

**ACH Minerals Pty Ltd
Ravensthorpe Gold Project ERD**

***Populations of five Priority Flora species
in the Kundip Development Envelope***



**A report prepared for
ACH Minerals Pty Ltd**

Lot 1968 Hopetoun-Ravensthorpe Rd, Ravensthorpe WA 6346

January 2020



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DISCLAIMER

In undertaking this work, the author has made every effort to ensure the accuracy of the information used. Any conclusions drawn or recommendations made in the report and maps are done in good faith and the consultant takes no responsibility for how this information is used subsequently by others.

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Cover photo:

Melaleuca sophisma at Ravensthorpe Gold Project area, Kundip

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Executive Summary

The Ravensthorpe Gold Project (RGP) is a proposal by ACH Minerals Pty Ltd to mine for gold and copper on the Kundip mining leases (tenements M74/41, 51, 53 & 135 and P74/153) located approximately 17 km south-east of Ravensthorpe and 31 km north of the coastal town of Hopetoun.

Five Priority flora species occur within the RGP Development Envelope. The Department of Biodiversity, Conservation and Attractions (DBCA) requested further information on the known populations of these species, especially abundance data.

Searches were made of the WA Herbarium specimen database (WAHerb) and the Threatened and Priority Flora database (TPFL). It was found that DBCA had not updated their TPFL databases for 10 years for these species. Subsequently, copies were obtained of Threatened and Priority Flora report forms that had not been databased. Data from DBCA, previous surveys in the Kundip area and targeted surveys in December 2019 of the known locations within the RGP Development Envelope and a 20 m buffer were collated into a single database.

The results are summarized in the following table:

TaxonName	WAConStat	TOTAL known plants	Abundance in Development Envelope & buffer	Percentage of known populations (%)
<i>Calothamnus roseus</i>	P1	4,700	3,200	68
<i>Melaleuca sophisma</i>	P1	60,247	347	0.6
<i>Hydrocotyle tuberculata</i>	P2	237	- ¹	-
<i>Thomasia</i> sp. Hopetoun (K.R. Newbey 4896)	P2	243	44	18
<i>Dampiera</i> sp. Ravensthorpe (G.F. Craig 8277)	P3	36,893	- ²	-

¹ annual plant not found in Dec 2019 survey; c. 60 plants in 2011; previously 110 plants in 2005

² not found in Dec 2019 survey; 1500 plants in 2009

The December 2019 survey failed to find either the annual *Hydrocotyle tuberculata* due to the dry conditions or *Dampiera* sp. Ravensthorpe (G.F. Craig 8277). It is not known whether the latter species is a short-lived perennial and has disappeared from the site until another fire or disturbance occurs, or the author was unable to find this cryptic species because it was not flowering. Seed banks of both species would still remain at their known sites. Surveys in winter-spring for *Dampiera* sp. Ravensthorpe and in October for *Hydrocotyle tuberculata* are recommended.

Introduction

ACH Minerals propose to mine for gold and copper on the Kundip mining leases (tenements M74/41, 51, 53 & 135 and P74/153) which comprise approximately 664 ha, the majority of which is located east of the Hopetoun-Ravensthorpe Road, 17 km south east of Ravensthorpe and 31 km north of the coastal town of Hopetoun.

ACH Minerals requested that further information on known populations of five species within the Development Envelope of their Ravensthorpe Gold Project and at 'Ard Patrick' to the north be surveyed and collated (Figs 1 and 2, Table 1).

Table 1 – Five Priority species targeted for survey

Priority	Taxon	Work required
P1	<i>Calothamnus roseus</i>	<ul style="list-style-type: none"> Visit the known population within Development Envelope and undertake population counts. Undertake a population count of the known population in a 20 m buffer adjoining the Development Envelope.
P1	<i>Melaleuca sophisma</i>	<ul style="list-style-type: none"> Visit the known populations within Development Envelope and undertake population counts. Undertake a population count of the known population in a 20 m buffer adjoining the Development Envelope. Visit the known population at Ard Patrick and undertake a population count.
P2	<i>Hydrocotyle tuberculata</i>	<ul style="list-style-type: none"> Visit the known populations within Development Envelope and undertake population counts (if possible, species is an annual).
P2	<i>Thomasia</i> sp. Hopetoun (KR Newbey 4896)	<ul style="list-style-type: none"> Visit the two known locations within Development Envelope and undertake population counts. Collect all available data on plant counts from other locations.
P3	<i>Dampiera</i> sp. Ravensthorpe (GF Craig 8277)	<ul style="list-style-type: none"> Visit the one known location within Development Envelope and undertake a population count. Collect all available data on plant counts from other locations.

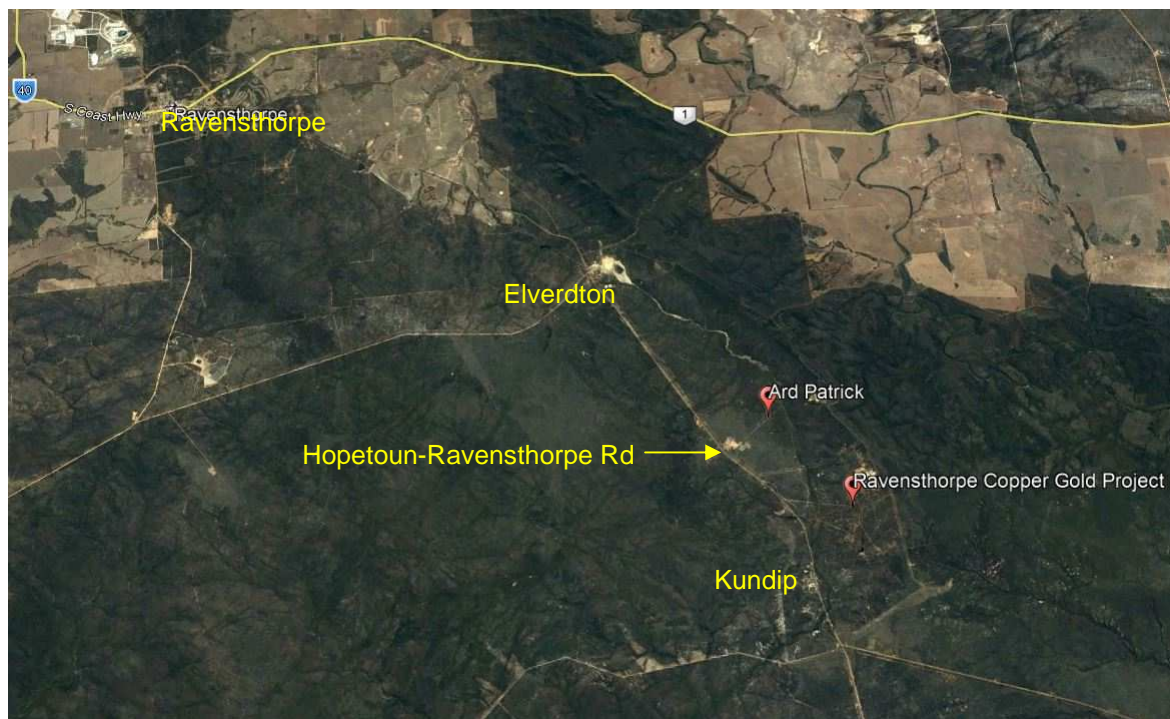


Figure 1 – Location of the ACH Minerals' Ravensthorpe Gold Project and 'Ard Patrick'.



Figure 2 – Location of five Priority species in the Kundip mining area.

Methods

Desktop

Priority flora population data of the five species which had been collated by Talis Consultants (Fig 1) which included data from APM (2017), McQuoid (2009), Hickman (2007, 2009) and database searches from the Department of Biodiversity, Conservation and Attractions (DBCA). The latter was recorded as 'DBCA Record' rather than whether the source was the WA Herbarium specimen database (WAHerb) or the Threatened and Priority Flora database (TPFL).

A request was made for DBCA database searches of WAHerb and TPFL for the five Priority flora species on 10 December 2019. Also, Sarah Barrett, Threatened Flora Officer, DBCA Albany District was asked for any additional information on these species.

All data was collated into an Excel file, including survey data from Craig (2004, 2011) which included information on *Melaleuca sophisma* (previously known as *Melaleuca* sp. Kundip) and *Hydrocotyle tuberculata* (previously known as *H. decipiens* ms). The Excel table was imported into a QGIS mapping program to obtain an overview of the distribution of the five species.

The polygon for *Calothamnus roseus* (Fig 2) was deleted from the database as it could not be ascertained whether this was a surveyed boundary by APM or extrapolated from known point locations.

Data was then packaged for the Index of Biodiversity Surveys for Assessments (IBSA). The Environmental Protection Authority (EPA), Department of Water and Environmental Regulation and Department of Mines, Industry Regulation and Safety require IBSA Data Packages to support assessment and compliance under the *Environmental Protection Act 1986*.

Field survey

The known populations of the five species, *Calothamnus roseus* (P1), *Melaleuca sophisma* (P1), *Hydrocotyle tuberculata* (P2), *Thomasia* sp. Hopetoun (KR Newbey 4896) (P2) and *Dampiera* sp. Ravensthorpe (GF Craig 8277) (P3) were surveyed within the Development Envelope and an adjoining 20 m buffer on 9 December 2019. Weather conditions were warm (max 26°C) and dry. Each patch was GPSed and actual counts of plants made, except for the three large patches of *Calothamnus roseus*. The boundary of each patch of >100 plants was tracked.

