HERITAGE ASSESSMENT REPORT

NAME:	Poole Creek Fossil Flora Complex	**PLACE:**	26547

ADDRESS: Arabana Country
Kati Thanda South (Lake Eyre South) and Covrichina Dam,
Callanna SA, 5733.
CL6178/960, CL6234/961, Outside of Hundreds.

This heritage assessment considers that the place meets criteria (b) and (c). Refer to Summary of State Heritage Place for final approved wording, including criteria statements.

Poole Creek Palaeochannel. Eyre Formation channel sands. Silcrete cement. Basal beds contain multicoloured quartz, agate, fossil wood. Plant fossils present in this outcrop.

Source: Government of South Australia. Department of State Development. Report Book, 90/00015

ASSESSMENT OF HERITAGE SIGNIFICANCE

Statement of Heritage Significance:

The Poole Creek Fossil Flora Complex, including a portion of the Poole Creek Palaeochannel Geological Monument located south of Kati Thanda (Lake Eyre South) contains rare silicified botanical fossils of leaves, wood and fruit and a unique type specimen of the pine *Manchesteria australis*, deposited during the Cenozoic Era (66 Million years ago to present). The fossil assemblages extend over 29.5km of dry riverbed and contain rare seed cones resembling *Banksia, eucalypt*-like nuts and leaves of various species with a high quality of preservation. The fossil record contained in the complex extends the known temporal and geographical range of some identified species. Poole Creek Fossil Flora Complex also has a high potential to yield further information that will enable a greater understand of the environment and evolution of the Australian continent in ancient times.

Statement of Palaeontological Designation

Poole Creek Fossil Flora Complex is a palaeochannel located south of Kati Thanda (Lake Eyre South). It is a rare and outstanding example of a Cenozoic fossil flora assemblage. The channel runs over ~29.5km kilometres (from 29.4087º S to 29.6493º S) with 14 significant sites in which fossil flora have been identified or are highly likely to be found. The fossil assemblage yielded fossilised and silicified wood, leaves and seeds.

The age of the fossil assemblage is still being refined by paleobotanists. The assemblage contains portions of the geological Eyre and Etadunna formations, respectively aged to 62-42Ma and 25.7-12.5Ma.

The fossil site has thus far yielded 89 fossil specimens, including 18 identified species and a unique type specimen for *Manchesteria australis Stull & Rozefelds* sp. nov., identified through seed remains. Other species include rare *Banksia* infructescences (seed cones) that are found within the geological formations and eucalypt-like specimens similar to those found at Stuarts Creek.[1]

The significant palaeontological features contained within the complex are:

- Complex of 14 fossil flora sites.
- Well-preserved silicified fossil flora in the form of leaves, seeds, fruits and infructescences.
- Type locality for *Manchesteria australis Stull & Rozefelds* sp. nov.[2]
- Eyre formation with the Etadunna formation overlaying unconformably, depicting a period of erosion and deposition and break in the geological record.
- An extensive assemblage that with further research can contribute to the understanding of the natural evolution of the State.

Relevant South Australian Historical Themes

1. Natural Environment

    1.1 Tracing climatic and topographical change

    1.2 Tracing the evolution of plants and animals

Comparability / Rarity / Representation:

The 'Fossil Heritage Survey for South Australia' (2021) identified over 800 fossil sites in South Australia.

Of the 800 fossil sites identified in the survey, 73 contain deposits of fossil flora (botanical fossils) of varying quality, including fossils of preserved leaves, seeds and pollen. Botanical fossils are rarer than animal fossils due to the decomposition process. Generally, hard, largely mineral-based material such as bones are more readily preserved than soft, organic material like leaves.

There are a number of highly significant plant fossil sites from the Cenozoic Era located in South Australia, of which four sites contain type specimens. Type specimens are the fossil(s) that when discovered are used to describe a species and are regarded by

the scientific community as the baseline for identification of the species. Of these four sites, one is already State Heritage listed, and two are currently being assessed, the four sites are:

- Maslin Bay to Aldinga Bay Coastal Cliff Section Geological Site, Maslin Beach (SHP 14040), Middle Eocene,
- Nelly Creek Fossil Flora Complex (currently being assessed), Middle-Late Eocene,).[3]
- Poole Creek Fossil Flora, General Cenozoic age (subject of this assessment)

The fossil assemblage at Poole Creek is diverse and contains silicified fossils from across the Cenozoic Era. Preliminary research undertaken at Poole Creek resulted in the collection and identification of 89 specimens[4] and 18 species.[5] Specimens of Gymnostoma, Brachychiton, *Syzygium* and other Myrtaceae-like specimens, [6] such as rare *Eucalyptus*-like gum nuts, potentially of the Leptospermoideae subfamily have been found.

