

**REVIEW OF RECORDS AND COLLECTIONS OF *LEPIDIUM HYSSOPIFOLIUM* (SOFT PEPPERCRESS) IN TASMANIA:  
BACKGROUND INFORMATION TO INFORM LONG-TERM  
MANAGEMENT OPTIONS OF SITES UNDER THE  
JURISDICTION OF THE TASMANIAN DEPARTMENT OF STATE  
GROWTH**



**Environmental Consulting Options Tasmania (ECOtas) for  
Department of State Growth**

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## **INTRODUCTION**

### ***Rationale for review***

The Department of State Growth (DofSG) sought a variation to EPBC 2007/3807, which related to the demolition of Maclaines Creek Bridge at Triabunna. The approved action under EPBC 2007/3807 was:

The proposed action involves the demolition of the Maclaines Creek Bridge, following the completion of an adjacent new bridge and southern approaches, on the Tasman Highway near Triabunna, Tasmania. The proposal includes the establishment of a 2000 m<sup>2</sup> conservation reserve for the endangered *Lepidium hyssopifolium*.

While the conservation reserve was established, some of the specific approval conditions were not met, specifically the maintenance of a self-sustaining population. The target (under condition 3) was at least 300 individuals within four years. This was not met and the required remediation and rehabilitation plans were designed, submitted and implemented as required by the approval conditions, but the population of *Lepidium hyssopifolium* continued to decline. By 2014, the number of individuals in the established reserve was less than 10, and the Department sought a variation to EPBC 2007/3807 to undertake alternative management of the species.

A variation to EPBC 2007/3807 was approved on 18 May 2016, with the following conditions now applicable. Comments on the conditions are provided below each.

1. The person taking the action must undertake, at least once every five years, a population count of Basalt Peppergrass (*Lepidium hyssopifolium*) individuals at the Maclaines Creek Bridge conservation reserve shown at Annexure 1.

EPBC 2007/3087 was signed on 5 March 2008 and was listed to extend to 2028 (presumably 5 March 2028). Apart from conditions 1-6 of the listed in the approved variation, none of the other original conditions of EPBC 2007/3087 were altered, such that the end date is still considered to be 2018. This would mean that the Maclaines Creek Bridge site needs to be monitored in 2021 (was monitored in 2016 as part of the present project) and 2026.

2. The person taking the action must submit to the Department a report every five years from the date of this decision, that addresses compliance with the conditions of this approval. The report must detail implementation of any management plans as specified in the conditions. Non-compliance with any of the conditions of this approval must be reported to the Department at the same time as the compliance report is published. The person taking the action must publish the report on their website.

The date of the approval of the variation was 18 May 2016, meaning reports to the Department are due 18 May 2021 and 18 May 2026 (and presumably a final report on 18 May 2028 at the conclusion of EPBC/3087).

3. To assist in the long-term protection of *L. hyssopifolium* the person taking the action must:

(a) undertake a literature review of known *L. hyssopifolium* population data; and

The present document is the formal presentation of the specified literature review (refer to text of the present report and to Table 1 at Appendix A). Note that there was no date specified for this action but it is logical that it needed to be completed (or at least substantially completed prior to undertaking condition 3.(b) i.e. field surveys.

- (b) by 30 April 2017 submit to the Department for approval, a Survey Plan and survey methodologies to undertake roadside surveys. The Survey Plan must include maps of survey areas and specific habitat conditions including, but not limited to:

- soil characteristics;



- canopy species cover;
- slope and aspect; and
- threats to the population.

The person taking the action must implement the approved plan.

The present report provides a list of all the sites targeted for field survey (the specified "Survey Plan") and Appendix B provides an example field proforma showing the variables to be collected (the specified "survey methodologies"). The field surveys have been completed (noting there was no specified completion date for such surveys – condition 3.(b) required the survey plan and methodologies to be submitted by 30 April 2017 but condition 6 required a "Species Management Plan" to be submitted by 30 June 2017. This would have left just May and June to undertake surveys and prepare a management plan. The surveys needed to be conducted during spring-summer (ideally not too close to winter) to maximise the detection window (the species is perennial but most luxuriant during non-winter months when plants can wither and identification is more difficult). As such, the present report also includes the results of these surveys (Appendix C) because these were used to guide the development of the management plan.

4. Unless otherwise agreed to in writing by the Minister, the person taking the action must publish all management plans and reports submitted under conditions 2, 3 and 6 on their website. Each management plan and report must be published within 1 month of being approved by the Minister.

This is a matter for the Department of State Growth.

5. If the Minister believes that it is necessary or desirable for the better protection of the relevant matters of national environmental significance to do so, the Department may require that the person taking the action must make specified revisions to any plan or plans approved pursuant to these conditions of approval. The person taking the action must comply with any such request. The revised plans must be implemented.

This is a matter for the Minister.

6. The person taking the action must utilise the findings of the literature review and Survey Plan required under condition 3 to prepare a Species Management Plan. The Species Management Plan must include but not be limited to:
  - detailed information on sites containing *L. hyssopifolium* that can be managed to maintain a long-term population under the Department of State Growth's Roadside Conservation Program;
  - site condition and current land management practices;
  - information about proposed short and long term management measures, including responsible parties, objectives and timeframes;
  - specific management actions and associated timeframes, including corrective measures if populations numbers decline; and
  - proposed monitoring and reporting measures.

The Species Management Plan must be submitted to the Department for approval by 30 June 2017.

The person taking the action must commence implementing the approved plan no later than 30 September 2017.

The present report included a detailed review of all populations supporting *Lepidium hyssopifolium* that occur on sites under the jurisdiction of the Department of State Growth, with the intention of identifying "sites that can be managed to maintain a long-term population under the Department of State Growth's Roadside Conservation Program". The remainder of the dot-pointed items of condition 6 are reliant on the identification of such sites.



## **METHODS**

### ***Review process***

#### Database and collections review

Three sources of records of *Lepidium hyssopifolium* were interrogated and reviewed to produce a complete list of all known locations of the species in Tasmania, as follows:

- Tasmanian Herbarium (Tasmanian Museum & Art Gallery)

The Tasmanian Herbarium (international herbarium code: HO) is part of the Tasmanian Museum & Art Gallery administered through the Tasmanian Department of State Growth. The collection database was interrogated for all collections of *Lepidium* and this was used to systematically examine every specimen of *Lepidium* held at this institute. The main reason all species of *Lepidium* were examined was to ensure that any collections of other species previously mis-identified were also considered (for the record, this resulted in one additional specimen of *Lepidium pseudotasmanicum* being re-determined as *Lepidium hyssopifolium*).

Every specimen was examined microscopically to confirm its identity as *Lepidium hyssopifolium*. In some cases, a confirmation slip was added to the collection sheet. This was mainly undertaken for the specimens previously determined as *Lepidium tasmanicum*, a taxon not currently accepted by the Tasmanian Herbarium (de Salas & Baker 2016). For the record, most of the specimens held at HO had previous "det. slips" from people considered as experts in the Brassicaceae and the genus (e.g. H. Hewson, N. Scarlett).

- DPIPWE's *Natural Values Atlas* database

The *Natural Values Atlas* (NVA) is the Tasmanian government's repository of all natural values data, managed by the Tasmanian Department of Primary Industries, Parks, Water & Environment. The database includes records of flora listed as threatened on the Tasmanian *Threatened Species Protection Act 1995* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The database incorporates the data from the Tasmanian Herbarium through a formal data exchange agreement.

Any records in the NVA that are not supported by a voucher at a recognised institute (such as HO) need to be treated with caution. While there is a vetting process for data input into the NVA, this is undertaken by DPIPWE staff who can only utilise the available information to make a reasonable decision on inclusion of the supplied data. While for many species this is not an issue (e.g. highly distinctive species), for a species such as *Lepidium hyssopifolium*, with its attendant (historical) identification issues and the requirement for some level of familiarity and expertise by the observer in its identification, any unvouchered records need to be considered carefully on a case-by-case merit basis.

The Observations Search function of the online database was used to access all records of *Lepidium hyssopifolium*. All data fields were included in the exported output.

- *Atlas of Living Australia*

The *Atlas of Living Australia* (ALA) is an e-infrastructure that is funded by the Australian Government via its National Collaborative Research Infrastructure Strategy (NCRIS). It is a collaborative partnership of organisations that have stewardship of biological data and expertise in biodiversity informatics, including museums, biological collections, community groups, research organisations, government (State and Commonwealth), and natural resource managers.





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The ALA includes data of threatened flora from DPIW's NVA and collection information from the Tasmanian Herbarium. It also includes collection information from other Australian herbaria.

The online species search function was used to access all records of *Lepidium hyssopifolium* from the Tasmanian region, with all available fields downloaded as a .csv file.

Data from all three sources were used to collate a table of collections/records of *Lepidium hyssopifolium* from Tasmania. All information considered relevant (such as notes on collection sheets and database records regarding habitat, abundance and extent) were transferred to the table.

### Specialist consultation

Several botanists were also contacted and staff of North Barker Ecosystem Services (most notably Andrew North) provided substantial information included in Table 1. Other environmental consultants also provided information (as acknowledged through pers. comm. in Table 1).

## **FIELD SURVEY**

### Site selection

The review of database and collection information was used to identify sites within the jurisdiction of the Department of State Growth that may be suitable for long-term conservation management. The intention was to assess these sites and ascertain the status of the population (extent, abundance, population structure), describe the supporting habitat, and identify current threats and practical management options.

The analysis, however, revealed that there were not very many subpopulations under State Growth jurisdiction and it was felt that the survey should be broadened to capture other sites to gain a better understanding of the factors controlling the species.

All sites under State Growth jurisdiction were field-assessed. The inclusion of other sites was on an ad hoc basis, with as many sites during the project period being visited as possible, with the intention of assessing a range of habitats (road verges, cemeteries, etc.).

### Field survey

All field work was undertaken under DofSG's minimum workplace health and safety requirements which included that all personnel involved in field work having completed traffic management training (*Implement Traffic Management Plan (RIIOHS302A)*) (except where field work occurred on public land away from roads e.g. Mt Nelson Signal Station), provision of safe work method statement (SWMS) to DofSG prior to field work, and the use of traffic management plans, if deemed to be necessary to complete the work (this was restricted to use of "surveyor ahead"-style signs at some sites as most field work was well off the road, except for short periods closer to the carriageway).

A field proforma was developed to record the required information on populations of *Lepidium hyssopifolium* (Appendix A includes examples of completed field proformas for positive and negative previously known sites surveyed for the species).

Prior to field survey, the known locations of *Lepidium hyssopifolium* were reviewed and transferred to field maps showing topography, cadaster and other features as necessary to



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maximise the chance of detecting the species in the field from the available information. These maps and hand-held GPS (Garmin Oregon 650) were used to navigate to the location of the known site. Surveys radiated out (or extended linearly along a road verge) from the known site.

Where *Lepidium hyssopifolium* was detected, abundance was estimated by direct counts using the waypoint function on the GPS (in most cases) or by estimates (where the species was locally abundant and counting individuals was not practical). The site supporting (or not supporting) the species was described using the variables on the proforma.

Voucher specimens were collected under DPIPWE permits TFL 15280 and 17029 (in the name of Mark Wapstra), where such voucher material was not already held at HO and where sufficient material was available for such a collection (some sites with only a low number of plants were not sampled).

In general, *Lepidium hyssopifolium* was identified in the field by examination of the scapes using a hand-lens (species is characterised by a short grey pubescence). Some material needed to be re-examined by microscope in the laboratory due to loss of most hairs (this occurs with older plants).

### Specimen and data management

The field reports include reference to the author's specimen collecting number under which the specimens will be submitted to HO. The author usually submits batches of 100 (number of labels in HO's collecting booklets) so this will not occur for some months.

Data on each site has been compiled using Excel to produce the maps included with the present report. This will be further manipulated to conform to the batch entry worksheet provided by DPIPWE for submission to the NVA. A permit condition requires this to be completed within three months of collection of the data (in this case, this will occur as soon as the report is approved by the Minister).

## **FINDINGS**

Table 1 at Appendix A was constructed to identify sites within State Growth's jurisdiction that support *Lepidium hyssopifolium* and that may be suitable for longer-term conservation management through addition to the Department's Roadside Conservation Program. Table 1 was also used to guide prioritisation of confirmation surveys. Note that the State Growth-funded surveys were only on road verges under the Department's jurisdiction but the author chose to extend the survey to additional road verge sites and other (e.g. cemetery) sites to gain a broader understanding of the species' requirements and contemporary conservation status. Table 2 (included below) is a pared down version of Table 1 provided for easier reference.

Figure 1 provides an overview of the distribution of *Lepidium hyssopifolium* within Australia and New Zealand (based on records held in the ALA). The distribution of the species in Tasmania is shown in Figure 2 (based on records in the ALA) and Figure 3 (based on records in the NVA). Figures 4 & 5 shows the NVA records by IBRA region and municipality, respectively.

The following notes refer to the fields in Tables 1 & 2. Note that the order of subpopulations included in Tables 1 & 2 are generally from south to north, and regionally grouped for easier reference.

No.

At this stage I have simply allocated a number to a record or set of records that represent a discrete site (or subpopulation). Some discrete subpopulation allocations may be better allocated to sub-sites within the one subpopulation (e.g. those sub-sites less than 1 km apart) but this will depend on the degree of connectivity between the sub-sites.



*Location*

If the location appears as "Site Name" (i.e. in "" marks), it is a direct citation of the location name given in either database or collection (the latter takes precedence).

If the location appears as [Site Name] (i.e. in [] brackets), I have allocated a site name because one is not provided with the database or collection.

*Source of record*

NVA = Natural Values Atlas

HO = Tasmanian Herbarium accession number

Other herbaria (CANB, AD, NSW, MEL) as per ALA (Atlas of Living Australia) records

Literature (citation provided)

*Details*

Collector name (where known) and date of collection (where known). If the NVA record indicates the collector as "unknown" but there is a matching HO collection with the collector listed, this latter name has been used.

*Information*

Any notes associated with the record has been copied verbatim into this field. Information in square brackets is provided for clarification.

(T)enure (I)BRA (M)unicipality (N)RM

This field summarises the key land tenure information usually included in documents such as listing statements. It provides an easy guide to sites that occur within the jurisdiction of the Department of State Growth.

*Database recommendations*

These are simply file notes that will be provided to DPIPWE for corrections, additions and deletions to the NVA. The information will be provided as is for a decision by DPIPWE but if original collectors provide any notes against these suggestions, these will be included in the correspondence to DPIPWE as support for/against the initial suggestion.

*Status*

The current status of the population/site is listed as: extant, locally extinct, or uncertain (the notes below each population provide the rationale for the allocation to a status category). Below each status a note is made on the existence of voucher collections.

Note that the information in Table 1 is supported by.xls and .shp files of the associated NVA and ALA data, an .xls download of HO's collection database for all *Lepidium* species in their collection, and an .xls file of novel data collected by the author as part of surveys for the present project (latter will all be provided to the NVA author on conclusion of the project).



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**Table 2.** Summary of sites/subpopulations of *Lepidium hyssopifolium* within Tasmania  
[sites under the jurisdiction of State Growth are highlighted with pale grey shading]

No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
1	Ralphs Bay	unknown unknown	T: uncertain I: South East M: City of Clarence N: South	1931	<b>UNCERTAIN (vouchered)</b>
2	Mount Nelson Signal Station	14 + 2 unknown	T: Public reserve (Parks & Wildlife Service) I: South East M: City of Hobart N: South	2002	<b>LOCALLY EXTINCT (vouchered in part)</b>
3	Glebe, Oakdowns	3+ or 5 1 x 2 m	T: private I: South East M: City of Clarence N: South	2004	<b>UNCERTAIN (not vouchered)</b>
4	Howrah Beach, Wentworth Park	4 unknown	T: local government I: South East M: City of Clarence N: South	2004	<b>UNCERTAIN (vouchered)</b>
5	Domain	unknown unknown	T: local government I: South East M: City of Hobart N: South	1995	<b>UNCERTAIN (not vouchered)</b>
6	"Potters Croft"	12 unknown	T: private I: South East M: Sorell N: South	2008	<b>EXTANT (not vouchered)</b>
7	opposite 470 Bay Road, Boomer Bay	20 unknown	T: local government I: South East M: Sorell N: South	2010 2017	<b>EXTANT (not vouchered)</b>
8	Burnt Hill Road (southeast)	10 unknown	T: local government I: South East M: Sorell N: South	2010	<b>EXTANT (not vouchered)</b>
9	Burnt Hill Road (junction with Bream Creek Road)	unknown unknown	T: local government I: South East M: Sorell N: South	1993	<b>LOCALLY EXTINCT (not vouchered)</b>
10	Shones Corner, Risdon	c. 40 unknown	T: State Growth I: South East M: City of Clarence N: South	1992 1993 2002	<b>LOCALLY EXTINCT (vouchered)</b>
11	Knights Point, Windermere Bay Reserve	unknown unknown	T: local government I: South East M: City of Glenorchy N: South	1986	<b>UNCERTAIN (vouchered)</b>
12	Black Snake Road, Granton	unknown unknown	T: local government I: South East M: City of Glenorchy N: South	1991	<b>LOCALLY EXTINCT (vouchered)</b>





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No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
13	Bridgewater Causeway	unknown unknown	T: State Growth I: South East M: Brighton/Derwent Valley? N: South	1978	<b>UNCERTAIN (vouchered)</b>
14	Granton, 14km NE of New Norfolk. Derwent River, S bank (E side of bridge)	20-25 unknown	T: local government or TasRail I: South East M: City of Glenorchy N: South	1986	<b>UNCERTAIN (vouchered)</b>
15	Cove Hill	2 1 x 1 m	T: private property I: South East M: Brighton N: South	2006	<b>UNCERTAIN (vouchered)</b>
16	Salmon Ponds c. 8km NW of New Norfolk	25-50 unknown	T: uncertain I: South East M: Derwent Valley N: South	1986	<b>UNCERTAIN (vouchered)</b>
17	Lyell Highway, opposite Woolpack Road	No information associated with record.	T: uncertain I: South East M: Central Highlands N: South	1993	<b>UNCERTAIN (not vouchered)</b>
18a	Lyell Highway, c. 2 km SE of Ouse	11 (2016) 18 (2017)	T: State Growth I: South East M: Central Highlands N: South	2016 2017	<b>EXTANT (vouchered)</b>
18b	"The Ouse"	unknown unknown	T: unknown I: South East M: Central Highlands N: South	1918	<b>UNCERTAIN (vouchered)</b>
19	Hollow Tree Road (south)	3 unknown	T: local government I: South East M: Central Highlands N: South	2011	<b>LOCALLY EXTINCT (not vouchered)</b>
20	Hollow Tree Road (north)	31 (2014) 30 (2017) c. 250 m	T: local government I: South East M: Central Highlands N: South	2014 2017	<b>EXTANT (vouchered)</b>
21	Bothwell	unknown unknown	T: unknown I: South East M: Central Highlands N: South	1991	<b>UNCERTAIN (vouchered)</b>
22	Bothwell cemetery	10 (2006) Xxx (2017)	T: private I: South East M: Central Highlands N: South	1991 2006 2017	<b>EXTANT (vouchered)</b>
23	Bothwell, N of fence between school and paddock	c. 80 xxx	T: private I: South East M: Central Highlands N: South	2014	<b>EXTANT (vouchered)</b>
24	Bothwell tip	unknown unknown	T: local government I: South East M: Central Highlands N: South	1991 1993	<b>UNCERTAIN (vouchered)</b>



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No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
25	Nant Lane	220+ 50 m	T: local government I: South East M: Central Highlands N: South	2014 2017	<b>EXTANT</b> (not vouchered)
26	Dennistoun Road	44 25 2	T: local government I: South East M: Central Highlands N: South	2007 2009 2017	<b>EXTANT</b> (vouchered)
27	Hermitage	unknown unknown	T: uncertain I: South East M: Central Highlands N: South	1984	<b>UNCERTAIN</b> (not vouchered)
28	Bagdad Uniting Church, Chauncy Vale Road	<10	T: private I: South East M: Southern Midlands N: South	1999	<b>LOCALLY EXTINCT</b> (vouchered)
29	Midland Highway, Bagdad	"common"	T: State Growth I: South East M: Southern Midlands N: South	1974 1982 1991 1993	<b>LOCALLY EXTINCT</b> (vouchered in part)
30	East side of road opposite the Bagdad Caltex Service Station, 10km N of the Pontville Bridge on the Midland Highway	15 large plants and 30-40 seedlings and smaller plants	T: State Growth I: South East M: Southern Midlands N: South	1984	<b>LOCALLY EXTINCT</b> (vouchered)
31	Bagdad, SE corner of training track	unknown unknown	T: private I: South East M: Southern Midlands N: South	1990	<b>UNCERTAIN</b> (not vouchered)
32	Bagdad [middle of training track]	unknown unknown	T: private I: South East M: Southern Midlands N: South	1990	<b>UNCERTAIN</b> (vouchered)
33	Private Paddock, E Bagdad Rd	unknown unknown	T: private I: South East M: Southern Midlands N: South	1999	<b>UNCERTAIN</b> (not vouchered)
34	E Bagdad Rd jct, Midland Hwy	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1995 1999	<b>LOCALLY EXTINCT</b> (not vouchered)
35	East Bagdad Road	"dense and thick stand"	T: local government I: South East M: Southern Midlands N: South	1991 1999	<b>LOCALLY EXTINCT</b> (vouchered)
36	Dysart Drive (south)	1 (1994)	T: State Growth I: South East M: Southern Midlands N: South	1994 1995 2007	<b>LOCALLY EXTINCT</b> (vouchered)



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No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
37	Dysart junction area	unknown unknown	T: local government/private? I: South East M: Southern Midlands N: South	1984 1995 2003	<b>UNCERTAIN (not vouchered)</b>
38	Dysart Drive (north)	4 (2009) 4 (2017)	T: local government/private? I: South East M: Southern Midlands N: South	1991 2002 2009 2017	<b>EXTANT (vouchered)</b>
39	Maclaines Creek, Triabunna	5 (2004) c. 60 (2006) 50 (2016)	T: State Growth I: South East M: Glamorgan-Spring Bay N: South	2004 2006 2014 2015 2016	<b>EXTANT (vouchered)</b>
40	Spring Hill, Midland Highway	25+7+15+8+10 xxx	T: State Growth I: South East M: Southern Midlands N: South	2014 2017	<b>EXTANT (vouchered)</b>
41	Jericho cemetery	unknown unknown	T: private I: South East M: Southern Midlands N: South	1991	<b>LOCALLY EXTINCT (vouchered)</b>
42	Jericho Road	unknown unknown	T: local government I: South East M: Southern Midlands N: South	1999	<b>LOCALLY EXTINCT (not vouchered)</b>
43	[Baden, junction of Tunnack Road and Woodsdale Road]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994	<b>LOCALLY EXTINCT (not vouchered)</b>
44	[Tunnack Road near 'Woodside' property]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1996 2002	<b>LOCALLY EXTINCT (not vouchered)</b>
45	[Tunnack Road near 'Lint Hill' property]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	2002	<b>LOCALLY EXTINCT (not vouchered)</b>
46	[Tunnack Road, c. 200 m W of 'Woodstock']	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994 2002	<b>EXTANT (vouchered)</b>
47	[c. 500 m NE of Tunnack Road on 'Woodstock' near Tin Dish Rivulet]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994	<b>LOCALLY EXTINCT (not vouchered)</b>
48	[Tunnack Road, c. 150 N of Black Gate Road junction]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1996?	<b>LOCALLY EXTINCT (not vouchered)</b>



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No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
49	[Tunnack Road, c. 300 m S of entrance to 'View Banks']	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1996?	<b>LOCALLY EXTINCT (not vouchered)</b>
50	[Tunnack Road, 'View Banks']	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994	<b>LOCALLY EXTINCT (not vouchered)</b>
51	[Tunnack Road, c. 350 N of entrance to 'Tramore']	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994 1996? 2002	<b>LOCALLY EXTINCT (not vouchered)</b>
52	"Tunnack Main Road, S of Parattah"	c. 10 unknown	T: State Growth I: South East M: Southern Midlands N: South	1996?	<b>LOCALLY EXTINCT (not vouchered)</b>
53	[Tunnack Road, c. 100 m SE of Beards Road junction]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994	<b>LOCALLY EXTINCT (not vouchered)</b>
54	[junction Tunnack and Inglewood roads]	unknown unknown	T: State Growth I: South East M: Southern Midlands N: South	1994 2002	<b>LOCALLY EXTINCT (not vouchered)</b>
55	[Parattah railway line]	unknown unknown	T: TasRail I: South East M: Southern Midlands N: South	2002	<b>LOCALLY EXTINCT (not vouchered)</b>
56a	Edge of Lake Dulverton, Oatlands	100s to 1,000s	T: Lake Dulverton Conservation Area & local government I: South East M: Southern Midlands N: South	1994 2017	<b>EXTANT (vouchered)</b>
56b	[Oatlands, Esplanade, between Barrack Street and Mill Point]	100s to 1,000s	T: Lake Dulverton Conservation Area & local government I: South East M: Southern Midlands N: South	1999 2017	<b>EXTANT (vouchered)</b>
57	[Oatlands, 'Weedington']	100s	T: local government & private? I: South East M: Southern Midlands N: South	1999 2017	<b>EXTANT (vouchered)</b>
58	"Oatlands, Mahers Point"	c. 20+ (2007)	T: local government I: South East M: Southern Midlands N: South	2007 2017	<b>EXTANT (vouchered)</b>
59	York Plains Road, near Coffin Gully Creek	unknown unknown	T: local government I: South East M: Southern Midlands N: South	1995 1996?	<b>EXTANT (vouchered)</b>



## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
60	“Kewstoke York Plains”	unknown unknown	T: local government I: South East M: Southern Midlands N: South	1995 1996?	<b>UNCERTAIN (vouchered)</b>
61	Township Lagoon Nature Reserve	4 unknown	T: Township Lagoon Nature Reserve (PWS) I: Northern Midlands M: Northern Midlands N: North	1991 1992 1993	<b>LOCALLY EXTINCT (vouchered)</b>
62	river bank at Ross	unknown unknown	T: local government? I: South East M: Southern Midlands N: South	1981	<b>UNCERTAIN (vouchered)</b>
63	‘Annanvale’ property	unknown unknown	T: private I: Northern Midlands M: Northern Midlands N: North	1990 1993 1996	<b>UNCERTAIN (vouchered)</b>
64	‘Fosterville’, Campbell Town	unknown unknown	T: private I: Northern Midlands M: Northern Midlands N: North	unknown	<b>UNCERTAIN (vouchered)</b>
65	Barton Road at Stewarton Bridge	unknown unknown	T: private I: Northern Midlands M: Northern Midlands N: North	1994 2001 2017	<b>EXTANT (vouchered)</b>
66	Junction of Barton Road and Valleyfield Road	xxx	T: local government I: Northern Midlands M: Northern Midlands N: North	1994 1996? 2017	<b>EXTANT (vouchered)</b>
67	Lake River Church	“common”	T: private I: Northern Midlands M: Northern Midlands N: North	1991	<b>LOCALLY EXTINCT (vouchered)</b>
68	Ellerslie property, Kingston Road	unknown unknown	T: private I: Northern Midlands M: Northern Midlands N: North	1994	<b>UNCERTAIN (vouchered)</b>
69	Ormley, Esk Main Road	60 in 50 m <sup>2</sup> (2012) 15 (2016)	T: private & State Growth I: Northern Midlands M: Break O’Day N: North	1994 1998 2002 2012 2017	<b>EXTANT (vouchered)</b>
70	Fingal, South Esk Highway, north roadside	unknown unknown	T: uncertain I: Ben Lomond M: Break O’Day N: North	None.	<b>LOCALLY EXTINCT (vouchered)</b>
71	South Esk Highway, Fingal	unknown unknown	T: uncertain I: Ben Lomond M: Break O’Day N: North	1991 1993	<b>LOCALLY EXTINCT (vouchered)</b>
72	Fingal	unknown unknown	T: uncertain I: Ben Lomond M: Break O’Day N: North	1984 1990 1993	<b>LOCALLY EXTINCT (not vouchered)</b>





## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Abundance Extent	(T)enure (I)BRA (M)unicipality (N)RM	Year(s) seen	Status
73	East of Fingal. Esk Main Road at Fingal Culvert no. B3169	c. 25 plants around <i>Pinus radiata</i> 50-100+ (2017)	T: State Growth/private I: Ben Lomond M: Break O'Day N: North	2014 2017	<b>EXTANT (vouchered)</b>
74	Falmouth		T: State Growth I: Flinders M: Break O'Day N: North	1992 1993 1995 2002	<b>LOCALLY EXTINCT (vouchered)</b>
75	[Cressy, west of school]	unknown unknown	T: unknown (presume local government) I: Northern Midlands M: Northern Midlands N: North	1994	<b>UNCERTAIN (not vouchered)</b>
76	[Macquarie Road, Cressy, road to pump station]	7 10 x 2 m	T: local government I: Northern Midlands M: Northern Midlands N: North	1994 2017	<b>EXTANT (not vouchered)</b>
77	"Glen Mavis", Deddington Road"	"unknown unknown	T: local government I: Northern Midlands M: Northern Midlands N: North	1994	<b>UNCERTAIN (vouchered)</b>
78	Nile Road	c. 500 20-30 x 4 m	T: local government & private I: Northern Midlands M: Northern Midlands N: North	1994 2017	<b>EXTANT (vouchered)</b>
79	"Clarendon"	unknown unknown	T: uncertain (local government?) I: Northern Midlands M: Northern Midlands N: North	1994	<b>UNCERTAIN (not vouchered)</b>
80	"Blessington", west of O'Briens Road	unknown unknown	T: Sydney Cove Historic Site? I: Ben Lomond M: Northern Midlands N: North	1995	<b>UNCERTAIN (vouchered)</b>
81	Cove Point, Preservation Island	unknown unknown	T: Sydney Cove Historic Site? I: Flinders M: Flinders Island N: North	1976	<b>UNCERTAIN (vouchered)</b>
82	Tasmania	unknown unknown	T: unknown I: unknown M: unknown N: unknown	1840- 1873	<b>UNCERTAIN (vouchered)</b>



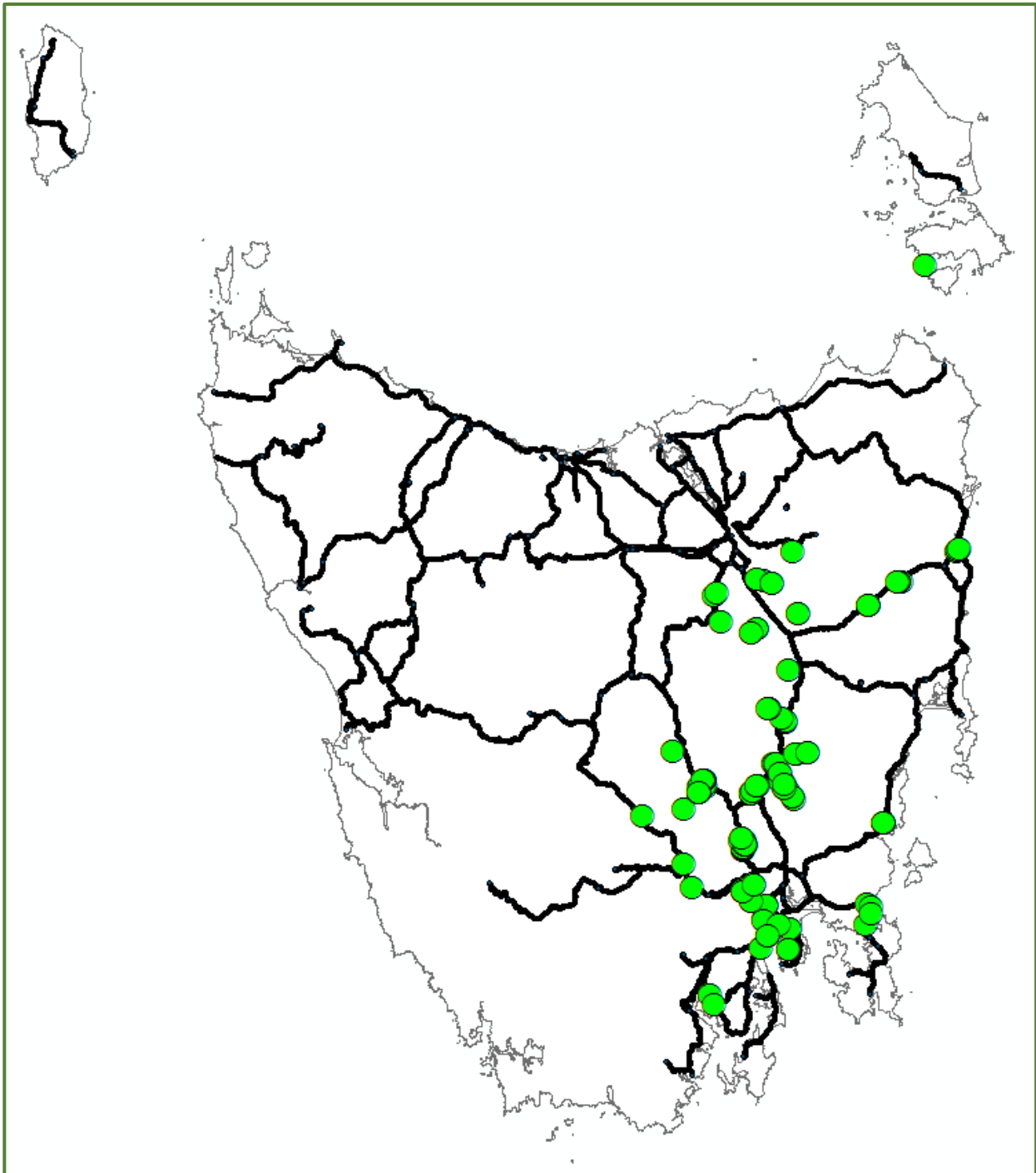


**Figure 1.** Distribution of *Lepidium hyssopifolium* in Australia and New Zealand  
[source: *Atlas of Living Australia*, accessed 28 April 2017]



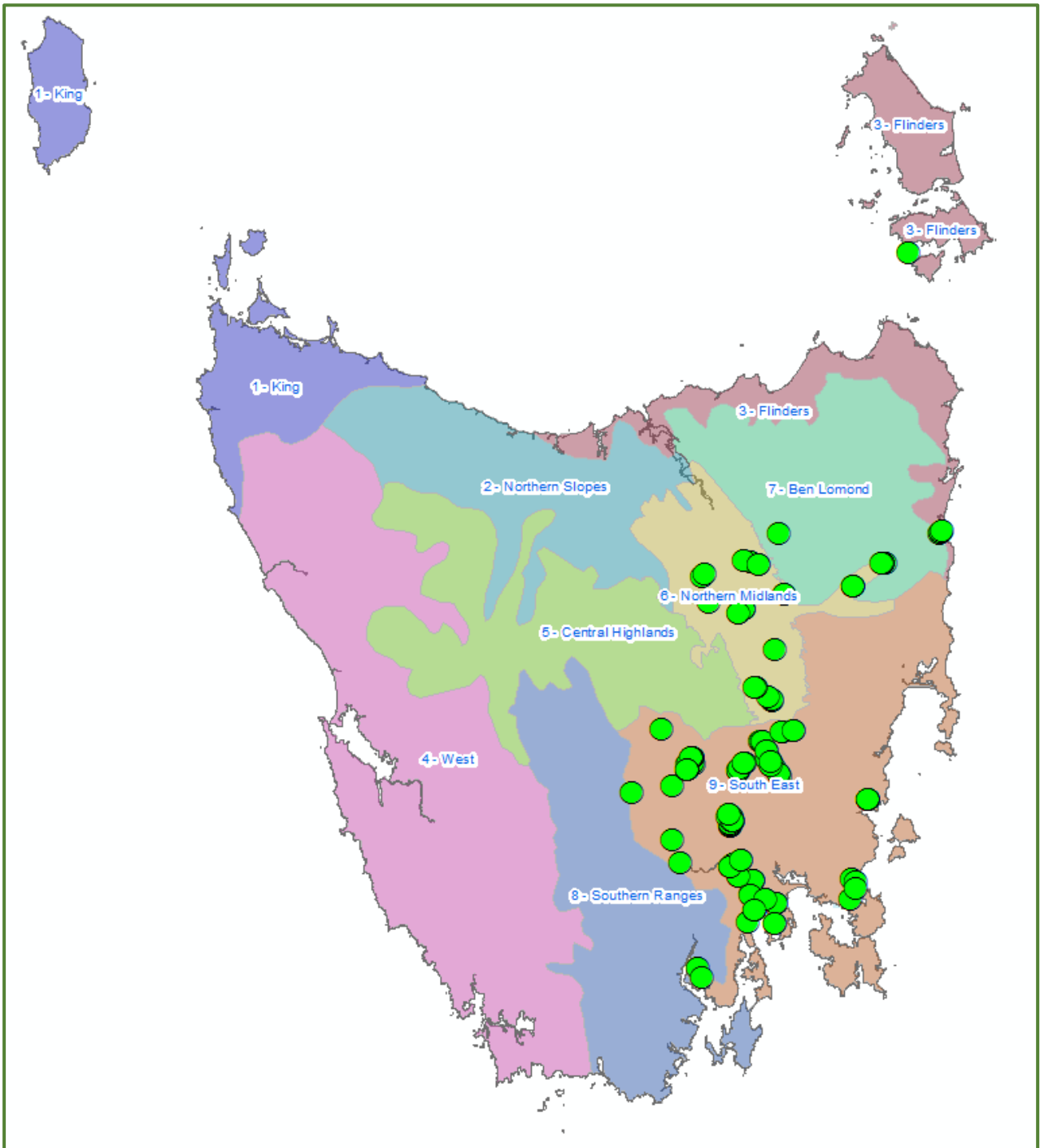
**Figure 2.** Distribution of *Lepidium hyssopifolium* in Tasmania – circled records not in NVA  
[source: *Atlas of Living Australia*, accessed 28 April 2017]





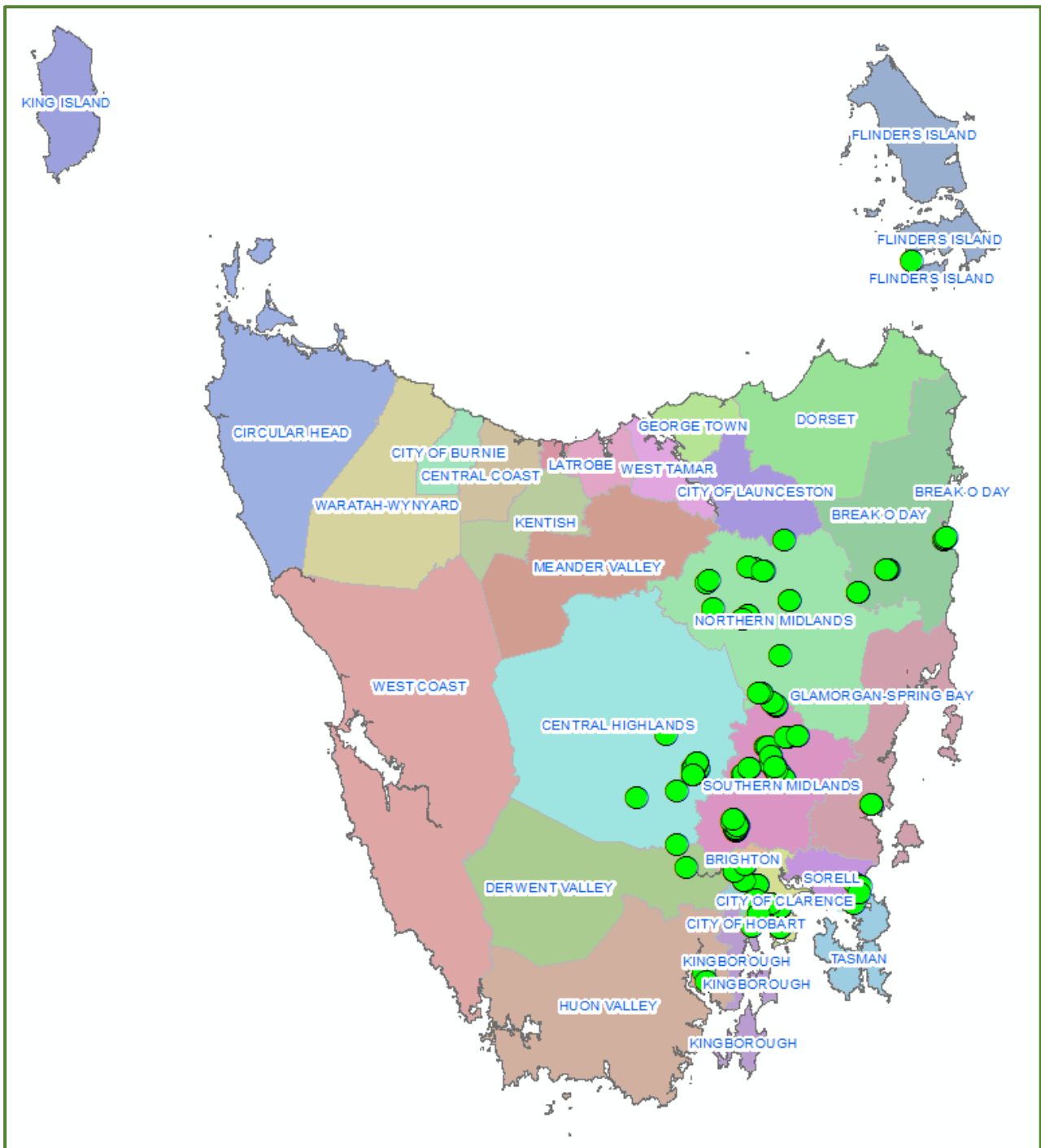
**Figure 3.** Distribution of *Lepidium hyssopifolium* in Tasmania – road network under the jurisdiction of the Department of State Growth is also shown [source: *Natural Values Atlas*, 12 March 2017]





**Figure 4.** Distribution of *Lepidium hyssopifolium* in Tasmania – by IBRA [source: *Natural Values Atlas*, 12 March 2017]





**Figure 5.** Distribution of *Lepidium hyssopifolium* in Tasmania – by municipality [source: *Natural Values Atlas*, 12 March 2017]





**Classification conundrum: is *Lepidium hyssopifolium* native or naturalised in Tasmania (or a bit of both)?**

With almost all the Tasmanian collections of *Lepidium hyssopifolium* post-dating the 1980s, it is tempting to suggest that it has an anthropogenic origin in this State. Recent studies have shown another native grassland specialist to be most likely naturalised viz. *Rytidosperma popinense* (Lorimer 2016), hitherto considered (and managed) as an endangered species. Similarly, *Aristida benthamii* (three-awned speargrass) was also considered native (Curtis & Morris 1994) and listed as threatened, but has since been considered to be naturalised (e.g. de Salas & Baker 2016). The lesson from these species is that assumption is dangerous and critical review of collections is needed to elucidate the origins of some species. An example of such a review comes from *Xerochrysum viscosum*, whose origin was uncertain but clearly demonstrated to be anthropogenic (Wapstra & Yeates 2013). It is noted, of course, that several species, quite clearly considered native (e.g. *Mirbelia oxylobioides*), apparently escaped detection until the late 1900s. In the case of *Lepidium hyssopifolium*, the story appears to be somewhat more complex than first anticipated.

If only the records from DPIPWE's *Natural Values Atlas* are reviewed, the earliest collection from Tasmania is 1931 ("Ralphs Bay"). Even this could be considered quite a late-in-the-piece collection, with most of our native species recorded prior to 1900. Of some note is that the next collection of *Lepidium hyssopifolium* shown in the *Natural Values Atlas* is from 1974, a gap of 44 years. The next collection is from 1981, after which the collections become regular, with only 1983, 1985, 1987, 1988, 1989, 1997, 2000, 2005, & 2013 missing collections. Unfortunately, the 1931 collection from Ralphs Bay (represented by three different sheets at the Tasmanian Herbarium) bears no information that points to an origin. It is tempting to suggest it may have been introduced at the time of major works in the Lauderdale area e.g. Lauderdale Canal underwent substantial works post-1924.

Where the suggestion of a possible anthropogenic origin falls short is that there is a collection held at the Tasmanian Herbarium (HO 54050) attributed to "Archer" and simply labelled "Tasmania". Unfortunately, Archer's collection is undated and bears no detailed locality information. His dated collections (NVA – 17 April 2017) include just 42 records, with most from 1848 (18 collections) and 1851 (19 collections), and the balance with just one collection each from the years 1840, 1841, 1862, 1863 and 1877. His collections are from a wide area but are focused on his places of residence at 'Woolmers' near Longford (Stillwell 1969) and possibly his more frequent travel routes. He did make several collections of different species (including grassland and grassy woodland species that may have co-occurred with *L. hyssopifolium*) from the northern Midlands, most notably sites near Cressy and Lake River. Even with such an early collection, it is difficult to entirely discount *Lepidium hyssopifolium* as native to Tasmania. Archer's collection was most likely from a rural site, settled early in colonial days, where stock, feed and seed from mainland Australia would have been frequently imported.

There is a Maiden collection labelled "The Ouse" from 1918 held in at NSW (this record is in the ALA but not the NVA so has hitherto escaped consideration). Another relatively early collection such as this starts to build to a picture of a native taxon. The problem with this record is its very low precision (and the odd use of the impersonal pronoun i.e. "The Ouse"), and again, the collection is from one of the earliest developed primary production parts of Tasmania. In 2016, a novel site of *L. hyssopifolium* was recorded from east of Ouse but this was from a highly disturbed road verge and its source was almost certainly road works and/or roadside slashing (although it is not possible to discount that it has arisen from a source population that has been in the area since Maiden's collection in 1918).

My main concern with a native origin for *Lepidium hyssopifolium* is that unlike many other threatened grassland ecosystem species, *L. hyssopifolium* is almost entirely restricted to anthropogenic habitats. Most other species that are most frequently recorded from road verges do also occur in non-anthropogenic habitats viz. species of *Vittadinia*, *Austrostipa*, etc. Most of the collections of *L. hyssopifolium* made away from road verges hardly qualify as "natural" (e.g. Bothwell tip, Township Lagoon below tip, various private properties with sites around farmyards, etc.). It is tempting to fall back on the oft-cited scale of clearing and modification of



## Review of *Lepidium hyssopifolium* in Tasmania

the Midlands grassy ecosystems to explain the apparent (almost complete) restriction of *L. hyssopifolium* to road verges. However, as mentioned, there are no other species that seem to have this restriction and the fact that such habitats have received a disproportionate amount of survey and research strongly suggests that the species is not present. Many species have thrived in anthropogenic habitats and are considered native. For example, *Cotula australis* is most often recorded in city and suburban streets but it is also found in a range of natural habitats. *Lepidium pseudotasmanicum* has thrived in disturbed habitats, probably expanding its natural extent and habitat (which may be unstable cliffs and soils) considerably.

I have questioned if there are any truly "natural" sites for *L. hyssopifolium* in Tasmania. The site along East Bagdad Road was from under light *Eucalyptus viminalis* forest but was on a road verge (has since been eliminated). The date of observation of this location coincides with the flurry of records in and around Bagdad, so it seems reasonable to assume that the species was introduced to this site. The site near Falmouth is the most interesting "natural" occurrence in that the roadside verge in which the species occurred is a natural (not planted) stand of grassy *Eucalyptus globulus* forest. In itself, this provides some evidence that the species can occur in "natural" habitats. A closer examination of this site, however, shows it to be modified – the site was an access to a refuse facility (this would be the third near-tip site for the species).

The notesheet for the species (TSS 2003) indicated that Barker & Johnson (1998) considered the Annandale (private property) at Tunbridge to be especially significant as it is the only relatively natural occurrence of the species. I have not seen this site but assume it occurs in sheep-grazed grassy eucalypt woodland. The status of this population is unknown. The original collection from this site described the habitat as "*Eucalyptus amygdalina* woodland, growing under trees of *Acacia dealbata*". Kirkpatrick & Gilfedder (1998) also regarded this as the site closest to a natural situation for the species, noting: "only one stand, near Tunbridge, has a substantial cover of native plants. Here, *Lepidium* occurs beneath trees in *E. amygdalina* woodland that is very occasionally lightly grazed by sheep". Of course, it is perhaps a stretch to argue that this site is also "naturalised" but one would expect a weedy species to also extend into more natural habitats i.e. just because a species occurs in a less disturbed habitat does not mean it is native.

Kirkpatrick & Gilfedder (1998) suggested that the main agent of extirpation appears likely to be domestic stock because the species was only found in areas either ungrazed or extremely lightly grazed by stock. Where the growth suppression zone beneath introduced conifers extends from a non-grazed road reserve to a grazed, but unploughed sheep or cattle paddock, *Lepidium* was found in the road reserve and not in the paddock (I concur with this observation at several sites viz. Oatlands, Nant Lane, Hollow Tree Road). Where I struggle to find this a strong point for the native status of the species is the almost complete lack of records from "natural" situations (apart from the site on "Annanvale") and the fact that many other "road verge species" persist in quite heavily-grazed sites (in patches that escape grazing).

If *Lepidium hyssopifolium* is accepted as native to Tasmania, I then question if its contemporary distribution is caused predominantly by anthropogenic activities. Most records of the species are from road verges and often from several sites along a relatively short section of road viz. Bagdad to Dysart, Spring Hill to Jericho, Baden to Oatlands on Tunnack Road, Barton Road, etc. There is anecdotal evidence that the species may get introduced to one site and then be spread along the road through road works, and then possibly maintained through actions such as roadside slashing. This leads to a philosophical question regarding management. Should we be dedicating public resources to complex management of a "threatened" species on such disturbed sites? In my opinion, the answer is clearly the negative. What is clear that despite what management does or does not go on, *Lepidium hyssopifolium* has persisted since the mid-1800s, and there are still many viable sites such that extinction of the species from Tasmania is highly improbable, almost irrespective of the degree of management input.

An examination of the older floras for Tasmania may provide some further insight to the native or naturalised status of *Lepidium hyssopifolium* in Tasmania.

