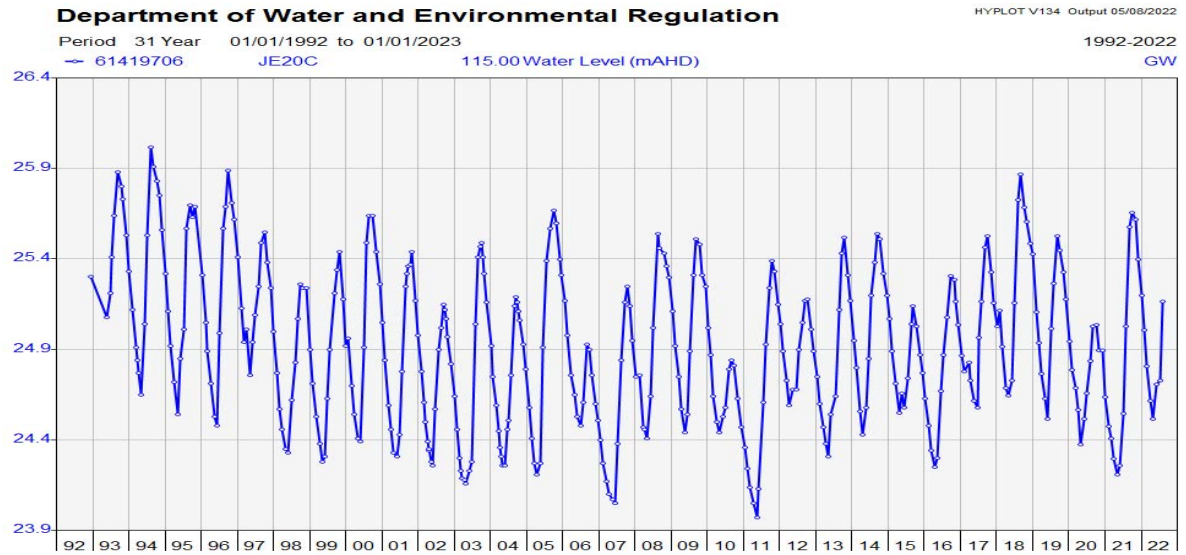
Date	Groundwater bTOC	Groundwater mAHD	Depth Below NS m
16/09/2011	1.00	25.39	0.37
1/11/2011	0.92	25.46	0.29
4/01/2012	1.26	25.13	0.63
7/03/2012	1.70	24.68	1.07
16/05/2012	1.67	24.71	1.04
5/07/2012	1.36	25.02	0.73
7/09/2012	1.04	25.34	0.41
5/10/2012	1.04	25.34	0.41
4/12/2012	1.30	25.08	0.67
9/01/2013	1.44	24.94	0.81
4/02/2013	1.80	24.58	1.17
22/03/2013	2.23	24.16	1.60
15/05/2013	1.72	24.66	1.09
2/07/2013	1.70	24.68	1.07
21/08/2013	1.05	25.33	0.42
20/09/2013	0.66	25.72	0.03
25/10/2013	0.68	25.70	0.05
21/11/2013	0.92	25.46	0.29
28/02/2014	1.73	24.65	1.10
24/03/2014	2.14	24.25	1.51
30/05/2014	1.41	24.97	0.78
8/08/2014	0.81	25.57	0.18
19/09/2014	0.71	25.67	0.08
15/10/2021	0.61	25.77	-0.02
29/10/2021	0.62	25.76	-0.01
27/01/2022	1.31	25.07	0.68
22/04/2022	2.17	24.21	1.54
3/08/2022	0.98	25.40	0.35

