# GRANTS LITHIUM PROJECT

Environmental Impact Statement

# Appendix R

*Stylidium ensatum* survey report

Prepared by EcOz

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# *Stylidium ensatum* survey report

# Grants Lithium Project

## Core Exploration

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# 1 INTRODUCTION

Core Exploration Limited propose developing the Grants Lithium Project (the project) on Mineral Lease ML(A)31726, ~ 20 km south-west of the Darwin CBD on the Cox Peninsula. The project is being assessed under the *Environmental Assessment Act* at the level of an Environmental Impact Statement (EIS), Terms of Reference for which require:

> *The area of habitat and the results of targeted surveys for Stylidium ensatum. The surveys should be undertaken by a suitably qualified and experienced person that has demonstrated experience in surveying for and the identification of threatened species in the Northern Territory. If targeted surveys find S. ensatum, potential impacts should be evaluated using the EPBC Significant Impact Guidelines*

EcOz Environmental Consultants were engaged to undertake targeted on-ground surveys at a time of year appropriate for detecting the species.

This report presents the methods used to define suitable search areas, and results of the targeted surveys; it is intended as an appendix to the EIS for the project.

## 1.1 Investigation area

The mineral lease (the project area) is surrounded by undeveloped vacant Crown land; currently, the main land use is mining exploration. Approximately 117 ha of the 750 ha lease will be disturbed for construction and operation of the mine. A new 19 ha mine site dam will be constructed on the western edge of the lease, and a ~ 6 km buried pipeline will transport water to the project from the existing Observation Hill dam, which is situated ~ 2.5 km to the south-east of the lease boundary. These areas outside the mineral lease were also considered as part of this *Stylidium* survey. Figure 1 depicts the project area and components, and the broader *Stylidium* survey area.

