Ottelia Ecology
Environmental Services | Aquatic Ecosystem Specialists
0417 997 388
info@otteliaecology.com.au
www.otteliaecology.com.au

White-bellied Frog – *Anstisia alba*
Targeted Survey
Lot 1002 Warner Glen Road

December 2024

Prepared by:
Robyn Paice
Principal Ecologist, Ottelia Ecology

Prepared for:
Brad Noakes

10-12-2024

Contents

Summary

This report presents the findings of a targeted survey conducted for the critically endangered **White-bellied Frog (*Anstisia alba*)** within a proposed dam construction site at Lot 1002 Warner Glen Road, Forest Grove, Western Australia. The survey aimed to assess the presence or absence of the species and evaluate habitat suitability to support clearing permit application(s) related to dam construction.

No prior records of *A. alba* exist for Lot 1002 Warner Glen Road. There are records of subpopulations on adjacent Lots 2765 and 2760, however recently published information indicates these subpopulations have been lost.

The survey combined habitat assessment and acoustic monitoring during the peak breeding season (September to November 2024). Acoustic monitoring included a relatively high density of recording sites providing thorough coverage of the drainage lines. While the study confirmed the presence of other frog species, the most common being *Crinia glauerti*, no evidence of A. alba was detected. Habitat conditions at the site are considered unsuitable due to the probably lack of dry-season soil moisture, and the absence of appropriate vegetated habitat.

These findings suggest that the proposal site does not currently support *A. alba* populations and that it is unlikely to provide future suitable habitat. Based on this survey, it is considered that there is negligible risk that *A. alba* would be directly impacted by dam construction at Lot 1002.

1 Introduction

1.1 Background

Landholders of Lot 1002 Warner Glen Road in Forest Grove propose to construct a new dam to provide additional water supplies for irrigated pasture, and to deepen and repair the wall of an existing dam (Figure 1). This work will require clearing remnant vegetation along a low-order tributary to the Chapman Brook. The total extent of vegetation along this drainage line is 3.7 hectares.

Owing to the vicinity of the proposal to known populations of the critically endangered White-Bellied Frog (*Anstisia alba*[1]), a targeted survey for this species was required to inform assessment for a clearing permit related to construction of the proposed dam. Due to the significance of this species, its occurrence would require referral of the proposal to the Federal Department of Climate Change, Energy, the Environment and Water for assessment under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

A previous survey was completed in October 2023 to January 2024 (Harewood 2024), in response to a request for additional information from the Department of Water and Environmental Regulation (DWER). However, the Department of Biodiversity, Conservation and Land Management (DBCA, 2024) advised that additional surveys were required to confirm the presence or absence of this species in the proposed development area.

1.2 Target species information - White-Bellied Frog (*Anstisia alba*)

The White Bellied Frog (*Anstisia alba*, [Wardell-Johnson and Roberts 1989]; formerly *Geocrinia alba*) is a small brown-grey frog about 25mm in size with a white to very pale-yellow ventral surface[2]. It is endemic to the southwest of Western Australia, where it occurs in small isolated populations.

1.2.1 Conservation listing

Anstisia alba is currently listed as "Critically Endangered" under both the Western Australian Biodiversity Conservation Act (2016) and the federal EPBC Act due to severe habitat fragmentation and continuing decline of a small area of occupancy (<10km^2) (Department of Parks and Wildlife [DPAW] 2015).

1.2.2 Range

Anstisia alba occurs along drainage lines and headwater streams within a restricted range of approximately 200km^2 in the Margaret River region in southwest of Western Australia. A DBCA Threatened and Priority Fauna Database search in October 2024 to identify known subpopulations of *A. alba* in the vicinity of the proposal (Figure 1). This data includes one subpopulations on adjacent Lot 2760 and two on Lot 2785 to the west. However, this data was from surveys in 1988-1994 and more recent survey information published by Hoffman et al (2021a) indicates that these subpopulations are

[2] Link to photos of the species: https://www.frogid.net.au/frogs/anstisia-alba

now extinct. More recent unpublished DBCA surveys have determined 54.4% of known subpopulations as extinct (Threatened Species Scientific Committee [TSSC] 2019).

