Biota Environmental Sciences

Yannarie Salt Project Flora and Vegetation Assessment

Baseline Botanical Survey

Prepared for

Straits Salt Pty Ltd

Prepared by

Biota Environmental Sciences Pty Ltd

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ABN 49 092 687 119
14 View Street
North Perth Western Australia 6006
Ph: (08) 9328 1900 Fax: (08) 9328 6138

Project No.: 261

Prepared by: K. McCreery, R. Orifici, G. Humphreys

Checked by: G. Humphreys
M Maier

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1.0 Introduction

1.1 Project Background and Assessment Context

Straits Salt Pty Ltd (Straits) is planning to develop a 10 million tonne per annum (Mtpa) solar salt field along the eastern margin of Exmouth Gulf, Western Australia (Figure 1.1). A Referral Document was prepared and submitted to the Western Australian Environmental Protection Authority (EPA) in accordance with Section 38 of the *Environmental Protection Act 1986* on 15th April 2004. The EPA determined that the level of assessment for the proposed Straits Salt Project would be set at Environmental Review and Management Programme (ERMP).

The project was also referred to the Department of the Environment and Heritage (DEH) in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*). The DEH confirmed that the project would be treated as a controlled action on the basis of the 'threatened communities and migratory species' factor and that assessment under the *EPBC Act 1999* would be required. This assessment would, however, be conducted in accordance with the bilateral agreement between the Commonwealth and State Governments, whereby it would primarily follow the Western Australian environmental assessment process.

An Environmental Scoping Document was prepared by Straits (2005), setting out the relevant factors and scope of work required for the ERMP. This document was subsequently approved by the EPA and forms the basis for the forthcoming environmental assessment.

1.2 Summary Project Description

Straits proposes to undertake the construction and subsequent operation of all necessary facilities for a 10 Mtpa conventional solar salt field and the subsequent export of the salt product. A conceptual layout for the salt field, based on the most recent version of the working design for the project, is shown in Figure 1.2.

The facilities will consist of two intake pump stations delivering seawater into a series of concentration ponds. Seawater within the concentration ponds would then undergo natural evaporation resulting in an increase in salt concentration. The resultant brine (high salt concentration sea water) is then pumped into a series of smaller crystalliser ponds where, again via natural evaporation, the salt concentration in the brine reaches a point where solid salt (NaCl) crystals are formed. The salt crystals are allowed to build up to a depth of approximately 0.5 m in the crystalliser pond. The pond is then drained and a mechanical harvester removes the salt crystals, which are taken to a washing facility to produce export quality salt. This salt is stockpiled before being loaded onto barges. It will then be transhipped into the central Gulf and unloaded onto waiting bulk carrier ships.

The residual brine (known as bitterns), which contains remnant salts from the seawater, will be either retreated or discharged to the ocean. The current preferred bitterns disposal options is via the barge harbour to be constructed at the western point of Hope Point (see Figure 1.2).

Figure 1.1: Locality plan for the Yannarie Salt project.

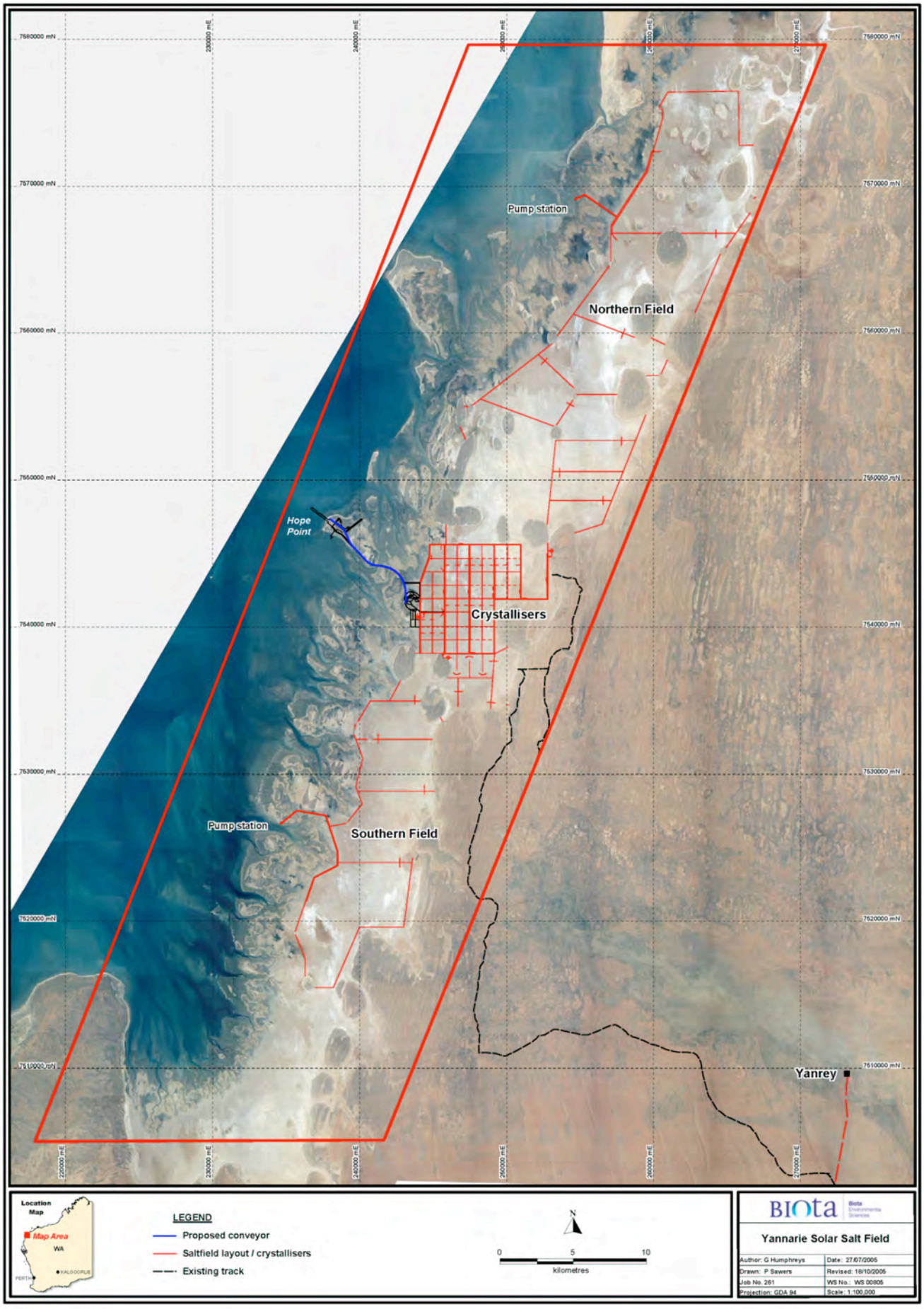

Figure 1.2: Conceptual layout for the ultimate 10 Mtpa Straits solar saltfield (red polygon outlines study area).

1.3 Study Area

The study area addressed by this report comprised the terrestrial flora and vegetation occurring in the areas that may be affected by the proposed Yannarie Salt project (see Figure 1.2). This included the hinterland at the eastern margin of the Onslow Plain and associated mainland remnant 'islands' extending across the saltflats toward the eastern margin of Exmouth Gulf (DC Blandford and Oceanica 2005).

Specifically, the flora and vegetation survey focused on:

- the terrestrial habitats of the mainland remnant, supratidal 'islands' that occur on the saltflat area proposed to accommodate the saltfield; and
- the adjacent hinterland area, particularly along the nominal alignment for the proposed site access road.

Some additional targeted flora collecting was completed for soil profiles and groundwater investigations on the mainland.

1.4 Scope and Objectives of this Study

This survey was designed and carried out as far as practicable to meet the requirements of EPA Guidance Statement No. 51 (Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia) (EPA 2004). It also meets the scope of work identified in the Straits Salt Project Environmental Scoping Document as approved by the EPA (Straits Salt 2005). This document has been prepared primarily to assist the EPA in carrying out the formal environmental assessment of the proposed Yannarie Salt project, and to allow it to judge the impacts of this proposal on terrestrial flora and vegetation. Mangrove flora and subtidal flora are considered in separate studies (Biota 2005a and Oceanica 2005, respectively).

Consistent with the intent of Guidance No. 51, the general objectives of this study were to:

1. identify significant flora and vegetation biodiversity, to allow for their conservation and management through best practice in the development of the Yannarie Salt proposal;
2. develop and enhance Western Australia's knowledge base of flora and vegetation biodiversity and biogeography at both the local and regional scale; and
3. collect survey data capable of underpinning long-term observation and of value in the measurement of future project compliance.

With the nature of the proposed development, and the habitats present, the survey focussed on:

1. identification and comparison of the flora and vegetation of the various mainland remnant 'islands' that will become isolated within the saltfield, and comparison with those occurring on the immediately adjacent hinterland; and
2. identification of any threatened flora species or restricted vegetation types which may occur in areas that could be disturbed by the construction or operation of the Yannarie salt project.

2.0 Methodology

2.1 Review of Existing Information

Searches of the Department of Conservation and Land Management (CALM) and Western Australian Herbarium rare flora databases were commissioned to identify rare and Priority flora species that have been previously recorded from the Exmouth Gulf area. The searches were based on an area of approximately 50 km radius centred on the study area.

Limited systematic flora and vegetation survey work has been completed in the project area. Regional level mapping of broad vegetation units is available from the mapping of Beard (1975) and subsequent work completed on land system units by the Western Australian Department of Agriculture. Systematic flora and vegetation work was also carried out by CALM as part of ongoing survey work at Giralia Station to the south of the project area. These studies aside, the available reference information in regards to flora and vegetation provides regional context rather than site-specific information.

2.2 Field Survey

2.2.1 Seasonal Conditions and Survey Timing

The closest meteorological recording station to the study area is at Onslow; although conditions on site at Yannarie would be slightly different to those experienced by Onslow, the data for the latter site would still be indicative of the conditions within the study area. Monthly rainfall at Onslow from January 2003 to June 2005 is shown in Figure 2.1.

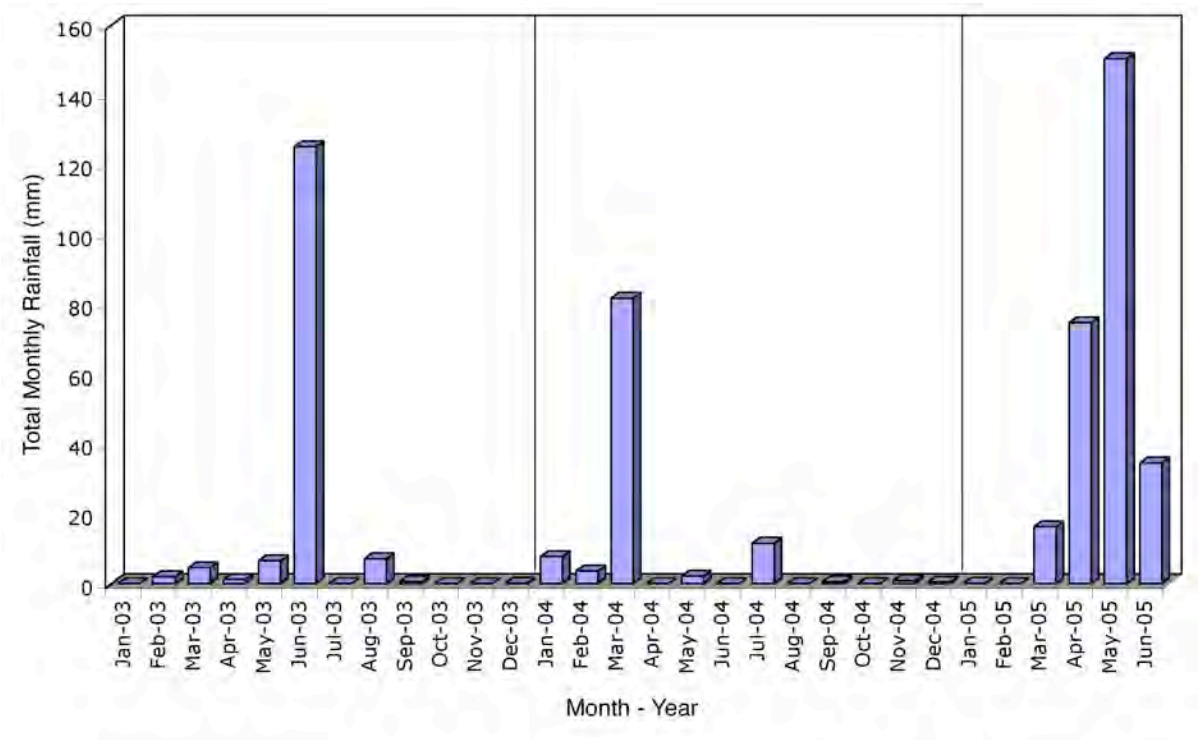

Figure 2.1: Monthly rainfall for the Onslow weather station for January 2003 to August 2004 (source: Bureau of Meteorology).

Two botanists (Kelli McCreery and Raimond Orifici of Biota Environmental Sciences) surveyed the vegetation and flora of the Yannarie Salt project area between 13th and 22nd of August 2004. This survey followed a lengthy dry period: the average total rainfall for the area is 274 mm, however in the 12 months preceding the survey there had been only 115 mm, with the only significant rainfall being received in March 2004 (Figure 2.1).

Ephemeral flora species in arid areas respond quickly to significant rainfall events. In spite of the long-term dry conditions prior to the main survey in August 2004, moderate rainfall events in July 2004 resulted in good representation of spring flowering annuals during the period of that field survey.

Rainfall in the locality is bimodal, meaning that there is significant summer rainfall, usually resulting from thunderstorms or cyclones, along with winter rainfall from southern cold front systems. Particular ephemeral flora species usually respond to either winter or summer rainfall but not both. During the main flora survey, the species responsive to winter rain were adequately represented in the collection, however those species stimulated by summer rainfall may have been dormant and therefore not collected.

An additional site visit, on the 6th and 7th of June, was conducted by Michi Maier (botanist with Biota) to survey the vegetation of a number of islands within extensions to the northern and southern ends of the area surveyed previously in August 2004. This site visit followed substantial rainfall in the two preceding months (Figure 2.1), and numerous annual flora were present.

2.2.2 Flora and Vegetation Sampling Method

Forty-one sites were assessed within the Yannarie Salt project area (see Figure 3.1; Appendix 1). Quadrats were 50 m x 50 m in size. This is generally accepted as the standard flora quadrat size in the Eremaean Botanical Province, as it gives a good sample of flora presence while being small enough to accommodate within a single vegetation type. Quadrat shape and/or size was adjusted as necessary to fit smaller or oddly shaped habitats (e.g. flowlines), or small vegetation stands.

The quadrats were permanently marked using steel fence droppers, and were uniquely numbered (SS01 to SS20 and SS101 to SS122).

The following parameters were recorded for each quadrat:

1. Location - AMG coordinates recorded in WGS84 (GDA94) datum using a hand-held Global Positioning System (GPS), to an accuracy within 5 m; readings taken for all four corners;
2. Vegetation Description - Broad description based on the height and estimated cover of dominant species after Aplin's (1979) modification of the vegetation classification system of Specht (1970);
3. Habitat - Description of landform and habitat;
4. Soil - Broad description of soil type;
5. Disturbance Details - Evidence of grazing, mining exploration activities, weed invasion, frequent fires etc. Note that fire effects are only considered as a negative impact if they appear to be caused by repeated burning (such as that done for pastoral purposes). Fire is a natural and frequent process in the Pilbara to which the vegetation has adapted, and to class areas as being in poor condition simply because they have been recently burnt is misleading; and
6. Percentage Foliar Cover - Estimated visually for each species. Estimates were made to the nearest percent where possible, or a range (eg. 5-10%) was used. '+' was used where only occasional individuals were present, with a cover of less than 1%.

Colour photographs of the vegetation in the survey area were also taken with a digital camera.

The condition of the vegetation was attributed in the areas surveyed using the following vegetation condition scale derived from that developed by Trudgen (1988):

E = Excellent

Pristine or nearly so; no obvious signs of damage caused by the activities of European man.

VG = Very Good

Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds or occasional vehicle tracks.

G = Good

More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive species.

P = Poor

Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive species.

VP = Very Poor

Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.

D = Completely Degraded

Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

2.2.3 Flora Identifications

Common species that were well known to the survey botanists were identified in the field. Voucher specimens of most flora were collected and assigned a unique number to facilitate tracking of data.

The vouchers were identified by keying out, reference to appropriate publications, use of reference collections and comparison to the collections held at the Western Australian Herbarium. Some specimens of difficult taxa were submitted to relevant specialists for identification (see Section 7.0). Specimens will be lodged with the Western Australian Herbarium and Karratha Regional Herbarium for all taxa for which suitable material is available.

Nomenclature was checked against the current listing of scientific names recognised by the Western Australian Herbarium <http://www.florabase.calm.wa.gov.au>, and updated as necessary. The only outdated nomenclature retained was that relating to *Cassia.* This genus is currently recognised as *Senna* (see Randell 1989), however the older *Cassia* classification (Symon 1966) was perceived to be a more realistic level of separation of the taxa (eg. with taxa such as 'glutinosa' and 'pruinosa' recognised at specific rather than subspecific level). A more detailed discussion is contained in Trudgen and Casson (1998), while a comparison of the nomenclature under the two classifications is presented in Appendix 2.

2.2.4 Map Preparation

To gather the spatial information, rectified 1:20,000 scale colour digital photographs were marked up with vegetation type boundaries. Several of the vegetation units were either too small to show at the scale of mapping, or too variable to map individually based on the level of investigation that was possible during the field survey. These latter units were mapped as mosaics. Manual mapping was captured scanned and registered, before being digitised on-screen digitising using MapInfo Professional v7.0. The resulting polygons were attributed with

the relevant vegetation unit code. Other point source datasets, such as locations of quadrats, weeds and priority flora, were generated by linking to a Microsoft Access database.

These datasets, in conjunction with other data supplied from other organisations, were used in the production of the maps contained in this report.

2.3 Limitations of the Assessment

A number of limitations of the field survey, floristic analysis and conservation assessment are discussed in the following sections. These factors must be considered when reviewing and applying the results of this study. Despite these limitations, the field study and the subsequent analyses are believed to give an adequate representation of the flora and vegetation values of the study area.

- Fungi and nonvascular flora (eg. algae, mosses and liverworts) were not sampled.
- Although the field work was done at an appropriate time for detecting most ephemeral flora, some species (eg. annual daisies that would germinate mostly after winter rains) would not have been present or identifiable at the time of survey.
- As only a portion of the area of the project area could be systematically sampled, not all of the variation in vegetation, nor all the flora species, would have been identified.
- The survey sites were only sampled once, and additional species would inevitably be recorded if the sites were revisited. The species list should therefore be taken as indicative rather than exhaustive.
- The Department of Agriculture Land Systems mapping (Payne et al. 1988) assigns units based on a combination of landform and geology. Given that a number of the Land Systems are widely distributed in the region through areas with significantly different rainfall, it is likely that there are significant differences in vegetation within a Land System across its range. Therefore, separated areas of a Land System will probably have somewhat different vegetation and flora. There is very little information available to define the scale of such differences, limiting the ability to use Land Systems for assessment of vegetation conservation value.
- The vegetation units for this study were defined based on interpretation of aerial photography signatures combined with the site data recorded during the field survey. As it was not possible to map areas outside the study area in this way, the distribution of these units outside the study area can only be inferred by their correlation with the Department of Agriculture Land Systems (Payne et al. 1988) and the floristic units defined in this report. This means that there is a level of uncertainty regarding the assessment of distribution of these vegetation types outside the current study area.
- This document is primarily a survey report and provides an account of the survey team, methodology, the flora and vegetation types recorded from the site, and their perceived conservation significance. No assessment of potential impacts or recommendations for environmental management are provided here, as these will be addressed in the forthcoming ERMP.