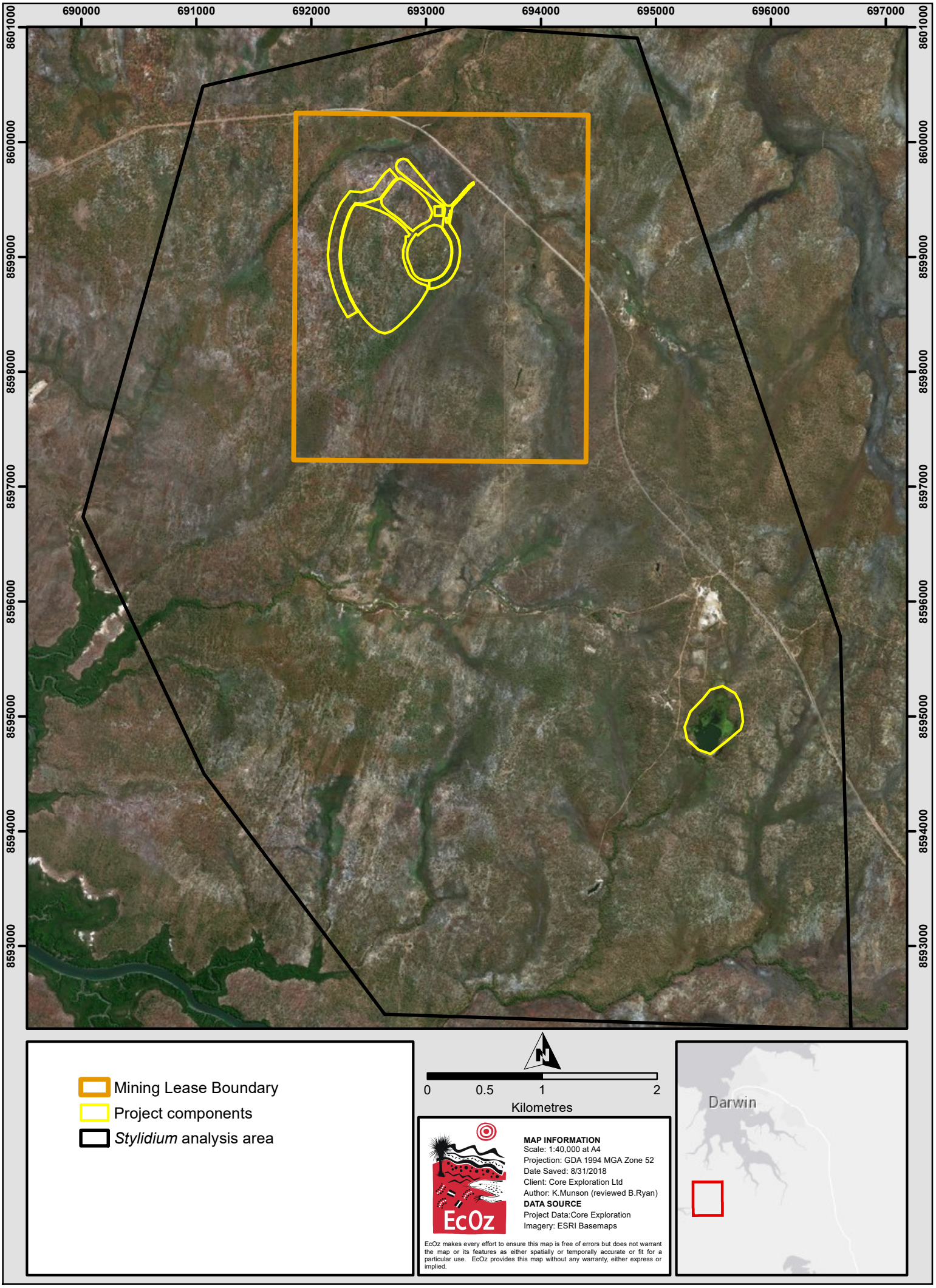


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**Figure 1. Grants Lithium Project *Stylidium* investigation area**

## 1.2 *Stylidium ensatum*

*Stylidium ensatum* is a small annual herb, one of approximately 40 described species of *Stylidium* (commonly known as triggerplants) from the Northern Territory (NT Herbarium 2015). *Stylidium ensatum* is listed as Endangered under the *Territory Parks and Wildlife Conservation Act* and the Commonwealth *Environment Protection and Biodiversity Conservation Act.*

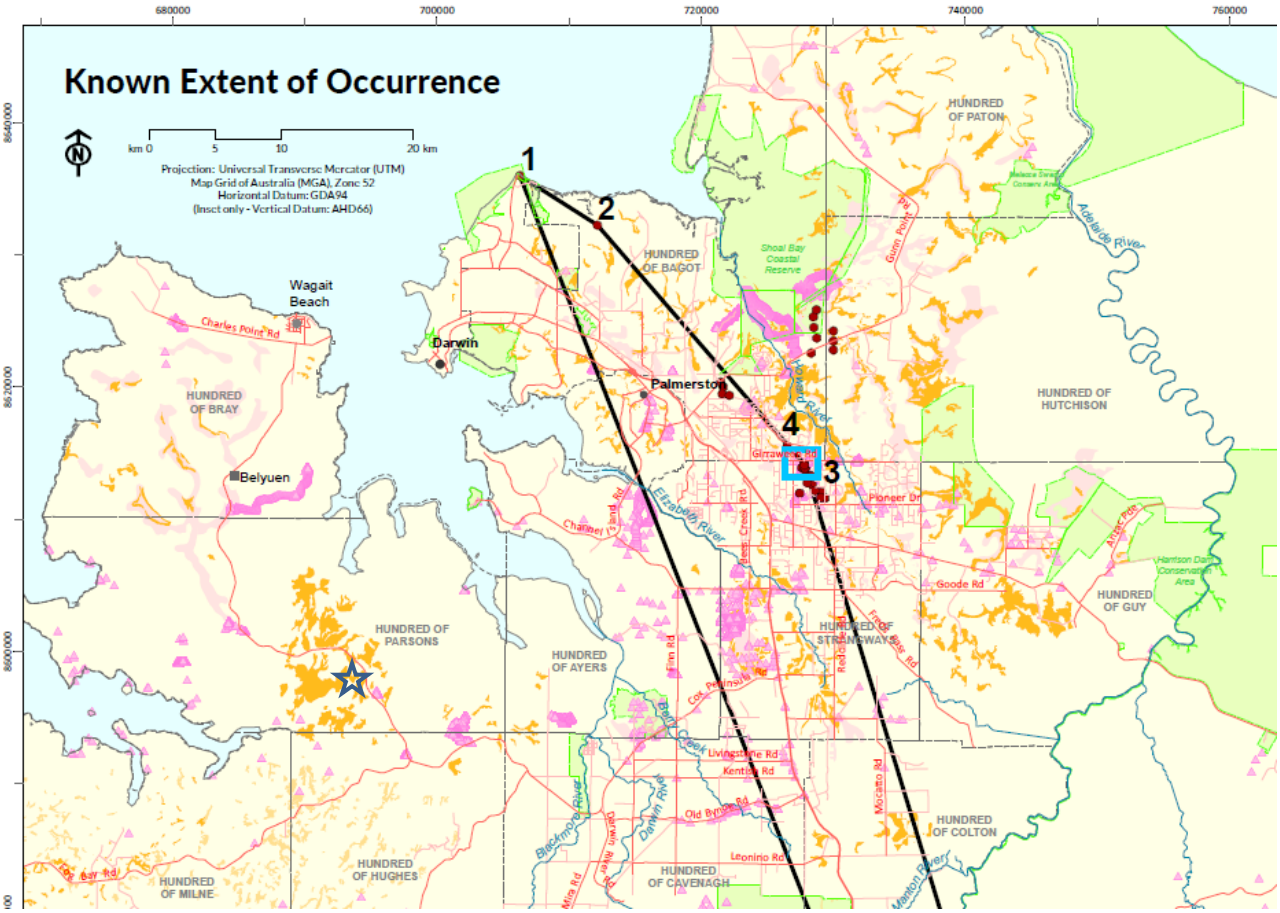
The species grows to 22 cm tall, has sessile obovate or orbicular leaves attached to a short stem, and small pink flower with lobed petals, as shown in Figure 2. *S. ensatum* is a member of the *Stylidium* subgenus *Andersonia,* species known from South-east Asia and northern Australia (Bean 2000), where the climate is monsoonal and rainfall is strongly seasonal. As is typical of other species of *Stylidium*, *S. ensatum* is likely to germinate where water has recently receded in seepage areas and seasonally inundated sites. Plants grow in the early dry season, and are best able to be detected between June - July when flowering and fruiting occurs.