On 17 December 2019, an estimate of population size of the three large patches of *Calothamnus roseus* was made using the Wandering Quarter method (Catana, 1963) assisted by Vern Jones, Project Manager, ACH Minerals. Also, the 'Ard Patrick' site was surveyed for *Melaleuca sophisma*.

Results

Desktop

DBCA provided WAHerb and TPFL database information on 17/12/2019 (Ref: 20-1219FL), although their Flora Technical Officer noted that "not all Priority flora populations have been entered into the database. Therefore there were no results of a search of this database for the following species as these species are yet to be databased on TPFL:

- *Calothamnus roseus*
- *Thomasia* sp. Hopetoun (KR Newbey 4896)
- *Dampiera* sp. Ravensthorpe (GF Craig 8277).

There is also additional information on our [DBCA] files that has not yet been entered into TPFL for the following species (including the date of the last time the information on the file was entered into TPFL):

- *Calothamnus roseus*
- *Melaleuca sophisma* (February 2009)
- *Thomasia* sp. Hopetoun (KR Newbey 4896)
- *Dampiera* sp. Ravensthorpe (GF Craig 8277).”

Sarah Barrett (Threatened Flora Officer, DBCA Albany) provided additional Threatened Flora Report Forms for:

- *Calothamnus roseus* (2012)
- *Thomasia* sp. Hopetoun (KR Newbey 4896) (2011,2013, 2015)
- *Dampiera* sp. Ravensthorpe (GF Craig 8277) (2010 – which equated to WAHerb specimen data)

Tim Hammer, a botanist with Spectrum Ecology, accessed Threatened and Priority Flora (TPF) report forms on DBCA’s files on 9/1/2020. These were sent to the author for inclusion in the collated database.

APM (2019), McQuoid (2009), Hickman (2007), Craig (2004 & 2011) provided information on all five species. It should be noted that there are five TPF reports by McQuoid (dated 17/3/2009) which duplicate the information given in McQuoid (2009). The latter were not added to the database. All desktop and new field data was collated into shapefiles:

- ACH_2B_Flora_ALL_pt.shp (includes point data on all five species)
- ACH_2B_Flora_Calothamnus roseus_py.shp
- ACH_2B_Flora_Melaleuca sophisma_py.shp

Field survey

Calothamnus roseus (P1)



The known range of *Calothamnus roseus* is 11 km with three main populations, i.e. Kundip Nature Reserve, Road Eleven and the Kundip area (which includes a number of sub-populations). Interrogation of the WAHerb data found two specimens that had incorrect lat/longs compared to the location description.

Survey of the sub-population that occurs within the Development Envelope plus 20 m buffer found 8 discrete patches, varying in size from 6 to an estimated 1250 plants (Figs 3 & 4). This represents 68% of the known plants of *C. roseus* (Table 2).

Plate 1 – *Calothamnus roseus* fruits

Table 2 – Population summary of *Calothamnus roseus*

SiteName	Abundance	Percentage of known populations (%)
Eastern end of Kundip Plateau, Kundip Nature Reserve*	100	2
Road Eleven, WSW of Kundip	800	17
Small hill, W side of the Ravensthorpe - Hopetoun Road, 1.4 km N of Kundip	200	4
Kundip, Hopetoun-Ravensthorpe Rd	500	11
Ravensthorpe Gold Project - Development Envelope (DE)	1700	36
Ravensthorpe Gold Project - 20 m buffer adjoining DE	1500	32
TOTAL	4700	

*abundance = "common on summit only" so nominated 100 plants

***Melaleuca sophisma* (P1)**

Melaleuca sophisma (previously known as *Melaleuca* sp. Kundip (GF Craig 6020)) is an erect, robust shrub, 1-2 m tall with recurved leaves and white flowers. It is an obligate seeder that grows in dense stands, with individual plants often only a few centimetres apart. It is very vulnerable to disturbance, being killed by fire and maintenance activities such as firebreaks.

Plate 2 – *Melaleuca sophisma* flowers

McQuoid (2009) found that although *M. sophisma* is locally common in the immediate Kundip vicinity, it has a very restricted distribution within a 2.5 km x 1.5 km area (Fig 5). He considered there to be one population with an estimated 60,000 plants, which included five relatively indistinct sub-populations. One of these occurs in the Development Envelope and comprises less than 1% of the known plants (Table 3).

A search for the two locations at 'Ard Patrick', previously recorded by APM (2017) failed to find *M. sophisma*. The very similar looking *Melaleuca undulata* was common and could have been mistaken for the former species.

Table 3 – Population summary of *Melaleuca sophisma*

SiteName	Abundance	Percentage of known populations (%)
South of Kundip Mining leases, east of Hopetoun-Ravensthorpe Rd	1500	2.5
Kundip Mining Leases, east of Hopetoun-Ravensthorpe Rd (excl. DE)	26200	43.5
Kundip townsite and west of Hopetoun-Ravensthorpe Rd	14600	24.2
Road Eleven area, west of Hopetoun-Ravensthorpe Rd	17600	29.2
Ravensthorpe Gold Project - Development Envelope (DE)	347	0.6
TOTAL	60247	

***Hydrocotyle tuberculata* (P2)**

Hydrocotyle tuberculata is a winter annual herb, with flowering and fruiting occurring from September to November (Perkins, 2018). It grows in winter-moist drainage areas in damp sandy loams. It is known from six other locations besides the Development Envelope at Kundip, extending from near Middle Mt Barren in the Fitzgerald River National Park to north-east of Esperance, a range of 250 km (Fig 6).

Plate 3 – *Hydrocotyle tuberculata* growing with moss in 2011.

The survey on 9 December 2019 failed to find any *H. tuberculata* (previously known as *H. decipiens* ms). The Kundip area has experienced below average rainfall for the past two years, with only 230 mm recorded at Ravensthorpe in 2019 compared with an annual average of 430 mm. It is therefore unlikely that this species successfully germinated this year.

In 2011, only two of the three sub-populations of *H. tuberculata* were relocated at the known location in the Development Envelope (Craig, 2011). At these two sites, the numbers of plants had considerably diminished since the 2005 survey by Craig (2005) (Fig 7).

Table 4 - Population summary of *Hydrocotyle tuberculata*

SiteName	Abundance
Fitzgerald River National Park, ca 6 km W of Middle Mount Barren	-
20 m north of Desmond Track (between Moir Rd and Hopetoun-Ravensthorpe Rd)	2
'Ard Patrick', 3 km N of Kundip	35
28.5 km E of Ravensthorpe along South Coast Highway	-
Salt lake, S side of Scaddan Road, 5.2 km E of Coolgardie-Esperance Highway	100
Mount Ridley, ca 80 miles NE of Esperance	100
Ravensthorpe Gold Project - Development Envelope (DE)	N/A*
TOTAL	237

*Not found in Dec 2019; c. 60 plants in 2011; previously 110 plants in 2005

***Thomasia* sp. Hopetoun (K.R. Newbey 4896) (P2)**



This is a soft, rounded shrub that grows to about 70 cm tall, has pale green leaves and white flowers in spring. It is known from five locations in the Fitzgerald River National Park as well as in the Elverdton – Kundip area, with a range of about 100 km (Fig 8).

Plate 4 - *Thomasia* sp. Hopetoun fruiting in 2019.

Population counts at each site are low (< 80 plants recorded per site) with a total of 243 plants overall. In the Kundip Development Envelope there were two patches 90 m apart in a creekline, totaling 44 plants in 2019 (Fig 9). This population represents about 18% of known plants (Table 5).

Table 5 - Population summary of *Thomasia* sp. Hopetoun

SiteName	Abundance	Percentage of known populations (%)
Quaalup	-	
Fitzgerald River National Park, Mount Bland area	30	12
Fitzgerald River National Park, Thumb Peak area	80	33
Fitzgerald River National Park, west of Quoin Head	9	4
Fitzgerald River National Park, Whoogarup Range	20	8
Elverton Rd area, east of Hopetoun-Ravensthorpe Rd	10	4
Adjacent Hopetoun-Ravensthorpe Road at Kundip	50	21
Ravensthorpe Gold Project - Development Envelope (DE)	44	18
TOTAL	243	

***Dampiera* sp. Ravensthorpe (G.F. Craig 8277) (P3)**

This is a low, herbaceous shrub with multiple stems from the base and blue flowers. It is known from a number of scattered populations through the Ravensthorpe System – on the Ravensthorpe Range and east to near Bandalup Hill, with a range of about 30 km, plus a disjunct population near Munglinip (over 100 km to the east) (Fig 10).

Plate 5 - *Dampiera* sp. Ravensthorpe growing in the Ravensthorpe Range in 2005.

The current survey failed to find any plants of this taxon in the Development Envelope, although 1500 plants had been recorded 10 years ago on the Kundip firebreak in open shrubland regenerating after fire (Fig 11). Recently, the firebreak has been scrub-rolled again.



There were three possible scenarios as to why there were no plants; (i) the original collection by D.Rathbone DAR 255 had been wrongly identified, or (ii) the species has disappeared from the site due to it being a short-lived plant, or (iii) I just didn't find it because it wasn't flowering and it was disguised by the common *Chorizema trigonum* which has superficially similar stems.