1.2.3 Breeding

Anstisia alba breeds terrestrially, has a unique breeding strategy characterized by terrestrial nesting and direct development. Egg, larval and metamorphic stages occurring in small burrows in damp soil under cover of protection of vegetation or litter (Driscoll 1996, Conroy 2001). The specific microhabitat conditions required for successful breeding include consistently moist but not submerged soils, making the species sensitive to changes in hydrology and climate (Hoffman et al 2021b).

The breeding calls of *A. alba* males are distinct frequently used in surveys of occurrence and population size. The call is characterized by a distinct series of short pulse trains, consisting of 9–18 pulses per call (Roberts and Warnell-Johnson 1995). Only *Anstisia vitellina* (Orange-bellied Frog) has a similar call. However populations of the two species are separated by at least 8.3km and calls can be distinguished by pulse rate, duration and frequency (Roberts and Warnell-Johnson 1995).

Male calling activity occurs persistently during the breeding season from August to December, with peak calling from mid-September to mid-November, and with frogs calling from after dusk throughout the night (Driscoll 1998).

1.2.4 Habitat

Due to the very specific conditions for breeding, *A. alba* has a limited range and specific habitat requirements. Its occurrence is associated with the following characteristics:

- Shallow drainage depressions in gently sloping landscape.
- Sandy waterlogged soil (but not submerged) with consistent soil moisture persisting during dry seasons.
- Dense overstorey shrub cover (e.g. *Taxandria linearifolia, Homalospermum firmum, Astartea*) and a protective ground layer of moss, litter and/or rhizomatous vegetation (e.g. Restionaceae).
- Preference for cooler, wetter microclimates with minimal temperature fluctuations.

(Wardell-Johnson and Roberts 1993, DBCA 2015, Hoffman et al 2021a).

1.2.5 Threats

The southwest region is experiencing a substantial drying trend owing to climate change, and this is considered the main contributing factor to ongoing decline of the species (Hoffman et al 2021a). Other key threats include habitat degradation and loss, livestock grazing, feral pigs, and hydrological alterations (DBCA 2015). Limited mobility and the dependence on specific habitats heighten its vulnerability to these threats.

1.3 Survey Objectives and Scope

The primary aim of this targeted survey was to determine whether *A. alba* occurs within the proposal site for repair of the existing dam wall and construction of the new dam. Specific objectives were to:

1. Define the habitat within the proposal site with respect to suitability for *A. alba* occurrence.
2. Determine presence or absence of *A. alba* through acoustic surveys for calling males.

Two options for the size of the dam have been considered by the landholder which would involve varied extent of clearing. This survey includes the whole extent of the vegetated drainage channel on Lot 1002 to inform future decisions related to clearing and dam construction.

1.4 Personnel

Ottelia Ecology Principal Ecologist and Director Robyn Paice completed the survey. Robyn has a PhD in freshwater ecology, and more than 25 years of experience in ecological survey of fauna and vegetation in aquatic and semi-aquatic habitats in southwest Western Australia. She is also a lecturer in environmental management, including in experimental design and statistics.

Figure 1. Location of survey area for proposed dam construction and known subpopulations Anstisia alba (indicated by white starred icons).

2 Methodology

This survey was conducted in alignment with Technical Guidance (Environmental Protection Authority [EPA] 2020), which informed survey design, site selection, and timing. The survey employed targeted techniques during the peak activity period of *Anstisia alba*, to maximize the likelihood of detection.

2.1 Habitat assessment

Habitat suitability for *A. alba* contributes to an assessment of likelihood of occurrence; and may provide useful information for future management even where the species is absent. The assessment included:

- Observations of vegetation type and dominant species during initial site visits.
- Observations of soil type and throughout the site during initial site visits.
- Observations of soil moisture throughout the site during survey visits (30 September to 8 November 2024)
- Soil samples collected from two sites (Figure 2) at commencement of survey for off-site analysis of field texture, pH and salinity, and soil moisture.
- Desktop assessment of topographic contours, soil types and vegetation communities.

Soil sample sites were located as close as possible to the stream at one accessible location in each of the upstream and downstream sections of the proposal site. Field texture was analysed using bolus formation as described by McDonald and Isbell (1984). pH and salinity of a distilled water extract were measured using a Hanna multiparameter meter (HI98194). Soil moisture content was obtained by drying known weight of wet samples at 105°C for 48 hours and calculating soil moisture content (%) as: [(wet-dry weight)/wet weight] x 100. If necessary, this sampling ca be repeated during summer to determine soil moisture during the dry season, which is an important habitat factor for A. alba survival.