*Stylidium ensatum* inhabits margins of drainage areas in damp heavy clay or peaty soil (Cowie & Westaway 2012), although it may prefer sandier or loamy soils (Ian Cowie, NT Herbarium, pers. comm. 2017). Suitable areas for *S. ensatum* tend to be adjacent to *Lophostemon* swamps, where surface moisture is maintained into the early to mid-dry season (Nic Cuff, NT Herbarium, pers. comm., 2017). The preferred habitat for *S. ensatum* generally supports sedges, perennial grasses such as *Eriachne burkittii,* and scattered *Banksia dentata* (TSSC 2016). The species does not occur in areas with deeper water, for example the margins of billabongs (Ian Cowie, NT Herbarium, pers. comm. 2017)

**Figure 2 *Stylidium ensatum* leaves and flower; plants from the Girraween Road location.**

## 1.3 Known Extent of Occurrence

The Extent of Occurrence of *Stylidium ensatum* has been mapped based on known recorded locations close to Darwin and a site at Hayes Creek (DLRM 2016). Potential habitat for the species has also been mapped from historical land resource survey information, and serves as a guide to identify areas where the species may be present (DLRM 2016). While the species has not previously been recorded from the Cox Peninsula, mapping (as shown in Figure 3) indicates the potential for habitat in portions of the investigation area.




*Source: Threatened species of the Greater Darwin Region – Stylidium ensatum (DLRM, 2016)*

*Blue Star - approximate location of Grants Lithium Project in relation to NT Herbarium mapping of potential habitat for S. ensatum.*

*Orange – mapped potential habitat of S. ensatum (NT Herbarium)*

*Pink triangle – locations of previous surveys with no S. ensatum records*

*Red circle – S. ensatum records*

*Black lines – Extent of Occurrence of S. ensatum*

**Figure 3 Known extent of occurrence and modelled habitat of *S. ensatum***

# 2 METHODS

## 2.1 Survey area selection

Existing land unit and vegetation mapping, and satellite imagery were examined to identify potential areas of suitable *Stylidium ensatum* habitat to be targeted for on-ground investigation. Given the species' relatively restricted habitat requirements outlined in Section 1.2, areas where water is retained at the surface into the mid-part of the dry season (June-July) were targeted. These areas were identified by analysing satellite imagery; a normalised difference water index (NDWI) was derived from Sentinel imagery (image date 04/06/2018). This index reflects the moisture content of plants and soil, and is derived from the near infrared and short infrared wavelengths.

