Golden Beach Gas Project,

Golden Beach

Pipeline Alignment Heritage Assessment

Sponsor: Golden Beach Energy

Author: Jonathan Howell-Meurs

ANDREW LONG + ASSOCIATES

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Victoria 3065 Australia

Andrew Long + Associates Pty Ltd
ACN 131 713 409
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TABLE OF CONTENTS

MAPS

FIGURES

TABLES

1

INTRODUCTION

1.1 Background

This report presents the results of an Aboriginal cultural heritage assessment of the Project extent encompassing all proposed onshore infrastructure and facilities required as part of the Golden Beach Gas Project. The assessment was commissioned by CNC Project Management on behalf of GB Energy.

1.2 The Name of the Cultural Heritage Advisor

This assessment has been authored by a qualified archaeologist and heritage consultant, experienced in professional Aboriginal heritage assessment and evaluation since 1991, in accordance with section 189 of the Act.

The author of this assessment:

Jonathan Howell-Meurs Director, Andrew Long and Associates

1.3 The Location of the Activity Area

The Golden Beach gas field is located in Victorian state waters, approximately four kilometres offshore of Ninety Mile Beach and the Golden Beach township, in the Upper Latrobe formation of the Gippsland Basin.

The gas accumulation is about 5 kilometres long by 2.5 kilometres wide and 40 metres deep and is located between 630 metres and 650 metres beneath the seabed in strata that is found even deeper onshore (at a depth of 710 metres to 810 metres). It is sealed beneath a layer over 200 metres thick of impermeable calcareous claystones and marls which are in turn overlain by 200 metres to 250 metres of interbedded marls and limestones.

The onshore components of the proposed development are located in the jurisdiction of the West Gippsland Catchment Management Authority, and the local government authority is the Wellington Shire Council. The Wellington Shire is largely supported by the agriculture, forestry, fishing, mining, government/administration, defence and education sectors. Oil and gas have been a major growth source in the region, but employment levels have fallen due to improved efficiencies in processing and depletion of some reserves.

Apart from the township of Golden Beach, coastal development within the vicinity of the Golden Beach Project includes over 11,000 subdivided lots along the Ninety Mile Beach between Paradise Beach and the Honeysuckles, east of Seaspray. Most lots remain undeveloped. These lots occur both on the sand dunes of the Ninety Mile Beach and on the adjacent sandy soils. Part of this subdivision extends into Lake Reeve itself. None of the lots are connected to reticulated water or sewerage systems.

West of Lake Reeve, buildings and infrastructure are sparse and include isolated farm houses and outbuildings. Gippsland Water's Dutson Downs wastewater and waste treatment facilities occupy a large parcel of land, approximately 8000 hectares in this area. The Jemena Vic Hub Compressor Station and Esso Longford Gas Plant are located approximately 17 kilometres west of the Golden Beach town and are central to a network of buried oil and gas pipelines which traverse the regional landscape.

The preferred pipeline route runs directly to shore, crossing the shore and Lake Reeve approximately 1.5 km southwest of the developed portion of Golden Beach. The pipeline will then run west to terminate at a new gas processing facility to be built near the existing Jemena Vic Hub compressor station. Several options are being developed for the onshore pipeline route, with potential alignments as much as 5 km apart. The Project traverses private property and public land, including roadside reserves, coastal dunes and lakes, and watercourses.

1.4 Registered Aboriginal Parties

The Gunaikurnai Land and Waters Aboriginal Corporation (GLWAC) is the RAP for the activity area.

2

THE ACTIVITY

2.1 Description and Extent of the Activity

GB Energy (VIC) Pty Ltd (GBE), as operator of retention lease VIC/RL1(V), is developing the Golden Beach gas field located in the Gippsland Basin approximately 4 km offshore from the Ninety Mile Beach coast line and close to the Golden Beach township. The field was originally discovered in 1967. GB Energy are developing this field as a gas storage facility.

The current development concept is:

- Drilling two vertical (or low-angle) subsea appraisal wells located directly over the reservoir;
- A 5km subsea pipeline and control umbilical to shore via a Horizontal Directionally Drilled (HDD) shore crossing to an onshore valve station;
- A 20km onshore pipeline to a new gas processing facility (GPF); and

A GPF constructed adjacent to either the existing APA or Jemena plants close to the Longford Gas Plant or it may be located inside the Gippsland Water Dotson Downs waste water property.

The main components of the project are:

Offshore:

- Conventional offshore HZ wells drilled by a jack-up rig
- Short drilling program in shallow water (~20m) to only ~750m
- Standard subsea well completions tied into offshore pipeline
- Initially 2 wells for field drawdown, with the same wells used for initial storage, potentially additional wells

Pipelines:

- 3 km submarine pipeline sized for injection and withdrawal storage function
- Horizontal Directional Drill for shore crossing
- ~19 km onshore pipeline to a tie-in point at a simple gas processing facility

Gas Processing Facility:

- Very simple, Dehydration and Compression
- Located in vicinity of Longford Gas Plant
- Export metering and connections to EGP and Victorian Gas network

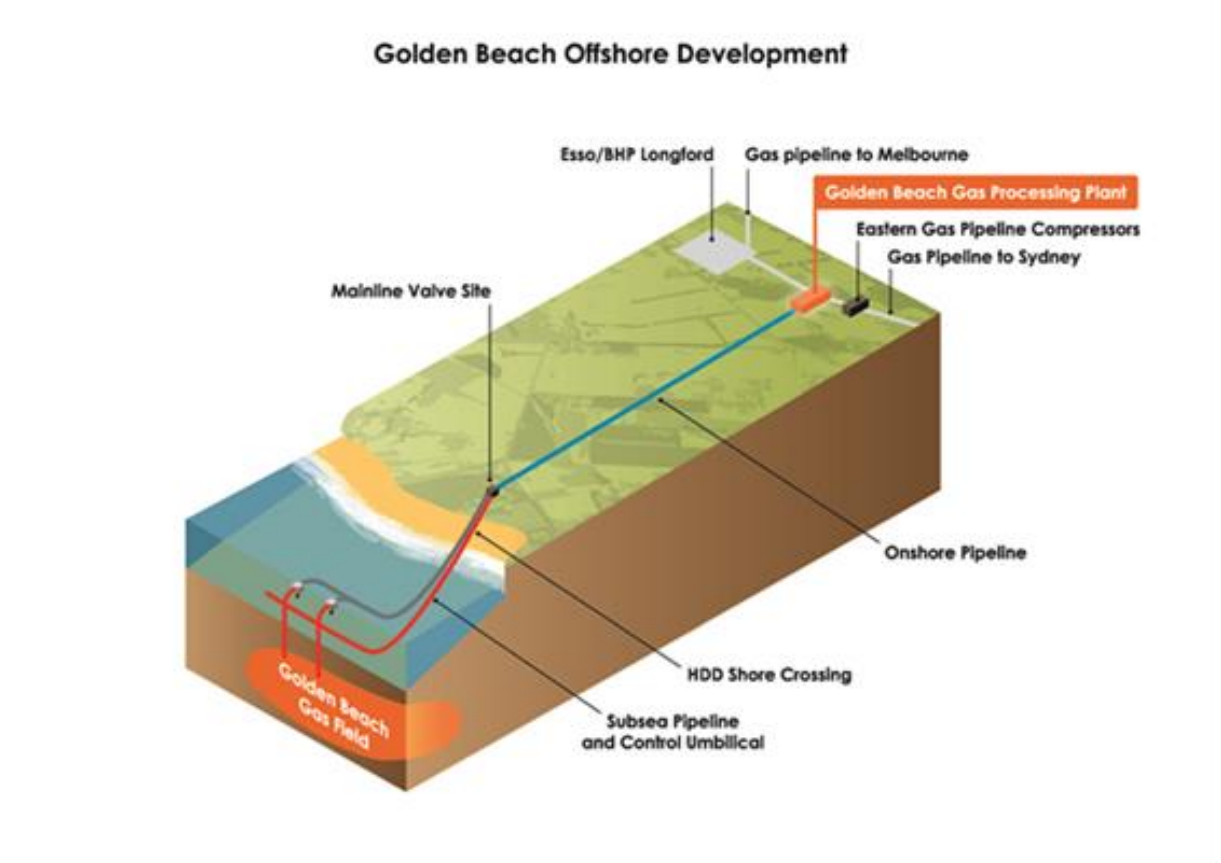
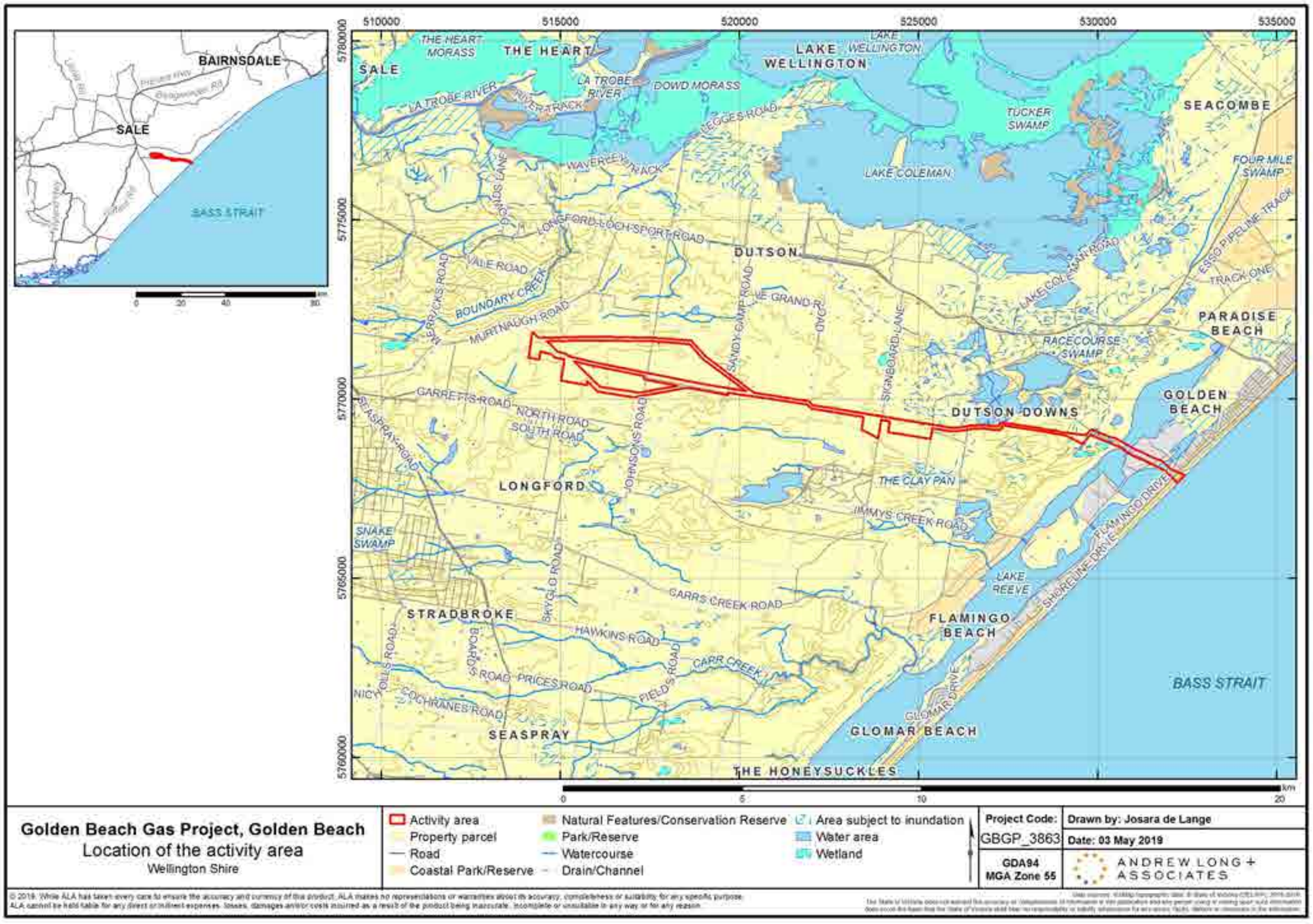
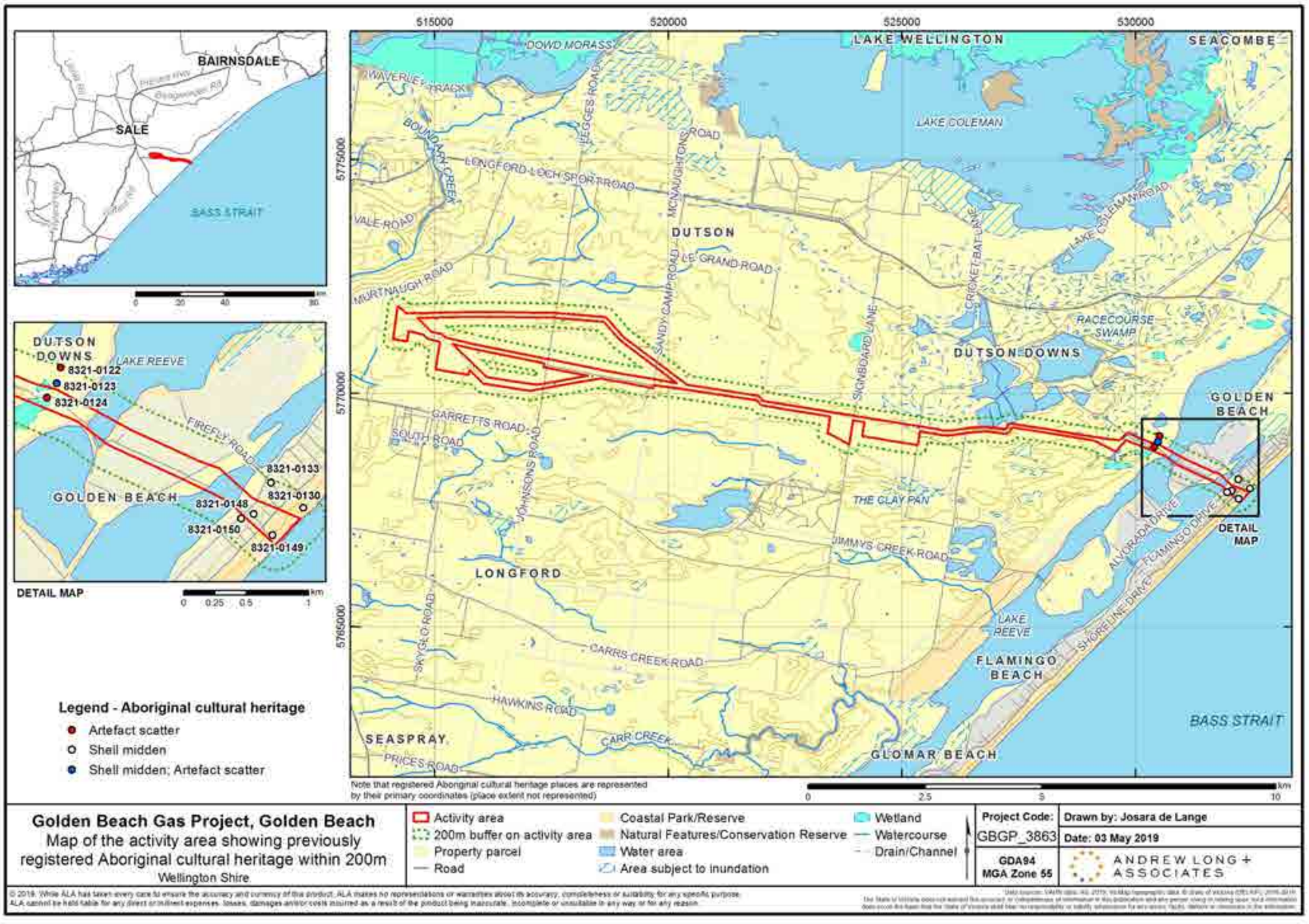