3.0 Project Area Regional Context

3.1 Bioregion

The Yannarie Salt project area falls into the Carnarvon bioregion as defined in the most recent update of the Interim Bioregionalisation of Australia (IBRA) (Thackway and Cresswell 1995, Environment Australia 2000).

The Carnarvon bioregion is described as:

"Quaternary alluvial, aeolian and marine sediments overlying Cretaceous strata. A mosaic of saline alluvial plains with samphire and saltbush low shrublands, Bowgada low woodland on sandy ridges and plains, Snakewood scrubs on clay flats, and tree to shrub steppe over hummock grasslands on and between red sand dune fields. Limestone strata with Acacia stuartii / bivenosa *shrublands outcrop in the north, where extensive tidal flats in sheltered embayments support mangal. Arid."*

CALM (2002), places the project area in the CAR1 (Cape Range) biological subregion within the Carnarvon bioregion. The CAR1 subregion is 2,547,911 ha in size and is described as:

"Cape Range and Giralia dunefields form the northern part of Carnarvon Basin. Rugged tertiary limestone ranges and extensive areas of red aeolian dunefield, Quaternary coastal beach dunes and mud flats. Acacia *shrublands over* Triodia *on limestone (*Acacia stuartii *or* A. bivenosa*) and red dunefields,* Triodia *hummock grasslands with sparse* Eucalyptus *trees and shrubs on the Cape Range. Extensive hummock grasslands (*Triodia*) on the Cape Range and eastern dune-fields. Tidal mudflats of sheltered embayments of Exmouth Gulf support extensive mangroves. Beach dunes with* Spinifex *communities. An extensive mosaic of saline alluvial plains with samphire and saltbush low shrublands along the eastern hinterland of Exmouth Gulf. Islands of the Muiron, Barrow, Lowendal and Montebello groups are limestone-based. Climate is arid, semi-desert to sub-tropical climate, with variable summer and winter rainfall. Cyclonic activity can be significant, and cyclonic systems may affect the coast and hinterland annually."*

Note that the parts of this description relating to *'Rugged tertiary limestone ranges...'* relate to the Cape Range Peninsula rather than the eastern portion of the subregion which contains the current study area.

3.2 Land Systems

Land System (Rangelands) mapping covering the project area has been prepared by Agriculture Western Australia (Payne et al. 1988). These are broad units that each consist of a series of "land units" that occur on characteristic physiographic types within the Land System.

The portion of the project area that is proposed to accommodate the salt field is dominated by three land systems: Dune, Littoral and Yankagee (see Figure 3.1; Table 3.1). Some small areas of the Onslow land system also occur and the easternmost portions of the planned access road pass through areas of the Minderoo, Yanrey and Giralia land systems in the south (Figure 3.1). The dominant land systems in the project area are typical of the coastal portion of the locality (Payne et al. 1988).

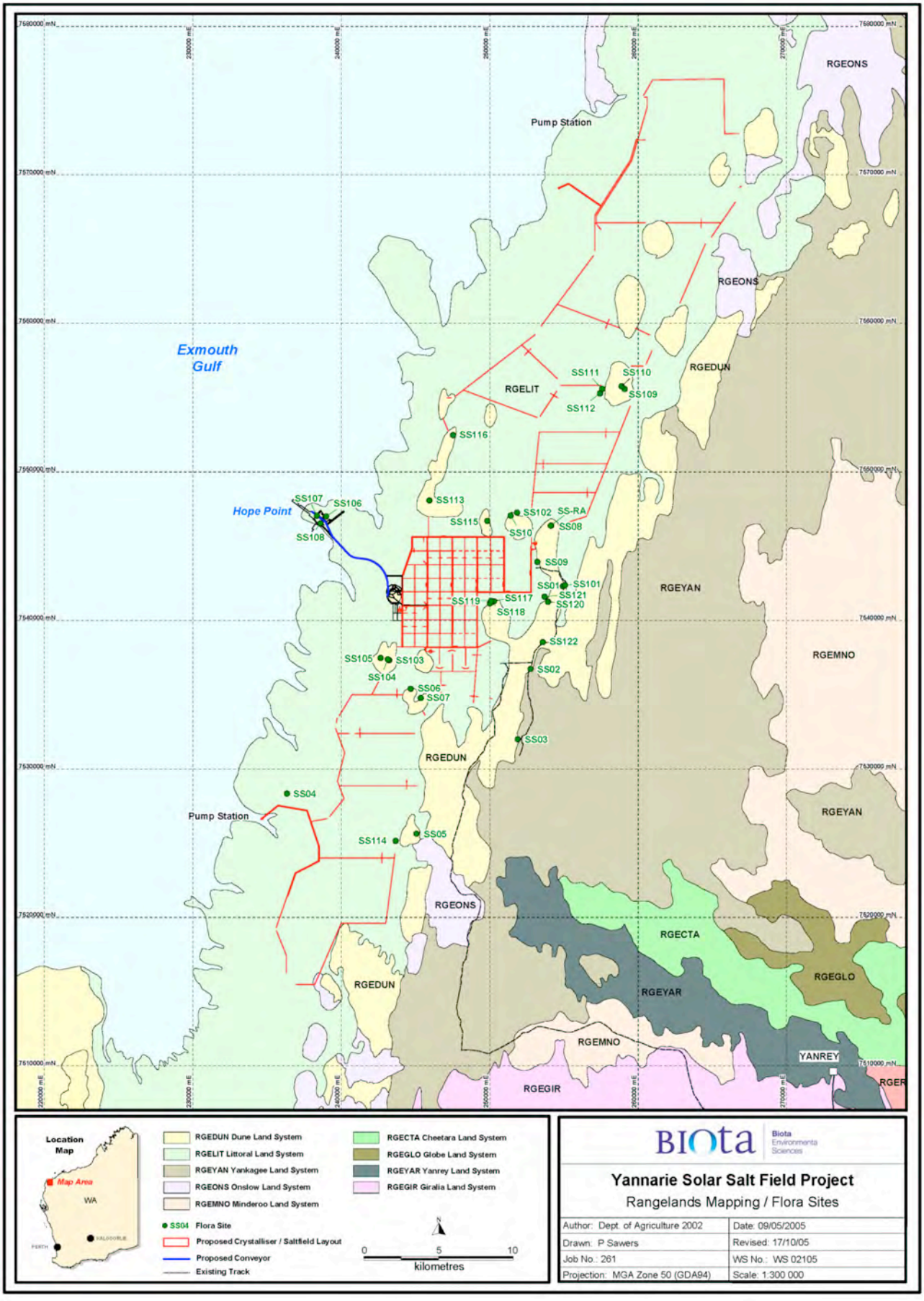

Figure 3.1: Land systems (rangelands) of the Yannarie Salt project area, showing the locations of the flora and vegetation survey quadrats.

Table 3.1: Systems (rangelands) present in the Yannarie Salt project area (source: Payne et al. 1988).

Land System	Description	Extent in Project Area (ha)
RGEDUN – Dune	Dunefields near the coast; soft spinifex pastures in excellent condition; no erosion.	25,765
RGELIT – Littoral	Tidal mudflats; mangroves and samphire; little pastoral value.	101,341
RGEMNO – Minderoo	Alluvial plains covered with sand in parts; tussock grasses and spinifex pastures in fair to good condition; minor erosion.	4,054
RGEONS – Onslow	Undulating sand plain between clay plains; soft spinifex and tussock grass pastures in good condition; no erosion.	9,280
RGECTA – Cheetara	Gilgai plains; tussock grasses in fair condition; no erosion.	7,332
REGGLO – Globe	Active floodplains with snakewood; degraded chenopod and tussock grass pastures in very poor to fair condition; moderate erosion.	3,864
REGYAR – Yanrey	Gilgai floodplains; coolibah woodland with weeping grass and other tussock grasses in fair condition; no erosion.	9,745
RGEYAN - Yankagee	Sandy plains with dunes and numerous claypans; soft spinifex and stony chenopod pastures in fair to excellent condition; minor erosion.	67.769
RGEGIR - Giralia	Longitudinal dunes and broad sandy plains supporting hard and soft spinifex grasslands.	2,652

3.3 Beard's Vegetation Mapping Units

Beard (1975) mapped the vegetation of the 'Pilbara' at a scale of 1:1,000,000. The extent of this map sheet also covered the northern Carnarvon Basin Region and, within this, the Carnarvon Botanical District as defined by Beard. The Yannarie Salt project area is located in this Botanical District and more specifically falls within the Yannarie Coastal Plain as delineated by Beard (1975).

Three topographic / soils units were recognised from the Yannarie Coastal Plain:

1. Pediplains and hills on siltstones and other marine rocks. Chief soils are hard alkaline red soils.
2. Extensive plains with some occasional rocky hills in the inland parts, claypans in the coastal parts, and considerable sandy stretches with parallel sand dune formations. Chief soils of the dunes are red sands and the soils of the plains are acid, neutral and alkaline red earths, with non-cracking clays in the claypans.
3. Salt flats, tidal swamps and coastal sand dunes on the seaward fringe. The chief soils are saline loams with shelly sands and small areas of calcareous and/or siliceous sands on coastal dunes. Saline clays or muds on slopes and flats submerged at high tide occur in the mangrove zone.

Due to the inaccessibility of the coastline of the Yannarie Coastal Plain during the Beard (1975) vegetation survey, the area was not visited and the vegetation community types identified at this time were interpreted from aerial photography.

Beard's (1975) survey identified three main vegetation types in the study area based on aerial photo interpretation only:

1. Mangrove vegetation on the coastline and covering the intertidal zone, *Avicennia marina* listed as the principal species, with some *Rhizophora stylosa.*

2. Behind the intertidal zone is a belt of bare hypersaline mud, which sometimes floods with spring tides. This zone is quite devoid of any vegetation, but some samphire communities occur locally (*Halosarcia* species).
3. Behind the saline tidal mud flats area is a zone mapped as shrub steppe on sandhills with numerous small claypans. The shrub steppe is typically dominated by *Triodia* species (*T. epactia/pungens*) with *Acacia bivenosa, A. synchronicia, A. tetragonophylla* and *A. xiphophylla* the most common shrub species present.

The vegetation mapping of the current survey effectively supersedes these earlier descriptions, being based on field survey data and a finer scale of resolution of vegetation types.

3.4 Site-specific Soils Descriptions

Each survey site was broadly classified by landform type and position in the landscape. The sites were then described in more detail in terms of soils (by DC Blandford and Oceanica 2005) and the vegetation type(s) present.

Table 4.2 provides a summary of survey sites grouped by broad landform habitat units with a general description of the soil present within each of the units.

Table 4.2: Summary of survey sites and their soils and habitats present in the project area.

Landform Habitat Unit	Soils	Survey Sites
Longitudinal dunes with mixed low shrublands over *Triodia* hummock grasslands	Uniform red sand profile; earthy sand. Fabric is single grained with increasing fabric development with depth.	SS01, SS04, SS07, SS10, SS11, SS15, SS17, SS20, SS103, SS110, SS111, SS117 and SS-RA
Open shrublands over *Triodia* hummock grasslands on duplex soils in dune swales	Red duplex soil with surface sand overlying a slightly alkaline, saline, fine sandy clay loam. Clay loam over shallow calcarenite nodules.	SS03, SS06, SS13, SS16, SS101, SS104, SS105, SS106, SS109, SS113, SS115, SS116, SS118 and SS122
Low, open *Acacia* shrublands over dense *Triodia* hummock grasslands on duplex soils on interdune flats	Red sandy clay.	SS05, SS12, SS14 and SS107
Open samphire shrublands on saline clay pans	Uniform textured profile, neutral, strongly saline, light sandy clay loam. Salt crusting on surface and with sub-rounded pebbles at 0.8m depth of alluvial origin.	SS02, SS19, SS102, SS108, SS112 and SS121
Margin of sandsheet	Red unconsolidated sand.	SS08, SS119 and SS120
Dune ridge on margin of clay pan	Consolidated red fine to medium grained sand.	SS18
Eroded coastal dune	Alkaline, non-saline sand to loamy sand, becoming stratified and more saline with depth. The basal unit of the dune was the most saline with calcrete nodules.	SS09 and SS114

4.0 Vegetation

4.1 Vegetation Types

Eleven vegetation types were recorded from the Yannarie Salt project area during the current survey, representing three broad groupings based on landform position. Detailed descriptions of these vegetation types follow, with an overview of their spatial extent and distribution mapped in Figure 4.1. Detailed maps are provided in Appendix 3.

1. Saline Flats

1a: Samphire on mainland remnant margins and inland saline flats
Low open heath of samphire species, dominated by *Halosarcia indica* but also typically *H. halocnemoides* subsp. *halocnemoides*, *H. halocnemoides* subsp. *tenuis, H. pruinosa, H. syncarpa, H. auriculata* and *H. pterygosperma* subsp. *denticulata*. Other typical shrub species included *Neobassia astrocarpa, Lawrencia viridigrisea, Frankenia pauciflora, Suaeda arbusculoides* and *Muellerolimon salicorniaceum*. Scattered tussock grasses of *Eragrostis falcata* were usually present, and there were some dense patches of Marine Couch *Sporobolus virginicus*. Grasses were more prevalent on the edges of this vegetation type. Herbs were sparse but *Cyperus bulbosus* occurred occasionally and the annual pea *Swainsona pterostylis* occurred in patches. Condition: Excellent. Sites SS019, SS102, SS108, SS112 and SS121; Plate 4.1 and Plate 4.2.

2. Vegetation of Coastal Dune Systems

2a: Vegetation of Eroded dunes on the edge of the Hinterland
Acacia sclerosperma over *Acacia stellaticeps* over *Triodia epactia* and Buffel grass **Cenchrus ciliaris* on eroded slopes. Very Good to Very Poor condition.

2a.1: Scattered to Open Shrubland of *Acacia sclerosperma* over Scattered Low Shrubs of *Acacia stellaticeps* over Mid-dense Hummock Grassland of *Triodia epactia*
Other species typically present included *Acacia coriacea* subsp. *coriacea*, *Solanum lasiophyllum* or *Cassia glutinosa* x *luerssenii*. This vegetation type often occurred in naturally eroded gullies. The understorey included scattered or occasional Buffel grass **Cenchrus ciliaris, Rhagodia eremaea* and *Lawrencia viridigrisea*. Condition: Very Good to Excellent, although condition is likely to deteriorate over time with further spread of Buffel. Site SS119; Plate 4.3.

2a.2: Scattered to Open Shrubland of *Acacia sclerosperma* over Scattered Low Shrubs of *Acacia stellaticeps* over Tussock Grassland of Buffel grass **Cenchrus ciliaris*
Occasional scattered hummock grassland of *Triodia epactia* remained in some areas, although this was mostly replaced by Buffel. Condition was Poor to Very Poor, with this vegetation type being a degraded version of 2a.1. Gully erosion from storm events has probably affected this vegetation type, exacerbated by lack of vegetative cover. Other associated species included *Salsola tragus, Neobassia astrocarpa, Lawrencia viridigrisea, Swainsona pterostylis, Atriplex semilunaris, Lepidium platypetalum* and *Angianthus milnei.* Site SS114; Plate 4.4

2b: *Melaleuca cardiophylla* shrubland over *Triodia epactia* on Limestone outcroppings in coastal dunes
This community occurred as scattered patches on Hope Island. It comprised a low open shrubland of *Melaleuca cardiophylla* as well as *Acacia gregorii, A. bivenosa, Cassia artemisioides* subsp. *oligophylla* and *C. glutinosa* x *luerssenii, Solanum lasiophyllum* and *Rhagodia preissii* subsp. *obovata,* over a mid-dense hummock grassland of *Triodia epactia*. Other associated species included *Acanthocarpus preissii, Indigofera brevidens, Enchylaena tomentosa* var. *tomentosa, Boerhavia coccinea, Rhynchosia minima* and *Solanum cleistogamum.* This vegetation types was only recorded on Hope Island and associated islets. Condition Excellent. Site SS107; Plate 4.5.

2c: Vegetation of Dune Swales and Interdune Flats
Shrub species comprised *Acacia synchronicia* and/or *A. coriacea* subsp. *coriacea*, *A.*

sclerosperma, A. tetragonophylla, Scaevola spinescens and/or *Stylobasium spathulatum*, over *A. gregorii, A. stellaticeps* and/or *Solanum lasiophyllum*, over *Triodia epactia*, and less widespread *T. lanigera*, with localised infestations of Buffel Grass **Cenchrus ciliaris*. This vegetation type was very widespread in the survey area including dune swales, small islands and interdune flats. Termite mounds were often present in this vegetation type, predominantly on the mainland.

The composition of the overstorey varied slightly from site to site but generally occurred as scattered shrubs to a shrubland of *Acacia synchronicia, A. sclerosperma, A. tetragonophylla, A. bivenosa, Scaevola spinescens* and/or *Stylobasium spathulatum*, except on coastal low dunes and small islands where *A. coriacea* subsp. *coriacea* became the single dominant overstorey species. A scattered low shrubland of *Acacia gregorii, A. stellaticeps, Corchorus elachocarpus, Cassia oligophylla* and/or *Solanum lasiophyllum* was also recorded. The single dominant feature of this vegetation type was a mid-dense hummock grassland of *Triodia epactia* in the understorey. Another spinifex species, *Triodia lanigera,* occurred in pockets on some of the islands where the underlying limestone was exposed in dune swales. In some areas the understorey included scattered tussock grasses of *Eulalia aurea* or Buffel grass **Cenchrus ciliaris*, with areas adjacent to salt flats or samphire having patches of Marine Couch *Sporobolus virginicus*.

The Dodder Laurel *Cassytha racemosa* and Prickle lily *Acanthocarpus preissii* were often present, with other herbs including *Lepidium platypetalum, Euphorbia tannensis* subsp. *eremophila, Euphorbia coghlanii* and *Murchisonia volubilis*. Other associated species included *Stemodia* sp. Onslow, *Hakea stenophylla* subsp. *stenophylla, Lawrencia viridigrisea, Scaevola cunninghamii, Streptoglossa decurrens* and *Rhagodia eremaea.* Generally this vegetation type was in Excellent condition, however there were isolated infestations of Buffel grass **Cenchrus ciliaris*. Sites SS03, SS05, SS06, SS08, SS12, SS15, SS101, SS105, SS106, SS109, SS113, SS115, SS116, SS118 and SS122. Plate 4.6 and Plate 4.8. Stunted Coolibah *Eucalyptus victrix* was frequent in swales on the hinterland, where there were semi-formed vegetated claypans (Plate 4.13), bare claypans (Plate 4.13) or patches where these may influence the floristics of the vegetation present (Plate 4.17; Type 3 below).

2d: Vegetation of Longitudinal Red Sand Dunes

Shrubland to open shrubland dominated *by Acacia murrayana, A. coriacea* subsp. *coriacea, Hakea stenophylla* subsp. *stenophylla, Grevillea stenobotrya* and *Scaevola sericophylla* but also including *Acacia tetragonophylla*, *Grevillea eriostachya* and *Scaevola spinescens*. Occasionally, there were some *Santalum lanceolatum, Corymbia zygophylla* or *Stylobasium spathulatum* in the overstorey. The lower shrubland to low open shrubland was dominated by *Pityrodia loxocarpa*, *Acacia stellaticeps* and *Solanum lasiophyllum,* but also typically included *Tephrosia rosea* var. *clementii*, *Olearia dampieri* subsp. *dampieri, Trichodesma zeylanicum* var. *grandiflorum, Corchorus elachocarpus, Verticordia forrestii* and *Crotalaria cunninghamii*. A mid-dense hummock grassland of *Triodia epactia was* present on slopes, with *T. schinzii* often occurring along the dune crest.