Existing land unit mapping was also considered. Of the land units mapped within the project area, those in low-lying areas of gentle lower slopes (unit 4a) and alluvial plains (unit 5a) with a wet season water table were considered more likely to provide potential habitat for *S. ensatum.* However, even within these land units only some localities would be suitable, as much of the area dries out rapidly following the end of the wet season. Select locations in land unit 6b could also retain water into the dry season; however,the majority of this lowland plain land unit drains rapidly in the early part of the dry season so that the surface is dry by June.

Vegetation communities within the project area have been mapped previously (EcOz Environmental Consultants 2017). Of this mapping, vegetation Type 3 was considered to have the highest likelihood of supporting *S. ensatum;* this community is described as Low isolated trees of *Pandanus spiralis*, *Lophostemon lactifluus*, *Livistona humilis* over sparse shrubland of *Pandanus spiralis*, *Lophostemon lactifluus*, *Livistona humilis* over tussock grassland of *Sorghum stipoideum*, *Eriocaulon spectabile*, *Melaleuca nervosa* on alluvial soils. These areas are poorly drained with seasonal inundation or waterlogging and have hydrosol soils, i.e. they are saturated with water for extended periods, and are generally a greyish colour and have a high organic content.

Riparian areas were also considered to have some likelihood of providing habitat, and were assessed for suitability. However, this is limited to seepage areas adjacent to drainage lines as deeper pools in creek and river channels are not suitable for *S. ensatum.* Riparian zones correspond with vegetation Type 4 or Type 5, although it should be noted that there is some variation in riparian communities outside the previously mapped areas.

Based on consideration of the above data sources, three higher likelihood areas for *S. ensatum* were identified in the broader project area. These were designated (from south to north) as the Dam area, Drainage 1 and Drainage 2 (Figure 4).