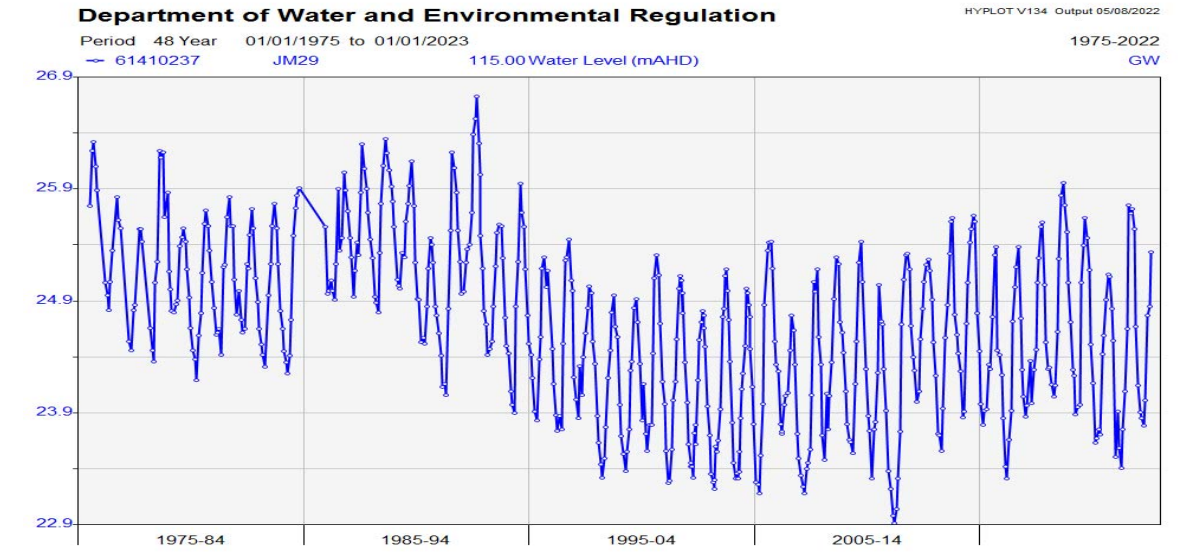
Minimum Recorded Level (mAHD)	24.155
Maximum Recorded Level (mAHD)	25.772

Attachment 3
Long Term DWER Bore Hydrographs

Date: 09/08/2022 Job No. H21089







Source: DWER (2022)

Attachment 4
Groundwater Quality Monitoring Data

H21089
Aubin Grove & Banjup
Groundwater Quality Summary

NUTRIENTS AND METALS (mg/L)

G1								
	WL mBTOC	EC (mS/cm)	pH	TN	NOx-N	NH3-N	TP	FRP
29/10/2021	2.96	0.219	6.25	1.10	0.050	0.005	0.050	0.03
27/01/2022	3.64	0.408	6.57	0.60	0.005	0.005	0.080	0.06
22/04/2022	4.00	DRY	DRY	DRY	DRY	DRY	DRY	DRY
3/08/2022	3.33	0.513	6.54	1.30	0.029	0.006	0.050	0.03
Average	3.48	0.380	6.45	1.00	0.028	0.005	0.060	0.04
G5								
	WL mBTOC	EC (mS/cm)	pH	TN	NOx-N	NH3-N	TP	FRP
29/10/2021	1.27	0.484	4.33	5.30	0.013	0.540	0.570	0.56
27/01/2022	2.15	0.568	4.50	5.30	0.014	0.640	0.310	0.31
22/04/2022	2.68	0.740	4.52	6.50	0.050	0.130	2.500	0.05
3/08/2022	1.70	1.260	3.45	5.30	0.340	0.260	0.370	0.34
Average	1.95	0.763	4.20	5.60	0.104	0.393	0.938	0.32
G7								
	WL mBTOC	EC (mS/cm)	pH	TN	NOx-N	NH3-N	TP	FRP
29/10/2021	0.82	0.216	5.22	2.40	0.050	0.009	0.050	0.01
27/01/2022	1.85	0.458	5.83	4.60	0.005	0.078	0.060	0.01
22/04/2022	1.92	DRY	DRY	DRY	DRY	DRY	DRY	DRY
3/08/2022	1.25	0.965	5.62	3.00	0.050	0.007	0.050	0.01
Average	1.46	0.546	5.56	3.33	0.035	0.031	0.053	0.01
G12								
	WL mBTOC	EC (mS/cm)	pH	TN	NOx-N	NH3-N	TP	FRP
29/10/2021	0.62	0.470	4.17	3.00	0.050	0.005	0.050	0.02
27/01/2022	1.31	0.743	4.15	2.30	0.005	0.011	0.050	0.01
22/04/2022	2.17	3.223	5.00	13.00	0.012	0.520	12.000	0.35
3/08/2022	0.98	1.488	3.86	3.30	0.007	0.007	0.050	0.01
Average	1.27	1.481	4.30	5.40	0.018	0.136	3.038	0.10