Due to recent rains, ephemeral herbs were present as a scattered to open herbland, typically including *Brachyscome ciliocarpa, Euphorbia tannensis* subsp. *eremophila, Nicotiana occidentalis* subsp. *occidentalis, Rhodanthe psammophila* and the tiny sedge *Bulbostylis barbata*. Other associated species included *Acacia sclerosperma, Adriana urticoides* var. *urticoides, Tephrosia uniovulata, Pityrodia paniculata, Rhagodia eremaea, Diplopeltis eriocarpa, Bonamia rosea, Eremophila setacea, Triodia lanigera* and *Acanthocarpus preissii.* Vegetation condition was Very Good to Excellent, with occasional infestations of Buffel grass **Cenchrus ciliaris*. Sites SS01, SS04, SS07, SS10, SS15, SS17, SS20, SS103, SS110 and SS117; Plate 4.7 and Plate 4.8.

2e: Unconsolidated Sandsheet

This vegetation type was only represented in two locations in the project area; the mobile sandsheet at 'Yanrey Point' and a smaller, similar formation on another headland on the hinterland (see Figure 4.1). It comprised a sparse cover of *Acacia murrayana* and/or *A. coriacea* subsp. *coriacea* over *Trichodesma zeylanicum* var.

grandiflorum, *Tephrosia rosea* var. *clementii* and the grass species *Paractaenum refractum*, with scattered *Triodia epactia* or *T. schinzii*. Scattered tall shrubs to shrubland of *Acacia murrayana* with occasional *A. coriacea* subsp. *coriacea* over scattered low shrubs including *Trichodesma zeylanicum* var. *grandiflorum*, *Tephrosia rosea* var. *clementii*, *Acacia stellaticeps*, *Cullen martinii, Crotalaria cunninghamii* and *Solanum lasiophyllum*. Scattered *Triodia epactia or T. schinzii* occurred occasionally, but Spinifex was largely absent. There were scattered tussock grasses of *Paractaenum refractum*, which is a grass typical of red sand dunes. Other associated species included *Acacia stellaticeps, A. synchronicia, Abutilon dioicum, Eriachne aristidea, Rhagodia eremaea* and *Salsola tragus.* Condition was generally Excellent, although occasional Buffel grass **Cenchrus ciliaris* were seen on the edges of these areas. Sites SS120, SS-RA; Plate 4.9 and Plate 4.10.

3. Vegetation of Claypans

3a: Bare Claypans with Fringing Plant Communities (Plates 4.11 and 4.12)

3a.1 Fringing *Eucalyptus victrix* and *Melaleuca leiopyxis* over *Triodia epactia* surrounding bare claypan.
Scattered to low open woodland to absent Coolibah *Eucalyptus victrix* and/or *Melaleuca leiopyxis* fringed the lip of these claypans, over mid-dense hummock grassland of *Triodia epactia* (Plate 4.18). The claypan itself was completely devoid of vegetation (Plate 4.12). This vegetation type was more typical of areas further inland and the eastern edge of the hinterland part of the survey area only just included the outliers of this association. Further inland to the east, Melaleuca and Coolibah covered often extended to cover the whole claypan. The project access track passed through these claypans approximately 15 km south of Yanrey Point. Condition was Excellent to Very Good with occasional Buffel grass present.

3a.2: Bare pans with *Triodia epactia*, herbs and grasses on fringe
A mid-dense hummock grassland of *Triodia epactia* usually occurred on the raised bund-like lip of these pans (Plate 4.14). There were occasional scattered shrubs also, with the species present usually typical of the adjacent swale vegetation (Type 2c). Herb and grass species were usually at scattered densities, although, where the claypans were small or shallow, they were often present across the surface as an open herbland or tussock grassland (Plate 4.13). Herb species typical of claypans included *Swainsona pterostylis, Trianthema triquetra, Evolvulus alsinoides, Crotalaria medicaginea, Angianthus acrohyalinus* and *Gnephosis arachnoidea*. Grasses recorded from claypans included *Eragrostis dielsii, E. pergracilis, E. setifolia, Dactyloctenium radulans, Eulalia aurea, Sporobolus mitchellii* and several unidentifiable grasses (peak grass time is after summer rains, many were dead or dormant during the survey such as *Eriachne* species). Other associated species included *Amaranthus pallidiflorus, Solanum lasiophyllum, Rhynchosia minima, Salsola tragus* and *Trichodesma zeylanicum* var. *grandiflorum.* This vegetation type was generally in Excellent condition, although Buffel grass **Cenchrus ciliaris* was sometimes present around the edges at low density. Sites SS16, SS104.

3b: Vegetated claypans of Coolibah *Eucalyptus victrix* Low Woodland over Grassland
Open woodland to woodland of Coolibah *Eucalyptus victrix* over grassland on heavy clay soils in vegetated claypan. The timing of the survey was not ideal for sampling of this habitat type. Collected grasses were dead and difficult to identify. It is likely that there are many more species present in these claypans than were identified during this survey. Four weeks after substantial summer rain would be a suitable time to survey for these ephemeral grasses. Condition: Very Good. Site SS123; Plate 4.15.

4. Saline Mudflats (Vegetative cover absent)
Occasional scattered individual samphires (Vegetation Type 1a) in close proximity to mainland remnant islands and the hinterland, but otherwise entirely devoid of vegetation cover. Plate 4.16.

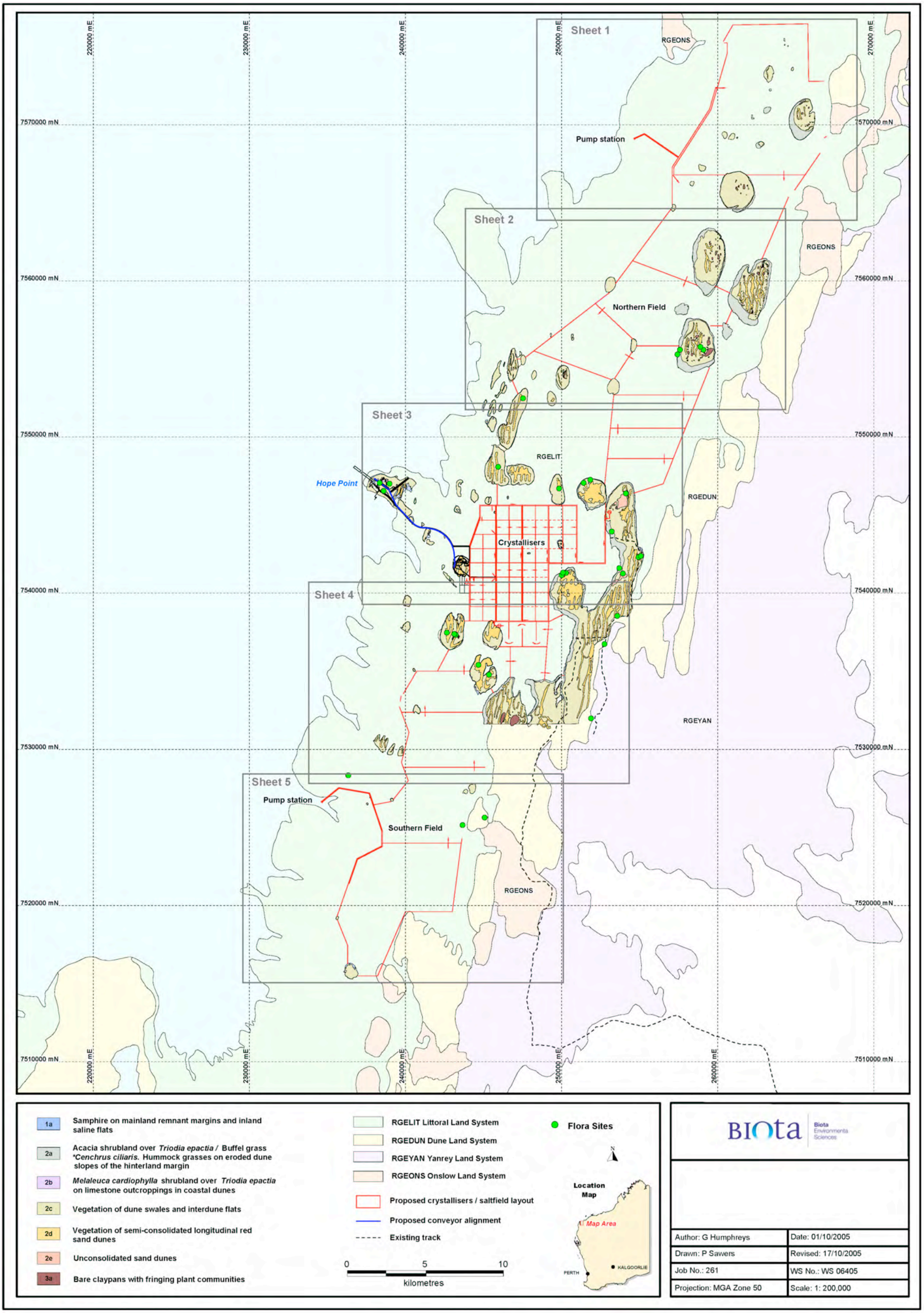

Figure 4.1: Vegetation type map for the Yannarie Salt project area.

Plate 4.1: Vegetation Type 1a: Samphire on salt flats on mainland (Site SS002).

Plate 4.2: Vegetation Type 1a: Narrow strip of samphire typical of edges of mainland remnants and hinterland (Site SS102).

Plate 4.3: Vegetation Type 2a.1: *Acacia sclerosperma* over *Acacia stellaticeps* over *Triodia epactia* (Site SS119).

Plate 4.4: Vegetation Type 2a.2: *Acacia sclerosperma* over *Acacia stellaticeps* over Buffel **Cenchrus ciliaris*. (Site SS114).

Plate 4.5: Vegetation Type 2b: *Melaleuca cardiophylla* over *Triodia epactia* in patches of exposed limestone. (Aerial view of Hope Point; Site SS107).

Plate 4.6: Vegetation Type 2c: Sparse Mixed shrub and *Acacia* species over *Triodia epactia* (Site SS14).

Plate 4.7: Vegetation Type 2d: Mixed shrubs over *Triodia epactia* and *T. schinzii* on longitudinal red sand dunes.

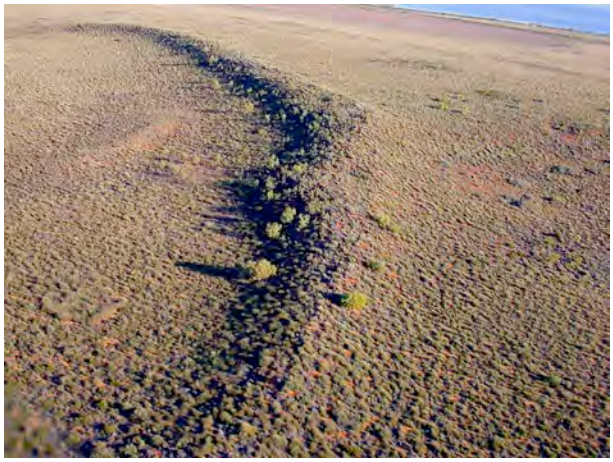

Plate 4.8: Longitudinal red sand dune (Vegetation Type 2d) with dune swales (Type 2c) to either side.

Plate 4.9: Vegetation Type 2e: Mobile sand sheet with scattered shrubs and herbs, showing *Trichodesma zeylanicum* var. *grandiflorum* (Site SS-RA).

Plate 4.10: Vegetation Type 2e: Mobile sand sheet with sparse shrubs and herbs. Photo shows *Acacia murrayana and A. coriacea* with mixed shrubs (Site SS120).

Plate 4.11: Aerial view of claypans on mainland (looking west to main project area).

Plate 4.12: Vegetation Type 3a.1: Bare claypans with fringing Paperbarks *Melaleuca leiopyxis* and stunted Coolibah *Eucalyptus victrix* (on access road).

Plate 4.13: Vegetation Type 3a.2: Claypan on mainland with some *Triodia epactia*, herbs and grasses, usually at edge, but often covering smaller pans.

Plate 4.14: Vegetation Type 3a.2: Bare claypans (large) with *Triodia epactia*, herbs and grasses on the edge (claypan on Island 18).

Plate 4.15: Vegetation Type 3b: Coolibah *Eucalyptus victrix* woodland over ephemeral tussock grasslands on claypan (Site SS123).

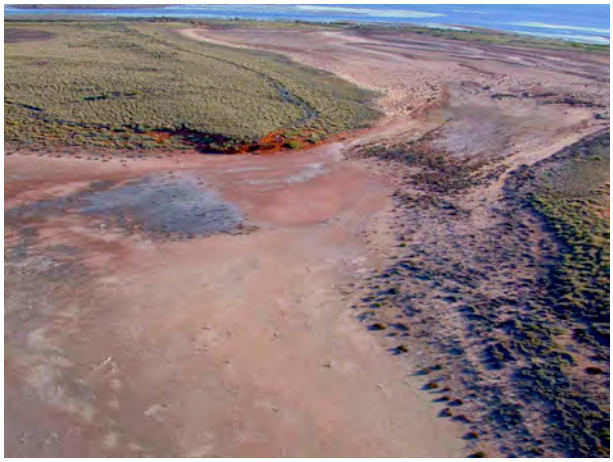

Plate 4.16: Vegetation Type 4: Saltflat with vegetative cover absent. Some samphire (Vegetation Type 1a) near islands,.

Plate 4.17: Coolibah growing in dune swales (Site SS16).

Plate 4.18: Stunted Coolibah growing on edge of claypan (access track approximately 16 km south of Yanrey Point).

4.2 Vegetation Condition

The vegetation of the Yannarie Salt project area was generally in Very Good to Excellent condition, with little ground disturbance and very few weed species. However there were some areas where severe infestations of Buffel grass **Cenchrus ciliaris* occurred and these areas were classified as being in Very Poor condition. This highly invasive species was also present throughout the study area as scattered individuals and could be considered a 'sleeper' weed species within the study area. It is currently at low levels, but processes such as soil disturbance or a fire during construction may cause it to proliferate. It was particularly recorded along the edge of the hinterland coast where erosive processes had disturbed the soil, and also from sand dunes and swales.

4.3 Vegetation Conservation Significance

There is a small area of *Melaleuca cardiophylla* shrubland over *Triodia epactia* on Hope Island (vegetation type 2b). While this community only exists in a small area within the survey area, this community is moderately common in the Cape Range area (CALM, 2002).

It is difficult to conclusively determine the conservation significance of vegetation in a region if there is a lack of contextual information. The lack of data is due to a scarcity of resources available for detailed regional botanical surveys across the large areas that remain poorly researched across much of Western Australia. In the absence of extensive survey data with which to compare results of this study, the following discussion of vegetation conservation significance mainly utilises information from the CALM IBRA subregion audit.

The survey area is situated within the Carnarvon bioregion (see Section 3.1). The 2002 Subregional Biodiversity Audit (CALM 2002), split the Carnarvon bioregion into two sub-regions of which the study is in the Cape Range sub-region. This sub-region is the northern part of the Carnarvon IBRA region and includes Cape Range, the Exmouth Gulf and the mainland to the east of the gulf, northwards to Onslow. Only 2-3% of this sub-region is protected within reserves.

The audit of the Cape Range subregion identified those ecosystems that had low, medium or high priority for reservation. Several medium to high priority ecosystems were identified within the survey area (Table 4.1). Accurate matching of the vegetation types identified from the survey area with the CALM reservation priority ecosystems was somewhat limited due to the level of detail provided in the CALM document.

Table 4.1: Reservation priority ecosystems within the Cape Range subregion as they relate to the survey area.

Ecosystem (CALM, 2002)	Reservation Priority	Study area equivalent vegetation type	Location and likely impacts
Medium Woodland; Coolibah (*E. microtheca**)	High	Ambiguous community description. Possible equivalent to 3b: Coolibah *Eucalyptus victrix* Low Woodland over Grassland on vegetated claypans. There were some patches of *E. victrix* also within dune swales (Vegetation Type 2c).	Mainly inland. May be minimally affected by access road construction. Borrow pits have not been chosen yet but are likely to be along the access track.
Bare Areas: mudflats	High	Ambiguous community description. Possible equivalent to 4: Saline mudflats (devoid of vegetation). Could also refer to tidal mudflats.	Provide the basin for the salt evaporators. Soil will be disturbed and flats inundated. The study area covers a large proportion of the largest expanse of tidal salt flats in the Cape Range sub-bioregion.
Succulent Steppe: samphire	High	1a: Island and coast margins and inland saline flats: Samphire.	Island margins and saline flats on islands will be inundated. Inland samphire flats should only be minimally affected by access road.
Open Dwarf Scrub, waterwood (*Acacia coriacea*) on recent dunes	High	Ambiguous community description. Probably equivalent to 2d: Semi-consolidated Linear and Parallel Dunes.	Mainly in the centre of islands and inland. Minimal impact expected, although these areas are vulnerable to slow decline through Buffel grass invasion. Increased fires or soil disturbance may aid Buffel.
Bare Areas: claypans	High	3a: Bare Claypans	Island claypans may be inundated. Inland claypans may be minimally affected by construction of access track or borrow pits, which are likely to be located at intervals along access track.
Shrublands: *Acacia sclerosperma* and *A. victoriae*** scrub	Medium	2c: Sparse Mixed shrub and Acacia species over *Triodia epactia*.	This vegetation type is widespread in the study area, occurring on islands and the mainland. Low lying areas may be inundated on islands. Level of disturbance on mainland will depend on where borrow pits are to be located. This area will be vulnerable to Buffel grass infestation if disturbed.

* *Eucalyptus microtheca* in this area is now *E. victrix*.
** *Acacia victoriae* in this area is now *A. synchronicia*
*** Soft spinifex refers to *Triodia pungens*, which is actually more likely to be *T. epactia*, although both species are known to occur in the area. The only species recorded in the study area was *T. epactia*. The two species are often misidentified.

Both the project hinterland and mainland remnants contained a repeated landform and vegetation association of linear, red, parallel dunes interspersed with swales (the latter containing claypans; more frequently on the hinterland). Bare claypans have been listed as having a high reservation priority (Table 4.1). There were numerous vegetated and bare claypans within the study area, mostly on the hinterland but also occurring on the mainlands remnant islands (see Figure 4.1). These were generally in Excellent condition from a vegetation perspective. Buffel grass was sometimes observed at sparse densities on the margins of these features. There is little data available to determine the uniqueness of the vegetation associated with these claypans, and very few detailed botanical surveys appear to have been completed in the sub-region, particularly the eastern part of it (some studies

have been done in the west at Cape Range and one is underway on Giralia Station to the south).

The Beard 1:1,000,000 series vegetation mapping of the Pilbara (Beard 1975) shows that there are only two areas of parallel dunes interspersed by claypans. Both of these are, however, extensive, with an area of approximately 75,000 ha south of Onslow and an area approximately 70,000 ha encompassing the current study area. Approximately 9,010.4 ha of this association were recorded within the broader study area (a combination of veg types 2c, 2d and 3a) (see Figure 4.1).

The occurrence of Coolibah *Eucalyptus victrix* (previously known as *E. coolibah*) around the edge of small claypans and scattered in dune swales is also of interest. These trees are usually associated with areas that have accessible groundwater, typically along major creeks or as woodlands on low-lying drainage flats. In the dune swales they are often very stunted, being a third of their usual height, and although they looked like saplings, they were fruiting like mature trees. On the hinterland, this association is often severely degraded through grazing by introduced animals and associated Buffel grass invasion. This was not the case in the majority of the study area, with these areas still persisting in Excellent condition, with low weed invasion, little or no soil disturbance and little or no evidence of grazing or trampling. Coolibah habitats are under threat across the Eremaean province of Western Australia from pastoral activities and introduced animals such as goats, horses, donkeys, rabbits and camels. Kangaroo numbers have also increased as a result of increased water availability due to pastoralism, and these also result in grazing pressure on these habitats. Coolibah communities that are still relatively intact therefore have conservation significance. '*E. coolibah (E. victrix*) medium woodland' was listed (Table 4.1) as a high reservation priority within the Cape Range Sub-region (CALM 2002).