2.2 Acoustic survey

2.2.1 Recordings

Six recording units were used for the survey: Wildlife Acoustics Song Meter (3) and Song Meter Micro (3) units. Units were deployed at 9 locations within the proposal site during 4 survey visits from 30 September to 8 November 2024. These units embed metadata into the recording files (date, time, GPS location).

Recording site locations are shown in (Figure 2). Within the proposal site, two sections were considered separately for assessment to inform future dam location: the upstream section (Sites 1, 2, 3, 6); and the downstream section (Sites 4, 5, 7, 8, 9). Initially, 3 recorders were available and were deployed in the upstream section of the proposal site. From the second survey visit, six recorders were available, and the downstream section was included.

The survey approach was to:

- locate recorders approximately 100m apart to ensure adequate capture of sounds;
- record at least three sites within each of the upstream and downstream sections of the proposal area;

- record at least 3 times within each of the upstream and downstream sections of the proposal area.
- Time recordings from around dusk until at least an hour after last light.

In addition, some recordings were completed in the vicinity of previously known subpopulations of *A. alba* in a drainage depression on Lot 2760 to the west (*West site*, Figure 2).

The surveyor was present on site throughout the duration of all survey visits, and traversed the proposal site during recordings to listen for frog sounds and assess adequate coverage. During the second survey visit, a recorder was kept with the surveyor (roaming) to capture additional frog calls as deemed appropriate. Sites for recording were amended in response to recording results as the survey progressed, with the resulting recordings as shown in Table 1.

In an attempt to gain a recording of *A. alba* for comparison and to validate the survey timing, additional recordings were made near the drainage line in the western part of the property (West site) in the vicinity of the previously recorded *Anstisia alba* populations (Figure 1, *West site* in). This included roaming recordings on 28 October to select a suitable site, and a deployed unit on 8 November. However, it was subsequently learned through literature review that these populations have since been deemed extinct (Hoffman 2021a).

Survey visits were scheduled during low wind conditions with generally fine conditions (light rain acceptable). Weather conditions and sunset times were recorded for each survey visit using information from the Bureau of Meteorology Witchcliffe West weather station (ID: 10921), located 11km from the site.

2.3 Acoustic data analysis

All recordings were listened to while simultaneously observing the associated spectrogram and oscillogram using Kaleidoscope Pro analysis software (Wildlife Acoustics 2024). This software provides a visual overview of entire recordings to focus listening on times of interest and facilitates detailed analysis of sound amplitude and frequency. Frog calls were identified and assessed for pulse number, rates and frequency for identification purposes.

- Oscillogram: This represents the waveform of audio amplitude, indicating the loudness of sounds and thereby the proximity of their origin. For frog calls oscillograms are particularly useful for identifying distinct pulse numbers, rates, and the duration of pulse trains.
- Spectrogram: This is a visual representation of audio frequency, including pulse rates and pulse train durations, with a colour-contour overlay to represent amplitude.

Additionally, cluster analysis was performed on batches of recordings from each site to categorise distinct sounds, such as species vocalizations, environmental noises, or combinations of these. This process groups recordings with similar vocalisations for more in-depth analysis of sound characteristics.

Figure 2. Survey site locations for deployment of recording units (white) and soil sample sites (yellow).

Table 1. Details of acoustic recordings made for frog call analysis. Unit types: SM2= Song Meter 2, SM4=Song Meter 4, Mi2=Song Meter Micro 2)