Below laboratory detectable limit

^In situ values via calibrated water quality meter

H21089
Aubin Grove & Banjup
Groundwater Quality Summary

NUTRIENTS AND METALS (mg/L)

G1								
	As	Cd	Cr	Cu	Pb	Ni	Zn	Hg
29/10/2021	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.00005
27/01/2022	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.00005
22/04/2022	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
3/08/2022	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.00005
Average	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.00005
G5								
	As	Cd	Cr	Cu	Pb	Ni	Zn	Hg
29/10/2021	0.001	0.0001	0.002	0.001	0.001	0.001	0.004	0.00005
27/01/2022	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.00005
22/04/2022	0.001	0.0001	0.001	0.001	0.001	0.001	0.011	0.00005
3/08/2022	0.001	0.0001	0.002	0.001	0.001	0.001	0.002	0.00005
Average	0.001	0.0001	0.001	0.001	0.001	0.001	0.004	0.00005
G7								
	As	Cd	Cr	Cu	Pb	Ni	Zn	Hg
29/10/2021	0.001	0.0001	0.002	0.001	0.001	0.003	0.002	0.00005
27/01/2022	0.002	0.0001	0.003	0.001	0.001	0.007	0.004	0.00005
22/04/2022	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY
3/08/2022	0.002	0.0001	0.003	0.007	0.001	0.006	0.002	0.00005
Average	0.002	0.0001	0.003	0.003	0.001	0.005	0.003	0.00005
G12								
	As	Cd	Cr	Cu	Pb	Ni	Zn	Hg
29/10/2021	0.001	0.0001	0.002	0.001	0.001	0.002	0.002	0.00005
27/01/2022	0.001	0.0001	0.002	0.001	0.002	0.002	0.001	0.00005
22/04/2022	0.007	0.0001	0.048	0.001	0.007	0.036	0.002	0.00005
3/08/2022	0.001	0.0001	0.003	0.001	0.001	0.003	0.001	0.00005
Average	0.003	0.0001	0.014	0.001	0.003	0.011	0.002	0.00005

Below laboratory detectable limit

^In situ values via calibrated water quality meter

Attachment 5
Laboratory Reports

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph 08 9317 2505 fax 08 9317 4163
lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 271388

Client Details

Client	Hyd2O
Attention	Georgia Ross
Address	Suite 6B, 103 Rokeby Rd, Subiaco, WA, 6008

Sample Details

Your Reference	**H21089 Aubin Grove & Banjup**
Number of Samples	4 Water
Date samples received	29/10/2021
Date completed instructions received	29/10/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	05/11/2021
Date of Issue	05/11/2021

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Results Approved By
Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Nutrients in Water						
Our Reference	UNITS	PQL	271388-1	271388-2	271388-3	271388-4
Your Reference			G1	G5	G7	G12
Date Sampled			29/10/2021	29/10/2021	29/10/2021	29/10/2021
Type of sample			Groundwater	Groundwater	Groundwater	Groundwater
Date prepared	-		29/10/2021	29/10/2021	29/10/2021	29/10/2021
Date analysed	-		29/10/2021	29/10/2021	29/10/2021	29/10/2021
Total Nitrogen	mg/L	0.1	1.1	5.3	2.4	3.0
NOx as N	mg/L	0.005	<0.05	0.013	<0.05	<0.05
Ammonia as N	mg/L	0.005	<0.005	0.54	0.009	<0.005
Total Phosphorus	mg/L	0.05	<0.05	0.57	<0.05	<0.05
Phosphate as P	mg/L	0.005	0.033	0.56	<0.005	0.021