In *Flora Tasmaniae* (Hooker 1860), only two species of *Lepidium* were recognised in Tasmania: *L. cuneifolium* and *L. ruderale*. The taxonomy and nomenclature of the genus has moved on considerably and Hooker's concept of *L. cuneifolium* is now recognised as *L. foliosum* (de Salas



& Baker 2016), a species of coastal habitats. Under his *L. cuneifolium* he notes its habitat and distribution as “coasts of various parts of the Island: Macquarie Harbour, A Cunningham; Bass Straits: Circular Head and Woolnorth, Gunn” and that it is found “growing in the wash of the sea, where with a few other plants it forms the boundary of phænogamic vegetation”, which would accord with our contemporary view of *L. foliosum*, which occurs around all coasts but is particular prevalent on the Bass Strait islands and north and west coasts.

Hooker’s concept of *L. ruderale* is more difficult to convert into the modern taxonomy of the genus. Broadly, de Salas & Baker (2016) indicate “*Lepidium ruderale* L. *sensu* Bentham (1863) = *Lepidium foliosum* (misapplied in Tasmania)”. This would mean that Hooker (1860) was referring to just one species of *Lepidium*. Hooker (1860) noted that “this common and widely-diffused plant is probably described under many names, but it is quite impossible to identify its numerous forms satisfactorily by their published descriptions”. Of importance is that Hooker (1860) also wrote (my emphasis) “Mr. Gunn at one time thought that it might possibly be an introduced weed, and, from its localities at Hobarton, I was inclined to coincide with him; but we changed our opinions independently, on finding the plant to be abundant along all the coasts”. In my opinion, it appears likely that Hooker’s concept of *L. ruderale* was referring to a suite of species including at least *L. pseudotasmanicum* and *L. hyssopifolium* (but possibly also *L. africanum* and *L. desvauxii*). Both *L. pseudotasmanicum* and *L. africanum* are widespread in anthropogenic habitats such as the streets of “Hobarton” but *L. pseudotasmanicum* also extends commonly to sea cliffs and other coastal habitats, especially on the east coast. *L. desvauxii* is particularly associated with coastal habitats, often occurring just above the high wave wash line, but also now seems to be recorded along road verges in inland areas. In Hooker’s description, he described the leaves as “foliis linearibus integris v. varie incisae pinnatisectisve plerumque serratis glaberrimis puberulisve” – this captures the entire to pinnatisect (and variably hairy) leaves of *L. pseudotasmanicum* quite well. Under his notes on the species, Hooker writes “it also varies extremely in being smooth or pubescent”. Of the species we currently recognise in Tasmania, only *L. hyssopifolium* could be described as “pubescent” – some of the other species do develop hairs but they are never “pubescent” (*L. desvauxii* has shorter stiffer hairs that are almost always much sparser and retrorse).

In *The Tasmanian Flora*, Rodway (1903) recognised three species of *Lepidium* in Tasmania. His *Lepidium foliosum* is equivalent to Hooker’s *L. cuneifolium*. He also recognised the pasture weed *Lepidium campestre*. His *Lepidium ruderale* is difficult to assign to contemporary species’ limits because he describes the distribution as “very common throughout Australia and Europe”. His species had “leaves linear, lower ones divided, upper ones entire” suggesting he was mainly referring to *L. pseudotasmanicum*, one of the only species that develops “divided” (pinnatisect) leaves, especially in young plants. Unfortunately, Rodway (1903) makes no mention of the degree of hairiness of the stems.

In the *Student’s Flora of Tasmania*, Curtis (1975) recognised nine species of *Lepidium* in Tasmania. Under *Lepidium pseudotasmanicum*, the following notes were made: “An allied sp., *L. tasmanicum* Thell., was named from material collected by R. C. Gunn at Penquite, Launceston: this was distinguished essentially by the character of its hairs. Further study is needed of the group of spp. *L. pseudotasmanicum*, *L. tasmanicum*, *L. desvauxii* in relation to the European *L. ruderale* L. which may be introduced”. Modern nomenclature subsumes Curtis’ *L. desvauxii*, *L. praetervisum* and *L. halmaturinum* into *L. desvauxii* (de Salas & Baker 2016). All Curtis’ other species are definitively weeds, mainly of pasture crops. This means that apart from an oblique reference to a species “distinguished essentially by the character of its hairs” under *L. pseudotasmanicum*, any concept of a pubescent-stemmed *Lepidium* in the State was not yet recognised. The mention by Curtis (1975) of “material collected by R. C. Gunn at Penquite, Launceston” could refer to an early collection of *L. hyssopifolium*. However, no Gunn material or material collected from “Penquite, Launceston” has come to light in any database or collection searches.



**Reservation status**

*Lepidium hyssopifolium* is poorly reserved in Tasmania.

The Preservation Island collection from 1976 may be from the Sydney Cove Historic Site (reserved under the *Nature Conservation Act 2002*), although the precise location from the island is unknown and only part of the island is reserved.

A population also occurs in the Township Lagoon Nature Reserve (reserved under the *Nature Conservation Act 2002*), although the status of the species at this site is uncertain, having not been seen since the original collection 1991/1992 when only four plants were observed. This reserve has received considerable botanical survey in recent years by Threatened Plants Tasmania (Wildcare Inc.), Threatened Species Section (DPIPWE) and many field botanists, and if still present, *Lepidium hyssopifolium* would have been reported.

Parts of the population in Oatlands technically fall within the Lake Dulverton Conservation Area (reserved under the *Nature Conservation Act 2002*), although most of the population occurs in highly modified habitats utilised for recreation rather than conservation.

The population at the Mt Nelson Signal Station is in a Public Reserve (under the *Crown Lands Act 1976*), although the status of this population is uncertain with recent surveys failing to detect the species.

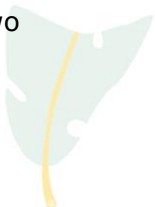
Some sites occur in "reserves" managed by local government authorities. For example, the site at Howrah Beach is in a parkland area managed by City of Clarence and the sites on the Queens Domain are in an area managed largely for their bushland conservation values by City of Hobart (the status of the sites on the Domain are highly uncertain).

TSS (2003) stated the following regarding the reservation status of the species: "A small population of *Lepidium hyssopifolium* is reserved in the Township Lagoon Nature Reserve. A population occurs in the Sydney Point Historic Site, two populations occur in Cemetery Reserves [not actually "reserves"] and one population occurs on a council managed Crown Reserve. A population has also been introduced to the Conara Roadside Park (B. Nicholson pers comm). The largest population occurs in a Private Comprehensive, Adequate and Representative (CAR) Reserve" ("Annanvale").

Lawrence et al. (2008) reported that *Lepidium hyssopifolium* occurs in five reserves: one formal reserve in the Flinders bioregion (presumably the Sydney Cove Historic Site), one formal reserve in the Northern Midlands bioregion (presumably the Township Lagoon Nature Reserve), one private reserve in the Northern Midlands bioregion ("Annanvale"), and one informal reserve in each of the Northern Midlands and South East bioregions (these latter reserves may refer to the Oatlands and Mt Nelson sites, respectively). These authors allocated the species a status of 3a, which meant it was partially reserved because it is reserved in half or more of the bioregions in which the species occurs (indicates "comprehensiveness" and "representativeness"), a conclusion at odds with the obviously very low reservation status of the species. Apart from the fact that the status of most of the "reserved" populations are at best uncertain, none of the reserves in question have management plans that take account of the species (or in fact any management plans at all).

Prior to this, Kirkpatrick et al. (1991) had identified *Lepidium hyssopifolium* as an unreserved species and suggested "Bells Lagoon" as a reservation site. This site is located north of Tunbridge Tier Road and is a naturally saline inland lagoon, wholly on private land, with no evidence that *L. hyssopifolium* ever occurred at the site.

Due to the almost exclusive occurrence of *Lepidium hyssopifolium* on road verges, the opportunities for improving the reservation status of the species are limited. In addition, any sites on private property are not ideally suited to negotiating long-term conservation outcomes because of the potential conflicts between land management and the conservation requirements of the species (e.g. eventual need to remove mature pines that appear to form the key component of the habitat for the species). Small private cemeteries can provide locations for longer-term conservation management, although to date *Lepidium hyssopifolium* appears to have disappeared from the Jericho, Lake River and Bagdad cemeteries (the former two





presumably due to the removal of the old pine trees), and is only persisting in the Bothwell cemetery (where the pine trees have been maintained).

### **A review of the formal conservation status of *Lepidium hyssopifolium***

*Lepidium hyssopifolium* is presently listed as endangered on both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Tasmanian *Threatened Species Protection Act 1995*. It is impractical herein to review the conservation status on the EPBCA because that would require substantially more information on its mainland Australian distribution that is available to the author. However, a review of its status on the TSPA is considered warranted because the present documentation has collated essentially all the available information on the species, something that has not been done since the species was first listed on the TSPA. There are too many examples of fauna and flora species listed on the TSPA that there is wide speculation that their formal conservation status is inappropriate, noting that this is not a statement implying *Lepidium hyssopifolium* is one such species or that there is any notion of it warranting delisting. In fact, to date, the species has been treated very much as an endangered entity.

The Scientific Advisory Committee, established under the provisions of the TSPA, produced a set of "*Guidelines for Eligibility for Listing under the Threatened Species Protection Act 1995*" (SAC 2008). These have been used below to review the status of *Lepidium hyssopifolium* in Tasmania, moving from the highest (endangered – Schedule 3) to the lowest (rare – Schedule 5) threat categories on the TSPA. Phrasing below in green text is verbatim copy from the *Guidelines*. Author commentary against each statement or criterion is provided in turn below each.

There are some key population variables that are used in most measures of conservation status, and these are explored below for *Lepidium hyssopifolium*.

#### Number of subpopulations or locations

The *Guidelines* describe this variable as follows:

Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less). For most plants, separation by at least one kilometre would be enough to warrant classification as separate subpopulations. For species known or believed to have very strong dispersal potential (for example, many aquatic species and species with effective wind dispersal of seeds), subpopulations would need to be separated by greater distances.

The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat. If the total population occurs across a number of private properties on which land use may change with change of ownership, it may be more appropriate to consider the number of landowners rather than the number of subpopulations for relevant criteria.

The analysis has revealed 82 (or 84 if two sub-sites are treated separately) locations of *Lepidium hyssopifolium* recorded from Tasmania. The breakdown of the status of these sites is shown in Table 3.





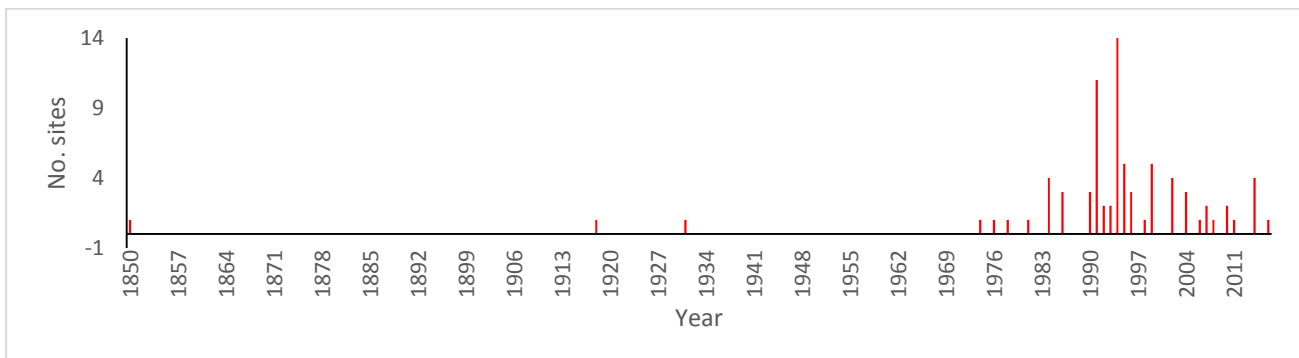
**Table 3.** Status of subpopulations of *Lepidium hyssopifolium* in Tasmania

Status category	No.
<b>Extant</b>	<b>24</b>
- voucher available	19
- voucher absent	5
<b>Locally extinct</b>	<b>31</b>
- voucher available	14
- voucher absent	17
<b>Uncertain</b>	<b>29</b>
- voucher available	20
- voucher absent	9
<b>TOTAL</b>	<b>84</b>

Of concern is that of the 84 sites/subpopulations known, only 24 are now considered extant. Most of these are confirmed by a voucher specimen. However, five still do not have a supporting voucher collection, which is concerning for such an historically confused taxon. Of greater concern is that 31 of the 84 sites/subpopulations are now considered locally extinct. Some of these are a small group of sub-sites along Tunnack Road considered as separate sites but possibly all part of one larger meta-population (this hardly changes the conclusion regarding the trends). Of the 84 sites/subpopulations, 29 are classified as uncertain, most with a supporting voucher. Sites without a voucher cannot be guaranteed to even be *Lepidium hyssopifolium* but are included herein because it is not possible to properly discount the sites. Those with vouchers are listed as uncertain mainly because the population has not been confirmed for over a decade.

The conclusion at this stage is that we can reliably confirm 24 extant populations of *Lepidium hyssopifolium* in Tasmania, suggest that 31 may be locally extinct, and that 29 have an uncertain status.

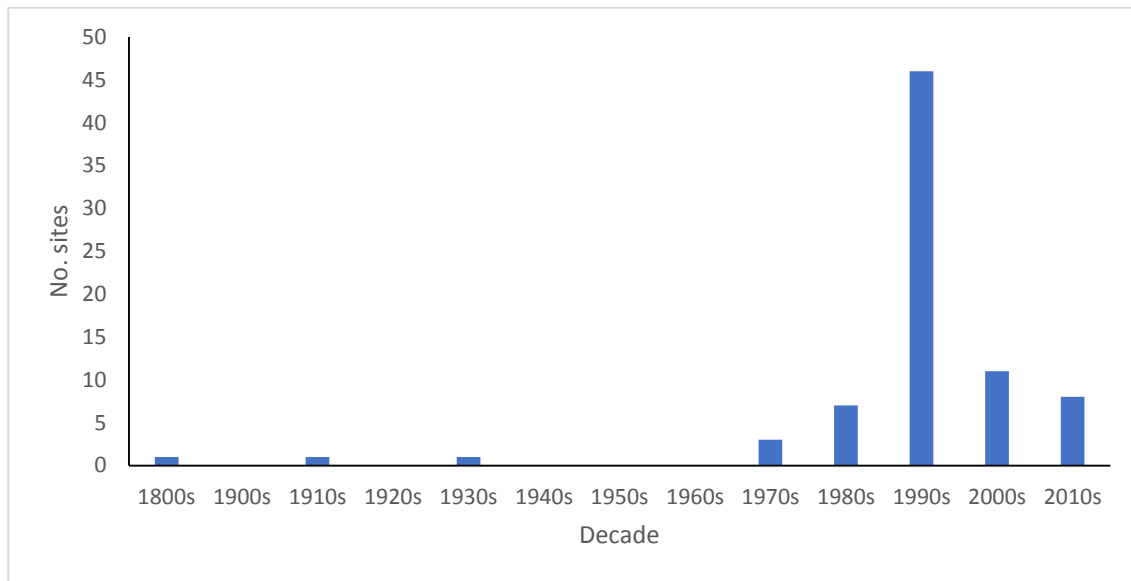
It is interesting to examine the historical change in the number of subpopulations of *Lepidium hyssopifolium* in Tasmania. Figure 6 shows the number of new populations added each year. Until the 1970s, there are just three records for the species. After this time, the records become more frequent, with a high number in the early to mid-1990s, which corresponds to research undertaken by Louise Gilfedder and Jamie Kirkpatrick on the floristics of lowland grassland remnants, and an increase in the number of roadside surveys (by the then Department of Transport). Note that very few of the novel sites are the result of re-determinations of collections previously allocated to other species.



**Figure 6.** Number of subpopulations of *Lepidium hyssopifolium* added in each year



When this is analysed by decade (Figure 7), the pattern of novel sites is clearer, with most sites added in the 1990s and 2000s.



**Figure 7.** Number of subpopulations of *Lepidium hyssopifolium* added in each decade

### Extent of occurrence

The *Guidelines* describe this variable as follows:

Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

In the case of *Lepidium hyssopifolium*, it is important to describe how the extent of occurrence is estimated. In the first instance, a minimum convex polygon was created around all populations that can be reasonably considered to be the species (i.e. the "populations" in Table 1 marked as "0" are not included). This equates to an extent of occurrence of 19,183 km<sup>2</sup>. If only the confirmed extant subpopulations are included, the extent of occurrence is reduced to about 10-11,000 km<sup>2</sup>.

If the status of the subpopulation is not taken into account, there has been no major change to the extent of occurrence over time because of the collections at Ouse in 1918, at Ralphs Bay in 1931 and on Preservation Island in 1976, as these three sites provide effective outliers to any minimum convex polygon. That is, while the number of sites has increased (see Figures 6 & 7), the extent of occurrence has not.

It is difficult to estimate if there has been a change in the extent of occurrence over time because we do not know precisely when subpopulations may have become locally extinct or the status of many subpopulations. The key measures for the endangered and vulnerable categories under the *Guidelines* are 50% over the last 10 years and 20% over the last 5 years, respectively. As sites such as Nile Road (far north), Maclaines Creek (east), Bream Creek area (southeast), Ouse (southwest) and Bothwell (west) remain extant and have done so for at least the last 10 years (based on either the original date of collection and/or an obviously persistent population such as at Nant Lane near Bothwell), there can only have been a minimal reduction in the extent of occurrence over the nominal periods, probably not exceeding the thresholds of 20% or 50%.



### Area of occupancy

The *Guidelines* describe this variable as follows:

Area of occupancy is defined as the area within its 'extent of occurrence' which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon.

In the case of *Lepidium hyssopifolium*, it is difficult to estimate the area of occupancy because most records are not accompanied by detailed collection notes. However, most sites appear to be restricted to the growth suppression zone around a few isolated conifers, and such sites generally occupy c. 10 m<sup>2</sup> – even if 50 of the sites had this area of occupancy, the area occupied equates to about 0.05 ha. Some sites are more extensive. For example, around Oatlands, the species is scattered over c. 500 m of the fringe of Lake Dulverton and probably occupies 1-2 ha. I would not be willing to suggest that *Lepidium hyssopifolium* has an area of occupancy of greater than c. 5 ha.

A key question under the *Guidelines* is whether there has been a reduction in the area of occupancy (same values as for extent of occurrence are applied i.e. 50% over 10 years or 20% over 5 years). It is unlikely that the area of occupancy has changed to these thresholds, simply because some subpopulations with the greater area of occupancy are long-persistent.

### Number of mature individuals

The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity, the following points should be borne in mind:

- mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilization);
- in the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which take this into account;
- where the population size fluctuates, use a lower estimate (in most cases this will be much less than the mean);
- reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals);
- in the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding; and
- re-introduced individuals must have produced viable offspring before they are counted as mature individuals.

As with area of occupancy, estimating the total Statewide abundance of mature individuals for *Lepidium hyssopifolium* is difficult due to the lack of information associated with most records. Where information is available, it can be difficult to separate the number of mature individuals from seedlings. This is a difficult concept with the species anyway because often the flush of seedlings, which can achieve "wheatfield" proportions, can include many smaller fertile plants. Most sites do not appear to have more than 100 mature individuals, and many have much less than this. Some sites, however (e.g. Oatlands, Nile Road, Stewarton Bridge), have locally very high abundance, perhaps in the high 100s to low 1,000s of individuals (fertile). However, even a site such as Stewarton Bridge, which was originally described as a "dense" population (and this is how it appeared in 2017), was only estimated with 47 waypoints (even if each waypoint was up to 5 plants, the total population is only 235 mature individuals). In my estimate, the



Statewide population may be in the order of low 1,000s but probably does not exceed 10,000 mature individuals. Importantly, there are few populations with locally high abundance.

### Severely fragmented

The *Guidelines* describe this variable as follows:

The phrase 'severely fragmented' refers to the situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a low probability of recolonisation.

For flora, fragmentation is considered relevant if:

- a. it increases the risk of disease or weed invasion by increasing edge effects; or
- b. it increases inbreeding effects, or decreases reproductive output by reduced pollinator visitation or by decreasing cross compatibility (e.g. because of a decreasing number of S alleles in subpopulations).

Overall *Lepidium hyssopifolium* probably displays a severely fragmented distribution pattern. For some parts of the species' range, if one population were to become locally extinct, there is little opportunity (in most cases) for recolonisation of that site. For example, the site at Falmouth is now considered locally extinct and based on present knowledge, there appears to be no local source of propagules. That said, the fragmentation picture is blurred in some parts of the species' range. For example, there are several reported populations along the Midland Highway, Tunnack Road and Barton Road, and along any one of these road features populations of *Lepidium hyssopifolium* appear to become locally extinct but the species remains present at other sites and there is at least anecdotal evidence for a mechanism of recolonisation. For example, the sites along Tunnack Road may have been created by initial road works and while most sites are now apparently extinct, further road works may re-spread the species from some core sites. Similarly, along the Midland Highway, the loss of one site appears to be "compensated" by the detection of novel sites shortly after. On this basis, the distribution of the *Lepidium hyssopifolium* is probably best described as "partially fragmented".

### **CRITERION (1) – ENDANGERED**

An extant taxon of native flora or fauna may be listed as endangered if it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating. (Section 15(1) of the Act).

A critical concept in this introductory statement of the guidelines for the endangered category is a measure of "long-term survival". There is little doubt that *Lepidium hyssopifolium* has demonstrated such survival, with an increase in the number of populations/locations over time. Another critical concept is knowledge of the "factors causing it to be endangered", which assumes that we have sufficient knowledge to identify such threatening factors and the degree to which they may affect the "long-term survival" prospects of a species. In the case of *Lepidium hyssopifolium*, in my opinion we remain quite uncertain as to most of the threatening factors beyond some nebulous ideas such as inappropriate habitat management. Irrespective of the factors involved, what is quite clear that despite any such factors, *Lepidium hyssopifolium* has persisted at numerous sites in the "long-term" and it has remained present in Tasmania despite these factors operating. On this basis, I argue that *Lepidium hyssopifolium* fails the basic test of the endangered category. However, below I explore each of the more detailed criteria.

The following criteria (A–D) may provide evidence of the level of threat. In order to be considered as endangered at least ONE of the criteria A–D should apply.

(A) Total population reduction in the form of EITHER of the following:



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1. an observed, estimated, or inferred reduction of at least 50% over the last 10 years or within the past three generations of the species, whichever is the longer (to a maximum of 100 years), based on (and specifying) any ONE of the following:

I do not believe that there has been a reduction in any of the population variables of greater than 50% in the last 10 years but the specific factors are considered below. It is difficult to demonstrate that this criterion is met.

a. direct observation;

Direct observation is lacking for many of the subpopulations and this sub-criterion should not be applied.

b. an index of abundance appropriate for the taxon;

There is insufficient information available for most subpopulations to apply this sub-criterion. Because several subpopulations with quite high abundance are extant, it is difficult to see how this threshold would be met.

c. a decline in area of occupancy, extent of occurrence and/or quality of habitat;

The area of occupancy may have declined slightly over the last 10 years but probably not by more than 50% because the loss of any one subpopulation of c. 10 m<sup>2</sup> contributes little to the overall loss of area of occupancy due to some subpopulations with a much greater area. The extent of occurrence has probably changed little in the last 10 years. There has been a reduction in the quality of habitat in the last 10 years at a few sites (e.g. Maclaines Bridge) but most localised extinctions caused by habitat modification (e.g. loss of over-topping conifers, road works, etc.) have occurred much earlier than this.

d. actual or potential levels of exploitation; or

There is no evidence of actual or potential exploitation.

e. the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.

There is no evidence of introduced taxa affecting *Lepidium hyssopifolium*. While some sites supporting the species are "weedy", there is no evidence that introduced species have resulted in the loss of any population. There is no evidence of hybridization between species of *Lepidium* in Tasmania. There is no evidence of pollutants having an impact on *Lepidium hyssopifolium* in Tasmania. Some sites supporting *Lepidium hyssopifolium* also support other species of *Lepidium* (most notably *L. pseudotasmanicum* and/or *L. africanum*, the latter considered introduced) but there is no evidence of the other species out-competing *Lepidium hyssopifolium* (in fact, at several sites such as Oatlands, *Lepidium hyssopifolium* appears to be the dominant species). There is no evidence of parasites on *Lepidium hyssopifolium*.

2. a reduction of at least 50%, projected to be met within the next ten years or the next three generations, whichever is the longer (to a maximum of 100 years), based on (and specifying) any one of (b), (c), (d), or (e) above.

It is difficult to envisage a reduction of this proportion in the next 50 years. On the contrary, it is more likely that further surveys will detect additional sites for the species.

(B) Extent of occurrence estimated to be less than 5,00 km<sup>2</sup> or area of occupancy estimated to be less than 0.1 km<sup>2</sup> (10 ha) for sessile taxa, and any TWO of the following apply:

The extent of occurrence of *Lepidium hyssopifolium* is estimated at 19,183 km<sup>2</sup> (all sites) or about 10-11,000 km<sup>2</sup> if only the confirmed extant sites are considered. That is, the nominal threshold is far exceeded in relation to the extent of occurrence. The area of occupancy is estimated at less than 10 ha, which means the intent of criterion B is met. However, sub-criteria (1), (2) and (3) so not appear to be properly met.

1. Severely fragmented or known to exist at no more than five locations.

The distribution of the species has been described as partially fragmented only and occurs at well over five locations (84 in total, 24 extant, 29 uncertain). I do not believe this sub-criterion is met.