Riparian areas within rangelands are generally considered to be under threat from pastoral activities, as the impact of particularly goats, sheep and cattle are greatest around freshwater areas where there is water to drink and palatable vegetation. 'All Riparian zones are degraded and infested with Buffel grass. Permanent and semi-permanent pools are affected by cattle, sheep and goats and are in declining condition' (CALM 2002). Riparian generally refers to the banks and flood areas of creeks and rivers. The claypans in the area are part of a very broad drainage system of the Yannarie River and probably also the Ashburton River and can be considered to have riparian elements. Even though it is a poorly defined, broad drainage system, significant rain events cause an overland flow across the complex series of claypans. The Yannarie River itself is in relatively good condition, although it is itself naturally sparsely vegetated – more typical of samphire flats than typical riparian vegetation, although it becomes more typical Coolibah woodland further inland. Some of the species recorded in claypans and the river are generally associated with riparian areas, such as *Chrysopogon fallax, Eulalia aurea* and *Eucalyptus victrix*. According to the National Land and Water Resources audit, all riparian ('watercourses') within the Cape Range Sub-region are listed as Degraded, which is the poorest condition of four categories <http://www.audit.deh.gov.au>. The fact that the mainland drainage features within the survey area are still in good condition means that they have high conservation significance.

The linear, parallel, red sand dunes that are located on islands in the supratidal salt flats are likely to be of interest floristically. Although these sand dunes are fairly widespread within the Cape Range Sub-region, the dunes on the islands have coastal influences evident in their floristics, which quite possibly makes them unique at a detailed floristic level.

4.3.1 Threatened Ecological Communities

No Threatened Ecological Communities (TECs) were recorded within the study area. Within the Cape Range Sub-region there have been only two ecosystems listed under state legislation, and these are both cave systems associated with the karstic limestones of the Cape Range. However, the Biodiversity Audit (CALM, 2002) listed another 26 ecosystems that were considered to be under threat in the Cape Range Sub-region by regional ecologists. These included floodplain and samphire, which occurred in the survey area, as well as an ambiguous 'plant assemblages'.

5.0 Flora

5.1 General

A total of 192 taxa of terrestrial vascular flora from 100 genera belonging to 41 families was recorded from the survey area (see Appendix 2). Of this total number, approximately 26% (50 taxa) was represented by ephemeral (annual or perennial) species, which are only present in areas at times of suitable environmental conditions. Only two species of introduced flora were recorded in the survey area; Buffel Grass **Cenchrus ciliaris* and Algaroba or "Mesquite" **Prosopis pallida* (see Section 5.4).

The low number of vascular flora recorded reflects a number of factors:

- the low number of habitat types present in the survey area;
- the habitats present in the survey area having low numbers of constituent species due to the harsh environments in these habitats (eg. hypersaline mudflat and claypan areas, windblown deep red sand dunes);
- the survey area being located in an area that experiences low summer and winter rainfall, therefore not having many annual or ephemeral perennial species present; and
- the paucity of the flora of the coastal environments in the Cape Range sub-region of the Carnarvon Bioregion.

The families and genera with the greatest number of taxa are shown in Table 5.1. These families and genera are those that are predominant in the vegetation of the coastal areas of the Carnarvon and Pilbara Bioregions. They usually have the most representatives on flora lists in surveys in this region, due to their prominence in the Eremaean flora. Some of the families (eg. the Amaranthaceae, Malvaceae and Poaceae) are more species rich in the Northern flora and poorer in the Southern flora, while others (such as the Chenopodiaceae, Mimosaceae and Papilionaceae) are abundant in all three.

In contrast to these families and genera that have many representatives, 18 families and 61 genera recorded during the survey were represented by only a single taxon. These included *Acanthocarpus* (Dasypogonaceae), *Bergia* (Elatinaceae), *Boerhavia* (Nyctaginaceae), *Cassytha* (Lauraceae), *Corchorus* (Tiliaceae), *Diplopeltis* (Sapindaceae), *Erodium* (Geraniaceae), *Frankenia* (Frankeniaceae), *Gyrostemon* (Gyrostemonaceae), *Haloragis* (Haloragaceae), *Hannafordia* (Sterculiaceae), *Lepidium* (Brassicaceae), *Muellerolimon* (Plumbaginaceae), *Mukia* (Cucurbitaceae), *Santalum* (Santalaceae), *Stemodia* (Scrophulariaceae), *Stylobasium* (Surianaceae) and *Trachymene* (Apiaceae). Some of the genera, such as *Bergia, Boerhavia, Muellerolimon, Mukia* and *Stemodia* have Northern and Eremaean affinities, with only a few species in the state, while the genus *Corchorus* has Northern and Eremaean affinities with many species present in the state. Other genera such as *Acanthocarpus, Cassytha, Erodium, Haloragis, Lepidium, Santalum, Stylobasium* and *Trachymene* have mostly southern affinities but also have some representative species in the Northern and Eremaean parts of the state.

The most frequently recorded species were *Triodia epactia* (34 records), *Solanum lasiophyllum* (32 records), **Cenchrus ciliaris* (29 records), *Scaevola spinescens* (26 records), *Acacia coriacea* subsp. *coriacea* (21 records), *Acacia tetragonophylla* (19 records) and *Hakea stenophylla* subsp. *stenophylla* (16 records). Some of these species are common dominants in the vegetation of the coastal parts of the Carnarvon and Pilbara Bioregions (eg. *Triodia epactia, Acacia coriacea* subsp. *coriacea* and *Scaevola spinescens*), or at least frequently contribute to the vegetation structure. Others are species with wide environmental tolerance, but usually with low abundance (eg. *Acacia tetragonophylla* and *Solanum lasiophyllum*). Forty-nine taxa were recorded from only a single collection during the survey.

Table 5.1: The most species rich families and genera within the project area.

Family	Number of Native Taxa (Number of Introduced Taxa)
Poaceae (Grass family)	26 (1)
Chenopodiaceae (Saltbush, Bluebush family)	23 (0)
Asteraceae (Daisy family)	16 (0)
Papilionaceae (Pea family)	15 (0)
Mimosaceae (Wattle family)	12 (1)
Malvaceae (Hibiscus family)	9 (0)
Goodeniaceae (Leschenaultia family)	7 (0)
Caesalpiniaceae (Cassia/Senna family)	6 (0)
Myrtaceae (Myrtle family)	6 (0)
Genus	Number of Native Taxa (Number of Introduced Taxa)
Acacia (Wattle family)	12 (1)
Halosarcia (Saltbush, Bluebush family)	7 (0)
Cassia (Cassia/Senna family)	6 (0)
Eriachne (Grass family)	5 (0)
Eragrostis (Grass family)	5 (0)
Scaevola (Leschenaultia family)	5 (0)
Atriplex (Saltbush, Bluebush family)	4 (0)
Indigofera (Pea family)	4 (0)
Ptilotus (Mulla-mulla family)	4 (0)
Pluchea (Daisy family)	4 (0)

Ignoring the incompletely recorded sites, species richness per quadrat (detailed flora recording site) ranged from four to 39 taxa with an average of 19 – 20 taxa (see Appendices 1 and 4). Quadrats with the lowest species richness included SS02 (8 taxa), SS19 (11 taxa), SS102 (8 taxa), SS108 (4 taxa), SS112 (6 taxa), SS119 (10 taxa), SS122 (11 taxa) and Relevé KB (10 taxa). A number of these sites were located on the saline clay, tidal mudflat areas (SS102, SS108 and SS112), and others were located within the low lying, saline clay-loam samphire low shrubland found adjacent to the tidal mudflat areas (SS02 and SS19). Site SS119 was located on a beachfront semi-consolidated sand dune adjacent to a samphire low shrubland, site SS122 was located on a flat area of dune swale between two parallel red sand dunes and the site relevé KB was located on a saline claypan within a dune swale area.

Sites with the highest species richness values were located on the sand dune crest areas (SS11, SS17 and SS103) and within the sand dune swale areas (SS12, SS16, SS104, SS105, SS115 and SS116). Each of these sites had between 30 and 40 taxa present. The main factor driving differences in the number of species recorded in different quadrats thus seems to be habitat type. Habitats with generally good conditions (deep, well-drained soils with some available water) typically had more species than the habitats with less favourable soils, or extreme conditions such as high salinity, wind exposure or occasional tidal influence.

5.2 Flora of Conservation Significance

5.2.1 Statutory Framework

While all native flora are protected under the *Wildlife Conservation Act 1950 – 1979*, a number of plant species are assigned an additional level of conservation significance based on the limited number of known populations and the perceived threats to these populations (Table 5.2). Species of the highest conservation significance are designated Declared Rare Flora (DRF), either extant or presumed extinct. Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories.

In addition, the presence of some threatened flora species means that it may be necessary to refer proposals to the Federal Minister for the Environment under the terms of the *Environment Protection and Biodiversity Conservation* (*EPBC*) *Act 1999*. The Cape Range sub-region of the Carnarvon Bioregion is located within the Pilbara region as designated by the

Department of CALM for the purposes of the Declared Rare and Priority Flora list boundaries for Western Australia. In this region, only the two Declared Rare Flora species *Lepidium catapycnon* and *Thryptomene wittweri* are currently listed as 'Vulnerable' under the *EPBC Act 1999*.

Table 5.2: Categories of conservation significance for flora species under the *Wildlife Conservation Act 1950-1979* (Atkins, 2005).

R: Declared Rare Flora – Extant Taxa. Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X: Declared Rare Flora – Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1: Priority One – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat.
2: Priority Two – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3: Priority Three – Poorly Known Taxa. Taxa which are known from several populations, and the taxa are not believed to be under immediate threat.
4: Priority Four – Rare Taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors.

5.2.2 Previous Threatened Flora Records from the Locality

A search of CALM's Threatened (Declared Rare) and Priority Flora database and the Western Australian Herbarium Specimen database was commissioned for the area, bounded by the coordinates: 114° 21' 45"E, 22° 29' 33"S; 114° 21' 45"E, 21° 50' 02"S; 115° 38' 36"E, 21° 50' 02"S and 115° 38' 36"E, 22° 29' 33"S. The centre point coordinate for this bounded area is 22° 09' 58"S and 114° 27' 17"E. From the search of this area, records of 131 locations of 26 taxa were obtained from the two databases. Of the 26 taxa listed on the database search, three are Priority 1 (P1), eight are Priority 2 (P2), 11 are Priority 3 (P3) and four are Priority 4 (P4). Note that many of these records are from the WA Herbarium Specimen database and have not been verified for accuracy.

None of these locations were from within 10 km of the proposed Yannarie Salt project area, with the closest known record for a population of a flora species of conservation significance approximately 35 - 40 kilometres from the proposed project area. This record is for a population of a Priority 3 grass species, *Eragrostis crateriformis;* an annual species which prefers clay or clay-loam soils of creek banks and depressions. Populations of two additional Priority 3 species, *Acacia startii* and *Goodenia pascua,* are also known from an area between 45 and 55 km from the proposed project area. The habitat preference for these two species is also different to the habitats represented in the Yannarie Salt project area, and they are therefore unlikely to occur. Most of the records for the Priority species listed following the database search are from the North West Cape region, on the opposite side of Exmouth Gulf.

The low number of database records of flora species of conservation significance from near the Yannarie Salt project area is probably due to the small number of collections from the locality, and the low level of flora species diversity in the habitats present within the proposed project area. The previous records of flora species of conservation significance returned from the database searches are summarised, along with habitat and distribution comments, in Table 5.3.

Table 5.3: Threatened flora species previously recorded from within 50km of the Yannarie Salt project area.

Taxon	Distribution, Growth Habit and Habitat Preferences
Abutilon uncinatum (P1)	Not known from the North West Cape or Exmouth Gulf areas, but more frequently recorded in the western Pilbara. A prostrate perennial herb which grows on red sand and typically found on flat plain areas.
Helichrysum oligochaetum (P1)	Mostly collected from the Pilbara bioregion (one population on the boundary of the Pilbara and Carnarvon bioregions). An annual herb typically found on red clay soils of alluvial plain areas.
Myriocephalus nudus (P1)	Collected inland (SE) from the Exmouth Gulf area in the Carnarvon bioregion. An annual herb typically found in moist areas along rivers and creeks, or associated with granite outcrops.
Abutilon sp. Cape Range (P2)	Collected from North West Cape. A shrub growing on calcareous loam and typically found in limestone gullies.
Acacia ryaniana (P2)	Collected from the North West Cape and coastal areas of the Carnarvon bioregion. A prostrate, straggly, spiny shrub growing on white or red sand and typically found on coastal sand dunes.
Acanthocarpus rupestris (P2)	Collected from the North West Cape. A perennial herb/low shrub typically growing on red sand over limestone areas.
Daviesia pleurophylla (P2)	Collected from the North West Cape. A low, branched shrub typically growing on sand dunes.
Eremophila occidens (P2)	Collected from the North West Cape. A shrub typically growing on orange-brown sand on limestone ranges and dunes.
Harnieria kempeana (P2)	There are two subspecies of this taxon, but only one (*H. kempeana* subsp. *rhadinophylla*) is assigned the P2 conservation status. This subspecies has been collected from North West Cape. It is an erect or sprawling straggly shrub typically growing on calcareous loam amongst limestone rocks or on creek banks.
Tinospora esiangkara ms. (P2)	Collected from the North West Cape. A climber species typically found on pebbly orange-brown calcareous loam on limestone outcrops or ridges, or near creek banks.
Verticordia serotina (P2)	Collected from the North West Cape. A shrub growing on red sand and typically found on sand dunes.
Acacia alexandri (P3)	Collected from the North West Cape. A dense or wispy shrub growing on limestone and typically found in stony creeks and on steep rocky slopes.
Acacia startii (P3)	Collected from the North West Cape. A shrub growing on calcareous loam with limestone pebbles and typically found on stony hills and in watercourses.
Beyeria cygnorum (P3)	Collected south of the Cape Range and the North West Cape (coastal areas of the Carnarvon and Geraldton Sandplains bioregions). A low, open, erect shrub growing in sand over limestone and typically found on road verges and in gullies.
Corchorus interstans (P3)	Collected from the North West Cape. A spreading low shrub typically growing on sandplains.
Eragrostis crateriformis (P3)	Collected from the eastern side of the Exmouth Gulf and from some sites in the Pilbara bioregion. An annual grass growing on clay or clayey loam and typically found on creek banks and wet depressions.
Goodenia filiformis (P3)	Collected from the North West Cape. An erect, slender perennial herb typically growing on sandy soils in winter-wet depressions.
Goodenia pascua (P3)	Collected from coastal and some inland locations in the Pilbara bioregion and from one location near the coast in the northern part of the Carnarvon bioregion (east of the Exmouth Gulf). An erect herb typically growing on red sandy soils of basaltic plains.
Grevillea calcicola (P3)	Collected from the North West Cape. A small tree or shrub typically found on limestone hilltops.
Owenia acidula (P3)	Collected from the Carnarvon and Pilbara bioregions. A tree typically growing on clay soils.
Rhynchosia bungarensis (P3)	Collected from the Pilbara bioregion. A climber species typically found in rocky gullies and/or gorges and floodplain areas.
Stackhousia umbellata (P3)	Collected from the North West Cape. A perennial herb typically growing on sandy soils on limestone.

Table 5.3: Threatened flora species previously recorded from within 50km of the Yannarie Salt project area.

Taxon	Distribution, Growth Habit and Habitat Preferences
Brachychiton obtusilobus (P4)	Collected from the North West Cape. A tree typically growing in skeletal soils on rocky limestone ranges, gorges and occasionally sandplains.
Eremophila glabra (P4)	This taxon has a number of subspecies which are widely spread throughout the Southwest and Eremaean botanical regions of WA. Based on the most current conservation status listed for this species on the Department of CALM Florabase database, the taxon is no longer listed as P4. Only one subspecies, *E. glabra* subsp. *psammophora* ms. is listed as a Priority taxon (P2). This subspecies has previously been collected from sandy dune areas in coastal areas of the Carnarvon bioregion south of the North West Cape and from the Shark Bay area (Peron and Edel land peninsulas and Dirk Hartog Island).
Eremophila youngii (P4)	There are two subspecies of this taxon, but only one (*E. youngii* subsp. *lepidota* ms.) is assigned the P4 conservation status. This subspecies has been collected from the tip of the North West Cape. It is a dense, spreading shrub typically growing in stony red sandy loam on flat plains, flood plains, sometimes semi-saline areas and clay flats.
Livistona alfredii (P4)	Collected from the North West Cape and the Pilbara bioregion. A palm tree typically found on the edges of permanent pools (e.g. Millstream).

5.2.3 Threatened Flora Recorded from the Project Area

None of the Priority species identified on the CALM database search listing for the area were recorded from the Yannarie Salt project area during the field survey.

As there are no species of Declared Rare Flora (DRF) listed on the database search results, and no DRF species were recorded during the survey, no flora species of significance under the *EPBC Act 1999* are known from the survey area.

Of the 26 Priority species listed in the CALM database search, only nine were considered to possibly occur in the project area based on the suitability of the habitats present. These species are:

- *Abutilon uncinatum* – P1;
- *Acacia ryaniana* – P2;
- *Acanthocarpus rupestris* – P2;
- *Beyeria cygnorum* – P3;
- *Daviesia pleurophylla* – P2;
- *Eremophila occidens* – P2;
- *Eremophila youngii* subsp. *lepidota* ms. – P4;
- *Stackhousia umbellata* – P3; and
- *Verticordia serotina* – P2.

5.3 Flora Species at the Geographical Boundaries of their Distribution

The geographical distribution of each of the flora species recorded in the field survey was checked on the Western Australian Herbarium 'FloraBase' database. A number of the flora species present are found at their northern, southern or western extremities of their state distribution. The flora and vegetation of the Exmouth Gulf and North-west Cape areas has overlapping species which occur in both the Southwest Botanical Province (influenced by winter rainfall patterns) and the Northern and Eremaean Botanical Provinces (influenced by cyclonic summer rainfall patterns).

5.3.1 Flora Species at the Northern End of their Distribution

The survey recorded a total of 21 species (11% of the recorded flora) that are located at the northern end of their known geographical distribution in Western Australia (based on the distribution map in 'FloraBase').

These species were:

Acacia murrayana, A. rostellifera, Acanthocarpus preissii, Atriplex paludosa subsp. *moquiniana, Calandrinia polyandra, Cassytha racemosa, Eragrostis pergracilis, Eremophila setacea, Erodium cygnorum, Gnephosis arachnoidea, Goodenia ochracea, Grevillea gordoniana, Hakea stenophylla* subsp. *stenophylla, Halgania cyanea* var. *latisepala, Halosarcia syncarpa, Melaleuca leiopyxis, Murchisonia volubilis, Rhyncharrhena linearis, Scaevola anchusifolia, Senecio pinnatifolius* and *Tricoryne corynothecoides.*

None of these species are otherwise considered to be of special conservation significance.

5.3.2 Flora Species at the Western End of their Distribution

The survey recorded a total of 16 species (8% of the recorded flora) that are located at the western end of their known geographical distribution in Western Australia (based on the distribution map in 'FloraBase').

These species were:

Abutilon dioicum, Acacia sphaerostachya, Aristida latifolia, Corchorus elachocarpus, Cullen martinii, Hakea chordophylla, Heliotropium pachyphyllum, H. transforme, Hibiscus brachychlaenus, H. sturtii var. *campylochlamys, Lepidium platypetalum, Pluchea* sp. B Kimberley Flora, *Streptoglossa bubakii, S. decurrens, Trachymene pilbarensis* and *Trianthema triquetra.*

None of these species are otherwise considered to be of special conservation significance.