Poole Creek Fossil Flora Complex is the only site in the State and only one of two locations in Australia where fossils of Icacinaceae have been recorded.[7] Poole Creek is the type fossil locality of *Manchesteria australis sp. nov (*a new species identified from the site), citing two different specimens of Mid-Eocene age. The finding provides a strong connection between Cenozoic Australia and rainforest environments.[8] It is also the area where rare *Banksia*-like infructescences have been identified, including cones that remains on-site. [9]

Much like Nelly Creek, another significant aspect of Poole Creek is its location. A majority of Cenozoic-age fossil sites are coastal, however, both Nelly and Poole creeks present information on Australia's interior during the Cenozoic.[10]

Like Nelly Creek, the Poole Creek fossil assemblage is believed to have originated from a monsoonal environment[11] with rainfall likely being seasonal.[12] However, like the State Heritage Listed Tertiary Flora Stuarts Creek, Poole Creek also has evidence of eucalypt-like specimens.[13]

Age and Fossil Type

Poole Creek Fossil Flora Complex contains examples of silicified floras that are present as impressions of the epidermal (outer) cells of the plant tissue and extends across a number of sites, making it difficult to precisely pinpoint its origin within the Cenozoic Era. The Cenozoic Era is divided into five Epochs ranging from 66 million years ago to the present day. The large area of the site means that numerous geological formations ranging from this time are present.

According to Greenwood *et al*. (1990), the latest age of the site is the Late Palaeocene to Middle Eocene[14] (~50-44Ma) spanning approximately 14 million years. Additionally, with the close proximity of the Etadunna Formation[15] it is possible that sites as young as the Late Miocene (~12-5Ma) are present, although less common than the older formations. The Miocene aged specimens are also noted as often being poorly preserved.[16] Similarly the silicified fossils of the Etadunna Formation present much less diversity of macroflora than those in the Eyre formation areas.[17] While the two formations share taxa, the Etadunna Formation does contain additional

unique specimens. Despite this, though, a confident age for the fossils has not yet been identified.

The Poole Creek Fossil Flora Complex can be used to determine the characteristics of the environment at the time of deposition. Organisms that suggest a rainforest environment, such as *Athertonia* or Elaeocarpaceae are present. However, more common specimens found at the complex include rare Myrtaceae fruits and leaves,[18] including those attributed to *Syzygium,* and *Lophostemon*, which suggest slightly more arid adapted (or drier) environments.[19] Similarly, the presence of rare examples of Elaeocarpaceae and Cunoniaceae[20] also supports an environment of mixed rainforest and dry adapted species.[21]

Condition, Integrity and Importance of Specimens

The fossil specimens at Poole Creek Fossil Flora Complex are well-preserved. The fossils, often in the form of fruits, seeds, leaves and stems are commonly found as impressions or voids within silicified rocks. However, the internal structures and cuticles of the plants are rarely preserved.[22]

It is noted that the palaeochannels where the fossil leaves were deposited now sits higher in the landscape, depicting a major change in the environment. While the fossils in the Palaeochannel at Poole Creek appear to have a lower species richness than comparable fossil sites, the fossils have finer grains than similar sites, therefore providing slightly better preservation and ability to yield information. The fossils present also depict a slightly wetter and more rainforest-like environment.[23]

Only preliminary research has thus far been undertaken on the fossils found at the Poole Creek Fossil Flora Complex. These initial studies recorded ~89 specimens with 18 different species identified.[24] In comparison to Nelly Creek Fossil Flora Complex, Poole Creek Fossil Flora Complex has yielded a higher diversity of species. [25]

Common leaf fossil types in the Poole Creek Fossil Flora Complex are Gymnostoma, common across the Complex, two forms of Myrtaceae that are found sporadically throughout the Complex[26] and also unique, most likely Miocene-aged *Banksia* infructescences (seed cones) that were found in 1988 and remain in-situ.[27] The fossil *Banksia* extends the geographical range of this genus.

Additionally, Poole Creek is recognised as the type locality of *Manchesteria australis Stull & Rozefelds sp. nov.*, through seed remains that were only identified in 2020.[28]

Potential for Further Research

Palaeobotanists anticipate that Poole Creek is also highly likely to contain further high quality specimens.

The identification of these specimens could result in the broadening of the geological and temporal ranges of the fossil flora. This will enhance the ability of researchers to identify the age of the site with more confidence and draw conclusions about the assemblage, further progressing scientific knowledge.

Similarly, the presence of Eucalypt-like fossil specimens requires much additional research. It is believed that Eucalypts may have evolved at the Cretaceous-Cenozoic boundary, however, additional research is required to further define its evolutionary

chronology. Identification of the key eucalyptus-like nuts, fruits and leaves found at the site is required to do this.

Interpretations of the Poole Creek palaeochannel fossil assemblage have led some to believe that the ancient environment was rainforest-like with areas of interfluves (the valley between watercourses), above the rainforest valleys that supported more drier-adapted environments.[29] Analysis of future data yielded from the Poole Creek Fossil Flora Complex and the nearby Nelly Creek Fossil Flora Complex may make it possible to reconstruct the climate of the area. For example, the mean annual temperature and mean annual rainfall of the area around Kati Thanda (Lake Eyre) during the Middle Eocene.[30]

Assessment against Criteria under Section 16 of the *Heritage Places Act 1993*. All Criteria have been assessed using the 2020 Guidelines.