2. Continuing decline, inferred, observed or projected, in any one of the following:

a. extent of occurrence;

The extent of occurrence is likely to remain quite stable, with the population continuing to show geographic and temporal transience.

b. area of occupancy;

As above.

d. area, extent and/or quality of habitat;

This is an interesting concept for a species such as *Lepidium hyssopifolium*, which appears to rely on the maintenance of quite specific anthropogenic habitats. The overall extent of potential habitat will probably remain quite constant but there may be localised modifications that may cause the species to decline (the fact that it has persisted in the absence of over-topping conifers, however, makes this a hard to apply concept).

e. number of locations or subpopulations;

This is likely to fluctuate but I doubt if there will be a measurable decline (this may related to survey effort, however).

e. number of mature individuals.

See sections above – overall population likely to remain steady.

3. Extreme fluctuations in any one of the following:

a. extent of occurrence;

b. area of occupancy;

c. number of locations or subpopulations; or

d. number of mature individuals.

See discussion under sub-criterion (2). The populations of *Lepidium hyssopifolium* appear to fluctuate with seasonal conditions and land use but this is unlikely to result in extreme fluctuations on extent of occurrence. Area of occupancy, number of subpopulations, or number of mature individuals.

(C) Total population estimated to number fewer than 2,500 mature individuals and EITHER:

The critical part of this criterion is if the total population is fewer than 2,500 mature individuals. I have suggested that the Statewide population may be in the order of low 1,000s but probably does not exceed 10,000. It is difficult to be more precise than this. If it is assumed that the population is c. 2,500, then the question is whether the sub-criteria are met.

1. an estimated continuing decline of at least 20% within 5 years or two generations, whichever is the longer (to a maximum of 100 years); OR

No decline of this order is estimated.

2. a continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:

a. i. severely fragmented (i.e. no subpopulation estimated to contain more than 250 mature individuals); or

ii. at least 90% of all mature individuals in a single subpopulation; or

The population is not severely fragmented because some populations support more than 250 mature individuals (although the number of such subpopulation is few e.g. Oatlands, perhaps Stewarton Bridge). It is difficult to argue that more than 90% of mature individuals is in a single subpopulation, although most are in the Oatlands area.

b. extreme fluctuations in number of mature individuals.

I do not believe that there are extreme fluctuations in the number of mature individuals.



(D) Total population extremely small or area of occupancy very restricted. EITHER:

1. total population estimated to number fewer than 250 mature individuals; OR

The total population of *Lepidium hyssopifolium* is well in excess of 250 mature individuals.

2. total population with an area of occupancy less than 0.01 km<sup>2</sup> (1 hectare), and typically in five or fewer locations that provide an uncertain future due to the effects of human activities or stochastic events, and thus capable of becoming extinct within a very short time period.

*Lepidium hyssopifolium* occupies at least 1 ha and occurs in at least 24 extant subpopulations, meaning this criterion is not met.

On the basis of the above consideration of the *Guidelines*, I do not believe that *Lepidium hyssopifolium* properly meets the intent of the criteria for the endangered category. That said, many of the estimates are vague and nebulous and applying the criteria is difficult. Taking a cautionary approach is recommended and it is suggested that the status of species should remain as endangered. The criteria for the vulnerable category are considered below, and it appears the species better meets those.

### **CRITERION (3) – VULNERABLE**

A taxon of native flora or fauna may be listed as vulnerable if it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating. (Section 15(3) of the Act).

The following criteria (A–D) may provide evidence of the level of threat. In order to be considered as vulnerable at least ONE of the criteria A–D should apply.

(A) Total population reduction in the form of EITHER of the following:

1. an observed, estimated, or inferred reduction of at least 20% over the last 10 years or within the past three generations, whichever is the longer (to a maximum of 100 years), based on (and specifying) any ONE of the following:

a. direct observation;

b. an index of abundance appropriate for the taxon;

c. a decline in area of occupancy extent of occurrence and/or quality of habitat;

d. actual or potential levels of exploitation; or

e. the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.

This criterion is phrased the same as criterion (A) of the endangered category but the reduction is set at 20% not 50%. While it was difficult to demonstrate a decline of 50% in any of the factors listed, implying a 20% reduction is much easier.

2. a reduction of at least 20%, projected to be met within the next ten years or the next three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above. Criterion A would not be applied to species that could reasonably be expected to have very large and widespread populations not subject to the agency of decline. The Committee would normally take a flexible and pragmatic approach towards species that show exceptionally high inter-annual variation in abundance.

See above.

(B) Extent of occurrence estimated to be less than 2,000 km<sup>2</sup> or area of occupancy estimated to be less than 0.5 km<sup>2</sup> (i.e. 50 ha) for sessile taxa, and any TWO of the following apply:

The extent of occurrence is estimated (for extant sites only) as greater than 10,000 ha but the area of occupancy far less than 50 ha.



1. severely fragmented or known to exist at no more than ten locations.

This criterion is phrased the same as criterion (B) of the endangered category but the number of locations set at 10 not five. The species' distribution is best described as partially fragmented and it occurs at far greater than ten locations.

2. continuing decline, inferred, observed or projected, in any one of the following:
  - a. extent of occurrence;
  - b. area of occupancy;
  - c. area, extent and/or quality of habitat;
  - d. number of locations or subpopulations; or
  - e. number of mature individuals.

See response for the endangered criterion, which is phrased the same.

3. extreme fluctuations in any one of the following:
  - a. extent of occurrence;
  - b. area of occupancy;
  - c. number of locations or subpopulations; or
  - d. number of mature individuals.

See response for the endangered criterion, which is phrased the same.

Criterion (b) is probably not properly met.

(C) Total population estimated to number fewer than 10,000 mature individuals and ANY ONE OF THE FOLLOWING:

The total population has been estimated as fewer than 10,000 mature individuals.

1. an estimated continuing decline of at least 10% within 10 years or three generations, whichever is the longer (to a maximum of 100 years); OR

While it is difficult to estimate a rate of decline, a 10% decline is not particular high and is certainly possible to envisage.

2. a continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
  - a. severely fragmented (i.e. no subpopulation estimated to contain more than 1,000 mature individuals; or

The population is not severely fragmented but perhaps only the population(s) around Oatlands contain more than 1,000 mature individuals.

- b. all individuals are in a single subpopulation; OR

Individuals are in more than one subpopulation.

3. a continuing decline, observed, projected, or inferred, in numbers of mature individuals combined with extreme fluctuations in number of mature individuals.

I do not believe that there are extreme fluctuations in the number of mature individuals.

(D) Total population very small or area of occupancy restricted. EITHER:

1. total population estimated to number fewer than 1,000 mature individuals; OR

Total population estimated at well over 1,000 mature individuals.

2. total population with an area of occupancy less than 0.05 km<sup>2</sup> (5 hectares) and typically in five or fewer locations that provide an uncertain future due to the effects of human activities or stochastic events, and thus capable of becoming endangered in a very short time period.



The area of occupancy is estimated at well under 10 ha but it is difficult to be more precise under the 5 ha threshold but I believe this may be the case. However, the species occurs in many more than five locations.

On the basis of the above consideration of the *Guidelines*, I believe that *Lepidium hyssopifolium* better meets the intent of the criteria for the vulnerable category than the endangered category because the category "copes" with vague and nebulous estimates of various populations factors better. However, I do not recommend a re-consideration of the formal conservation status of the species (see reasons under the endangered category).

### CRITERION (4) – RARE

A taxon of native flora or fauna may be listed as rare if it has a small population in Tasmania that is not endangered or vulnerable but is at risk. (Section 15(4) of the Act).

There are two terms within this statement that are not defined in the *Guidelines* and are subjective. The first is "small population" and the key question is whether *Lepidium hyssopifolium* can be considered to have such a population. On the basis that most confirmed/extant sites for the species support well under 1,000 mature individuals each (most well under 100 mature individuals), it is reasonable to consider the Statewide population of mature individuals to be "small". The second term is "not endangered or vulnerable but is at risk".

The following criteria may provide evidence of the level of threat. In order to be considered as rare at least ONE of the criteria A-B should apply.

(A) A taxon of limited distribution or numbers, threatened by existing on-going processes occurring over sufficient of their range to suggest that they would satisfy the indicative criteria for vulnerable unless the threatening process was abated based on (and specifying) any one of the following:

1. the extent of occurrence is less than 80 x 80 km or 2,000 km<sup>2</sup>;

Extent of occurrence of extant sites is greater than 10,000 km<sup>2</sup>.

2. the area of occupancy is not more than 0.5 km<sup>2</sup> (50 hectares);

Area of occupancy estimated to be well under 10 ha.

3. taxa that are not A1 or A2 above, but that have very small and localised subpopulations wherever they occur (generally no subpopulation with an area of occupancy greater than 0.01 km<sup>2</sup> (1 hectare) and no more than 1,000 mature individuals)

Most subpopulations occur in an area well under 1 ha and most support well under 1,000 mature individuals.

(B) Total population small or restricted and at risk in the form of EITHER of the following:

1. the total population consists of fewer than 10,000 mature individuals, and no more than 2,500 mature individuals occur on land that is in an area free from sudden processes capable of causing largely irreversible loss of individuals or habitat; OR

Total population of mature individuals is estimated at fewer than 10,000. It is difficult to estimate the proportion of the population that is in an area free from the type of threats indicated but the intent of the sub-criterion is met in that virtually no subpopulations occur in "secure" sites.

2. 90% of mature individuals occur in 15 or fewer subpopulations or locations and no more than 5 of these occur in an area that is free from sudden processes capable of causing largely irreversible loss of individuals or habitat.

This is difficult to estimate but most of the total population occurs in a small number of subpopulations (e.g. Oatlands, Stewarton Bridge, Nant Lane) and the intent of the criterion is considered to be met.



On the basis of the above consideration of the *Guidelines*, I believe that *Lepidium hyssopifolium* properly meets the intent of the criteria for the rare category, generally far exceeding the nominal thresholds and concept statements suggesting its status should be vulnerable or endangered.

### MANAGEMENT OPTIONS

#### *General*

It is clear that the persistence of *Lepidium hyssopifolium* in Tasmania will be reliant on actions (or inactions – see below) of local government authorities in combination with private landowners i.e. the key extant populations are either on private land and/or council-managed road verges adjacent to private property. To date, I am unaware of any attempts by local government authorities to actively manage *Lepidium hyssopifolium*. This is a conservation matter that needs to be guided by DPIPWE, not DofSG.

In my opinion, there are four broad management options available for *Lepidium hyssopifolium* in Tasmania, which are outlined below:

1. no management
2. ex situ conservation only
3. benign neglect
4. active management.

#### OPTION 1: no management

While this may seem an extreme line to take with an “endangered” species, I am concerned that there is no substantive evidence that any form of active management has resulted in a direct benefit to the species in Tasmania. Usually active management aims to maintain the population in its current state or improve its status (e.g. increase in numbers). The abundance of *Lepidium hyssopifolium* at any particular site appears to be unrelated to management actions at a site, except where the management has resulted in the loss of over-topping ornamental trees (which has generally resulted in a decrease in abundance or in some cases the complete loss of the population).

I remain strongly of the view that the “active management” at the Maclaines Creek bridge site was always inappropriate for the species and that the notion of attempting to increase the size of the “natural” population from c. 60 plants to 300+ was nonsensical (habitat removed and then further modified). There are other examples of active management that have failed. For example,

#### OPTION 2: ex situ conservation only

In my opinion, this is a genuine long-term conservation management option for the species. If there is little (or no) active management of wild populations, ensuring that the species is represented in ex situ conservation programs is important. The species is already included in collections of the Millennium Seed Bank Project (Dennistoun Road site) and further collections would ensure that the genetic diversity of the species is represented. This option was rejected as part of the alternative offset package for the Maclaines Bridge site.

#### OPTION 3: benign neglect

This term is used to refer to the current management at almost all sites for *Lepidium hyssopifolium* in Tasmania. That is, no active management of the species but routine



management of the site supporting the species such as slashing of roadside grass. My finding is that sites subject to benign neglect usually support the best performing populations of *Lepidium hyssopifolium*. For example, many road verge sites (mainly council-managed) are obviously long-persistent and include multi-aged and locally abundant populations. The extreme of this is observed around Oatlands where the species is acting as a weed of gravel car parks and "lawns" in recreation areas. Other examples include sites such as York Plains Road, Nile Road, Stewarton Bridge and Ormley, where the species is performing extremely well, despite roadside management or complete neglect.

Part of the argument for managing *Lepidium hyssopifolium* by benign neglect is that there is simply no evidence that throwing resources at active management of a site results in a manifest benefit for the species. On the contrary, it seems much more likely that if a site is benignly neglected for a decade or two, that the species will still be present in much the same state as the present.

### OPTION 4: active management

Active management is appropriate for some sites where the species is directly threatened by proposed works. Two recent examples include the protection of the population of *Lepidium hyssopifolium* by barrier mesh around the sites: at Ouse for protection during weed spraying and at Fingal for protection during bridge works. Note that these examples demonstrate the principle of maintaining the status quo – there was no intention to increase the local population (as was the apparent objective at Maclaines Bridge).

### **Management options – sites under jurisdiction of State Growth**

Within the road network under the direct jurisdiction of the Tasmanian Department of State Growth, there are several sites supporting extant subpopulations of *Lepidium hyssopifolium* (Table 4). Sites of uncertain status or presumed extinct are not included in this consideration.

#### **Maclaines Creek, Triabunna**

This site once supported *Lepidium hyssopifolium* but was modified for the construction of a new bridge. The modification involved the removal of all of the mature conifers under which the species was growing, which was followed by an attempt to re-establish the species under a new set of low shrubs never associated with the species. I have previously discussed the futility of further active management of this site.

As part of the present assessment of known sites of *Lepidium hyssopifolium*, I took the opportunity to once again survey this population. Interestingly, there are now 50 individuals (admittedly mainly seedlings but also several mature and fertile individuals), which is approaching the maximum ever reported from this general area of 60. Certainly, what is clear is that despite the failed active management, the species has persisted under the old radiata pine at the entrance to "Woodstock" (and now represented by both mature individuals and 15 seedlings – it was a "good" season for weedy species on road verges across the State), remains present under the old spruce at the end of the "reserve", is still present in the "reserve" and has now colonised the dense grass at the entrance to the reserve (under the gate). Refer to more detailed site report for more information.

I remain of the view that further active management of this site is not warranted. The most appropriate course of action is a "watching brief" of how the species performs under a regime of benign neglect. I recommend periodic assessments of the site (but not formally scheduled) and informal recording of how the abundance and distribution changes over time. I do not suggest any particular slashing regime or special protection of individuals in any location i.e.





simply see how the species performs. If State Growth wishes to install the standard yellow roadside markers, I do not object to this but they will serve little practical function.

**Table 4.** Summary of populations of *Lepidium hyssopifolium* under State Growth jurisdiction

No.	Location	(T)enure (I)BRA (M)unicipality (N)RM	Status	Suitable for addition to roadside conservation program
18a	Lyell Highway, c. 2 km SE of Ouse	T: State Growth I: South East M: Central Highlands N: South	<b>EXTANT (vouchered)</b>	<b>NO</b> See reasoning in text.
39	Maclaines Creek, Triabunna	T: State Growth I: South East M: Glamorgan-Spring Bay N: South	<b>EXTANT (vouchered)</b>	<b>Part of current RCP.</b>
40	Spring Hill, Midland Highway	T: State Growth I: South East M: Southern Midlands N: South	<b>EXTANT (vouchered)</b>	<b>NO</b> See reasoning in text.
46	[Tunnack Road, c. 200 m W of 'Woodstock']	T: State Growth I: South East M: Southern Midlands N: South	<b>EXTANT (vouchered)</b>	<b>NO</b> See reasoning in text.
69	Ormley, Esk Main Road	T: private & State Growth I: Northern Midlands M: Break O'Day N: North	<b>EXTANT (vouchered)</b>	<b>Part of current RCP.</b>
73	East of Fingal. Esk Main Road at Fingal Culvert no. B3169	T: State Growth? I: Ben Lomond M: Break O'Day N: North	<b>EXTANT (vouchered)</b>	<b>NO</b> See reasoning in text.
74	Falmouth	T: State Growth I: Flinders M: Break O'Day N: North	<b>LOCALLY EXTINCT (vouchered)</b>	<b>Part of current RCP.</b>

### Lyell Highway, c. 2 km SE of Ouse

The context for long-term conservation management of this site is poor. The species is restricted to a small patch in dense roadside grass. It appears to have been present for some time (based on size of some plants), although this cannot be certain. In the absence of any active management, it seems likely that the species will persist for some time, perhaps eventually disappearing through natural attrition. Occasional (but unplanned) roadside slashing of grass is likely to be beneficial. However, no timing (schedule, time of year) is suggested because the species has flowers and fruit for much of the year.

In my opinion, this site is not suitable for formal inclusion in the Department of State Growth's Roadside Conservation Program. At most I recommend that the standard yellow roadside markers be placed about 10 m each side of the patch. I do not recommend a particular slashing regime. It may be prudent to suggest that any herbicide application within the marked zone be a grass-only herbicide, although even this may not be beneficial to the species because while it may reduce the cover of grass, it will probably only encourage the growth of herbaceous



weeds, which may outcompete *Lepidium hyssopifolium*, which is probably “hanging on” because of the shade afforded by the tall grass.

### Falmouth

This is one of State Growth’s current Roadside Conservation Program sites. *Lepidium hyssopifolium*, however, now appears to be locally extinct. I recommend that no active management is warranted for this site. Any notion of attempting to “revive” the population, by actions such as scraping the ground to attempt to re-activate soil-stored seed, is not supported. As with Maclaines Creek, periodic and informal monitoring is suggested.

### “Ormley”, Esk Main Road

This is one of State Growth’s current Roadside Conservation Program sites. *Lepidium hyssopifolium* is performing extremely well (see site report), present in high numbers along the densely grassy roadside verge and extending into the private property. The species appears to be tolerating the roadside slashing and herbicide regime, persisting in the gravel of the immediate road verge (this is quite typical for the species viz. Oatlands where it grows through compacted blue metal and gravel of car parks).

I see no need to change the current management regime at this site. I do note, however, that the persistence of the population in the long-term will be reliant on the maintenance of the shading conifers. These are on private property and while there may be an informal agreement to maintain this tree, State Growth has no direct influence over this (e.g. landowner changes, primary production priorities, etc.). It is noted that this is one of the longer-persistent sites for the species and continuing the effort to maintain the population is warranted.

### East of Fingal. Esk Main Road at Fingal Culvert no. B3169

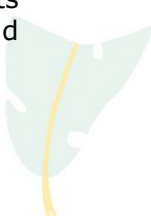
Technically, all the recorded individuals of *Lepidium hyssopifolium* at this location are on the private title and not within the easement title under State Growth’s jurisdiction. The population is present under mature *Pinus radiata* on private titles, which State Growth have no control over. As such, the long-term prospects for this site, even if it were under State Growth jurisdiction, are subject to the vagaries of the private land owner and local government restrictions on removal of trees on private land. Adding this site to the formal Roadside Conservation Program would not serve any manifest benefit for the species.

Note that I am fully supportive of the fact that (a) the works area was surveyed prior to works and threatened flora identified; and (b) on-site management (barrier mesh) during works to minimise the risk of inadvertent disturbance (such as dumping further gravel on the population).

### Tunnack Road, c. 200 m W of “Woodstock”

This is one of several sites along Tunnack Road between Baden (southern end) and Oatlands (northern end) for *Lepidium hyssopifolium* that may have originated from one or two roadside gravel piles, possibly sourced from around Oatlands, where *Lepidium hyssopifolium* is locally abundant. The sites along Tunnack Road were nearly all short-lived as none occurred in typical habitat i.e. not under large old conifers – sites appeared to be random adventitious “pop-ups” caused by road works (Tunnack Road was extensively re-sealed).

Of all the sites checked, this is the only one that was extent. It is restricted to a few plants growing about 1-2 m from the sealed road edge amongst frequently slashed dense grass and



weeds. The long-term prospects are poor and it is reasonable to assume this localised patch is just “hanging on” by chance. For the record, State Growth has a permit under the Tasmanian *Threatened Species Protection Act 1995* allowing all maintenance works to be undertaken within 3 m of the sealed edge of a road without consideration of threatened flora that may be growing in roadside gravel. I fully support this management regime. It would be nonsensical to then manage this localised site as a part of the formal Roadside Conservation Program, especially since road maintenance works would also be exempt from referral under the EPBCA.

### Spring Hill, Midland Highway

This population comprises two main parts: there is a locally dense patch on the eastern side of the Midland Highway under some weedy wattles, and two patches on a steep rise on the western side of the Midland Highway above the truck pull-off.

The eastern population is restricted to the shade of several closely-planted introduced wattle species (*A. baileyana*, *A. pravissima*, *A. floribunda*, *A. longifolia*). It is assumed that these were planted as some form of highway beautification. However, as with many of these shrubby wattles, these specimens are all showing signs of senescence (these species simply do not live long). Current management is to slash the grass around the clump of wattles only.

As soon as the wattles die, it is presumed that *Lepidium hyssopifolium* will begin to decline. It may persist amongst dense grass for some time (as it has at sites such as Hollow Tree Road) and may even spread due to roadside slashing now being able to cut through the fertile heads and deposit seed further afield. This obviously implies that active management is not warranted. Note that I am not suggesting that the population should not be protected during any road works – I fully support temporary protection measures (such as barrier mesh and/or bollards) to minimise the risk of inadvertent disturbance during works.

The two sites on the western side of the highway are actually growing on the flat above the now very steep roadside batter – this flat is the old alignment of the Midland Highway. The northern patch occurs under planted (c. 20-30 years old?) *Eucalyptus globulus* and the introduced *Acacia baileyana*. The southern patch is growing amongst very dense grass and young *Acacia dealbata*. There is no active management of either of these patches. There is no reason to expect that the species will not persist in the long-term in the continued absence of active management i.e. benign neglect is recommended for this site. I understand that the species has been fully accounted for in the design of proposed upgrades to the Midland Highway in this area and that there will be no disturbance to this part of the population.

There is no practical need to install the standard yellow roadside markers for either the eastern or western side of the highway as they will serve no practical purpose. This is based on the current road configuration but may need to be re-assessed if changes affect how exposed the populations become to inadvertent disturbance.

### Management options – alternative

Condition 6 of the varied EPBC 2007/3089 required that:

6. The person taking the action must utilise the findings of the literature review and Survey Plan required under condition 3 to prepare a Species Management Plan. The Species Management Plan must include but not be limited to:
  - detailed information on sites containing *L. hyssopifolium* that can be managed to maintain a long-term population under the Department of State Growth's Roadside Conservation Program;
  - site condition and current land management practices;



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- information about proposed short and long term management measures, including responsible parties, objectives and timeframes;
- specific management actions and associated timeframes, including corrective measures if populations numbers decline; and
- proposed monitoring and reporting measures.

The Species Management Plan must be submitted to the Department for approval by 30 June 2017.

The person taking the action must commence implementing the approved plan no later than 30 September 2017.

In my opinion, there are no subpopulations of *Lepidium hyssopifolium* at sites subject to the jurisdiction of the Department of State Growth that are suitable for inclusion in the Roadside Conservation Program. However, there are several actions that could benefit the species. These are outlined below for consideration.

- Database management

Ensure all sites of *Lepidium hyssopifolium* are incorporated into DPIPWE's *Natural Values Atlas* (through a batch input of novel data collected during the course of this project by the consultant), including the corrections recommended in Table 1. The NVA is the standard database routinely accessed by planners and consultants working on State Growth projects. Note that State Growth cannot make changes to existing records the *Natural Values Atlas* and can only facilitate this through supply of the present report and through consultation with representatives of DPIPWE.

- Case-by-case consideration of known sites

If a known site of *Lepidium hyssopifolium* is present within or close to proposed works, a survey by a suitably qualified person should be undertaken to document the extent of the population to develop, if practical, on-site measures to protect the population during and post-works.

If the population cannot be practically protected, a permit under the Tasmanian *Threatened Species Protection Act 1995* will need to be sought from DPIPWE. If that permit is issued, a consideration of the need for referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* will need to be made. This would include a detailed review of the *Significant Impact Guidelines (CofA 2013)* and any other relevant provisions of the Act (e.g. Section 43B – exemption for maintenance works).

There are several examples where case-by-case site-specific management has resulted in the appropriate protection of *Lepidium hyssopifolium* during works. This includes a recent bridge replacement at Fingal and weed spraying near Ouse (barrier mesh used to protect the sites at both locations). Ongoing and complex monitoring was not considered warranted for these sites.

- Management of potential habitat

Most major works that occur under State Growth's jurisdiction are already subject to detailed and appropriate ecological assessments and reporting that meet DPIPWE's *Guidelines for Natural Values Assessments – Terrestrial Development Proposals* (DPIPWE 2015). Such surveys are how most of the road verge populations of *Lepidium hyssopifolium* have been discovered. No change to this process is suggested.

Minor works, however, may be subject to less rigorous site assessments. For example, managing one or two roadside trees. Often such actions "come up" during the course of routine inspections, discussions with adjacent land owners, etc. and are done "on the fly". For most threatened flora and fauna, the risk of such minor works significantly impacting on a localised population is very



low. However, for *Lepidium hyssopifolium*, a sub-set of these ad hoc actions may have a significant impact on previously undetected populations i.e. the removal (or substantial modification) of mature roadside ornamental conifers and eucalypts.