5.3.3 Flora Species at the Southern End of their Distribution

Four species (2% of the recorded flora) were collected that are located at the southern end of their known geographical distribution in Western Australia (based on the distribution map in 'FloraBase').

These species are:

Canavalia rosea, Pluchea sp. B Kimberley Flora, *Suaeda arbusculoides* and *Tribulus hystrix.*

5.4 Introduced Flora

Only two species of introduced flora were recorded from the project area.

Buffel grass **Cenchrus ciliaris* is a common and widespread species in the Pilbara and Carnarvon bioregions. This species, and the less common species in this genus, Birdwood grass **Cenchrus setigerus,* were introduced as fodder species by pastoralists. While these highly invasive species have demonstrated allelopathic capacities (whereby they release chemicals which inhibit the growth of other species), they are not listed as Declared Plant species by the Department of Agriculture due to their importance to the pastoral industry.

Buffel grass was widespread in the project area and was recorded at 29 of the 42 sites assessed during the field survey. These sites (with an approximate level of the cover by Buffel) are listed in Table 5.4.

Table 5.4: Sites where Buffel grass was recorded during the survey and approximate cover.

Site	Extent of Buffel grass Cover
SS01	Covered approximately up to 1% of a 40m x 65m quadrat
SS11 and SS15	Covered approximately up to 1% of a 20m x 125m quadrat
SS16	Covered approximately up to 1% of an unbounded relevé
SS06, SS07, SS103, SS105, SS112, SS116, SS117, SS119 and SS121	Covered approximately less than or up to 1% of a 50m x 50m quadrat
SS05, SS10, SS17, SS104 and SS109	Covered approximately up to 2-6% of a 50m x 50m quadrat
SS101 and SS120	Covered approximately up to 10-15% of a 50m x 50m quadrat
SS08, SS18, SS110, SS114 and SS115	Covered approximately up to 25-35% of a 50m x 50m quadrat
SS09 and SS111	Covered approximately up to 60-65% of a 50m x 50m quadrat
SS118	Some localised areas have dense Buffel grass (up to 50% cover).

The species was also recorded opportunistically in areas where no quadrats or reeve's were completed (e.g. on the edge of the Yannarie River channel).

Sites which had a high density of Buffel grass (greater than 25% cover in the quadrat) were typically associated with disturbed island or mainland edges (the causes likely to be grazing by cattle and erosive processes, with seed deposition to weed free areas during flood and run-off events).

The introduced genus **Prosopis* has been recorded mainly from the northern regions of the State, with occasional records from the Southwest. Algaroba or "Mesquite" **Prosopis pallida* has been recorded from various locations along the Pilbara coast. Three individuals of this species were recorded scattered locations all as mature trees ~4 m tall. No juveniles were noted in the surrounding areas. This taxon is not the same as the hybrid form of **Prosopis pallida,* an extremely vigorous suckering shrub-form Mesquite, which has invaded vast areas (particularly on Mardie Station).

6.0 Discussion

The flora survey of the Yannarie Salt project area recorded 192 flora species. A number of the flora species recorded during the survey of the Yannarie Salt project area were found to be at the geographical boundaries of their distribution (see Section 5.3). There were 21, 16 and four flora species found at the northern, western and southern ends of their distribution respectively (totalling over 20% of the recorded flora at distributional limits). None of these taxa are listed by CALM as species of conservation significance, and it is likely that they are found in this Cape Range Sub-region as a result of the area being a meeting zone between two different climatically influenced areas (the southwest area of WA with its winter rainfall pattern and the northern area of WA with its cyclonic summer rainfall pattern).

Eleven vegetation types were recorded from the Yannarie Salt project area during the survey, representing three broad groupings based on landform position. None of these represent Threatened Ecological Communities (TECs) or vegetation types that are otherwise of special conservation significance. Most vegetation types were widespread within the project area and were consistent with the regional framework provided the Department of Agriculture land system studies (Payne et al. 1988) and the regional scale vegetation mapping of Beard (1971).

The survey area contained a representation of various vegetation types that:

- were in relatively good condition, unlike a number of ecosystems in the Cape Range Sub-region which are under threat (known to be at risk), largely from pastoral activity and feral animals such as goats, foxes, cats and rabbits;
- are poorly reserved;
- are poorly known floristically (poorly surveyed);
- are probably restricted to the Cape Range Sub-region of the Carnarvon IBRA region;
- have identifiable threatening processes – weed invasion, feral animals, pastoral activity and/or development across their distribution; or
- their extent of representation outside the survey area is unknown, with some likely to be relatively well represented and others not very well represented.

Most of the flora and vegetation sites assessed during the field survey were in a very good to excellent condition, with few signs of disturbance such as heavy weed infestation, grazing by livestock and/or evidence of frequent fires. Only a single weed species was documented from the 191 species recorded (less than 1% of the flora of the study area), highlighting the high degree of intactness of the flora of the Yannarie Salt project area.

7.0 Acknowledgments

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- Kelly Shepherd (University of Western Australia) kindly confirmed identifications of samphire specimens (*Halosarcia* species) collected during this survey.
- Confirmation of identifications of *Cassia*, *Euphorbia*, *Hibiscus*, *Sida* and *Tephrosia* species were carried out by Michi Maier (Biota) and Malcolm Trudgen (ME Trudgen and Associates).

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Appendix 1

Site Data from Quadrats and Relevés Assessed in the Yannarie Salt Project Area

Straits Saltfield Site SS01

Described by	Raimond Orifici		Quadrat size	40 x 65m
Date	8/14/04			
AMG Zone	50	254928mE, 7542300mN	254945mE, 7542327mN	
		254940mE, 7542263mN	254902mE, 7542268mN	
Habitat	Sand dune to approximately 20 metres tall			
Soil	Red fine grained sand			
Rock Type	None visible			
Vegetation	Scattered tall shrubs of *Acacia murrayana* over open shrubland of *Pityrodia loxocarpa* over low open shrubland of *Tephrosia rosea* var. *clementii* over very open hummock grassland of *Triodia epactia*			
Veg Condition	Very good; small areas of Buffel grass on dune crest of upper slopes, but it is present on lower slopes and in swales			
Fire Age	No evidence of fire			

Straits Saltfield Site SS02

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/14/04			
AMG Zone	50	252751mE, 7536734mN	252792mE, 7536760mN	
		252817mE, 7536716mN	252777mE, 7536692mN	
Habitat	Low lying saline clay-loam dominated by halophytic chenopod species of *Halosarcia*			
Soil	Sandy clay loam. Precipitated salt visible on soil surface in patches.			
Rock Type	Unknown - none visible			
Vegetation	*Halosarcia auriculata* low open heath over *Halosarcia indica* and *Halosarcia halocnemoides* subsp. *halocnemoides* scattered low shrubs on saline clay - loam (with some sandier areas)			
Veg Condition	Excellent; no sign of livestock grazing or weeds.			
Fire Age	No visible evidence of fire.			

Straits Saltfield Site SS03

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/21/04			
AMG Zone	50	251887mE, 7531994mN	251880mE, 7531945mN	
		251830mE, 7531955mN	251839mE, 7532004mN	
Habitat	Dune swale area between two parallel red sand dunes, with some small areas of low lying, saline claypans (sandy clay)			
Soil	Red fine grained sand			
Rock Type	Unknown - none visible			
Vegetation	*Stemodia* sp. Onslow low open shrubland over mid-dense hummock grassland of *Triodia epactia*			
Veg Condition	Excellent; no Buffel present or evidence of livestock grazing.			
Fire Age	Burnt in the last 2 years.			

Straits Saltfield Site SS04

Described by	Raimond Orifici		Quadrat size	35 x 70m
Date	8/22/04			
AMG Zone	50	236339mE, 7528344mN	236364mE, 7528318mN	
		236322mE, 7528263mN	236297mE, 7528288mN	
Habitat	Crest and upper slopes of a red sand dune			
Soil	Red fine grained sand			
Rock Type	Unknown; not visible			
Vegetation	*Hakea stenophylla* subsp. *stenophylla* open shrubland over *Scaevola sericophylla* low open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent; no Buffel grass present			
Fire Age	No evidence of fire			

Straits Saltfield Site SS05

Described by	Kelli McCreery and Raimond Orifici		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	245067mE, 7525639mN	245051mE, 7525687mN	
		245100mE, 7525701mN	245114mE, 7525654mN	
Habitat	Plain with termite mounds			
Soil	Red sandy clay			
Rock Type	Sandstone			
Vegetation	*Scaevola spinescens* low open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent - Very Good; some Buffel grass present			
Fire Age	None evident			

Straits Saltfield Site SS06

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	244669mE, 7535396mN	244719mE, 7535384mN	
		244710mE, 7535335mN	244657mE, 7535340mN	
Habitat	Dune swale between two parallel red sand dunes			
Soil	Red fine grained sand; weak dry crust on soil surface			
Rock Type	Unknown - none visible			
Vegetation	*Acacia synchronicia* open shrubland over *Scaevola spinescens* and *Acacia stellaticeps* low open shrubland over *Triodia schinzii* and *Triodia lanigera* hummock grassland			
Veg Condition	Excellent; Buffel grass present in minute quantities			
Fire Age	No evidence of fire in vegetation			
Notes	This site was recorded on the island designated as Island 5.			

Straits Saltfield Site SS07

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	245349mE, 7534775mN	245380mE, 7534738mN	
		245343mE, 7534706mN	245310mE, 7534744mN	
Habitat	Linear parallel inland dune			
Soil	Dark red sand			
Rock Type	Sandstone			
Vegetation	*Hakea stenophylla* subsp. *stenophylla* open shrubland over *Pityrodia loxocarpa* low open shrubland over *Triodia epactia* and *Triodia schinzii* mid-dense hummock grassland			
Veg Condition	Excellent			
Notes	This site was recorded on the SE section of the island designated as Island 5			

Straits Saltfield Site SS08

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/15/04			
AMG Zone	50	254135mE, 7546389mN	254087mE, 7546404mN	
		254104mE, 7546452mN	254152mE, 7546436mN	
Habitat	Dune swale			
Soil	Red sand			
Rock Type	Sandstone?			
Vegetation	*Acacia synchronicia* scattered shrubs over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Very Good; Buffel			
Fire Age	None evident			

Straits Saltfield Site SS09

Described by	Raimond Orifici		Quadrat size	50 x 50 m
Date	8/14/04			
AMG Zone	50	253209mE, 7543941mN	253293mE, 7543941mN	
		253277mE, 7543868mN	253239mE, 7543899mN	
Habitat	Crest and upper slopes of a red sand dune			
Soil	Fine red sand			
Rock Type	None visible			
Vegetation	*Acacia sclerosperma* and *Acacia synchronicia* open shrubland over *Acacia stellaticeps* scattered low shrubs over **Cenchrus ciliaris* tussock grassland			
Veg Condition	Very Poor - Poor; upper slopes mostly dominated by Buffel grass.			
Fire Age	No evidence of fire			
Notes	Elevation at NW peg 1 = 14 m Flora site SS09 is at the same site as fauna site SS-9 at Yanrey Point			

Straits Saltfield Site SS10

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/15/04			
AMG Zone	50	251409mE, 7547061mN	251454mE, 7547037mN	
		251432mE, 7546988mN	251382mE, 7546993mN	
Habitat	Red sand dune			
Soil	Red sand			
Rock Type	Unknown; not visible			
Vegetation	*Corymbia zygophylla* scattered low trees over *Grevillea stenobotrya* scattered tall shrubs over *Triodia epactia* closed hummock grassland			
Veg Condition	Very Good; some Buffel present but not in large quantities			
Fire Age	Doesn't look to have been burnt at all.			
Notes	Site recorded on island designated as Island 12			

Straits Saltfield Site SS101

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/14/04			
AMG Zone	50	255070mE, 7542375mN	255117mE, 7542395mN	
		255138mE, 7542350mN	255090mE, 7542329mN	
Habitat	Inland dune swale			
Soil	Red clayey sand with patches of clay (<10%)			
Rock Type	?Granite / Limestone			
Vegetation	*Acacia synchronicia* scattered shrubs over *Triodia epactia* mid-dense hummock grassland and **Cenchrus ciliaris* open tussock grassland			
Veg Condition	Good (Buffel present)			
Fire Age	None evident			
Notes	Inland, on inland dune system, just east of access track and Fauna Site SS01			

Straits Saltfield Site SS102

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/15/04			
AMG Zone	50	251840mE, 7547259mN	251845mE, 7547273mN	
		251615mE, 7547356mN	251614mE, 7547365mN	
Habitat	Edge of salt mud flats and island			
Soil	Pale orange clayey sand			
Vegetation	*Halosarcia pruinosa* low open shrubland over *Sporobolus virginicus* very open tussock grassland			
Veg Condition	Excellent			
Fire Age	None evident			

Straits Saltfield Site SS103

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/16/04			
AMG Zone	50	243223mE, 7537325mN	243273mE, 7537313mN	
		243259mE, 7537263mN	243211mE, 7537278mN	
Habitat	Crest of red sand dune			
Soil	Red fine - medium grained dune sand			
Rock Type	Unknown; no rock visible			
Vegetation	*Acacia coriacea* subsp. *coriacea* and *Grevillea stenobotrya* scattered tall shrubs over *Pityrodia loxocarpa* open shrubland over *Triodia lanigera* and *T. schinzii* mid-dense hummock grassland			
Veg Condition	Very Good to Excellent; very scattered individuals of Buffel grass present.			
Fire Age	No visible evidence of fire on large trees / shrub			
Notes	This detailed quadrat is located on the vegetated island designated as Island no. 7 in this study (same island as Fauna Site SS16 and relevé at SS16)			

Straits Saltfield Site SS104

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/16/04			
AMG Zone	50	243128mE, 7537381mN	243178mE, 7537369mN	
		243165mE, 7537323mN	243117mE, 7537334mN	
Habitat	Red sand dune swale with some small, localised claypans of red clay			
Soil	Red fine-medium grained sand in the dune swale and slope areas			
Rock Type	Unknown; none visible			
Vegetation	*Acacia synchronicia*, *Rhagodia eremaea* and *Scaevola spinescens* open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Very Good; small amount of Buffel grass present.			
Fire Age	No evidence of fire present.			
Notes	The quadrat was located on the vegetated island designated as Island no. 7 (near Fauna Site SS16) in this study			

Straits Saltfield Site SS105

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/16/04			
AMG Zone	50	242649mE, 7537470mN	242650mE, 7537420mN	
		242600mE, 7537420mN	242597mE, 7537471mN	
Habitat	Dune swale			
Soil	Red clayey sand			
Rock Type	Sandstone - calcarenite			
Vegetation	*Scaevola spinescens* (broad form) low open shrubland over scattered individuals of the climbing species *Cassytha racemosa* over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent - Very Good; occasional Buffel grass.			

Fire Age	None evident			
Notes	This quadrat was located on the western end of the vegetated island designated as Island no. 7 in this study			

Straits Saltfield Site SS106

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/17/04			
AMG Zone	50	238981mE, 7547006mN	239032mE, 7547016mN	
		239036mE, 7546963mN	238986mE, 7546959mN	
Habitat	Flat dune swale area			
Soil	Red fine grained sand with some clay in it			
Rock Type	Limestone - exposed in some places.			
Vegetation	*Diplopeltis eriocarpa, Corchorus elachocarpus* and *Solanum lasiophyllum* scattered low shrubs over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent			
Fire Age	No evidence of fire present			
Notes	This quadrat was located on the vegetated island designated as Hope Island in this study (east of Fauna Site SS15)			

Straits Saltfield Site SS107

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/17/04			
AMG Zone	50	238345mE, 7547056mN	238394mE, 7547063mN	
		238402mE, 7547014mN	238354mE, 7547005mN	
Habitat	Low hill in undulating plain. Some areas of calcrete rock outcropping.			
Soil	Pale orange brown clayey sand			
Rock Type	Outcropping calcarenite			
Vegetation	*Melaleuca cardiophylla* low open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent			
Fire Age	None evident			

Straits Saltfield Site SS108

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/17/04			
AMG Zone	50	238600mE, 7546547mN	238647mE, 7546527mN	
		238626mE, 7546482mN	238581mE, 7546065mN	
Habitat	Salt flats			
Soil	Pale clayey sand			
Rock Type	?Sandstone / Calcareous			
Vegetation	*Halosarcia indica, H. halocnemoides* subsp. *tenuis* and *Muellerolimon salicorniaceum* low shrubland to open heath			
Veg Condition	Excellent			
Fire Age	None evident			

Straits Saltfield Site SS109

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	259088mE, 7555584mN	259043mE, 7555604mN	
		259025mE, 7555558mN	259071mE, 7555538mN	
Habitat	Dune swale			
Soil	Red sandy clay loam			
Vegetation	*Acacia synchronicia* and *A. tetragonophylla* scattered shrubs over *Scaevola spinescens* (broad form) scattered low shrubs over *Triodia epactia* and *T. lanigera* mid-dense hummock grassland			
Veg Condition	Very Good - Good; Buffel grass			
Notes	This quadrat was located on the eastern side of the vegetated island designated as Island no. 18 in this study			

Straits Saltfield Site SS11

Described by	Kelli McCreery		Quadrat size	125 x 20 m
Date	8/15/04			
AMG Zone	50	247422mE, 7548070mN	247405mE, 7548079mN	
		247377mE, 7547953mN	247361mE, 7547963mN	
Habitat	Linear 'inland' sand dune			
Soil	Red sand			
Rock Type	?Sandstone			
Vegetation	Tall open shrubland of *Grevillea stenobotrya* over mid-dense hummock grassland of *Triodia schinzii*			
Veg Condition	Excellent - Very Good; Buffel			

Straits Saltfield Site SS110

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/18/04			
AMG Zone	50	258887mE, 7555774mN	258936mE, 7555761mN	
		258930mE, 7555712mN	258876mE, 7555723mN	
Habitat	Crest and upper slopes of parallel, red sand dune			
Soil	Red fine grained sand			
Rock Type	Unknown; not visible			
Vegetation	*Olearia dampieri* subsp. *dampieri* scattered tall shrubs over *Acacia coriacea* subsp. *coriacea* and *Hakea stenophylla* subsp. *stenophylla* scattered shrubs over *Triodia epactia* mid-dense hummock grassland and **Cenchrus ciliaris* open tussock grassland			
Veg Condition	Poor - Good; due to the presence of Buffel grass.			
Fire Age	No visible evidence of fire present			

Straits Saltfield Site SS111

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/18/04			
AMG Zone	50	257578mE, 7555586mN	257628mE, 7555594mN	
		257634mE, 7555539mN	257581mE, 7555537mN	
Habitat	Coastal dune crest and upper slope on edge of salt mud flat			
Soil	Red fine grained sand			
Rock Type	Unknown; no rock visible			
Vegetation	*Acacia coriacea* subsp. *coriacea*, *A. synchronicia* and *A. sphaerostachya* open shrubland over *Acacia stellaticeps* low open shrubland over **Cenchrus ciliaris* tussock to closed tussock grassland			
Veg Condition	Very Poor; vegetation community dominated by **Cenchrus ciliaris*			
Fire Age	No evidence of previous burning			
Notes	On western edge of vegetated island designated as Island no. 18 in this study			

Straits Saltfield Site SS112

Described by	Kelli McCreery		Quadrat size	20 x 125m
Date	8/19/04			
AMG Zone	50	257422mE, 7555286mN	257440mE, 7555284mN	
		257429mE, 7555159mN	257410mE, 7555162mN	
Habitat	'Beach' front (tidal salt flat/island meeting point) near saltpan			
Soil	Orange loamy sand			
Vegetation	*Halosarcia pruinosa, H. halocnemoides* subsp. *tenuis* and *Lawrencia viridigrisea* low shrubland			
Veg Condition	Very good; some Buffel			
Fire Age	None evident			
Notes	Quadrat located on western edge of vegetated island designated as Island no. 18 in this study			