Plate 6 – Scrub-rolled firebreak at Kundip, Dec 2019.

Subsequently, Michael Hislop (DBCA WA Herbarium) confirmed the identification of DAR 255 is *Dampiera* sp. Ravensthorpe (G.F. Craig 8277). Therefore another survey is recommended between July and October, i.e. when this taxon should be flowering, to ascertain whether it is a short-lived disturbance opportunist or is so inconspicuous that it cannot be readily seen unless flowering.

Table 6 – Population summary of *Dampiera* sp. Ravensthorpe

SiteName	Abundance	Percentage of known populations (%)
Ravensthorpe Range, Mt McMahon-Mt Benson	44	0.1
Ravensthorpe Range, Cordingup Creek area	230	0.6
UCL north of the South Coast Highway, W of Nindabillup Road	35000	94.9
W of Hatfield Road	3	0.0
W side of Bandalup Hill	8	0.0
Shoemaker Levy, E of Bandalup Track	6	0.0
Rocky outcrop to side of Maydon link, E end of Ravensthorpe Range	2	0.0
Munglinup Mining Reserve	100	0.3
Ravensthorpe Gold Project - Development Envelope (DE)	1500¹	4.1
TOTAL	36893	

¹ not found in Dec 2019 survey; 1500 plants in 2009

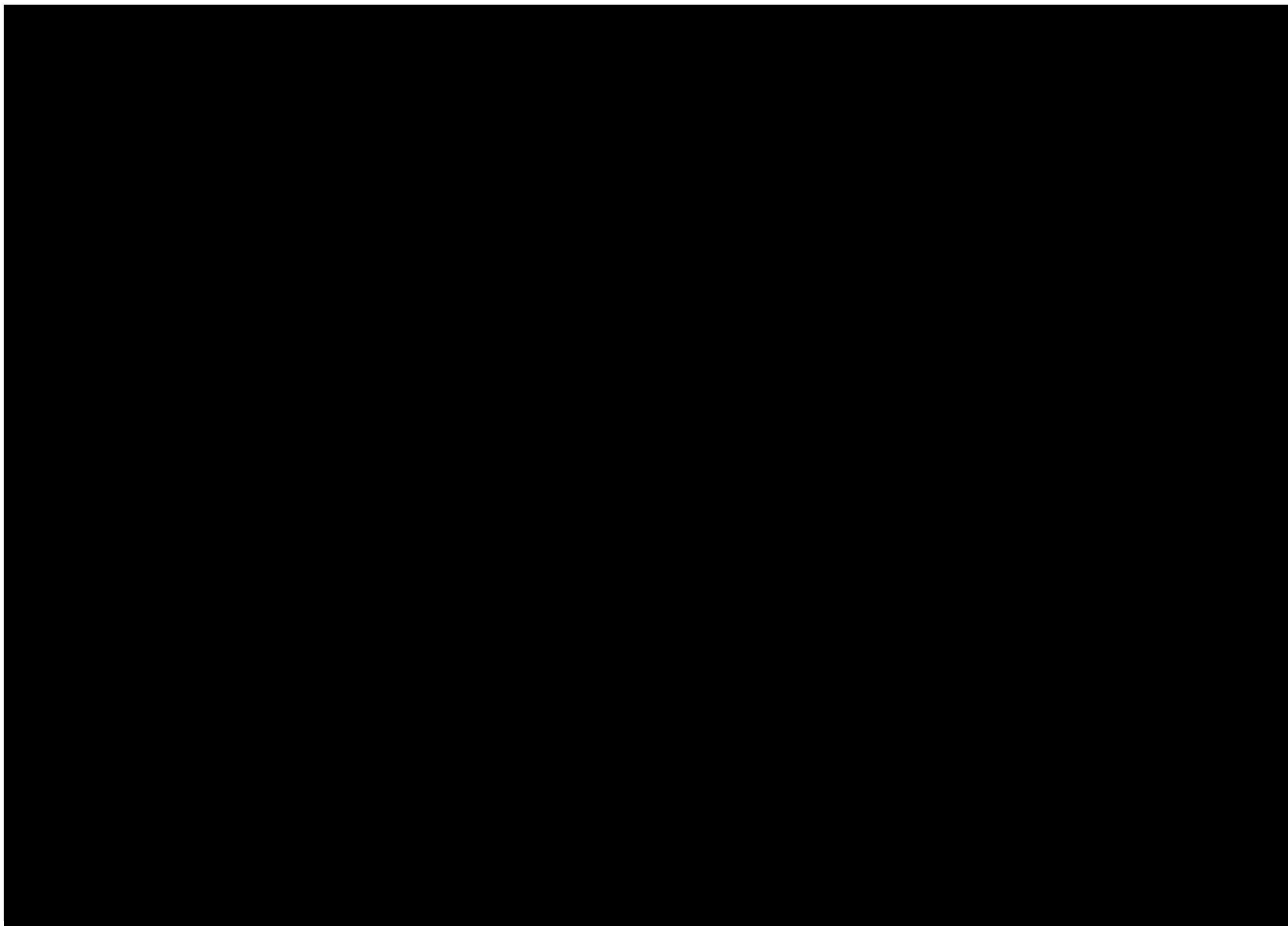


Figure 3 – Known *Calothamnus roseus* populations

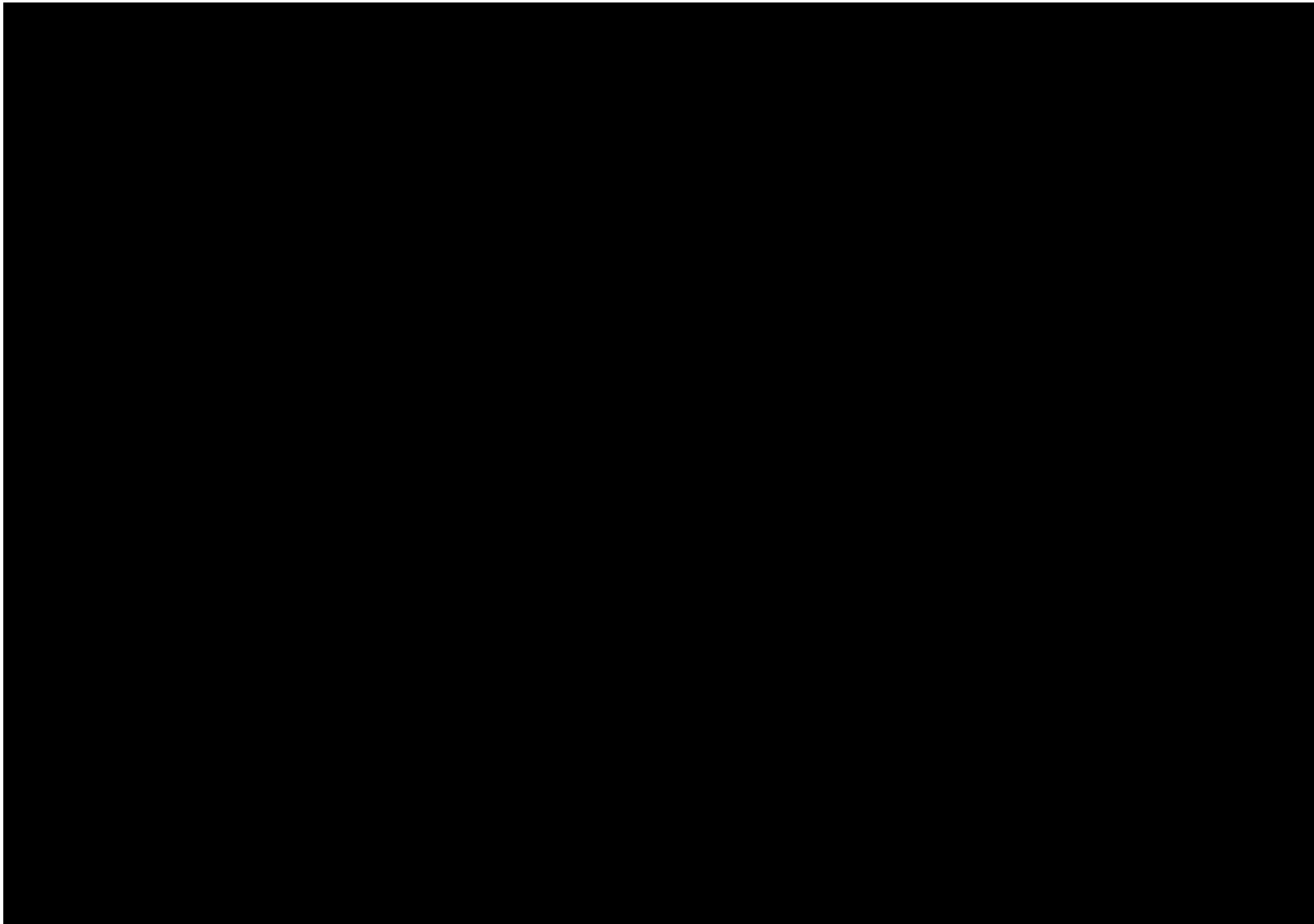


Figure 4 - Patches of *Calothamnus roseus* surveyed in the Development Envelope, plus 20 m buffer, in December 2019