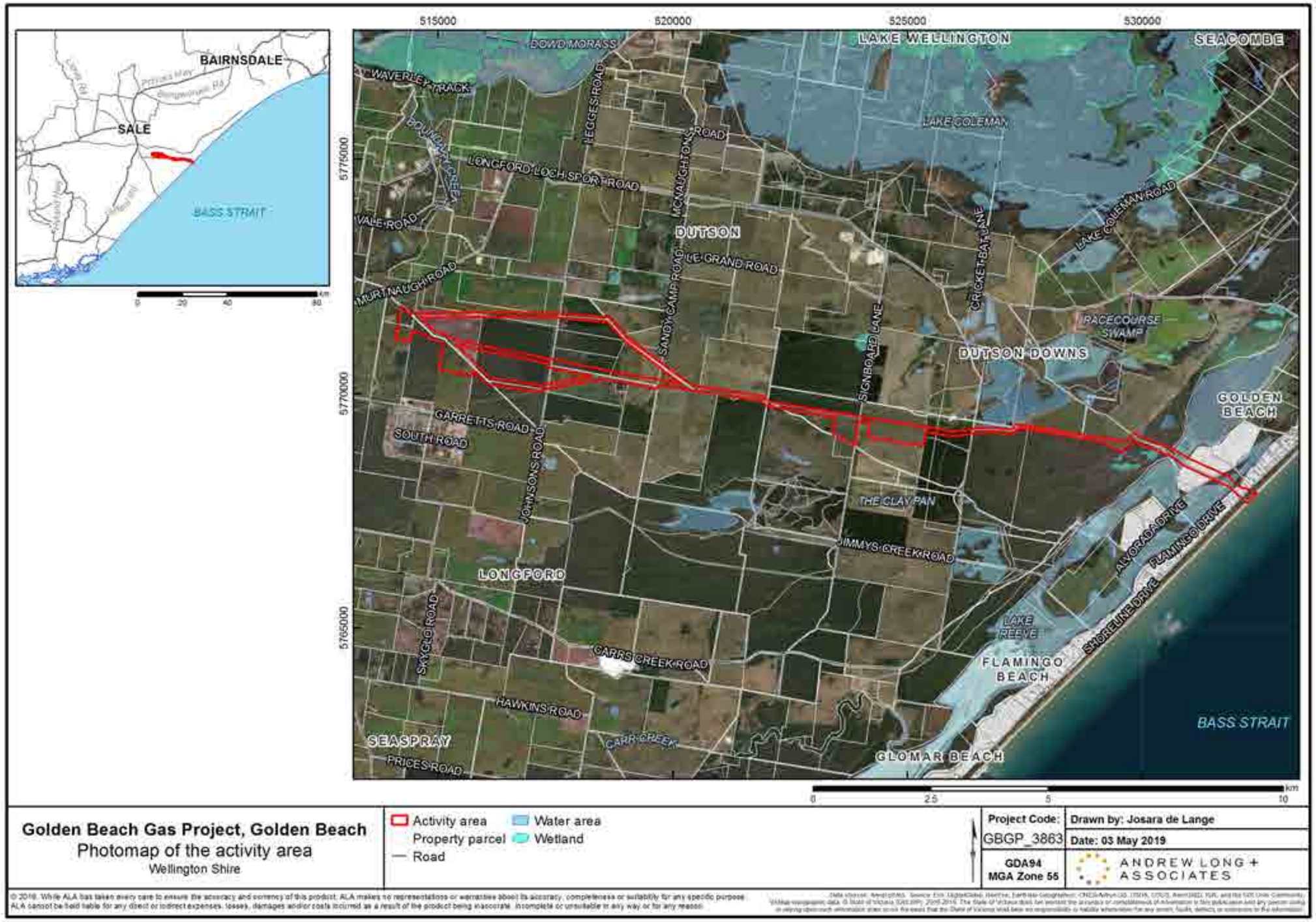
Figure 1: A typical schematic of the proposed development concept.



Map 1: Location of the Activity Area (Wellington Shire Council).



Map 2: Activity Area.



Golden Beach Gas Project, Golden Beach
Photomap of the activity area
Wellington Shire

Activity area
Property parcel
Road
Water area
Wetland

Project Code: GBGP_3863	Drawn by: Josara de Lange
	Date: 03 May 2019
GDA94 MGA Zone 55	ANDREW LONG + ASSOCIATES

Map 3: Photomap of the Activity Area.

3

DESKTOP ASSESSMENT

3.1 Method of Assessment

This section outlines the aims, methods and results of the desktop assessment. The aims of the desktop assessment were threefold:

- to determine the level of previous investigation of the activity area and the surrounding region;
- to determine the presence of registered Aboriginal places within the activity area;
- to determine the environmental context of the activity area with regard to landform and geomorphology.

To these ends a search of the VAHR was undertaken, relevant previous cultural heritage assessments and relevant environmental information were consulted.

3.2 Obstacles

There were no obstacles to undertaking the desktop assessment.

3.3 Persons Involved in the Desktop Assessment

The desktop assessment was conducted prior to the commencement of the standard and complex assessment. The following individuals were involved:

- **Jonathan Howell-Meurs,** Director
  Industry experience – 20 years

3.4 RAP Information

Please note that no oral information was collected during the desktop assessment.

3.5 Geographic Region

For the purposes of this assessment a region encompassing the activity area and a one kilometer buffer was utilised.

3.6 A Review of the Landforms or Geomorphology of the Activity Area

3.6.1 Landforms / Geomorphology

For the purpose of this investigation, the activity area can be broadly divided into two parts. At the eastern extremity of the activity area the subject land is situated within Unnamed Holocene Aeolian coastal dunes of the Barrier Complexes - Discovery Bay, Gippsland Lakes (Qdl1). These are characterised by pale calcareous sands and sandy duplex soils. Closely associated are the swamp and lake deposits associated with Lake Reeve which is situated behind the barrier dune complex.

The remainder and majority of the activity area traverses rolling sandy hills and plains characterised by aeolian dune deposits (Qd2) and alluvial terrace deposits (Qa2).

Surface drainage across the activity area is limited and ephemeral.

Table 1: Geomorphological units within the activity area

Geomorphology		
GMU	**Area (sqm)**	**% area**
8.4: Coastal barriers (Ninety Mile Beach)	98405.08	2.19
7.3.2: Plains with dunes (Woodside, Longford, Munro plains with dunes)	3842930.77	85.49
8.6.2: Lagoonal (Nelson, Tamboon Inlet)	209968.97	4.67
wland:	70095.83	1.56
7.3.1: Plains without dunes (Darnum, Loy Yang, Giffard, Leongatha South, Munro plains)	273795.52	6.09
GRAND TOTAL:	**4495196.17**	**100.00**

Table 2: Geomorphological units within the geographic region

Geomorphology		
GMU	**Area (sqm)**	**% area**
8.4: Coastal barriers (Ninety Mile Beach)	1674564.12	2.32
7.3.2: Plains with dunes (Woodside, Longford, Munro plains with dunes)	57360726.43	79.53
8.6.2: Lagoonal (Nelson, Tamboon Inlet)	3127077.15	4.34
wland:	4775068.50	6.62
7.3.1: Plains without dunes (Darnum, Loy Yang, Giffard, Leongatha South, Munro plains)	5190826.89	7.20
GRAND TOTAL:	**72128263.09**	**100.00**

Table 3: Geology units within the activity area

Geology 250K		
Geological unit	**Area (sqm)**	**% area**
Alluvial terrace deposits (Qa2)	497131.78	11.24
Dune deposits (Qd2)	3520743.11	79.57
Coastal dune deposits (Qdl1)	406900.73	9.20
GRAND TOTAL:	**4424775.62**	**100.00**

Table 4: Geology units within the activity area

Geology 250K		
Geological unit	**Area (sqm)**	**% area**
Haunted Hills Formation (Nlh)	4806806.21	6.95
Alluvial terrace deposits (Qa2)	11560137.68	16.72
Dune deposits (Qd2)	47125787.01	68.18
Coastal dune deposits (Qdl1)	5628386.84	8.14
GRAND TOTAL:	**69121117.75**	**100.00**

3.6.2 Environment

The climate of the geographic region can be broadly described as temperate, characterised by warm summers and cool winters.

Little remains of the native vegetation that would have covered the activity area with much of the land within the activity area cleared for early European agricultural purposes. Prior to 1750, vegetation in the activity area most probably comprised:

- Herb rich Woodlands
- Riparian Scrubs or Swampy Shrubs and Woodlands
- Heathy Woodlands
- Heathlands

Aboriginal occupation often focused on waterways, and areas adjacent to water sources, including swamps, and these areas would have provided a wide range of food and material resources for Aboriginal people.

Water rushes and marsh vegetation as well as a number of plant-food resources important to Aboriginal people would have grown in nearby watercourses and swamps. The rivers, creeks, lagoons and swamp areas, would have supported various species of fish, eel, frogs, tortoises and other aquatic species as well as various birds, kangaroos, wallabies, wombat, possums and emu inhabiting the plains of the wider geographic region. Plants were used for non-culinary purposes; such as making nets, baskets, and ornaments. Grasses such as Kangaroo Grass (*Themeda triandra*), were used in the manufacture of fishing nets (Zola and Gott 1992, 58), while Tussock grass fibres were used to make string for bags, baskets and mats.

Table 5:1750 and current EVCs within the activity area

1750 EVCs				
EVC group name	**EVC**	**EVC name**	**Area (sqm)**	**% area**
Coastal Scrubs Grasslands and Woodlands	**TOTAL:**		**256607.91**	**5.71**
	2	Coast Banksia Woodland	256607.91	5.71
Heathy Woodlands	**TOTAL:**		**987298.98**	**21.96**
	48	Heathy Woodland	987298.98	21.96
Herb-rich Woodlands	**TOTAL:**		**3097289.06**	**68.90**
	3	Damp Sands Herb-rich Woodland	3097289.06	68.90
Lowland Forests	**TOTAL:**		**10656.40**	**0.24**
	16	Lowland Forest	10656.40	0.24
No native vegetation recorded	**TOTAL:**		**67389.67**	**1.50**
	992	Water Body - Fresh	67389.67	1.50
Salt-tolerant and/or succulent Shrublands	**TOTAL:**		**58124.13**	**1.29**
	9	Coastal Saltmarsh	58124.13	1.29
Wetlands	**TOTAL:**		**17830.02**	**0.40**
	10	Estuarine Wetland	7978.19	0.18
	136	Sedge Wetland	9851.84	0.22
GRAND TOTAL:			**4495196.17**	**100.00**

2005 EVCs				
EVC group name	**EVC**	**EVC name**	**Area (sqm)**	**% area**
Coastal Scrubs Grasslands and Woodlands	**TOTAL:**		**84367.88**	**3.29**
	2	Coast Banksia Woodland	84367.88	3.29
Heathy Woodlands	**TOTAL:**		**617199.10**	**24.03**
	48	Heathy Woodland	617199.10	24.03
Herb-rich Woodlands	**TOTAL:**		**1742372.07**	**67.85**
	3	Damp Sands Herb-rich Woodland	1742372.07	67.85
Lowland Forests	**TOTAL:**		**8258.93**	**0.32**
	16	Lowland Forest	8258.93	0.32
No native vegetation recorded	**TOTAL:**		**67389.67**	**2.62**
	992	Water Body - Fresh	67389.67	2.62
Salt-tolerant and/or succulent Shrublands	**TOTAL:**		**36138.25**	**1.41**
	9	Coastal Saltmarsh	36138.25	1.41
Wetlands	**TOTAL:**		**12257.64**	**0.48**
	10	Estuarine Wetland	7978.19	0.31
	136	Sedge Wetland	4279.46	0.17
GRAND TOTAL:			**2567983.56**	**100.00**

Table 6: 1750 and current EVCs within the activity area

1750 EVCs				
EVC group name	**EVC**	**EVC name**	**Area (sqm)**	**% area**
Coastal Scrubs Grasslands and Woodlands	**TOTAL:**		**2919732.47**	**4.05**
	1	Coastal Dune Scrub/Coastal Dune Grassland Mosaic	442529.83	0.61
	2	Coast Banksia Woodland	2477202.64	3.43
Heathy Woodlands	**TOTAL:**		**14335000.64**	**19.87**
	48	Heathy Woodland	14335000.64	19.87
Herb-rich Woodlands	**TOTAL:**		**45840852.57**	**63.56**
	3	Damp Sands Herb-rich Woodland	45840852.57	63.56
Lowland Forests	**TOTAL:**		**1641977.06**	**2.28**
	16	Lowland Forest	1641977.06	2.28
No native vegetation recorded	**TOTAL:**		**2910367.99**	**4.04**
	992	Water Body - Fresh	2910367.99	4.04
Riparian Scrubs or Swampy Scrubs and Woodlands	**TOTAL:**		**1537774.47**	**2.13**
	191	Riparian Scrub	1537774.47	2.13
Salt-tolerant and/or succulent Shrublands	**TOTAL:**		**679908.37**	**0.94**
	9	Coastal Saltmarsh	679908.37	0.94
Wetlands	**TOTAL:**		**2262183.58**	**3.14**
	10	Estuarine Wetland	970272.65	1.35
	136	Sedge Wetland	1291910.93	1.79
GRAND TOTAL:			**72127797.15**	**100.00**

2005 EVCs				
EVC group name	**EVC**	**EVC name**	**Area (sqm)**	**% area**
Coastal Scrubs Grasslands and Woodlands	**TOTAL:**		**970025.11**	**2.66**
	1	Coastal Dune Scrub/Coastal Dune Grassland Mosaic	260459.10	0.72
	2	Coast Banksia Woodland	709566.00	1.95
Heathy Woodlands	**TOTAL:**		**10506033.68**	**28.86**
	48	Heathy Woodland	10506033.68	28.86
Herb-rich Woodlands	**TOTAL:**		**17377319.06**	**47.73**
	3	Damp Sands Herb-rich Woodland	17377319.06	47.73
Lowland Forests	**TOTAL:**		**1596056.46**	**4.38**
	16	Lowland Forest	1596056.46	4.38
No native vegetation recorded	**TOTAL:**		**2910368.17**	**7.99**
	992	Water Body - Fresh	2910368.17	7.99
Riparian Scrubs or Swampy Scrubs and Woodlands	**TOTAL:**		**979875.45**	**2.69**
	191	Riparian Scrub	979875.45	2.69
Salt-tolerant and/or succulent Shrublands	**TOTAL:**		**503075.62**	**1.38**
	9	Coastal Saltmarsh	503075.62	1.38
Wetlands	**TOTAL:**		**1562009.57**	**4.29**
	10	Estuarine Wetland	946392.66	2.60
	136	Sedge Wetland	615616.91	1.69
GRAND TOTAL:			**36404763.11**	**100.00**

3.7 Victorian Aboriginal Heritage Register Search

Table 7: Aboriginal Heritage Places located with 1 km of the Activity Area. Places situated within the activity area are shade orange. (ARSC = Artefact scatter; LDAD = Low Density Artefact Distribution.