Date	Sunset time	Site	Recording unit # (type)	Start time	End time	Duration hours)
30-09-2024	18:16	1	4552 (SM4)	16:36		3:13
		3	4888 (SM4)	16:50	19:48	2:58
		3	11287 (SM2)	16:38	19:40	3:02
06-10-2024	18:26	1	4888 (SM4)	17:20	20:30	2:10
		2	4552 (SM4)	17:22	20:22	2:00
		3	11287 (SM2)	17:18	20:12	1:54
		4	4056 (Mi2)	17:38	20:15	1:37
		5	4025 (Mi2)	17:45	20:11	1:26
		6-9	3453 (Mi2) roaming	18:06	19:57	0:51
		6	4888 (SM4)	19:48	20:16	0:28
28-10-2024	18:44	3	11287 (SM2)	17:18	21:12	1:54
		2	4552 (SM4)	19:00	21:15	2:15
		6	4888 (SM4)	19:18	21:38	2:20
		West site	3453 (Mi2) roaming	20:18	20:59	0:41
		7	4056 (Mi2)	19:23	21:27	2:04
		8	4025 (Mi2)	19:29	21:31	2:02
08-11-2024	18: 54	6	4888 (SM4)	17:51	20:59	3:08
		7	4056 (Mi2)	17:57	20:48	2:51
		8	4025 (Mi2)	18:03	20:51	2:48
		9	3453 (Mi2)	18:00	20:47	2:47
		West site	4552 (SM4)	18:34	20:21	1:47

3 Results

3.1 Habitat assessment

The proposal site is a moderately sloping valley, with a gradient of approximately 1:10 (topographic contours), which includes a vegetated drainage line within a paddock cleared and grazed by dairy cattle (Photo 1). The stream drains from both the existing dam and from a small tributary to the north-east of the dam, and flows into Chapman Brook to the south (Figure 2).

Corresponding with regional vegetation complexes, regional soil mapping shows the proposal site as Treeton wet valleys (Twv) along the drainage lines surrounded by Treeton Slopes (T) for the surrounding area (Table 2). The site occurs within pre-clearing mapping vegetation complexes of Treeton valleys (Tw) for the drainage lines and Treeton uplands (T) for the surrounding area, characterized by Open forest and woodland (Table 2). However, the remnant vegetation is not considered representative of this complex, as described further below.

Most of the vegetated area in the site is inaccessible for detailed assessment due to infestation of Blackberry (*Rubrus ulmifolius*). There is extensive Blackberry along both sites of the drainage line throughout the site (Photo 2). Some effect of recent herbicide of control was evident. Pasture grasses are also present throughout the site.

Noting limited accessibility, the stream appears to be mainly a narrow channel with three ponding areas: one near the crossing (Photo 3) and two in the north east tributary (Photo 4). The stream was observed to be flowing during the survey, but it was not possible to determine if this was limited to flow from the dam spillway or from the north-east tributary.

The area directly adjacent to the dam is waterlogged habitat that is very degraded with vegetation being introduced species, mainly *Juncus microcephalus* and grassy weeds (Photo 5). Moist conditions here are apparently owing to leakage through the dam wall. Another waterlogged area occurs at the most eastern extent of the site (Photo 6). This area is degraded from stock trampling with introduced species including *Zantedeschia aethiopica* (Arum Lily), *Plantago* sp. (Plantain), *J. microcephalis* and other grassy weeds (Photo 6). A seepage area was observed in the paddock near site 6 during October but was dry in November.

The remnant vegetation in the site is typically dominated by Swamp Peppermint (*Taxandria* linearifolia) along the drainage line with Blackberry growing densely on both sides (Photo 2). *Gastrolobium ebracteolatum* is also common along the main channel, particularly in wetter areas, Native rhizomatous rushes are limited to patchy occurrence of *Juncus pallidus*. Limited accessible parts of the drainage line had understory of pasture grass (Photo 7). The most downstream ~50m includes some remnant Marri (*Corymbia calophylla* and Karri (*Eucalyptus diversicolor*) overstorey; as well as *G. ebracteolatum* over *Lepidospermum tetraquetrum* (Angled Sword Sedge) (Photo 6, Photo 8). Isolated occurrences of *Astartea* sp. and Mohan (*Melalueca viminea*) were also present here.

Photo 1. Proposal site area, showing vegetated drainage line.

Photo 2. Example of Blackberry infestation along both sites of drainage line throughout the site, showing effects of herbicide control. Sites 7, 8 and 9 were located along this bank.

Photo 3. Crossing and ponded area upstream (also ponded downstream).

Photo 4. Ponded area in northeast tributary section; Site 6 adjacent to this

Photo 5. Waterlogged area adjacent to dam wall; Site 2.

Photo 6. Downstream waterlogged area, adjacent to eastern property boundary.

Photo 7. Vegetation in drainage line where there is no Blackberry infestation, showing grass understorey.

Photo 8. Vegetation in drainage line in eastern downstream section.