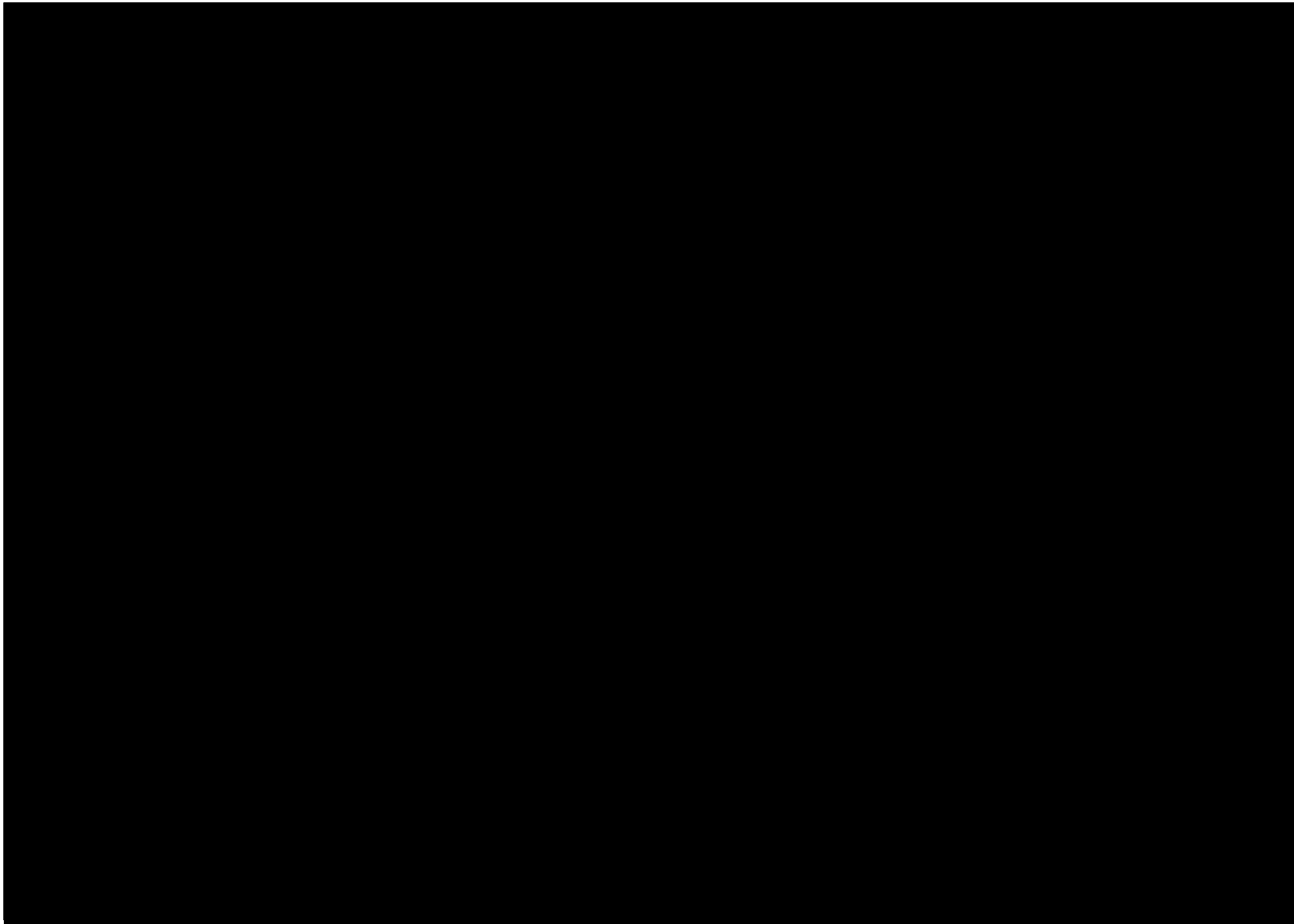


Figure 5 - Known sub-populations of *Melaleuca sophisma*

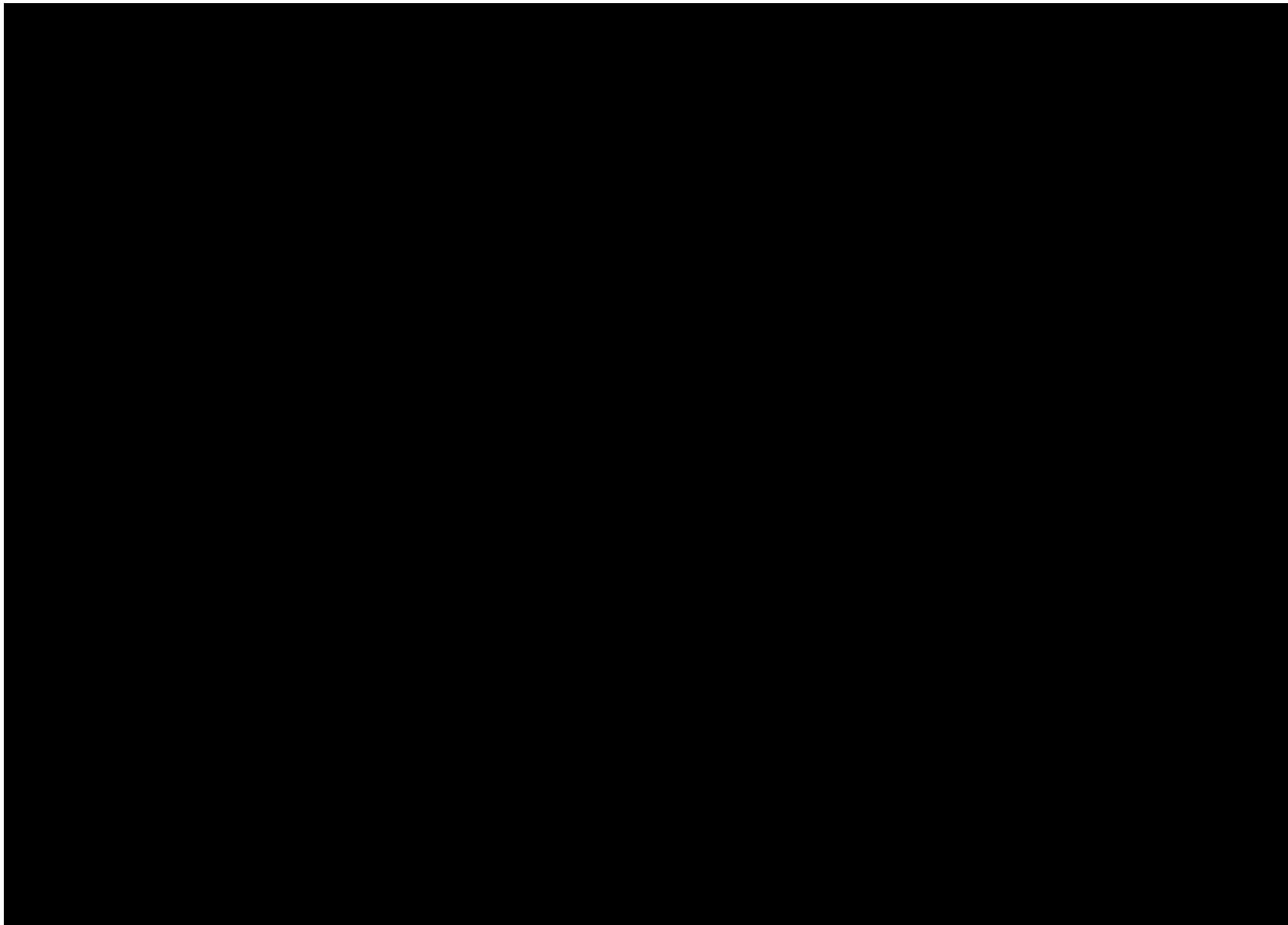


Figure 6 – Known populations of *Hydrocotyle tuberculata*

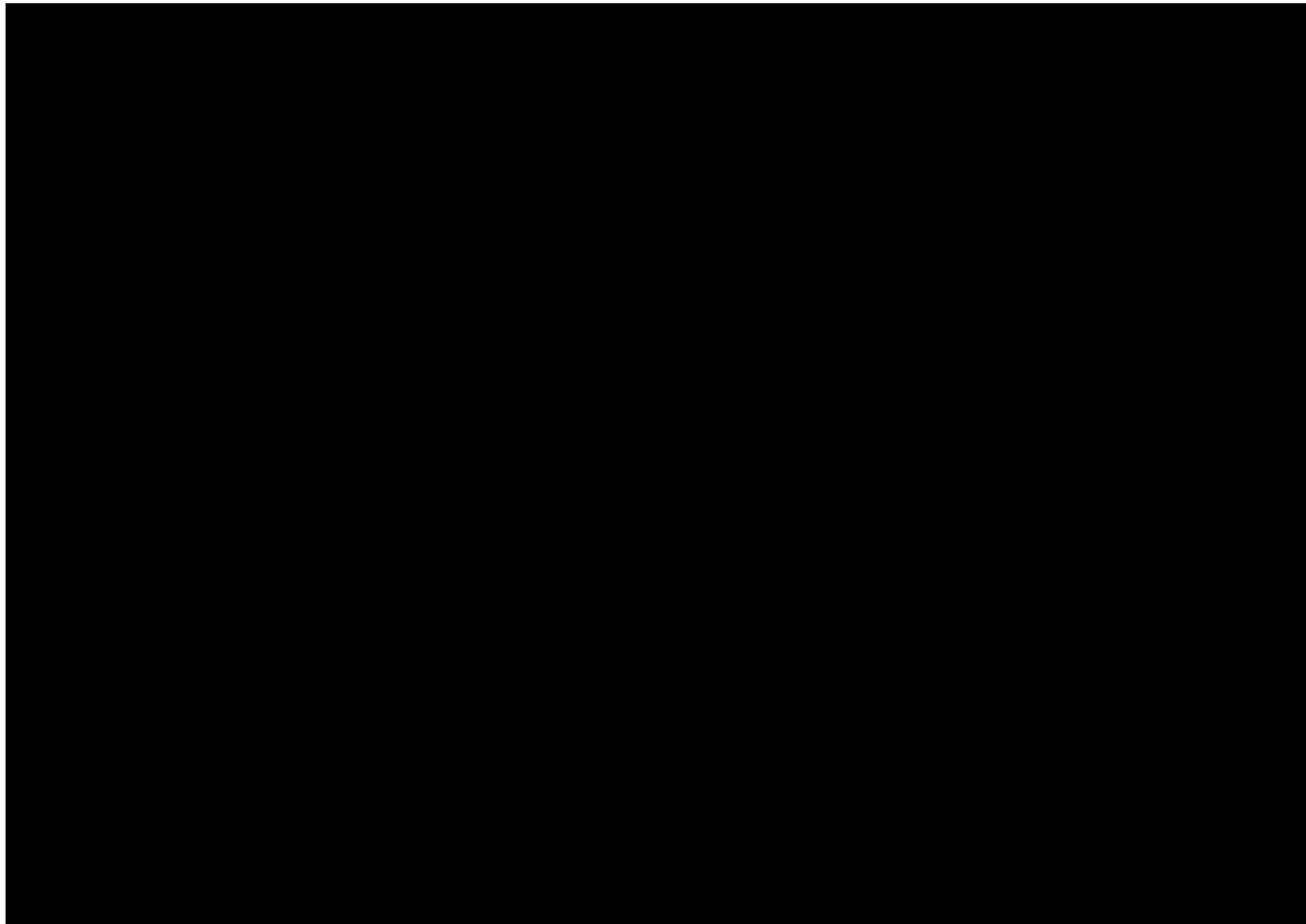


Figure 7 – Known sub-populations of *Hydrocotyle tuberculata* in the Development Envelope in 2011