Metals in Water - Low Level						
Our Reference	UNITS	PQL	271388-1	271388-2	271388-3	271388-4
Your Reference			G1	G5	G7	G12
Date Sampled			29/10/2021	29/10/2021	29/10/2021	29/10/2021
Type of sample			Groundwater	Groundwater	Groundwater	Groundwater
Date prepared	-		04/11/2021	04/11/2021	04/11/2021	04/11/2021
Date analysed	-		04/11/2021	04/11/2021	04/11/2021	04/11/2021
Arsenic-Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Cadmium-Dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium-Dissolved	mg/L	0.001	<0.001	0.002	0.002	0.002
Copper-Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Lead-Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	0.001
Mercury-Dissolved	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel-Dissolved	mg/L	0.001	<0.001	<0.001	0.003	0.002
Zinc-Dissolved	mg/L	0.001	0.001	0.004	0.002	0.002

Method ID	Methodology Summary
INORG-055	NOx - determined colourimetrically. Soils are analysed from a water extract.
INORG-057	Ammonia by colourimetric analysis based on APHA latest edition 4500-NH3 F.
INORG-060	Phosphate- determined colourimetrically. Soils are analysed from a water extract.
INORG-110	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Dissolved/Total Carbon and Dissolved/Total Organic and Inorganic Carbon by high temperature catalytic combustion with NDIR
METALS-020	Determination of various metals by ICP-AES.
METALS-021	Determination of Mercury by Cold Vapour AAS. For urine samples total Mercury is determined, however, mercury in urine is almost entirely in the inorganic form (CDC).
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Nutrients in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/10/2021	[NT]	[NT]	[NT]	[NT]	29/10/2021	[NT]
Date analysed	-			29/10/2021	[NT]	[NT]	[NT]	[NT]	29/10/2021	[NT]
Total Nitrogen	mg/L	0.1	INORG-110	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
NOx as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	[NT]	[NT]	101	[NT]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	[NT]	[NT]	104	[NT]
Total Phosphorus	mg/L	0.05	METALS-020	<0.05	[NT]	[NT]	[NT]	[NT]	114	[NT]
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	[NT]	[NT]	113	[NT]

QUALITY CONTROL: Metals in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/11/2021	1	04/11/2021	04/11/2021		04/11/2021	[NT]
Date analysed	-			04/11/2021	1	04/11/2021	04/11/2021		04/11/2021	[NT]
Arsenic-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	105	[NT]
Cadmium-Dissolved	mg/L	0.0001	METALS-022	<0.0001	1	<0.0001	<0.0001	0	102	[NT]
Chromium-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	102	[NT]
Copper-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	103	[NT]
Lead-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	103	[NT]
Mercury-Dissolved	mg/L	0.00005	METALS-021	<0.00005	1	<0.00005	[NT]		109	[NT]
Nickel-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	104	[NT]
Zinc-Dissolved	mg/L	0.001	METALS-022	<0.001	1	0.001	0.002	67	102	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

NOx: PQL raised on samples#1, 3 and 4 due to matrix interference.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 275845

Client Details

Client	Hyd2O
Attention	Georgia Ross
Address	Suite 6B, 103 Rokeby Rd, Subiaco, WA, 6008

Sample Details

Your Reference	**H21089 Aubin Grove & Banjup**
Number of Samples	4 Water
Date samples received	27/01/2022
Date completed instructions received	27/01/2022

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	03/02/2022
Date of Issue	03/02/2022

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Results Approved By
Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Nutrients in Water						
Our Reference	UNITS	PQL	275845-1	275845-2	275845-3	275845-4
Your Reference			G1	G5	G7	G12
Date Sampled			27/01/2022	27/01/2022	27/01/2022	27/01/2022
Type of sample			Groundwater	Groundwater	Groundwater	Groundwater
Date prepared	-		28/01/2022	28/01/2022	28/01/2022	28/01/2022
Date analysed	-		28/01/2022	28/01/2022	28/01/2022	28/01/2022
Total Nitrogen	mg/L	0.1	0.6	5.3	4.6	2.3
NOx as N	mg/L	0.005	<0.005	0.014	<0.005	<0.005
Ammonia as N	mg/L	0.005	<0.005	0.64	0.078	0.011
Total Phosphorus	mg/L	0.05	0.08	0.31	0.06	<0.05
Phosphate as P	mg/L	0.005	0.055	0.31	0.011	0.007