It is recommended that State Growth implement a system whereby when such trees require management, the potential for the site to support *Lepidium hyssopifolium* is considered. This may mean that a site survey by a suitably qualified person is undertaken. If the species is absent, obviously the works can continue. If the species is present, case-by-case management would be developed as per the section above i.e. it becomes a "known site". Note that this recommendation does not apply to routine maintenance activities and emergency-type activities –this recommendation targets actions such as removing a line of ornamental conifers from along a private fence at a request of a landowner or from a site office in a paddock as part of a broader road works project that may not have been considered in the natural values assessment.

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- Andrew North (North Barker Ecosystem Services): detailed commentary on draft table of populations and provision of various reports and management plans;
- Joe Quarmby (environmental consultant): details on population near Ouse on Lake Highway;
- Grant Daniels (North Barker Ecosystem Services): general discussion on some populations and management options;
- Richard Schahinger, Wendy Potts & Tim Rudman (DPIPWE): details on Bass Strait island populations;
- Lorilee Yeates (Environmental Consulting Options Tasmania): field work assistance (Lauderdale) and discussion of findings; and
- James Wapstra (Environmental Consulting Options Tasmania): field work assistance (Mount Nelson Signal Station).

## **ABBREVIATIONS**

AD	State Herbarium of South Australia, Adelaide
ALA	<i>Atlas of Living Australia</i>
CANB	Australian National Herbarium, Canberra
DofE&E	Commonwealth Department of the Environment & Energy
DPIPWE	Tasmanian Department of Primary Industries, Parks, Water & Environment
DofSG	Tasmanian Department of State Growth
EPBCA	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
HO	Tasmanian Herbarium, Hobart





MEL	National Herbarium of Victoria, Melbourne
NSW	National Herbarium of New South Wales, Sydney
NVA	<i>Natural Values Atlas</i>
TMAG	Tasmanian Museum & Art Gallery
TSPA	Tasmanian <i>Threatened Species Protection Act 1995</i>

### **DISCLAIMERS & QUALIFICATIONS**

The opinions expressed in this document are those of the author and not necessarily the Department of State Growth.

I have explored several aspects of the ecology and collections of *Lepidium hyssopifolium* in Tasmania and made conclusions (or hinted at such conclusions) that are not in accordance with peer-reviewed literature. I have done this to ensure that management decisions (and commitment of public resources) with complete consideration of the context of the species.

For the record, I have concluded that unless there is critical evidence to the contrary, *Lepidium hyssopifolium* should be treated as a native species that is classified as an endangered species at both the Commonwealth and State level. While I have not advocated for additional sites to be added to a program of long-term active management and monitoring, I do wholly support the appropriate case-by-case management of known sites during works that may impact on the species.



APPENDIX A. Population review

**Table 1.** Locations (subpopulations) of *Lepidium hyssopifolium* in Tasmania based on records held in the *Natural Values Atlas* and the *Atlas of Living Australia* and collections held at the Tasmanian Herbarium (and other institutes)

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
0	[Long Island]	Literature (Scarlett et al. 1973; Harris et al. 2001)	Not applicable.	Not applicable.	T: uncertain I: Flinders M: Flinders Island N: North	None.	Not applicable.
<p>Scarlett et al. (1973) described the floristics of the Hogan Group and noted the occurrence of <i>L. hyssopifolium</i> on both Hogan Island and Long Island but no further details were provided.</p> <p>Harris et al. (2001) in "Harris et al. (2001) in <i>One Hundred Island: The Flora of the Outer Furneaux</i> note that "It [<i>Lepidium hyssopifolium</i>] occurs in the <i>Allocasuarina</i> forest". The source of this information is not reported but later correspondence between John Whinray and the Threatened Species Section clearly indicated that any collections he had made from the island have now been identified as <i>Lepidium desvauxii</i>.</p>							
0	[Hogan Island]	ALA Literature (Scarlett et al. 1973; Carlyon et al. 2011)	Not applicable.	Not applicable.	T: unallocated Crown I: Flinders M: Flinders Island N: North	Has already been deleted from NVA – next exchange between NVA and ALA should result in deletion from ALA.	Not applicable.
<p>The ALA includes a record attributed to Tim Rudman from 31 Dec. 1989 and allocated to NVA 1239947. This record does not appear in DPIPWE's version of the NVA because it was deleted after correspondence between DPIPWE and Bob Parsons in August 2012: "I work with Neville Scarlett, who is the best taxonomist for Vic.- Tas. <i>Lepidium</i>. He says for that record that because there is no specimen the plant could have been <i>L. africanum</i>, <i>L. desvauxii</i> or <i>L. pseudotasmanicum</i> and so should be deleted - unless the recorder/observer is known to have a good knowledge of that difficult group. This is especially so because many workers kept on using the <i>L. h.</i> binomial for the widespread weed we now know as <i>L. africanum</i>".</p> <p>The original source of the record is in Scarlett et al. (1973), who described the floristics of the Hogan Group and noted the occurrence of <i>L. hyssopifolium</i> on both Hogan Island and Long Island but no further details were provided. The record presumably became attributed to Tim Rudman because of his authorship of the section on flora in: Carlyon, K., Pemberton, D. &amp; Rudman, T. (2011). <i>Islands of the Hogan Group, Bass Strait: Biodiversity and Oil Spill Response Survey</i>. Resource Management &amp; Conservation Division, DPIPWE, Hobart, Nature Conservation Report Series 11/03.</p> <p>In that report, it was noted that: "Six plant species found in the island group are listed as Threatened under the Tasmanian <i>Threatened Species Protection Act 1995</i> and one species is listed as Threatened under Commonwealth legislation (Table 2). Of these all but <i>Lepidium hyssopifolium</i> and <i>Banksia integrifolia</i> were observed in 2011" and "The most critical species for protection <i>Lepidium hyssopifolium</i> has not been recorded on the island since 1968 and its persistence and distribution is unknown". The report also noted the presence of <i>Lepidium desvauxii</i>, <i>L. foliosum</i> and <i>L. pseudotasmanicum</i> for the Hogan Group, presumably meaning the attribution of a specimen to <i>L. hyssopifolium</i> could have been in error.</p>							
0	"Lymington Road, Cygnet"	NVA 943670 (HO 526186)	M. Baker (10 Jul. 2003) 2003	Re-detted to <i>Lepidium pseudotasmanicum</i> by M. Wapstra 14 Dec. 2016.	T: local government I: South East M: Huon Valley	Data exchange agreement between HO and DPIPWE will correct this record.	Not applicable.

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No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
					N: South		
0	[Channel Highway, Cygnet]	NVA 345743	Unknown (1 Jan. 1993)	No information associated with record.	T: local government I: Southern Ranges M: Huon Valley N: South	Suggest record is marked as "uncertain" in NVA unless further information can be found.	Not applicable.
Impractical to attempt to re-locate due to low precision of original data ( $\pm 10$ years) and significant changes to Huon Highway verges since 1993.							
0	[Firthside roundabout]	NVA 356859	P. Barker (12 Sep. 1994)	No information associated with record.	T: local government I: South East M: Kingborough N: South	Delete record as database artefact?	Not applicable.
This record probably relates to <i>Lepidium desvauxii</i> rather than <i>L. hyssopifolium</i> , due to early mis-identifications of the species (A. North pers. comm.). Refer also to file note by North Barker Ecosystem Services: "Re: <i>Lepidium hyssopifolium</i> and <i>Lepidium pseudotasmanicum</i> at the Kingston Interchange" (note to Pitt & Sherry, Jan. 5 2005). Impractical to attempt to re-locate due to low precision of original data and significant changes to Huon Highway verges since 1993.							
1	"Ralphs Bay"	NVA 229371 (HO 15738) NVA 1307443 (HO 15739) HO 104494 (not in NVA)	F.H. Long (23 Jan. 1930) F.H. Long (23 Jan. 1930) F.H. Long (23 Jan. 1930)	No information associated with any of the collections except noted as being a "herb, 0.6m high, flower white" (HO 15739).	T: uncertain I: South East M: City of Clarence N: South	HO 104494 (apparent duplicate of HO 15738 & HO 15739) is not included in the NVA. It may be prudent to shift the database location to somewhere such as Lauderdale to maximise the chance that a standard 5 km NVA search will capture the species (at present, the record is at a random point on the edge of Ralphs Bay).	<b>UNCERTAIN (vouchered)</b>
The specimens are labelled "Ralphs Bay" and could have come from virtually anywhere on South Arm in the region of the bay e.g. Lauderdale, etc. There have been no subsequent records of the species on South Arm. The identity of the specimens is certain. "I thought someone had recorded this under the blue gums at Ralphs Bay??" (A. North pers. comm.) This statement is not supported by NVA information or collections at HO. However, a site survey was conducted by Mark Wapstra on 8 Apr. 2017. The line of mature gums on the western side of South Arm Highway south of Lauderdale was searched (No <i>Lepidium</i> detected), as was the area along the footpath and into the grounds of Lauderdale Primary School on the eastern side of South Arm Highway because this area had a line of mature and younger macrocarpa (and other) pines. <i>Lepidium desvauxii</i> and <i>L. pseudotasmanicum</i> were both detected but no evidence of <i>L. hyssopifolium</i> found. Unfortunately, "Ralphs Bay" is a large search area and it is not reasonable to assign this population a status of anything other than uncertain. SEE SITE REPORT.							

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No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
2	"Mount Nelson Signal Station, No. 689 Nelson Road, old NPWS ranger station"	NVA 930142 (HO 522260)	A. North (1 Jul. 2002)	"14 plants growing in lawn behind house, 2 more plants in bushland 10m downslope of property".	T: Public reserve (Parks & Wildlife Service) I: South East M: City of Hobart N: South	Make minor typographical correction to NVA 343735 ("Nelso" to "Nelson").	<b>LOCALLY EXTINCT (vouchered in part)</b>
	"Mt Nelson, nr signal station"	NVA 343735 NVA 343736 NVA 342634 NVA 342635	W. Potts (12 Nov. 2002)	NVA 343735 labelled "Mt Nelso, PWS house nr signal station". NVA 343736, 342634 & 342635 labelled "Mt Nelson, nr signal station". Otherwise no information associated with any of the records, all of which are presumably GPSed and represent discrete patches defining the one subpopulation.			
<p>HO 522260 was examined and confirmed as <i>L. hyssopifolium</i>. Unfortunately, the other records from the site are not supported by vouchers. I have searched for the species in this area on a number of occasions in the last decade and have never found it. I have found <i>L. pseudotasmanicum</i> to be locally frequent south of the buildings amongst the close-grazed grassy blue gum (no specimens collected).</p> <p>The area was searched again on 16 Apr. 2017 by Mark Wapstra and no evidence of any <i>Lepidium</i> species. The search included the fringes and yard of the "old NPWS ranger station" and around the bases of all tall trees around the signal station. It appears that <i>Lepidium hyssopifolium</i> is now locally extinct.</p> <p>SEE SITE REPORT.</p>							
3	"Glebe, Oakdowns Estate Subdivision, Rokeyby"	NVA 925650	N. Gill (8 Jul. 2004)	"Abandoned pasture with occasional eucalypts- Bursaria-Allocasuarinas", "At least 3 in 1 x 2 m", "5".	T: private I: South East M: City of Clarence N: South	None.	<b>UNCERTAIN (not vouchered)</b>
	[Oakdowns]	NVA 948017	A. North (29 Oct. 2004)	No information associated with record. (same point location as NVA 925650).			
<p>"I inspected to confirm presence of N. Gill record. I think I found even less plants. Only known from a tiny population recorded on the edge of Public Open Space created by recent residential subdivision at Oakdowns. Long term conservation will require a pro-active approach to the management of the particular reserve" (A. North pers. comm.).</p>							

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No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
4	"Howrah Beach, Wentworth Park"	NVA 929982 (HO 523511)	A. North (4 Mar. 2004)	"4 plants only, amongst Phragmites australis behind dunes, beside track".	T: local government I: South East M: City of Clarence N: South	Delete NVA 1047595 (database duplicate of NVA 929982: HO record ± 100 m, other record as ± 10 m and literally a few metres different).	<b>UNCERTAIN (vouchered)</b>
	"Howrah Beach Council Reserve"	NVA 1047595	A. North (1 Mar. 2004)	"4".			
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
5	[Domain (south)]	NVA 300113	J. Kirkpatrick (1 Feb. 1995)	No information associated with record.	T: local government I: South East M: City of Hobart N: South	None.	<b>UNCERTAIN (not vouchered)</b>
	[Domain (north)]	NVA 301102	J. Kirkpatrick (1 Jan. 1995)	No information associated with record.			
<p>MW has searched extensively around both sites in 2016 for projects such as shared use tracks with only <i>Lepidium pseudotasmanicum</i> and <i>Lepidium africanum</i> being detected. In 2007 I wrote (A. North pers. comm.):</p> <p>"This is apparently confined to the growth suppression zones in the shade of several cedars long the Soldiers Memorial Walk. Other recorded sites have been unable to be confirmed for several years despite repeated searches. Management of threatened flora on Soldiers Memorial Walk has been considered in a separate consultancy (Kirkpatrick 2003 and 2006). In these studies plants of <i>L. hyssopifolium</i> were recorded beneath the canopies of six trees in 2003 and at least two in 2006. No evidence could be found in summer 2007. The decline has been explained by the preceding drought conditions but has also driven management recommendations of the vegetation around the relevant trees (Kirkpatrick 2006). Ongoing monitoring is recommended to take place every 3 years in optimum conditions - spring except following winter drought."</p> <p>"I am not confident the 2003 and 2006 IDs were correct. A case of the Emperors clothes?? These were done by JBK for Council but I suspect Jamie used one of his students. Like you I have searched on numerous occasions without success". (A. North pers. comm.).</p>							
6	"Potters Croft" [Ryans Point, Boomer Bay area]	NVA 1068779	A. North (25 Sep. 2008)	"12"	T: private I: South East M: Sorell N: South	None.	<b>EXTANT (not vouchered)</b>
<p>"Site burnt in 2013, blue gums very dense" (A. North pers. comm.).</p> <p>SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
7	"opposite 470 Bay Road, Boomer Bay"	NVA 1234117	A. North (30 Oct. 2010)	"20"	T: local government I: South East M: Sorell N: South	None.	<b>EXTANT (not vouchered)</b>
<p>"Still there in 2016" (A. North pers. comm.).</p> <p>SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
8	[Burnt Hill Road (southeast)]	NVA1234118	A. North (30 Oct. 2010)	"10"	T: local government I: South East M: Sorell N: South	None.	<b>EXTANT (not vouchered)</b>
"Still there in road gravel next to culvert 2017" (A. North pers. comm.). SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
9	[Burnt Hill Road (junction with Bream Creek Road)]	NVA 300453	A. Pyrke (1 Jan. 1993)	No information associated with record.	T: local government I: South East M: Sorell N: South	None.	<b>LOCALLY EXTINCT (not vouchered)</b>
<p>This site was searched by Mark Wapstra on 3 Mar. 2017. Both sides of Bream Creek Road and Burnt Hill Road for c. 100 m from the junction of the roads were searched. Most sections are densely grassy and probably unsuitable (at least at present). Interestingly, the northern side of the first few hundred metres of Burnt Hill Road supports a large fenceline stand of mature macrocarpa pines, superficially ideal habitat for <i>Lepidium hyssopifolium</i>. This area was searched without success. For the record, <i>Lepidium pseudotasmanicum</i> was detected in roadside gravel of Bream Creek Road north of the Burnt Hill Road junction.</p> <p>In the absence of a confirmed population of <i>Lepidium hyssopifolium</i> from this site, development of site-specific management prescriptions is not practical.</p> <p>"Last seen in 2000. Change of owner and more intensive mowing resulted in decline. Extinct" (A. North pers. comm.).</p> <p>"There are more records collected and lodged of <i>L. hyssopifolium</i> growing with <i>L. pseudotasmanicum</i> approx. 3 km along Bream Creek Road to the north. Small single digit nos and population under stress from encroaching <i>Vinca</i> and other weeds and decline of canopy pines and macrocarpa. Odd plants appear in roadside of Bream Creek Road presumably stirred up by graders before disappearing again" (A. North pers. comm.). This area equates approximately to the site mentioned in the preceding paragraph where I only found <i>L. pseudotasmanicum</i> in roadside gravel under a paddock macrocarpa.</p> <p>SEE SITE REPORT.</p>							
10	"Shones Corner, Risdon"	NVA 930327 (HO 522259)	A. North (17 Jan. 2002)	"approx. 40 plants, on N side of bank above Risdon Brook on outside of bend, beneath silver wattle".	T: State Growth I: South East M: City of Clarence N: South	None.	<b>LOCALLY EXTINCT (vouchered)</b>
	[Shones Corner, Risdon]	NVA 780997 NVA 345851	A. North (1 Sep. 1992) Unknown (1 Jan. 1993)	No information associated with either record.			
<p>This site was surveyed on 16 March 2017 by Mark Wapstra. No evidence of <i>Lepidium hyssopifolium</i> was found at any of the sites indicated. <i>Lepidium pseudotasmanicum</i> was found at several micro-sites in this area (confirmed by microscopic examination of the stems from all of the micro-sites). These two species often co-occur and it is possible <i>Lepidium hyssopifolium</i> has been locally eliminated. The site is extremely weedy on the banks of Risdon Brook. The western (presume this coincides with the "N side of bank" mentioned on HO 522259) side is now dominated by overhead-high <i>Reseda luteola</i>, <i>Conium maculatum</i>, <i>Cirsium vulgare</i> and <i>Silybum marianum</i>, with a dense understorey of <i>Vinca major</i>, <i>Prunella vulgaris</i>, <i>Myosotis</i> sp., <i>Euphorbia lathyris</i>, <i>Ulex europaeus</i>, <i>Chrysanthemoides monilifera</i> and exotic grasses. <i>Lepidium pseudotasmanicum</i> is struggling in these conditions (just 12 individuals found). The site is over-shadowed by old macrocarpa pines, superficially ideal for <i>Lepidium hyssopifolium</i>, but none were found. The road verge between the roundabout and the first private entrance to the west was also searched (beneath the pines) with no success. Old pines have also been removed from</p>							



## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>northwest of the roundabout but no evidence of <i>Lepidium</i> species was found here. <i>Lepidium pseudotasmanicum</i> was also found growing in the garden bed of the adjacent private residence (at the southern end of the macrocarpa pines close to the creek) and also under a coppicing <i>Eucalyptus viminalis</i> on the eastern side of Risdon Brook in frequently slashed "paddock".</p> <p>In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i>, this site is not considered suitable as an addition to the roadside conservation program for the species because it is impractical to develop site-specific management prescriptions. State Growth have no control over the management of the macrocarpa pines (all on private property) so if removed, any management for <i>Lepidium hyssopifolium</i> will be effectively rendered moot. Furthermore, almost militant weed control is needed to bring these creek banks back to a semblance of normal native riparian vegetation, and such management would probably eliminate (at least temporarily) any <i>Lepidium</i> species. The adjacent private title (new owners – met on site, uncertain of their title boundary) now extends into Crown land through informal sitting areas and new row plantings of <i>Hakea laurina</i> and <i>Pittosporum tenuifolium</i>, and deep slashing of the vegetation (to ground level).</p> <p>"I can confirm the site has been cleared. Previously in the program then suspended due to decline of L.hyssop. Site in 2001 - plants were under the wattles" (A. North pers. comm.).</p> <p>From: Conservation Sites Progress Report High Priority Botanical Sites Botanical Monitoring Contact No. 1075 April 2009 Prepared for: Department of Infrastructure, Energy and Resources Report by: Christine Corbett and Laurel Waddell and Jen Styger Greening Australia Tasmania: "<i>Lepidium hyssopifolium</i> is no longer present on the site. The habitat has been degraded with growth of cocksfoot grass and other weeds, and the death of the older, shading wattles. There were no <i>Lepidiums</i> found under the new wattles that have grown around the site".</p> <p>SEE SITE REPORT.</p>							
11	"Knights Point"	NVA 944754 (HO 512566)	K. Williams & F. Duncan (27 Mar. 1986)	"Coastal point, with <i>Einadia nutans</i> "	T: local government I: South East M: City of Glenorchy N: South	Delete NVA 300109 as apparent database duplicate of NVA 944754.	<b>UNCERTAIN (vouchered)</b>
	[Knights Point, Windermere Bay Reserve]	NVA 300109	K. Williams (27 Mar. 1986)	No information.			
<p>I have previously recorded <i>L. pseudotasmanicum</i> to be locally common in this area. SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
12	"Black Snake Lane, Granton"	NVA 227784 (HO 304968)	A. Pyrke (4 Nov. 1991)	"Road verge, with <i>Lepidium pseudotasmanicum</i> (see AFP67) and <i>L. africanum</i> (see AFP69), under a large <i>Eucalyptus viminalis</i> " & "only one plant"	T: local government I: South East M: City of Glenorchy N: South	Delete NVA 857213 as apparent duplicate of vouchered NVA 227784. Delete NVA 925334 as directly overlies NVA 227784 (database artefact?).	<b>LOCALLY EXTINCT (vouchered)</b>
	[Black Snake Road, Granton]	NVA 857213 NVA 925334	A. Pyrke (4 Nov. 1991) Unknown (4 Jan. 1991)	No information associated with either of these records.			
<p>Black Snake Road was slow-driven and sections walked on 19 April 2017 by Mark Wapstra. No evidence of <i>Lepidium</i> species was detected. SEE SITE REPORT.</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
13	"Bridgewater Causeway"	CANB 280009.2 CANB 280010.1	D.I. Morris (12 Apr. 1978)	No information associated with either record.	T: State Growth I: South East M: Brighton/Derwent Valley? N: South	Needs to be added to NVA – suggest grid reference positioned on middle of causeway.	<b>UNCERTAIN (vouchered)</b>
<p>Insufficient location information to attempt to re-locate site. In the absence of a confirmed location, this location is not considered suitable for roadside management. This is one of only three collections of <i>Lepidium hyssopifolium</i> from Tasmania not represented in any Tasmanian collections or State-based database i.e. it only came to light through examination of the ALA. SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
14	"Granton, 14km NE of New Norfolk. Derwent River, S bank (E side of bridge)"	NVA 228480 (HO 106136)  Duplicates at: MEL 2014409A AD 98731207 CANB 280010.1	W.R. Archer (21 Apr. 1986)	"Between the roadside and railway line, south bank of Derwent River, E side of the bridge, growing with <i>Lepidium africanum</i> ", "20-25 plants".	T: local government or TasRail I: South East M: City of Glenorchy N: South	Shown in NVA as "unknown" collector but HO 106136 clearly identifies the collector as "W.R. Archer".	<b>UNCERTAIN (vouchered)</b>
<p>Insufficient location information to attempt to re-locate site. SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
15	"Cove Hill"	NVA 1307446 (HO 544013)  NVA 1206856	D. Ziegeler (15 May 2006) D. Ziegeler (1 Jun. 2006)	"Two plants present over one square metre", "Degraded <i>Eucalyptus viminalis</i> grassy woodland on dolerite" (from HO 544013). [Records are c. 100 m apart and probably refer to two slightly different patches representing the one subpopulation].	T: private property I: South East M: Brighton N: South	Correct NVA 1206856 to read "Cove Hill" and not "Waddamana Power line".	<b>UNCERTAIN (vouchered)</b>
<p>"Dave was doing this work as part of a transmission line survey which ended at Waddamana hence the reference. Would need to review report to better understand (A. North pers. comm.). SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
16	"Salmon Ponds c. 8km NW of New Norfolk"	NVA 227068 (HO 106135)  Duplicates at: MEL 2012785A MEL 2014407A AD 98731206	W.R. Archer (20 Mar. 1986)	"Roadside shoulder, with <i>Lepidium pseudotasmanicum</i> ", "25-50 plants".	T: uncertain I: South East M: Derwent Valley N: South	Add collector to NVA record (clearly shown as W.R. Archer on HO 106135).	<b>UNCERTAIN (vouchered)</b>
<p>Original lat/long is given as 42 45 146 58, which was presumably read off the Tyenna 1: 100,000 map, and this positions the site on the "Salmon Ponds". The current NVA point location is just off Salmon Ponds Road (about 50 m up a farm lane) and about 500 m NE of the Salmon Ponds themselves. It is most likely that the population was discovered under the rows of roadside ornamental trees that line most of Salmon Ponds Road].</p> <p>The general area was assessed by Mark Wapstra on 7 Apr. 2017 with no evidence of <i>L. hyssopifolium</i> found. Both <i>L. africanum</i> and <i>L. hyssopifolium</i> were locally frequent about 500 m east of the Salmon Ponds Road junction. Strong suspicion this may be the site of original collection because of the site description.</p> <p>SEE SITE REPORT.</p>							
17	[Lyell Highway, opposite Woolpack Road]	NVA 345404	Unknown (1 Jan. 1993)	No information associated with record.	T: uncertain I: South East M: Central Highlands N: South		<b>UNCERTAIN (not vouchered)</b>
<p>"This came from Jill Hickie state-wide drive by surveys for DoT in 1990. I've never been able to confirm but good chance it was <i>L. pseudotasmanicum</i> in my opinion" (A. North pers. comm.).</p> <p>Mark Wapstra has also surveyed the Woolpack Road junction area (both sides of the Lyell Highway) on three occasions (latest on 7 Apr. 2017) and could not detect the species, although <i>Lepidium pseudotasmanicum</i> and <i>L. africanum</i> are both widespread and locally common on road verges.</p> <p>Woolpack Road was assessed on 7 Apr. 2017 (first few hundred metres, both sides) but no <i>Lepidium</i> found. The verge of the Lyell Highway was not assessed but no likely habitat was detected c. 500 m each side of the Woolpack Road junction.</p> <p>In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i>, this site is not considered suitable as an addition to the Roadside Conservation Program for the species because it is impractical to develop site-specific management prescriptions.</p> <p>SEE SITE REPORT.</p>							
18a	"Lyell Highway, c. 2 km SE of Ouse"	NVA 1475699	J. Quarmby (18 Mar. 2016)	"11"	T: State Growth I: South East M: Central Highlands N: South	None.	<b>EXTANT (now vouchered)</b>
<p>"Not suitable in dense roadside grass subject to mowing. If mowing stopped they would disappear" (A. North pers. comm.).</p> <p>"Just an incidental find during surveys for African Lovegrass - so not included in a report" (J. Quarmby pers. comm.).</p> <p>"This site currently has a temporary barrier around it to protect from roadworks. It is very narrow section of roadside opposite a farm house and is very degraded, essentially non-native pasture grasses and herbaceous weeds. Population appears to have tolerated slashing but doubt whether it persist long-term - definitely at risk of spray-drift. I think it would be very difficult to manage and not sure that it would be worth adding to the RCP. Would be worth banking some seed from though" (J. Quarmby pers. comm.).</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
This site was assessed by Mark Wapstra on 7 Apr. 2017 and <i>Lepidium hyssopifolium</i> found to be present. SEE SITE REPORT.							
18b	"The Ouse"	NSW 136526	J.H. Maiden (Mar. 1918)	No information associated with record.	T: unknown I: South East M: Central Highlands N: South	Needs to be added to the NVA but suggest it be placed on the township of Ouse.	<b>UNCERTAIN (vouchered)</b>
This is one of only three collections of <i>Lepidium hyssopifolium</i> from Tasmania not represented in any Tasmanian collections or State-based database i.e. it only came to light through examination of the ALA. While the specimen has not been seen (held at NSW), the ALA indicates it was determined as the species in August 1977 by H.J. Hewson, author of the Brassicaceae treatment for the <i>Flora of Australia</i> (i.e. considered a reliable identification). The ALA does not have a specific date of collection but suggested 03/1918 (presumably based on other Maiden collections). For the purposes of data analysis, this collection is considered to overlap with the more recent collection from near Ouse (site 18a above) because we can never know what Maiden may have meant by "The Ouse" (odd use of the impersonal pronoun).							
19	"Hollow Tree Road" [near Springhill Creek]	NVA 1215576	A. North (11 Jan. 2011)	"3"	T: local government I: South East M: Central Highlands N: South	None.	<b>LOCALLY EXTINCT (not vouchered)</b>
This site has been the subject of a targeted survey in January 2014 by Mark Wapstra as part of an ecological assessment for the Southern Highlands Irrigation Scheme's distribution pipeline, which was reported in: ECOtas (2014). <i>Ecological Assessment of the Proposed Southern Highlands Irrigation Scheme, Tasmania</i> . Report by Environmental Consulting Options Tasmania (ECOtas) for Tasmanian Irrigation, 10 March 2014. [report effectively in public domain because proposed scheme was referred under the EPBCA and permits were applied for under the TSPA]. That report found that: "A previously reported site for <i>Lepidium hyssopifolium</i> on the eastern verge of Hollow Tree Road near Springhill Creek was not able to be detected despite searches on two different occasions. This site is on the opposite side of the road to the proposed pipeline so should not be materially affected, if still present. <i>Lepidium hyssopifolium</i> can form short-lived but geographically transient populations so failure to re-detect a site is not unusual". In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i> , this site is not considered suitable as an addition to the roadside conservation program for the species because it is impractical to develop site-specific management prescriptions. It is presumed that the species will "pop up" again following some form of roadside slashing of the dense grass, as it appears to have done further north along Hollow Tree Road. It is probably better to consider these sites as geographically and temporally transient and as such, unlikely to be eliminated by any one particular action. The site was again assessed by Mark Wapstra on 7 Apr. 2017. The location of the record and about 150 m each side of the record on both sides of Hollow Tree Road were searched by slow-walking. No evidence of <i>Lepidium hyssopifolium</i> was found. SEE SITE REPORT.							
20	"Hollow Tree Road (W side), just south of Bothwell"	NVA 1465785 (HO 574436)	M. Wapstra (20 Jan. 2014)	"Grassy roadside bank", "Locally common on both sides of road, especially in disturbed (e.g. farm gate, stock gate) and weedy areas".	T: local government I: South East M: Central Highlands N: South	NVA 140253 needs to be altered to "Hollow Tree Road, just S of Grass Hut Rivulet crossing (east verge)" – currently states N of rivulet.	<b>EXTANT (vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	"Hollow Tree Road, just north of Grass Hut Rivulet crossing (west verge)"	NVA 1401272 NVA 1401273 NVA 1401274 NVA 1401275 NVA 1401276	M. Wapstra (24 Jan. 2014)	"road verge, at farm gate, gravel track", "10" "front gate of property", "3" "west verge, on bank", "1" "west verge, on bank", "1" "west verge, on bank", "1" [grid references define extent of population on this side of road]		NVA 140271 needs to be altered to "Hollow Tree Road, just N of Grass Hut Rivulet crossing (east verge)" – currently states S of rivulet.	
	"Hollow Tree Road, just S of Grass Hut Rivulet crossing (east verge)"	NVA 1401253 NVA 1401270	M. Wapstra (24 Jan. 2014)	"road verge amongst metre high weeds/grass", "2" & "3"			
	"Hollow Tree Road, just N [sic] of Grass Hut Rivulet crossing (east verge)"	NVA 1401271	M. Wapstra (24 Jan. 2014)	"road verge amongst metre high weeds/grass", "10+"			