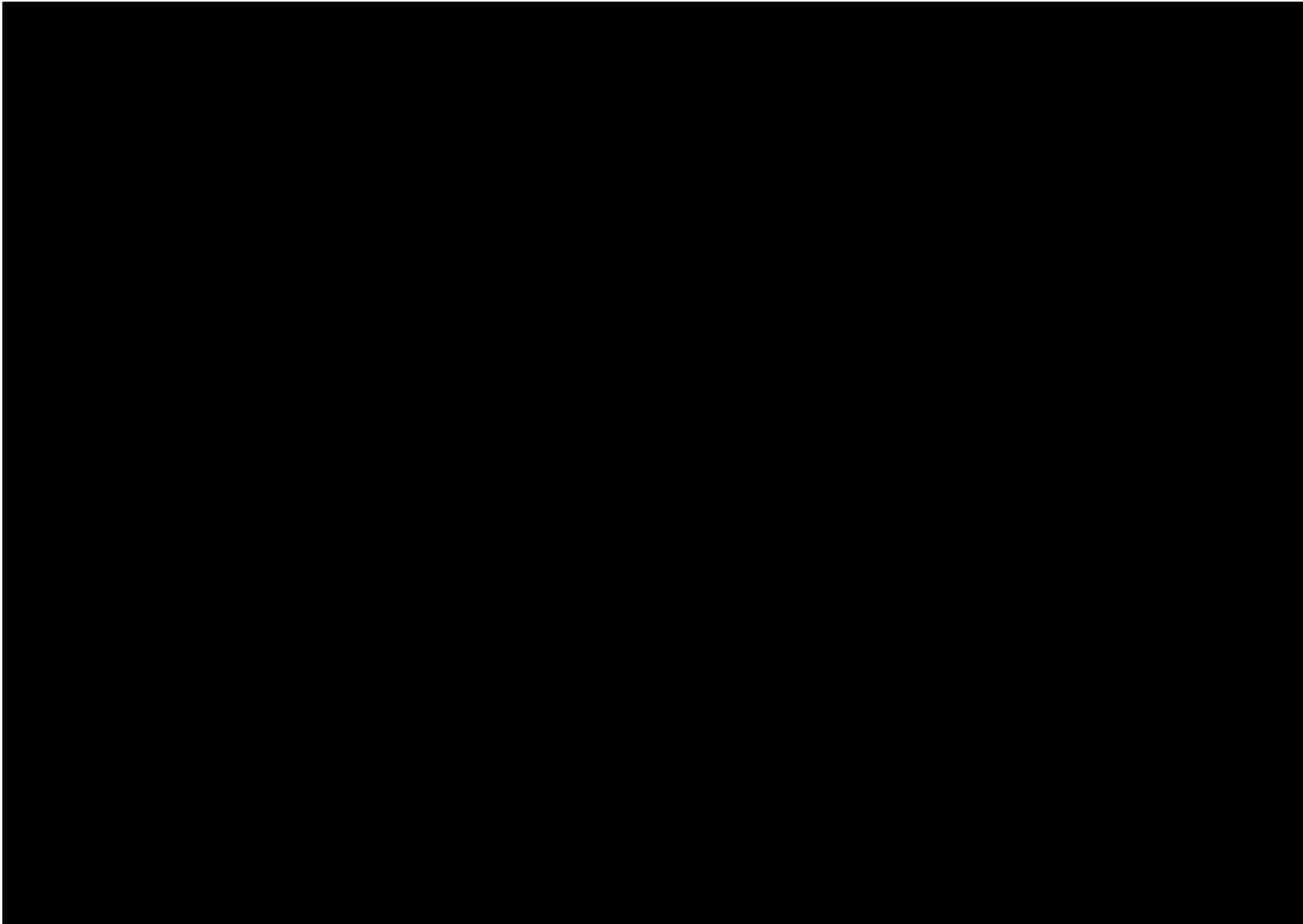


Figure 8 – Known populations of *Thomasia* sp. Hopetoun (KR Newbey 4896)

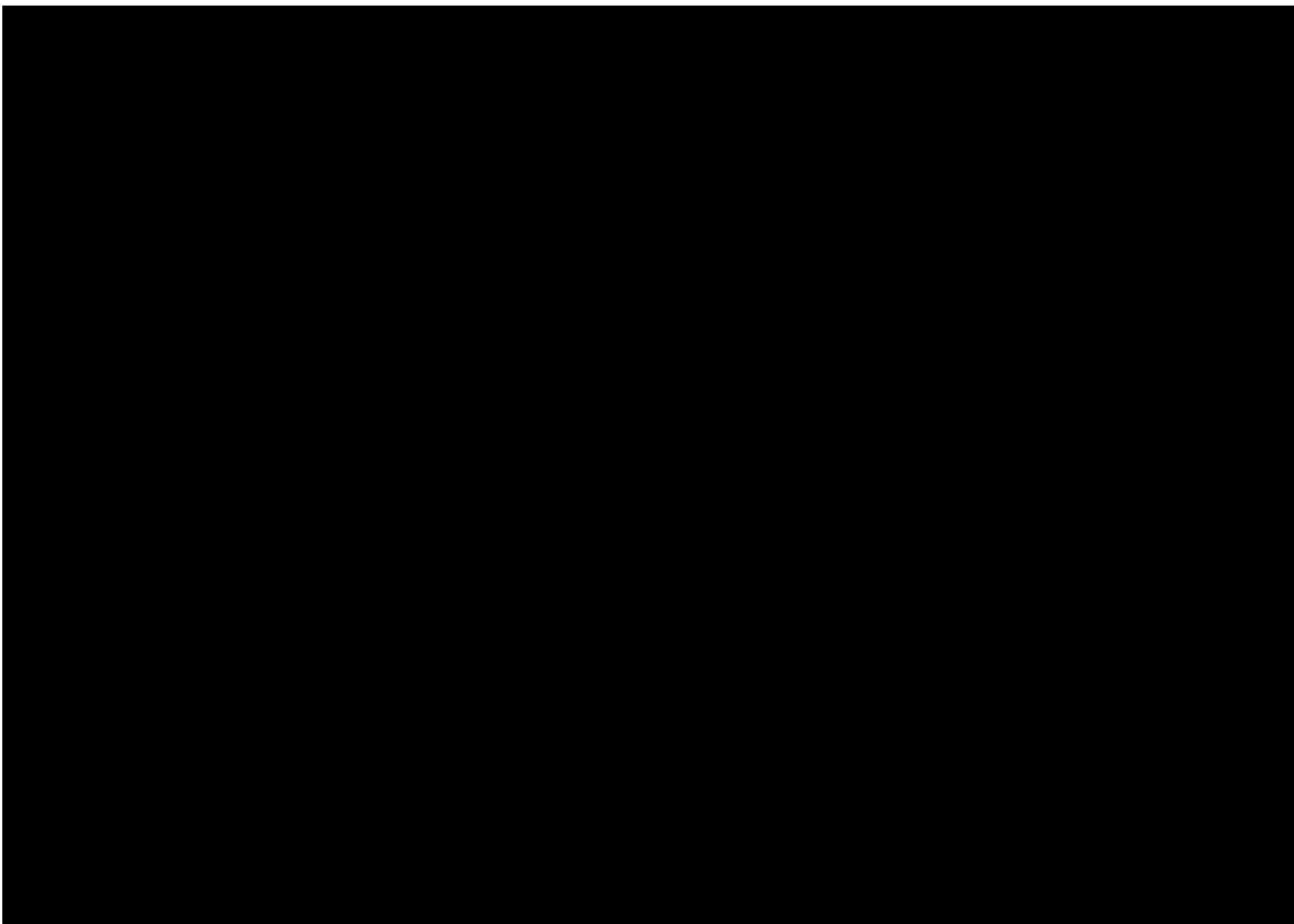


Figure 9 – Sub-population of *Thomasia* sp. Hopetoun (KR Newbey 4896) surveyed in the Development Envelope in December 2019