Metals in Water - Low Level						
Our Reference	UNITS	PQL	275845-1	275845-2	275845-3	275845-4
Your Reference			G1	G5	G7	G12
Date Sampled			27/01/2022	27/01/2022	27/01/2022	27/01/2022
Type of sample			Groundwater	Groundwater	Groundwater	Groundwater
Date prepared	-		02/02/2022	02/02/2022	02/02/2022	02/02/2022
Date analysed	-		02/02/2022	02/02/2022	02/02/2022	02/02/2022
Arsenic-Dissolved	mg/L	0.001	<0.001	<0.001	0.002	<0.001
Cadmium-Dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium-Dissolved	mg/L	0.001	<0.001	<0.001	0.003	0.002
Copper-Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Lead-Dissolved	mg/L	0.001	<0.001	<0.001	<0.001	0.002
Mercury-Dissolved	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Nickel-Dissolved	mg/L	0.001	<0.001	<0.001	0.007	0.002
Zinc-Dissolved	mg/L	0.001	<0.001	<0.001	0.004	<0.001

Method ID	Methodology Summary
INORG-055	NOx - determined colourimetrically. Soils are analysed from a water extract.
INORG-057	Ammonia by colourimetric analysis based on APHA latest edition 4500-NH3 F.
INORG-060	Phosphate- determined colourimetrically. Soils are analysed from a water extract.
INORG-110	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Dissolved/Total Carbon and Dissolved/Total Organic and Inorganic Carbon by high temperature catalytic combustion with NDIR
METALS-020	Determination of various metals by ICP-AES.
METALS-021	Determination of Mercury by Cold Vapour AAS. For urine samples total Mercury is determined, however, mercury in urine is almost entirely in the inorganic form (CDC).
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Nutrients in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			28/01/2022	[NT]	[NT]	[NT]	[NT]	28/01/2022	[NT]
Date analysed	-			28/01/2022	[NT]	[NT]	[NT]	[NT]	28/01/2022	[NT]
Total Nitrogen	mg/L	0.1	INORG-110	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
NOx as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	[NT]	[NT]	120	[NT]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	[NT]	[NT]	100	[NT]
Total Phosphorus	mg/L	0.05	METALS-020	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Phosphate as P	mg/L	0.005	INORG-060	<0.005	[NT]	[NT]	[NT]	[NT]	108	[NT]

QUALITY CONTROL: Metals in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	275845-2
Date prepared	-			02/02/2022	1	02/02/2022	02/02/2022		02/02/2022	02/02/2022
Date analysed	-			02/02/2022	1	02/02/2022	02/02/2022		02/02/2022	02/02/2022
Arsenic-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	101	[NT]
Cadmium-Dissolved	mg/L	0.0001	METALS-022	<0.0001	1	<0.0001	<0.0001	0	101	[NT]
Chromium-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	106	[NT]
Copper-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	106	[NT]
Lead-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	105	[NT]
Mercury-Dissolved	mg/L	0.00005	METALS-021	<0.00005	1	<0.00005	<0.00005	0	96	90
Nickel-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	105	[NT]
Zinc-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	<0.001	0	105	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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CERTIFICATE OF ANALYSIS 280542

Client Details

Client	Hyd2O
Attention	Georgia Ross
Address	Suite 1, 387 Hay St, PERTH, WA, 6008

Sample Details

Your Reference	**H21089**
Number of Samples	2 Water
Date samples received	22/04/2022
Date completed instructions received	22/04/2022
Location	Aubin Grove & Banjup

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	03/05/2022
Date of Issue	03/05/2022

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Results Approved By
Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Nutrients in Water				
Our Reference	UNITS	PQL	280542-1	280542-2
Your Reference			G5	G12
Date Sampled			22/04/2022	22/04/2022
Type of sample			Groundwater	Groundwater
Date prepared	-		22/04/2022	22/04/2022
Date analysed	-		26/04/2022	26/04/2022
Total Nitrogen	mg/L	0.1	6.5	13
NOx as N	mg/L	0.005	<0.05	0.012
Ammonia as N	mg/L	0.005	0.13	0.52
Total Phosphorus	mg/L	0.05	2.5	12
Phosphate as P	mg/L	0.005	0.052	0.35