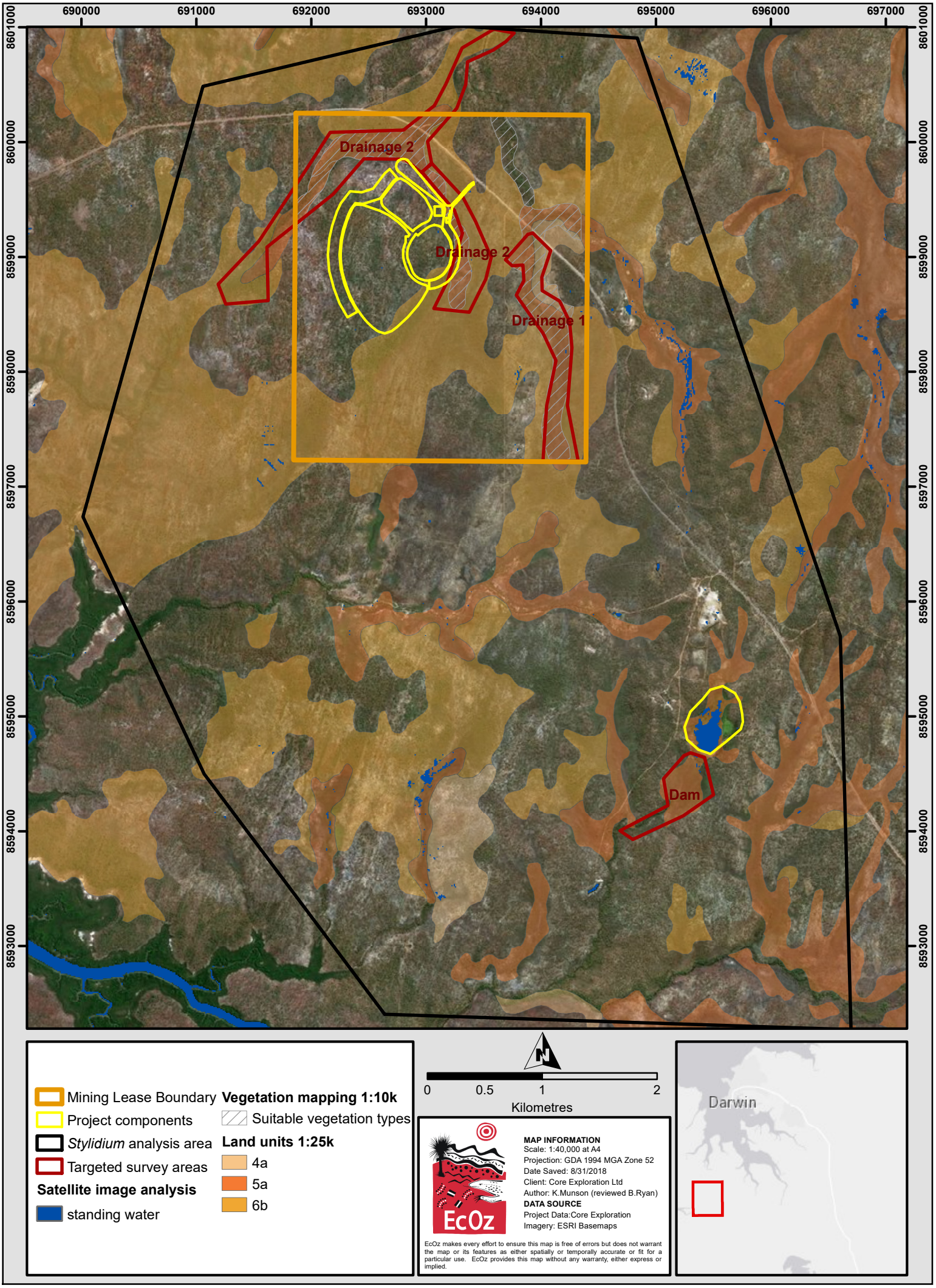



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**Figure 4. Stylidium targeted search areas**

## 2.2 Field survey

The checksite near Girraween Road was visited on the 21 June 2018 prior to the survey to inspect a population of *S. ensatum* for flowering and detectability, and record attributes of the habitat where the species is known to occur.

On-ground survey was undertaken on 21-22 June 2018. Higher likelihood areas (Figure 4) were searched for *S. ensatum* and potentially suitable locations were targeted for more intensive on-ground investigation. Relevant features used to determine potentially suitable locations on-ground were primarily:

- Shallow inundation or saturated soils in the mid dry season
- Overstorey consisting of *Lophostemon lactifluus, Pandanus spiralis* and/or *Melaleuca* spp.
- Ground layer incorporating grasses and herbs that occur in poorly drained habitats
- Relatively open overstorey

A GPS track was recorded to provide a record of the survey range and effort, and photographs of habitats were taken. Survey was undertaken by senior botanist David van den Hoek, and managing ecologist Stephen Reynolds. David has extensive experience in undertaking vegetation surveys in the Top End, including surveys for and identification of threatened flora. Stephen has worked in the Top End for over a decade, has a broad knowledge of the flora and fauna of monsoonal northern Australia, and has undertaken targeted surveys for threatened flora.

# 3 RESULTS

At the Girraween Road checksite over 20 individual *S. ensatum* plants were observed. Only some of these were in flower; the majority were located on raised debil-debil mounds surrounded by saturated soils, but were not sitting in water.

No *S. ensatum* plants were found in the project survey area. Two individuals of the related species *S. schizanthum* were found on stony ground on the dam wall. *S. tenerrimum* was recorded from the edge of the creekline on a seepage flat, and an unidentified *Stylidium* sp. 'pink' was recorded near Cox Peninsula Road in an area of woodland. Figure 5 maps survey tracks and the locations searched most thoroughly due to the presence of water and/or soil moisture. Table 1 provides details of the search areas including general habitat notes.