VAHR		Name	Type	Context
8321	-0066	Reeve Island 1	Midden	Dune slope
8321	-0067	Reeve Island 2	Midden	Dune slope
8321	-0068	Lake Reeve Burial	Ancestral remains	Associated with midden
8321	-0121	Dutson Downs 1	ARSC/midden	Top of low ridge close to swamp
8321	-0122	Dutson Downs 2	ARSC	Top of low ridge close to swamp
8321	-0123	Dutson Downs 3	ARSC	Top of low ridge close to swamp
8321	-0124	Dutson Downs 4	ARSC	Flat, level land
8321	-0125	Dutson Downs 5	ARSC	Top of low ridge
8321	-0130	Delray Beach 1	Midden	Side of dune.
8321	-0131	Delray Beach 2	Midden	Side of dune.
8321	-0132	Delray Beach 3	Midden	Side of dune.
8321	-0133	Delray Beach 4	Midden	Top of dune
8321	-0134	Delray Beach 5	Midden	Side of dune
8321	-0148	Delray Beach 6	Midden	Flat, level land adjacent to Lake Reeve
8321	-0149	Delray Beach 7	Midden	Top of dune
8321	-0150	Delray Beach 8	Midden	Side of dune
8321	-0326	Lake Reeve 2	Midden	Top of dune between Lake Reeve and small swamp.
8321	-0327	Lake Reeve 2	Midden	Top of dune between Lake Reeve and small swamp.
8321	-0360	TNGP IA 1	ARSC	NA
8321	-0433	Longford artefact 1	LDAD	NA
8321	-0436	Dutson Downs Pipeline AS1	LDAD	Dune swale close to swamps
8321	-0437	Dutson Downs Pipeline AS2	LDAD	Sand hill crest
8321	-0438	Dutson Downs Pipeline AS4	LDAD	Adjacent to former swamp
8321	-0443	Dutson Downs Pipeline AS3	LDAD	Sand hill slope
8321	-0455	Longford LDAD 1	LDAD	Flat, level ground
8321	-0457	Longford LDAD 2	LDAD	Flat, level ground
8321	-0466	Shoreline Drive C.9 Midden1	Midden	Crest and slope of dune
8321	-0467	Shoreline Drive C.9 Midden1	Midden	Crest of dune

A total of twenty-eight registered Aboriginal cultural heritage places were located within the 1500m of the activity area. These places are predominantly made up of shell middens in proximity to the coast and or Lake Reeve immediately inland. The remaining places comprise stone artefact scatters of relatively low density, in one instance associated with a midden. Ancestral remains were identified in association with a midden on the western shore of Lake Reeve. The majority of places known in the region are concentrated towards the eastern end of the activity area with only very limited quantities having been

identified in the hinterland. This may reflect patterns of occupation and land use or alternatively may in some part be an artefact of survey coverage to date.

Four registered places are situated with the activity area, again at its eastern extremity. These places are shown shaded orange in Table 7, above. These places comprise three shell middens situated between the costa and Lake Reeve and a single artefact scatter on the west side of Lake Reeve. The three shell middens were originally recorded as being a poor state of preservation and subsequent inspections by Aboriginal Victoria staff have failed to reidentify these places and as such in unclear what the current state of preservation of these places is. Similarly, the artefact scatter, a single quartz artefact was not able to be relocated.

3.8 Review of Historical and Ethno-Historical Accounts of Aboriginal Occupation in the Geographic Region

In this section the available ethnohistorical and historical information relating to Aboriginal people in the East Gippsland region is briefly reviewed. This information can assist in formulating a model of Aboriginal subsistence and occupation patterns in the activity area. In conjunction with an analysis of the documented archaeological record of this area, the ethnohistorical information assists in the interpretation of archaeological sites in the wider area, and in predicting the potential location of archaeological site types within the immediate study region.

Current understanding of the Aboriginal occupation of Gippsland prior to contact with Europeans is highly constrained owing to the absence of written records from that period and the minimal information that was recorded of Aboriginal culture at the time of contact. Despite these limitations, ethnographic information recorded in the 19th century combined with an analysis of archaeological evidence from the region can shed some light on this history.

Aboriginal people have occupied Gippsland since the late Pleistocene. Archaeological excavations of Cloggs Cave (8522-18), north of Orbost, established that Aboriginal people occupied the shelter from as early as 18,000 years ago (Flood 1983, 26) and dates as early as the last Glacial Maximum have been recorded at New Guinea II (8523-12) in Gippsland. Dates from excavations of coastal dunes tend to date to the Holocene period, predominantly during the past 1,000 years, though occasional assemblages dating to c. 4,000 years BP have been identified (Lomax 1992). Archaeological evidence suggests that Aboriginal subsistence patterns during the Holocene were focussed on estuarine and coastal sources and that groups occupied semi-permanent camps near freshwater and food resources.

There is currently little recorded information available on those people who occupied the land encompassing the activity area. What is known is that the activity area is located within the *Gunai Kurnai* language group (Clark 1990, 364; Barwick 1984), who occupied Gippsland between Wilson's Promontory and New South Wales (Volume 2: Figure 7).

Wesson (2000, 17) suggests that land custodianship and ownership in Gippsland was based around the 'local descent group', who she terms a 'named group'. Each group was responsible for the care and maintenance of a region of land, though this region may only have been a portion of their overall domain. As such these groups may have exercised a high degree of residential mobility within and beyond their 'tribal territories'.

Alfred Howitt, an early anthropologist who spent much time in Gippsland, noted that the Gunai Kurnai comprised five clans: Bratualong, Braiakaulung, Tatungalung, Krauatungalung and Brabralung. According to Wesson (2000, 39) the naming of these groups was based on compass direction taken from the position of the Mitchell River people who called themselves "the" people. According to Wesson, Bulmer said that this naming was sexually specific, for example while a man of the west was one of the *Braiakaulung* (husband+west+father; i.e. we look after/have a duty towards the west country which is the country of our fathers), a woman of the west was one of the *Yaktoon worcat* (west+woman) (or *Yakthun ookah*). A man who was from outside *Kurnai* territory was described as a *Brajerak* whereas his female equivalent was a *Louajerak/Lowajerak* (Wesson 2000, 39). The five Kurnai groups were further divided into sub-groups that were named (Howitt refers to these sub-groups as divisions, 1904, 272). The names of the sub-groups were often derived from the principal locality occupied by the particular division, with the local groups also sometimes giving their name to a location (Wesson 2000, 20).

The activity area lies within the traditional territory of the Braiakaulung people, who occupied the region north of the Latrobe River, east to the Mitchell River and north to the headwaters of the Wonnangatta River (Wesson 2000, 41-42). According to Wesson, the closest named group of the Braiakaulung appear to have been the Bunjil Kraura/Woollum Woolum, who were associated with the Latrobe River around Longford and Rosedale (Wesson 2000, 28). Interestingly, 'named groups' tended to cluster around the Gippsland Lakes hinterland, indicating the high resource potential of this area (Wesson 2000, 21).

The *Braiakaulung* people occupied the Latrobe River Valley, and the valleys of the Thompson, Avon and Macalister Rivers. The southern boundary of this territory occurs along the Strezlecki Ranges (Howitt 1904: Sketch Map of Gippsland). According to Howitt (1904, 76) the *Braiakaulung* claimed all of the country west of Providence Ponds watered by the Avon, Macalister, Thompson and La Trobe Rivers down to the junction of the two latter, following the east side of the Latrobe to Lake Wellington, then eastwards by the lakes to near Roseneath and then northwards towards Providence Ponds. The *Bunjil Kraura* (Clark 1998b, 187-188; Wesson 2000 Figure 6) have been identified as the *Braiakaulung* clan most closely associated with sections of the geographic region. This group has also been known by the name of *Woolloom/Woollam-ba-bellum-bellum* (Hagenauer 1863 and 1866 in Wesson 2000, 28).

The only known references regarding the *Bunjil Kraura* are in relation to a *Birraark*, or medicine man who belonged to the clan (Howitt 1904, 393), a 'leading man', who carried the clan name of *Bunjil-kraura*, meaning 'West Wind' (Howitt 1904, 738). According to Howitt, *Bunjil Kraura* was the father of Billy Wood's wife, Sarah (or *Warrawort*) and he lived at the country between Morwell, Rosedale, Toongabbie (Howitt 1053/4a in Wesson 2000, 28).

Population estimates at contact for the Gunai Kurnai range from 700 to nearly 5,000 (Fison & Howitt 1880, 181; Rhodes 1996, 15; Smyth 1878 vol. 1, 36). In 1863 the Bellum Bellum were recorded as consisting of 22 men, 17 women, 7 boys and 5 girls (Wesson 2000, 23). Almost all references to Gunai Kurnai subsistence strategies refer to the Gunai Kurnai in general or to those of the Gippsland Lakes. The Rev. John Bulmer, who ran the Lake Tyers Aboriginal Mission in the second half of the 19th century, recorded the following information on the diet of Aboriginal people in the region:

> In summer time their days were spent chiefly in fishing for eels and fat mullet (Pert-piang). They camped at the entrance to the Lakes, where they are plentiful at this season. They would find also in the gullies near the entrance plenty of Koonyang (kangaroo apples), and these, with the fish, would form their chief diet. Excepting when they desired a change of food, a day would be spent in going back into the bush for wallaby. The entrance to Reeves River has always have been a very favourite camping ground, as food in the summer is very plentiful *(Bulmer in Smyth 1878 vol. 1, 141)*

Bulmer (Smyth 1878 vol. 1, 141-143) also recorded that Aboriginal people in the Gippsland area spent autumn and winter in the hinterland hunting kangaroo, koalas and wombats as well as collecting various vegetable roots. Bulmer has listed a wide range of marine, lacustrine and terrestrial resources exploited by Aboriginal people in Gippsland and at Lake Tyers Mission station (Campbell 1994, 53-54). George Augustus Robinson, Chief Protector of Aborigines, was informed that all the tribes from Gippsland seasonally went to the mountains around Omeo to collect Bogong moths (Clark 1998, 88).

European settlement of the Gippsland Lowlands began in the 1840s after Angus McMillan first explored the area and established a shipping port at Port Albert, during an expedition from Maneroo in NSW. Further favourable reports by the explorer Count Paul Strezlecki stimulated interest with squatters arriving from Port Phillip or Van Diemen's Land via Port Albert, or from New South Wales via Omeo (LCC 1982, 15-16). European settlement in this region was surprisingly rapid given the difficulties of accessibility. By 1842, the central plain between the Tambo and Latrobe Rivers had been occupied and by 1844 there were 327 settlers in the district accompanied by 2,000 head of cattle and 62,000 sheep (Synan 1994, 19). Lands surrounding Lake King were taken up by squatters as early as 1844, when Archibald MacLeod took up the Bairnsdale Run (Adams 1987, 18).

By this time, most of the open grazing country was occupied while large tracts of inhospitable land remained only partly occupied or in the hands of the Crown until the 1860s (Spreadborough & Anderson 1983, xii-xxvi; LCC 1982, 15-16). Pastoral land use practice during this period centred predominantly on sheep and cattle (LCC 1982, 22).

One of the few recorded references to initial contact between the Gunai Kurnai and European settlers in the Gippsland Lakes region is at Bunga Creek, near Bairnsdale. Eliza O'Rourke, from the Brabralung clan recounted the following:

> …the people were down c'roborin' at Bunga Creek, bangin' their sticks and singin' and going on, when up the creek come a boat with some lohans [white people] rowing it, leanin' over tasting water, lookin' for fresh water, see? That was the first time some of those blacks saw a white man…One lohan got out of the boat and come over to them and they poked him and felt him, rubbing his skin, then he got out his pipe and lit it up. The blacks jumped on him and threw him in the water to put him out Granny O'Rourke said. When this bloke got out of the water he showed them the pipe and showed them a gun, too, and how it went off. The white men were friendly to the Aborigines and Granny said her people knew they wanted fresh water, so they led them to it. (Pepper 1980, 44).

While Eliza O'Rourke reported this benign encounter between her people and the European settlers, it stands in contrast to the devastating effects colonisation would have on Aboriginal society and culture in Gippsland. Within a relatively short time period Aboriginal people lost access to land and resources that were central components of their cultural life. During the period following pastoral settlement, the combined effects of introduced disease, dispossession, inter-tribal conflict, alcohol abuse and conflict with Europeans dramatically reduced the Gunai Kurnai population. By 1857 there were 50 people left in the *Brayakaulong* tribe, the largest clan amongst the Gunai Kurnai at this time (Pepper & de Araugo 1985, 113). In 1863 the Bellum Bellum were recorded as consisting of 22 men, 17 women, 7 boys and 5 girls (Wesson 2000, 23).The intensity and severity of conflict between Gunai Kurnai and Europeans in the broader regions as well as in close proximity to the activity area is illustrated by the Warrigal Creek Massacre which occurred in 1843 to the southeast of the current activity area. Approximately 150 Aboriginal were massacred at the Warrigal Creek waterhole in retaliation for the killing of Ronald Macalister at Port Albert, which in itself appears to have been a retaliatory attack for the killing of some Gunai Kurnai at the same location (Gardner 1983, 8; 1990, 40). Available evidence indicates that these

were by no means isolated occurrences and that conflict and atrocities were widespread albeit often undertaken in a surreptitious manner (Gardner 1990, 43).

The Government attempts at balancing the colonial imperative of pastoral settlement with the needs of a rapidly diminishing and demoralised indigenous population was entirely inadequate. Many people who survived the contact period were forced to gather at Government sponsored stations or conversely, to eke out an existence on pastoral stations where they might obtain work or collect supplies in lieu of their traditional resource base.

The gold rush of the 1850s had stimulated the economy in Gippsland, and as alluvial mining diminished miners sought to become farmers. This, combined with changes to the Land Acts eventually brought an end to the squatting era in the 1860s as runs were opened up for selection as smaller parcels of land. This placed increased pressure on Aboriginal people as access to the resources that they were accustomed to using became largely inaccessible. Pastoral land practices continued to dominate although the cultivation of crops such as maize, wheat, barley, oats, and potatoes did occur in river valleys in the region (LCC 1982, 17, 23).

By the 1860s, substantial settlements were emerging at centres such as Sale and Bairnsdale. In response to the pressures placed on Aboriginal people in the Gippsland region, the Moravian church established Ramahyuck Mission Station on the northern side of Lake Wellington in 1863. Hundreds of Aboriginal people lived at the mission until its closure in 1908. The Aborigines Protection Board also established the Lake Tyers Government Station in 1861. By the late 1800s, large populations of Aboriginal people from across Victoria lived on the Lake Tyers Mission Station and Ramahyuck Mission. The 1886 *Aborigines Protection Act* forced the removal of Aboriginal people of mixed descent and under the age of 35 from these stations. To survive, they established settlements on Crown Land and struggled to gain employment as itinerant workers picking crops across Gippsland and up into NSW.

There are many descendants of the Gunai Kurnai who live in Gippsland today and who maintain strong ties to the Gippsland landscape.

3.9 Review of Reports and Published Work about Aboriginal Cultural Heritage in the Region

Previous archaeological research consists of *regional studies*, which assist in characterising the general pattern of archaeological site distribution across a broad region, and *localised studies*, which assist in developing an understanding of archaeological sensitivity and the extent and scope of prior investigation in a relatively limited area or environment.

4.9.1 Regional Studies

The following two studies (Hall 1992; Lomax 1992) have examined the archaeology of the district within a regional, rather than a localised context.

Gippsland Lakes Archaeological Survey (Hall 1992)

In 1988-1989 Roger Hall undertook out a regional survey of the Gippsland Lakes for the Australian Heritage Commission, the results of which have been reported in a preliminary form (1992). Hall divided

the region into eight landscape units: coast, coast to lakes, lakeshore south, islands, lakeshore north, wetlands, plains and hills (Hall 1992, 86-87). By Hall's definition, the present activity area occurs at the interface between coast and plains (1992, 18).

Hall effectively surveyed 2.1 km^2 of tracks, logging coupes, fuel reduction burns and erosion scars. Stone artefacts occurrences were the most common archaeological site type recorded (n=215). Scarred trees (n=33) and a burial were also recorded (Hall 1992, 83).

The stone artefact analysis found that 63% of scatters contained fewer than 10 artefacts, 20% contained 10 to 50 artefacts and 17% contained between 50 and 4,000 artefacts (Hall 1992, 84).[1]

Stone artefact scatters were most common on lakeshores and wetlands. Hills and plains had a lesser number of artefact scatters, although better watered parts of the plains contained a higher proportion (Hall 1992, 86). At a local level, Hall determined that scatters were located in all landforms, with over half of the sites recorded on top of terraces and on flats. Both of these localities tended to be associated with water sources, and sites on flats were located on slight prominences above the surrounding terrain (Hall 1992, 88-9). Most of the sites were located near water sources with only 11 sites recorded further than 200m from water. Larger sites, with extensive artefact scatters were associated with lakeshores and wetlands whilst sites on the plains tended to have low to moderate (<1000 artefacts) numbers of artefacts (Hall 1992, 90).

Quartz was the dominant raw material in the recorded assemblages, though silcrete (fine grained and coarse grained), chert and volcanics were also identified in lesser proportions. Unmodified flakes were the most common artefact type with formal tools consisting of less than 1% of the assemblage. The quartz dominated assemblages were thought to date to the recent past (c. 1,000-2,000 years BP) (Hall 1992, 107).