(a) it demonstrates important aspects of the evolution or pattern of the State's history.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be closely associated with events, developments or cultural phases which have played a significant part in South Australian history. Ideally it should demonstrate those associations in its fabric.*
>
> *Places will not normally be considered under this criterion if they are of a class of things that are commonplace, or frequently replicated across the State, places associated with events of interest only to a small number of people, places associated with developments of little significance, or places only reputed to have been the scene of an event which has left no trace or which lacks substantial evidence.*

The Poole Creek Fossil Flora Complex demonstrates important aspects of the State's natural history, including representing several periods of evolution. However, the place not only demonstrates this significance, but also has considerable potential to demonstrate many more aspects of our history, which means it could be said to meet both criterion (a) and criterion (c) for similar reasons.

Criterion (a) focuses on the 'State's history'. The first test asks which 'historic theme' is demonstrated by the place. In this case, the theme is 'natural history'. However, criterion (c) refers to 'history, including its natural history'. Given that the Poole Creek Fossil Flora Complex is believed to meet criterion (c) because of its significant associations with natural history as well as its *potential* to demonstrate important aspects of our natural history, it seems more relevant to consider the place meets (c) because of its historical significance and potential, rather than meeting criterion (a) using a similar argument.

It is recommended that the nominated place **does not fulfil** criterion (a).

(b) it has rare, uncommon or endangered qualities that are of cultural significance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should demonstrate a way of life, social custom, industrial process or land use which is no longer practised, is in danger of being lost, or is of exceptional interest. This encompasses both places which were always rare, and places which have become scarce through subsequent loss or destruction.

Places will not normally be considered under this criterion if their rarity is merely local, or if they appear rare only because research has not been done elsewhere, or if their distinguishing characteristics have been degraded or compromised, or if they are at present common and simply believed to be in danger of becoming rare in the future.

The Burra Charter states: "Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations," and is embodied within the fabric of the place.

In the case of the Poole Creek Fossil Flora Complex, its cultural significance lies in its considerable scientific value, in particular through its remarkable fossil record, the types of fossils found in the complex, their age, and the species represented. The complex contains rare fossils such as eucalypt-like fruits and nuts, banksia-like infructescences and a type specimen of the pine *Manchesteria australis*. Each fossil specimen could contribute to an understanding of the evolution of the state over a geological time period, including recording climate variance between the Cenozoic and present day.

Both the identified geological formations and the fossils present can provide extensive information on the changing environment during the majority of the Cenozoic Era and with its well-preserved fossils, is likely to yield high quality scientific data.

Despite the relatively low level of research completed at Poole Creek in comparison to more accessible sites, Poole Creek has been identified as the type location for one of 18 species thus far identified from the Complex. Given the high level of preservation and high potential for more finds, the scientific community anticipates identifying further type specimens at the Poole Creek Fossil Flora Complex. Furthermore, the type specimen found at Poole Creek Fossil Flora Complex is unique (thus far) to this site and contributes greatly to providing an insight into the natural history of this part of South Australia and to the botanical fossil record.

The Poole Creek Fossil Flora Complex has a fossil assemblage that will provide insights into climate change and South Australia's environment during the Cenozoic Era. It contains rare fossilised botanical specimens including a thus far unique type specimen. It is for these reasons that the Complex is considered to possess uncommon and rare qualities that are of cultural significance to South Australia.

It is recommended that the nominated place **fulfils** criterion (b).

(c) it may yield information that will contribute to an understanding of the State's history, including its natural history.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should provide, or demonstrate a likelihood of providing, information that will contribute significantly to our knowledge of the past. The information should be inherent in the fabric of the place. The place may be a standing structure, an archaeological deposit or a geological site.

Places will not normally be considered under this criterion simply because they are believed to contain archaeological or palaeontological deposits. There must be good reasons to suppose the site is of value for research, and that useful information will emerge. A place that will yield the same information as many other places, or information that could be obtained as readily from documentary sources, may not be eligible.

The fossil assemblage at Poole Creek Fossil Flora Complex is diverse and offers the potential to reveal further information about the natural history of central South Australia. The Poole Creek Fossil Flora Complex has yielded numerous fossils in the past and is considered by palaeobotanists to be highly likely to continue to yield numerous fossils in the future. The silicified leaves present at Poole Creek record plant families, genus and species. The specimens can provide vital information to help understand the climate, environment and ecological interactions that occurred during the Cenozoic Era.

While some investigation and research has occurred at Poole Creek, the site remains understudied. Thus far, 18 specimens have been positively identified at Poole Creek Fossil Flora Complex, including at least one type specimen that is thus far unique to this site. Palaeobotanists anticipate the site is highly likely to yield many further examples, including type specimens. The type specimen found at the Complex, Icacinaceae (*Manchesteria australis* Stull & Rozefelds *sp. nov*.), is highly significant due to the unexpected appearance of the plant species in Central Australia. Fossil records for this family are predominantly from the Northern Hemisphere having been found in Europe and North America.

Similarly, the identification of eucalypt-like specimens from the locality suggests the potential for further eucalypt-like specimens to be identified potentially providing valuable data about the evolution of one of Australia's most abundant modern flora.

The Poole Creek Complex has high potential to yield further information that will contribute to building our understanding of the vegetation, climate and environment of central South Australia. In particular, the site is likely to yield meaningful information about past environmental conditions and the impact of climate change on vegetation during the Cenozoic, including possibly the evolution of Eucalypts. It is for these reasons that Poole Creek Fossil Flora Complex is considered to meet criterion (c).

It is recommended that the nominated place **fulfils** criterion (c).