The pale grey Mungite soils for the Treeton Slopes was evident in the site. Soil properties analysed for the two sites within the drainage line had very similar properties (Table 3). Field texture analysis classified the soil as sandy loam, consistent with this soil type.

Soil moisture was high at both sites, but was higher at the downstream site which was on flatter, wetter ground (Table 3). Although not analysed further at this stage, declining soil moisture content throughout the site was evident over the period of the survey. For example, a notable seepage area near site 6 had dried by the 8 November survey visit. Both sites were mildly acidic and had very low salinity (Table 3).

Table 2. Pre-clearing vegetation extent and soil land units within the proposal site and surrounding area from regional mapping.

Area applicable	**Vegetation complexes and descriptions[1]**	**Land units and descriptions[2]**
Drainage depression in proposal site	Treeton valleys (Tw): Open forest of *Eucalyptus patens-Corymbia calophylla-Eucalyptus marginata* subsp*. marginata* on lower slopes and on floors of minor valleys in the perhumid zone.	Treeton Wet Valleys (Tvw): Broad U-shaped depressions with swampy floors
Surrounding land within proposal site	Treeton uplands (T): Woodland of Eucalyptus marginata subsp. marginata-Corymbia calophylla with some Allocasuarina fraseriana on mild slopes in the perhumid zone.	Treeton Slopes (T): Slopes with gradients generally ranging from 2-15% and gravelly duplex (Forest Grove) and pale grey mottled (Mungite) soils.
Western drainage line in vicinity of previously known population.	Blackwood (BK): Open forest of *Corymbia calophylla-Eucalyptus marginata* subsp*. marginata* on the variable slopes in perhumid and humid zones.	Treeton Fertile Flats (Tf): Well drained valley flats and floodplains with deep alluvial soil, often red brown loams

[1] Department of Parks and Wildlife (DPAW) 2017

[2] Tille and Lantzke 1988

Table 3. Soil properties for samples taken 30th September 2024.

Soil properties	Site A (upstream)	Site B (downstream)
Soil moisture content (% water content by weight)	34.0%	45.7%
pH	6.4	6.6
Conductivity	542 µS/cm	496 µS/cm
Field texture	Sandy loam	Sandy loam

3.2 Acoustic survey results

Anstisia alba was not encountered during this survey, either in the proposal site or in the area where it has previously been recorded in the western part of the property.

Frog recordings were completed at the site on 30 September, 6 October, 28 October and 8 November 2024. The surveyor was present on site during all monitoring. Timings varied owing to practical constraints for site visits, but all recordings included at least one hour after last light (Table 1). A total of 48 hours 48 minutes of recordings were obtained in the proposal site: 31 hours 3 minutes for the upstream section over four nights; and 20 hours 43 minutes over three nights for the downstream section of the proposal site.

Recording site selection and timing was adapted to optimize outcomes as follows:

- Based on the survey on 30 September, subsequent recordings were made later due to overwhelming dominance of bird sounds before sunset.
- During roaming recording on 6 October, prominent frog calls at site 6 led to a change from site 1 for subsequent visits.
- Absence of frog calls at sites 4 and 5 during the first recordings in the downstream section led to a shift in site location for this area, with an additional site added on the final survey visit when a recorder was available.

Weather conditions during all survey visits were suitable for recordings, being light winds, mild temperatures and fine weather, aside from some very light rain on 6 October (Table 4). Each survey visit was preceded by some rainfall.

Table 4. Weather conditions during recording survey visits.

Survey Date	Conditions during survey		Temperature range (°C)	Rainfall (mm, to 9am following day)	Rainfall preceding week (mm total)
	Temperature (°C)	Wind speed and direction			
30-09-2024	18.8	9.7-19.7	2kn E	0	13.2
6-10-20244	16.7	14.4-18.0	7kn W	0	33.8
28-10-2024	17.1	10.4-25.4	7kn SSE	0	18.6
08-11-2024	16.2	9.2-18.9	9kn SSE	0	8.4

Based on the recordings made, and supported by on-site observations, frogs were present only in the upstream section of the proposal site. No frog calls were detected in the downstream section, other than sounds from the ponded area near the crossing, where *Crinia glauerti* (Rattling Froglet) was present. On 30 September, *Crinia georgiana* (Quacking Frog) was heard downstream to the east of the property boundary, but was not recorded or heard again during subsequent visits. Harewood (2024) also did not record any frog sounds in this downstream section of the drainage line.