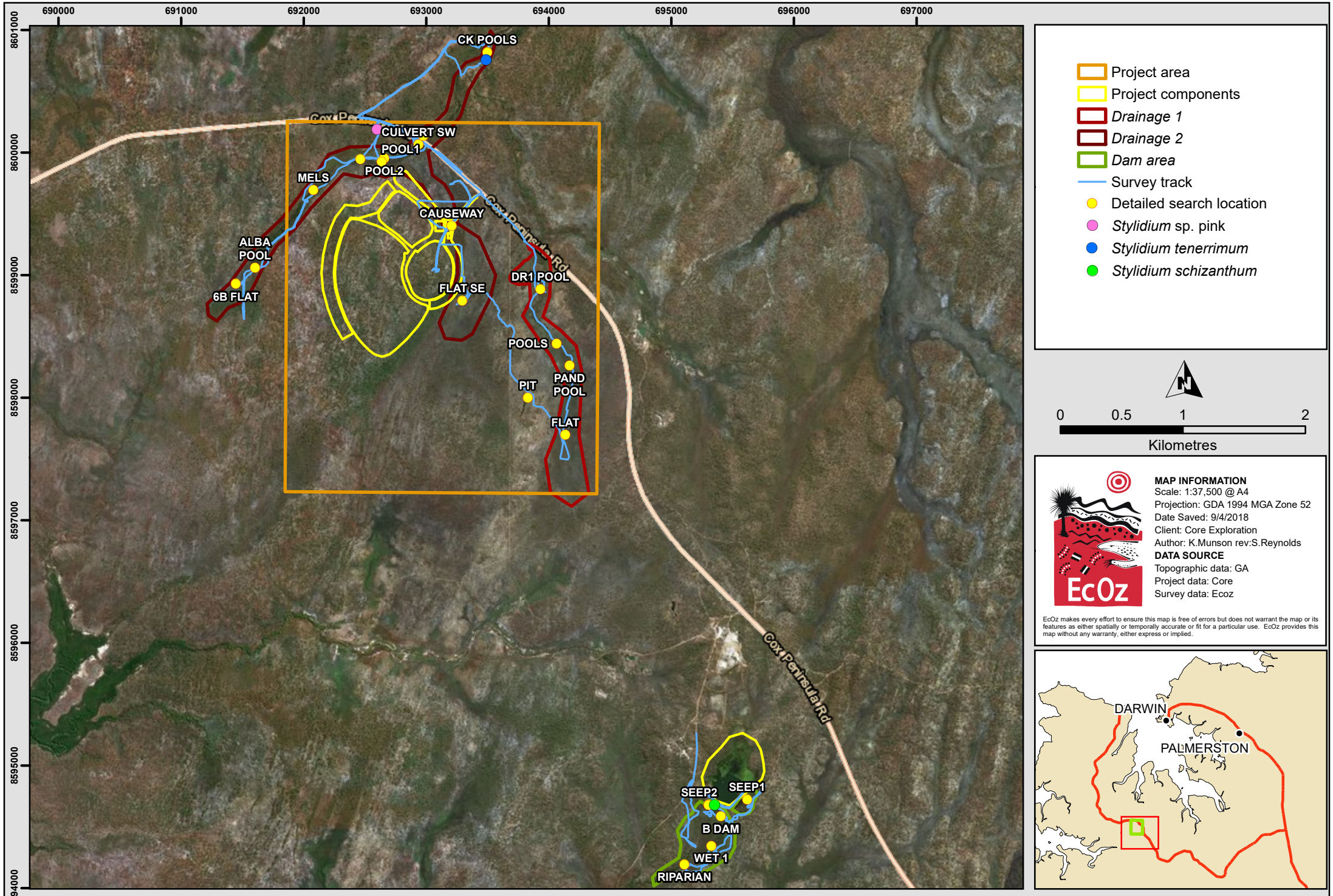


**Figure 5. *Stylidium ensatum* survey tracks and detailed search areas**

**Table 1. Descriptions of areas searched for *Stylidium ensatum***

| Search area | Description | Photos |
|---|---|---|
| **DAM – Observation Hill Dam with drainage flat and riparian corridor to the south** | | |
| SEEP 1 | Seepage and inundated area adjacent to dam; *Melaleuca* forest with some herbs but generally sparse ground layer | |
| SEEP 2 | Seepage area with saturated soils below dam; *Carallia brachiata, Osbeckia australiana* with dense understorey of grasses and *Lycopodiella* (*Lycopodium*) *cernua* | |
| B DAM | Moderately deep pool below main dam; some aquatics (*Nymphaea* spp.) and sedges, pig damage near edges | Figure 6 |
| WET 1 | Saturated soils and some surface water on portion of alluvial plain; herbs included *Drosera petiolaris, Eriocaulon* sp., *Utricularia chrysantha* | Figure 7 |
| RIPARIAN | Riparian vegetation (included *Pandanus spiralis, Syzygium armstrongii, Melicope elleryana, Lophostemon lactifluus, Melastoma malabathricum, Xanthostemon eucalyptoides, Flagellaria indica*) with creekline pools | |
| **DRAINAGE 1 – alluvial plains with a more defined drainage line in the north** | | |
| PIT | Deep (> 3 m) excavated steep-sided pit filled with water | |
| FLAT | Drainage flat supporting vegetation type 3; no surface water | |
| PAND POOL | Pool ~15 m x 15 m, mainly >0.5 m deep with *Pandanus spiralis.* | |
| POOLS | Muddy pools along drainage line with generally steep banks | |
| DR1 POOL | Shallow pool (< 30 cm) ~40 m x 50 m at time of survey with wet edges; few herbs recorded and no species of *Stylidium* noted. | |
| **DRAINAGE 2 – alluvial plain grading into a more defined drainage line** | | |
| FLAT SE | Drainage flat supporting vegetation type 3; no surface water | |
| CAUSEWAY | Formed track slightly elevated above level of surrounding plain; water pools along edges in wet season but ground surface completely dry at time of survey | |
| 6B FLAT | Mapped as land unit 6b but essentially similar to vegetation type 3; no surface water | |
| ALBA POOL | Pool ~10 m x 10 m, generally >0.5 m deep edged with *Eucalyptus alba* and *Pandanus spiralis* | Figure 8 |
| MELS | Patch of *Melaleuca viridiflora* with some ground layer herbs | |
| POOL 3 | Pool ~20 m x 60 m, mainly >0.5 m deep on drainage flat that supports regularly fired *Lophostemon lactifluus*, *Pandanus spiralis* and *Livistona humilis* over grasses (vegetation type 3) | |
| POOL 2 | Pool ~15 m x 10 m, to ~1 m deep with *Eleocharis* sp. on drainage flat as above | |
| POOL 1 | Pool ~20 m x 15 m, mainly >0.5 m deep on drainage flat as above | Figure 9 |