(d) it is an outstanding representative of a particular class of places of cultural significance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should be capable of providing understanding of the category of places which it represents. It should be typical of a wider range of such places, and in a good state of integrity, that is, still faithfully presenting its historical message.

Places will not be considered simply because they are members of a class, they must be both notable examples and well-preserved. Places will be excluded if their characteristics do not clearly typify the class, or if they were very like many other places, or if their representative qualities had been degraded or lost. However, places will not be excluded from the Register merely because other similar places are included.

The Poole Creek Fossil Flora Complex can be considered to be a member of a number of classes of place. Broadly speaking, it is a scientific site or a fossil site, both of which could be considered to be of cultural significance. More specifically, it is a plant fossil site and/or a 'Cenozoic plant fossil site'.

In the future, Poole Creek Fossil Flora Complex may be considered an outstanding representative of a fossil site or Cenozoic fossil flora site in South Australia. However, as these sub-classes only occur rarely in South Australia, and there are not a wide range of such places against which to compare, the class of place is not yet considered to be of cultural significance.

With regard to the broader class of fossil sites, Poole Creek has a number of features worth considering. However, two factors reduce its ability to meet this criterion.

Firstly, most of the notable characteristics of the fossil site are rare rather than 'typical of a wider range of such places'. For this reason, the place is considered to meet criterion (b) to a high degree, rather than criterion (d).

Secondly, although the Poole Creek Fossil Flora Complex has already produced a number of fossils with high preservation and intactness, the vast majority of the site has not yet been investigated. So far, 89 fossils and 18 taxa have been initially described from Poole Creek – in comparison, more than 2,000 fossils have been recorded at Maslin Bay.

Although Poole Creek is believed to have considerable potential for yielding well-preserved and significant finds, further research should be completed and a fuller understanding of the site recorded before the site can be considered an outstanding representative of a fossil site.

Therefore, criterion (d) is not yet considered to be met. The potential of the site to yield vital information about the state has been explored under criteria (b) and (c) and the recommendation to list the site under those criteria.

It is recommended that the nominated place **does not fulfil** criterion (d).

(e) it demonstrates a high degree of creative, aesthetic or technical accomplishment or is an outstanding representative of particular construction techniques or design characteristics.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should show qualities of innovation or departure, beauty or formal design, or represent a new achievement of its times. Breakthroughs in technology or new developments in design would qualify, if the place clearly shows them. A high standard of design skill and originality is expected.*
>
> *Places would not normally be considered under this criterion if their degree of achievement could not be demonstrated, or where their integrity was diminished so that the achievement, while documented, was no longer apparent in the place, or simply because they were the work of a designer who demonstrated innovation elsewhere.*

This criterion relates to the man-made qualities of a place. As the Poole Creek Fossil Flora Complex is a natural site, it is not considered to demonstrate a high degree of aesthetic, creative or technical accomplishment nor is it an outstanding representative of particular construction techniques or design characteristics.

It is recommended that the nominated place **does not fulfil** criterion (e).

(f) it has strong cultural or spiritual association for the community or a group within it.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be one which the community or a significant cultural group have held in high regard for an extended period. This must be much stronger than people's normal attachment to their surroundings. The association may in some instances be in folklore rather than in reality.*
>
> *Places will not be considered if their associations are commonplace by nature, or of recent origin, or recognised by a small number of people, or not held very strongly, or held by a group not widely recognised, or cannot be demonstrated satisfactorily to others.*

The Poole Creek Fossil Flora Complex is located within the Arabana People's Native Title Determination and is approximately ~11km south of Kati Thanda South (Lake Eyre South). Kati Thanda (Lake Eyre) is a highly significant place for the Arabana People, however, it is recommended that Arabana cultural knowledge and spiritual attachment to Kati Thanda and surrounding areas is more appropriately recognised by the Arabana People under the provisions of the *Aboriginal Heritage Act 1986*.

Additionally, while the site is of importance to the scientific community, particularly palaeobotanists, a connection to small communities of researchers does not resonate with the wider South Australian community and is not considered to be sufficient for the site to meet the criterion.

It is recommended that the nominated place **does not fulfil** criterion (f).

(g) it has a special association with the life or work of a person or organisation or an event of historical importance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place must have a close association with a person or group which played a significant part in past events, and that association should be demonstrated in the fabric of the place. The product of a creative person, or the workplace of a person whose contribution was in industry, would be more closely associated with the person's work than would his or her home. Most people are associated with many places in their lifetime, and it must be demonstrated why one place is more significant than others.

Places will not generally be considered under this criterion if they have only brief, incidental or distant association, or if they are associated with persons or groups of little significance, or if they are associated with an event which has left no trace, or if a similar association could be claimed for many places, or if the association cannot be demonstrated. Generally the home or the grave of a notable person will not be entered in the Register unless it has some distinctive attribute, or there is no other physical evidence of the person's life or career in existence.

The Poole Creek Fossil Flora Complex is not considered to have a special association with any person, organisation or event of state significance.

Perhaps the person most associated with the site is Dr Neville Alley, a palynologist who spent much of his career studying pollen and other microscopic organic material and Roger Callen, an independent researcher with a background in geology who predominantly focuses on South Australian inland geology. Dr Alley has undertaken many explorations and searches for fossil flora material throughout South Australia and the world. However, as the complex is one of many sites they have investigated, there is no evidence of a stronger association or attachment with Poole Creek than other places that the two have worked.