In the upstream section, six frog species were detected but *Anstisia alba* was not. The dominant species was C. glauerti, which was heard in all recordings that included frog calls. This species was notably present near the crossing and near the other two ponded areas of the tributary in the north-east section of the proposal site. These two ponded areas clearly provided habitat for the greatest number and diversity of frogs, which was captured by recordings at site 6. Frogs here included:

- *Crinia glauerti* (Rattling Froglet)
- Crinia pseudinsignifera (Bleating Froglet)
- *Crinia insignifera* (Squelching Froglet)
- *Geocrinia leai* (Ticking Frog)
- *Litoria adelaidensis* (Slender Tree Frog)
- *Litoria moorei* (Motorbike Frog)

Frog calls in recordings at sites 2 and 3 in the upstream section were relatively quiet and are likely to be distant calls from these ponded areas. *Litorea moorei* calls were also very quiet (distant) in all recordings and observations indicated it was mainly present around the existing dam.

Many bird and insect sounds were also picked up in the recordings. Birds were most prevalent during earlier recordings, while cricket sounds were common in the background of later recordings.

At the West site where there are previous records of *A. alba*, roaming recording on 28 October suggested most frogs occurred in the more downstream area, with limited calls detected upstream. Therefore, a recorder was deployed in the downstream area on 8 November. It was hoped that this recording may find *A. alba* but it did not. A large number of *C. glauerti* were clearly present at this site, and calls of *C. pseudinsignifera* and *L. adelaidensis* were also common.

Recordings from site and the West site were analysed in detail for call frequency, pulse rate and pulse train duration to determine whether *A. alba* was present. Comparison of call metrics obtained from survey recordings and known *Crinia* spp. metrics (Littlejohn 1958) were made with existing *A. alba* recordings and call metrics in Roberts and Wardell-Johnson (1995). This was necessary to ensure that potential calls from the target species were not masked by other species. A recording was made from a known *A. alba* call to provide a spectrogram and oscillogram for comparison to the common *Crinia* species found in this survey (Figure 3), which demonstrates the differences outlined below.

While there was some overlap of frequency, the common *Crinia* species present has a higher frequency (2.5-4 kHz) than *A. alba* (~2-3kHz), and the frequency varied throughout the pulse train of *Crinia* spp., while the *A. alba* pulse train has a uniform frequency throughout each call. Other metrics differed considerably. The pulse rate was much faster for *Crinia* spp. found here (~20 pulses per second) and the call duration much shorter (~0.8 seconds) than is typical for *A. alba* (7.5-9.5 pulses per second and ~1.5 seconds).