Significantly, Hall (1992, 92-93) determined that fine grained silcrete, which does not naturally occur in the region, formed a larger proportion of assemblages in sites adjacent to wetlands, and in some cases dominating the assemblage. Two explanations for this are postulated.

Firstly, that the association between fine grained silcrete and the microblade industry was geared to the manufacture of specialised hunting tools, primarily backed blades for hafting barbs in composite spears (McBride 1985). It has been argued that these tools are specifically employed to hunt swamp fauna (Luebbers 1978, 304).

The second explanation is that the suite of fine-grained silcrete dominated scatters are older than the quartz dominated ones. If so, then these places reflect occupation for a longer time period, potentially extending back to 3,800 years BP (cf. similar dated assemblages at Jack Smith Lake; Hotchin 1982; Hotchin & May 1984).

On the basis of his research, Hall (1992, I) identified four overlapping zones of greatest archaeological potential, namely:

- Lakeshores;

[1] Hall (1992) estimated the numbers of artefacts at each site based on sample counts of artefacts in available exposures. As such these figures do not provide a direct comparison with the calculations of artefact density undertaken for the present project.

- High ground adjacent to wetlands;
- Within 200m lakes, swamps or streams (permanent and intermittent);
- Within 500m of the coast.

Gippsland Lakes Archaeological Survey Stage 2 (Lomax 1992)

Lomax (1992) undertook further investigations in the Gippsland Lakes hinterland aimed primarily at refining the understanding of Aboriginal cultural heritage place distribution in the region. An additional 59 archaeological sites were identified, including 48 artefact scatters and 11 scarred trees.

As part of her investigation, excavations were undertaken at two sites in the Lake King hinterland, including Eagle Point 1 (8422-269) and Metung 3 (8422-287), including the collection of a C14 date at Metung 3 (8422-287) of 3,090 ± 110 (Beta-52471).

On the basis of the results from both sites, Lomax concurred with Hall's (1992) findings that a change in lithic industry occurred ~2,000 years ago, characterised by a transition from a predominantly silcrete microlith technology, to one dominated by quartz bipolar techniques. Although both Metung 3 (8422-287) and Eagle Point 1 (8422-269) were broadly comparable in this regard, another excavation undertaken by Lomax (1992) at the same time at Dowd Morass, near Sale (8321-239), indicates that this transition is not apparent at all sites in the region.

Lomax (1992) hypotheses that this change in raw material use and tool production techniques reflects a behavioural change associated with the increasing productivity of wetland resources in the Gippsland Lakes system during the Late Holocene, resulting in an intensification of its exploitation.

4.9.2 Local Studies

Several archaeological assessments have been conducted in the general Wombat Gasfields area (Witter *et. al.* 1976; Luebbers 1976; Simmons 1976; Bell *et. al.* 1977; Hotchin 1982; Hotchin 1986; Hotchin and May 1984); Debney *et. al.* 2001; Murphy and Amorosi 2001, 2002, 2003, 2007; Freslov 2003).

Dutson Downs Sewerage Farm and Pipeline (Hotchin 1986, 1987)

In 1986, Hotchin recorded 30 Aboriginal archaeological sites as part of the survey of proposed pipeline routes between the Dutson Downs Sewerage facility and the Ninety Mile Beach. This survey was extended in 1987 when a reported Aboriginal burial along the chosen pipeline route necessitated further investigation. Most of these sites are situated on the Ninety Mile Beach barrier dune complex. Hotchin (1986) has characterised these sites as falling into three broad categories:

i) Sites that predominantly contain:

- estuarine shell (*Anadara trapezia, Ostrea angasi*)
- microlithic assemblages of exotic silcrete
- cultural material dated to between 2,000 and 4,000 years

ii) Sites that are characterised as:

- Thin *Plebidonax* middens along the Ninety Mile Beach

- Including sparse quartz assemblages with a minority of silcrete
- Dating to within 1,000 years before present

iii) Substantial sites that:

- Are situated in the back dunes
- Are predominantly *Plebidonax* middens
- Include microlithic assemblages dominated by quartz and some silcrete
- Date to the last 1,000 years

Extensive archaeological investigation of the Gippsland Lakes conducted by Hall (in prep.) recorded 678 Aboriginal sites. The results of this research found that on the whole, the inland sites equated with Hotchin's Type 3 sites (although a smaller percentage of sites did not fit into this pattern) (Hall & Lomax 1990: 3). It found that the density of shell middens falls markedly approximately 1-2 km from the coast.

Dutson Downs Irrigation Pipeline (Barker 2013)

Barker undertook a complex CHMP for a proposed eight kilometre long irrigation pipeline within the with the Dutson Downs Wastewater Treatment Facility, Dutson Downs. Three previously registered places were located within or in close proximity to the propose works area. No Aboriginal cultural heritage was identified during the course of the standard assessment despite reasonable ground surface visibility, however, a total 83 shovel test pits, 62 mechanical excavations, five 0.5m x 0.5m test pits and four 1m x 1m test pit were excavated, resulting in the identification of nine previously unrecorded places. The majority of places identified comprised low density artefact deposits of less than five artefacts. Two places were of higher density and consisted of 25-28 stone artefacts of silcrete, quartz and quartzite. Place location generally conformed to the expected pattern with proximity to former swamps and watercourses being a key determinant.

Bream Gas Pipeline (Freslov and Goulding 2001; Goulding et al. 2003)

Freslov & Goulding (2001) undertook a pedestrian survey of the proposed Bream Gas Pipeline from Valve Site 3 (approximately 5.6 kilometres). The study area consisted of a 24 metre wide corridor that extended from Paradise Beach (on the Ninety Mile Beach) inland to the onshore Valve Site 3. The study area followed an existing pipeline easement.

The field assessment determined that a previously identified Aboriginal site (AAV 8321-165) extended across the barrier dune where the pipeline underbored the dune. Two previously unidentified Aboriginal sites (AAV 8321-345 and AAV 8321-346) were identified within the easement further inland. All three sites comprised middens with shell and stone contents. No historic European sites were recorded during the survey.

Freslov & Goulding concluded that the sites within their study area were consistent with Hall and Lomax (1990) and Hotchin's (1987) site modelling for the Gippsland Lakes and Ninety Mile Beach barrier dunes, with the sites corresponding to Hotchin's Type 2 and Type 3 sites (Freslov & Goulding 2001, 18).

Goulding *et al*. (2003) undertook a subsurface testing programme in response to recommendations made by Freslov & Goulding (2001). Testing was undertaken at three locations including the site locations of AAV 8321-345 and AAV 8321-346. Additional cultural material was identified as part of AAV 8321-345. A new site, AAV 8321-347 was identified on the ground surface during the testing, comprising burnt shell and quartz artefacts (Goulding *et al*. 2003, 16).

Golden Beach Gas Project (Murphy and Amorosi 2007)

In 2007 Murphy and Amorosi conducted a cultural heritage assessment for the Golden Beach Gas Project where the construction of a drill pad was proposed at Delray Beach. Delray Beach is located in the coastal dunes landform, approximately 200m west of the coastline. The drill pad site had been highly disturbed by the construction of the Delray Beach ocean outfall sewer in 1992, and vegetation was cleared from the area during this construction. Soils in this area comprise light creamy yellow sand. A previously registered shell midden was located in the drill pad area (8321-0148), much of which was disturbed during former construction activities. This midden had been subject to previous subsurface investigations by Hotchin (1988) and was found to contain no buried deposits. Murphy assessed the wetland area between Flamingo Drive and the ''inner barrier'' dune at Lake Reeve as a recently emerged lake bed that has no cultural potential, with the top of the ''inner barrier'' dune system as having moderate cultural heritage potential. The shell midden site 8321-0148 was re-identified during the field survey, and high disturbance was noted. Murphy and Amorosi concluded that although the drill pad area is located on the highly sensitive coastal dunes landform, the area has low Aboriginal archaeological potential due to the high level of disturbance.

Jack Smith Lake (Simmons 1976; Hotchin 1982; Hotchin and May 1984)

The first documented archaeological research conducted in the Jack Smith Lake Reserve was the recording and analysis of skeletal remains discovered near Blue Hole in 1976 (Simmons 1976). Subsequently, Jack Smith Lake was the subject of a detailed archaeological study conducted during 1981-82 (Hotchin 1982; Hotchin & May 1984), which focused on a small area (approx. 375 ha.) at the north east end of the Reserve defined by Ninety Mile Beach, the intermittent lake bed and the outlets known as the "Swashway" and the "Blue Hole". The primary aims of the study were to locate and record archaeological sites in the study area and to formulate appropriate recommendations for the management of important archaeological sites and areas (*ibid.,* 1). The study methodology comprised a systematic survey, complemented by a series of auger transects and surface collection at selected sites. Radiocarbon samples were collected and analysed.

A total of 28 shell middens were identified, consisting of the discarded remains of either of estuarine shellfish dominated by *Anadara trapezia* (Mud ark or cockle) and *Ostrea angasi* (Mud oyster), or ocean beach shellfish, dominated by *Plebidonax deltoides* (Pipi). The systematic collection of archaeological material demonstrated the presence of fish and other animal bone in selected midden deposits, notably snapper (*Chrysphrys auratus*). Flaked stone artefacts, predominantly quartz or silcrete were also a common site component, and human skeletal remains were present at 12 sites.

The sites were exclusively distributed along the raised Pleistocene and Holocene ridgelines (physiographic units A & B) situated behind the present Ninety Mile Beach (Figure 4). These features have evolved from a prior barrier system and the residual spits and islands that formed around relict tidal channels in the ancient lake bed.

The analysis of the material demonstrated 2 phases of Aboriginal occupation in the area;

- *ca.* 4,000 - 2,000 BP - the collection of the shellfish *Anadara trapezia* and *Ostrea angasi,* with possible netting of *Chrysphrys auratus* in the lake. The stone tool assemblage was microlithic employing heavily reduced imported stone. This usage was likely to be associated with the estuarine phase of the lake.
- < 500 BP - the exclusive collection of *Plebidonax deltoides,* with a greater use of locally available quartz pebbles. Microliths comprised a minor component of the stone artefact assemblage, and both burins and bone points were also present. It is likely that this phase resulted from the transition of the lake from an estuarine environment to a freshwater environment.

During this survey a burial was discovered in the Lagoon ridge area which was later recorded and analysed by Green (1989).

Loy Yang – Bass Strait Pipeline (Witter *et. al.* 1976; Bell *et. al.* 1977)

Witter *et. al.* (1976) undertook a field survey of the proposed Loy Yang – Bass Strait pipeline. One of the survey areas included in the investigation either included or passed very close to the current activity area. The current activity area falls within the 'lowland plains' unit identified by Witter *et. al.* (1976, 5). Witter *et. al.* (1976, 9-10) identified no correlation between site location and local environment. The investigation only draws broad conclusions regarding Aboriginal activities in the region, identifying a cultural change from inland habitation to a more coastal, estuary and lagoon based focus and a shift in raw material preference from the earlier imported chert to more recent utilisation of local quartz resources Witter *et. al.* (1976, 15).

Further survey conducted in response to a change in the proposed pipeline route ran north-south c. 4km west of the current activity area (Bell *et. al.* 1977). Nine additional sites were identified. Bell *et. al.* (1977, 12-13) suggest that two different site uses can be identified according to the location and contents of the sites; those sites containing both lithics and shell and located in association with several environmental zones tend to be bigger and, Bell *et. al.* (1977, 12-13) conclude, were utilised for longer by more people; those sites that comprise a particular resource associated with a single environmental zone were transitory and used by less people. According to Bell *et. al.* (1977, 13), these differences may be associated with seasonal occupation differences, ceremonial significance or chronological differences.

Telstra Cable Route (Luebbers 1996)

Luebbers (1996) undertook a field survey of a proposed 1300 m cable route south of Giffard, c. 6 km south west of the current activity area and similarly, c. 4 km inland from the coast. Two sites, 8321-0316 and the 'Old Giffard School House Site' (apparently unregistered), both artefact scatters including both lithics and shell remains. Both of the sites comprise silcrete and sandstone artefacts eroding from the upper 300-350 mm of deposit and represent locations of 'domestic habitation and tool production' (Luebbers 1996, 6). The site 8321-0316 comprises silcrete artefacts associated with the Australian Small Tool Tradition (ASTT) of the past 5,000 years as well as sandstone artefacts which, given their size and frequency, Luebbers (1996, 6-7) interprets as representing the results of primary core reduction.

Basslink (Debney *et. al.* 2001; Freslov 2003)

Debney *et. al.* (2001) undertook a field survey of a proposed Basslink HVDC interconnector between Tasmania and Victoria and following the route of the Old Rosedale road. This study area is located c. 18 km west of the current activity area but, in some sections, traversing a similar landform. Prior to the survey, two sites, 8221-0026 and 8221-0027 were located along the proposed route and as a result of the survey, an additional four sites 8221-0093, 8221-0094, 8221-0096 and 8321-0340, all artefact scatters, were identified. The four newly recorded sites occurred in the 'High Terraces' and 'Fans' landscape units and were located, predominantly, on hills and ridges with one isolated artefact identified in a valley. Debney *et. al.* (2001, 80) highlight limitations with making statements associated with the results of the survey as general knowledge of the archaeological record in the wider region was poor as not many investigations have been undertaken in the area, the survey are was small, ground visibility was poor and ground disturbance was noted along much of the route.

An additional small area (900 x 11 m) of proposed pipeline associated with the Basslink project was investigated by Freslov (2003). This short route option runs north from McGaurans Beach, c. 9 km south west of the current activity area. The area was initially stripped of vegetation by a bulldozer enabling the observation of the surface sediments. As a result of the survey, one site (8321-0373), a midden, was recorded comprising a wide spread of *Anadara trapezia* shells and one silcrete artefact across a relict Pleistocene barrier dune (Freslov 2003, 24). Subsurface testing was undertaken along the alignment and no further site material was identified outside of the boundaries of 8321-0373.

Tasmania Natural Gas Project (Murphy & Amorosi 2001, 2002, 2003)

Murphy and Amorosi (2001) conducted a survey of a proposed 20 km long pipeline forming the terrestrial component of the proposed Tasmania Natural Gas Pipeline Route running north from Seaspray. As a result of the survey, one site 8321-0341, an artefact scatter and one area of area of Aboriginal archaeological potential were identified. The site 8321-0341 comprised two silcrete flakes identified on the mid-slope of the inner dune north of Lake Reeve and was determined to be of low archaeological sensitivity. Murphy and Amorosi (2001, 29-30) highlight that the presence of silcrete at 8321-0341 reflects the dominance of silcrete in assemblages associated with the western region of the Gippsland Lakes and may indicate a local silcrete source, a hypothesis further supported by the presence of cortex on one of the flakes. Murphy and Amorosi (2001, 29) identified the other flake as containing features associated with the ASTT. Murphy and Amorosi (2001, 40) suggest that the proposed pipeline has low overall cultural heritage values and that the dune associated with Lake Reeve was the only area of Aboriginal archaeological potential within the proposed pipeline route.

As a result of recommendations made by Murphy and Amorosi (2001, 40-41), a subsurface testing program was conducted in the area of Aboriginal archaeological potential, the Lake Reeve dune (Murphy and Amorosi (2002). One site 8321-0350, comprised two artefacts; one quartz broken flake identified in the plough zone at 150 mm in a shovel probe and a silcrete broken flake was identified on the surface. The subsurface testing identified a generally uniform stratigraphy across the dune, comprising an upper c. 200 mm of humic sand (ploughzone) overlying a light-grey or mid-greyish brown sand which overlies an orange coarse sand and gravel deposit.

A final investigation involved additional subsurface testing and monitoring of all earth disturbances and backfill along the pipeline route (Murphy and Amorosi 2003). As a result of this stage of investigation

fifteen newly identified sites were recorded (8321-0051 – 8321-0065) and the previously identified sites, 8321-0341 and 8321-0350 were expanded. Of these seventeen sites, however, only two (8321-0341 and 8321-0365) comprised dense concentrations of artefacts 8321-0341: n=117 and 8321-0365: n=145) and a range of artefact types and raw materials (Murphy and Amorosi 2003, 12). The majority of isolated artefacts (sites comprising less than 5 artefacts) were associated with flat land while the artefact scatters were predominantly associated with the inner barrier dune at Lake Reeve.