Straits Saltfield Site SS113

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	245933mE, 7548084mN	245977mE, 7548105mN	
		245955mE, 7548040mN	245933mE, 7548084mN	
Habitat	Dune swale - wind exposed calcarenite			
Soil	Red-orange sandy clay loam			
Rock Type	Calcarenite			
Vegetation	*Acacia gregorii* and *Solanum lasiophyllum* low shrubland over *Triodia lanigera* mid-dense hummock grassland			
Veg Condition	Excellent			
Fire Age	None evident			
Notes	This quadrat was located on the central part of the vegetated island designated as Island no. 9 in this study			

Straits Saltfield Site SS114

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	243654mE, 7525156mN	243702mE, 7525146mN	
		243691mE, 7525099mN	243642mE, 7525107mN	
Habitat	Slope into saltpan (before samphire fringe).			
Soil	Orange sandy clay			
Rock Type	Sandstone			
Vegetation	*Acacia sclerosperma* open shrubland over *Acacia stellaticeps* and *Salsola tragus* scattered low shrubs over **Cenchrus ciliaris* tussock grassland			
Veg Condition	Poor; erosion (serious gullies all along coast), Buffel dominant - most of it is dead.			
Fire Age	None evident			
Notes	Site is located just north of the Yannarie River mouth, on the edge of the mainland			

Straits Saltfield Site SS115

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/20/04			
AMG Zone	50	249838mE, 7546701mN	249887mE, 7546713mN	
		249898mE, 7546664mN	249841mE, 7546651mN	
Habitat	Red sand dune swale between two parallel dunes			
Soil	Red fine grained sand			
Rock Type	No rock visible; unknown rock type.			
Vegetation	*Scaevola spinescens* low open shrubland over *Triodia epactia* mid-dense hummock grassland and **Cenchrus ciliaris* tussock grassland			
Veg Condition	Poor; due to percentage of **Cenchrus ciliaris* present.			
Fire Age	No evidence of fire present			
Notes	This quadrat is located on the vegetated island designated as Island no. 11 in this study			

Straits Saltfield Site SS116

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/20/04			
AMG Zone	50	247529mE, 7552478mN	247573mE, 7552478mN	
		247577mE, 7552428mN	247528mE, 7552428mN	
Habitat	Dune swale			
Soil	Red sandy clay			
Rock Type	Sandstone / Calcarenite; some exposed Calcarenite (<5%)			
Vegetation	*Acacia bivenosa* and *Stylobasium spathulatum* open shrubland over *Acacia gregorii* low open shrubland over *Triodia epactia* and *T. lanigera* mid-dense hummock grassland			
Veg Condition	Very Good; some Buffel			
Fire Age	None evident			
Notes	Quadrat is located on the northern end of the vegetated island designated as Island no. 13 in this study			

Straits Saltfield Site SS117

Described by	Raimond Orifici		Quadrat size	50 x 50 m
Date	8/20/04			
AMG Zone	50	250281mE, 7541290mN	250332mE, 7541289mN	
		250328mE, 7541238mN	250277mE, 7541240mN	
Habitat	Crest of red sand dune and its upper slopes			
Soil	Red fine grained sand			
Rock Type	No rock visible; unknown rock type.			
Vegetation	*Scaevola spinescens* low shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent; no sign of Buffel grass present on dune or its upper slopes.			
Fire Age	No evidence of fire on dune crest, but trunk of Co			
Notes	Two individuals of *Corymbia zygophylla* in dune swale between two parallel sand dunes. Approx. 3-4 m tall.			

Straits Saltfield Site SS118

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/20/04			
AMG Zone	50	250009mE, 7541147mN	250053mE, 7541122mN	
		250030mE, 7541079mN	250986mE, 7541103mN	
Habitat	(Giant) swale. Dunes either side = SS117			
Soil	Red clayey sand			
Rock Type	Sandstone			
Vegetation	*Acacia stellaticeps*, *Cassytha racemosa* and *Scaevola spinescens* low open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent			
Fire Age	?None evident			

Straits Saltfield Site SS119

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/20/04			
AMG Zone	50	250093mE, 7541309mN	250135mE, 7541278mN	
		250103mE, 7541237mN	250063mE, 7541268mN	
Habitat	Beach front semi-consolidated dune			
Soil	Red sand			
Rock Type	Sandstone / Calcarenite			
Vegetation	*Acacia sclerosperma* open shrubland over *Acacia stellaticeps* low open shrubland over *Triodia epactia* mid-dense hummock grassland			
Veg Condition	Excellent to Very Good; some Buffel			
Fire Age	No fire evidence			

Straits Saltfield Site SS12

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/15/04			
AMG Zone	50	245161mE, 7547640mN	245194mE, 7547679mN	
		245243mE, 7547662mN	245220mE, 7547615mN	
Habitat	Swale of red sand dune			
Soil	Red sand			
Rock Type	No rock visible			
Vegetation	*Acacia bivenosa* open shrubland over *Scaevola spinescens* low open shrubland over *Triodia epactia* and *Triodia lanigera* mid-dense hummock grassland			
Veg Condition	Very Good - Excellent			
Fire Age	No evidence of fire			

Straits Saltfield Site SS120

Described by	Kelli McCreery		Quadrat size	50 x 50m
Date	8/20/04			
AMG Zone	50	253925mE, 7541252mN	253974mE, 7541236mN	
		253957mE, 7541189mN	253910mE, 7541206mN	
Habitat	Mobile, unconsolidated red sand dune			
Soil	Red unconsolidated sand			
Rock Type	Sandstone			
Vegetation	*Acacia murrayana* and *A. coriacea* subsp. *pendens* tall open shrubland over *Acacia stellaticeps* scattered low shrubs over **Cenchrus ciliaris* open tussock grassland			
Veg Condition	Very Good; patches of Buffel - worse in site actually			
Fire Age	No evidence of fire			

Straits Saltfield Site SS121

Described by	Raimond Orifici		Quadrat size	20 x 125m
Date	8/20/04			
AMG Zone	50	253699mE, 7541598mN	253722mE, 7541588mN	
		253665mE, 7541475mN	253639mE, 7541492mN	
Habitat	Edge of saline mudflat at base of dune and before mudflat. Flat, low area of halophytes dominated by *Halosarcia* species.			
Soil	Red fine to medium grained sand with salt crust on soil surface			
Rock Type	Unknown			
Vegetation	*Halosarcia pruinosa, H. halocnemoides* subsp. *halocnemoides* and *Neobassia astrocarpa* low open heath over *Sporobolus virginicus* very open tussock grassland			
Veg Condition	Excellent			
Fire Age	No evidence of fire.			
Notes	Photos the same as those taken by Kelli at Samphire sites.			

Straits Saltfield Site SS122

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/21/04			
AMG Zone	50	253567mE, 7538537mN	253522mE, 7538556mN	
		253541mE, 7538602mN	253585mE, 7538583mN	
Habitat	Flat area of dune swale between two parallel red sand dunes			
Soil	Red sandy clay with a firn crust on the soil surface			
Rock Type	Unknown; no rock visible			
Vegetation	*Acacia synchronicia* open shrubland over scattered low shrubs of *Corchorus elachocarpus* over *Triodia epactia* mid-dense hummock grassland and *Eulalia aurea* very open tussock grassland			
Veg Condition	Very Good; a small amount of Buffel present.			
Fire Age	Burnt in the last 1-2 years.			
Notes	Claypan in the dune swale has characteristic claypan species present - *Eragrostis setifolia*, *Eriachne benthamii, Trianthema triquetra, Rhynchosia minima*, *Calandrinia* sp., *Portulaca oleracea*, *Heliotropium crispatum, Streptoglossa tenuiflora*, *Sporobolus mitchellii* (up to 30% cover in the claypan), *Sida* aff. *fibulifera*/*Cullen pogonocarpum* and *Evolvulus alsinoides*. This claypan was not included in the species inventory for the dune swale area due to the differing vegetation community type.			

Straits Saltfield Site SS14

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/17/04			
AMG Zone	50	240072mE, 7545230mN	240124mE, 7545231mN	
		240125mE, 7545181mN	240073mE, 7545178mN	
Habitat	Red sandy clay plain at sea level (or 1 - 2m above or below sea level). Mild slope to dunes (wind/water deposition).			
Soil	Red sandy clay			
Rock Type	Unknown; none visible			
Vegetation	*Acacia bivenosa* scattered shrubs over *Scaevola spinescens* low open shrubland over *Triodia epactia* closed hummock grassland			
Veg Condition	Excellent; no weeds visible and no other disturbances.			
Fire Age	No evidence of fire			
Notes	Elevation of the quadrat ranges from 1 to 2-3 m.			

Straits Saltfield Site SS15

Described by	Raimond Orifici		Quadrat size	20 x 125 m
Date	8/17/04			
AMG Zone	50	238698mE, 7547150mN	238719mE, 7547155mN	
		238775mE, 7547044mN	238758mE, 7547036mN	
Habitat	Crest and upper slopes of a red sand dune			
Soil	Red fine grained mud			
Rock Type	Limestone likely to be present at base of dune.			
Vegetation	*Pityrodia loxocarpa* and *Scaevola cunninghamii* low open shrubland over *Triodia epactia* closed hummock grassland			
Veg Condition	Very Good; some Buffel grass present.			
Fire Age	No evidence of fire visible			

Straits Saltfield Site SS16

Described by	Kelli McCreery		Quadrat size	Relevé
Date	8/16/04			
AMG Zone	50	243165mE, 7537252mN	243202mE, 7537402mN	
Habitat	Depression in dune swale			
Soil	Dark red sand			
Rock Type	Sandstone - calcarenite			
Vegetation	*Eucalyptus victrix* low woodland over *Triodia epactia* open hummock grassland			
Veg Condition	Excellent - Very Good; Buffel			
Fire Age	None evident			
Notes	This site is a relevé rather than a detailed 50m x 50m quadrat. It is located on the vegetated island designated as Island 7 in this study.			

Straits Saltfield Site SS17

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/16/04			
AMG Zone	50	245394mE, 7537921mN	245445mE, 7537931mN	
		245464mE, 7537870mN	245411mE, 7537869mN	
Habitat	Crest of linear red sand dune			
Soil	Red fine - medium grained sand			
Rock Type	Unknown; none visible			
Vegetation	*Pityrodia loxocarpa* and *Scaevola sericophylla* open shrubland over *Triodia epactia* and *T. schinzii* mid-dense hummock grassland			
Veg Condition	Very Good; small amount of Buffel is present.			
Fire Age	No visible sign of fire			
Notes	This quadrat was located on the vegetated island designated as Island No. 6 in this study.			

Straits Saltfield Site SS18

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/18/04			
AMG Zone	50	259461mE, 7555749mN	259510mE, 7555742mN	
		259506mE, 7555693mN	259452mE, 7555694mN	
Habitat	Low red sand dune surrounding mudflat/claypan			
Soil	Red fine - medium grained sand			
Rock Type	Unknown; none visible			
Vegetation	*Atriplex paludosa* subsp. *moquiniana* and *Rhagodia eremaea* scattered low shrubs over *Triodia epactia* mid-dense hummock grassland and **Cenchrus ciliaris* open tussock to tussock grassland			
Veg Condition	Poor; high level of Buffel grass present.			
Fire Age	No evidence of fire			
Notes	This quadrat was located on the vegetated island designated as Island no. 18 in this study			

Straits Saltfield Site SS19

Described by	Raimond Orifici		Quadrat size	50 x 50 m
Date	8/17/04			
AMG Zone	50	239470mE, 7546812mN	239518mE, 7546798mN	
		239501mE, 7546749mN	239453mE, 7546765mN	
Habitat	Samphire low shrubland on clay			
Soil	Light brown fine grained sandy clay			
Rock Type	?Calcrete / limestone underneath.			
Vegetation	*Halosarcia indica* low open heath with *Muellerolimon salicorniaceum* and *Halosarcia halocnemoides* subsp. *tenuis* as low open shrubland			
Veg Condition	Excellent			
Fire Age	No sign of fire in area			
Notes	Elevation 5-6 m			

Straits Saltfield Site SS20

Described by	Raimond Orifici		Quadrat size	50 x 50m
Date	8/19/04			
AMG Zone	50	246671mE, 7550766mN	246723mE, 7550765mN	
		246721mE, 7550715mN	246672mE, 7550715mN	
Habitat	Crest and upper slopes of a red sand dune			
Soil	Red fine grained sand			
Rock Type	Unknown; none visible			
Vegetation	*Acacia stellaticeps*, *Pityrodia loxocarpa* and *Scaevola sericophylla* low open shrubland over *Triodia schinzii* mid-dense hummock grassland			
Veg Condition	Excellent; no Buffel grass present on dune.			
Fire Age	No evidence of fire in the vegetation			
Notes	This quadrat was located on a vegetated island designated as Island no. 13 in this study			

Straits Saltfield Relevé SS-RA

Described by	Raimond Orifici		Quadrat size	Relevé
Date	8/15/04			
AMG Zone	50	254119mE, 7546382mN	254098mE, 7546060mN	
Habitat	Mobile red sand dunes			
Soil	Red fine to medium grained sand			
Rock Type	Unknown; no rock visible.			
Vegetation	*Trichodesma zeylanicum* var. *grandiflorum* and *Cullen martinii* scattered shrubs over *Salsola tragus* and *Lepidium platypetalum* scattered low shrubs over *Eriachne aristidea* scattered tussock grasses			
Veg Condition	Very Good; on edge of dunes with few individuals of Buffel present. In sand dunes			
Fire Age	No fire can travel through these poorly vegetated vegetation condition (where vegetation is present) is excellent.			

Appendix 2

List of Vascular Flora Recorded from the Yannarie Salt Project Area

Notes:

* denotes introduced species (weeds)

Correspondence of *Cassia/Senna* nomenclature:

Cassia artemisioides	-	*Senna artemisioides* subsp. x *artemisioides*
Cassia chatelainiana	-	*Senna glutinosa* subsp. *charlesiana*
Cassia ferraria	-	*Senna ferraria*
Cassia glaucifolia	-	*Senna glaucifolia*
Cassia glutinosa	-	*Senna glutinosa* subsp. *glutinosa*
Cassia helmsii	-	*Senna artemisioides* subsp. *helmsii*
Cassia luerssenii	-	*Senna glutinosa* subsp. x *luerssenii*
Cassia notabilis	-	*Senna notabilis*
Cassia oligophylla	-	*Senna artemisioides* subsp. *oligophylla*
Cassia pruinosa	-	*Senna glutinosa* subsp. *pruinosa*
Cassia 'stricta'	-	*Senna stricta*
Cassia sturtii	-	*Senna artemisioides* subsp. x *sturtii*
Cassia venusta	-	*Senna venusta*

AIZOACEAE (110)
Trianthema pilosa
Trianthema triquetra
AMARANTHACEAE (106)
Amaranthus pallidiflorus
Ptilotus axillaris
Ptilotus exaltatus var. *exaltatus*
Ptilotus polystachyus var. *polystachyus*
Ptilotus villosiflorus
ANTHERICACEAE (054F)
Murchisonia volubilis
Tricoryne corynothecoides
APIACEAE (281)
Trachymene pilbarensis
ASCLEPIADACEAE (305)
Cynanchum floribundum
Rhyncharrhena linearis
Sarcostemma viminale subsp. *australe*
ASTERACEAE (345)
Angianthus acrohyalinus
Angianthus milnei
Brachyscome cheilocarpa
Flaveria australasica
Gnephosis arachnoidea
Olearia dampieri subsp. *dampieri*
Pluchea dentex
Pluchea dunlopii
Pluchea rubelliflora
Pluchea sp.B Kimberley Flora
Pterocaulon sphacelatum
Rhodanthe psammophila
Senecio pinnatifolius
Streptoglossa bubakii
Streptoglossa decurrens
Streptoglossa tenuiflora
BORAGINACEAE (310)
Halgania cyanea var. *latisepala*
Heliotropium crispatum
Heliotropium pachyphyllum
Heliotropium transforme
Trichodesma zeylanicum var. *grandiflorum*
BRASSICACEAE (138)
Lepidium platypetalum
CAESALPINIACEAE (164)
Cassia chatelainiana x
Cassia ? *chatelainiana* x *glutinosa*
Cassia glutinosa
Cassia notabilis
Cassia oligophylla (thinly sericeous MET 15,035)
Cassia oligophylla var. *sericea*
Cassia oligophylla x *helmsii*
Cassia aff. *oligophylla*
Cassia pruinosa
CHENOPODIACEAE (105)
Atriplex bunburyana
Atriplex codonocarpa
Atriplex paludosa subsp. *moquiniana*
Atriplex semilunaris
Dysphania plantaginella
Enchylaena tomentosa var. *tomentosa*
Halosarcia auriculata
Halosarcia halocnemoides
Halosarcia halocnemoides subsp. *halocnemoides*
Halosarcia halocnemoides subsp. *tenuis*
Halosarcia indica
Halosarcia pruinosa
Halosarcia pterygosperma subsp. *denticulata*
Halosarcia syncarpa
Maireana georgei
Maireana planifolia
Maireana tomentosa subsp. *tomentosa*
Neobassia astrocarpa
Rhagodia eremaea
Rhagodia preissii subsp. *obovata*
Salsola tragus
Sclerolaena costata
Sclerolaena uniflora
Suaeda arbusculoides

CONVOLVULACEAE (307)
Bonamia rosea
Evolvulus alsinoides var. *villosicalyx*
CUCURBITACEAE (337)
Mukia maderaspatana
CYPERACEAE (32)
Bulbostylis barbata
Cyperus bulbosus
DASYPOGONACEAE (054C)
Acanthocarpus preissii
ELATINACEAE (235)
Bergia perennis
EUPHORBIACEAE (185)
Adriana urticoides var. *urticoides*
Euphorbia coghlanii
Euphorbia myrtoides
Euphorbia tannensis subsp. *eremophila* (Panorama form)