It is recommended that the nominated place **does not fulfil** criterion (g).

PHYSICAL DESCRIPTION

Poole Creek Fossil Flora Complex is located approximately 36km West of the town of Marree and approximately 11km from Kati Thanda South (Lake Eyre South). The complex is a palaeochannel that extends for about 29.5km kilometres from 29.4087º S to 29.6493º S and contains 14 areas from which fossils have been recorded.

The area of the palaeochannel is seasonally dry with very little water throughout the year. The fossil flora are deposited and preserved in silcrete, a hard layer of duricrust that preserves cavities and impressions of fossil leaves, wood, stems and fruits. Only a few mummified fossils and carbonate casts of plant materials have been found.[31]

The most notable fossil sites have been included within the proposed State Heritage Place. It is also noted that site 13 is likely to contain fossil flora within the surrounding cliffs and as such, has been included in the Poole Creek Fossil Flora Complex.

The fossil sites within the proposed State Heritage Place are split between two geological formations. One of these being the Etadunna Formation, a layer of rock 25-80 metres thick[32] and spanning into Queensland and the Northern Territory. The age

is 25.7-12 Million years old. The Eyre formation, the second of the geological layers in the proposed Poole Creek State Heritage Place and is between 42 and 62 Million years old. It is similarly large, being up to 120 metres thick and spanning into NSW, NT and QLD. [33] However, despite the known age of the formation, the fossils have not been aged absolutely.[34]

A majority of the proposed State Heritage Place lies within the much larger Geological Monument recognised as "Poole Creek Palaeochannel", a 35km long area. This monument was recognised by the Geological Society of Australia's South Australian Branch as an area of Geological Significance in 1994. The Monument report focuses heavily on the fossil plants found within the site but also mentions the Eyre and Etadunna geological formations in the area while also focusing on the 'River and swamp deposits of Middle Eocene to Late Pleistocene age'.[35]

Within the report, the "best" Eocene outcrops are noted to have plant fossils within them, each of which is included in the proposed State Heritage Place. The Miocene Etadunna formation sequence is less represented in the State Heritage Place, reflecting the lower fossil presence. However, the importance of the formation in the Geological Monument report is punctuated by the presence of fossils, all of which the known localities of have been included in the proposed State Heritage Place. This demonstrates that, while smaller, the proposed State Heritage Place includes the identified areas of geological interest which are also tightly incorporated into the areas of palaeontological significance, rather than being a separate entity. As a result of both the overlap and predominantly palaeontological focus of the geological monument report, it was determined that the area did not need to be designated as a place of Geological significance unless additional evidence of geological significance emerges in the future.

Elements of Significance:

Elements of heritage significance include (but are not necessarily limited to):

- 14 richly fossiliferous 'hotspots' (identified on site plan) including high abundance and diversity of fossil flora and samples of rare Banksia infructescences and Eucalyptus-like fruits,
- 26km long palaeochannel containing fossiliferous geological formations from the Etadunna and Eyre formations,
- Silicified and compressed wood and leaves that are taphonomically unique,
- Type locality for Manchesteria australis Stull & Rozefelds sp. nov,
- Eyre formation with the Etadunna formation overlaying 'unconformably', depicting a period of erosion and deposition and break in the geological record.

Elements not considered to contribute to the significance of place include (but are not necessarily limited to):

- Built tracks, walkways and signage.

HISTORY

Geological Time (Dates approximate)

During the Jurassic, approximately ~199-145Ma, Australia began separating from Gondwana and started its northward movement towards the equator. Before this northward movement, the majority of the Australian continent experienced light summers and dark winters.

Between ~150 and ~100 Ma the environment was originally believed to be largely fluvial (rivers) and/or lacustrine (lakes). However, the presence of river systems is currently in debate with some evidence concluding that there may not been river and drainage systems until the middle Eocene,[36] though the climate was very wet and humid[37] and there were drastic changes in sea level, leading some of the region to be underwater.[38]

By ~70 Ma, the climate was uniformly humid. During the Palaeocene and Early-Eocene (~66- 50 Million years ago), the environment within central Australia was 'warm temperate with seasonally high precipitation'.[39] Mean annual temperatures were 18-19 degrees Celsius and rainfall approximately 1400 mm/year. The temperature and rainfall levels created ideal conditions for rainforest plants to grow, and such vegetation is reflected in the fossil record.

During the Middle Eocene, the oldest possible time of deposition for Poole Creek, the surrounding places (such as Nelly Creek) show evidence of dry-adapted (Sclerophyllous) and semi-deciduous monsoon-like forests (Mesophyll).[40] At this time, it is thought that the mean annual temperature was >20 degrees Celsius and the warm and strongly seasonal environment created distinct macroflora which are smaller than other Middle Eocene-aged floras. [41]

In central Australia, approximately ~60 Ma, there were believed to be large amounts of transient swamp-like land in the west and sandy alluvial fans common in the east.

By ~38 Ma, Tasmania and Antarctica finally separated, allowing the Antarctic Circumpolar current to form. The Antarctic Circumpolar current caused cooling throughout the Antarctic and Australia.