The stratigraphy across the dune was generally uniform with the upper 400 mm comprising dark, humic deposit overlying a thin layer (to c. 500 mm) of the same deposit but comprising charcoal from the banksia roots and overlying a light, fine grey sand deposit extending to c. 900 mm. In the low, swamp areas a uniform dark grey loam or peat deposit was present (Murphy and Amorosi 2003, 34).

Murphy and Amorosi (2003, 35) determined that none of the sites comprised *in situ* artefacts and that neither the artefactual nor stratigraphic evidence supports any intensive occupation of the particular area tested. In conclusion, Murphy and Amorosi (2003, 36) suggest that the overall results of the combined investigations support their original prediction that small sites with low artefact numbers would occur on the Plains landform and that, closer to the more resource rich zones the site sizes and densities would increase accordingly. An association between flat land (on plains, on top of rises, hills and dunes) and site location is suggested by Murphy and Amorosi (2003, 36) rather than a connection between site location and distance to potable water, which they suggest is irrelevant (however no major watercourses occur within their study area). The identification of artefacts on hill and dune slopes is explained as reflecting movement resulting from the unconsolidated nature of the sand, a problem which was observed during the excavation component of the investigation (Murphy and Amorosi 2003, 36).

3.10 A Review of the History of the Use of the Activity Area

Aboriginal peoples' occupation of the wider area extends over thousands of years (Section 4.8). This occupation would likely have taken the form of temporary camps used on a seasonal basis and that made use of diverse resources in the area. The landscape was undoubtedly well known to generations of people and it is probable that associations extended to spiritual attachments.

European settlement of the Gippsland Lowlands began in the 1840s after Angus McMillan first explored the area and established a shipping port at Port Albert, during an expedition from Maneroo in NSW. Further favourable reports by the explorer Count Paul Strezlecki stimulated interest with squatters arriving from Port Phillip or Van Diemen's Land via Port Albert, or from New South Wales via Omeo (LCC 1982, 15-16). European settlement in this region was surprisingly rapid given the difficulties of accessibility. By 1842, the central plain between the Tambo and Latrobe Rivers had been occupied and by 1844 there were 327 settlers in the district accompanied by 2,000 head of cattle and 62,000 sheep (Synon 1994: 19). By this time, most of the open grazing country was occupied while large tracts of inhospitable land remained only partly occupied or in the hands of the Crown until the 1860s (Spreadborough & Anderson 1983, xii-xxvi; LCC 1982, 15-16). Pastoral land use practice during this period centred predominantly on sheep and cattle (LCC 1982, 22).

Lands surrounding Lake Wellington were taken up as early as 1843. In January 1843, John Foster took up The Heart, 25 km north west of the project area. In 1844, Charles Tyers, Crown Lands Commissioner, visited The Heart where he found 20 settlers, sheep and several cultivation paddocks (Synon 1994: 19). It

appears that the project area was once part of the Lowlands Run. This run was first taken up in 1845 by Frank Allman Niall (Billis & Kenyon 1974: 238).

One of the few recorded references to initial contact between the Gunai Kurnai and European settlers in the Gippsland Lakes region is at Bunga Creek, near Bairnsdale. Eliza O'Rourke, from the Brabralung clan recalled the following encounter:

> …the people were down c'roborin' at Bunga Creek, bangin' their sticks and singin' and going on, when up the creek come a boat with some lohans [white people] rowing it, leanin' over tasting water, lookin' for fresh water, see? That was the first time some of those blacks saw a white man…One lohan got out of the boat and come over to them and they poked him and felt him, rubbing his skin, then he got out his pipe and lit it up. The blacks jumped on him and threw him in the water to put him out Granny O'Rourke said. When this bloke got out of the water he showed them the pipe and showed them a gun, too, and how it went off. The white men were friendly to the Aborigines and Granny said her people knew they wanted fresh water, so they led them to it. (Pepper 1980, 44).

While Eliza O'Rourke reports a benign encounter between her people and the European settlers, it stands in contrast to devastating effects colonisation would have on Aboriginal society and culture in Gippsland. Within a relatively short time period Aboriginal people lost access to land and resources that were central components of their cultural life. During the period following pastoral settlement, the combined effects of introduced disease, dispossession, inter-tribal conflict, alcohol abuse and conflict with Europeans dramatically reduced the Gunai Kurnai population. By 1857 there were 50 people left in the *Brayakaulong* tribe, the largest clan amongst the Gunai Kurnai at this time (Pepper & de Araugo 1985: 113).

The Government attempts at balancing the colonial imperative of pastoral settlement with the needs of a rapidly diminishing and demoralised indigenous population was entirely inadequate. Many people who survived the contact period were forced to gather at Government sponsored stations or conversely, to eke out an existence on pastoral stations where they might obtain work or collect supplies in lieu of their traditional resource base.

The gold rush of the 1850s had stimulated the economy in Gippsland, and as alluvial mining diminished miners sought to become farmers. This combined with changes to the Land Acts eventually brought an end to the squatting era in the 1860s as runs were opened up for selection as smaller parcels of land. This placed increased pressure on Aboriginal people as access to the resources that they were accustomed to using became largely inaccessible. Pastoral land practices continued to dominate although the cultivation of crops such as maize, wheat, barley, oats, and potatoes did occur in river valleys in the region (LCC 1982, 17, 23).

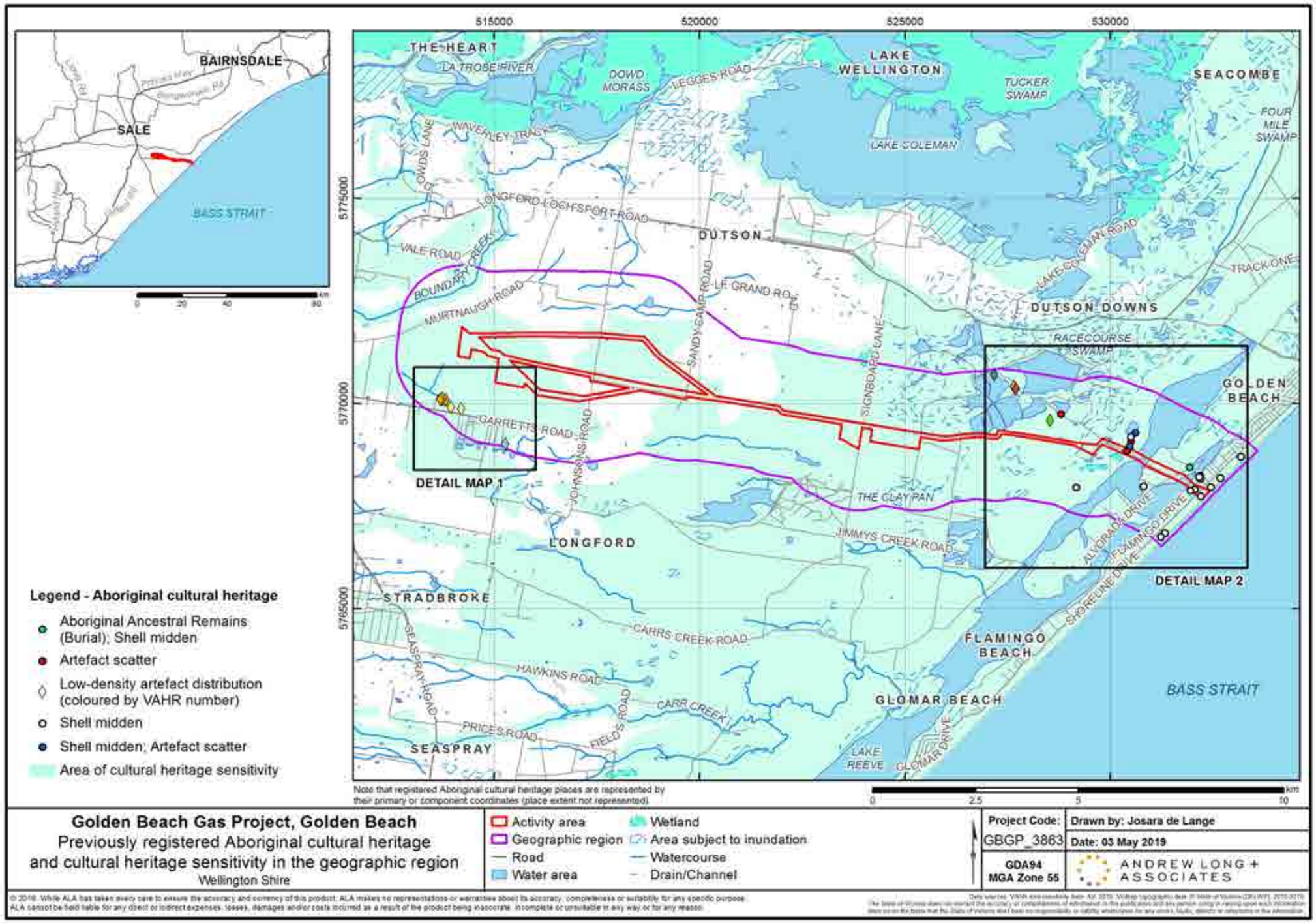
By the 1860s, substantial settlements were emerging at centres such as Sale and Bairnsdale. In response to the pressures placed on Aboriginal people in the Gippsland region, the Moravian church established Ramahyuck Mission Station on the northern side of Lake Wellington in 1863. Hundreds of Aboriginal people lived at the mission until its closure in 1908. By the late 1800s, large populations of Aboriginal people from across Victoria lived on the Lake Tyers Mission Station and Ramahyuck Mission. The 1886 *Aborigines Protection Act* forced the removal of Aboriginal people of mixed descent and under the age of 35 from these stations. To survive, they established settlements on Crown Land and struggled to gain employment as itinerant workers picking crops across Gippsland and up into NSW.

There are many descendants of the Gunai Kurnai who still live in Gippsland today and who maintain strong ties to the Gippsland landscape.

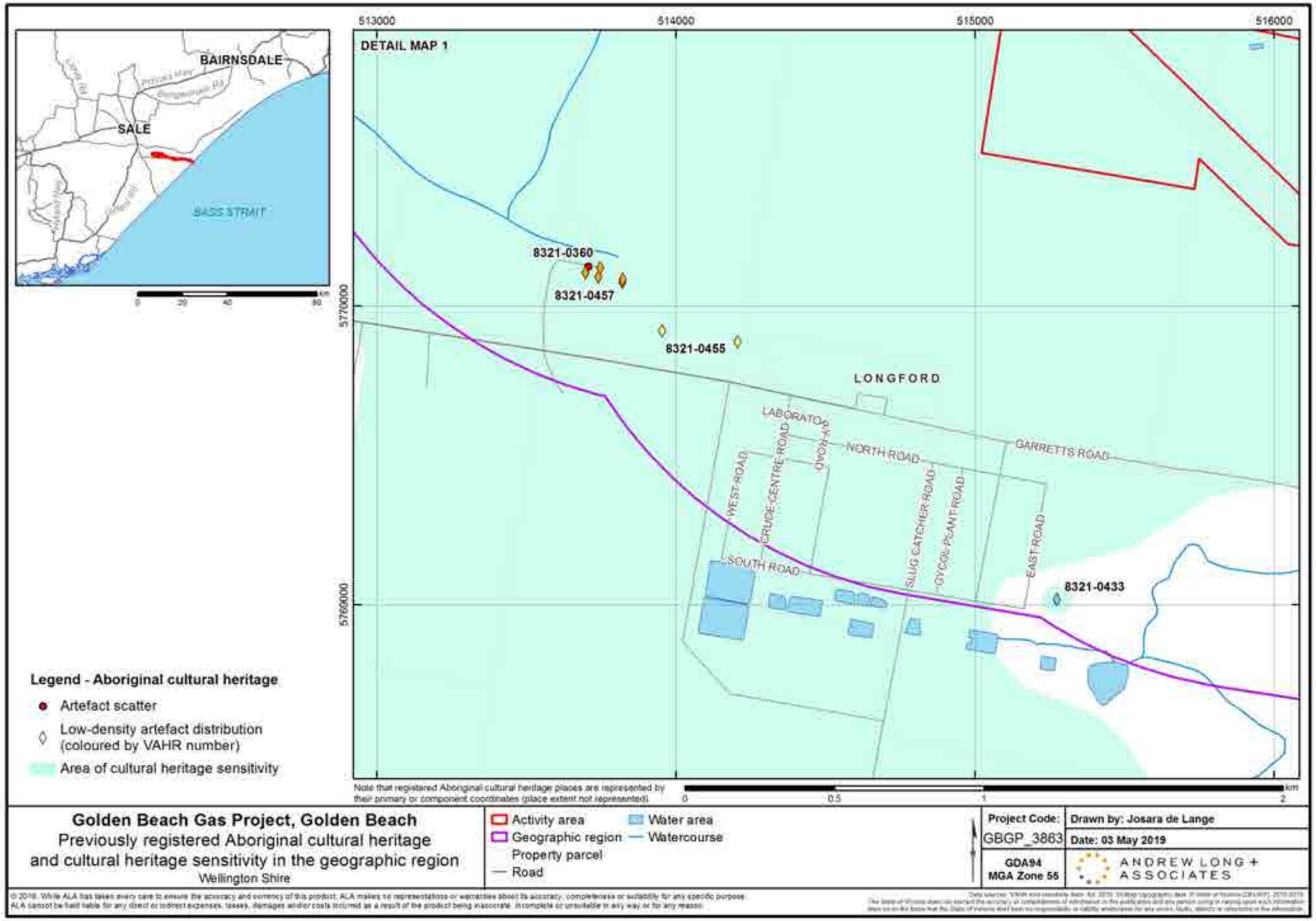
3.11 Implications

By comparing the results of the background research and the archaeological investigations previously undertaken within the geographic region, the following implications can be drawn:

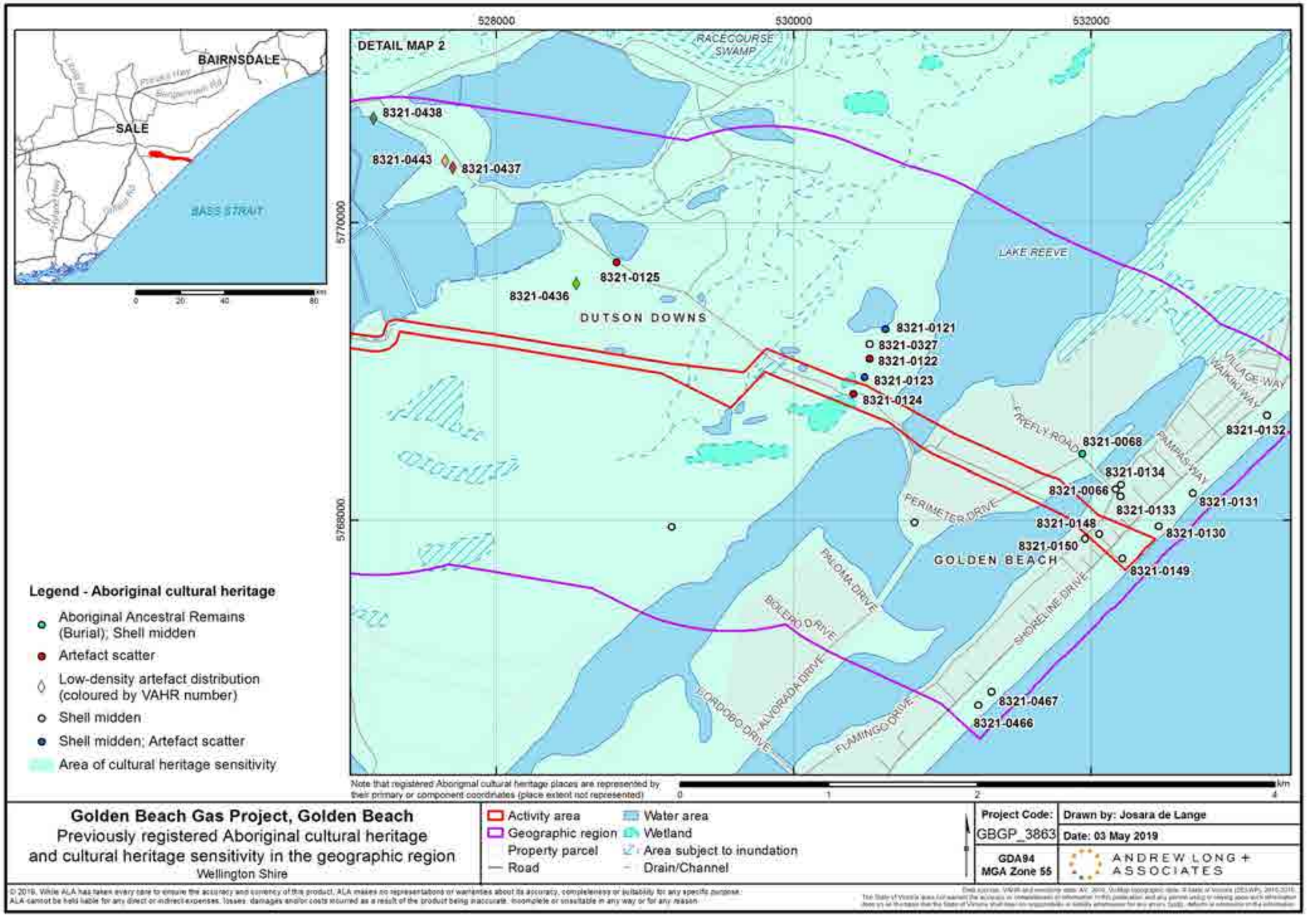
- The activity area falls within a region that is associated with the *Kurnai* or *Gunai*/*Ganai* Aboriginal peoples, in particular the *Braiakaulung* people.
- Although there is no documentation concerning specific camping areas within the activity area, large campsites were often placed close to water sources such as lakes, rivers, creeks and swamps.
- There is a limited range of geological units within the activity area including: Costal dune deposits, aeolian dune deposits, and alluvial terrace deposits.
- There are four registered Aboriginal places within the activity area. There are 21 registered Aboriginal places within on kilometer of the activity area. The majority of these registered Aboriginal places are middens, followed by artefact scatters and low density artefact distributions, and a single occurrence of ancestral remains.
- Regionalised archaeological studies have revealed that Aboriginal cultural heritage can be found on a range of localised contexts including ridgelines to sloping ground and level ground. Wesson and Beck found that Aboriginal places were often located on rises/ridges and hillsides, as well as on other landforms such as flat plains, undulating plains and creek banks, river terraces, also noting that Aboriginal places were often identified in areas with the greatest ground surface visibility (Wesson and Beck 1981).
- Ethnographic information on the movements of the Gunai Kurnai points to seasonally based movement that follows the availability of different food types. This type of activity might involve semi-permanent camps at particularly resource-rich localities or temporary camps that mark the transition from one location to another.
- Hall (1992) also found that the majority of Aboriginal places were found in association with waterways and elevated landforms.
- Research conducted by Hotchin, Hall and Lomax suggests that sites exploiting coastal and estuarine resources are more likely to occur within 1-2 km of the coastline and that they will be made up predominantly of *Plebidonax* shell and quartz artefacts.
- Localised archaeological studies have indicated that prior land disturbance will have an effect on the identification of intact Aboriginal cultural heritage material.
- Seasonal inundation of areas containing alluvial soils and floodplains may also explain the paucity of Aboriginal cultural heritage material within these landforms.
- Ridges within the broader landscape have been identified as landforms Aboriginal people utilised for travel, and ephemeral campsites are likely to be found in association with these uses (Barker 2012).



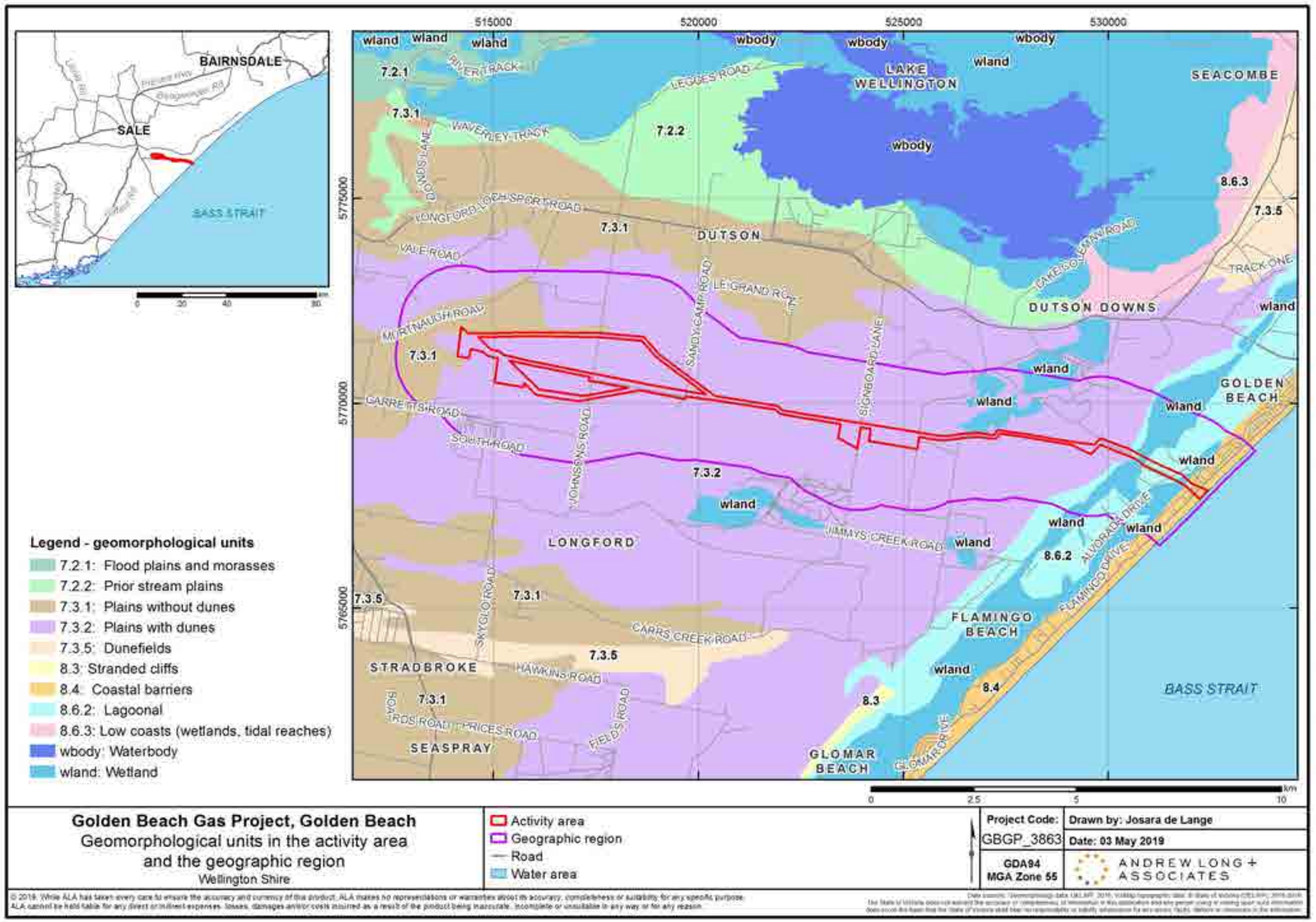
Map 4: VAHR within the Activity Area (overview)



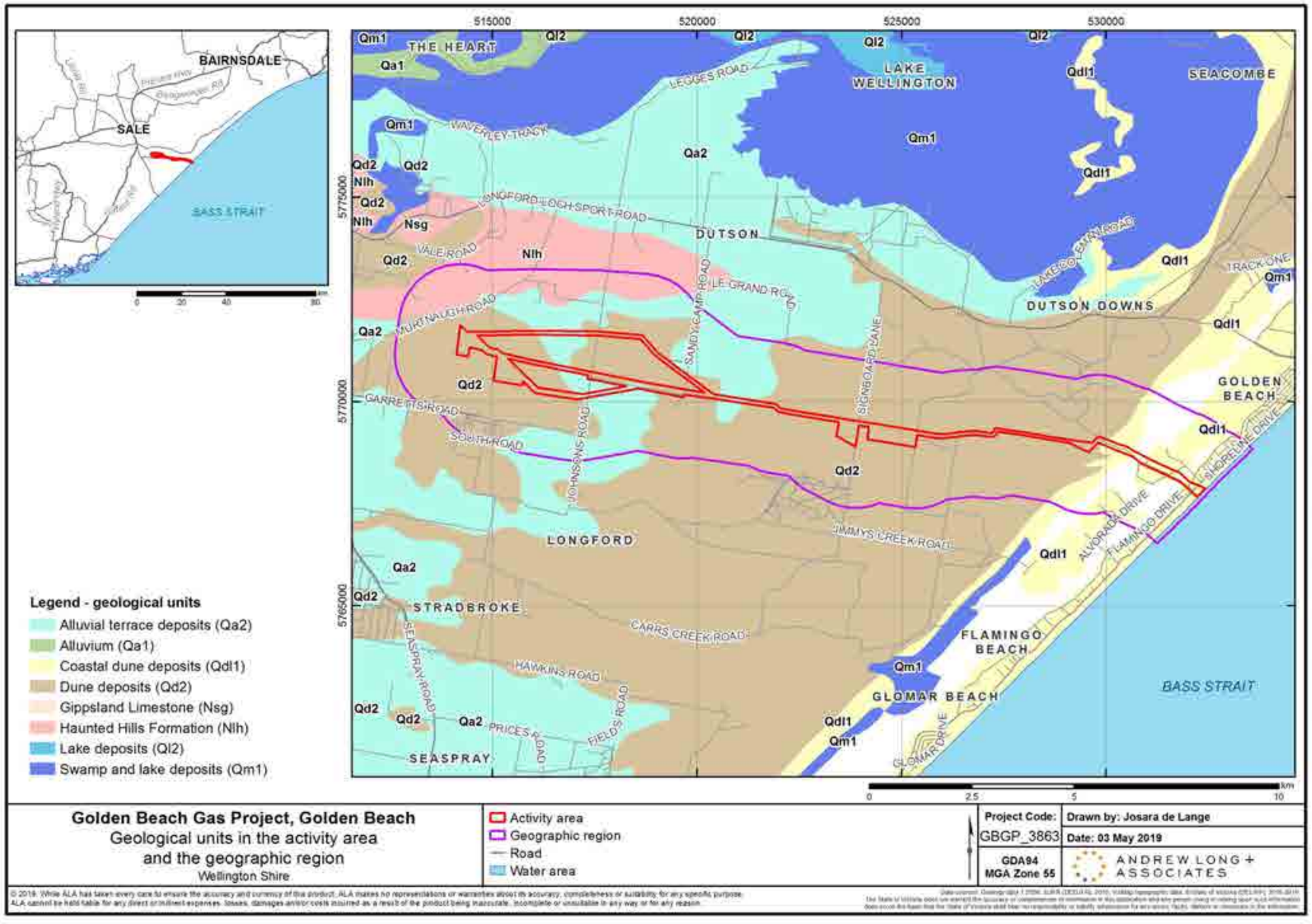
Map 5: VAHR within the activity area (Detail Map 1)



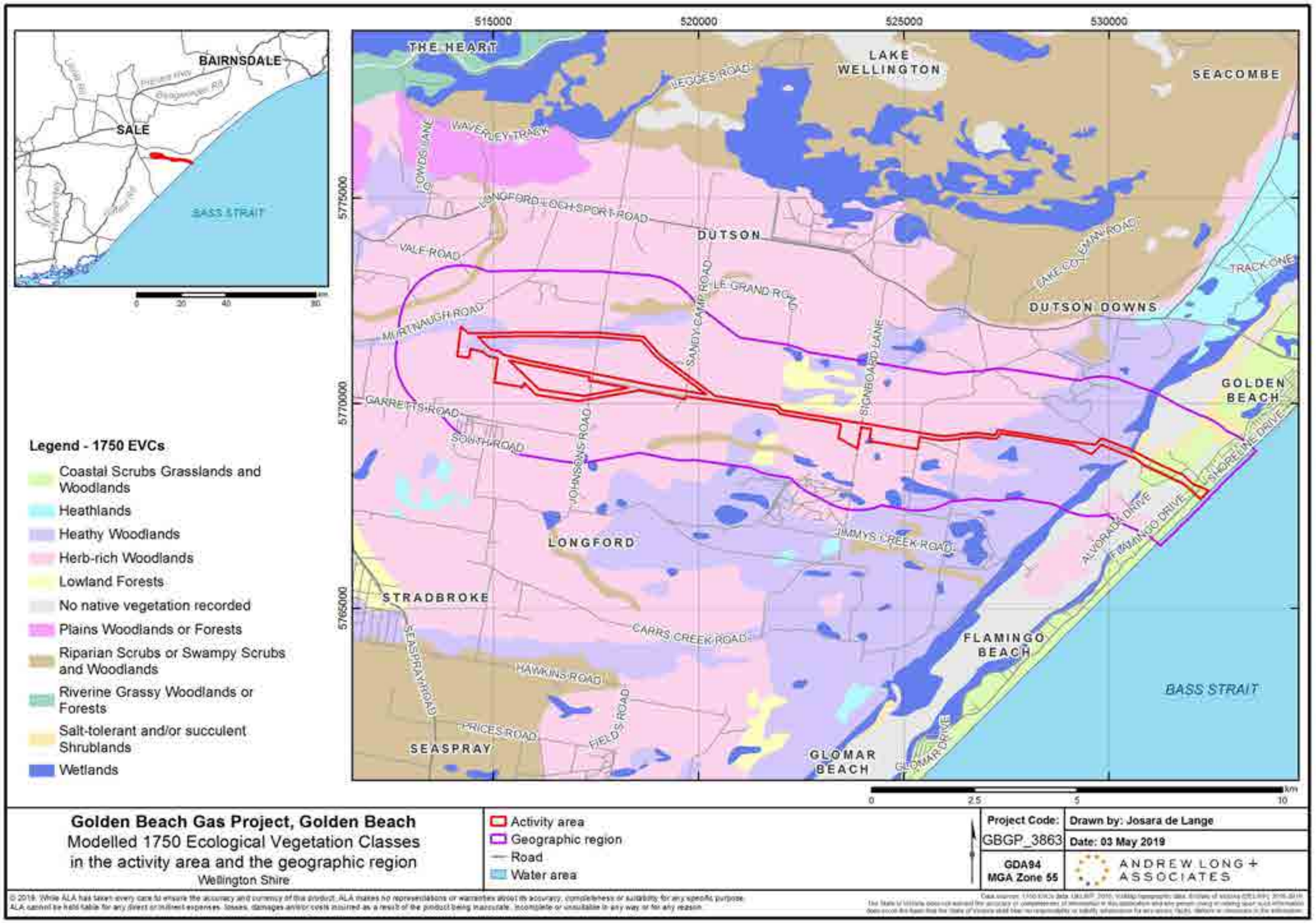
Map 6: VAHR within the activity area (Detail Map 2)



Map 7: Geomorphology of the activity area



Map 8: Geology of the activity area



Map 9: 1750 EVCs within the activity area

4

PREDICTIVE MODEL

4.1 Introduction

A predictive model was developed to provide a greater level of comparability between options for the purposes of potentially rating these options against each other and to demonstrate a pattern of occupation and use of the landscape.

The predictive model considered various existing spatial datasets including the VAHR data (registered cultural heritage places), geomorphological data, EVC data, hydrological data, and additional datasets created utilising land use history (disturbance mapping), ethnohistory (observations of Aboriginal lifestyles and activities) and a review of archaeological reports.

A selection of the most relevant attributes was assessed. These attributes were selected on the basis that the environmental features they represented would have had a modifying influence on the Aboriginal occupation and use of the activity area and that this influence may be detectable in variations in the distribution and density of sites in the activity area.

Within each of the relevant attributes, ratings were assigned based on the relative distribution and density of Aboriginal places in each attribute unit and considering environmental factors within the study area.