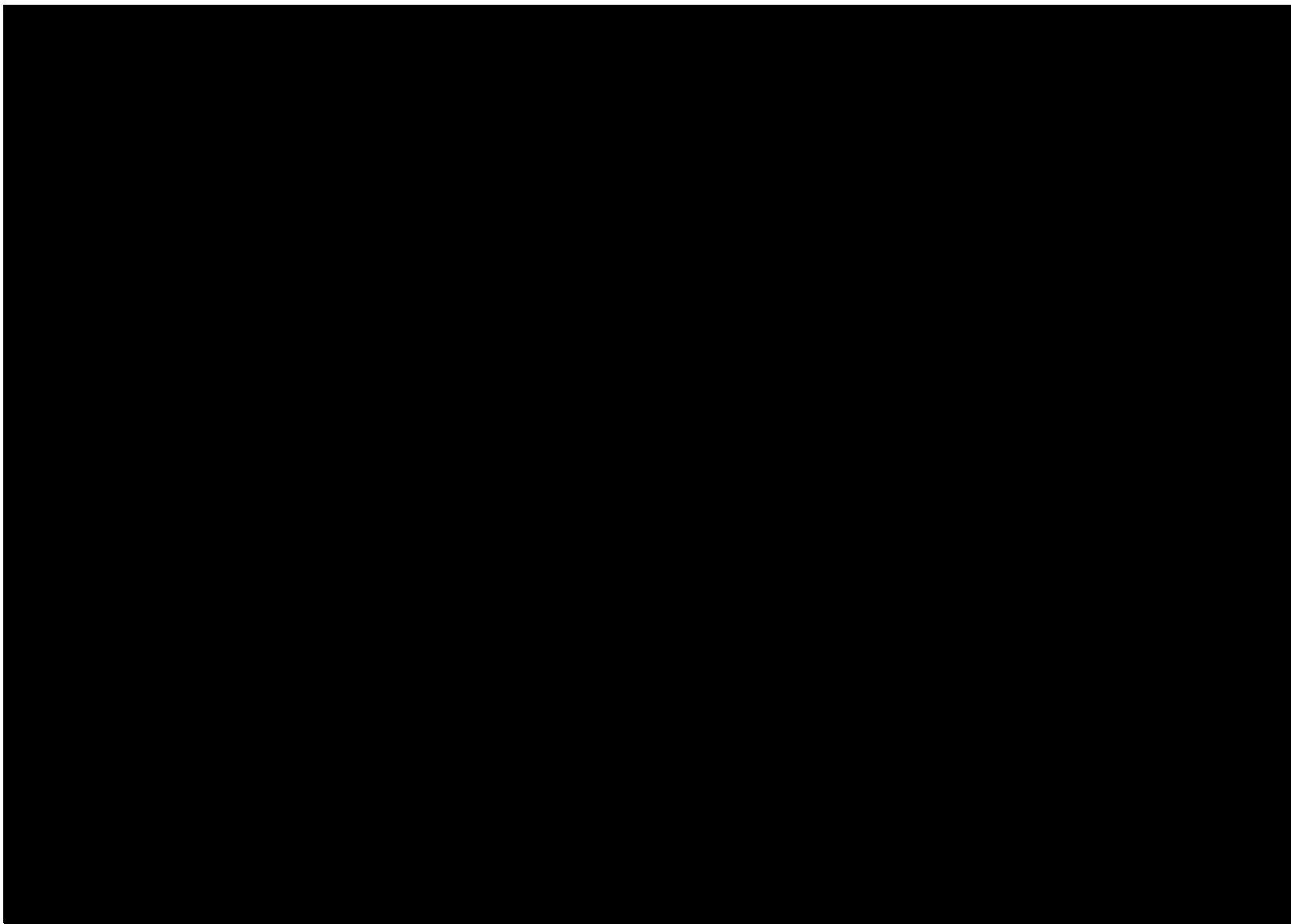


Figure 10 – Known populations of *Dampiera* sp. Ravensthorpe (GF Craig 8277)

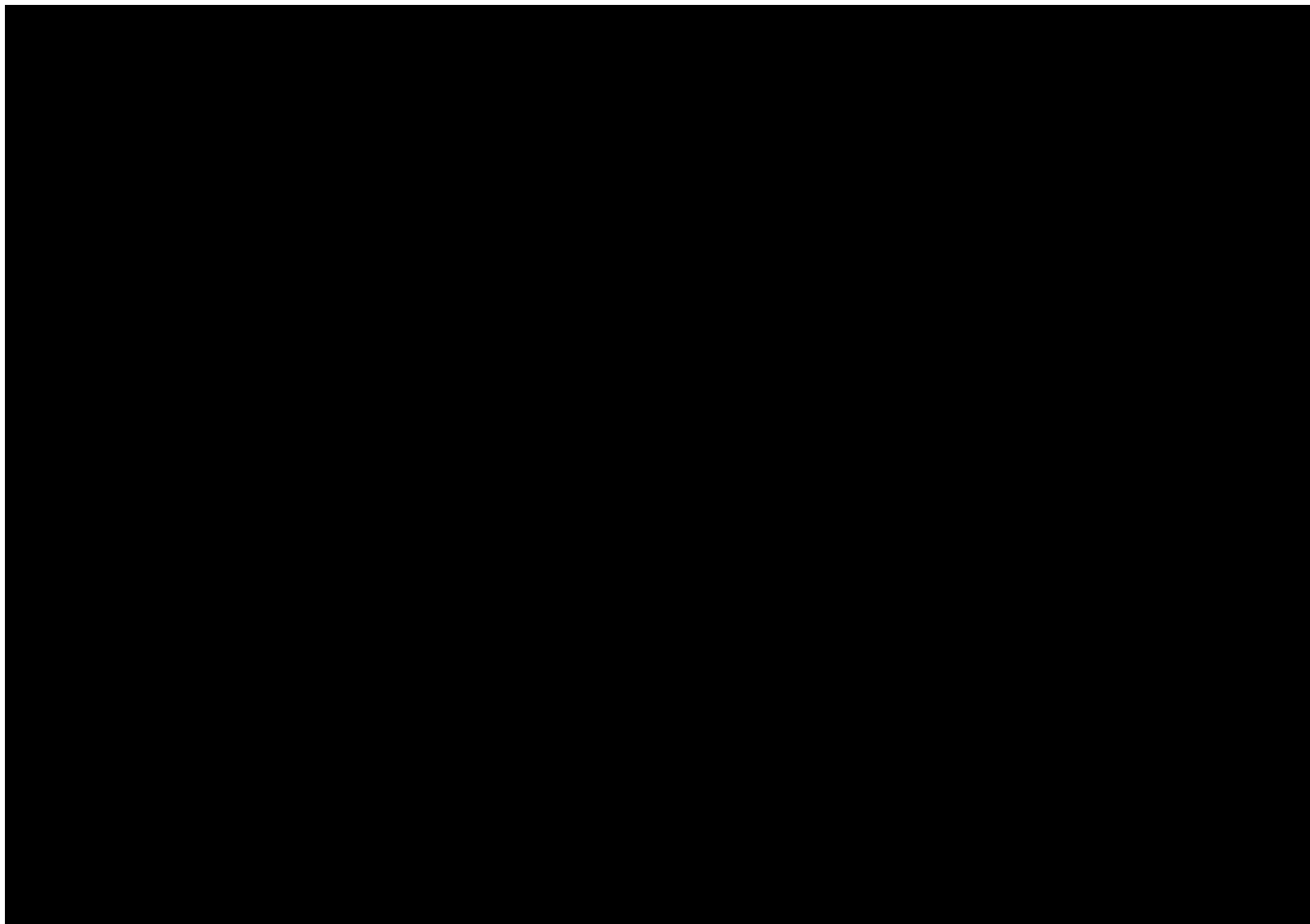


Figure 11 – Known population of *Dampiera* sp. Ravensthorpe (GF Craig 8277) in the Development Envelope in 2009

Discussion

Desktop

There are major flaws with the DBCA databases when one is attempting to interrogate species population data. Some of these are recognized by DBCA, e.g. old specimen records without GPS locations which have been manually given geographic coordinates that don't tally with the location description. However, by today's standards their TPFL system is archaic because:

- species' population data is based on hard copy Threatened Flora Report Forms. Therefore, it is no surprise that DBCA have not updated the data for the five priority species here, for at least 10 years. In contrast, data provided digitally could be uploaded within days.
- TPFL information is based a single point within a population – it is not possible to provide polygon or multiple-point population data to DBCA. Therefore DBCA has (i) no method for determining loss or increase to a particular population's area, or (ii) whether two separate points represent a continuum of a single population or are disparate groups of plants.
- TPFL and WAHerb data does not provide the collector's name, although it is possible to cross-reference using DBCA's Florabase (the author has Level 4 access) which is a tedious process. It would help if this data was included, so that it could be cross-referenced with published and unpublished reports that may be available.
- It was also found that some populations were repeated in both the WAHerb and TPFL databases, so care was needed not to simply sum all the abundance data, otherwise one would double the population size. It would be preferable that if a specimen is lodged in PERTH and therefore appears on the WAHerb database, that a Threatened Flora Report Form does not need to be filled out too.