Over time central Australia's lakes periodically dried and returned, allowing sporadic survival of rainforests until they dwindled in the Late Miocene. Open grasslands came to dominate, with rainforests standing only close to water sources as an annual dry period developed.[42]

By ~20 Ma, northern Australia gained its monsoonal climate and rainforest-like environment, while the rest of the continent became drier with duricrusted (a hard soil layer produced through evaporation of water and precipitation of minerals, common in arid areas) ground surfaces common. At this point, lakes were still common in the Australian outback.

At ~10 Ma, central Australia became increasingly dry, nearing modern levels of aridity,[43] as South Australia had drifted northward into latitudes that most often develop dry environments. This time period is the absolute latest that the fossil floras at

Poole Creek could have been deposited. This implies that the fossil Flora of Poole Creek may show evidence of the changing environment over this extended period of geological time.

Heritage South Australia thanks Neville Alley and Robert Hill for their contributions to paleontological sections of this report, including providing advance access to forthcoming publications.

First Nations Interactions (overview)

The Arabana People have an ongoing association with Kati Thanda (Lake Eyre) and surrounding areas. In the mid-1800s, the Arabana People were recorded as living to the South and West of Kati Thanda (Lake Eyre) and may have camped at times near or at the Poole Creek Fossil Flora Complex.

Please contact the Aboriginal Heritage Unit for further details about cultural sites for the Arabana People.

Research Conducted at Poole Creek Fossil Flora Complex

Explorations were conducted and recorded in the South Australian Resources Information Gateway (SARIG) in the form of rock sample analysis by Roger Callen and David Greenwood in 1986 and 1988 respectively. Another exploration was conducted by D. J. Barrett and B. Gare from the Department of Mines and Energy of South Australia in 1988.[44] However, it was some time before findings from Poole Creek were published. This occurred in a 1990 paper by Greenwood *et al*.[45]

Greenwood *et al*.'s 1990 paper identified 11 of 14 fossil sites.[46] Remaining localities were identified in 1986 and two 1988 explorations. While further research has been conducted, with some ongoing as of this report, little further exploration of the area has been completed.

Despite limited exploration, the area was noted as a place of high palaeontological significance with a high likelihood to further contribute to the South Australian palaeontological record in the 2006 'Australia's Fossil Heritage: A Catalogue of important Australian fossil sites' document, produced by the Australian Heritage Council.[47]

Chronology

Year	Event
~56Ma	Beginning of the Eocene Epoch & Palaeocene-Eocene Thermal Maximum
~50Ma	Earliest age of deposition
~30Ma	Tectonics altering environmental factors within Australia as the continent moves northward.
~15-5Ma	**Beginning of Central Australia's Aridification in earnest. Environment dried and plant assemblages changed greatly.**

Pre-1836	Aboriginal People operate trade routes throughout the area.
Post 1836	European arrival in the area.
~1860	Nearby Marree Township founded as Hergott Springs.
1937	Inland Australia becomes area of palaeontological interest.[48]
1990	**First confirmed paper published on the fossil flora[49] at Poole Creek and the area is recognised as a site of great palaeontological interest.**
1990-Present	Subsequent explorations and publications, primarily by Neville Alley, Roger Callen, Robert Hill and David Greenwood.
1994	**April. Recognised as a Geological Monument by the South Australian Division of the Geological Society of Australia.[50]**
2006	**Included as part of 12 sites in Australian Heritage Council's *Australia's Fossil Heritage: A Catalogue of Important Australian Fossil Sites*.[51]**
2021	Included as priority for assessment in *Fossil Heritage Survey for South Australia*.
2022	Neville Alley forthcoming publication.

References

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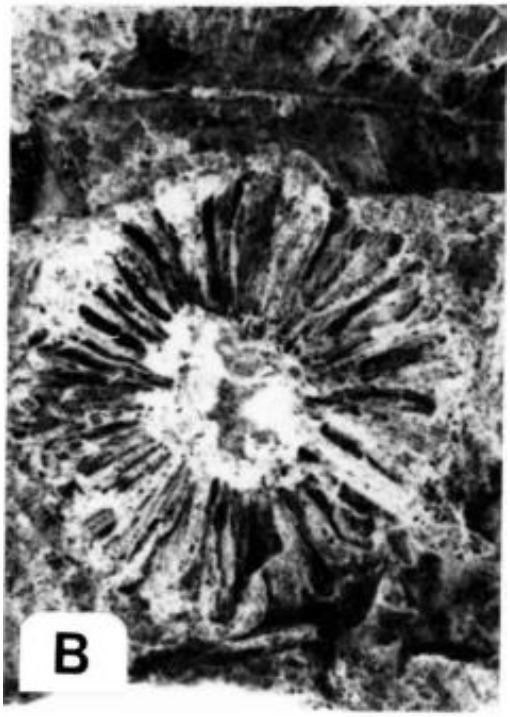
SITE RECORD