Metals in Water - Low Level				
Our Reference	UNITS	PQL	280542-1	280542-2
Your Reference			G5	G12
Date Sampled			22/04/2022	22/04/2022
Type of sample			Groundwater	Groundwater
Date prepared	-		29/04/2022	29/04/2022
Date analysed	-		29/04/2022	29/04/2022
Arsenic-Dissolved	mg/L	0.001	<0.001	0.007
Cadmium-Dissolved	mg/L	0.0001	<0.0001	<0.0001
Chromium-Dissolved	mg/L	0.001	<0.001	0.048
Copper-Dissolved	mg/L	0.001	<0.001	<0.001
Lead-Dissolved	mg/L	0.001	<0.001	0.007
Mercury-Dissolved	mg/L	0.00005	<0.00005	<0.00005
Nickel-Dissolved	mg/L	0.001	<0.001	0.036
Zinc-Dissolved	mg/L	0.001	0.011	0.002

Method ID	Methodology Summary
INORG-055	NOx - determined colourimetrically. Soils are analysed from a water extract.
INORG-057	Ammonia by colourimetric analysis based on APHA latest edition 4500-NH3 F.
INORG-060	Phosphate- determined colourimetrically. Soils are analysed from a water extract.
INORG-110	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Dissolved/Total Carbon and Dissolved/Total Organic and Inorganic Carbon by high temperature catalytic combustion with NDIR
METALS-020	Determination of various metals by ICP-AES.
METALS-021	Determination of Mercury by Cold Vapour AAS. For urine samples total Mercury is determined, however, mercury in urine is almost entirely in the inorganic form (CDC).
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Nutrients in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			22/04/2022	2	22/04/2022	22/04/2022		22/04/2022	[NT]
Date analysed	-			26/04/2022	2	26/04/2022	26/04/2022		26/04/2022	[NT]
Total Nitrogen	mg/L	0.1	INORG-110	<0.1	2	13	[NT]		100	[NT]
NOx as N	mg/L	0.005	INORG-055	<0.005	2	0.012	[NT]		104	[NT]
Ammonia as N	mg/L	0.005	INORG-057	<0.005	2	0.52	[NT]		88	[NT]
Total Phosphorus	mg/L	0.05	METALS-020	<0.05	2	12	[NT]		104	[NT]
Phosphate as P	mg/L	0.005	INORG-060	<0.005	2	0.35	[NT]		114	[NT]

QUALITY CONTROL: Metals in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/04/2022	1	29/04/2022	29/04/2022		29/04/2022	[NT]
Date analysed	-			29/04/2022	1	29/04/2022	29/04/2022		29/04/2022	[NT]
Arsenic-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	[NT]		111	[NT]
Cadmium-Dissolved	mg/L	0.0001	METALS-022	<0.0001	1	<0.0001	[NT]		105	[NT]
Chromium-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	[NT]		116	[NT]
Copper-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	[NT]		113	[NT]
Lead-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	[NT]		105	[NT]
Mercury-Dissolved	mg/L	0.00005	METALS-021	<0.00005	1	<0.00005	<0.00005	0	108	[NT]
Nickel-Dissolved	mg/L	0.001	METALS-022	<0.001	1	<0.001	[NT]		113	[NT]
Zinc-Dissolved	mg/L	0.001	METALS-022	<0.001	1	0.011	[NT]		112	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Nutrients:PQL raised on sample #1 for NOx_N due to matrix interference.

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Certificate of Analysis PDH0232

Client Details

Client	Hyd2O
Contact	Georgia Ross
Address	Suite 6B, 103 Rokeby Rd, SUBIACO, WA, 6008

Sample Details

Your Reference	H 21089 - Aubin Grove & Banjup
Number of Samples	4 Water
Date Samples Received	03/08/2022
Date Samples Registered	03/08/2022

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	10/08/2022
Date of Issue	11/08/2022

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Authorisation Details

Results Approved By	Heram Halim, Operations Manager Michael Mowle, Inorganics Supervisor Todd Lee, Group Operations Manager
Laboratory Manager	Michael Kubiak

Certificate of Analysis PDH0232

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PDH0232-01	G1	Water	03/08/2022	03/08/2022
PDH0232-02	G5	Water	03/08/2022	03/08/2022
PDH0232-03	G7	Water	03/08/2022	03/08/2022
PDH0232-04	G12	Water	03/08/2022	03/08/2022