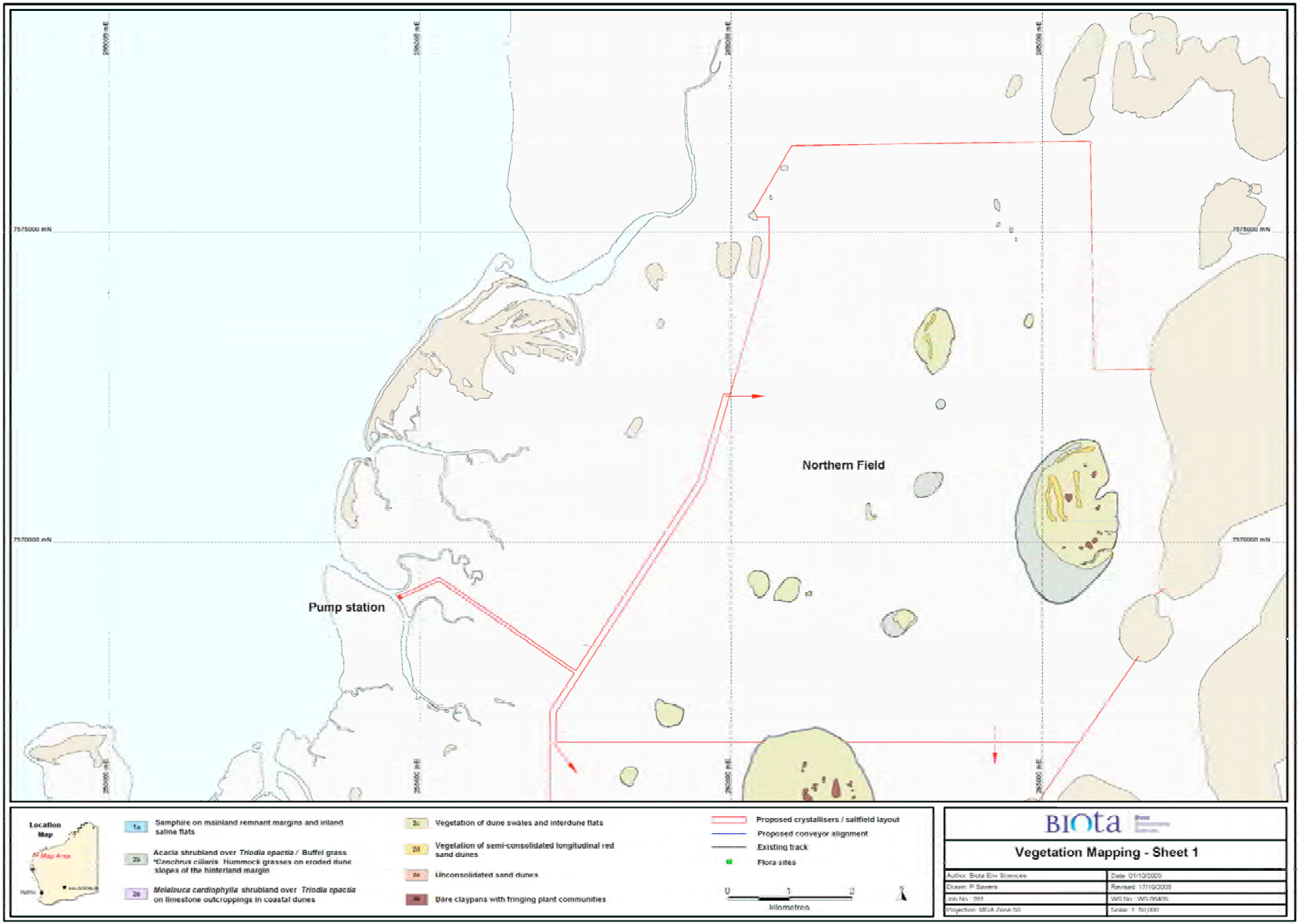
FRANKENIACEAE (236)
Frankenia pauciflora
GERANIACEAE (167)
Erodium cygnorum
GOODENIACEAE (341)
Goodenia forrestii
Goodenia ochracea
Scaevola anchusifolia
Scaevola crassifolia
Scaevola cunninghamii
Scaevola sericophylla
Scaevola spinescens
Scaevola spinescens (broad form)
GYROSTEMONACEAE (108)
Gyrostemon ramulosus
HALORAGACEAE (276)
Haloragis gossei
LAMIACEAE (313)
Pityrodia loxocarpa
Pityrodia paniculata
LAURACEAE (131)
Cassytha racemosa
MALVACEAE (221)
Abutilon dioicum
Abutilon lepidum
Alyogyne pinoniana
Hibiscus brachychlaenus
Hibiscus sturtii var. *campylochlamys*
Hibiscus sp.
Lawrencia viridigrisea
Sida rohlenae subsp. *rohlenae*
Sida aff. *fibulifera* (B64-13B)
Sida aff. *fibulifera* (HD148-13)
Sida aff. *fibulifera* (MET Site 1308)
MIMOSACEAE (163)
Acacia bivenosa
Acacia coriacea
Acacia coriacea subsp. *coriacea*
Acacia coriacea subsp. *pendens*
Acacia gregorii
Acacia murrayana
Acacia rostellifera
Acacia sclerosperma
Acacia sphaerostachya
Acacia stellaticeps
Acacia synchronicia
Acacia tetragonophylla
Acacia xiphophylla
**Prosopis pallida*
MYOPORACEAE (326)
Eremophila forrestii subsp. *forrestii*
Eremophila longifolia
Eremophila setacea
Myoporum montanum
MYRTACEAE (273)
Corymbia hamersleyana
Corymbia zygophylla
Eucalyptus victrix
Melaleuca cardiophylla
Melaleuca leiopyxis
Verticordia forrestii
NYCTAGINACEAE (107)
Boerhavia coccinea
PAPILIONACEAE (165)
Canavalia rosea
Crotalaria cunninghamii
Crotalaria medicaginea var. *neglecta*
Cullen lachnostachys
Cullen martinii
Cullen pogonocarpum
Indigofera brevidens
Indigofera chamaeclada
Indigofera colutea
Indigofera georgei
Rhynchosia minima
Swainsona pterostylis
Tephrosia flammea
Tephrosia rosea var. *clementii*
Tephrosia sp.
PLUMBAGINACEAE (294)
Muellerolimon salicorniaceum
POACEAE (31)
Aristida contorta
Aristida holathera var. *holathera*
Aristida latifolia
**Cenchrus ciliaris*
Chrysopogon fallax
Eragrostis dielsii
Eragrostis eriopoda
Eragrostis falcata
Eragrostis pergracilis
Eragrostis setifolia
Eriachne aristidea
Eriachne benthamii
Eriachne flaccida
Eriachne mucronata
Eriachne sp.
Eulalia aurea
Panicum decompositum
Paractaenum refractum
Spinifex longifolius
Sporobolus mitchellii
Sporobolus virginicus
Triodia epactia
Triodia lanigera
Triodia schinzii
Triraphis mollis
Yakirra australiensis var. *australiensis*
PORTULACACEAE (111)
Calandrinia polyandra
Calandrinia ptychosperma
Portulaca oleracea
PROTEACEAE (90)
Grevillea eriostachya
Grevillea gordoniana
Grevillea stenobotrya
Hakea chordophylla
Hakea stenophylla subsp. *stenophylla*
SANTALACEAE (92)
Santalum lanceolatum
SAPINDACEAE (207)
Diplopeltis eriocarpa
SCROPHULARIACEAE (316)
Stemodia sp.Onslow(A.A.Mitchell 76/148)
SOLANACEAE (315)
Nicotiana occidentalis subsp. *occidentalis*
Solanum cleistogamum
Solanum diversiflorum
Solanum lasiophyllum
STERCULIACEAE (223)
Hannafordia quadrivalvis subsp. *recurva*
SURIANACEAE (160)
Stylobasium spathulatum

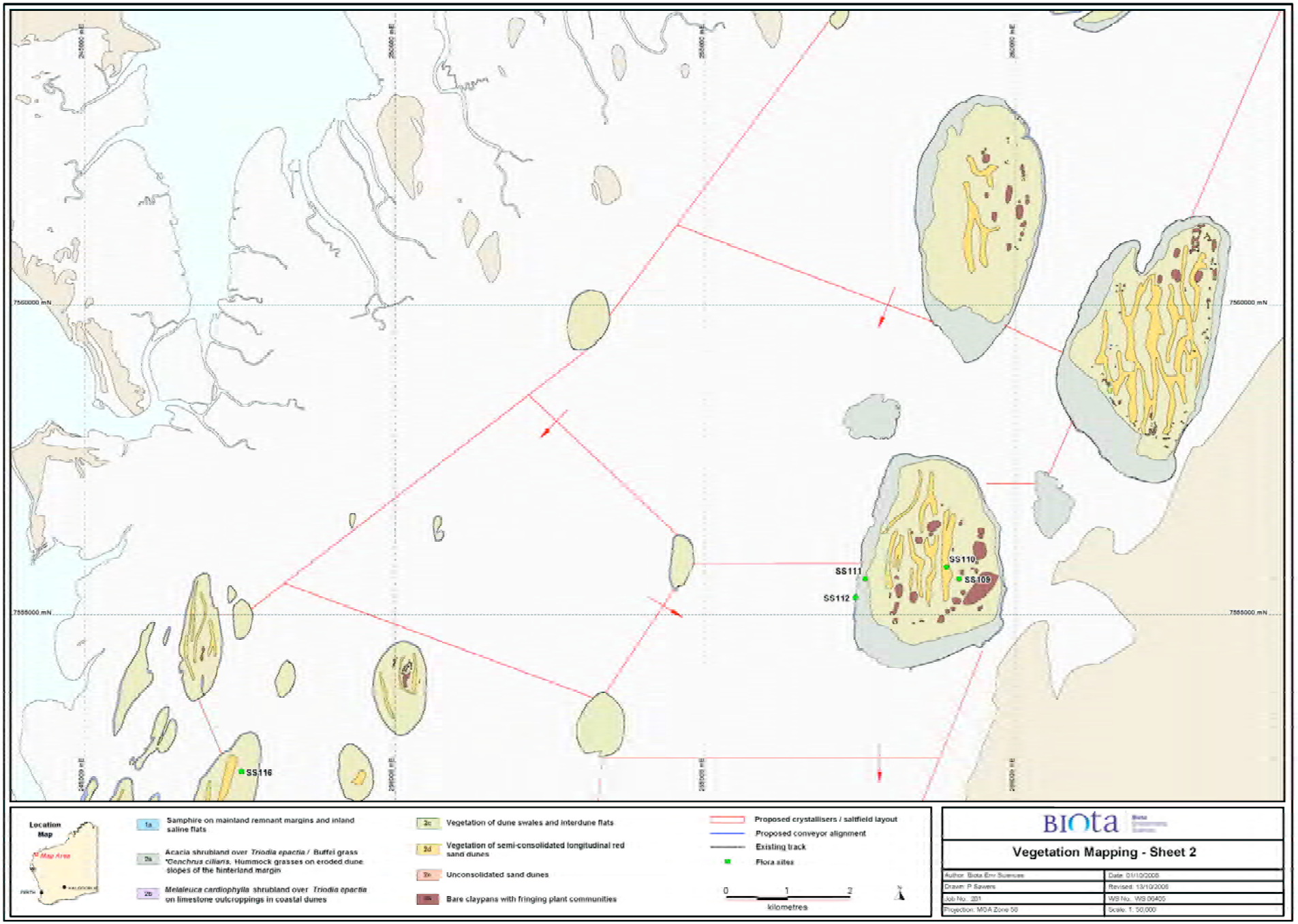
TILIACEAE (220)
Corchorus elachocarpus

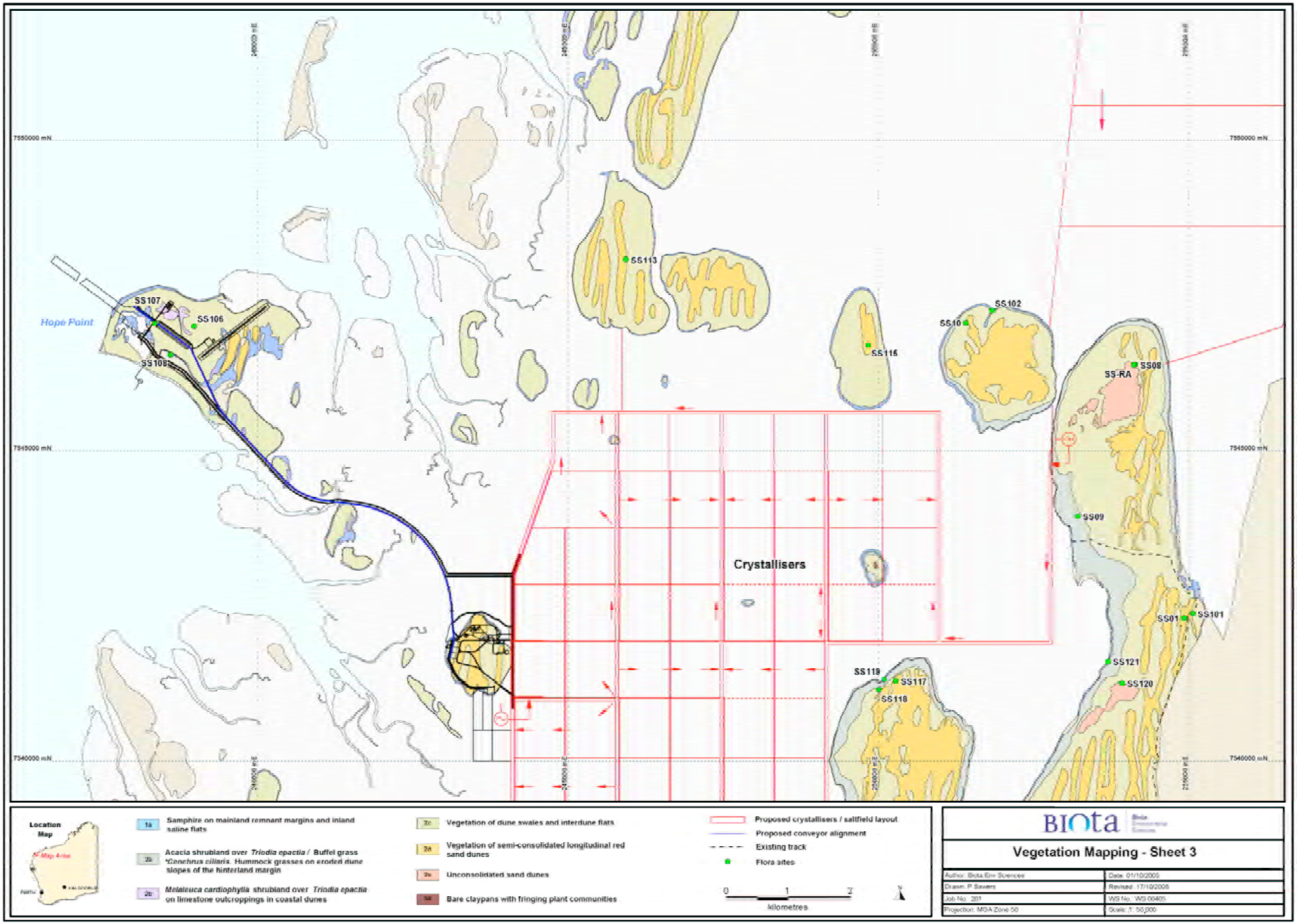
ZYGOPHYLLACEAE (173)
Tribulus hystrix
Tribulus macrocarpus
Zygophyllum retivalve

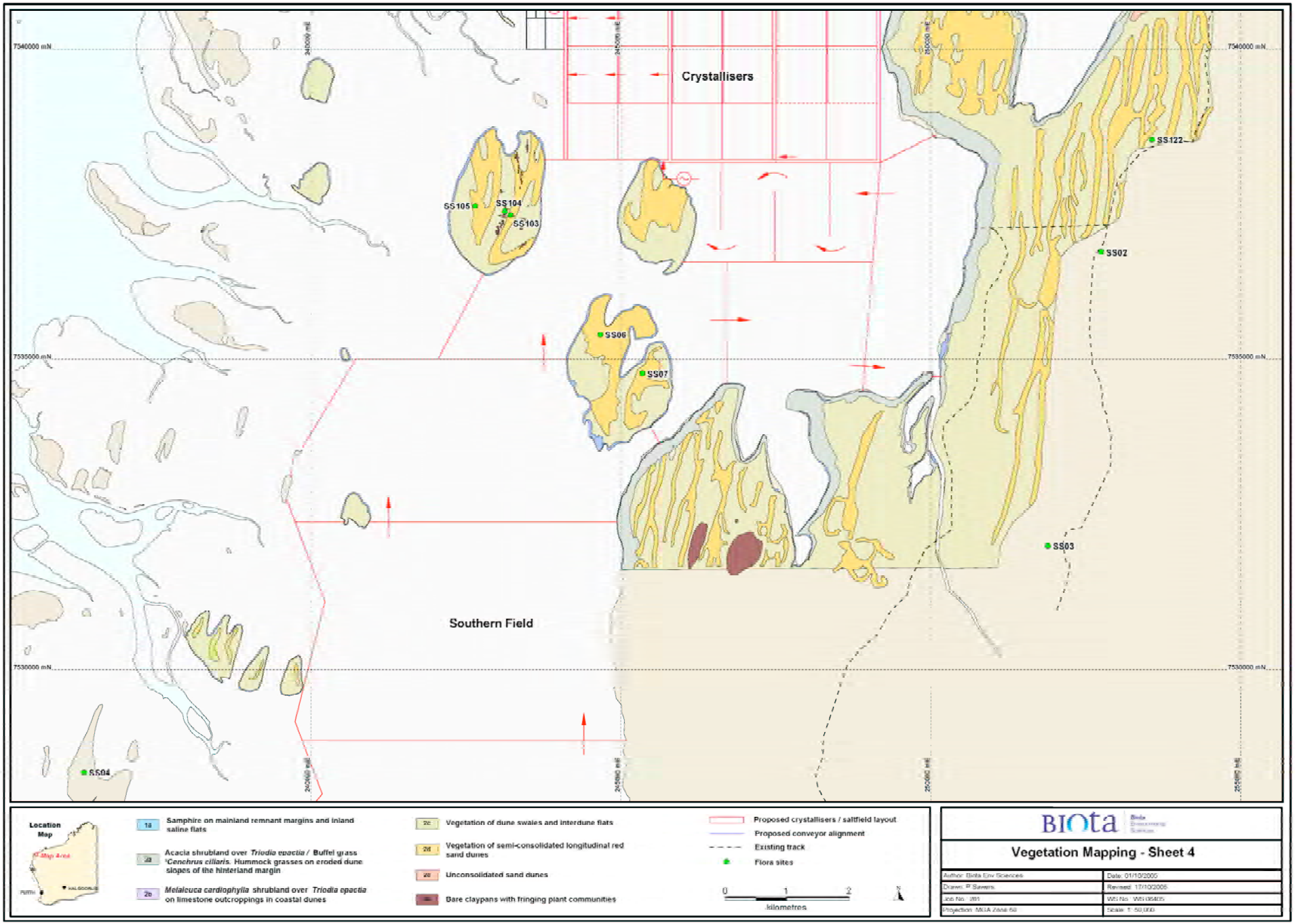
Appendix 3

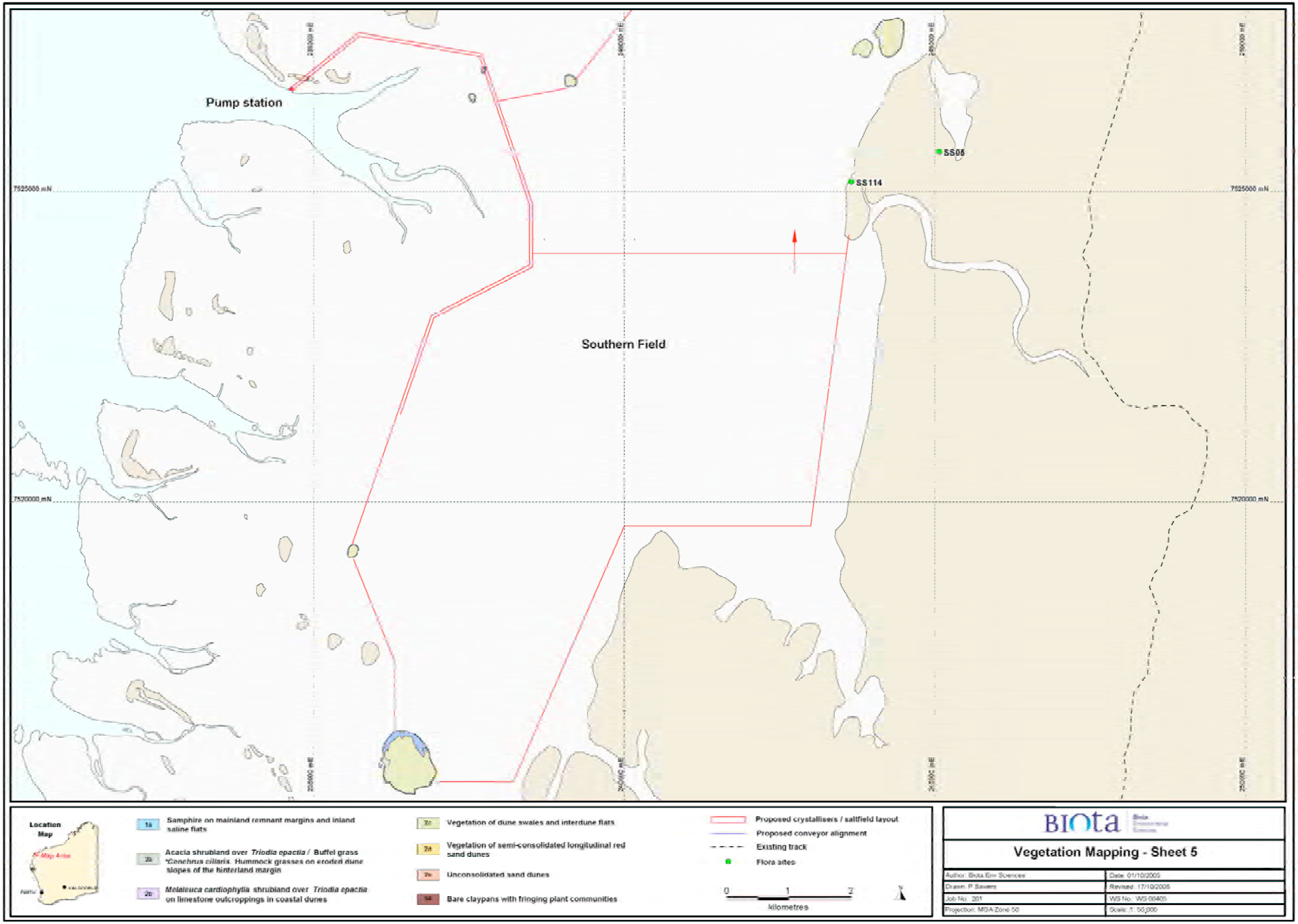
Vegetation Mapping of the Yannarie Salt Project Area