Formating the spreadsheet to be compliant with IBSA standards was time consuming:

- data was in a number of different geographic coordinate systems and needed to be transformed (in this case) to decimal degrees;
- column headings were inconsistent between WAHerb, TPFL and IBSA. It would be a great benefit if these government datasets were integrated.

Field survey

The field survey in December 2019 found three of the five Priority Flora species. The information from the desktop analysis and the survey are summarized in Table 7.

Table 7 – Summary of desktop analysis and field survey of Priority Flora species in the RGP Development Envelope and 20 m buffer.

TaxonName	WAConStat	TOTAL known plants	Abundance in Development Envelope & buffer	Percentage of known populations (%)
<i>Calothamnus roseus</i>	P1	4,700	3,200	68
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¹ annual plant not found in Dec 2019 survey; c. 60 plants in 2011; previously 110 plants in 2005

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The December 2019 survey failed to find either the annual *Hydrocotyle tuberculata* due to the dry conditions or *Dampiera* sp. Ravensthorpe (G.F. Craig 8277). It is not known whether the latter species is a short-lived perennial and has disappeared from the site until another fire or disturbance occurs, or the author was unable to find this cryptic species because it was not flowering. Seed banks of both species would still remain at their known sites. Surveys in winter-spring for *Dampiera* sp. Ravensthorpe and in October for *Hydrocotyle tuberculata* are recommended.

Acknowledgements

The assistance of the following people in preparing this report is gratefully acknowledged:

Greg Barrett – Talis Consultants
Sarah Barrett – DBCA Albany
David Groombridge – ACH Minerals
Tim Hammer – Spectrum Ecology
Michael Hislop – DBCA WA Herbarium
Vern Jones – ACH Minerals
Felicity Walker – Talis Consultants

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- Perkins AJ (2018) *Hydrocotyle eichleri, H. papilionella and H. tuberculata (Araliaceae), three new annual species from Western Australia*. *Nuytsia* 29: 240-243.

Appendix 1 – Threatened and Priority Flora report forms

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au> under Standard Report Forms

TAXON: Calothamnus roseus		TPFL Pop. No.: _____	
OBSERVATION DATE: 17/12/2019		CONSERVATION STATUS: P1	
OBSERVER/S: Gillian Craig		PHONE: 98381071	
ROLE: Botanist		ORGANISATION: _____	
CONSERVATION STATUS: P1		New population <input type="checkbox"/>	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
 17 km SE of Ravensthorpe. Located ca 250 m E of Ravensthorpe - Hopetoun Road in Kundip Mining leases

Reserve No.: _____

DBC DISTRICT: Albany		LGA: Ravensthorpe		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:	
GDA94 / MGA94 <input checked="" type="checkbox"/>		DecDegrees <input checked="" type="checkbox"/> DegMinSec <input type="checkbox"/> UTM <input type="checkbox"/>		GPS <input checked="" type="checkbox"/> Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: [REDACTED]		No. satellites: _____ Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: [REDACTED]		Boundary polygon captured: <input checked="" type="checkbox"/> Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: _____			
LAND TENURE:					
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/> SLK/Pole _____ to _____	
				Rail reserve <input type="checkbox"/> Shire road reserve <input type="checkbox"/>	
				MRWA road reserve <input type="checkbox"/> Other Crown reserve <input type="checkbox"/>	
				Specify other: __ mining lease __	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input checked="" type="checkbox"/> Full survey <input type="checkbox"/>		Area observed (m ²): 100,000	
EFFORT: Time spent surveying (minutes): 8 hrs		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input type="checkbox"/> Extrapolation <input checked="" type="checkbox"/> Estimate <input type="checkbox"/>		Count method: Wandering quarter	
		(Refer to field manual for list)	
WHAT COUNTED: Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>			
TOTAL POP'N STRUCTURE:			
	Mature:	Juveniles:	Seedlings:
Alive	3000	200	3200
Dead			
		Area of pop (m ²): 30,000	
		Note: Pls record count as numbers (not percentages) for database.	
QUADRATS PRESENT:		Total area of quadrats (m ²): _____	
No. _____ Size _____ Data attached <input type="checkbox"/>			
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:			
Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>			
Immature fruit <input type="checkbox"/> Fruit <input checked="" type="checkbox"/> Dehisced fruit <input type="checkbox"/> Percentage in flower: 0%			

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
Development Envelope for ACH Minerals' Ravensthorpe Gold Project	N	_____	_____

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>		Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	0-10% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input checked="" type="checkbox"/>	Limestone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input checked="" type="checkbox"/>	30-50% <input checked="" type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____	50-100% <input type="checkbox"/>	Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element:				
	(Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Very open mallee (Eucalyptus ecostata, E. pleurocarpa)
2. Thicket (Calothamnus pinifolia, C. roseus, C. quadrifidus, Taxandria spathulata)
- 3.
- 4.

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT: Old tracks which have regrown intersect the area.

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Eight distinct patches of plants were located within the Development Envelope and 20 m buffer survey area.

Full details of the survey and maps are available in report:

Craig GF (2020) Populations of five Priority Flora species in the Kundip Development Envelope. A report prepared for ACH Minerals Pty Ltd, Ravensthorpe Gold Project. January 2020.

DRF PERMIT/ LICENCE No: FB62000115 Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licencing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Gillian Craig _____ Role: Botanist Signed: _____ Date: 6/1/2020

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au/> under Standard Report Forms

TAXON: <u>Melaleuca sophisma</u>		TPFL Pop. No.: _____	
OBSERVATION DATE: <u>9/12/2019</u>		CONSERVATION STATUS: <u>P1</u> New population <input type="checkbox"/>	
OBSERVER/S: <u>Gillian Craig</u>		PHONE: <u>98381071</u>	
ROLE: <u>Botanist</u>		ORGANISATION: _____	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
1.6 km E of old Kundip townsite. [= original sub-population Mx-4 of Craig (2004); collection GFC 6020]

DBC DISTRICT: <u>Albany</u>		LGA: <u>Ravensthorpe</u>		Reserve No.: _____		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:			
GDA94 / MGA94 <input checked="" type="checkbox"/>		DecDegrees <input checked="" type="checkbox"/> DegMinSec <input type="checkbox"/> UTM's <input type="checkbox"/>		GPS <input checked="" type="checkbox"/>		Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: _____		No. satellites: _____		Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: _____		Boundary polygon captured: <input checked="" type="checkbox"/>		Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: _____					
LAND TENURE:							
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input type="checkbox"/>		Rail reserve <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>		MRWA road reserve <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/>		SLK/Pole _____ to _____	
						Shire road reserve <input type="checkbox"/>	
						Other Crown reserve <input type="checkbox"/>	
						Specify other: <u>mining lease</u>	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input checked="" type="checkbox"/> Full survey <input type="checkbox"/>		Area observed (m ²): <u>700</u>	
EFFORT: Time spent surveying (minutes): <u>90</u>		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input checked="" type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>		Count method: _____ <small>(Refer to field manual for list)</small>	
WHAT COUNTED: Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>			
TOTAL POP'N STRUCTURE:			
	Mature:	Juveniles:	Seedlings:
Alive	<u>346</u>		
Dead			
		Totals: <u>346</u>	
		Area of pop (m ²): <u>700</u>	
		Note: Pls record count as numbers (not percentages) for database.	
QUADRATS PRESENT:		Total area of quadrats (m ²): _____	
No. _____ Size _____ Data attached <input type="checkbox"/>			
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:		Percentage in flower: <u>10%</u>	
Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input checked="" type="checkbox"/>			
Immature fruit <input type="checkbox"/> Fruit <input checked="" type="checkbox"/> Dehisced fruit <input type="checkbox"/>			

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
Development Envelope for ACH Minerals' Ravensthorpe Gold Project	N	_____	_____

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>		Loam <input checked="" type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	0-10% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input checked="" type="checkbox"/>	Limestone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input checked="" type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input checked="" type="checkbox"/>	30-50% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____	50-100% <input checked="" type="checkbox"/>	Specify other: _____	Specify other: _____	
Drainage line <input type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element: (Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Open Woodland (Eucalyptus aff. astringens)

2. Open to mid-dense shrubs (Melaleuca sophisma, M. glaberrima)

3. _____

4. _____

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT: _____

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Recently a narrow vehicle has driven through sub-population knocking over 5 plants.