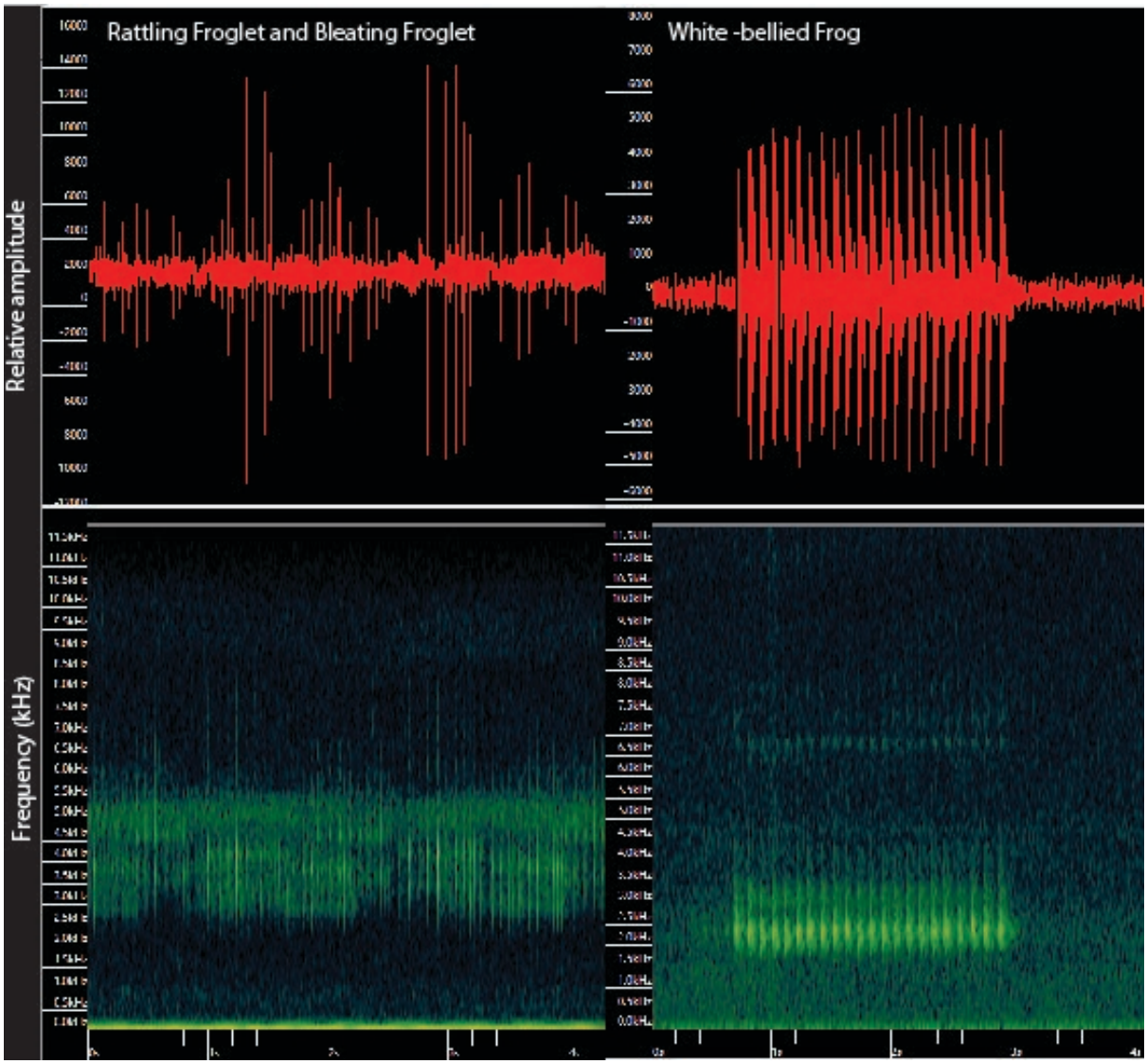

Figure 3. Comparison of call characteristics for common Crinia species found at the site (left) and Anstisia alba (White-bellied Frog, right). Recording of A. alba made from existing known recording by D. Roberts, available at https://museum.wa.gov.au/explore/frogwatch/frogs/white-bellied-frog.

4 Management Implications

Based on this survey, there is a high level of confidence that the White-bellied Frog *Anstisia alba* does not occur at the proposal site. This is based on an absence of calls of this species from comprehensive assessment of recordings obtained, as well as the habitat assessment findings which suggest that habitat is not suitable for the species.

The acoustic survey is considered sufficiently comprehensive to determine presence or absence of the species. Replicate recordings were conducted at the optimal time of year for *A. alba* calls to be heard, and the approach included a relatively high density of sites to ensure thorough coverage of the entire proposal site. Effort was made to demonstrate that *A. alba* would be heard if present by including a site with a known record of the species, however it is apparently now extinct from that site (Hoffman 2021a) and was not encountered.

The habitat at the proposal site is also not considered suitable for the presence of *A. alba.* While regional mapping of soil type is consistent with broad distribution of the species, the site is mainly sandy-loam slopes with drying soils rather than the sandy alluvial soils associated with the species (Wardell-Johnson and Roberts 1993).

Previous modelling of species distribution with climatic profiles has also not predicted any additional habitat sites (Wardell-Johnson and Roberts 1993). Based on observations drying during the survey period, it considered unlikely that the site would provide permanent moisture habitats in areas with suitable vegetation cover. The area downstream of the dam and the most downstream flat area may retain summer moisture due to dam wall leakage and dam releases, but these areas are very degraded.

In terms of vegetation as an indicator of habitat, the dense overstorey of Taxandria linearifolia aligns with known A. alba habitat but the site lacks a dense groundcover of rhizomatous Restionaceous typically associated with suitable habitat. The lack of these species may reflect insufficient soil moisture at the site. While the Blackberry infestation does not preclude the site of being suitable habitat for White-bellied frog, there is an apparent lack of permanently moist conditions required for successful breeding. In addition, a feral cat was observed in the proposal site on two occasions, in both the upstream and downstream sections, representing an additional threat to native fauna in the area.