| CULVERT SW | Partially fire protected patch of *Melaleuca viridiflora* with *Lophostemon lactifluus* | |
| CULVERT NE | Pool in bare stony creek bed below culvert | |
| CK POOLS | Pools generally 30-80 cm deep along rocky creek line with *Melaleuca viridiflora* and occasional *Leptospermum madidum*; some associated wet season seepage flats with sedges, *Lindernia lobelioides* and *Stylidium tenerrimum.* | Figure 10 |

**Figure 6. Large pool below dam (B DAM)**

**Figure 7. Wet area on plain below dam (WET 1)**

**Figure 8. Riparian zone in Drainage 2 with *Eucalyptus alba* and *Pandanus spiralis***

**Figure 9. Example of pool lined with *Pandanus spiralis* (POOL 1)**

**Figure 10. Wet season seepage adjacent to rocky creek**

# 4 DISCUSSION AND CONCLUSIONS

On the basis of on-ground survey the suitability of the project area for *S. ensatum* was generally considered to be low or none. Rocky areas with skeletal soils (rudosols) occupy much of the project area. Alluvial drainage flats are seasonally saturated but were dry at the surface in June and therefore do not provide habitat for *Stylidium ensatum*. The pools encountered along creeklines and at several locations within the drainage flats comprised deep water pools (> 30 cm and generally more) and were unsuitable habitat. Riparian corridors were either dry in the case of *Melaleuca* and *Eucalyptus alba* woodlands and open forests, or comprised creekline pools that were too deep for the species. Patchily distributed wet season seepages adjacent to drainages supported herbs but were unsuitable for *S. ensatum* as they were dry at the surface in June.

*Stylidium* species were found in the survey area but not *S. ensatum* and no species were found in habitat that could be suitable for the target species. *S. ensatum* was not found in the survey area despite searching in potentially suitable sites at an appropriate time of year. It is currently only known from several locations, and appears to have highly specific habitat requirements. The possibility exists that it occurs on Cox Peninsula, but not in the types of habitats assessed in the survey area; previous floristic surveys at an appropriate time of year have also not recorded the species (confirmed absence records) in the area (Figure 3; DLRM 2016).

Although portions of the project area and vicinity have been mapped as potential habitat, on-ground surveys indicate that none of the sites within the survey area were particularly suitable for *S. ensatum,* on the basis of its habitat preferences at a known location. Extremely high fire frequencies in the area is also likely to be a factor detrimental to the survival of this species and decreases the likelihood of its occurrence.

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