To determine the impact on registered and potential Victorian Aboriginal Heritage Register (VAHR) places, the following factors were taken into consideration:

Predictive Model
Ancestral remains/burial
Artefact scatters (major)
Scarred trees
Shell middens

Specialist Input
Existing Conditions Report
Land Use History
Disturbance

4.2 Rationale for the Predictive Model

In order to rate the performance of each option the assessment required an evaluation of the potential of each route to impact on as yet unidentified VAHR places. By definition, the locations of these places are unknown and the potential for them to be present is based on comparisons with the known archaeological record of the area. In order to approach a more quantifiable means to assessing potential impacts on as yet unidentified places a number of models were developed to predict the potential distribution of these places.

In order to promote transparency and repeatability of process as well as support the possibility to efficiently generate model variants, a formal predictive modelling approach was adopted, which is illustrated by Figure 2.

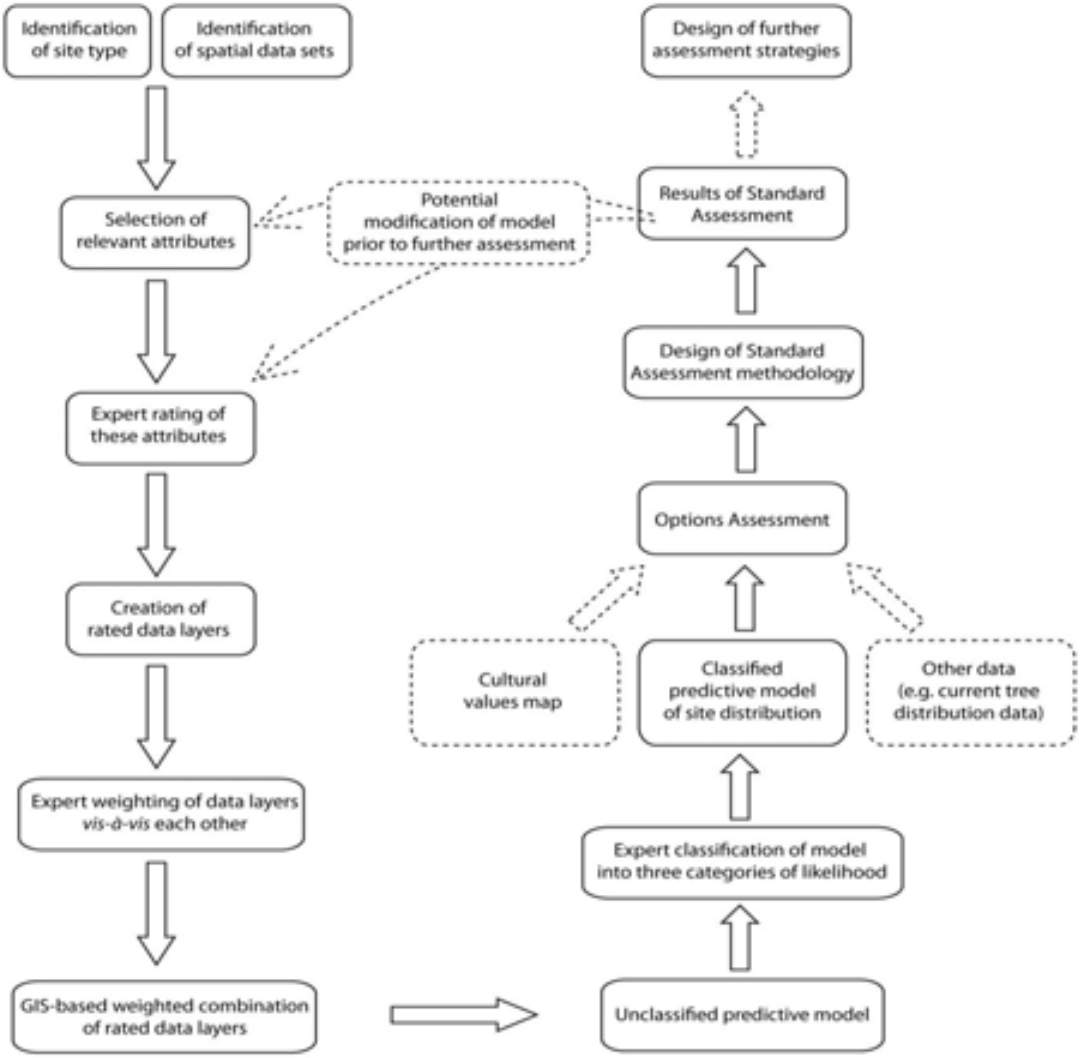


Figure 2: Flow chart outlining the predictive modelling process

Prior to model construction, four different site types were identified that are expected to be distributed differentially in relation to environmental variables:

- Burials;
- Artefact scatters (major);
- Scarred trees;
- Shell middens

This assessment has specifically excluded minor artefact scatters, including isolated artefacts as these have the potential to occur across the study area landscape as a whole without necessarily displaying any readily identifiable patterning in association with environmental factors.

Six relevant spatial datasets were identified:

- Geological units;
- Geomorphology;
- Slope;
- Modelled 1750 Ecological Vegetation Classes;
- Distance from water (fresh); and
- Distance from water (salt).

These datasets were critical for assessing the pattern of past human occupation across the landscape in relation to their effect on the archaeological record.

4.2.1 Model Ratings

The conversion of the spatial datasets into sets of rated data layers for input into the models involved the selection for each of the datasets, of the attribute class(es) to be rated, the actual assignment of ratings to these classes. The ratings range from 1 to 100 in set intervals, with 10 being neutral with respect to the presence of Aboriginal places (see Table 8). Although the attribute class(es) selected for rating were the same for each of the models, the actual ratings vary substantially between the models for the different site types (see below).

Table 8: Ratings interpretation

Rating	Interpretation
1	Strongly positively correlated with places of the relevant type
5	Weakly positively correlated with places of the relevant type
10	Neutral with regard to places of the relevant type
20	Weakly negatively correlated with places of the relevant type
40	Strongly negatively correlated with places of the relevant type
100	Nil likelihood

The strength and type of correlation between places and particular spatial data classes was established through assessment in workshops with a team of specialists and was informed by tabulated information regarding the association of known heritage places and environmental variables.

The ratings convey the likelihood that Aboriginal activities resulting in the formation of particular site types were associated with specific attribute classes. In other words, the predictive model is concerned with site formation, not with site preservation. Once the ratings for the first modelling iteration were agreed upon, rated layers were derived through the reclassification of the input data sets.

Ratings

The following ratings (Table 9-Table 14) were applied in the construction of the four models according to site type for study area (ancestral remains, major artefact scatters, scarred trees and shell middens).

Table 9: Ratings for Geology

Geological unit	Area (sqm)	% area	Ancestral remains/burials	Artefact scatters	Scarred trees	Shell middens
Haunted Hills Formation (Nlh)	4806806.21	6.95	10	10	10	10
Alluvial terrace deposits (Qa2)	11560137.68	16.72	5	5	10	10
Dune deposits (Qd2)	47125787.01	68.18	5	5	10	10
Coastal dune deposits (Qdl1)	5628386.84	8.14	5	5	10	10

Table 10: Ratings for Geomorphology

GMU	Area (sqm)	% area	Ancestral remains/ burials	Artefact scatters	Scarred trees	Shell middens
7.3.1: Plains without dunes (Darnum, Loy Yang, Giffard, Leongatha South, Munro plains)	5190826.89	7.20	10	10	5	40
7.3.2: Plains with dunes (Woodside, Longford, Munro plains with dunes)	57360726.43	79.53	5	5	5	40
8.4: Coastal barriers (Ninety Mile Beach)	1674564.12	2.32	5	5	40	1
8.6.2: Lagoonal (Nelson, Tamboon Inlet)	3127077.15	4.34	40	40	20	20
Wetland	4775068.50	6.62	40	40	20	20

Table 11: Distance from Watercourse

DistanceFromWater_m	Area (sqm)	% area	Ancestral remains/burials	Artefact scatters	Scarred trees	Shell middens
0 (in water)	7837715.56	10.82	100	100	100	100
<50	5057968.82	6.98	5	1	10	1

50-100	5207937.85	7.19	5	1	10	5
100-200	9737420.13	13.44	5	1	10	5
200-300	8270079.1	11.42	5	1	10	5
300-400	6600158.32	9.11	5	1	10	5
400-500	5224011.7	7.21	5	1	10	10
500-600	4348176.36	6	5	5	10	10
600-700	3350135.27	4.62	5	5	10	20
700-800	2953328.08	4.08	5	5	10	20
800-900	2509740.91	3.46	5	5	10	20
900-1000	2237457.24	3.09	5	5	10	20
1000-1500	7974660.9	11.01	10	10	10	20
1500-2000	1139344.58	1.57	10	10	10	20

Table 12: Ratings for Distance from Coast

DistanceFromCoast_m	Area (sqm)	% area	Ancestral remains/burials	Artefact scatters	Scarred trees	Shell middens
0 (in sea)	To be calculated	To be calculated	100	100	100	100
<25			5	5	10	1
25-50			5	5	10	1
50-75			5	5	10	1
75-100			5	5	10	1
100-200			5	5	10	5
200-300			5	5	10	5
300-400			10	10	10	10
400-500			10	10	10	10
500-600			10	10	10	20
600-700			10	10	10	20
700-800			10	10	10	20
800-900			10	10	10	20
900-1000			10	10	10	20
1000-5000			10	10	10	40
5000-10000			10	10	10	40
>10000			10	10	10	40

Table 13: Ratings for Slope

Slope	Area (sqm)	% area	Ancestral remains/burials	Artefact scatters	Scarred trees	Shell middens
< 5 degrees	70289926.95	97.02	1	1	10	1
5-10 degrees	1890268.19	2.61	5	10	10	10

10-15 degrees	249537.35	0.34	10	20	10	20
15-20 degrees	18402.34	0.03	10	20	10	20

Table 14: Ratings for pre1750 EVCs

EVC group name	EVC	EVC name	Area (sqm)	% area	Ancestral remains/ burials	Artefact scatters	Scarred trees	Shell middens
Coastal Scrubs Grasslands and Woodlands	1	Coastal Dune Scrub/Coastal Dune Grassland Mosaic	442529.83	0.61	10	10	20	10
Coastal Scrubs Grasslands and Woodlands	2	Coast Banksia Woodland	2477202.64	3.43	10	10	20	10
Heathy Woodlands	48	Heathy Woodland	14335000.6	19.87	10	10	5	10
Herb-rich Woodlands	3	Damp Sands Herb-rich Woodland	45840852.6	63.56	10	10	5	10
Lowland Forests	16	Lowland Forest	1641977.06	2.28	10	10	1	10
No native vegetation recorded	992	Water Body - Fresh	2910367.99	4.04	100	10	100	10
Riparian Scrubs or Swampy Scrubs and Woodlands	191	Riparian Scrub	1537774.47	2.13	10	10	5	10
Salt-tolerant and/or succulent Shrublands	9	Coastal Saltmarsh	679908.37	0.94	10	10	40	10
Wetlands	10	Estuarine Wetland	970272.65	1.35	100	10	40	10
Wetlands	136	Sedge Wetland	1291910.93	1.79	100	10	40	10

4.2.2 Model Weightings

To finalise the construction of the predictive models, the rated layers were combined. Rather than averaging the input of these layers, they were weighted differentially to reflect their differential importance *vis-à-vis* each other in influencing heritage place distribution. In order to determine the weight, a specialist workshop was conducted where each layer was compared to every other layer and scored either a 1 (more influential) or a 0 (less influential) with respect to the comparative layer. Scores were added up for each rated layer and divided by the overall score in order to derive the layer weightings (see below).

Weightings

The following weightings were applied:

Table 15: Weightings for models: ancestral remains

Ancestral remains/ burials	EVC	Geomorphology	Geology	Slope	Dist to water	Dist to Coast	Total	Weighting
EVC	1	0	0	0	0	0	1	0.058823529
Geomorphology	1	1	0	0	0	0	2	0.117647059
Geology	1	1	1	1	1	1	6	0.352941176
Slope	1	1	1	1	1	1	6	0.352941176
Dist to water	0	0	0	0	1	0	1	0.058823529
Dist to Coast	0	0	0	0	0	1	1	0.058823529
							17	1

Table 16: Weightings for models: major artefact scatters

Artefact scatters	EVC	Geomorphology	Geology	Slope	Dist to water	Dist to Coast	Total	Weighting
EVC	1	0	0	0	0	0	1	0.047619048
Geomorphology	1	1	0	0	0	0	2	0.095238095
Geology	1	1	1	0	0	0	3	0.142857143
Slope	1	1	1	1	1	1	6	0.285714286
Dist to water	1	1	1	0	1	0	4	0.19047619
Dist to Coast	1	1	1	0	1	1	5	0.238095238
							21	1

Table 17: Weightings for models: scarred trees

Scarred trees	EVC	Geomorphology	Geology	Slope	Dist to water	Dist to Coast	Total	Weighting
EVC	1	1	1	1	1	1	6	0.333333333
Geomorphology	0	1	1	0	0	0	2	0.111111111
Geology	0	0	1	0	0	0	1	0.055555556
Slope	0	1	1	1	0	0	3	0.166666667
Dist to water	0	1	1	1	1	1	5	0.277777778
Dist to Coast	0	0	0	0	0	1	1	0.055555556
							18	1

Table 18: Weightings for models: shell middens

Shell middens	EVC	Geomorphology	Geology	Slope	Dist to water	Dist to Coast	Total	Weighting
EVC	1	0	0	0	0	0	1	0.05
Geomorphology	1	1	1	0	0	0	3	0.15
Geology	0	0	1	0	0	0	1	0.05
Slope	1	1	1	1	0	0	4	0.2
Dist to water	1	1	1	1	1	0	5	0.25
Dist to Coast	1	1	1	1	1	1	6	0.3
							20	1

4.2.3 Model classification

Once the rating and weightings were established, the site type predictive models were constructed through raster calculation in an ESRI ArcGIS environment. The models were then classified into three classes of likelihood of site occurrence. Various classification methods were explored; the classified model outputs were created using a classification method based on geometric intervals, which involves the placement of class boundaries at points of relatively great data value variation, grouping similar values together.

4.2.4 Model Development: Obstacles, Limitations and Assumptions

The predictive models created have a number of limitations. Some of these are inherited from the input data. The 1750 EVC layer, for instance, is a modelled data set; the assumptions underlying this modelled data set also underlie the rated EVC model layers and hence the models themselves. The distance-to-watercourse data set was derived from the watercourses data, which is a line dataset that does not take into account the width of watercourses. Confluences, likewise, are points of intersection without an extent. The limitations of the parent data sets are set out in the relevant metadata statements.