Northern Field
Pump station
7575000 mN
7570000 mN
Location Map
1a Samphire on mainland remnant margins and inland saline flats
2a Acacia shrubland over Triodia epactia / Buffel grass *Cenchrus ciliaris. Hummock grasses on eroded dune slopes of the hinterland margin
2b Melaleuca cardiophylla shrubland over Triodia epactia on limestone outcroppings in coastal dunes
2c Vegetation of dune swales and interdune flats
2d Vegetation of semi-consolidated longitudinal red sand dunes
2e Unconsolidated sand dunes
Bare claypans with fringing plant communities
Proposed crystallisers / saltfield layout
Proposed conveyor alignment
Existing track
Flora sites
0 1 2
kilometres
BIOta
Vegetation Mapping - Sheet 1


7560000 mN
7555000 mN
SS116
SS111
SS110
SS109
SS112
Location Map
1a Samphire on mainland remnant margins and inland saline flats
2a Acacia shrubland over Triodia epactia / Buffel grass *Cenchrus ciliaris. Hummock grasses on eroded dune slopes of the hinterland margin
2b Melaleuca cardiophylla shrubland over Triodia epactia on limestone outcroppings in coastal dunes
2c Vegetation of dune swales and interdune flats
2d Vegetation of semi-consolidated longitudinal red sand dunes
2e Unconsolidated sand dunes
Bare claypans with fringing plant communities
Proposed crystalisers / saltfield layout
Proposed conveyor alignment
Existing track
Flora sites
0 1 2
kilometres
BIOta
Vegetation Mapping - Sheet 2
Author: Biota Env Sciences
Date: 01/10/2006
Drawn: P Sawers
Revised: 13/10/2006
Job No.: 261
WS No.: WS 00405
Projection: MGA Zone 50
Scale: 1: 50,000


Hope Point
SS107
SS106
SS108
SS113
SS115
SS102
SS10
SS08
SS-RA
SS09
SS01
SS101
SS121
SS120
SS119
SS117
SS118
Crystallisers
7550000 mN
7545000 mN
7540000 mN
Location Map
1a Samphire on mainland remnant margins and inland saline flats
2b Acacia shrubland over Triodia epactia / Buffel grass *Cenchrus ciliaris. Hummock grasses on eroded dune slopes of the hinterland margin
2b Melaleuca cardiophylla shrubland over Triodia epactia on limestone outcroppings in coastal dunes
2c Vegetation of dune swales and interdune flats
2d Vegetation of semi-consolidated longitudinal red sand dunes
2e Unconsolidated sand dunes
5a Bare claypans with fringing plant communities
Proposed crystallisers / saltfield layout
Proposed conveyor alignment
Existing track
Flora sites
0 1 2
kilometres
N
BIOta
Vegetation Mapping - Sheet 3
Author: Biota Env Sciences
Date: 01/10/2005
Drawn: P Sawers
Revised: 17/10/2005
Job No.: 261
WS No.: WS 00405
Projection: MGA Zone 50
Scale: 1: 50,000


Crystallisers
Southern Field
SS122
SS02
SS03
SS04
SS05
SS06
SS07
SS103
SS104
SS105
7540000 mN
7535000 mN
7530000 mN
Location Map
Map Area
PERTH
KALGOORLIE
1a Samphire on mainland remnant margins and inland saline flats
2d Acacia shrubland over Triodia epactia / Buffel grass *Cenchrus ciliaris*. Hummock grasses on eroded dune slopes of the hinterland margin
2b Melaleuca cardiophylla shrubland over Triodia epactia on limestone outcroppings in coastal dunes
2c Vegetation of dune swales and interdune flats
2d Vegetation of semi-consolidated longitudinal red sand dunes
2e Unconsolidated sand dunes
Bare claypans with fringing plant communities
Proposed crystallisers / saltfield layout
Proposed conveyor alignment
Existing track
Flora sites
0 1 2
kilometres
N
BIOta
Vegetation Mapping - Sheet 4
Author: Biota Env Sciences
Date: 01/10/2005
Drawn: P Sievers
Revised: 17/10/2005
Job No.: 261
WIS No.: WIS 06405
Projection: MGA Zone 50
Scale: 1: 50,000


Pump station
Southern Field
SS05
SS114
7525000 mN
7520000 mN
Location Map
1a Samphire on mainland remnant margins and inland saline flats
2b Acacia shrubland over Triodia epactia / Buffel grass *Cenchrus ciliaris. Hummock grasses on eroded dune slopes of the hinterland margin
2b Melaleuca cardiophylla shrubland over Triodia epactia on limestone outcroppings in coastal dunes
2c Vegetation of dune swales and interdune flats
2d Vegetation of semi-consolidated longitudinal red sand dunes
2e Unconsolidated sand dunes
5a Bare claypans with fringing plant communities
Proposed crystallisers / saltfield layout
Proposed conveyor alignment
Existing track
Flora sites
0 1 2
kilometres
N
BIOTA
Vegetation Mapping - Sheet 5
Author: Biota Env Sciences
Date: 01/10/2005
Drawn: P Sawers
Revised: 17/10/2005
Job No.: 261
WS No.: WS 00405
Projection: MGA Zone 50
Scale: 1: 50,000

Appendix 4

Species by Site Matrix for the Yannarie Salt Project Area

	SS 01	SS 02	SS 03	SS 04	SS 05	SS 06	SS 07	SS 08	SS 09	SS 10	SS 101	SS 102	SS 103	SS 104	SS 105	SS 106	SS 107	SS 108	SS 109	SS 11	SS 110	SS 111	SS 112	SS 113	SS 114	SS 115	SS 116	SS 117	SS 118	SS 119	SS 12	SS 120	SS 121	SS 122	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20	SS KB	SS RA	SS OPP
Abutilon dioicum													1																			1										1	
Abutilon lepidum														1						1						1										1							1
Acacia bivenosa																1	1										1				1				1	1						1
Acacia coriacea							1																							1												1
Acacia coriacea subsp. *coriacea*	1			1		1				1			1	1						1	1	1		1		1	1	1			1				1	1				1		1	
Acacia coriacea subsp. *pendens*																																1											
Acacia gregorii																	1			1				1		1	1																1
Acacia murrayana	1																									1		1				1				1		1				1	1
Acacia rostellifera																1																											
Acacia sclerosperma	1		1		1				1		1														1				1	1			1									1
Acacia sphaerostachya																						1																					1
Acacia stellaticeps	1		1			1	1		1	1									1	1	1	1			1			1	1	1	1	1								1			
Acacia synchronicia			1		1	1		1	1		1			1					1			1					1		1			1	1	1					1				
Acacia tetragonophylla				1	1	1	1	1			1			1	1				1	1	1	1				1	1	1			1			1				1					
Acacia xiphophylla																																											1
Acanthocarpus preissii																1	1							1						1				1	1							1
Adriana urticoides var. *urticoides*																				1															1		1					
Alyogyne pinoniana	1									1																		1															
Amaranthus pallidiflorus														1																							1						
Angianthus acrohyalinus														1	1											1																	
Angianthus milnei						1																			1		1						1										1
Aristida contorta											1																																
Aristida holathera			1																																								
Aristida holathera var. *holathera*																																								1			
Aristida latifolia																																						1					
Atriplex bunburyana													1							1						1					1				1							
Atriplex codonocarpa																																						1					
Atriplex paludosa subsp. *moquiniana*								1		1															1							1					1				1	
Atriplex semilunaris									1																1							1				1						1
Bergia perennis																																											1
Boerhavia coccinea																	1																			1						
Bonamia rosea							1			1			1		1						1					1											1					
Brachyscome cheilocarpa							1			1			1								1															1	1					
Bulbostylis barbata													1																											1			1
Calandrinia polyandra			1										1	1																			1					1		1			1
Calandrinia ptychosperma																																											1
Canavalia rosea																																											1
Cassia chatelainiana x				1											1		1																										
Cassia ?chatelainiana x *glutinosa*										1			1									1									1						1					
Cassia glutinosa																			1											1						1						
Cassia notabilis													1																							1							
Cassia oligophylla (thinly sericeous MET 15,035)																																											1
Cassia oligophylla var. *sericea*																																											1
Cassia oligophylla x *helmsii*						1																																				
Cassia aff *oligophylla*											1						1									1	1							1									
Cassia pruinosa																								1																			1
Cassytha racemosa					1		1	1		1			1	1	1	1				1						1			1		1					1						
**Cenchrus ciliaris*	1				1	1	1	1	1	1	1		1	1	1				1	1	1	1	1		1	1	1	1	1	1		1	1			1	1	1	1				1
Chrysopogon fallax											1																																
Corchorus elachocarpus	1		1			1				1	1					1	1				1			1		1		1	1		1			1								
Corymbia hamersleyana																																					1						
Corymbia zygophylla										1																																	
Crotalaria cunninghamii	1			1			1						1																			1								1			
Crotalaria medicaginea var. *neglecta*														1	1											1																	

	SS 01	SS 02	SS 03	SS 04	SS 05	SS 06	SS 07	SS 08	SS 09	SS 10	SS 101	SS 102	SS 103	SS 104	SS 105	SS 106	SS 107	SS 108	SS 109	SS 11	SS 110	SS 111	SS 112	SS 113	SS 114	SS 115	SS 116	SS 117	SS 118	SS 119	SS 12	SS 120	SS 121	SS 122	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20	SS KB	SS RA	SS OPP
Cullen lachnostachys																																											1
Cullen martinii																																										1	
Cullen pogonocarpum																																		1									
Cynanchum floribundum																																								1			
Cyperus bulbosus												1																											1				
Diplopeltis eriocarpa				1												1								1			1								1								1
Dysphania plantaginella			1	1						1																									1								
Enchylaena tomentosa							1													1																							1
Enchylaena tomentosa var. *tomentosa*					1				1		1		1	1			1				1					1					1					1	1			1			
Eragrostis dielsii														1																													
Eragrostis eriopoda				1						1			1													1											1						
Eragrostis falcata		1										1											1										1								1		1
Eragrostis pergracilis																																											1
Eragrostis setifolia																																		1									
Eremophila forrestii subsp. *forrestii*				1						1					1				1							1	1															
Eremophila longifolia																																											1
Eremophila setacea							1			1										1	1					1		1						1								
Eriachne aristidea																																1									1	
Eriachne benthamii																																		1									
Eriachne flaccida																																							1				
Eriachne mucronata																				1																							
Eriachne sp.																1				1																							
Erodium cygnorum											1				1					1							1							1									
Eucalyptus victrix			1																															1			1						
Eulalia aurea								1																					1					1									1
Euphorbia coghlanii																																		1									1
Euphorbia myrtoides	1			1			1								1					1											1			1			1			1		
Euphorbia tannensis ssp. *eremophila* (Panorama form)				1			1		1		1		1	1	1		1			1				1	1	1	1			1	1				1	1	1						1
Evolvulus alsinoides var. *villosicalyx*															1																		1									
Flaveria australasica													1																						1								
Frankenia pauciflora														1		1		1																					1				
Gnephosis arachnoidea														1																												
Goodenia forrestii						1																																				1
Goodenia ochracea						1																		1		1	1															1
Grevillea eriostachya							1						1							1						1																1
Grevillea gordoniana																																						1				
Grevillea stenobotrya	1			1		1	1			1			1							1	1					1		1										1			1		
Gyrostemon ramulosus																										1	1											1			1		
Hakea chordophylla																											1															
Hakea stenophylla subsp. *stenophylla*				1	1	1	1			1						1				1	1					1	1	1			1							1			1		1
Halgania cyanea var. *latisepala*																								1																			1
Haloragis gossei						1															1					1	1		1												1		
Halosarcia auriculata		1																																								
Halosarcia halocnemoides																																											1
Halosarcia halocnemoides subsp. *halocnemoides*		1																															1									
Halosarcia halocnemoides subsp. *tenuis*												1						1					1																	1			
Halosarcia indica		1																1															1							1			1
Halosarcia pruinosa												1											1										1								1		
Halosarcia pterygosperma subsp. *denticulata*																																	1									
Halosarcia syncarpa												1																														1
Hannafordia quadrivalvis subsp. *recurva*																								1							1											
Heliotropium crispatum	1																																									1
Heliotropium pachyphyllum																								1			1												1				
Heliotropium transforme							1			1										1																			1				

	SS 01	SS 02	SS 03	SS 04	SS 05	SS 06	SS 07	SS 08	SS 09	SS 10	SS 101	SS 102	SS 103	SS 104	SS 105	SS 106	SS 107	SS 108	SS 109	SS 11	SS 110	SS 111	SS 112	SS 113	SS 114	SS 115	SS 116	SS 117	SS 118	SS 119	SS 12	SS 120	SS 121	SS 122	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20	SS KB	SS RA	SS OPP
Hibiscus brachychlaenus	1					1	1													1				1		1																		1
Hibiscus sturtii var. *campylochlamys*											1				1																			1										1
Hibiscus sp.																																												1
Indigofera brevidens						1										1	1			1						1					1				1									
Indigofera chamaeclada																								1																				
Indigofera colutea														1	1																													
Indigofera georgei																																						1						
Lawrencia viridigrisea		1	1		1			1				1											1		1					1			1						1				1
Lepidium platypetalum								1	1					1								1			1									1			1				1		
Maireana georgei																																						1					1
Maireana planifolia	1				1																								1													
Maireana tomentosa subsp. *tomentosa*																																							1				
Melaleuca cardiophylla																	1																									1
Melaleuca leiopyxis																																											1
Muellerolimon salicorniaceum																		1																			1		1				
Mukia maderaspatana									1																																		
Murchisonia volubilis						1	1						1		1					1						1	1				1					1					1			
Myoporum montanum																											1				1												
Neobassia astrocarpa		1										1													1								1							1		1		1
Nicotiana occidentalis subsp. *occidentalis*				1									1	1							1					1				1					1	1			1			1
Olearia dampieri subsp. *dampieri*				1						1											1																		1			
Panicum decompositum										1																																	1
Paractaenum refractum	1																																									1	
Pityrodia loxocarpa	1			1			1						1							1	1					1		1								1		1			1			
Pityrodia paniculata				1			1			1										1								1			1											
Pluchea dentex																																											1
Pluchea dunlopii																																			1								1
Pluchea rubelliflora																																									1		1
Pluchea sp.B Kimberley Flora																1																											
Portulaca oleracea																																		1									
**Prosopis pallida*																																											1
Pterocaulon sphacelatum	1					1								1		1				1						1					1				1								
Ptilotus axillaris																																											1
Ptilotus exaltatus var. *exaltatus*					1	1								1												1	1															
Ptilotus polystachyus var. *polystachyus*	1												1	1	1						1					1																	
Ptilotus villosiflorus				1																																							1
Rhagodia eremaea			1	1		1								1	1				1		1	1					1			1		1					1		1				
Rhagodia preissii subsp. *obovata*				1													1																				1	1					1
Rhodanthe psammophila				1			1						1	1	1						1					1											1	1		1			1
Rhyncharrhena linearis													1																								1						
Rhynchosia minima															1		1																				1						
Rhynchosia minima var. *australis*																															1												
Salsola tragus	1												1	1	1						1				1											1					1	
Santalum lanceolatum													1																							1						
Sarcostemma viminale subsp. *australe*						1																																					1
Scaevola anchusifolia						1																																					
Scaevola crassifolia										1																																	
Scaevola cunninghamii					1											1										1	1	1			1					1							1
Scaevola sericophylla	1			1		1	1			1										1				1												1		1			1			
Scaevola spinescens			1		1	1	1	1		1			1	1								1				1		1			1				1		1		1				
Scaevola spinescens (broad form)															1				1		1			1			1		1							1						
Sclerolaena costata																																											1
Sclerolaena uniflora								1						1																													
Senecio pinnatifolius																1																											

	SS 01	SS 02	SS 03	SS 04	SS 05	SS 06	SS 07	SS 08	SS 09	SS 10	SS 101	SS 102	SS 103	SS 104	SS 105	SS 106	SS 107	SS 108	SS 109	SS 11	SS 110	SS 111	SS 112	SS 113	SS 114	SS 115	SS 116	SS 117	SS 118	SS 119	SS 12	SS 120	SS 121	SS 122	SS 14	SS 15	SS 16	SS 17	SS 18	SS 19	SS 20	SS KB	SS RA	SS OPP
Sida aff. *fibulifera* (B64-13B)																						1					1																	
Sida aff. *fibulifera* (HD148-13)															1																													
Sida aff. *fibulifera* (MET Site 1308)															1																													
Sida rohlenae subsp. *rohlenae*																				1																1								
Solanum cleistogamum													1			1	1														1			1		1							
Solanum diversiflorum	1										1									1									1			1											
Solanum lasiophyllum	1			1	1	1	1		1	1	1		1	1	1	1	1		1	1	1			1		1	1	1		1	1	1		1	1	1	1	1			1	1		1
Spinifex longifolius																							1																				
Sporobolus mitchellii																																		1									1
Sporobolus virginicus												1																					1										
Stemodia sp.Onslow(A.A.Mitchell 76/148)			1		1									1																			1					1			1		1
Streptoglossa bubakii															1																									1				
Streptoglossa decurrens			1		1	1								1																													
Streptoglossa tenuiflora																																		1									1
Stylobasium spathulatum			1	1											1				1								1		1														1
Suaeda arbusculoides																																							1				
Swainsona pterostylis		1												1											1									1		1		1		1		1		1
Tephrosia flammea	1												1																														
Tephrosia rosea var. *clementii*	1												1																			1					1				1		
Tephrosia sp.																																											1
Trachymene pilbarensis										1									1	1							1									1							1
Trianthema pilosa													1																														
Trianthema triquetra											1																															1		
Tribulus hystrix				1									1	1	1					1																1	1						
Tribulus macrocarpus	1																																										
Trichodesma zeylanicum var. *grandiflorum*	1												1							1	1															1		1			1		1	
Tricoryne corynothecoides													1																									1			1			1
Triodia epactia	1		1	1	1		1	1	1	1	1			1	1	1	1		1	1	1	1			1	1	1	1	1	1	1	1		1	1	1	1	1	1				1
Triodia lanigera						1				1			1		1				1					1			1				1											
Triodia schinzii						1	1						1							1											1					1			1			
Triraphis mollis				1																																							
Verticordia forrestii							1													1																	1						
Yakirra australiensis var. *australiensis*																				1																							
Zygophyllum retivalve															1																													1