Frogs in the proposal site are mainly concentrated around the ponded sections of the north-east tributary. It may be possible to avoid this area in the construction of a future dam. If considered during design, it may be possible to enhance this habitat for the species present by avoiding disturbance and extending the vegetation area. It is notable that apparently no frogs occur in the downstream section of the proposal site. This may be related to predation and/or blackberry control.

Recent surveys of *A. alba* have determined a reduction in subpopulations of over 50% to 2007 (TSSC 2019), with a decline in suitable habitat owing to a drying trend in the region (Hoffman et al 2021b). This apparently includes the subpopulation in the west of the property. This context further diminishes the likelihood that the proposal site supports a previously unknown *A. alba* subpopulation.

5 Conclusion

The acoustic survey and habitat assessment suggest that *Anstisia alba* is absent from the proposal site and the site is unlikely to provide suitable habitat for any potential future populations of this species. The site does nonetheless provide habitat for a diverse population of frogs, for which some habitat protection would be achievable in conjunction with dam construction.

6 References

Conroy SDS (2001) Population biology and reproductive ecology of *Geocrinia alba* and *G. vitellina*, two threatened frogs from southwestern Australia. PhD Thesis. University of Western Australia, Perth.

DBCA (2024) Correspondence from DBCA to Shire of Augusta-Margaret River (Ref: PRS 52173 2023003488).

DPAW (2015) White-bellied and Orange-bellied Frogs (*Geocrinia alba* and *Geocrinia vitellina*) Recovery Plan. Wildlife Management Program No. 59. Department of Parks and Wildlife, Perth, WA.

DPAW (2017) Vegetation Complexes - South West Forests. Published mapping. Government of Western Australia.

Driscoll DA (1996). Understanding the metapopulation structure of frogs in the *Geocrinia rosea* complex through population genetics and population biology: Implications for conservation and evolution. PhD Thesis. University of Western Australia.

Driscoll DA (1998) Counts of Calling Males as Estimates of Population Size in the Endangered Frogs *Geocrinia alba* and *G. vitellina. Journal of Herpetology* 32: 475-481.

EPA (2020) Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment. Government of Western Australia.

Harewood G (2024) White Bellied Frog (Anstisia alba) Survey. Proposed Clearing Area (CPS 9395/1) Lot 1002 Warner Glan Road Forest Grove. January 2024.

Hoffman EP, Cavanough KL, Mitchell NJ (2021b) Low desiccation and thermal tolerance constrains a terrestrial amphibian to a rare and disappearing microclimate niche. *Conservation Physiology* 9: 1-15

Hoffman EP, Williams K, Hipsey M, Mitchell N (2021a) Drying microclimates threaten persistence of natural and translocated populations of threatened frogs. *Biodiversity and Conservation* 30:1-34.

Littlejohn MJ (1958) Call differentiation in a complex of seven species of *Crinia* (Anura, Leptodactylidae). PhD Thesis, University of Western Australia.

Roberts JD and Wardell-Johnson G (1995) Call differences between peripheral isolates of the *Geocrinia rosea* complex (Anura: Myobatrachidae) in southwestern Australia. *Copeia* 1995: 899-906.

Tille PJ and Lantzke NC (1988) Land Resources of Busselton-Margaret River-Augusta Western Australia. Boraup Map Sheet. Department of Agriculture, Government of Western Australia.

TSSC (2019) *Geocrinia alba* (White-bellied Frog) Conservation advice. Threatened Species Scientific Committee. Australian Government.

Wardell- Johnson, G. and Roberts, J. D. (1993). Biogeographical barriers in a subdued landscape: the distribution of *Geocrinia rosea* (Anura: Myobatrachidae) complex in south-western Australia. *Journal of Biogeography*. **20**: 95-108.

Wardell-Johnson, G. and Roberts, J. D. (1989). Endangered! Yellow-bellied and white-bellied frog. *Landscope*, **5**: 17. Department of Conservation and Land Management, Perth**.**

Wildlife Acoustics (2024) Kaleidoscope Pro Analysis Software. https://www.wildlifeacoustics.com/shop#analysis-software