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PDH0232-01	PDH0232-02	PDH0232-03	PDH0232-04
Your Reference			G1	G5	G7	G12
Date Sampled			03/08/2022	03/08/2022	03/08/2022	03/08/2022
Phosphorus	mg/L	0.050	<0.050	0.37	<0.050	<0.050

Certificate of Analysis PDH0232

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PDH0232-01	PDH0232-02	PDH0232-03	PDH0232-04
Your Reference			G1	G5	G7	G12
Date Sampled			03/08/2022	03/08/2022	03/08/2022	03/08/2022
Arsenic	µg/L	1.0	<1.0	<1.0	1.6	<1.0
Cadmium	µg/L	0.10	<0.10	<0.10	<0.10	<0.10
Chromium	µg/L	1.0	<1.0	1.5	2.6	2.9
Copper	µg/L	1.0	<1.0	<1.0	6.6	<1.0
Mercury	µg/L	0.050	<0.050	<0.050	<0.050	<0.050
Nickel	µg/L	1.0	<1.0	<1.0	6.3	2.5
Lead	µg/L	1.0	<1.0	<1.0	<1.0	1.1
Zinc	µg/L	1.0	<1.0	1.6	1.9	<1.0

Certificate of Analysis PDH0232

Inorganics (Water)

Envirolab ID	Units	PQL	PDH0232-01	PDH0232-02	PDH0232-03	PDH0232-04
Your Reference			G1	G5	G7	G12
Date Sampled			03/08/2022	03/08/2022	03/08/2022	03/08/2022
Ammonia as N	mg/L	0.0050	0.0056	0.26	0.0066	0.0067
Nitrate as N	mg/L	0.0050	0.82	<0.050 [1]	<0.050 [1]	<0.050 [1]
Nitrite as N	mg/L	0.0050	0.0064	<0.050 [1]	<0.050 [1]	<0.050 [1]
Total Nitrogen	mg/L	0.10	1.3	5.3	3.0	3.3
NOx as N	mg/L	0.0050	0.83	0.074 [1]	<0.050 [1]	0.069 [1]
Phosphate as P	mg/L	0.0050	0.029	0.34	<0.0050	0.0067
Organic Nitrogen by calc.	mg/L	0.10	0.46	4.9	3.0	3.2
TKN as N by calculation	mg/L	0.10	0.46	5.2	3.0	3.2
Nitrate as NO3 by calculation	mg/L	0.020	3.6	<0.20	<0.20	0.21
Nitrite as NO2 by calculation	mg/L	0.020	0.021	<0.20	<0.20	<0.20

Result Comments

Identifier	Description
[1]	PQL(s) has/have been raised due to interferences from analytes (other than those being tested) in sample.

Method Summary

Method ID	Methodology Summary
Calc	Calculation
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-002	Samples are either filtered and acidified for 'dissolved metals' or digested (unfiltered) with nitric and hydrochloric acids for 'acid extractable metals' or digested for Mercury using Bromine Monochloride or a permanganate/sulphuric acid digestion
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS.
varies	

Certificate of Analysis PDH0232

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from the latest "Australian Drinking Water Guidelines", published by NHMRC & ARMC.

The recommended maximums for analytes are taken from the latest "TLVs and BEIs" as published by the ACGIH.

Data Quality Assessment Summary PDH0232

Client Details

Client	Hyd2O
Your Reference	H 21089 - Aubin Grove & Banjup
Date Issued	11/08/2022

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Data Quality Assessment Summary PDH0232

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
Total Phosphorus | Water	1-4	03/08/2022	08/08/2022	09/08/2022	Yes
Dissolved Metals (LL) | Water	1-4	03/08/2022	08/08/2022	09/08/2022	Yes
Dissolved Metals (LL)-Hg | Water	1-4	03/08/2022	09/08/2022	10/08/2022	Yes
Nitrogen - Ammonia | Water	1-4	03/08/2022	03/08/2022	04/08/2022	Yes
Nitrogen - Nitrate | Water	1-4	03/08/2022	03/08/2022	04/08/2022	Yes
Nitrogen - Nitrite | Water	1-4	03/08/2022	03/08/2022	04/08/2022	Yes
Nitrogen - NOx | Water	1-4	03/08/2022	03/08/2022	04/08/2022	Yes
Nitrogen - Total N | Water	1-4	03/08/2022	05/08/2022	10/08/2022	No
Phosphate as P | Water	1-4	03/08/2022	03/08/2022	04/08/2022	Yes
TKN as N calc | Water	1-4	03/08/2022	08/08/2022	08/08/2022	Yes