In addition to the inherited limitations, there are a number of additional assumptions and limitations:

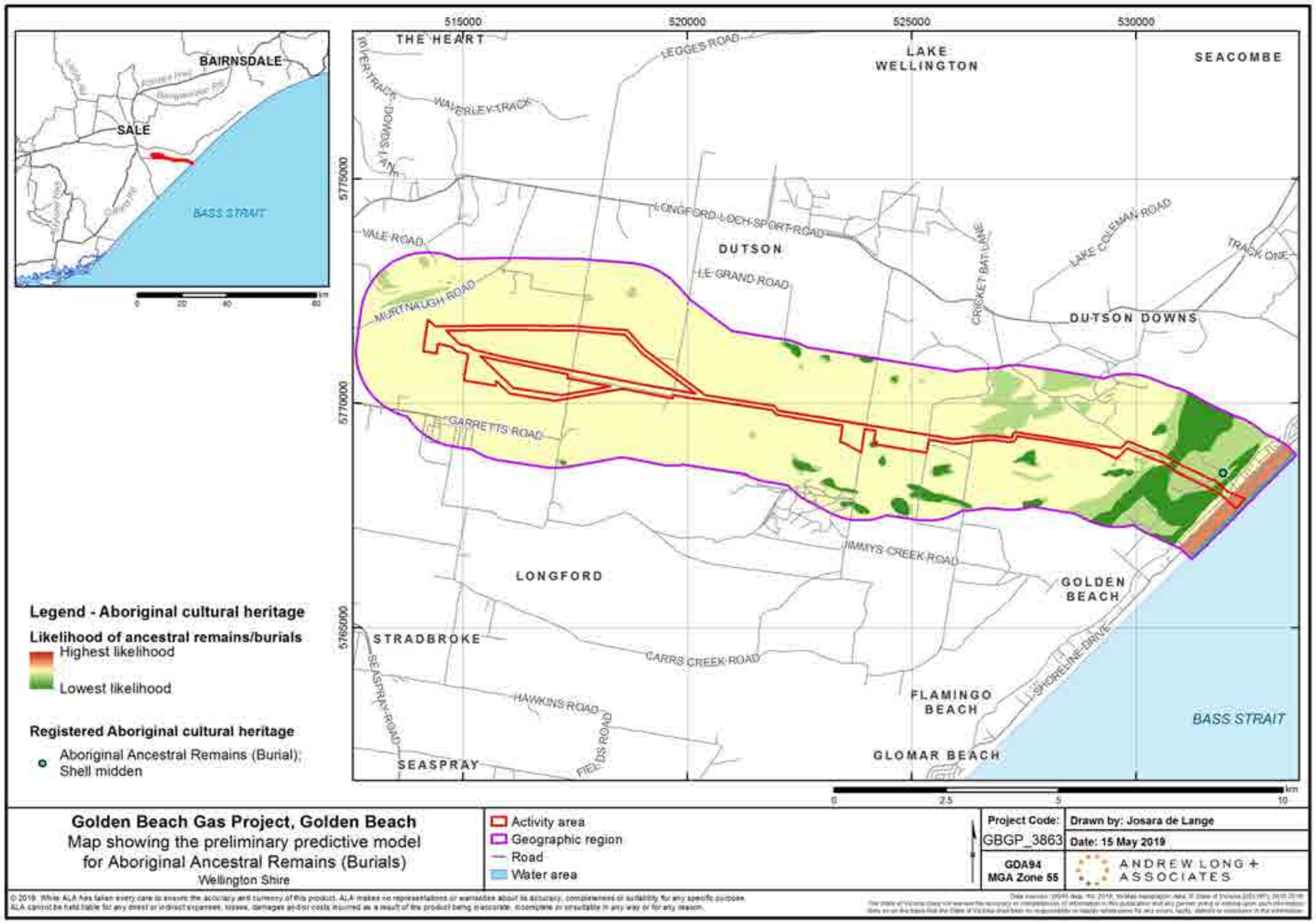
- Other data sets (cf. LIDAR) likely exist which would assist in the refinement of the modelling, however, the datasets used provide sufficient insight to be able to differentiate those locations that are more likely to contain items or areas of cultural heritage significance.
- The models are models of the predicted occurrence of specific Aboriginal activities in the landscape and the resulting formation of particular types of Aboriginal cultural heritage places.
- The assumption inherent in the use of the parent data sets is that these data sets adequately reflect the class of phenomena they purport to reflect for the time period during which Aboriginal people were present in the area.
- Expert knowledge of Aboriginal activities in the study areas and their surroundings is based on knowledge of what is a highly incomplete archaeological record. As a result of this incompleteness there are limitations to the expert assessments.

- The predictive models are limited by the fact that they represent a single modelling iteration, and have not benefited from systematic ground-truthing.
- Gaps occur in the existing datasets (e.g. geology) that will likely require ground-truthing.
- The model only considers known site types in the area; others may exist that have not been previously registered.
- Condition of preservation differs between site types.
- Artefact scatter model only considers places of moderate to high scientific significance (as per The Burra Charter, ICOMOS). Places of low scientific significance are considered to be evenly distributed across the landscape.

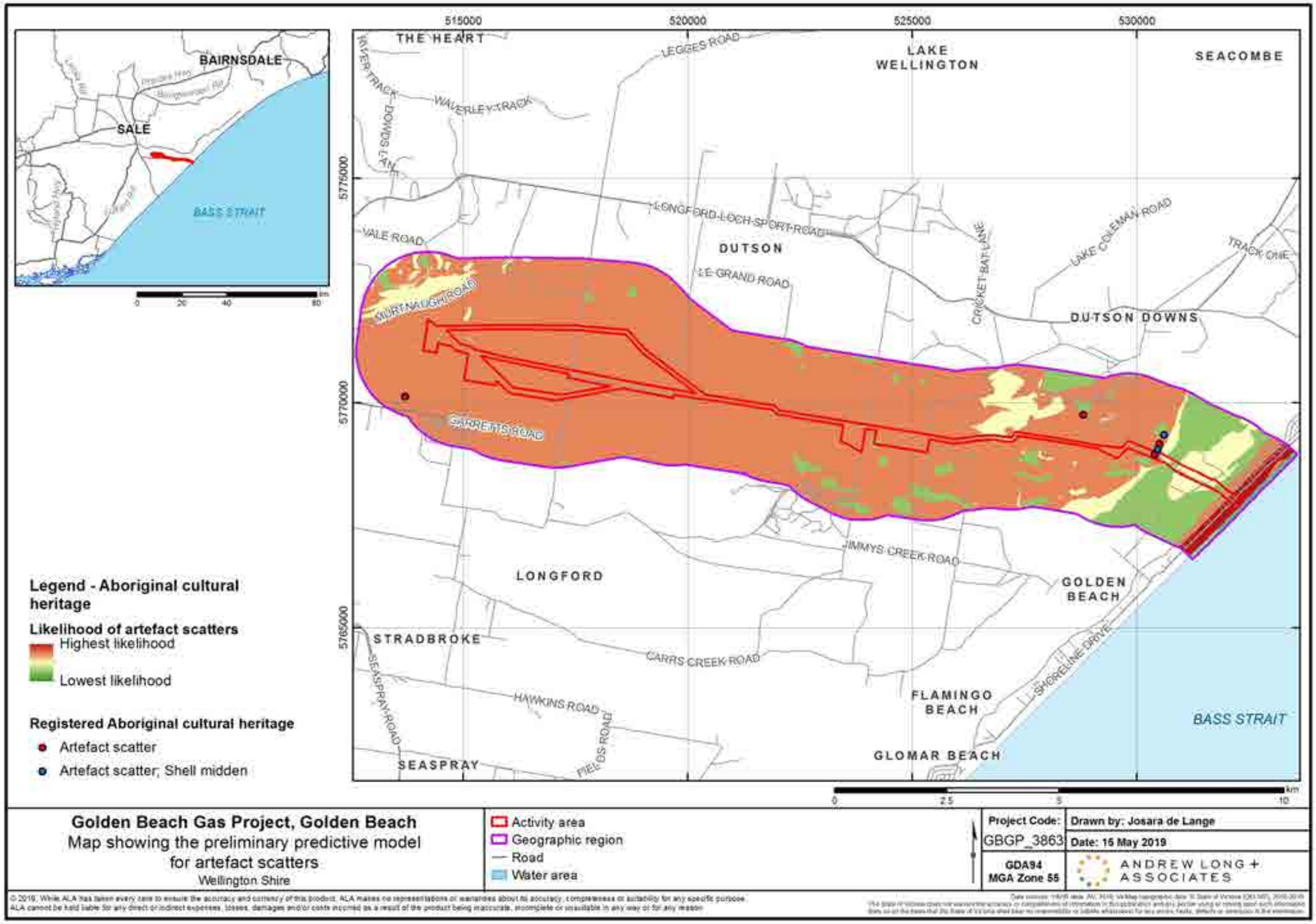
4.3 Results of the Predictive Modelling

The results of the preliminary Aboriginal site predictive modelling for each site type within the project boundary area are represented in Map 10 to Map 13. The predictive modelling exercise has revealed that there is little to separate the three options proposed in terms of likely impact on potential Aboriginal heritage. Partly this is a reflection on the graininess or lack of of the supporting data being used for this exercise which has resulted in the overall flattening of micro-topographical and more discrete geomorphological variations. Effectively, what this means is that decisions on option choice will of necessity only be affected peripherally by cultural heritage concerns.

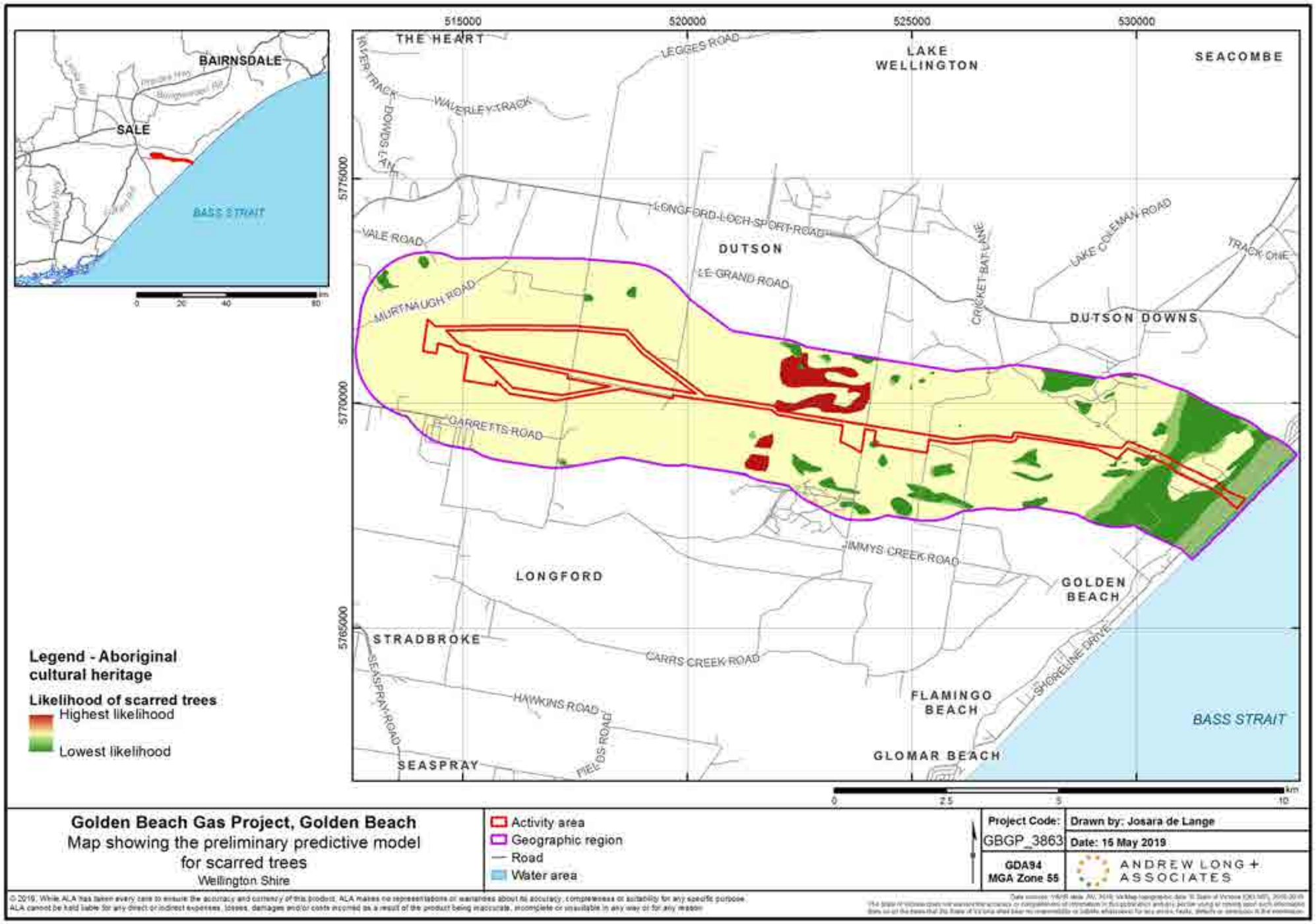
The modelling exercise does emphasise the sensitivity of the coastal margin/coastal barrier dune complex for ancestral remains, artefact scatters and shell middens. The model for scarred trees is virtually the opposite of the other place type models with the coastal margin being of the lowest sensitivity with hinterland areas being of generally higher sensitivity. Again, these variations between the different place type models does not impact the overall uniformity in the modelled outcomes for the three route options.



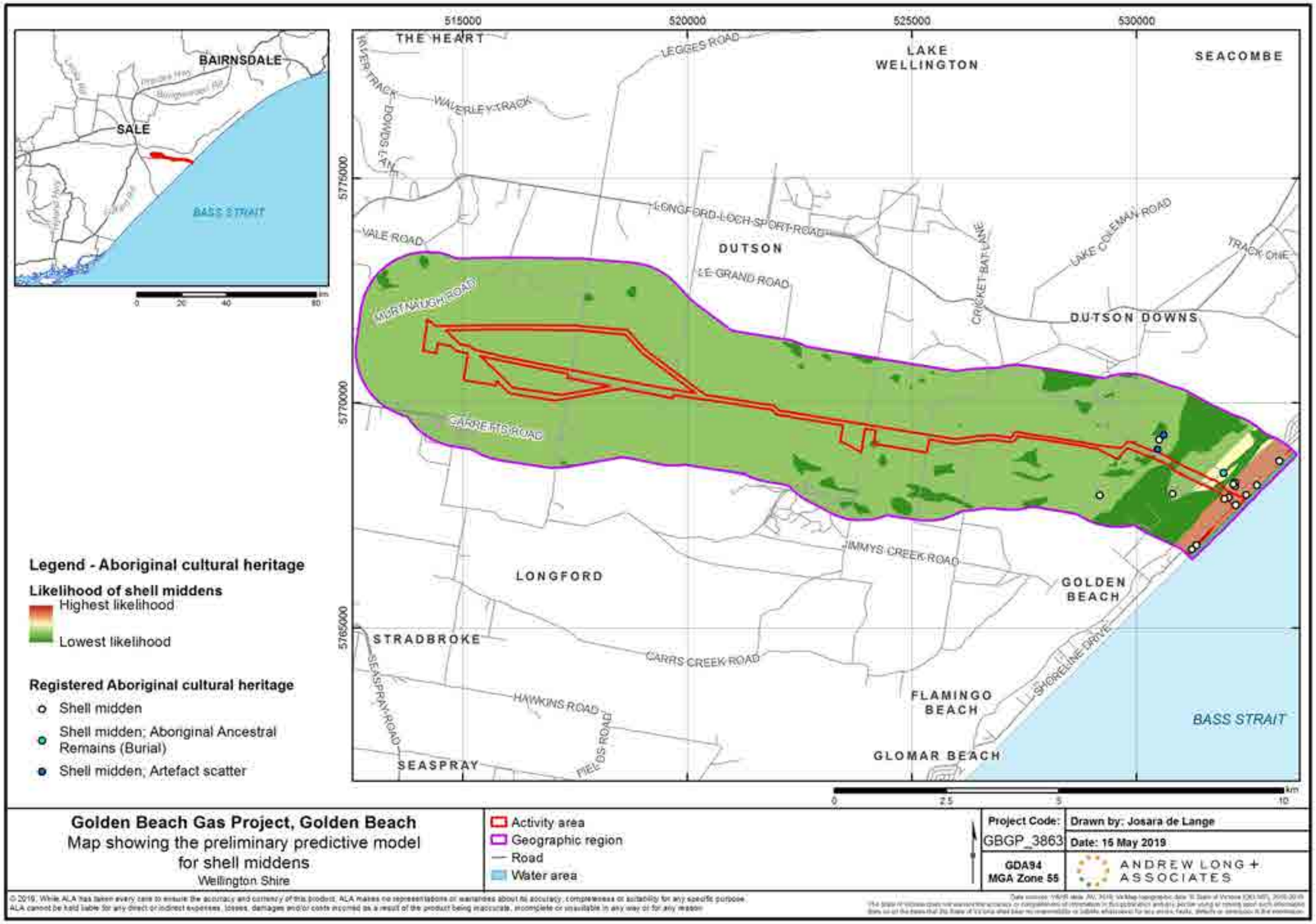
Map 10: Preliminary predictive model for ancestral remains



Map 11: Preliminary predictive model for artefact scatters



Map 12: Preliminary predictive model for scarred trees



Map 13: Preliminary predictive model for shell middens

5

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