This site was detected in January 2014 by Mark Wapstra as part of an ecological assessment for the Southern Highlands Irrigation Scheme’s distribution pipeline, which was reported in:

ECOtas (2014). *Ecological Assessment of the Proposed Southern Highlands Irrigation Scheme, Tasmania*. Report by Environmental Consulting Options Tasmania (ECOtas) for Tasmanian Irrigation, 10 March 2014. [report effectively in public domain because proposed scheme was referred under the EPBCA and permits were applied for under the TSPA].

That report found that:

"On the road verges just south of Bothwell, the species occurs amongst frequently slashed grass adjacent to a closely grazed paddock (and also in the highly disturbed stock-trampled ground at a paddock gate) alongside Hollow Tree Road. The species also occurs on the opposite (eastern) side of the road (the pipeline is proposed for the western side of the road) amongst dense exotic grass and weeds. Both patches are novel sites for the species".

Managing this site may be problematic in that the species is most prevalent on the very weedy and densely grassy (frequently slashed and/or grazed low) verges of the road but very close to a significant entrance to a farm (the species grows around the posts of the main stock access gate). Options for fencing and/or controlling slashing and stock access in any realistic manner are probably highly limited.

The site was assessed again on 7 Apr. 2017 by Mark Wapstra. The species is still present on both sides of the road, in about the same abundance and extent as in 2014. This site remains somewhat enigmatic in that the species is growing amongst dense grass and there is no shading from ornamental conifers or old eucalypts (and no evidence that this was ever the case). It is assumed that the source of this population may be frequent stock movement along the wide grassy roadside verge combined with infrequent

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>roadside grass slashing. The species continues to persist at the entrance to the stockyards on the western side of the road, indicating its very high tolerance for stock trampling and soil compaction and muddying.</p> <p>This population provides a very good example of managing the species through benign neglect i.e. maintain the status quo and do not change whatever is being done now to try to benefit the species. It is also a good example of the concept of geographic and temporal transience of the population with subtle shifts in the location of individuals over a short period (2014 to 2017 data point comparison).</p> <p>SEE SITE REPORT.</p>							
21	"Bothwell"	NVA 227171 (HO 443073)	L. Gilfedder (11 Nov. 1991)	"Under exotic conifer".	T: unknown I: South East M: Central Highlands N: South	None.	<b>UNCERTAIN (vouchered)</b>
<p>Insufficient information to relocate the original site of collection (presumably in the middle of Bothwell somewhere and therefore Council-managed site).</p>							
22	[Bothwell cemetery]	NVA 300897 NVA 954321	L. Gilfedder (1 Jan. 1991) G. Green (1 Nov. 2006)	"10" (NVA 954321)	T: private I: South East M: Central Highlands N: South	None.	<b>EXTANT (now vouchered)</b>
<p>Two records close to one another, Gilfedder record is ± 100 m and slightly to the northwest; Green record is ± 10 m and in middle of historic part of cemetery.</p> <p>Survey was conducted by Mark Wapstra on 7 Apr. 2017 – species was confirmed from two sites in the cemetery, both under exotic trees (northern site under an old <i>Pinus radiata</i>, western site under ornamental "macrocarpa"-type conifer around graves).</p> <p>SEE SITE REPORT.</p>							
23	"Bothwell, N of fence between school and paddock"	NVA 1401241-NVA 1401247 (7 records)	M. Wapstra (24 Jan. 2014)	"Paddock edge under Macrocarpa pine [...] alongside school fence", "c. 80 individuals between grid references".	T: private I: South East M: Central Highlands N: South	None.	<b>EXTANT (vouchered)</b>
<p>This site was detected in January 2014 by Mark Wapstra as part of an ecological assessment for the Southern Highlands Irrigation Scheme's distribution pipeline, which was reported in:</p> <p>ECOtas (2014). <i>Ecological Assessment of the Proposed Southern Highlands Irrigation Scheme, Tasmania</i>. Report by Environmental Consulting Options Tasmania (ECOtas) for Tasmanian Irrigation, 10 March 2014. [report effectively in public domain because proposed scheme was referred under the EPBCA and permits were applied for under the TSPA]. That report found that:</p> <p>"The species also forms a locally abundant patch immediately north of the Bothwell High School, where it occurs in sandy soil just at the edge of the drip zone of a row of macrocarpa pines (<i>Hesperocyparis macrocarpa</i>) and the start of the grass crop. This site is periodically slashed to maintain a buffer between the pines and the pasture. Occurrence in such highly disturbed situations is not unusual for <i>Lepidium hyssopifolium</i>".</p> <p>SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							



**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
24	[Bothwell, refuse facility E of Bothwell]	NVA 300902	L. Gilfedder (1 Jan. 1991)	No information associated with record. [Record is positioned in NVA directly over refuse site but the associated HO 5222261 that goes with NVA 944455 is placed well to the northwest].	T: local government I: South East M: Central Highlands N: South	Delete NVA 300902 as database duplicate of NVA 944455 (correct site so assign the grid reference of this record to NVA 944455).  The grid reference of 503212 5307233 from NVA 300902 should be assigned to this record, which is placed c. 600 m to the NNW in the middle of a poppy crop.	<b>UNCERTAIN (vouchered)</b>
	"Bothwell tip"	NVA 944455 (HO 522261)	L. Gilfedder (25 Oct. 1993)	"Heathy <i>E. tenuiramis</i> woodland. Weedy area above tip face".			
SITE NOT ASSESSED AS PART OF PRESENT PROJECT (except for brief drive-by and visual assessment, which suggested massive changes to the entrance to the refuse facility and the area around it since the early 1990s). Seriously doubt if the species has persisted. On a nearby road verge, <i>Lepidium africanum</i> was locally abundant.							
25	"Nant Lane, S side, along fence"	NVA1401248 NVA 1401149	M. Wapstra (24 Jan. 2014)	"slashed grassy verge, growing adjacent to fence", "c. 20 between GRs".	T: local government I: South East M: Central Highlands N: South	None.	<b>EXTANT (still not vouchered)</b>
	"Nant Lane, N. side, on slashed grassy verge S of fence"	NVA 1401150 NVA 1401251	M. Wapstra (24 Jan. 2014)	"slashed grassy verge between gravel road and fence", "c. 200+ between GRs".			
<p>This site was detected in January 2014 by Mark Wapstra as part of an ecological assessment for the Southern Highlands Irrigation Scheme's distribution pipeline, which was reported in:</p> <p>ECOtas (2014). <i>Ecological Assessment of the Proposed Southern Highlands Irrigation Scheme, Tasmania</i>. Report by Environmental Consulting Options Tasmania (ECOtas) for Tasmanian Irrigation, 10 March 2014. [report effectively in public domain because proposed scheme was referred under the EPBCA and permits were applied for under the TSPA]. That report found that:</p> <p>"For the record, <i>Lepidium hyssopifolium</i> was also detected on the verges of Nant Lane between "Nant" and Dennistoun Road, where it occurs as a locally dense population on the frequently slashed and grazed grassy roadside verge (both sides of the road)".</p> <p>This site is on a public road verge but appears to be frequently used as a stock route, making ongoing active conservation management problematic to implement, especially since the current land use appears to be manifestly benefiting the species (it persists along the immediate fenceline and probably periodically extends across the grassy verge towards the road during times of low disturbance).</p> <p>The site was briefly re-assessed by Mark Wapstra on 7 Apr. 2017. <i>Lepidium hyssopifolium</i> remains locally abundant on both verges of Nant Lane, both subject to frequent and heavy stock movements. Several large individuals growing through fence on both sides of the road. Extensive regeneration of seedlings on trampled ground. No shading trees at all.</p> <p>SEE SITE REPORT.</p>							

Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
26	<p>"4km along Dennistoun Road, from Bothwell" (1307444) [no site name] (1447188) "Road verge. 4km north from Bothwell, along Dennistown Road" (972366) "3.2km along Dennistoun Road from Bothwell" (1307447) [no site name] (1447189) "3.2km along Dennistown [sic] Road from Bothwell" (1100506)</p>	<p>NVA 1307444 (HO 543627) Duplicate at: CANB 692444.1</p> <p>NVA 1447188 NVA 972366</p> <p>NVA 1307447 (HO 550865) Duplicate at: MEL 2380643A</p> <p>NVA 1447189 NVA 1100506 [all effectively the same site with very minor differences in grid references]</p>	<p>M. Visoiu (2 Feb. 2007)</p> <p>M. Visoiu (2 Feb. 2007)</p> <p>M. Visoiu (2 Feb. 2007)</p> <p>M. Visoiu (14 Jan. 2009)</p> <p>M. Visoiu (14 Jan. 2009)</p> <p>M. Visoiu (14 Jan. 2009)</p>	<p>1307444: "Old plants many-stemmed and rounded under <i>Eucalyptus</i> along fence; younger plants on road margin which was graded <math>\pm</math> 9 months ago. Population size: 4 large and 40 small. Harvested from 25 individuals. Voucher for Millennium Seed Bank Project (Tasmania)", "Road verge beneath single <i>Eucalyptus pauciflora</i>; recent sediments; orange sands; good drainage; 2m x 10m area. Associated species: <i>Austrocynoglossum suaveolens</i> [sic. <i>C. suaveolens</i>] and <i>Dactylis</i>".</p> <p>1447188: "44", "1-50 sq. m."</p> <p>972366: "Older plants (along fence line) many stemmed and rounded. Younger plants developing along road margin which was graded ~9 months ago", "44".</p> <p>1307447: "Population size: 25. Harvested from 7 individuals. Voucher for Millennium Seed Bank Project (Tasmania): Royal Botanic Gardens, Kew,</p>	<p>T: local government I: South East M: Central Highlands N: South</p>	<p>Delete NVA 1100506 as effective duplicate of NVA 1307447.</p>	<p><b>EXTANT (vouchered)</b></p>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
				UK", "Roadside remnant under <i>Eucalyptus viminalis</i> [incorrect – <i>E. pauciflora</i> – see previous record]; good drainage; 3 x 5m area". 1447189: "~25", "1-50 sq. m." 1100506: no information associated with this record.			
<p>Survey was undertaken by Mark Wapstra on 7 Apr. 2017. No individuals were found under <i>E. pauciflora</i> on west side of road (now "rank" with <i>Lomandra longifolia</i> and <i>Dactylis glomerata</i>). Two individuals were located amongst dense <i>Lomandra longifolia</i> under <i>E. pauciflora</i> on eastern side of road (i.e. there has been an apparent massive population decline since 2007/2009 when the population was described between 25-44 individuals (although most not noted as large). SEE SITE REPORT.</p>							
27	[Hermitage]	NVA 425248	J. Kirkpatrick (1 Nov. 1984)	No information associated with record.	T: uncertain I: South East M: Central Highlands N: South	None.	UNCERTAIN (not vouchered)
<p>Insufficient information to relocate the original site of collection. In the absence of a voucher specimen, it is difficult to even assign this record to a species. The date of this record is questioned because almost all records attributed to this collector are from 1 Nov. 1994, not 1984. SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
28	"Bagdad Uniting Church, Chauncy Vale Road"	NVA 227789 (HO 504249)  NVA 344876	A. North (8 Oct. 1999) A. North (1 Nov. 1999)	"Amongst graves beneath <i>Cupressus macrocarpa</i> . <i>L. pseudotasmanicum</i> also present", "Small population of <10 plants" (HO 504249).	T: private I: South East M: Southern Midlands N: South	None.	<b>LOCALLY EXTINCT (vouchered)</b>
<p>Site was assessed by Mark Wapstra on 7 Apr. 2017. No evidence of <i>L. hyssopifolium</i> was found. <i>L. pseudotasmanicum</i> was present under the old radiata pine (3 specimens only). SEE SITE REPORT.</p>							
29	"Midland Highway, Bagdad"	NVA 227787 (HO 54417) Duplicate at: MEL 0646957A	D.I. Morris (11 Jul. 1982)	"Roadside, mown verge", "common".	T: State Growth I: South East M: Southern Midlands N: South	None.	<b>LOCALLY EXTINCT (vouchered in part)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	[southern end of Bagdad near Hall Lane]						
	"Bagdad, Midland Highway" [southern end of Bagdad, just north of Winstead Road]	NVA 228417 (HO 29290) Duplicate at: CANB 269788.1	D.I. Morris (1 Feb. 1974)	"Sandy roadside"			
	[Bagdad, Iden Road-Horfield Court junction]	NVA 343704	A. North (1 Jan. 1991)	No information associated with record.			
	[Bagdad, Iden Road-Midland Highway junction]	NVA 344140	Unknown (1 Jan. 1993)	No information associated with record.			
<p>"These sites all inspected in 1999 and again in 2015 (none were located in second survey)" (A. North pers. comm.).            SITE NOT ASSESSED AS PART OF PRESENT PROJECT (insufficient information to re-locate specific locations due to recent intensive road works).</p>							
30	"East side of road opposite the Bagdad Caltex Service Station, 10km N of the Pontville Bridge on the Midland Highway"	NVA 227785 (HO 111852) Duplicates at: CANB 349617.1 & CBG 8406944.a MEL 0697043A	J.D. Briggs (24 Apr. 1984)	"Dark brown clay-loam on mown road verge now dominated by introduced grass species. Adjacent paddocks extensively cleared and heavily grazed", "A nationally endangered species. Occasional along short distance of road verge where about 15 large plants and 30-40 seedlings and smaller plants were observed".	T: State Growth I: South East M: Southern Midlands N: South	Record currently lands on the AGD66 easting/northing crosshairs along Swan Street so this could be corrected based on the detailed location name associated with HO 111852. J.D. Briggs can be allocated as the collector (shown as unknown on NVA record). Suggest information is added to NVA 344878 as per details below.	<b>LOCALLY EXTINCT (vouchered)</b>
<p>"This site was included on the Register of the National Estate. In 1990 was marked out. Mowing stopped and plants were swamped by grass. Then a macrocrapa over fence was removed reducing habitat quality further. Uni trials with scraping failed to stir up any plants. I inspected it over many years without success. Presume extinct" (A. North pers. comm.).</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>"This survey covered several of your Bagdad /Dysart subpopulations: From National Highway - Pontville to Dysart Botanical Survey and Fauna Habitat Assessment Forming part of the Bagdad Planning Study Maunsell McIntyre Pty Ltd January 2000" (A. North pers. comm.): "road reserve, Midland Highway, Bagdad (GR 51795 528300) 0 in 2000, 50 in 1990". SITE NOT ASSESSED AS PART OF PRESENT PROJECT (insufficient information to re-locate specific locations due to recent intensive road works).</p>							
31	[Bagdad, SE corner of training track]	NVA 857212	A. Pyrke (1 Jan. 1990)	No information associated with record.	T: private I: South East M: Southern Midlands N: South	None.	<b>UNCERTAIN (not vouchered)</b>
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
32	"Bagdad" [middle of training track]	NVA 944527 (HO 522300)	L. Gilfedder (1 Jan. 1990)	"In horse paddock"	T: private I: South East M: Southern Midlands N: South	None.	<b>UNCERTAIN (vouchered)</b>
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
33	"Private Paddock, E Bagdad Rd"	NVA 344878	A. North (1 Nov. 1999)	No information associated with record.	T: private I: South East M: Southern Midlands N: South	Suggest information is added to NVA 344878 as per details below.	<b>UNCERTAIN (not vouchered)</b>
<p>"This survey covered several of your Bagdad /Dysart subpopulations: From National Highway - Pontville to Dysart Botanical Survey and Fauna Habitat Assessment Forming part of the Bagdad Planning Study Maunsell McIntyre Pty Ltd January 2000" (A. North pers. comm.). That report stated: Private paddock, East Bagdad Rd, GR 51845 528320, c. 5-10, new site - Rosettes of plants in paddock with <i>L. pseudotasmanicum</i>". SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
34	"E Bagdad Rd jct, Midland Hwy"	NVA 343705 NVA 344874	A. North (1 Nov. 1999) A. North (1 Jan. 1995)	No information associated with either record. [Records are coincidental with one another but collected on different dates. The point location is on the western side of the Midland Highway, just north of the East Bagdad Road junction (actually on Swan	T: State Growth I: South East M: Southern Midlands N: South	Suggest information is added to NVA 343705 & NVA 344874 as per details below.	<b>LOCALLY EXTINCT (not vouchered)</b>

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
				Street), so may be in slight error].			
<p>This [location] is accurate and distinct from the three records below – site lost to roadworks at this junction” (A. North pers. comm.).</p> <p>“This survey covered several of your Bagdad /Dysart subpopulations: From National Highway - Pontville to Dysart Botanical Survey and Fauna Habitat Assessment Forming part of the Bagdad Planning Study Maunsell McIntyre Pty Ltd January 2000” (A. North pers. comm.). Report stated: East Bagdad Rd junction, Midland Highway; GR 51790 528330; 2 (80 in 1995); Originally each side of junction (North 1995). Basal rosettes on mown traffic island on west side of highway”.</p> <p>General area of site was assessed by Mark Wapstra on 18 Apr. 2017 by Mark Wapstra. No evidence of any lepidium species detected (site has been modified to such an extent that species was presumably eliminated).</p> <p>SEE SITE REPORT.</p>							
35	“East Bagdad Road” [western site]	NVA 955365 (HO 522263)  NVA 343707 NVA 344875	L. Gilfedder (1 Jan. 1991 – undated in HO collection)  A. North (1 Feb. 1999) A. North (1 Nov. 1999) [All records at same point location].	“Under <i>E. viminalis</i> on road verge with <i>Bromus - Hordeum - Holcus</i> etc” (HO 522263).  No information for NVA 343707 & 344875.	T: local government I: South East M: Southern Midlands N: South	Allocated A. Pyrke to NVA 228457 (as per HO 304967).  Consider deleting NVA 857210 as database artefact?  Note A. North comment that “these are the same site” – adjust NVA records accordingly.  Suggest information is added to relevant records as per details below.	<b>LOCALLY EXTINCT (vouchered)</b>
	“East Bagdad Road” [middle site]	NVA 228457 (HO 304967)  NVA 857210	A. Pyrke (4 Jan. 1991) A. Pyrke (4 Nov. 1991) [Both records at same point location].	“Under <i>Eucalyptus viminalis</i> on very disturbed roadside mound on N side of road. Growing with <i>Lepidium pseudotasmanicum</i> (see AFP65)” (HO 304967).  No information associated with NVA 857210.			
	“East Bagdad Road” [eastern site]	NVA 227859 (HO 443101)	L. Gilfedder (16 Jan. 1991)	“Dense and thick stand”, “Very disturbed, weed-infected roadside under <i>Eucalyptus viminalis</i> ”.			
<p>“These are the same site. Council dumped fill on side of road burying the population in mid 1990s” (A. North pers. comm.).</p>							



## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>"This survey covered several of your Bagdad /Dysart subpopulations: From National Highway - Pontville to Dysart Botanical Survey and Fauna Habitat Assessment Forming part of the Bagdad Planning Study Maunsell McIntyre Pty Ltd January 2000" (A. North pers. comm.). That report stated: East Bagdad Rd, GR 51890 528410; 2 (50 in Feb 1999); Population has been buried by Council road maintenance practise. 10 mature plants and 40 seedlings recorded in Feb '99 (AJ North &amp; Associates 1999b)".</p> <p>Site was assessed by Mark Wapstra on 18 Apr. 2017. No specimens could be located on the location described above (northern side of road) – gravel dump still present. <i>Lepidium pseudotasmanicum</i> was found to be locally common on south side of road under black wattle scrub.</p> <p>SEE SITE REPORT.</p>							
36	"Dysart Drive jct"	NVA 344880	A. North (1 Jan. 1995)	No information associated with record. [NVA currently puts this record in the middle of a slope south of Clifton Vale Road, c. 1 km southwest of the junction of Dysart Drive].	T: State Growth I: South East M: Southern Midlands N: South	Suggest correcting NVA 344880 to match the southern (old) Dysart Drive junction as per the location name associated with the record.	<b>LOCALLY EXTINCT (vouchered)</b>
	"Midland Highway Constitution Hill" [southern end of Dysart Drive]	NVA 1059042	A. North (20 Jul. 2007)	No information associated with record.		"?? I think same record as above but not sure how it got on NVA as didn't record it in 2007. Probably mapped in that report as an old record" (A. North pers. comm.). Suggest this record be deleted from NVA.	
	"Junction of Dysart Drive and Midland Highway" (HO 410918) [southern end of Dysart Drive]	NVA 227813 (HO 410918) NVA 784004	A. North (21 Dec. 1984)  Unknown (1 Dec. 1994)	"Amongst roadside grasses and weeds in open. No evidence of regeneration', 'one plant" (HO 410918). No information associated with other record.		HO 410918 lists NVA 227813 as being from 21 Dec. 1994, which is correct. Delete NVA 784004 as database artefact?	
<p>"This is an old junction that was closed off. Plants never seen again Not same as sites below" (A. North pers. comm.).</p> <p>Site was surveyed by Mark Wapstra on 18 Apr. 2017. <i>Lepidium hyssopifolium</i> was not found.</p> <p>SEE SITE REPORT.</p>							
37	[Dysart, private property between Ely	NVA 300467	C. Strain (23 Apr. 2003)	No information associated with record.	T: local government/private?	None.	<b>UNCERTAIN (not vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	Street and Church Lane]				I: South East M: Southern Midlands N: South		
	[Junction Midland Highway and Clifton Vale Road]	NVA 794061	Unknown (1 Mar. 1995)	No information associated with record.			
	[just northwest of junction Midland Highway and Clifton Vale Road]	NVA 423063	J. Kirkpatrick (1 Nov. 1984)	No information associated with record.			
<p>Insufficient information to relocate the original sites of collection. In the absence of a voucher specimens, it is difficult to even assign these records to a species. The date of NVA 423063 is questioned because almost all records attributed to this collector are from 1 Nov. 1994, not 1984.</p> <p>SITE(S) NOT ASSESSED AS PART OF PRESENT PROJECT (except by drive through Dysart, including checking under old pines trees in church along church Road – no <i>Lepidium</i> located).</p>							
38	"Dysart - Old Highway"	NVA 227759 (HO 443076)	L. Gilfedder (15 Jan. 1991)	"Under <i>Eucalyptus globulus</i> (planted)".	T: local government I: South East M: Southern Midlands N: South	Delete NVA 301043 (database duplicate caused by herbarium update), but assign precision of ± 10 m as per original grid reference and notes.	<b>EXTANT (new voucher)</b>
	"Bagdad Bypass"	NVA 1231294	N. Meeson (11 Jun. 2009)	"4"			
	"Dysart, old highway beneath blue gum stumps"	NVA 930338 (HO 522258) Duplicate at: CANB 579640.1  NVA 301043	A. North (16 Jan. 2002)  A. North (17 Jan. 2002)	"Beneath recently felled blue gum stumps", "Six plants growing at the base of two trees" (HO 522258).  No information associated with other record.			
<p>"These [sites] are the same – see below" (A. North pers. comm.). "See GA notes below. Plants were always near blue gums and NEVER near conifers as suggested below. Worth checking area and worth establishing tenure. Will Fletcher even propogated and planted trees on northern side of Midland hwy in 1990s for DoT. They didn't last long!" (A. North pers. comm.).</p> <p>Statements from GA report:  <i>"Lepidium hyssopifolium</i> not present on site. The blue gums have resprouted and are now up to 10m tall, but still do not provide adequate shade to suppress weed growth on this site so on-going weed control would be required to create habitat for native <i>Lepidium</i> species. Apart from blackberry, cocksfoot, briar rose and gorse cover (photo below), the current site is also threatened by garden waste dumping nearby.</p>							

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>Large pines and macrocarpas occur just south of the site and suitable habitat for <i>L. hyssopifolium</i> occurs under these. Around 90 <i>Vittadinia gracilis</i> (rare) were found underneath the 2nd and 3rd macrocarpas".</p> <p>The verge of the old highway was assessed by Mark Wapstra on 7 Apr. 2017. No <i>Lepidium hyssopifolium</i> was found under the macrocarpa pines at the beginning of the road (<i>Lepidium africanum</i> was present). Four <i>Lepidium hyssopifolium</i> were found on the highway side of the big old blue gum stumps further north along the road.</p> <p>Recommend that the site be moved to the suitable habitat underneath the pines and macrocarpas to the south (photo below), and that the trial plots be planted here".</p> <p>From: Midland Highway - Bagdad Bypass Rifle Range Road to Dysart VEGETATION SURVEY AND FAUNA HABITAT ASSESSMENT For Pitt &amp; Sherry Consulting Engineers 28 April 2011 PAS048</p> <p>"Four plants of <i>L. hyssopifolium</i> were recorded in the study area during the current study. These are a remnant of a former larger population along Dysart Drive to the north of the junction with Clifton Vale Road. It was originally recorded by North in 1994 where the plants occurred beneath the canopy of mature blue gums. These trees have since been felled and introduced grasses and herbs have colonised the ground. With such competition the long term viability of this population is uncertain. During the current study, a search of other previously known locations was unsuccessful".</p> <p>SEE SITE REPORT.</p>							
39	"Paddock next to Maclaines Creek- just south of Triabunna"	NVA 925651	N. Gill (7 Apr. 2004)	"Paddock- under a Macrocarpa", "at least 5 plants", "2 x 2 m" [Point location is on the eastern side of the Tasman Highway, where there was once a row of macrocarpa pines – now felled].	T: State Growth I: South East M: Glamorgan-Spring Bay N: South	None.	<b>EXTANT (vouchered)</b>
	"Tasman Highway, W of Maclaines Creek Bridge. Triabunna"	NVA 1307445 (HO 543771)	A. North (7 Nov. 2006)	"Beneath <i>Pinus radiata</i> on E side of Woodstock access", "About 60 or so plants" [Record is positioned on the western side of the Tasman Highway but the notes suggest it represents the same site as NVA 925651].		"I think N. Gill missed these plants in her survey. Should read <u>north</u> side of Woodstock access" (A. North pers. comm.).	
	"junction Tasman Highway and entrance to 'Woodstock'"	NVA 1431104	M. Wapstra (10 Oct. 2014)	"1 x 15 cm (fertile), 1 x 7 cm (seedling)"		None.	
	"Maclaines Bridge	NVA 1431103	M. Wapstra (10 Oct. 2014)	"1", "revegetation 'reserve' & jute matting"		None.	

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	rehabilitation reserve"						
	"Maclaines Bridge, Triabunna" [near 'Woodstock' entrance]	NVA 1473720 NVA 1511872	M. Wapstra (15 Oct. 2015)	"2". [These two records coincide directly with NVA 1431104 – MW record from one year earlier – and are very close to NVA 1307445 – AN record from 2006].		Appear to be database duplicates with precisely same details – suggest deleting one.	
	"Maclaines Bridge, Triabunna" [in reserve – southern end]	NVA 1473717 NVA 1511871	M. Wapstra (15 Oct. 2015)	"1"		Appear to be database duplicates with precisely same details – suggest deleting one.	
	"Maclaines Bridge, Triabunna" [in reserve – further north]	NVA 1473718 NVA 1512419	M. Wapstra (15 Oct. 2015)	"1"		Appear to be database duplicates with precisely same details – suggest deleting one.	
	"Maclaines Bridge, Triabunna" [just outside north end of reserve]	NVA 1473719 NVA 1511995	M. Wapstra (15 Oct. 2015)	"1"		Appear to be database duplicates with precisely same details – suggest deleting one.	

The site was monitored again on 7 December 2016 by Mark Wapstra. The survey included the established reserve, the entrance to 'Woodstock' under the radiata pines, the pines in the paddock on the eastern side of the Tasman Highway, the verge of the 'Woodstock' entrance to the homestead/barn area (in company of landowner), the old sites of pines on the eastern side of the Tasman Highway, the area between the north end of the reserve to under Maclaines Bridge, and underneath the remaining mature eucalypts on the western side of the Tasman Highway just south of the 'Woodstock' entrance. *Lepidium hyssopifolium* was found within the reserve (one plant at previously reported site along with one new seedling and one plant at second previously reported site), just outside the north end of the reserve under the ornamental conifer (1 plant), and beneath the *Pinus radiata* on the southern side of the 'Woodstock' entrance (4 mature plants and 15 seedlings). This latter site represents an increase in numbers because of several seedlings. In addition, 31 individuals (all seedlings) were found amongst dense grass beneath the gate of the reserve (most technically on the south side of the gate, a few just inside) – this site has not been previously reported. In total in 2016, 54 individuals are reported. This appears to be more than has been recorded on this side of the road before and approaches the highest number ever reported from the general area.

In addition, the grassed area underneath the large mature pines in Triabunna (next to medical centre on highway) and the pines at the Freestone Point Road junction were surveyed again (see previous reports): no *Lepidium hyssopifolium* was found (*L. africanum* abundant at the Freestone Point Road junction).

The grassy/rocky verge of the Tasman Highway (western side) north of Triabunna (near 'Rostrevor' and opposite Vicarys Rivulet) was also searched (where there are a few mature roadside pines high on a bank): again, no *Lepidium hyssopifolium* was found.

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>Discussions with landowner indicated willingness to fence the plants under the <i>Pinus radiata</i>: while nearby areas get mown, there is essentially no grass or weeds under the shade of the pines so the area does not get disturbed anyway. However, informal fencing with an explanatory sign may prevent inadvertent herbicide spraying (by any parties) and alert land managers to the importance of maintaining the over-topping pine trees.</p> <p>"There was a population under native veg opposite police station in land around old track formation leading to an old bridge formation of Esplanade rd. I would have thought I would have lodged plants from there?? But presumably not seeing you don't reference that site" (A. North pers. comm.).</p> <p>SEE UPDATED STATEMENT FOR SITE: 2016 MONITORING.</p>							
40	[Spring Hill, Midland Highway, W side of highway]	NVA1428982	D. Sayers & G. Daniels (26 Nov. 2014)	"under <i>E. globulus</i> , 9 m off bitumen", "25".	T: State Growth I: South East M: Southern Midlands N: South	The easting and northing of NVA 1465786 should be altered to 521514 5305032 ± 10 m (as per the label on HO 576904). The remainder of the note should be kept.	<b>EXTANT (new vouchers)</b>
		NVA 1428983		"7".			
	[Spring Hill, Midland Highway, E side of highway]	NVA 1428996		"6m off bitumen, under <i>Acacia floribunda</i> ", "15".			
		NVA 1428997		"6m off bitumen L.africanum encroaching, under <i>Acacia baileyana</i> ", "8".			
		NVA 1428998	"7m off bitumen, under <i>Acacia pravissima</i> ", "10".				
	"Spring Hill, Midland Highway"	NVA 1465786 (HO 576904)	G. Daniels & D. Sayers (26 Nov. 2014)	<p>"Approximately 25 plants found growing under <i>E. globulus</i> at grid ref 521514 5305032 ± 10 m. Approximately 30 plants found under planted Acacias with <i>Lepidium africanum</i> on the outside of wattles at grid ref 521559 5304897 ± 10 m".</p> <p>[This record is positioned c. 1 km NNE of the main cluster of records for the species from "Spring Hill" – this record falling on the slopes of Sandhill</p>			

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
				Spur. The collection label clearly states "Spring Hill, Midland Highway" but was not supplied with a specific grid reference, perhaps leading to the obvious misplacement of the collection].			
<p>Site assessed by Mark Wapstra on 21 March 2017.</p> <p>Populations still present on either side of the highway. One patch on west is under planted blue gums and a cootamundra wattle but doing fine, other patch under regrowth silver wattle. Both on very high batter above highway unlikely ever to be affected. Patch on eastern side under several younger exotic wattles.</p> <p>SEE SITE REPORTS.</p>							
41	"Jericho Cemetery"	NVA 944498 (HO 513739)	G. Blake (1 Jan. 1991)	"Under conifers".	T: private I: South East M: Southern Midlands N: South	None.	<b>LOCALLY EXTINCT (vouchered)</b>
	"Jericho Cemetery"	NVA 228106 (HO 443104)	L. Gilfedder (20 Mar. 1991)	"Degraded native grassland under <i>P. radiata</i> with <i>Vittadinia gracilis</i> , <i>Einadia nutans</i> , <i>Bromus sterilis</i> ".			
<p>Site assessed by Mark Wapstra on 21 March 2017 and 27 March 2017. No evidence of <i>Lepidium hyssopifolium</i> under last remaining <i>Pinus radiata</i> in southwest corner of cemetery grounds. Large mature <i>Pinus radiata</i> at front fence of cemetery chopped down many years ago. Presumably loss of this tree has resulted in local extinction. Verge of "School House" yard west of cemetery also examined because of row of mature radiata pines (on private but shading grassy road verge) – no <i>Lepidium</i> species detected.</p> <p>SEE SITE REPORT.</p>							
42	[Jericho Road]	NVA 300111	A. North (1 Feb. 1999)	No information associated with record.	T: local government I: South East M: Southern Midlands N: South	None.	<b>LOCALLY EXTINCT (not vouchered)</b>
<p>Site assessed by Mark Wapstra on 27 March 2017. No evidence of <i>Lepidium hyssopifolium</i> along road verge (either side) within c. 100-200 m of record. Lack of suitable habitat (assume a one-off brief establishment only).</p> <p>SEE SITE REPORT.</p>							
43	[Baden, junction of Tunnack Road and Woodsdale Road]	NVA 782454	Unknown (1 Sep. 1994)	No information associated with record. [Aerial imagery shows point location at junction of roads,	T: State Growth I: South East M: Southern Midlands N: South	Allocate NVA 782454 to A. North as the collector based on other collections on that date	<b>LOCALLY EXTINCT (not vouchered)</b>



**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
				possibly under a big old pine tree, so is presumed to be quite precise].		in the general area by this collector. "Yes" (A. North pers. comm).	
44	[Tunnack Road near 'Woodside' property]	NVA 925258 NVA 357698	A. North (1 Jan. 2002) P. Barker (1 Jul. 1996)	No information associated with either record. [Aerial imagery shows both point locations (only separated by a short distance) in paddock northeast of Tunnack Road but more likely sites on the road verge with several larger pine trees].		Delete NVA 357698 (database artefact?).	<b>LOCALLY EXTINCT (not vouchered)</b>
45	[Tunnack Road near 'Lint Hill' property]	NVA 925257	A. North (1 Jan. 2002)	No information associated with record. [Aerial imagery shows this record to be positioned just on the north side of Tunnack Road, which appears to support a line of mature pines, presumably planted within the property boundary].			<b>LOCALLY EXTINCT (not vouchered)</b>
46	[Tunnack Road, c. 200 m W of 'Woodstock']	NVA 792250 NVA 925256 [same location]	Unknown (1 Sep. 1994) A. North (1 Jan. 2002)	No information associated with record. [Aerial imagery shows this record to be positioned just on the south side of Tunnack Road, close to a mature tree, possibly a eucalypt].		Associate A. North with NVA 792250 (based on nearby collections by this collector on this date). "Yes" (A. North pers. comm).	<b>EXTANT (now vouchered)</b>
47	[c. 500 m NE of Tunnack Road on 'Woodstock']	NVA 792435	A. North (1 Sep. 1994)	No information associated with record.			<b>LOCALLY EXTINCT (not vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	near Tin Dish Rivulet]			[Aerial imagery shows this record to be positioned several hundred metres north of Tunnack Road in the middle of a paddock].			
48	[Tunnack Road, c. 150 N of Black Gate Road junction]	NVA 357807	P. Barker (1 Jul. 1996)	No information associated with record. [Aerial imagery shows the record to be positioned on farm buildings behind a row of road verge trees, possibly eucalypts].		Delete NVA 357807 (database artefact?).	<b>LOCALLY EXTINCT (not vouchered)</b>
49	[Tunnack Road, c. 300 m S of entrance to 'View Banks']	NVA 356675	P. Barker (1 Jul. 1996)	No information associated with record. [Aerial imagery shows the record to be positioned on the western side of Tunnack Road but not associated with any obvious old trees].		Delete NVA 356675 (database artefact?).	<b>LOCALLY EXTINCT (not vouchered)</b>
50	[Tunnack Road, 'View Banks']	NVA 792249	Unknown (1 Sep. 1994)	No information associated with record. [Aerial imagery shows the record to be positioned just west of Tunnack Road on the property in paddocks].		Associate A. North with NVA 792249 (based on nearby collections by this collector on this date).	<b>LOCALLY EXTINCT (not vouchered)</b>
51	[Tunnack Road, c. 350 N of entrance to 'Tramore']	NVA 782515 NVA 357632 NVA 925255	Unknown (1 Sep. 1994) P. Barker (1 Jul. 1996) A. North (1 Jan. 2002)	No information associated with any of the records. [Aerial imagery shows the position of NVA 782515 & 925255 (same site) in open eucalypt woodland west of Tunnack Road].		Associate A. North with NVA 782515 (based on nearby collections by this collector on this date). Delete NVA 357643 (database artefact?) – record lands in open paddock to east of Tunnack Road.	<b>LOCALLY EXTINCT (not vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
52	"Tunnack Main Road, S of Parattah"	NVA 930320 (HO 522257)	A. North (31 Jan. 2002)	"Roadside gravel dump", "Approximately 10 plants".		None.	<b>LOCALLY EXTINCT (not vouchered)</b>
53	[Tunnack Road, c. 100 m SE of Beards Road junction]	NVA 792248	Unknown (1 Sep. 1994)	No information associated with record. [Aerial imagery places record inside private property paddock but assume it is associated with remnant vegetation along northern verge of Tunnack Road].		Allocate NVA 792248 to A. North as the collector based on other collections on that date in the general area by this collector.	<b>LOCALLY EXTINCT (not vouchered)</b>
54	[junction Tunnack and Inglewood roads]	NVA 782453 NVA 925254	Unknown (01 Sep. 1994) A. North (01 Jan. 2002)	No information associated with either record. [Aerial imagery shows site to be positioned on private property just south of Inglewood Road, associated with a clump of what is presumed to be <i>Eucalyptus pauciflora</i> or <i>E. viminalis</i> woodland].		Allocate NVA 782453 to A. North as the collector based on other collections on that date in the general area by this collector.	<b>LOCALLY EXTINCT (not vouchered)</b>
<p>"I surveyed the length of this road back in 1994 and found numerous plants which I think had originated from gravel dump infested with plants. I have hard copy with hand annotated maps. Perhaps grader had come from Oatlands where well established around Lake Dulverton for many years. Most sites in roadside gravel. Phil reinspected for RATS project in 1996. In 2002 I reinspected for Roadside Conservation project and found some of the plants. One site was incorporated [into RCP], for which I noted: Very little suitable habitat. Area where most of population occurred in 1994 no longer supports plants. 9 plants 34171 5308904 6 seedlings and 3 mature plants. Located adjacent to large eucalypt, 10-12m from fence, just south of private access. The use of this site for storing gravel and the weedy conditions suggest this site is vulnerable and not suitable long term. Plants should be planted in a new site - eg a nearby Private Forest Reserve" A. North pers. comm.).</p> <p>The sites along Tunnack Road were surveyed by Mark Wapstra on 18 Apr. 2017. <i>Lepidium hyssopifolium</i> was found at one location only.</p> <p>SEE SITE REPORT (for all sites).</p>							
55	[Parattah railway line]	NVA 925253	A. North (1 Jan. 2002)	No information associated with record.	T: TasRail I: South East M: Southern Midlands N: South	None.	<b>LOCALLY EXTINCT (not vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>Site was searched by Mark Wapstra on 19 Sep. 2016 (for TasRail-related threatened flora surveys) – could not be detected (note that rail corridor is frequently slashed and/or subject to herbicide spray). NO DETAILED SITE REPORT.</p>							
56a	"Edge of Lake Dulverton, Oatlands"	NVA 228452 (HO 410926)	A. North (24 Aug. 1994)	"Beneath pines at edge of lake". [The record is positioned in the middle of the nearby oval but clearly refers to a population associated with the pine trees on the eastern verge of the Esplanade].	T: Lake Dulverton Conservation Area & local government I: South East M: Southern Midlands N: South	None.	<b>EXTANT (vouchered)</b>
<p>This site was surveyed by Mark Wapstra on 13 Oct. 2016. The population extends from the immediate verge of the sealed road to the mown (grazed) slope above Lake Dulverton, with the highest abundance of plants under the old pine trees, but also numerous individuals scattered around picnic tables, rubbish bins and in the gravel of the road. The population comprises 100s of fertile plants and perhaps 1,000s of seedlings. Specimens from site have been lodged at HO (still being processed). "Each year I see new sites, extending from the car park / toilet block next to the little lake opp Callington Mill round to the pines adj to the main lake and Church Street" (A. North pers. comm.). SEE SITE REPORT (Oatlands sites combined).</p>							
56b	[Oatlands, Esplanade, between Barrack Street and Mill Point]	NVA 300258	A. North (1 Feb. 1999)	No information associated with record. [Aerial imagery suggests location is associated with old pines on road verge].	T: Lake Dulverton Conservation Area & local government I: South East M: Southern Midlands N: South	None.	<b>EXTANT (now vouchered)</b>
<p>This site was surveyed by Mark Wapstra on 18 Apr. 2017. The species is locally common and essentially forms a continuous (patchy) population under the pines from the southern part of The Esplanade to near the northwestern corner of Lake Dulverton. SEE SITE REPORT (Oatlands sites combined).</p>							
57	[Oatlands, 'Weedington']	NVA 300291	A. North (1 Feb. 1999)	No information associated with record. [Aerial imagery suggests location is associated with old pine on entrance road to property].	T: local government & private? I: South East M: Southern Midlands N: South	None.	<b>EXTANT (now vouchered)</b>
<p>This site was surveyed by Mark Wapstra on 18 Apr. 2017. The species occurs from the junction of Sandy Lane (east of "Weedington" to the front entrance of "Weedington", all on the road verge (no evidence of extending into private property).</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
SEE SITE REPORT (Oatlands sites combined).							
58	"Oatlands, Mahers Point"	Not in NVA or HO (was lodged but not in system). Mark Wapstra's personal herbarium.	M. Wapstra (22 Aug. 2007)	"Exotic pine trees, weeds", "c. 20+".	T: local government I: South East M: Southern Midlands N: South		<b>EXTANT (vouchered)</b>
This site was re-surveyed by Mark Wapstra on 13 Oct. 2016. The population is still present. Specimens from site have been lodged at HO (still being processed). SEE SITE REPORT.							
59	"York Plains Road, near Coffin Gully Creek"	NVA 229462 (HO 443061)	L. Gilfedder (26 May 1995)	"Under <i>Pinus radiata</i> ". [The original grid reference is given from the Lake Sorell 1:100,000 map as 399 206, which places the site on the slope of the hill, not on York Plains Road and also away from Coffin Gully Creek. Aerial imagery shows no large pines in this area but numerous pines along York Plains Road].	T: local government I: South East M: Southern Midlands N: South	Grid reference associated with this record should be corrected to better reflect the locality name and collection information – the grid reference associated with NVA 357177 appears to be much more accurate and can be used. Delete NVA 357177 (database artefact?) – covered by NVA 229462.	<b>EXTANT (new voucher)</b>
	[York Plains Road]	NVA 357177	P. Barker (23 Aug. 1996)	No information associated with record.			
Site assessed by Mark Wapstra on 18 April 2017. <i>Lepidium hyssopifolium</i> still present beneath and near old <i>Pinus radiata</i> on south side of road. SEE SITE REPORT.							
60	"Kewstoke York Plains"	NVA 228914 (HO 443062)  NVA 352414	L. Gilfedder (10 May 1995)  P. Barker (20 Sep. 1996)	"In tree planting, old conifers cut down, very weedy" HO 443062).	T: private I: South East M: Southern Midlands N: South	Delete NVA 352414 (database artefact?).	<b>UNCERTAIN (vouchered)</b>
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
61	"Township Lagoon Nature Reserve"	NVA 300426 NVA 944462 (HO 522262)	L. Gilfedder (1 Jan. 1991) L. Gilfedder (7 Apr. 1992)	"Only 4 plants noted", " <i>Themeda triandra</i> grassland in disturbed ground near tip".	T: Township Lagoon Nature Reserve (PWS) I: Northern Midlands	Delete NVA 300426 (duplicate of NVA 944462 – has precision of 25 years).	<b>LOCALLY EXTINCT (vouchered)</b>

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	[west of Tunbridge]	NVA 466249	L. Gilfedder (1 Jan. 1993)	No information associated with record (decoda:remnant project).	M: Northern Midlands N: North	Presume NVA 466249 is a duplicate of NVA 300426 or NVA 944462.	
<p>It is surprising that the species has not been reported since 1993 from this area: is one of the most frequently visited native grassland remnants in Tasmania by numerous highly qualified field botanists. The absence of novel records for over two decades strongly suggests the species is locally extinct.            SITE NOT ASSESSED AS PART OF PRESENT PROJECT (but author has searched for various threatened flora species in area for last two decades).</p>							
62	"River bank at Ross"	HO 97481	W. Curtis (20 May 1981)	"Around trunks of old pines".	T: local government? I: South East M: Southern Midlands N: South	Not in NVA because this is a re-det by M. Wapstra (14 Nov. 2016) from <i>Lepidium pseudotasmanicum</i> .	<b>UNCERTAIN (vouchered)</b>
<p>It is surprising that the species has not been reported since 1981 from Ross given the focus of the area by field botanists due to numerous species of threatened flora being present along the river margins, cemeteries and along road verges. Strongly suggests that the species is now locally extinct.            SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
63	"Annanvale' property" (NVA 228379)	NVA 857191	A. Pyrke (23 Mar. 1990)	No information associated with record.	T: private (reserve) I: Northern Midlands M: Northern Midlands N: North	Delete NVA 857191 (database duplicate of NVA 228379 with inaccurate date?). Delete NVA 355798 (database artefact?).	<b>UNCERTAIN (vouchered)</b>
		NVA 228379 (HO 125909) Duplicate at: MEL 2014408A	A. Pyrke (23 May 1990)	" <i>Eucalyptus amygdalina</i> woodland, growing under trees of <i>Acacia dealbata</i> ". [The original grid reference is given from the Lake Sorell 1:100,000 map as 288 387, which coincides with the "barns" on the edge of a forest patch, which appears to be unchanged based on recent aerial imagery].			
		NVA 355798	P. Barker (20 Sep. 1996)	No information associated with record.			
		NVA 479119	L. Gilfedder (1 Jan. 1993)	No information associated with record (decoda:remnant project).			