Quality Control PDH0232

METALS-020|Acid Extractable Metals (Water) | Batch BDH0505

Analyte	Units	PQL	Blank	DUP1 BDH0505-DUP1# Samp | QC | RPD %	DUP2 BDH0505-DUP2# Samp | QC | RPD %	LCS %	Spike % BDH0505-MS1#
Phosphorus	mg/L	0.050	<0.050	8.56 | 8.56 | 0.0234	<0.050 | <0.050 | [NA]	112	97.5

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020|Acid Extractable Metals (Water) | Batch BDH0506

Analyte	Units	PQL	Blank	DUP1 PDH0232-02 Samp | QC | RPD %	DUP2 BDH0506-DUP2# Samp | QC | RPD %	LCS %	Spike % PDH0232-03
Phosphorus	mg/L	0.050	<0.050	0.365 | 0.361 | 1.08	<0.050 | <0.050 | [NA]	111	111

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022|Dissolved Low Level Metals (Water) | Batch BDH0579

Analyte	Units	PQL	Blank	DUP1 BDH0579-DUP1# Samp | QC | RPD %	DUP2 BDH0579-DUP2# Samp | QC | RPD %	LCS %	Spike % BDH0579-MS1#
Arsenic	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	41.5 | 43.4 | 4.44	105	108
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	103	108
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	108	105
Copper	µg/L	1.0	<1.0	1.34 | 1.29 | 3.20	<1.0 | <1.0 | [NA]	108	101
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	106	82.6
Nickel	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	1.17 | 1.21 | 3.11	107	101
Zinc	µg/L	1.0	<1.0	5.44 | 5.48 | 0.696	2.71 | 2.50 | 7.79	102	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021|Dissolved Low Level Metals (Water) | Batch BDH0645

Analyte	Units	PQL	Blank	DUP1 BDH0645-DUP1# Samp | QC | RPD %	DUP2 BDH0645-DUP2# Samp | QC | RPD %	LCS %	Spike % PDH0232-01
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	117	112

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PDH0232

INORG-057|Inorganics (Water) | Batch BDH0247

Analyte	Units	PQL	Blank	DUP1 PDH0232-01 Samp | QC | RPD %	DUP2 BDH0247-DUP2# Samp | QC | RPD %	LCS %	Spike % BDH0247-MS1#
Ammonia as N	mg/L	0.0050	<0.0050	0.00556 | 0.00566 | 1.96	0.122 | 0.119 | 2.20	118	111
Nitrate as N	mg/L	0.0050	<0.0050	0.820 | 0.823 | 0.448	0.600 | 0.585 | 2.53	112	109
Nitrite as N	mg/L	0.0050	<0.0050	0.00644 | 0.00641 | 0.467	0.0110 | 0.0111 | 1.17	112	118
NOx as N	mg/L	0.0050	<0.0050	0.826 | 0.830 | 0.441	0.611 | 0.596 | 2.46	112	108
Phosphate as P	mg/L	0.0050	<0.0050	0.0293 | 0.0286 | 2.42	<0.0050 | <0.0050 | [NA]	115	123
Nitrate as NO3 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as NO2 by calculation	mg/L	0.020	<0.020			[NA]	[NA]
Nitrite as N	mg/L	0.005		0.00644 | 0.00641 | 0.467	0.0110 | 0.0111 | 1.17	112	118

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127|Inorganics (Water) | Batch BDH0751

Analyte	Units	PQL	Blank	DUP1 BDH0751-DUP1# Samp | QC | RPD %	DUP2 BDH0751-DUP2# Samp | QC | RPD %	LCS %	Spike % BDH0751-MS1#
Total Nitrogen	mg/L	0.10	<0.10	1.18 | 1.18 | 0.262	0.259 | 0.282 | 8.24	101	99.5

The QC reported was not specifically part of this workorder but formed part of the QC process batch.