NAME:	Poole Creek Fossil Flora Complex	**PLACE NO.:**	26547

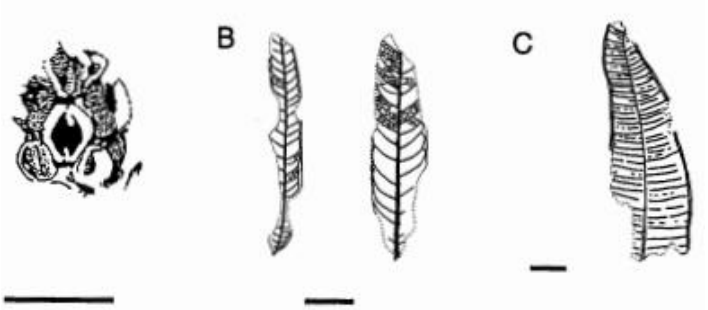
DESCRIPTION OF PLACE:	Cenozoic age fossil flora complex consisting of thirteen sites containing silicified fossil leaves, wood, stems and fruits. The fossils can be found within a mostly dried palaeochannel that can be seasonally wet. The rock found in the area is predominantly silcrete.	
REGISTER STATUS:	Provisional Entry: TBA	
CURRENT USE:	Creek Bed	
LOCAL GOVERNMENT AREA:	Pastoral Unincorporated Area	
LOCATION:	**Town/Suburb:** South of Kati Thanda South (Lake Eyre South) and Covrichina Dam	
	Title Reference:	CL6178/960, CL6234/961
	Plan No.:	D34847AL2, 255659
LAND DESCRIPTION:	**Hundred:**	Out of Hundreds
	Encumbrance:	Native Title Holder: Arabana Aboriginal Corporation RNTBC (Determination Date: 22 May 2012) Miscellaneous Crown Lease: CL6178/960 - ARABANA ABORIGINAL CORP RNTBC Pastoral Crown Land: CL6234/961 – GC Morphett

PHOTOS

NAME: Poole Creek Fossil Flora Complex **PLACE NO.:** 26547



Possible Proteaceae fruit from Poole Creek
(Greenwood 1992)

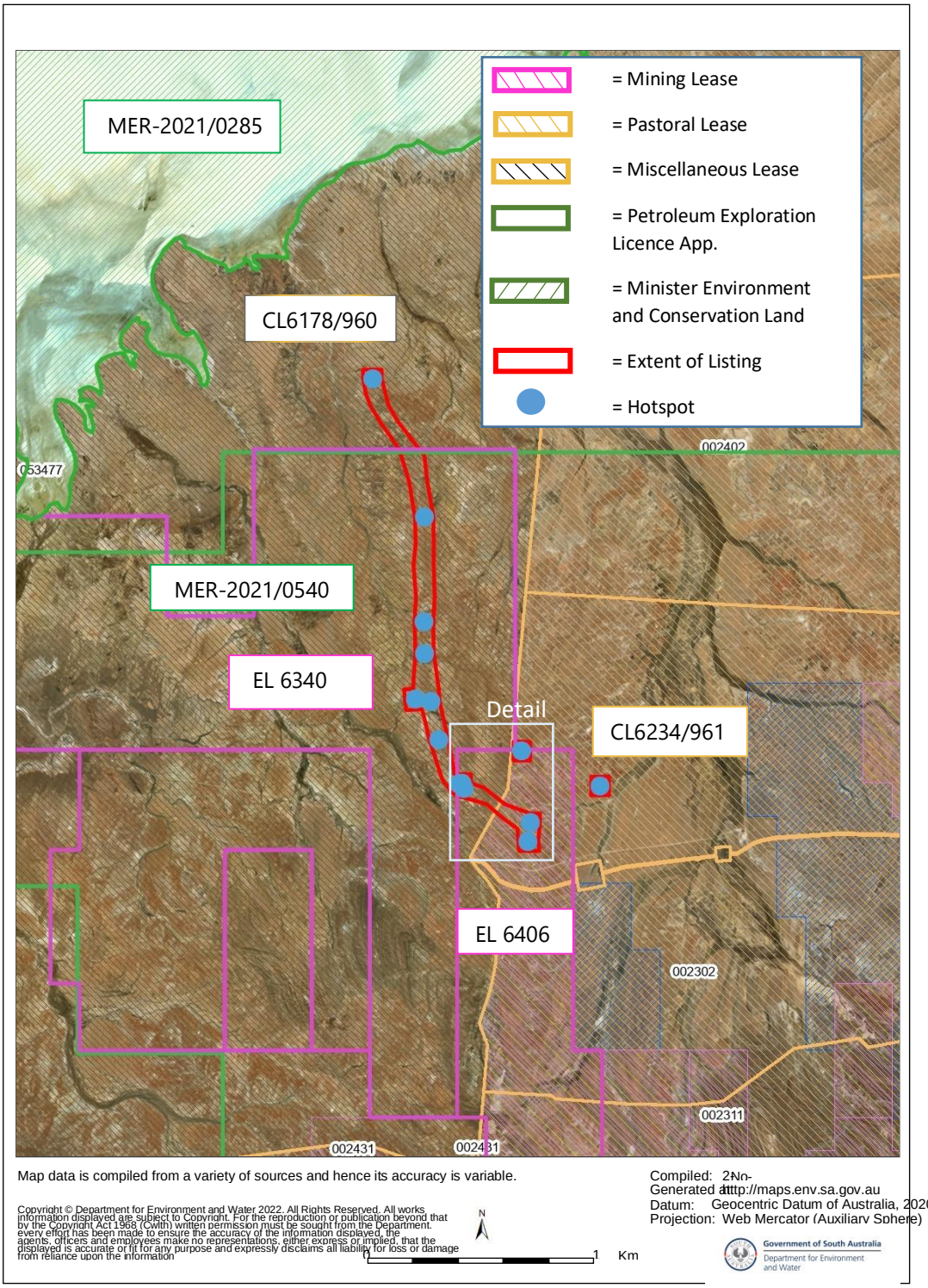


Line Drawings of fossils recorded from Poole Creek. From left to right: *Gymnostoma* cone, legume leaflet, Apocynaceae sp. leaf
(Greenwood 1996)