**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
				[Seems much more likely to be a duplicate of NVA 228379 (HO 125909) rather than an additional site but grid reference places site at western edge of forest remnant so site is not discounted].			
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
64	"Fosterville', Campbell Town"	NVA 229368 (HO 503691)	H. Foster (no date)	"Free from grazing and competition".	T: private I: Northern Midlands M: Northern Midlands N: North	None.	<b>UNCERTAIN (vouchered)</b>
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
65	"Barton Road at Stewarton Bridge" (NVA 944043)	NVA 854314	A. North (7 Nov. 1994)	No information associated with record.	T: private I: Northern Midlands M: Northern Midlands N: North	None.	<b>EXTANT (vouchered)</b>
		NVA 944043 (HO 522256)	H. & A. Wapstra (28 Oct. 2001)	"Dense population", "Under <i>Macrocarpa</i> old trees".			
Site assessed by Mark Wapstra on 21 & 27 March 2017. Population thriving (10s to low 100s) under row of mature <i>Pinus radiata</i> on private property (anglers' access to river nearby). SEE SITE REPORT.							
66	"Junction of Barton Road and Valleyfield Road" (NVA 410923)	NVA 228078 (HO 410923)	A. North (9 Nov. 1994)	"Under <i>Cupressus macrocarpa</i> " (HO 410923).	T: local government I: Northern Midlands M: Northern Midlands N: North	Delete NVA 854300 (database duplicate?). Delete NVA 355672 (database artefact?).	<b>EXTANT (new voucher)</b>
		NVA 854300 NVA 355672	A. North (7 Nov. 1994) P. Barker (9 Aug. 1996)	No information associated with either of the other two records.			
Site assessed by Mark Wapstra on 21 & 27 March 2017. Population still present but mature macrocarpa pine has been chopped down (some re-sprouting is occurring). Very dense grass – presume site will become unsuitable in absence of canopy. SEE SITE REPORT.							
67	"Lake River Church, 22km	NVA 227395 (HO 143052) Duplicates at:	P. Collier (26 Apr. 1991)	"Under a large pine tree, well mulched ground", "common in	T: private I: Northern Midlands M: Northern Midlands	None.	<b>LOCALLY EXTINCT (vouchered)</b>

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
	south of Longford"	CANB 476277.1 MEL1615409A		habitat, absent elsewhere"	N: North		
Site assessed by Mark Wapstra on 21 & 27 March 2017. No evidence of <i>Lepidium hyssopifolium</i> . One large <i>Pinus radiata</i> has been felled many years ago – presume site became unsuitable shortly after. SEE SITE REPORT.							
68	"Elleslie property, Kingston Road"	NVA 863036  NVA 229486 (HO 410924)	A. North (18 Nov. 1994)  A. North (20 Nov. 1994)	No information associated with either record.	T: private I: Northern Midlands M: Northern Midlands N: North	Minor correction to property name spelling required. Suggest delete NVA 863036 as database duplicate of NVA 229486.	<b>UNCERTAIN (vouchered)</b>
Road verge slow-drive by Mark Wapstra on 13 April 2017. No evidence of <i>Lepidium hyssopifolium</i> (no <i>Lepidium</i> species) on either side of road beneath rows of mature pine trees. NO DETAILED SITE REPORT.							
69	"Ormley, Fingal Valley"	NVA 229899 (HO 328682)	A. Buchanan (27 Jul. 1998)	"Roadside"	T: private & State Growth I: Northern Midlands M: Break O'Day N: North	Possible duplicate of NVA 930231 but precision is given as ± 10 m and that of NVA 930231 is ± 100 m (typical of HO records). Delete duplicate?	<b>EXTANT (vouchered)</b>
	"Esk Main Road, just W of entrance to Ormley"	NVA 930231 (HO 522255)	A. North (4 Mar. 2002)	"Growing beneath the shadow of a cypress tree, with <i>Einadia nutans</i> , <i>Bromus diandrus</i> , <i>Plantago coronopus</i> , <i>Hypochoeris radicata</i> , <i>Dactylis glomerata</i> ", "Approximately two dozen plants close to drip line of tree".			
	[entrance to 'Ormley']	NVA 301468	A. North (4 Mar. 2002)	No information associated with record.			
	[entrance to 'Ormley']	NVA 1369228	A. Williams (7 Feb. 2012)	"60", "50 m <sup>2</sup> ".			
	"Ormley, Fingal Valley"	NVA 1486955	A. North (12 Jan. 2016)	"15", "12 in road reserve 3, over fence. All mown or browsed. No flowering".			
"This is a RCS managed site see attachment and GA report extract. It is entirely dependent on the persistence of a cypress tree growing over the fence. There used to be plants (A Buchanan's collection) under trees at Ormley stn across road. I have undertaken extensive surveys in vicinity and not located any other plants" (A. North pers. comm.).							

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>"Since the 2013 SKM report we have monitored nos every year and collected seed and arranged with landowners to disperse seed under pine which we have fenced off from rest of driveway to keep sheep out. Wildseed are to be contracted to propagate seedlings for planting as part of the RCS program" (A. North pers. comm.). See also attached RCS report. Site assessed by Mark Wapstra on 21 March 2017. Going gangbusters between entrance and just down the road. Lots in road verge (even still going after roadside spraying in immediate gravel verge). Lots in private. These are all under old macrocarpa pines that DSG has no control over (on private land). Already sign-posted as part of RCM (labelled "NE RCS ORM1"). SEE SITE REPORT.</p>							
70	"Fingal, South Esk Highway, north roadside"	NVA 229745 (HO 443084)	L. Gilfedder (15 Feb. 1991)	"In township of Fingal, cnr Short & Talbot Streets", "N roadside under <i>P. radiata</i> with <i>Einadia nutans</i> and <i>Danthonia racemosa</i> ".	T: uncertain I: Ben Lomond M: Break O'Day N: North	None.	<b>LOCALLY EXTINCT (vouchered)</b>
<p>Site assessed by Mark Wapstra on 21 March 2017. No evidence of <i>Lepidium hyssopifolium</i> present. This junction used to have large pine trees but have been long-removed and species is now locally extinct. Disappointingly, a survey under large pines trees in the grassy cemetery yard nearly opposite this site only resulted in <i>Lepidium pseudotasmanicum</i> being found. "Trees have been removed at resultant loss of L.hyssop" (A. North pers. comm.). In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i>, this "site" is considered locally extinct.</p>							
71	"South Esk Highway, Fingal"	NVA 230419 (HO 443081)  NVA 344141	L. Gilfedder (15 Feb. 1991)  Unknown (1 Jan. 1993)	"Under <i>A. dealbata</i> in weed infested site with <i>P. lanceolata</i> , <i>H. radicata</i> ". [The original grid reference is given from the St Pauls 1:100,000 map as 807 898, which coincides with the middle of Fingal].	T: uncertain I: Ben Lomond M: Break O'Day N: North	Delete NVA 344141 (database duplicate of NVA 230419 – same site precisely but has 10 year precision).	<b>LOCALLY EXTINCT (vouchered)</b>
<p>Verges of main road through Fingal surveyed by Mark Wapstra on 21 March 2017 with no evidence of <i>Lepidium hyssopifolium</i>. In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i>, this "site" is considered locally extinct.</p>							
72	[Fingal]	NVA 345375 NVA 425294 NVA 857216	Unknown (1 Jan. 1993) J. Kirkpatrick (1 Nov. 1984) A. Pyrke (1 Jan 1990)	No information associated with any of the records.	T: uncertain I: Ben Lomond M: Break O'Day N: North	Delete NVA 345375 (database duplicate of NVA 344141 – nearly same site but has 10 year precision).	<b>LOCALLY EXTINCT (not vouchered)</b>
<p>Verges of main road through Fingal surveyed by Mark Wapstra on 21 March 2017 with no evidence of <i>Lepidium hyssopifolium</i>. The date of NVA 425294 is questioned because almost all records attributed to this collector are from 1 Nov. 1994, not 1984.</p>							

**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
In the absence of evidence of a contemporary population of <i>Lepidium hyssopifolium</i> , this "site" is considered locally extinct.							
73	"East of Fingal. Esk Main Road at Fingal Culvert no. B3169"	NVA 1465784 (HO 576915)	D. Sayers (4 Sep. 2014)	"c. 25 plants around <i>Pinus radiata</i> ".	T: State Growth? I: Ben Lomond M: Break O'Day N: North	None.	<b>EXTANT (vouchered)</b>
Site assessed by Mark Wapstra on 21 March 2017. <i>Lepidium hyssopifolium</i> going very well under radiata pines where bunting has been put in place during bridge works. A lot more plants than North Barker originally indicated. Also one large plant under large radiata pine a bit to the east (outside flagged area). Technically, none of the individuals of <i>Lepidium hyssopifolium</i> have been recorded in the casement title (all on private titles to south). SEE SITE REPORT.							
74	[Falmouth Road, c. 800 m E Tasman Highway junction]	NVA 300562	A. North (4 Mar. 2002)	No information associated with record.	T: State Growth I: Flinders M: Break O'Day N: North	Delete NVA 781257 as presumed database duplicate of NVA 925474 (same date, almost same site, presume same collector).	<b>LOCALLY EXTINCT (vouchered)</b>
	"Falmouth" [Falmouth Road near Devils Creek, N of road]	NVA 925474 NVA 230456 (HO 410921)	J. Lynch (1 Oct. 1992) A. North (4 Mar. 1995)	"Under Eucalyptus globulus" (HO 410921).			
	[Falmouth Road near Devils Creek, S of road]	NVA 345857	Unknown (1 Jan. 1993)	No information associated with record.			
	[Falmouth Road near Devils Creek, N of road]	NVA 781257	Unknown (1 Oct. 1992)	No information associated with record.			
	[Falmouth, c. 200 m W of junction to Falmouth]	NVA 791031	Unknown (1 Oct. 1992)	No information associated with record. [Assume same as NVA 925474 and a database duplicate but some distance away].			
"When this road was upgraded there were various spots under remnant trees on old reserve. I have original hard copy of report. Note on NVA there are low accuracy records from centroids of roadside surveys supplied by DIER to DPIWE leading to many duplicates on NVA. I hopped the fence and checked them all last year. All have been gobbled up by sheep and lost.							

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
<p>The one current roadside site is adj the old tip access, now a plantation. It is in the RCS program but I am tempted to suggest it is taken off as we haven't been able to have any regen even after raking, brushcutting and the Esk bushfire!" (A. North pers. comm.). See also RCS report attached. Site was assessed by Mark Wapstra on 23 March 2017. No evidence of <i>Lepidium hyssopifolium</i> found. This site is already part of the Roadside Conservation Program, although it is now recommended for removal from the program because there is no evidence of either <i>Lepidium hyssopifolium</i> or <i>Glycine microphylla</i>. SEE SITE REPORT.</p>							
75	[Cressy, west of school]	NVA 854168	A. North (9 Nov. 1994)	No information associated with record.	T: unknown (presume local government) I: Northern Midlands M: Northern Midlands N: North	None.	<b>UNCERTAIN (not vouchered)</b>
<p>General location assessed by Mark Wapstra on 30 March 2017. Most likely sites on Murfett Street west of school ground (mature pines along eastern road verge). No evidence of <i>Lepidium hyssopifolium</i> found. NO DETAILED SITE REPORT.</p>							
76	[Macquarie Road, Cressy, road to pump station]	NVA 300958	A. North (9 Nov. 1994)	No information associated with record.	T: local government I: Northern Midlands M: Northern Midlands N: North	Suggest shifting NVA 300958 to match more recent records.	<b>EXTANT (not vouchered)</b>
<p>General location of record assessed by Mark Wapstra on 30 March 2017. Species found in low numbers (7) on southern side of road under mature macrocarpa pines (growing on private land). SEE SITE REPORT.</p>							
77	"Glen Mavis", Deddington Road"	NVA 862852 NVA 228429 (HO 410919)	A. North (17 Nov. 1994) A. North (20 Nov. 1994)	"Beneath pines" (HO 410919).	T: local government I: Northern Midlands M: Northern Midlands N: North	Delete NVA 862852 (database artefact, duplicate of NVA 228429).	<b>UNCERTAIN (vouchered)</b>
<p>"All these 1994 records are from a Northern Midlands Roadside survey conducted through a GA contract. Grid pts taken form 1:100000 maps. So not accurate. Forms were completed with detailed info and databased by GA but probably long lost. Sometimes I collected plants and lodged them at herbarium hence duplicates. Occasionally I peeked over the fence so some are on adj private properties" (A. North pers. comm.). SITE NOT ASSESSED AS PART OF PRESENT PROJECT.</p>							
78	[Nile Road]	NVA 854248	A. North (18 Nov. 1994)	No information associated with record. [Record is positioned in paddocks west of Nile Road].	T: local government & private I: Northern Midlands M: Northern Midlands	Correct NVA 854248 to correspond to MW site on east side of Nile Road under macrocarpa pines.	<b>EXTANT (now vouchered)</b>

## Review of *Lepidium hyssopifolium* in Tasmania

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
					N: North	"You are correct this was east of the road on private land" (A. North pers. comm.).	
<p>This site was surveyed by Mark Wapstra &amp; Phil Bell on 2 Nov. 2016 as part of assessments for the proposed North Esk Irrigation Scheme (distribution pipeline section), which was reported in:</p> <p>ECOtas (2017). <i>Ecological Assessment of the Proposed North Esk Irrigation Scheme, Tasmania</i>. Report by Environmental Consulting Options Tasmania (ECOtas) for Tasmanian Irrigation Pty Ltd, 31 January 2017. [report effectively in public domain because proposed scheme will be referred under the EPBCA and permits have been applied for under the TSPA].</p> <p>That report found that:</p> <p>"There is a previously reported location along Nile Road (Figure 11), which has a precision of ± 100 m. However, the site lands west of Nile Road in a cultivated paddock. The species was confirmed from the eastern verge of Nile Road underneath a row of macrocarpa pines (growing on the private property side of the wire fence). This site almost certainly represents the earlier point location. The species is locally abundant (c. 500 individuals – most new seedlings) between the road edge and the fenceline, the linear extent defined by two GPSed end points at either end of the row of pines.</p> <p>The pipeline route is actually on the western side of Nile Road so in theory there is no reason for the patch of <i>Lepidium hyssopifolium</i> to be disturbed. However, the road verge, including underneath the macrocarpa pines, provides an ideal location to park vehicles. As such, it is recommended that the area be excluded from this risk during the construction period by the installation of a barrier (stakes and barrier mesh or bunting is all that should be required). Provided that disturbance to the patch can be excluded, no permit under Section 51 of the Tasmanian <i>Threatened Species Protection Act 1995</i> will be required and no referral under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> is considered warranted for the proposed works".</p> <p>As with other roadside populations that are reliant on the maintenance of trees growing on adjacent private property, developing site-specific management prescriptions is difficult because State Growth has no effective control over the actions of the adjacent landowner. In this case, the pines are old and associated with a poor quality wire fence and it is presumed that some time in the not too distant future, some works will occur that may render the site less suitable for <i>Lepidium hyssopifolium</i> (irrespective of any management imposed by State Growth on the public road verge).</p> <p>The site was re-assessed by Mark Wapstra on 13 April 2017 to review the progress of the population because in early Nov. 2016 it was a "wheatfield" of seedlings. By mid-April 2017, the seedlings had thinned out but counting was difficult because of recent roadside slashing.</p> <p>SEE SITE REPORT.</p>							
79	["Clarendon"]	NVA 854265	A. North (18 Nov. 1994)	No information associated with record.	T: uncertain (local government?) I: Northern Midlands M: Northern Midlands N: North	"More likely Council road given the project I was working on" (A. North pers. comm.) – suggest shifting record to nearby public road.	<b>UNCERTAIN (not vouchered)</b>
<p>The private road from that access the "Clarendon" homestead from Nile Road was informally surveyed by Mark Wapstra on 23 Feb. 2016 as part of surveys undertaken for TasRail. The main target of the survey was the rail corridor from c. 500 m south of the South Esk River to where it passes through the "Clarendon" property. No <i>Lepidium hyssopifolium</i> was found within the rail corridor. While the focus of the survey was the rail corridor, early arrival for the on-site meeting meant that a semi-targeted survey was opportunistically undertaken along the road verge, which is lined with ornamental trees (including conifers). No <i>Lepidium hyssopifolium</i> was found (but the cursory nature of the survey is reiterated).</p> <p>A follow-up survey was conducted on 13 April 2017 by Mark Wapstra by slow-driving the road from Nile Road to the "Clarendon" homestead, with the base of all pine trees examined for evidence of <i>Lepidium</i> species – none detected.</p>							



**Review of *Lepidium hyssopifolium* in Tasmania**

No.	Location	Source of record	Details	Information	(T)enure (I)BRA (M)unicipality (N)RM	Database recommendation	Status
NO DETAILED SITE REPORT (some digital images of habitat available).							
80	"Blessington" [west of O'Briens Road]	NVA 229414 (HO 327832)	A. Buchanan (5 Mar. 1995)	"Farmyard".	T: Sydney Cove Historic Site? I: Ben Lomond M: Northern Midlands N: North	None.	<b>UNCERTAIN (vouchered)</b>
SITE NOT ASSESSED AS PART OF PRESENT PROJECT.							
81	[Cove Point, Preservation Island]	NVA 343413 Duplicates at: CANB 262669.1 AD 97815330 MEL 0530838A	J. Whinray (14 Aug. 1981?)	No information associated with record.	T: Sydney Cove Historic Site? I: Flinders M: Flinders Island N: North	Unless there is evidence to the contrary, NVA 342413 should be changed to 29 May 1976.	<b>UNCERTAIN (vouchered)</b>
<p>This site is included in the NVA with the date noted as 14 Aug. 1981 but no other details provided. In the ALA, CANB 262669.1 is associated with John Whinray on 29 May 1976, MEL 053083A with John Whinray on 29 May 1976, and NVA 343313 with John Whinray on 13 Aug. 1981. It is assumed that the CANB, AD &amp; MEL collections bear the correct collection date. The identification of the material as <i>Lepidium hyssopifolium</i> seems quite certain as there is a note on the collecting sheets from N.H. Scarlett viz. "This specimen is very close to the Desvaux's type".</p> <p>Harris et al. (2001) in <i>One Hundred Island: The Flora of the Outer Furneaux</i> note that "[Preservation Island] has a history of settlement almost as long as the European settlement of Australia" and that "<i>Lepidium hyssopifolium</i>...has been collected from the island".</p>							
82	"Tasmania"	HO 54050 (not in NVA)	W.H. Archer (undated)	No information associated with record.	T: unknown I: unknown M: unknown N: unknown	Data exchange agreement between HO and DPIPWE will add record to NVA (uncertain why this one has been missed).	<b>UNCERTAIN (vouchered)</b>
Record is attributed to W.H. Archer, as most of his collections in herbaria and databases, although William Archer did not have a middle name (these records are accepted as correct). While there is no date with this collection (similar to many of Archer's collections), his dated collections in the NVA span 1840 to 1873.							

**APPENDIX B. Example field proformas**

The following are examples of the field proforma used to record population information for each of the sites surveyed. Some of the information was completed after field surveys were completed.

An example of a positive and a negative site is provided.

***Lepidium hyssopifolium* confirmation surveys**

**SURVEY DETAILS**

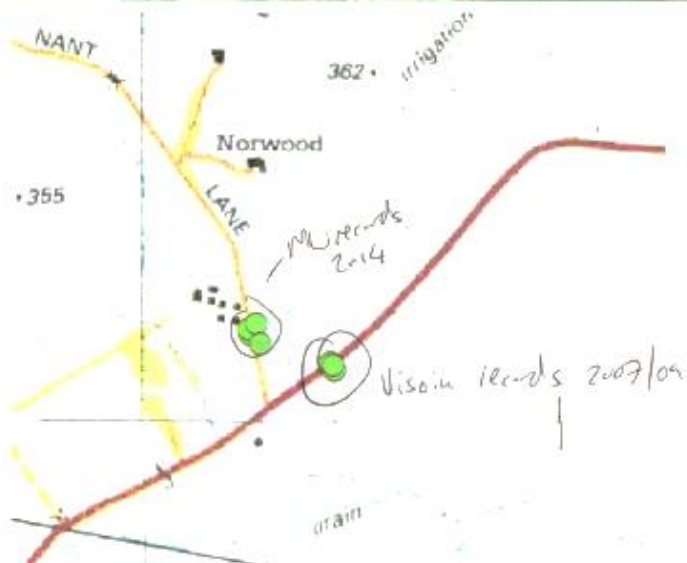
Site name (refer Table 1): Nant Lane e Dennistoun Road

Date of survey: 7 April 2017

Surveyor(s): Mark Wapstra

Jurisdiction: Coastal

**PREVIOUS INFORMATION** (include map, grid references, collector, notes):



100 extent pop  
in 2014 & 2016  
100s



**POPULATION INFORMATION** (annotate map above if necessary)

PRESENT     ABSENT

Waypoints collected:

Nornt - no WPs - just checked sp. as still there  
100s on N side road, 10s on S side  
→ looks about the same as in 2016

Number of individuals:

Extent of population:

Dennistoun Road - 1 WP - 2 plants

**SITE DESCRIPTION**

General notes:

Nornt - no change from 2016 - stock trampled  
bare dirt/grass verge

Road verge notes:

Side of road: (Dennistoun)

Dennistoun - sprouting Euc. pauciflora over  
dense *Lomandra longifolia* & grass.

Distance from sealed edge:

North South  East West (circle most applicable)

Vegetation description:

s. 2m  
Euc. pauciflora over dense *Lomandra longifolia*  
& *Dactylis glomerata*.

Geology:

Soil:

sandy

Aspect (if relevant):

nil

Slope (if relevant):

nil

Current management:

(incl. threats)

Nil - no apparent slashing (understorey  
very dense)

Suggested management:

Needs a good stock ch. hard due to  
trees

Photos taken:

Notes on images:

Yes  No

both sides of road

Specimens collected:

Yes  No  HO collecting number allocated: .....



*Lepidium hyssopifolium* confirmation surveys

**SURVEY DETAILS**

Site name (refer Table 1): Salmon Ponds  
 Date of survey: 7 April 2013  
 Surveyor(s): Mark Lapeere  
 Jurisdiction: ?

**PREVIOUS INFORMATION** (include map, grid references, collector, notes):

tennis court  
 Redlands  
 hops  
 water race  
 channel  
 399  
 40  
 RIVER  
 Salmon Ponds  
 fish hatchery  
 SALMON POND ROAD  
 3985 FISHERIES RESERVE  
 3984  
 clearing (perhaps once per year)  
 L. muscivora (quite young) - walked both ways  
 slow-driven, some sites checked on ground under trees  
 L. = fox - with mallee lots. Lp & La



**Review of *Lepidium hyssopifolium* in Tasmania**

**POPULATION INFORMATION** (annotate map above if necessary)

**PRESENT** **ABSENT**

**Waypoints collected:** N/A

**Number of individuals:** N/A

**Extent of population:** N/A

**SITE DESCRIPTION**

**General notes:** general area searched only - record location uncertain.

**Road verge notes:**

**Side of road:** North South East West (circle most applicable)

**Distance from sealed edge:**

**Vegetation description:** Lyell Highway - N.E.S verges - slowwalked.  
- row of semi-mature *L. nodata* near S.P.R.  
sunburn - grass & shrub access under (on private)  
- grass on road verge.

**Geology:** Lyell Highway - N.E.S verges c. SW to E

**Soil:** - old white gravels on grassy banks

**Aspect** (if relevant): Lpe Ca 1-ally abundant

**Slope** (if relevant):

**Current management:**  
(incl. threats)

**Suggested management:** Nil - species cannot be detected

**Photos taken:** Yes No

**Notes on images:** Various

**Specimens collected:** Yes No HO collecting number allocated:



**APPENDIX C. Individual site reports**

Appended as separate PDF files.