Full details of the survey and maps are available in report:
 Craig GF (2020) Populations of five Priority Flora species in the Kundip Development Envelope. A report prepared for ACH Minerals Pty Ltd, Ravensthorpe Gold Project. January 2020.

Note: 1 outlier shrub found 530 m NNE of this sub-population, previously noted by Hickman (2007)

DRF PERMIT/ LICENCE No: FB62000115 Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Gillian Craig _____ Role: Botanist Signed: _____ Date: 7/1/2020

Please complete as much of the form as possible, with emphasis on those sections bordered in black. For information on how to complete the form please refer to the Threatened & Priority Flora Report Form (TPRF) manual on the DBCA website at <http://dpaw.wa.gov.au/> under Standard Report Forms

TAXON: <u>Thomasia sp. Hopetoun (KR Newbey 4896)</u>		TPFL Pop. No.: _____	
OBSERVATION DATE: <u>9/12/2019</u>		CONSERVATION STATUS: <u>P2</u> New population <input type="checkbox"/>	
OBSERVER/S: <u>Gillian Craig</u>		PHONE: <u>98381071</u>	
ROLE: <u>Botanist</u>		ORGANISATION: _____	

DESCRIPTION OF LOCATION (Provide at least nearest town/named locality, and the distance and direction to that place):
Kundip Mining Leases, 2.5 km NE of old Kundip townsite

DBC DISTRICT: <u>Albany</u>		LGA: <u>Ravensthorpe</u>		Reserve No.: _____		Land manager present: <input type="checkbox"/>	
DATUM:		COORDINATES: (If UTM coords provided, Zone is also required)		METHOD USED:			
GDA94 / MGA94 <input checked="" type="checkbox"/>		DecDegrees <input checked="" type="checkbox"/> DegMinSec <input type="checkbox"/> UTM's <input type="checkbox"/>		GPS <input checked="" type="checkbox"/>		Differential GPS <input type="checkbox"/> Map <input type="checkbox"/>	
AGD84 / AMG84 <input type="checkbox"/>		Lat / Northing: _____		No. satellites: _____		Map used: _____	
WGS84 <input type="checkbox"/>		Long / Easting: _____		Boundary polygon captured: <input checked="" type="checkbox"/>		Map scale: _____	
Unknown <input type="checkbox"/>		ZONE: _____					
LAND TENURE:							
Nature reserve <input type="checkbox"/>		Timber reserve <input type="checkbox"/>		Private property <input type="checkbox"/>		Rail reserve <input type="checkbox"/>	
National park <input type="checkbox"/>		State forest <input type="checkbox"/>		Pastoral lease <input type="checkbox"/>		MRWA road reserve <input type="checkbox"/>	
Conservation park <input type="checkbox"/>		Water reserve <input type="checkbox"/>		UCL <input type="checkbox"/>		SLK/Pole _____ to _____	
						Shire road reserve <input type="checkbox"/>	
						Other Crown reserve <input type="checkbox"/>	
						Specify other: <u>mining lease</u>	

AREA ASSESSMENT: Edge survey <input type="checkbox"/> Partial survey <input type="checkbox"/> Full survey <input checked="" type="checkbox"/>		Area observed (m ²): <u>5000</u>	
EFFORT: Time spent surveying (minutes): <u>90</u>		No. of minutes spent / 100 m ² : _____	
POP'N COUNT ACCURACY: Actual <input checked="" type="checkbox"/> Extrapolation <input type="checkbox"/> Estimate <input type="checkbox"/>		Count method: _____ (Refer to field manual for list)	
WHAT COUNTED: Plants <input checked="" type="checkbox"/> Clumps <input type="checkbox"/> Clonal stems <input type="checkbox"/>			
TOTAL POP'N STRUCTURE:			
	Mature:	Juveniles:	Seedlings:
Alive	<u>44</u>		
Dead			
		Totals: <u>44</u>	
		Area of pop (m ²): <u>1,000</u>	
QUADRATS PRESENT:		No. _____ Size _____ Data attached <input type="checkbox"/> Total area of quadrats (m ²): _____	
Summary Quad. Totals: Alive			
REPRODUCTIVE STATE:			
Clonal <input type="checkbox"/> Vegetative <input type="checkbox"/> Flowerbud <input type="checkbox"/> Flower <input type="checkbox"/>			
Immature fruit <input type="checkbox"/> Fruit <input checked="" type="checkbox"/> Dehisced fruit <input checked="" type="checkbox"/> Percentage in flower: <u>0%</u>			

CONDITION OF PLANTS: Healthy Moderate Poor Senescent

COMMENT: _____

THREATS - type, agent and supporting information:	Current impact (N-E)	Potential Impact (L-E)	Potential Threat Onset (S-L)
Eg clearing, too frequent fire, weed, disease. Refer to field manual for list of threats & agents. Specify agent where relevant. Rate current and potential threat impact: N=Nil, L=Low, M=Medium, H=High, E=Extreme Estimate time to potential impact: S=Short (<12mths), M=Medium (<5yrs), L=Long (5yrs+)			
Development Envelope for ACH Minerals' Ravensthorpe Gold Project	N	_____	_____
	_____	_____	_____

HABITAT INFORMATION:

LANDFORM:	ROCK TYPE:	LOOSE ROCK:	SOIL TYPE:	SOIL COLOUR:	DRAINAGE:
Crest <input type="checkbox"/>	Granite <input type="checkbox"/>	(on soil surface; eg gravel, quartz fields)	Sand <input checked="" type="checkbox"/>	Red <input type="checkbox"/>	Well drained <input checked="" type="checkbox"/>
Hill <input type="checkbox"/>	Dolerite <input type="checkbox"/>		Sandy loam <input type="checkbox"/>	Brown <input checked="" type="checkbox"/>	Seasonally inundated <input type="checkbox"/>
Ridge <input type="checkbox"/>	Laterite <input type="checkbox"/>		Loam <input type="checkbox"/>	Yellow <input type="checkbox"/>	Permanently inundated <input type="checkbox"/>
Outcrop <input type="checkbox"/>	Ironstone <input type="checkbox"/>	0-10% <input type="checkbox"/>	Clay loam <input type="checkbox"/>	White <input type="checkbox"/>	Tidal <input type="checkbox"/>
Slope <input type="checkbox"/>	Limestone <input type="checkbox"/>	10-30% <input type="checkbox"/>	Light clay <input type="checkbox"/>	Grey <input type="checkbox"/>	
Flat <input type="checkbox"/>	Quartz <input type="checkbox"/>	30-50% <input type="checkbox"/>	Peat <input type="checkbox"/>	Black <input type="checkbox"/>	
Open depression <input type="checkbox"/>	Specify other: _____	50-100% <input type="checkbox"/>	Specify other: _____	Specify other: _____	
Drainage line <input checked="" type="checkbox"/>					
Closed depression <input type="checkbox"/>					
Wetland <input type="checkbox"/>					
	Specific Landform Element: (Refer to field manual for additional values)				
CONDITION OF SOIL:	Dry <input checked="" type="checkbox"/>	Moist <input type="checkbox"/>	Waterlogged <input type="checkbox"/>	Inundated <input type="checkbox"/>	

VEGETATION CLASSIFICATION*:

Eg: 1. Banksia woodland (B. attenuata, B. ilicifolia);
 2. Open shrubland (Hibbertia sp., Acacia spp.);
 3. Isolated clumps of sedges (Mesomelaena tetragona)

1. Woodland (Eucalyptus sporadica, E. flocktoniae)
2. Open scrub (Gastrolobium parviflorum, Dodonaea pinifolia, Acacia cyclops, A. disticha)
- 3.
- 4.

ASSOCIATED SPECIES:

Other (non-dominant) spp _____

* Please record up to four of the most representative vegetation layers (with up to three dominant species in each layer). Structural Formations should follow 2009 Australian Soil and Land Survey Field Handbook guidelines – refer to field manual for further information and structural formation table.

CONDITION OF HABITAT: Pristine Excellent Very good Good Degraded Completely degraded

COMMENT: _____

FIRE HISTORY: Last Fire: Season/Month: _____ Year: _____ Fire Intensity: High Medium Low No signs of fire

FENCING: Not required Present Replace / repair Required Length req'd: _____

ROADSIDE MARKERS: Not required Present Replace / reposition Required Quantity req'd: _____

OTHER COMMENTS: (Please include recommended management actions and/or implemented actions - include date. Also include details of additional data available, and how to locate it.)

Two distinct patches of plants were located 90 m apart in the creekline.

Full details of the survey and maps are available in report:

Craig GF (2020) Populations of five Priority Flora species in the Kundip Development Envelope. A report prepared for ACH Minerals Pty Ltd, Ravensthorpe Gold Project. January 2020.

DRF PERMIT/ LICENCE No: FB62000115 Note if only observing plants (i.e. no specimens or plant material is taken) then no permit/licence is required. For further information on permit and licencing requirements see the Threatened Flora and Wildlife Licensing pages on DBCA's website. Any actions carried out under licence/permit should be recorded above in the OTHER COMMENTS section.

SPECIMEN: Collectors No: _____ WA Herb. Regional Herb. District Herb. Other: _____

ATTACHED: Map Mudmap Photo GIS data Field notes Other: _____

COPY SENT TO: Regional Office District Office Other: _____

Submitter of Record: Gillian Craig _____ Role: Botanist Signed: _____ Date: 7/1/2020