A Banksia-like cone from Poole Creek
(Greenwood 2001)

SITE PLAN

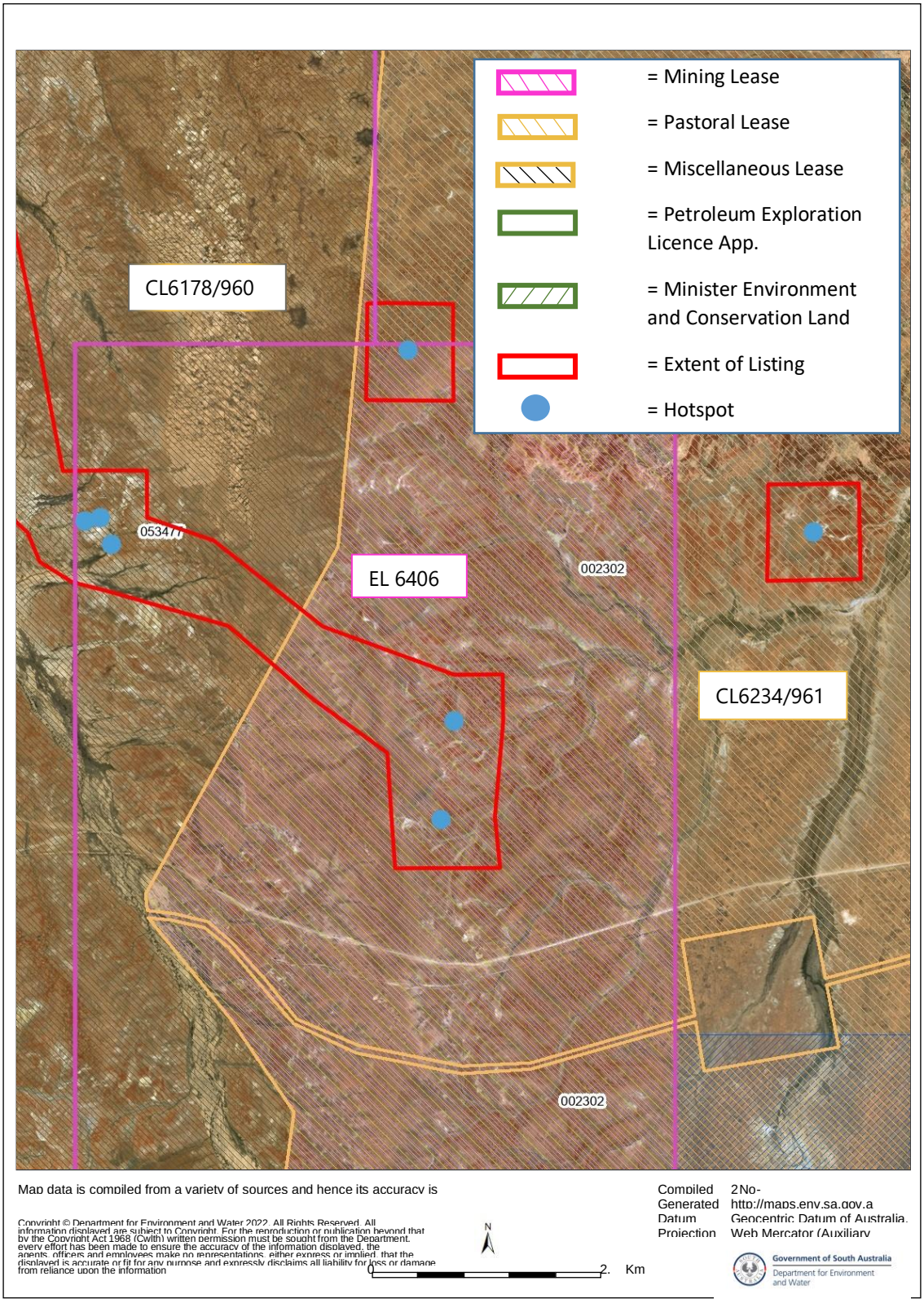
NAME: Poole Creek Fossil Flora Complex **PLACE NO.:** 26547



Poole Creek Fossil Flora Complex, South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna SA, 5733. CL6178/960, CL6234/961, Outside of Hundreds

SITE PLAN - DETAIL

NAME: Poole Creek Fossil Flora Complex **PLACE NO.:** 26547



Poole Creek Fossil Flora Complex, South of Kati Thanda South (Lake Eyre South) and Covrichina Dam, Callanna SA, 5733. CL6178/960, CL6234/961, Outside of Hundreds

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